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ATLAS SINGLE-INCISION LAPAROSCOPY



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20 procedural videos*

Giovanni DAPRI

Endo:Press®

ATLAS
SINGLE-INCISION LAPAROSCOPY

Giovanni DAPRI

*This Atlas is dedicated to my wife BARBARA,
who first made the suggestion that I should write this book, for supporting
me during the research, development and feasibility phases and finally teaching
this new technique.*

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ATLAS SINGLE-INCISION LAPAROSCOPY

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SECTION 1

HISTORY OF SINGLE-INCISION LAPAROSCOPY

1. HISTORY OF SINGLE-INCISION LAPAROSCOPY

Minimally invasive surgery gained popularity in 1985 with the first laparoscopic cholecystectomy performed by Eric Muhe, and two years later with the first video-laparoscopic cholecystectomy by Philippe Mouret⁽¹⁾. In the last decade, a new philosophy of less invasiveness in minimally invasive surgery and performing laparoscopy without visible scars interested surgeons, researchers and medical companies. The basic purpose was improved cosmesis, but reductions in post-operative pain, length of hospital stay, and patient's convalescence were also aspired to.

Natural Orifice Transluminal Endoscopic Surgery (NOTES) and Single-Incision Laparoscopy were the two main areas of study, research and material development.

NOTES was attempted through the stomach, vagina, rectum, trachea and bladder but, due to the main difficulty in closing the access route and the long operative time, it was abandoned with the exception of the transvaginal cholecystectomy, which remained the most common procedure in some centres performing NOTES⁽²⁾.

Another important area of research, recently developed thanks to NOTES and Single-Incision Laparoscopy, has been TransAnal Minimally Invasive Surgery (TAMIS) where, beyond the local rectal lesion excision⁽³⁾, other steps like total mesorectal excision were performed transanally⁽⁴⁾.

With the advent of NOTES, flexible endoscopy permitted further development of another important field, which is endoluminal surgery. Endoluminal surgery, already popular for transanal endoscopic microsurgery (TEM)⁽⁵⁾, prompted an impressive level of investment and development of endoscopes in other areas, such as bariatric surgery. New endoluminal revisional bariatric procedures have been reported as being feasible and safe^(6,7), and new primary endoluminal surgeries have shown promise as well⁽⁸⁻¹⁰⁾.

Single-Incision Laparoscopy was initially reported in 1969⁽¹¹⁾, but for many years it did not receive much interest and remained unpopular. Recently, thanks to this new philosophy of less invasiveness in minimally invasive surgery, Single-Incision Laparoscopy started to become more popular. In literature, it was described using many different terms like single-port, single-site, single-access, etc.

Medical companies worked with surgeons in order to develop new port-devices, new instruments, and new telescopes permitting work during Single-Incision Laparoscopy similar to conventional multiport laparoscopy. Then, new intra-abdominal devices and new techniques were developed to resolve problems in Single-Incision Laparoscopy, as the operative field's exposure improved⁽¹²⁻²⁰⁾. Finally, the most common abdominal procedures usually performed by conventional multiport laparoscopy have been reported to be feasible using this technique⁽²¹⁻²⁵⁾.

The umbilicus was described as the main access site for Single-Incision Laparoscopy because, the presence of the natural scar represented the embryonic natural orifice of scarless surgery⁽²⁶⁾. Use of other abdominal quadrants, like suprapubic access, have also been reported, especially in those procedures where a large specimen has to be removed, because the incision remains under the bikini line and it is cosmetically acceptable^(27,28).

Additionally, the availability of material for Single-Incision Laparoscopy and the overall learning curve for surgeons had to be considered⁽²⁹⁾. Hence, in this philosophy and keeping in mind the association between NOTES and Single-Incision Laparoscopy, a tendency to perform laparoscopy through a smaller number of trocars as well as the reduced size of each trocar appeared evident and became known as Reduced Port Laparoscopic Surgery (RPLS)⁽³⁰⁾. Nowadays, especially in centers known for advanced minimally invasive surgery, mixed procedures involving Single-Incision Laparoscopy, needlescopic instruments and specimen extraction through the natural orifices (rectum/vagina) are realized. The main goals are improved cosmetic outcomes, reduced post-operative pain and easier convalescence for patients, but also include reductions in trocar complications (bleeding, interfascial hematoma formation, visceral injury, local nerve irritation, incisional herniation).

Finally, this philosophy of less invasiveness in minimally invasive surgery will probably continue in the future with the development of multichannel operative endoscopes, robot-controlled systems, and use of transumbilical as well as endoluminal approaches.

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SECTION 2

TROCARS, TELESCOPES AND INSTRUMENTS

2. TROCARS, TELESCOPES AND INSTRUMENTS

Trocars

- 11-mm, reusable, rigid trocar (Figure 1)
- 6-mm, reusable, flexible trocar and rigid mandril (DAPRI flex trocar) (Figure 2)
- 13-mm, reusable, rigid trocar (Figure 3)



TransAnal Port

- reusable D-Port (DAPRI-Port): tube, obturator and silicon cap (Figure 4)
- reusable D-Port (DAPRI-Port): tube and silicon cap (Figure 5)



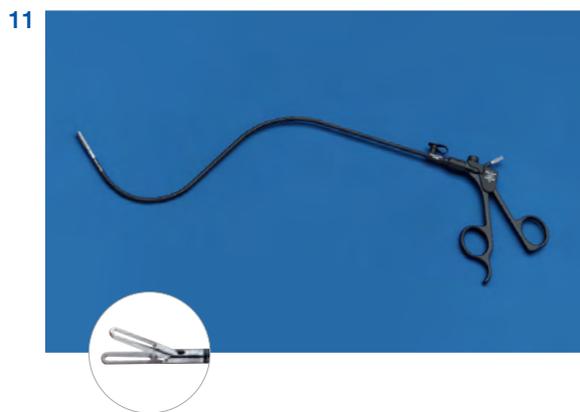
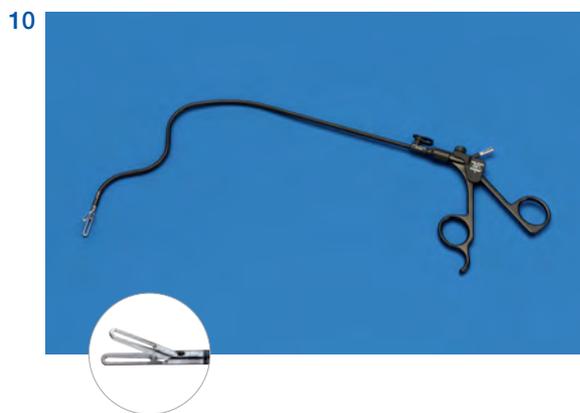
Telescopes

- 10-mm, 30°, straight, regular length (Figure 6)
- 5-mm, 30°, straight, long length (Figure 7)
- light cable, with 90° deflection (Figure 8)



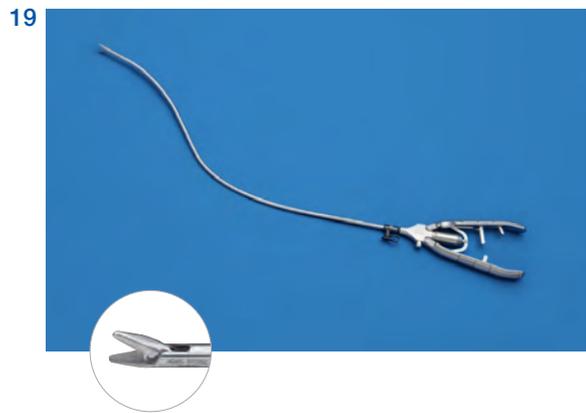
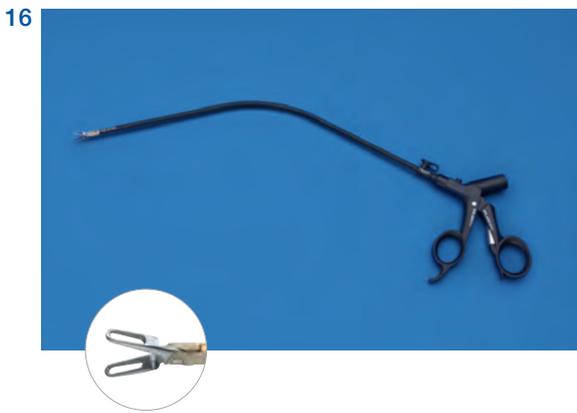
Curved Reusable Instruments

- 5-mm, bicurved grasping forceps (DAPRI grasping forceps I) (Figure 9)
- 5-mm, tricurved grasping forceps (DAPRI grasping forceps II) (Figure 10)
- 5-mm, bicurved grasping forceps (DAPRI grasping forceps III) (Figure 11)
- 5-mm, monocurved grasping forceps (DAPRI grasping forceps IV) (Figure 12)
- 5-mm, monocurved dissecting grasping forceps (DAPRI dissecting grasping forceps) (Figure 13)
- 5-mm, monocurved coagulating hook (DAPRI coagulating hook) (Figure 14)



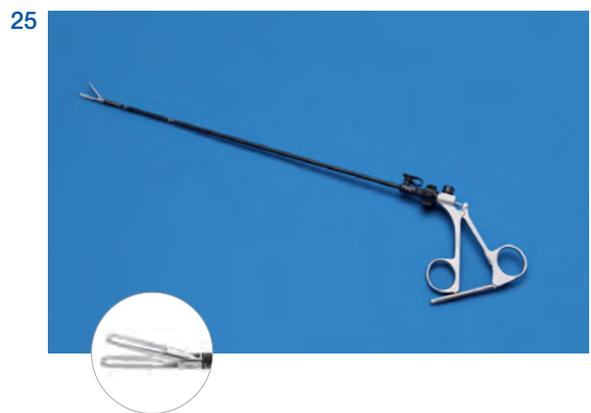
Curved Reusable Instruments

- 5-mm, monocurved scissors (DAPRI scissors) (Figure 15)
- 5-mm, monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps) (Figure 16)
- 5-mm, monocurved RoBi® bipolar scissors (DAPRI bipolar scissors) (Figure 17)
- 5-mm, monocurved needle holder (DAPRI needle holder I) (Figure 18)
- 5-mm, bicurved needle holder (DAPRI needle holder II) (Figure 19)
- 5-mm, monocurved suction and irrigation cannula (Figure 20)



Other Reusable Instruments

- 5-mm, monocurved anvil grasping forceps (DAPRI anvil grasping forceps) (Figure 21)
- purse-string suture device (DAPRI purse-string suture device) (Figure 22)
- 1.8-mm, straight trocarless grasping forceps (DAPRI trocarless grasping forceps) (Figure 23)
- 1.8-mm, straight Veress needle (Figure 24)
- 5-mm, straight grasping forceps (Figure 25)
- 5-mm and 10-mm, straight clip applier (Figure 26)
- 5-mm, straight endoloop device



Other Non-Reusable Tools

- 5-mm, straight harmonic shears or other similar devices
- 5-mm, straight tack device
- articulating linear stapler
- circular stapler
- custom-made plastic bag
- plastic wall protector
- nasogastric tube
- orogastric bougie
- rectal tube and syringe
- anal retractor
- cannula for morcellator
- mesh
- gastroscope
- ultrasound probe
- ileostomy set
- colostomy set
- drain

SECTION 3

FOREGUT

3.1 FUNDOPLICATION

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Nissen

Toupet

Post-operative Care

3.1 FUNDOPLICATION

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

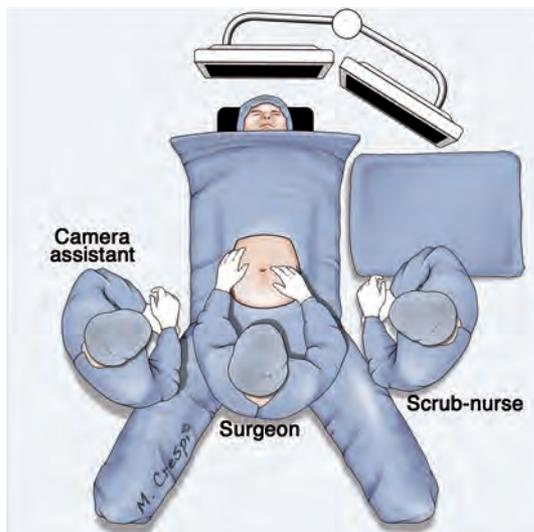
General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after intubation.

Antibiotic prophylaxis is applied as well.

Tools

- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needle-holders, two tissue forceps, two Farabeuf retractors, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), one 20 cm cotton tape, five silk 2/0 (silk 2/0, round tip, 1/2c, 26 mm), four Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable rigid mandril of 6-mm trocar
- one straight 10-mm, 30° regular length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps III)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable bicurved needle holder (DAPRI needle holder II)
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one reusable straight 5-mm clip applier
- one non-reusable 34-French orogastric bougie

1



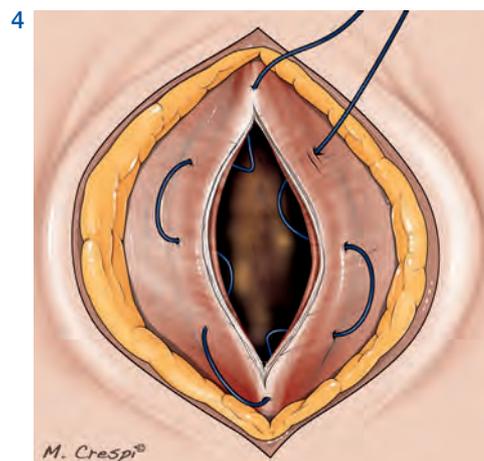
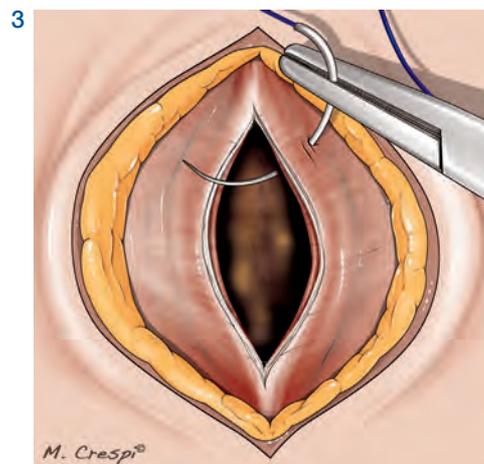
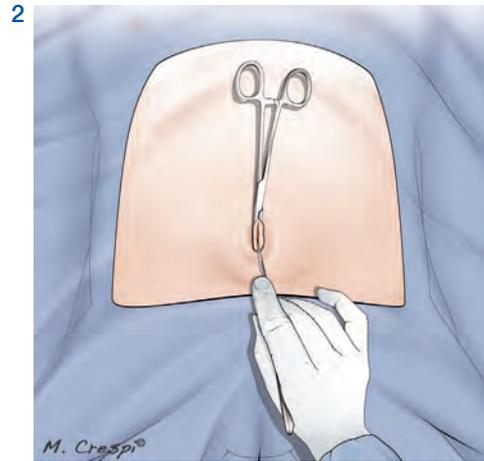
Patient and Team Positioning

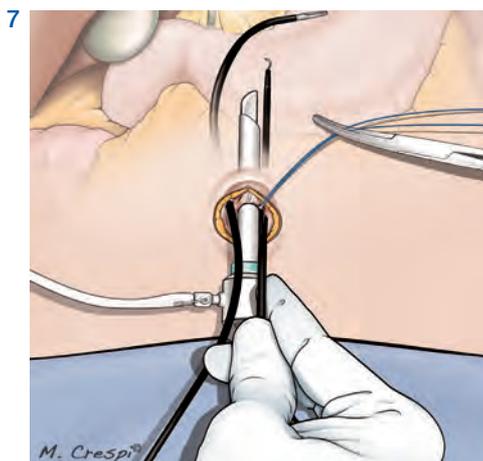
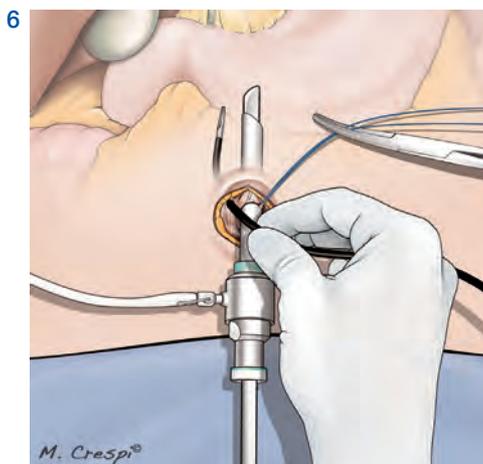
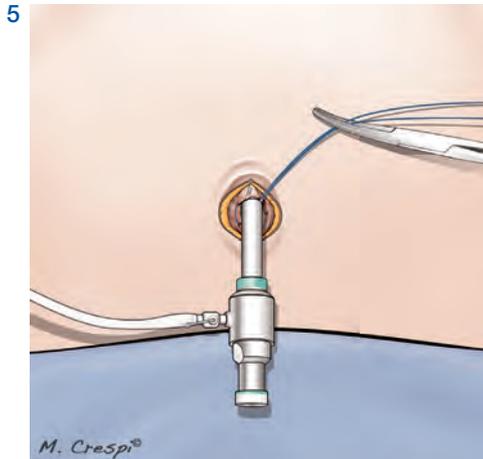
The patient is placed in a supine position, with the arms alongside the body and the legs apart. The patient's arms, ankles, and legs are secured and protected.

The surgeon stands between the patient's legs, and the camera assistant to the patient's right. The scrub-nurse stands to the patient's left. The video monitor is placed in front of the surgeon and camera assistant (Figure 1).

Technique

The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (Figure 2). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 3, 4). This suture is kept externally with a Pean-Rochester curved forceps.





An 11-mm trocar is introduced into the peritoneal cavity inside the purse-string suture, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar, and curved instruments are inserted into the abdomen through the umbilical scar without trocars.

The bicurved grasping forceps is inserted through a separate fascia window, created by a mandril of 6-mm trocar, approximately 5 mm outside the purse-string suture at the 10 o'clock position with respect to the patient's head (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

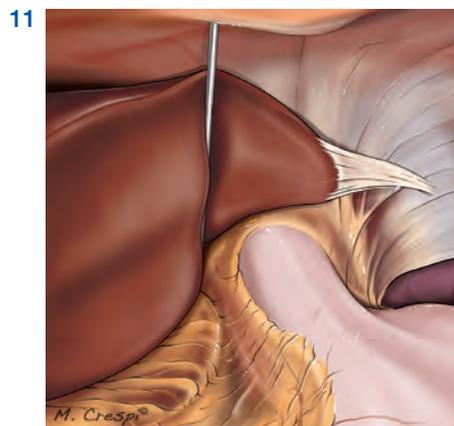
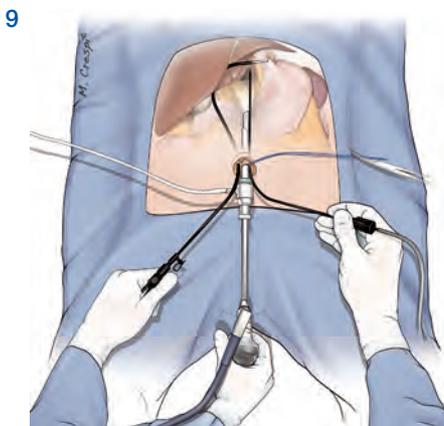
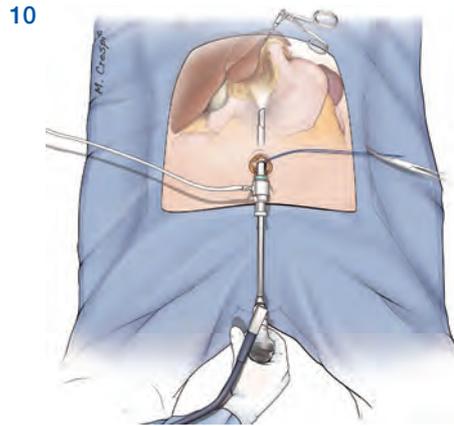
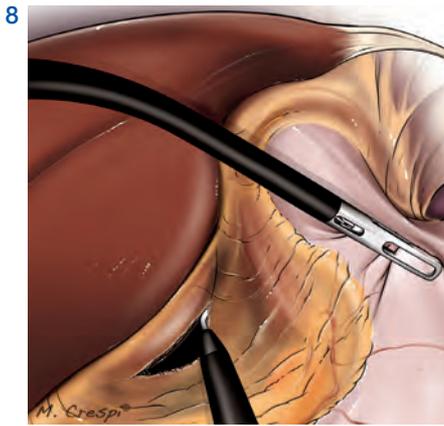
The other instruments, like the monocurved coagulating hook, the monocurved bipolar forceps and scissors, the bicurved needle holder, the monocurved scissors, the monocurved suction and irrigation cannula, the straight grasping forceps, and the straight 5-mm clip applier are introduced on the other side of the bicurved grasping forceps at the 3 o'clock position, parallel to the 11-mm trocar and inside the purse-string suture (Figure 7).

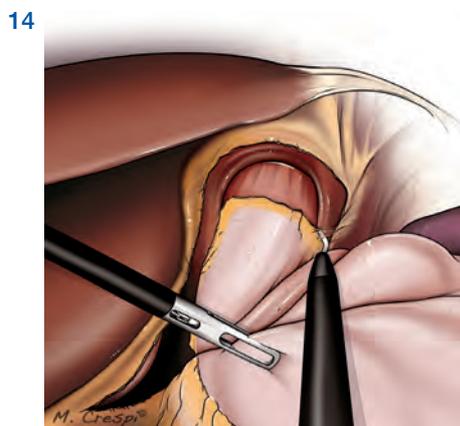
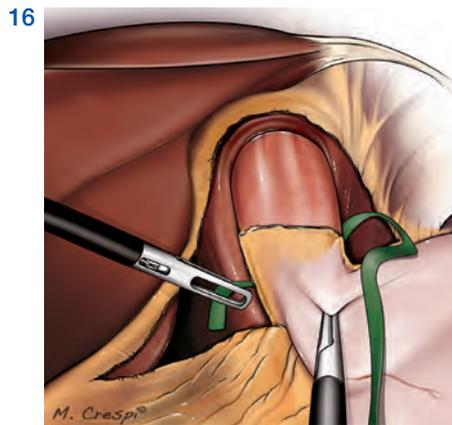
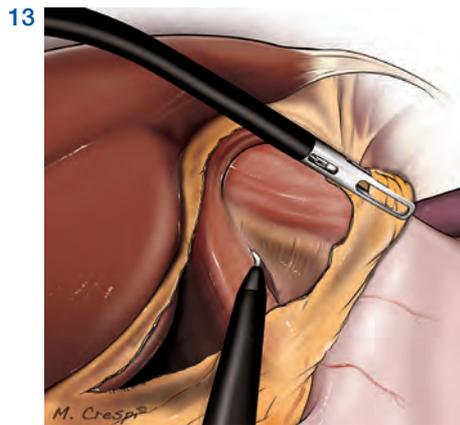
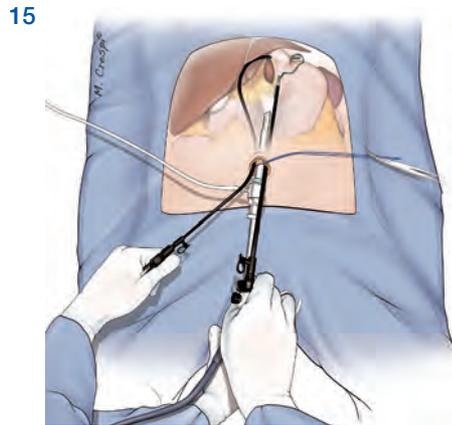
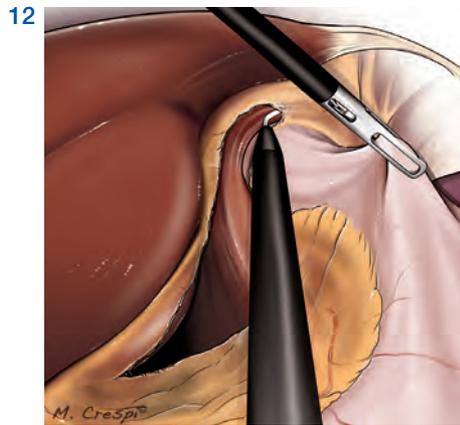
The suture is adjusted to maintain a tight seal around the 5-mm tools and the 11-mm trocar, and opened only for exchanging instruments and evacuating smoke created during the dissection.

The operating room table is placed in a reverse Trendelenburg position.

The distal curve of the grasper is used to retract the left liver lobe, simultaneously exposing the opening of the hepatogastric ligament on the lesser curvature (Figures 8, 9).

If insufficient exposure of the hiatal region is found, a straight 1.8-mm trocarless grasping forceps is inserted percutaneously by a skin puncture (created by a Veress needle) under the xyphoid access, placing the distal tip under the left liver lobe and against the upper right diaphragmatic crus (Figures 10, 11).

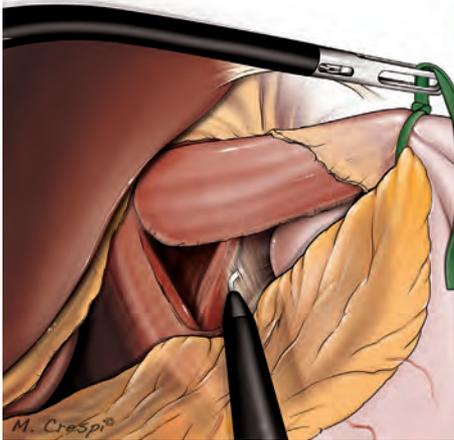




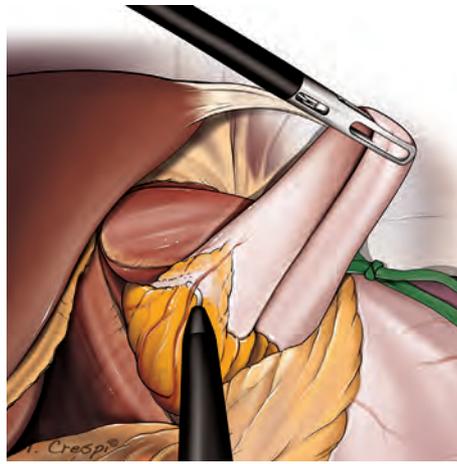
The hepatogastric ligament is sectioned close to the liver segment 1, going in the direction of the right phrenogastric ligament. If a vascular anomaly is found, the vessels are cut between 5-cm clips applied by the straight device. The right phrenogastric ligament is incised, dividing its anterior and posterior sheets (Figure 12). The right crus is freed from bottom to top (Figure 13).

The left phrenogastric ligament is incised (Figure 14), exposing the left crus. The lower esophagus is freed, encircled and suspended by a piece of cotton tape using the bicurved grasping forceps (Figures 15, 16).

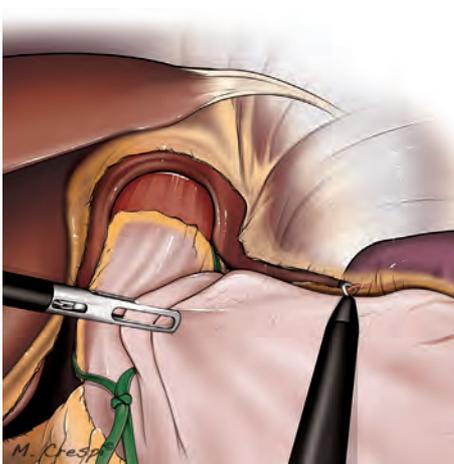
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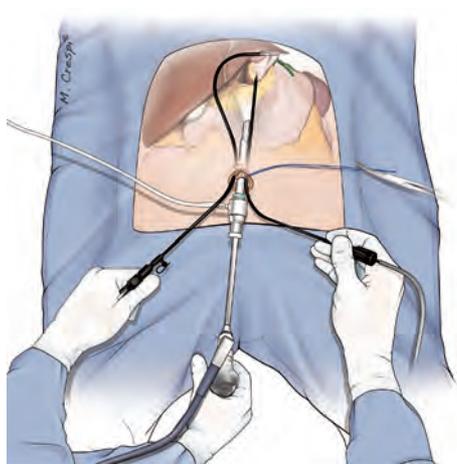
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Thanks to this maneuver, both crura under the esophagus can be better exposed and freed (Figure 17).

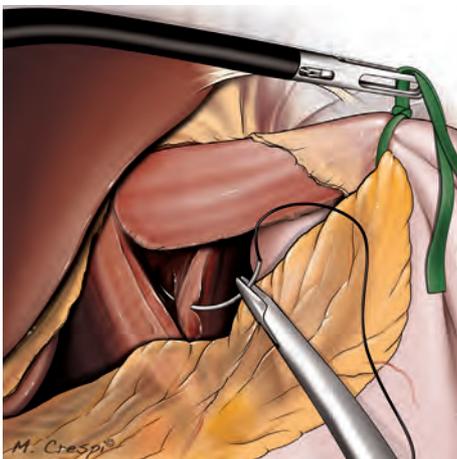
Because of the distinctive shape of the curved instruments, the scope never appears to conflict with the instruments' tips, and interference between the surgeon's hands and the scope is avoided.

The operating room table is maintained in a reverse Trendelenburg position with an increased right-sided tilt, permitting an increased exposure of the splenic region. The gastrosplenic ligament is incised starting from the previous dissection of

the left phrenogastric ligament and proceeding laterally, until the first short gastric vessel is reached (Figure 18).

Then, the operating room table is repositioned without any tilt, maintaining the reverse Trendelenburg position, moving behind the lower esophagus, the upper part of the gastric fundus. The other short gastric vessels are dissected just "à la demande", giving more slack to the wrap, using the monocurved coagulating hook (Figures 19, 20) or monocurved bipolar forceps and scissors.

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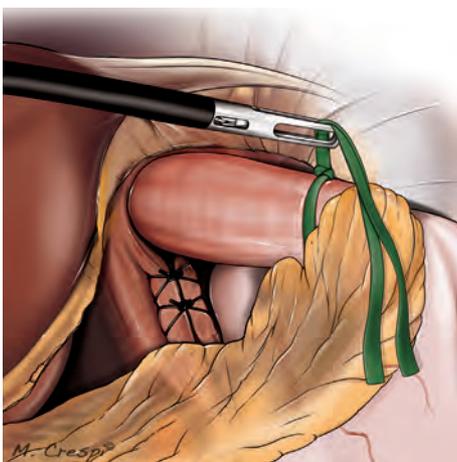


Once the wrap appears well freed, a cruraplasty is performed. The lower esophagus, surrounded by the cotton tape, is taken-up by the bicurved grasper, whereas the bicurved needle holder is used to place some sutures at the crura (Figure 21).

Silk 2/0 figure 8 sutures are used to close the crura (Figure 22). This maneuver is completed without the orogastric bougie in place.

After finishing the cruraplasty, the anesthesiologist inserts a 34-French orogastric bougie for closure of the wrap.

22



Nissen

A floppy 360° fundoplication is performed using silk 2/0 sutures, intracorporeal sutures and knotting technique, under comfortable ergonomic positions (Figure 23). One gastro-gastric suture and one gastro-eso-gastric suture are initially

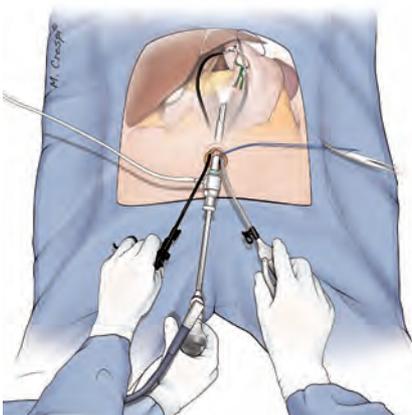
placed (Figure 24). Then, two other inferior gastro-esophageal sutures are applied on both sides of the lower esophagus (Figures 25, 26). The sutures are cut using the monocurved scissors (Figure 26).

Continued on page 46.

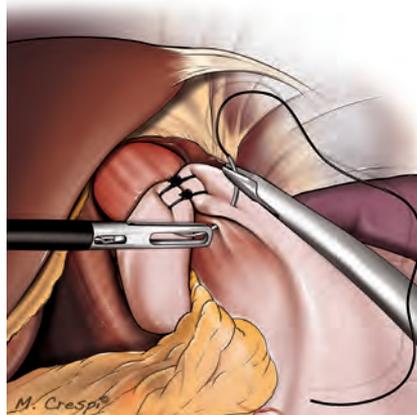


Click to watch the corresponding video
Nissen Fundoplication

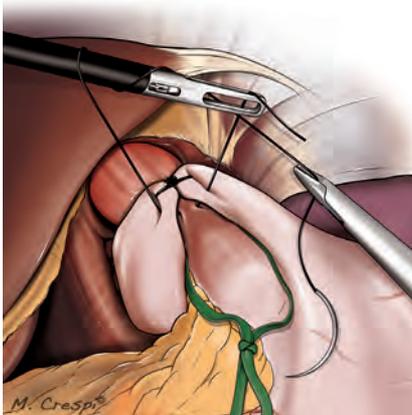
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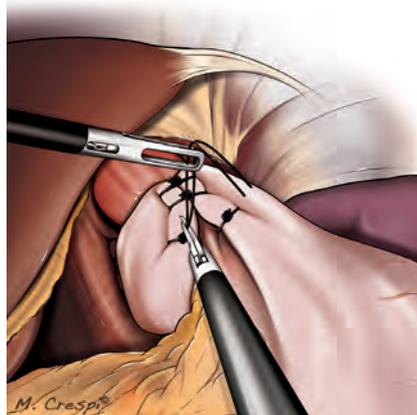
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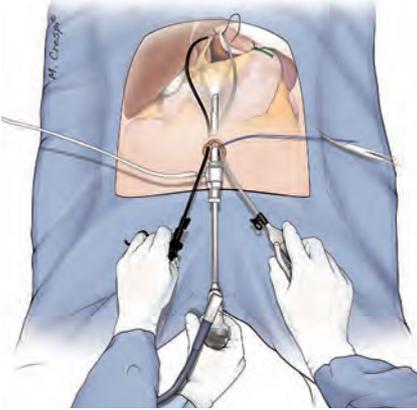
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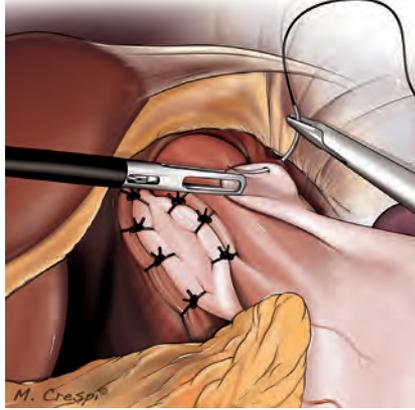
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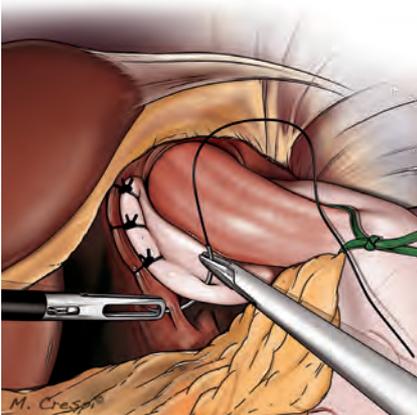
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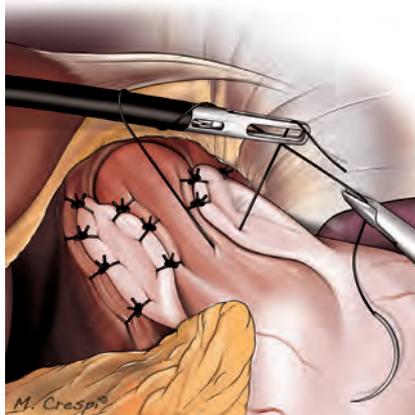
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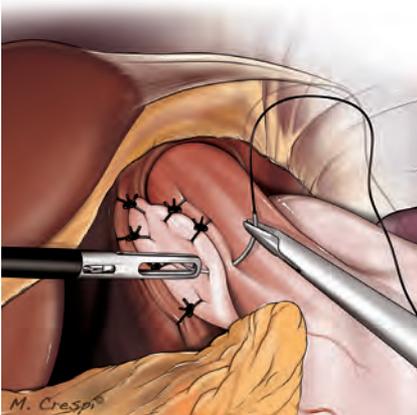
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29



Toupet

A 270° fundoplication is performed using silk 2/0 sutures with intracorporeal sutures and knotting technique, under satisfying ergonomic positions (Figure 27). The right side of the wrap is fixed to the right crura by 4 simple sutures (Figure 28), starting with the first one at the apex of the right crura (Figures 27, 28). Then, the right side of the wrap is anchored to the lower esophagus by 3 other simple sutures (Figure 29). Similarly, the left side of the wrap is first fixed to the left crura by 2 simple sutures (Figure 30), and finally to the lower esophagus by 3 more simple sutures (Figure 31).



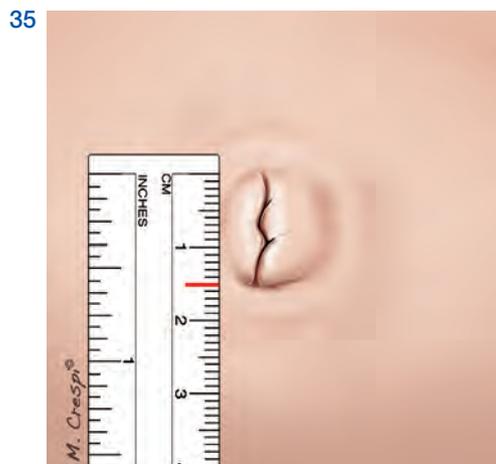
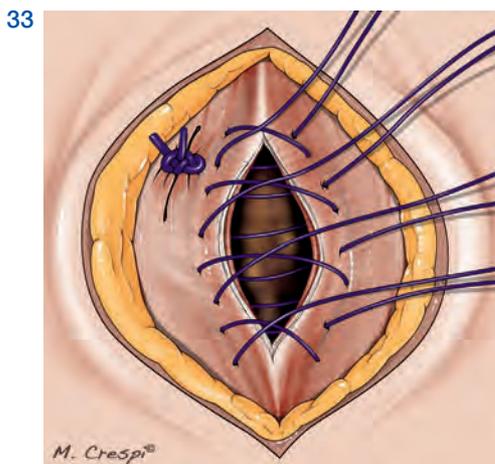
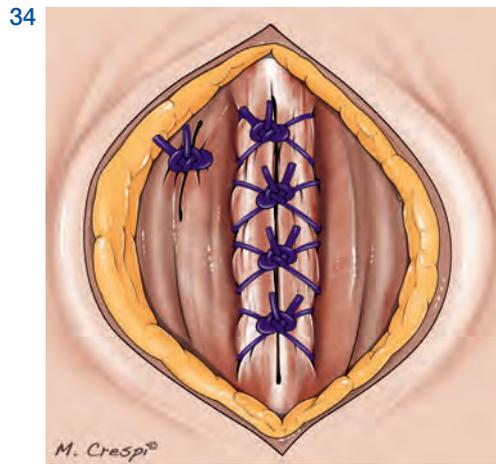
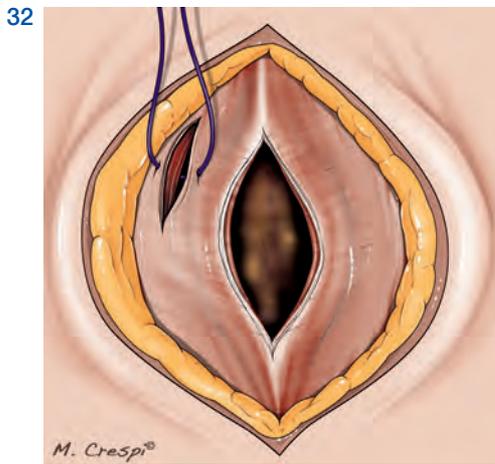
Click to watch the corresponding video
Toupet Fundoplication

End of Both Procedures

The operating room table is positioned as it was at the beginning of the procedure, without any Trendelenburg position and tilt.

The orogastric bougie, the piece of cotton tape, the sutures and all the instruments are removed under view. The bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

After having removed the 11-mm trocar and the umbilical purse-string suture, Vicryl 1 sutures are used to close the access. The separate fascia opening accommodating the bicurved grasping forceps is first closed (Figure 32); then, the main access is closed by figure 8 sutures (Figures 33, 34). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 35).



Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

A gastrografin swallow check is scheduled on the 1st post-operative day. If negative, the patient is allowed to drink water and after 24 hours to tolerate a liquid diet. If there are no complications, the patient can be discharged.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the gastroenterologist.

3.2 ESOPHAGEAL MYOTOMY

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Post-operative Care

3.2 ESOPHAGEAL MYOTOMY

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

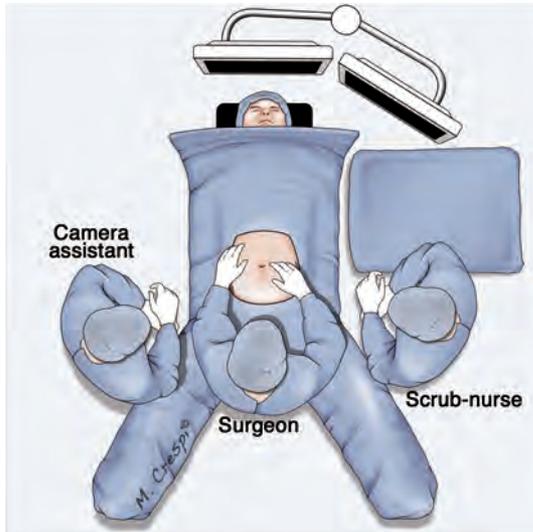
General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after intubation.

Antibiotic prophylaxis is applied as well.

Tools

- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needle-holders, two tissue forceps, two Farabeuf retractors, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), one 20 cm cotton tape, five silk 2/0 (silk 2/0, round tip, 1/2c, 26 mm), four Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable rigid mandril of 6-mm trocar
- one straight 10-mm, 30° regular length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps III)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable bicurved needle holder (DAPRI needle holder II)
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one reusable straight 5-mm clip applier
- one non-reusable 34-French orogastric bougie
- one gastroscope

1



Patient and Team Positioning

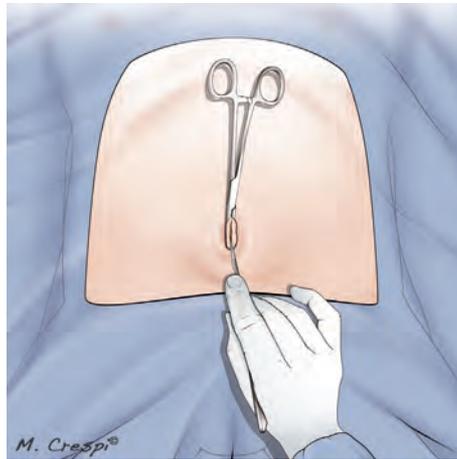
The patient is placed in a supine position, with the arms alongside the body and the legs apart. The patient's arms, ankles, and legs are secured and protected.

The surgeon stands between the patient's legs, and the camera assistant to the patient's right. The scrub-nurse stands to the patient's left. The video monitor is placed in front of the surgeon and camera assistant ([Figure 1](#)).

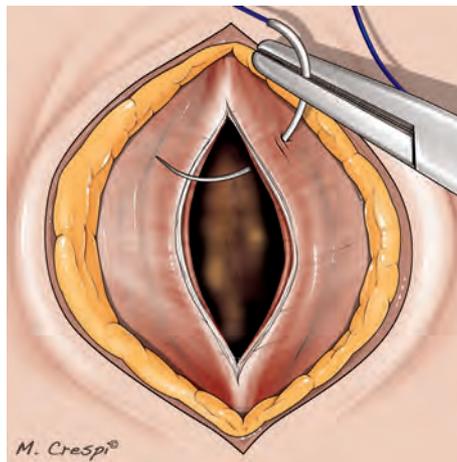
Technique

The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (Figure 2). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 3, 4). This suture is kept externally with a Pean-Rochester curved forceps.

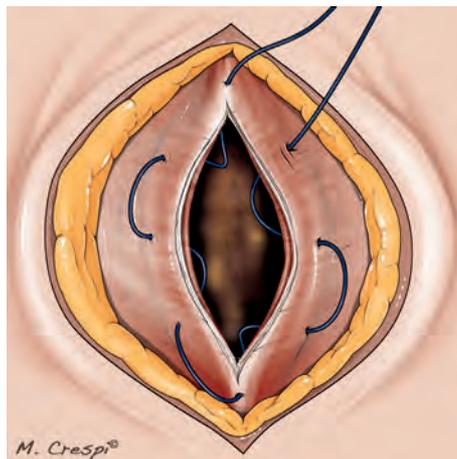
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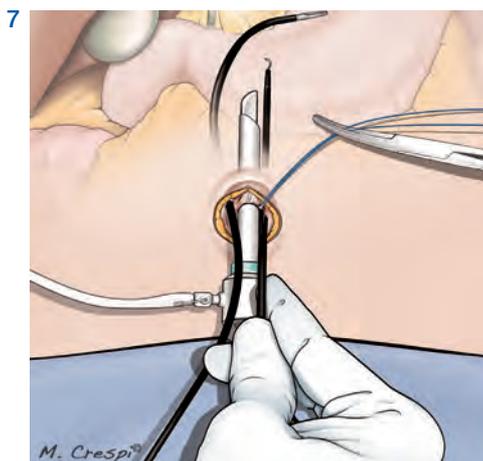
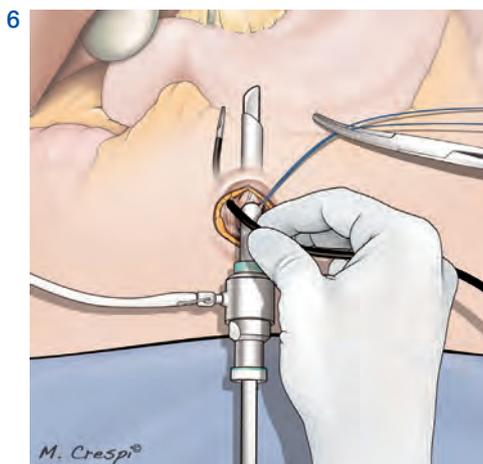
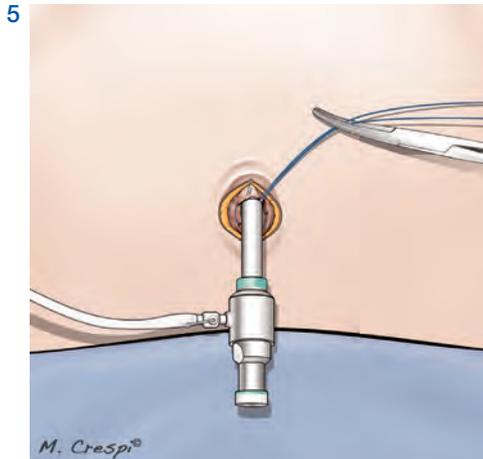


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An 11-mm trocar is introduced into the peritoneal cavity inside the purse-string suture, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar, and curved instruments are inserted into the abdomen through the umbilical scar without trocars.

The bicurved grasping forceps is inserted through a separate fascia window, created by a mandril of 6-mm trocar, approximately 5 mm outside the purse-string suture at the 10 o'clock position with respect to the patient's head (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

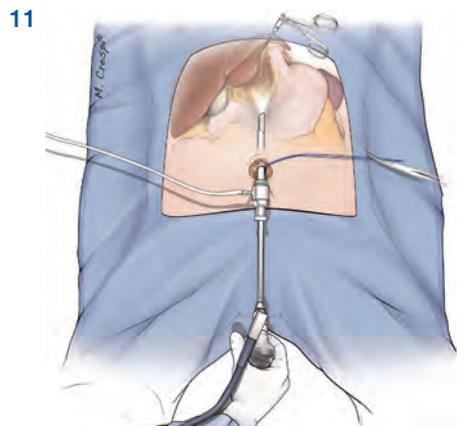
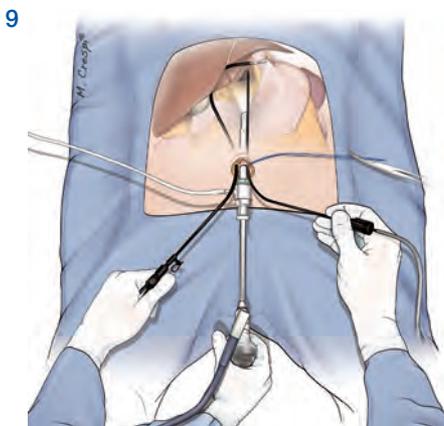
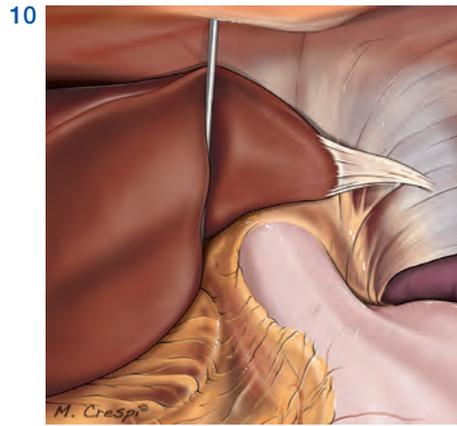
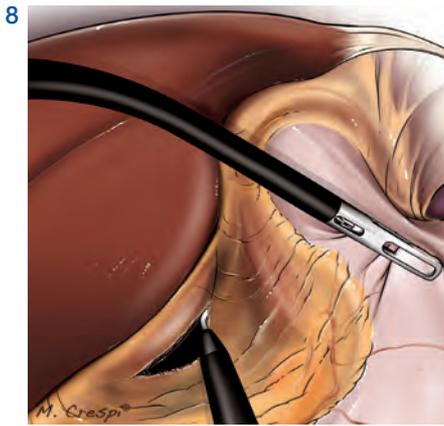
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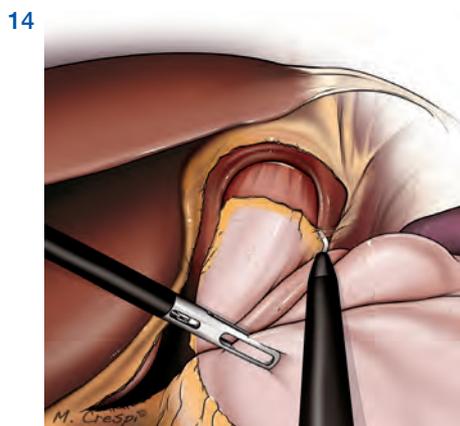
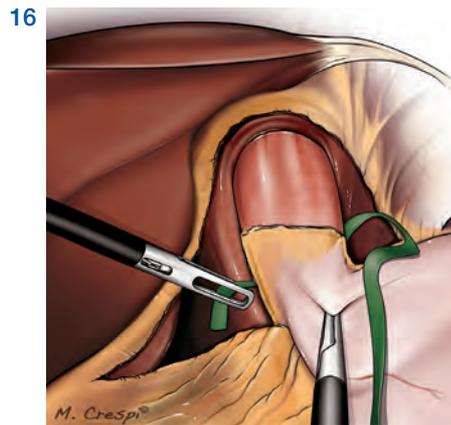
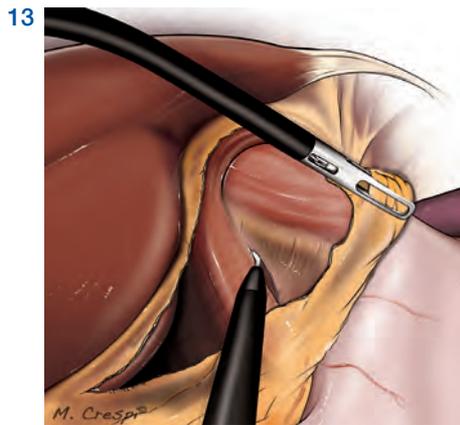
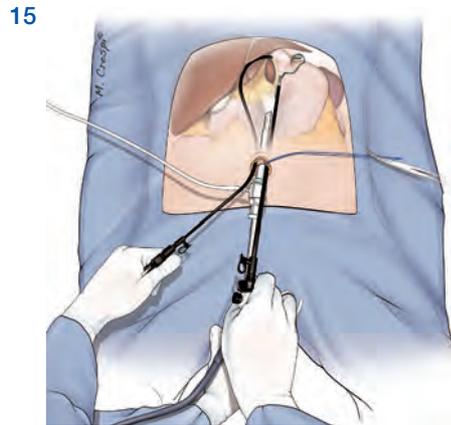
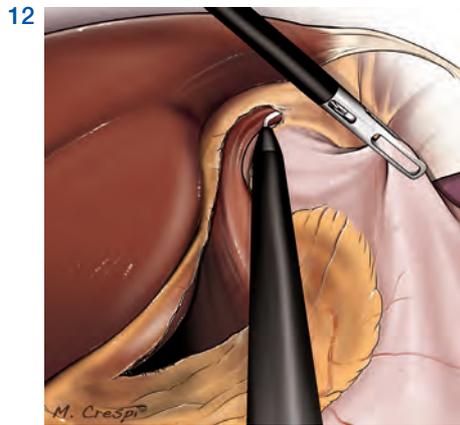
The suture is adjusted to maintain a tight seal around the 5-mm tools and the 11-mm trocar, and opened only for exchanging instruments and evacuating smoke created during the dissection.

The operating room table is positioned in a reverse Trendelenburg position.

The distal curve of the grasper is used to retract the left liver lobe, simultaneously exposing the opening of the hepatogastric ligament on the lesser curvature (Figures 8, 9).

If an insufficient exposure of the hiatal region is found, a straight 1.8-mm trocarless grasping forceps is inserted percutaneously by a skin puncture (created by a Veress needle) under the xyphoid access, placing the distal tip under the left liver lobe and against the upper right diaphragmatic crus (Figures 10, 11).





The hepatogastric ligament is sectioned close to the liver segment 1, going in the direction of the right phrenogastric ligament. If a vascular anomaly is found, the vessels are cut between 5-cm clips, applied by the straight device. The right phrenogastric ligament is incised, dividing its anterior and posterior sheets (Figure 12). The right crus is freed from bottom to top (Figure 13).

The left phrenogastric ligament is incised (Figure 14), exposing the left crus. The lower esophagus is freed, encircled and suspended by a piece of cotton tape using the bicurved grasping forceps (Figures 15, 16).

Thanks to this maneuver, both crura under the esophagus can be better exposed and freed (Figure 17).

Because of the distinctive shape of the curved instruments, the scope never appears to conflict with the instruments' tips, and interference between the surgeon's hands and the scope is avoided.

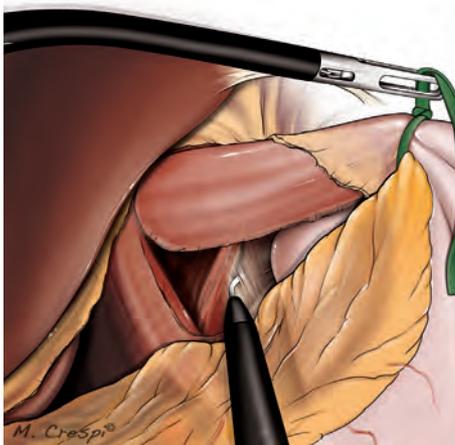
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the left phrenogastric ligament, and proceeding laterally until the first short gastric vessel is reached (Figure 18).

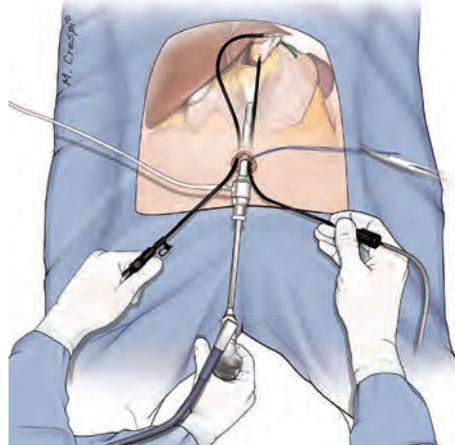
Then, the operating room table is repositioned without any tilt, maintaining the reverse Trendelenburg position, moving behind the lower esophagus, the upper part of the gastric fundus.

The other short gastric vessels are dissected just "à la demande", giving more slack to the wrap, using the monocurved coagulating hook (Figures 19, 20) or monocurved bipolar forceps and scissors.

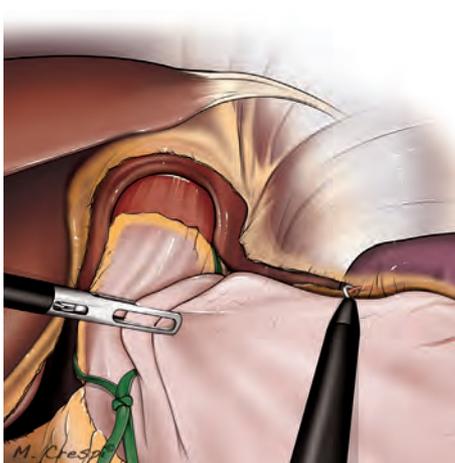
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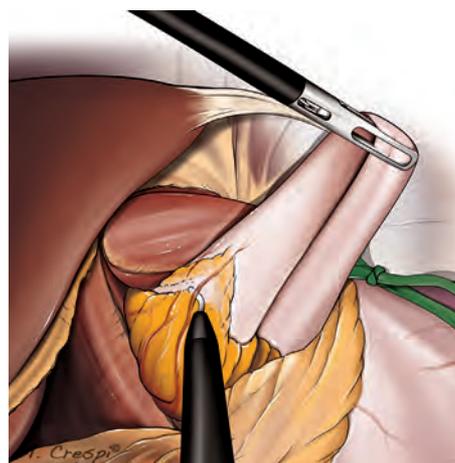
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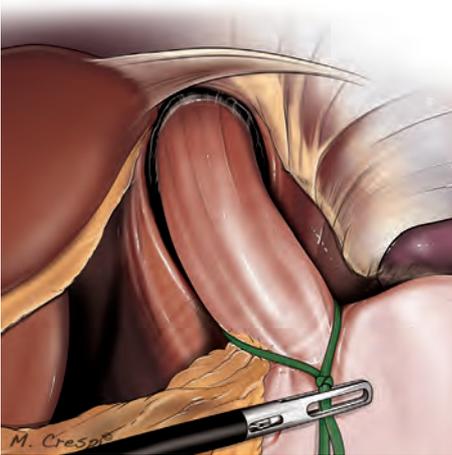
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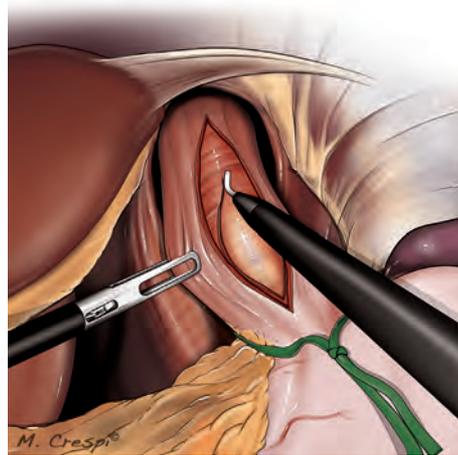
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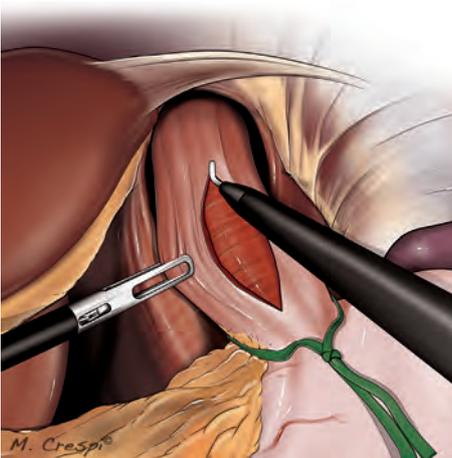
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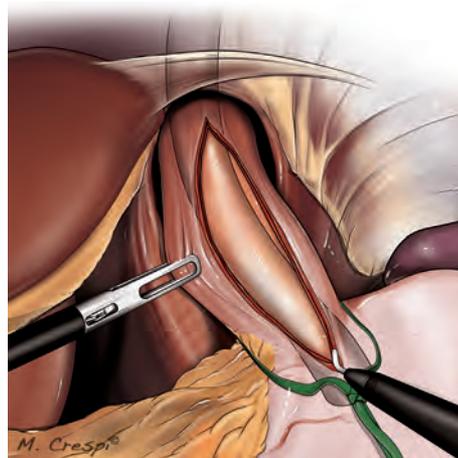
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The lower esophagus is mobilized into the mediastinum until the inferior pulmonary vein is evident, proceeding initially on the right side and posteriorly, and then on the left side and anteriorly (Figure 21). Once the lower esophagus has been mobilized, the anterior muscle fibers are divided using the monopolar coagulating hook (Figure 22). This dissection starts at the level of the gastroesophageal junction and continues superiorly for 5-6 cm, dissecting

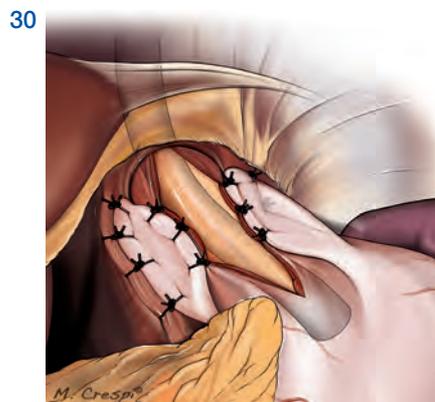
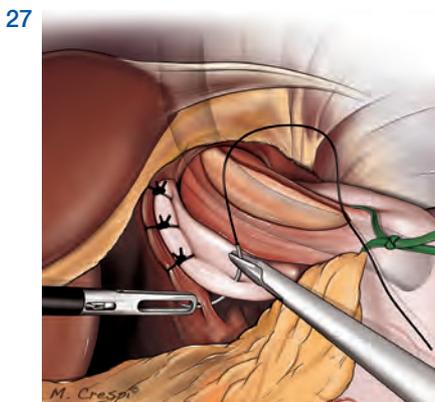
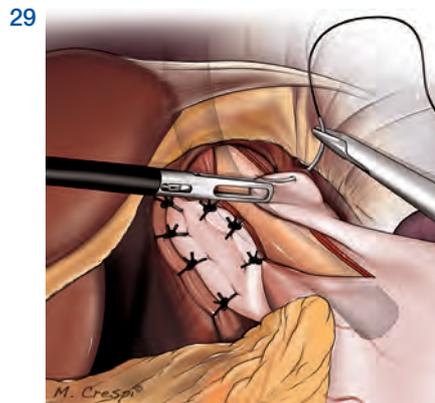
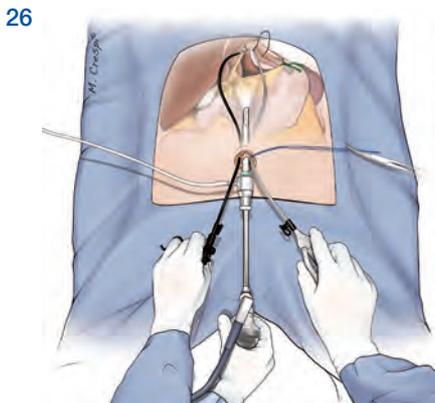
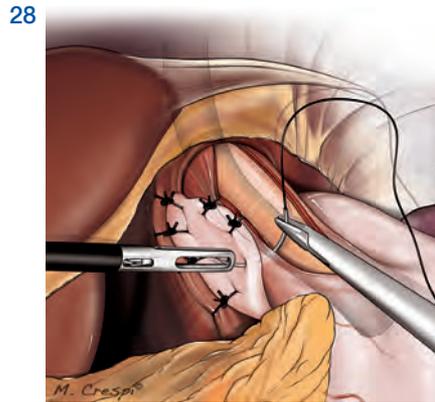
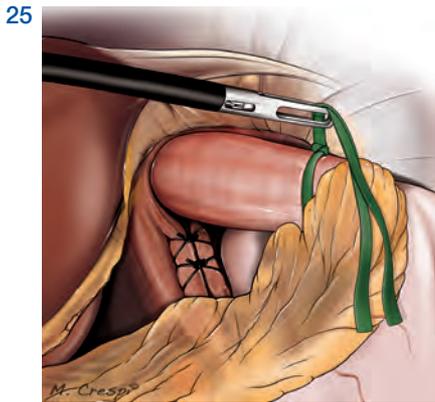
completely the longitudinal muscular fibers (Figure 22) and the deeper circular fibers (Figure 23).

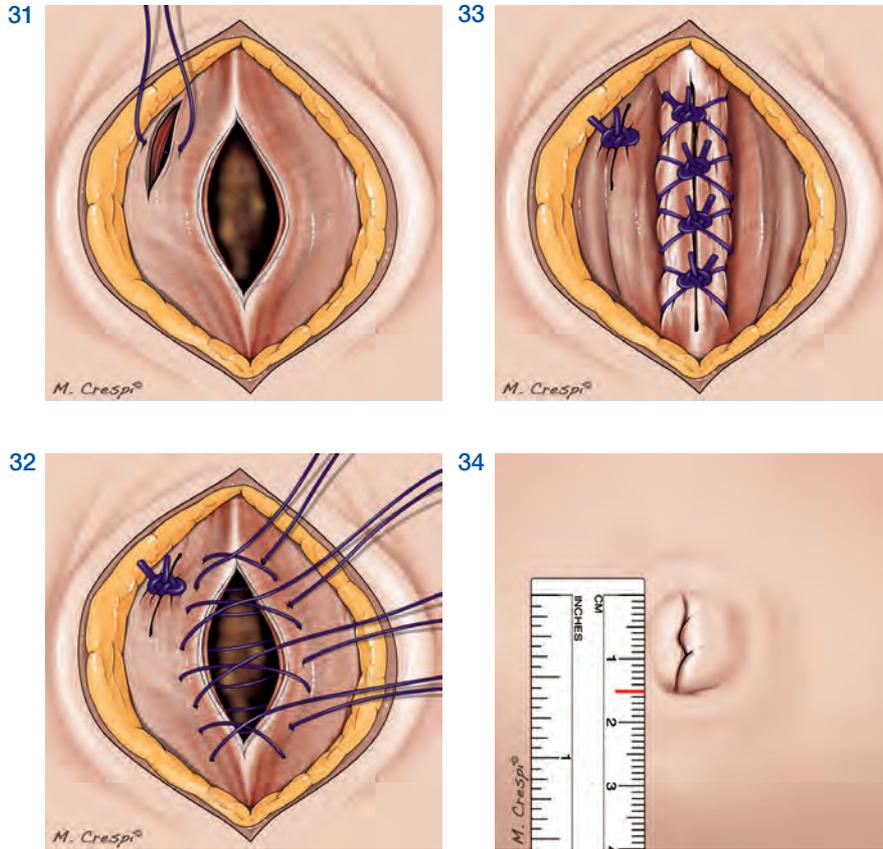
Once the esophageal mucosa is well exposed and the muscle layers appear cut on both sides of the esophagus, the dissection continues inferiorly for 2-3 cm on the gastric surface (Figure 24). Finally, the gastroscopic control is adopted to check the opening intraluminally (Figure 24).

At the end of the esophageal myotomy, cruraplasty with silk 2/0 sutures is performed using the bicurved grasper and the bicurved needle holder (Figure 25).

Under gastroscopic control, a 270° fundoplication (Toupet) is performed using silk 2/0 sutures with intracorporeal sutures and knotting technique, under comfortable ergonomic positions (Figure 26). The right side of the wrap is fixed to the right crura by 4 simple sutures (Figure 27), starting with

the first one at the apex of the right crura (Figures 26, 27). Then, the right side of the wrap is anchored to the right esophageal muscular layers by 3 other simple sutures (Figure 28). Similarly, the left side of the wrap is first fixed to the left crura by 2 simple sutures (Figure 29), and later to the left esophageal muscular layers by 3 other simple sutures (Figure 30). Finally, the esophageal mucosa will appear covered by the left liver segment 2, once all the instruments have been retrieved.





At the end, the operating room table is positioned as it was at the beginning of the procedure, without any Trendelenburg position and tilt.

The gastroscope, the piece of cotton tape, the sutures and all the instruments are removed under view. The bicurved grasping forceps is retrieved following its curves at 45° with the respect to the abdominal wall.

After having removed the 11-mm trocar and the umbilical purse-string suture, Vicryl 1 sutures are used to close the access. The separate fascia accommodating the bicurved grasping forceps is first closed (Figure 31); then, the main access is closed by figure 8 sutures (Figures 32, 33). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 34).

Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

A gastrografin swallow check is scheduled on the 2nd post-operative day. If negative, the patient is allowed to drink water and after 24 hours to tolerate a liquid diet. If there are no complications, the patient can be discharged.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the gastroenterologist.

3.3 GASTRIC WEDGE RESECTION

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

With Stomach Opening

Without Stomach Opening

Post-operative Care

3.3 GASTRIC WEDGE RESECTION

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat at least 8 hours prior to the procedure.

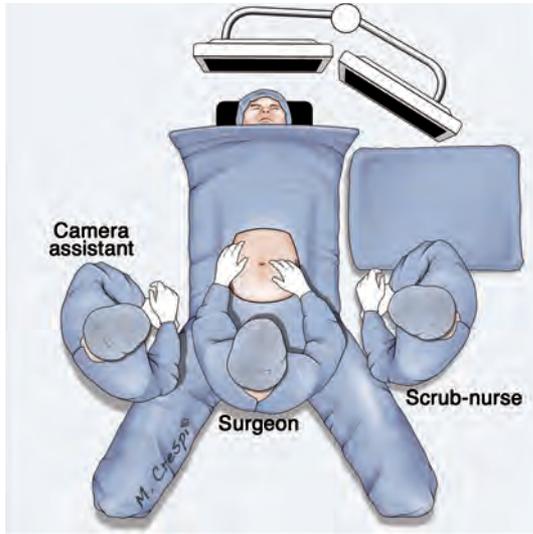
General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after intubation.

Antibiotic and TVP prophylaxis are applied as well.

Tools

- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needle-holders, two tissue forceps, two Farabeuf retractors, one purse-string suture device (DAPRI purse-string suture device), one monopolar electrode
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), one Polyglactin 2/0 (Vicryl 2/0, round tip, 1/2c, 36 mm), two Polydioxanon 2/0 (PDS 2/0, round tip, 1/2c, 26 mm), five Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable 13-mm rigid trocar or one non-reusable 12-mm trocar
- one reusable 6-mm flexible trocar and rigid mandril (DAPRI flex trocar)
- one straight 10-mm, 30° regular length scope
- one straight 5-mm, 30° long length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps III)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable bicurved needle holder (DAPRI needle holder II)
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one non-reusable straight 5-mm harmonic shears or other similar devices
- one non-reusable articulating 60 linear stapler
- one non-reusable custom-made plastic bag
- one nasogastric tube
- one gastroscope

1



Patient and Team Positioning

The patient is placed in a supine position, with the arms alongside the body and the legs apart. The patient's arms, ankles, and legs are secured and protected.

The surgeon stands between the patient's legs, and the camera assistant to the patient's right. The scrub-nurse stands to the patient's left. The video monitor is placed in front of the surgeon and camera assistant (Figure 1).

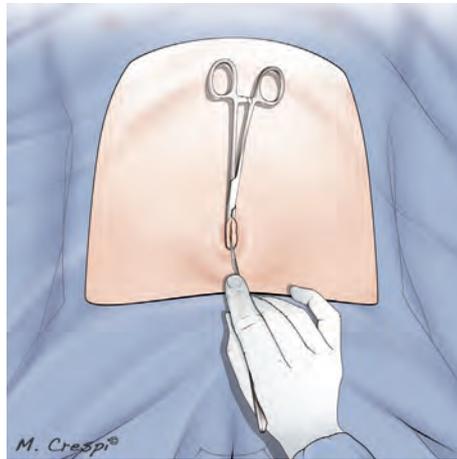
Technique

The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (Figure 2). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 3, 4). This suture is kept externally using a Pean-Rochester curved forceps.

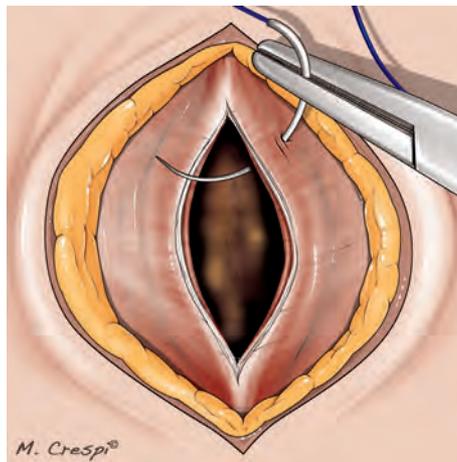


[Click to watch the corresponding video](#)
[Gastric Wedge Resection](#)

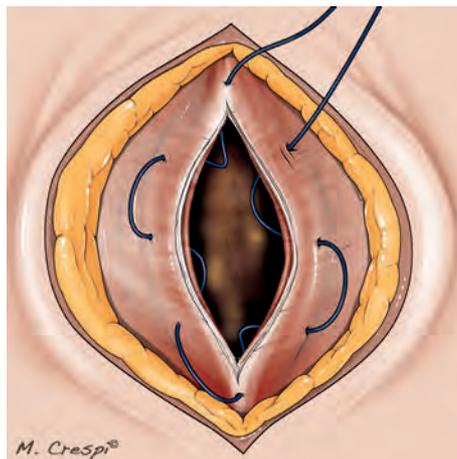
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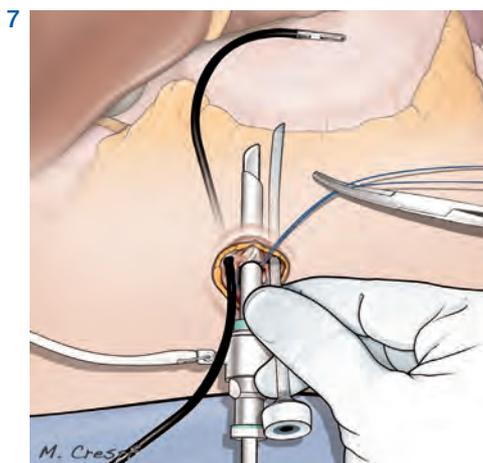
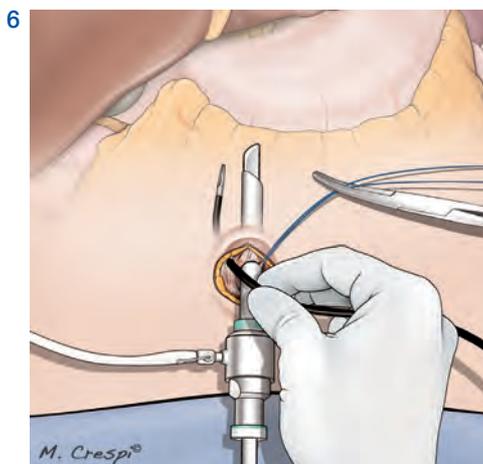
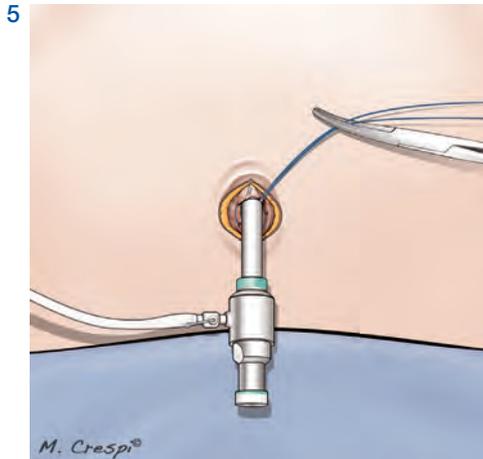


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An 11-mm trocar (or a 12-mm non-reusable trocar) is introduced into the peritoneal cavity inside the purse-string suture, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar.

The bicurved grasping forceps is inserted without trocar through a separate fascia window, created by a mandril of 6-mm trocar, approximately 5 mm outside the purse-string suture at the 10 o'clock position with respect to the patient's head (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

The other instruments, like the monocurved and bicurved needle holders, the monocurved scissors, the monocurved suction and irrigation cannula, the straight 5-mm harmonic shears or other similar devices, and the straight grasping forceps are introduced through a 6-mm flexible trocar positioned at some of 5 mm outside the purse-string suture at the 2 o'clock position with respect to the patient's head (Figure 7).

The operating room table is placed in a reverse Trendelenburg position.

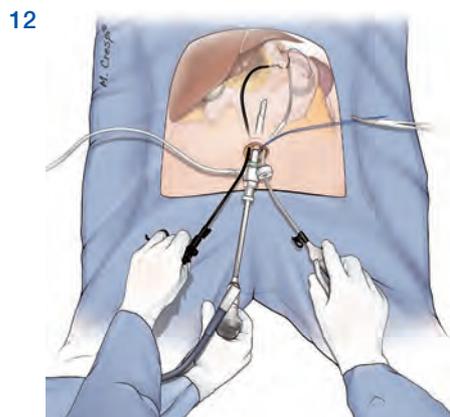
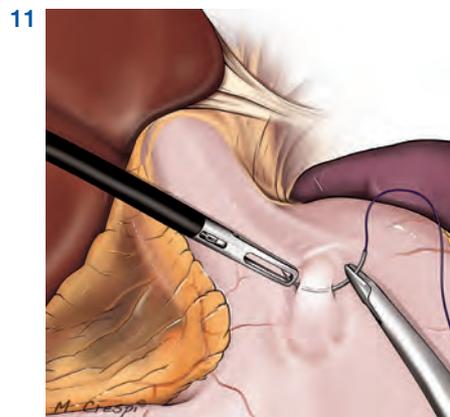
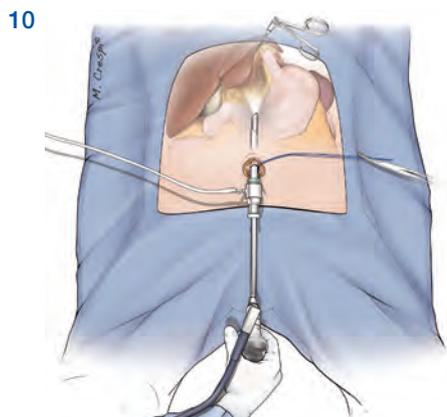
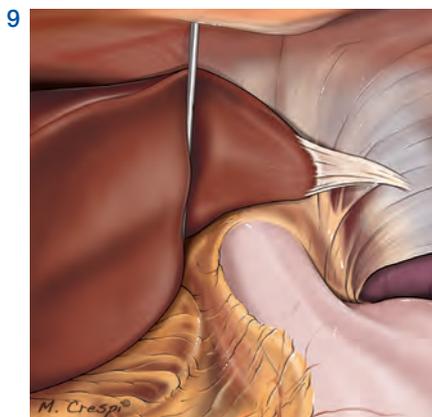
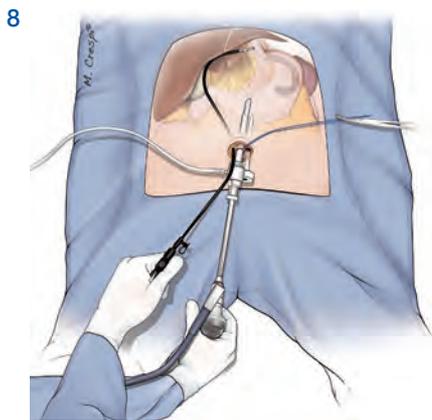
The distal curve of the grasper is used to retract the left liver lobe (Figure 8) but, if there is an insufficient exposure of the gastric region, a straight 1.8-mm trocarless grasping forceps will be inserted percutaneously through a skin puncture (created by a Veress needle) under the xyphoid access (Figures 9, 10).

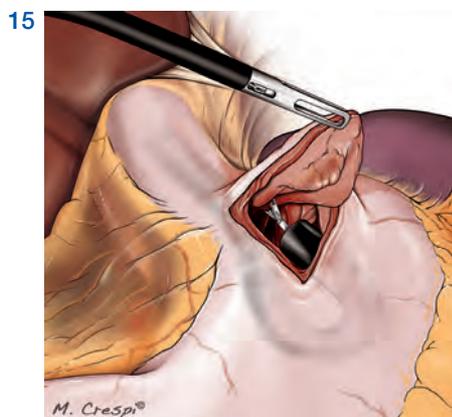
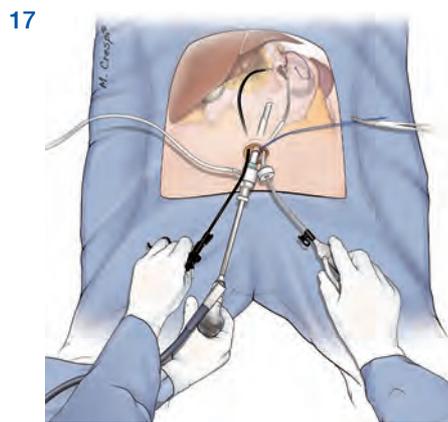
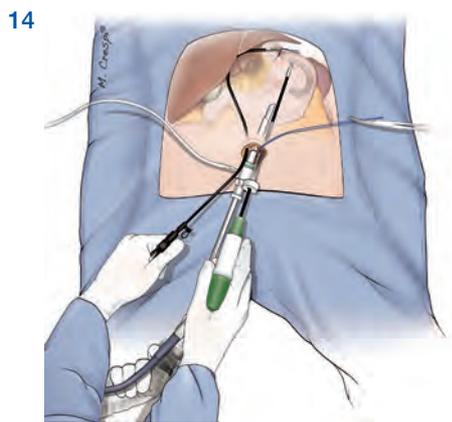
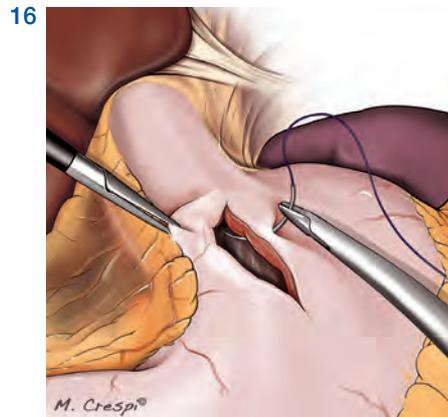
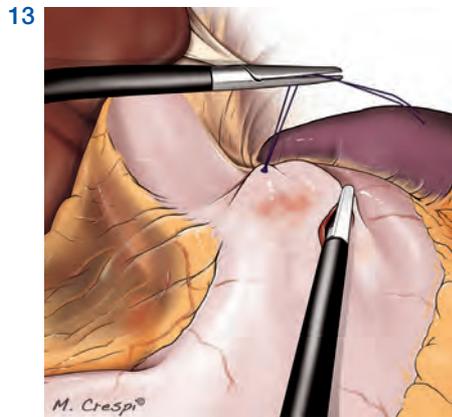
Peri-operative gastroscopy is absolutely necessary to localize the gastric lesion

intraluminally (Figure 8), as well as to ensure gastric closure at the end of the gastric resection.

A superficial simple suture by Vicryl 2/0 is placed in the center of the lesion in order to retract the gastric wall (Figure 11), using the bicurved grasping forceps and one of the curved needle holders (Figure 12).

If the gastric wedge resection includes the opening of the gastric wall, the straight harmonic shears or similar devices are used (ref. with stomach opening), otherwise the gastric wall remains closed and the resection is performed using firings of linear stapler (ref. without stomach opening).





With Stomach Opening

The suture placed in the center of the lesion is taken up by the bicurved grasping forceps, and the gastric wall is resected around the lesion using harmonic shears or similar devices (Figures 13, 14), ensuring that safe distal margins are maintained. The gastroscopic grasper can be useful in delimiting the safe margins of the resection (Figure 15).

Two converging PDS 2/0 running sutures are used to close the gastric openings. Preformed knots at the extremity of each suture are useful, permitting some intracorporeal sutures to be avoided and decreasing the operative time. The bicurved grasping forceps and the bicurved needle holder are used by the surgeon together with control of the gastroscope intraluminally (Figures 16, 17).

Because of the distinctive shape of the curved instruments, the surgeon works under comfortable ergonomic positions and internal working triangulation is established.

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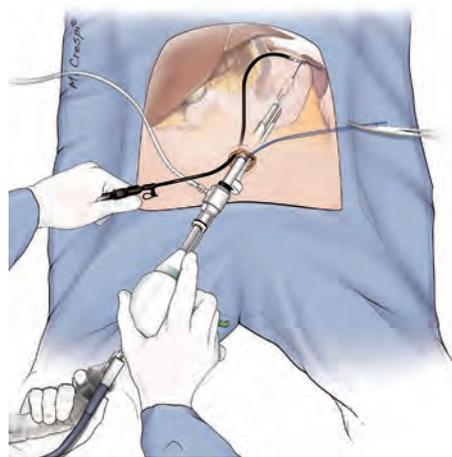
Without Stomach Opening

The 11-mm trocar is replaced by a reusable 13-mm trocar (if the 12-mm non-reusable trocar is inserted at the beginning, this replacement is not needed), in order to accommodate an articulating linear stapler. The 10-mm scope is exchanged for a 5-mm, 30° long scope, which is inserted through the 6-mm flexible trocar at 2 o'clock position (**Figure 18**).

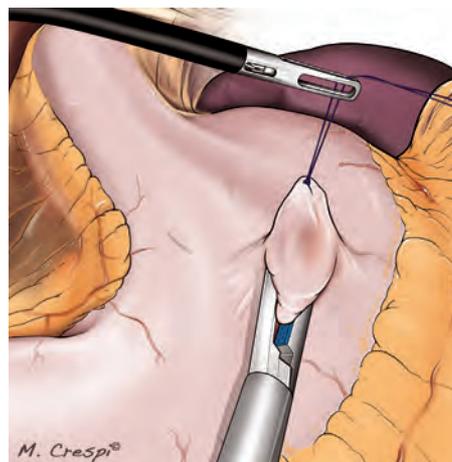
The suture placed in the center of the lesion is taken under tension using the bicurved grasping forceps, allowing placement of a linear stapler at the base of the lesion (**Figure 19**). One or more firings of linear stapler are applied. During this step, the gastroscope is maintained intraluminally for control and, if necessary, the operating room table is adjusted with a right-sided or left-sided tilt, permitting increased exposure of the operative field.

Then, the 11-mm trocar is reinserted in place of the 13-mm trocar, and the 10-mm scope is reused.

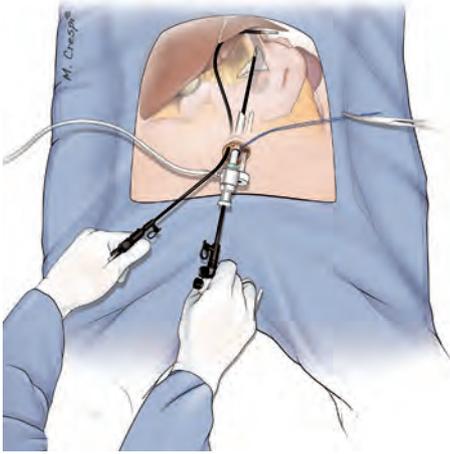
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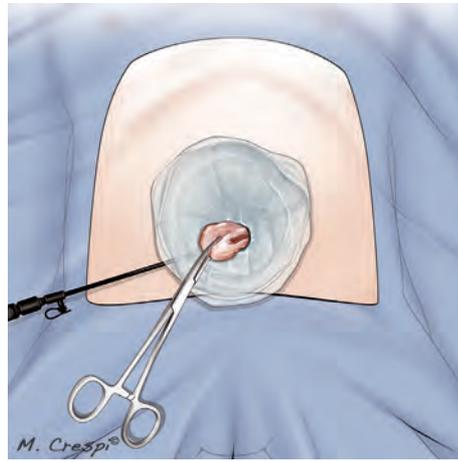
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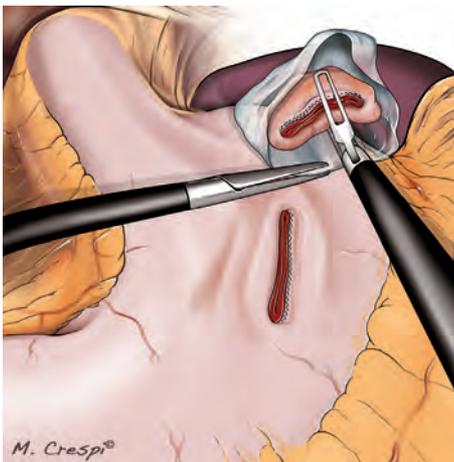
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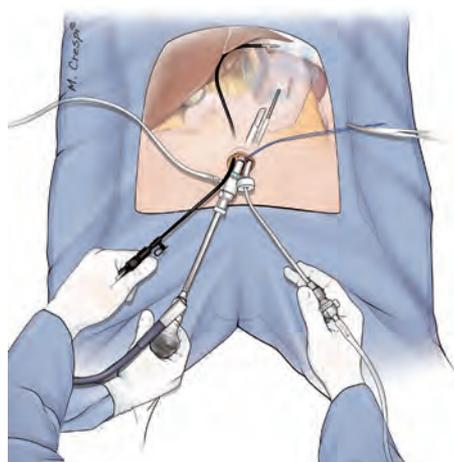
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End of Both Procedures

A custom-made plastic bag is introduced into the abdominal cavity through the central trocar using a straight grasping forceps (Figure 20). The resected lesion is placed inside the bag, using the bicurved grasping forceps and the straight grasping forceps (Figure 21). The bag is removed transumbilically (Figure 22).

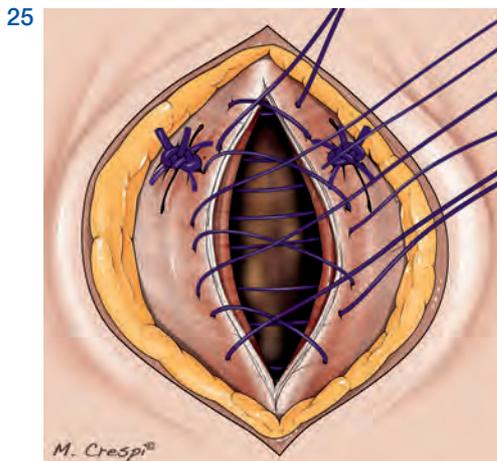
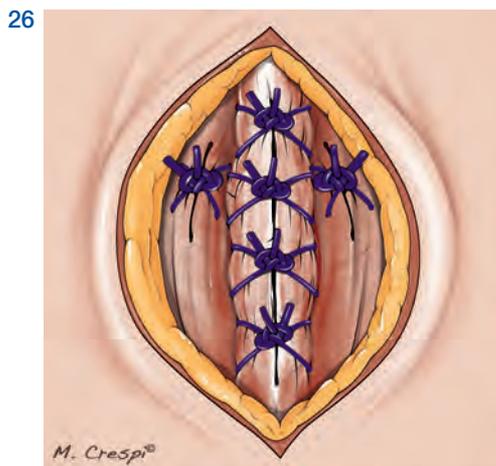
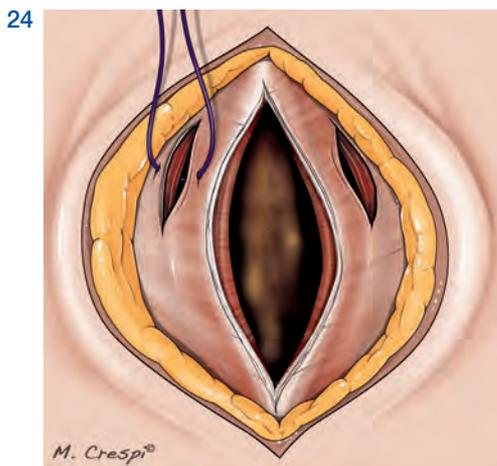
To perform a leak-test, the operating room table is placed in the Trendelenburg position and the gastric surface is immersed under physiologic solution using the monocurved suction and irrigation cannula (Figure 23). Air is insufflated through the gastroscope, permitting evaluation of the hermetic closure of the suture.

No drain is left in the abdominal cavity, and a nasogastric tube is positioned under laparoscopic view by the anesthesiologist.

The operating room table is positioned as it was at the beginning of the procedure, without any Trendelenburg position and tilt.

The bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

After having removed the central trocar, the umbilical purse-string suture and the 6-mm flexible trocar, Vicryl 1 sutures are placed in a figure 8 pattern to close the umbilical access, taking care to close the separate fascia openings for the bicurved grasping forceps and for the flexible trocar (Figures 24, 25, 26). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 27).



Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

Antibiotic prophylaxis is prescribed if necessary and TVP prophylaxis until the discharge of the patient from the hospital. The nasogastric tube is maintained in place until the 4th post-operative day. A gastrografin swallow check is scheduled on the same day and, if negative, the patient is allowed to drink water the day after. A liquid diet is permitted on the 6th post-operative day and, if there are no complications, the patient is allowed to be discharged.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed. Office visits are scheduled at 10 days, 1, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the gastroenterologist.

3.4 VERTICAL GASTRECTOMY (SLEEVE)

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Post-operative Care

3.4 VERTICAL GASTRECTOMY (SLEEVE)

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

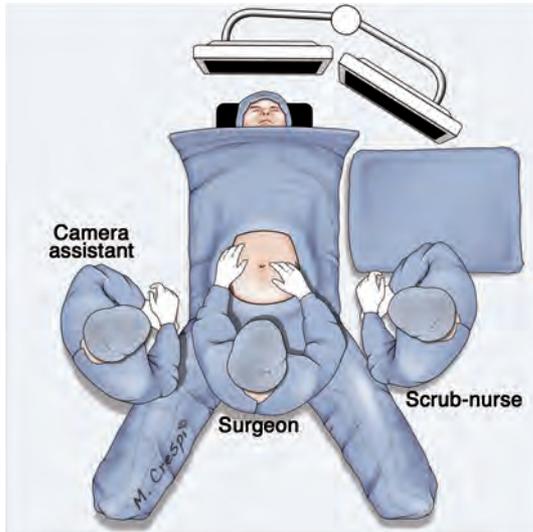
General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine (total body weight) are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after intubation.

Antibiotic and TVP prophylaxis are applied as well.

Tools

- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needleholders, two tissue forceps, two Farabeuf retractors, two Langenbeck retractors, one purse-string suture device (DAPRI purse-string suture device), one monopolar electrode
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), three Polyglactin 2/0 (Vicryl 2/0, round tip, 1/2c, 36 mm), five Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable 13-mm rigid trocar or one non-reusable 12-mm trocar
- one reusable 6-mm flexible trocar and rigid mandril (DAPRI flex trocar)
- one straight 10-mm, 30° regular length scope
- one straight 5-mm, 30° long length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps III)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one non-reusable articulating 60 linear stapler
- one non-reusable 36-French orogastric bougie
- one nasogastric tube

1



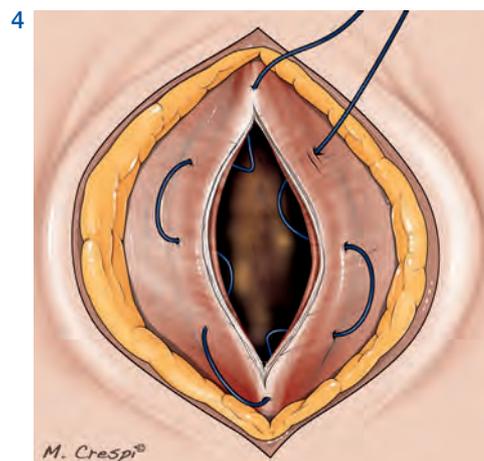
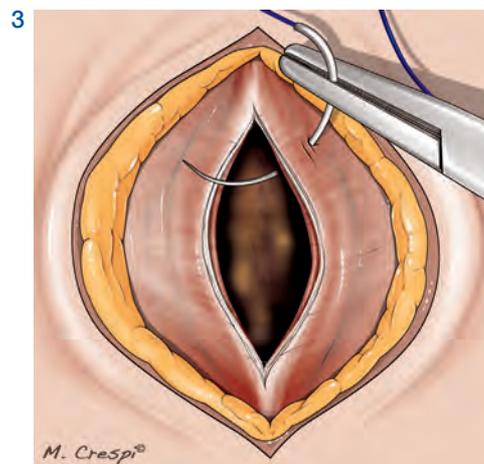
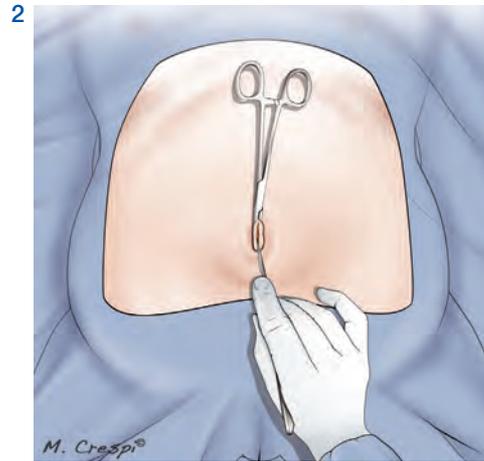
Patient and Team Positioning

The patient is placed in a supine position, with the arms alongside the body and the legs apart. The patient's arms, ankles, and legs are secured and protected.

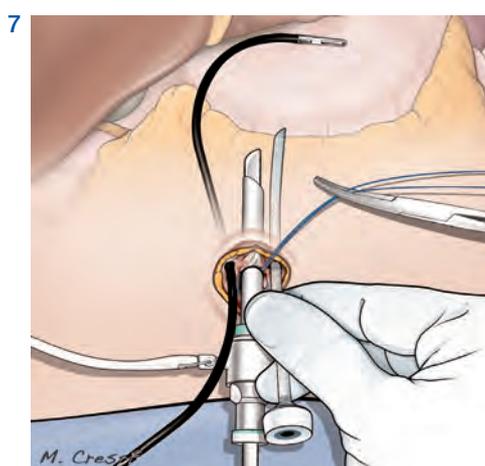
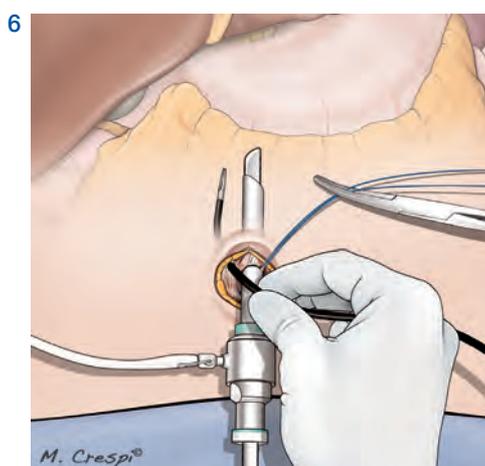
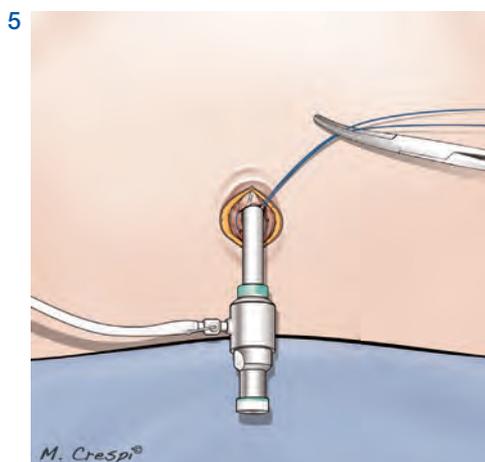
The surgeon stands between the patient's legs, and the camera assistant to the patient's right. The scrub-nurse stands to the patient's left. The video monitor is placed in front of the surgeon and camera assistant ([Figure 1](#)).

Technique

The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (Figure 2). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at the 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 3, 4). This suture is kept externally using a Pean-Rochester curved forceps.



Click to watch the corresponding video
Vertical Gastrectomy (Sleeve)



An 11-mm trocar (or a 12-mm non-reusable trocar) is introduced into the peritoneal cavity inside the purse-string suture, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar.

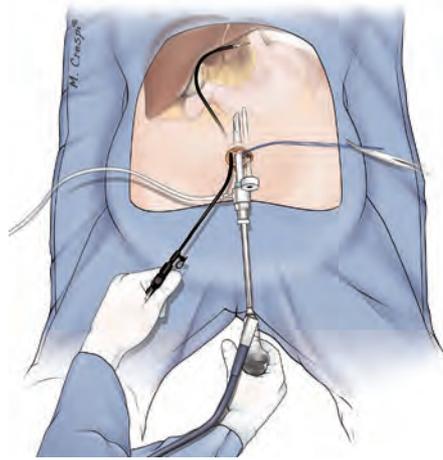
The bicurved grasping forceps is inserted without trocar through a separate fascia window, created by a mandril of 6-mm trocar, approximately 5 mm outside the purse-string suture at the 10 o'clock position with respect to the patient's head (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

The other instruments, like the monocurved coagulating hook, the monocurved bipolar forceps and scissors, the monocurved needle holder, the monocurved scissors, the monocurved suction and irrigation cannula, and the straight grasping forceps are introduced through a 6-mm flexible trocar positioned at some of 5 mm outside the purse-string suture at the 2 o'clock position with respect to the patient's head (Figure 7).

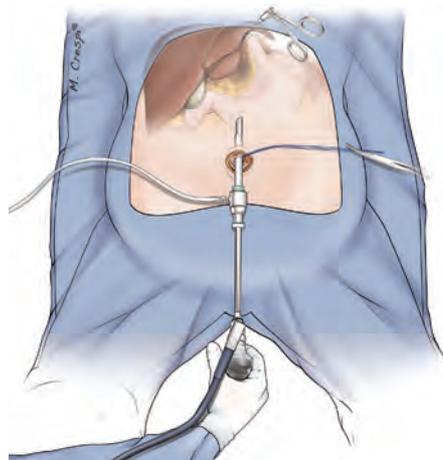
The operating room table is placed in a reverse Trendelenburg position.

The distal curve of the grasper is used to retract the left liver lobe (Figure 8) but, if an insufficient exposure of the gastric region is found, a straight 1.8-mm trocarless grasping forceps can be inserted percutaneously through a skin puncture (created by a Veress needle) under the xyphoid access (Figure 9), placing the distal tip under the left and part of right liver lobes. Another option is to insert a sponge (introduced through the 11-mm trocar) between the left liver lobe and the lesser curvature of the stomach.

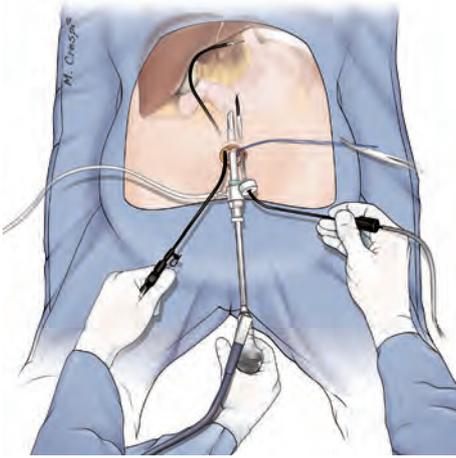
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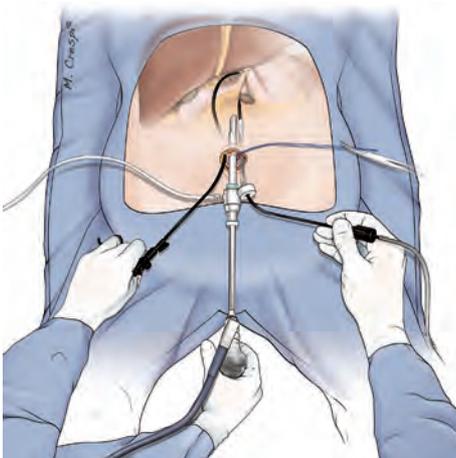
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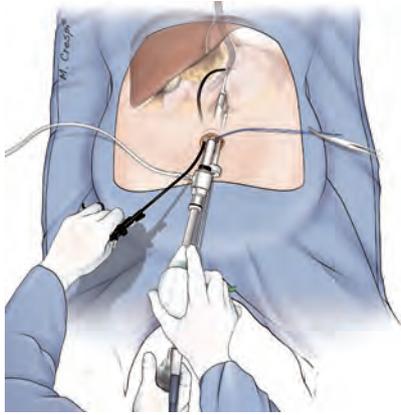


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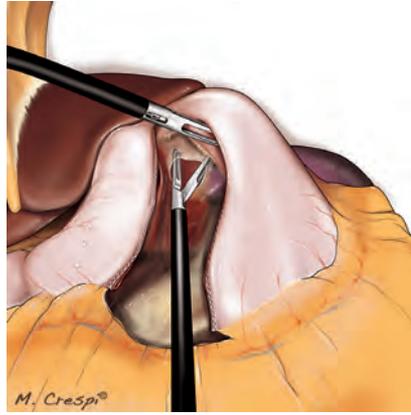


The procedure starts with the delimitation of the gastric resection at the level of the antrum, placing some scores on the anterior gastric surface with the monopolar coagulating hook (Figure 10). The lesser sac is opened 3-5 cm laterally to these scores using the monopolar coagulating hook (Figure 11), or the monopolar bipolar forceps and scissors. The greater omentum is separated from the gastric greater curvature, reaching the previous scores from laterally (Figure 12).

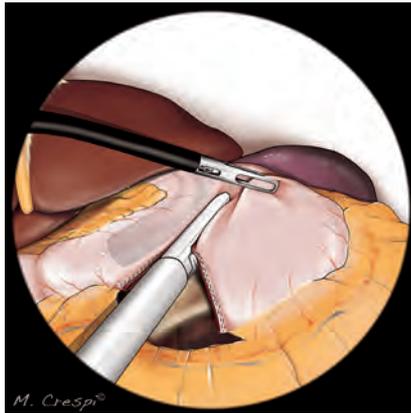
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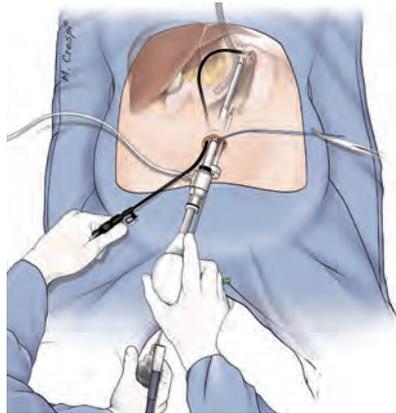
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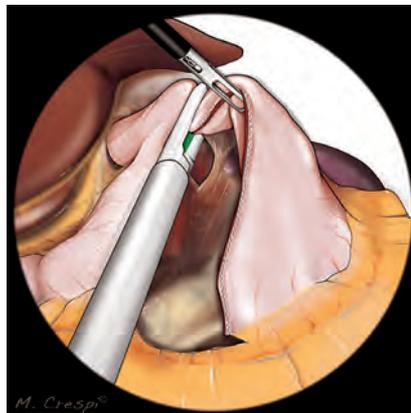
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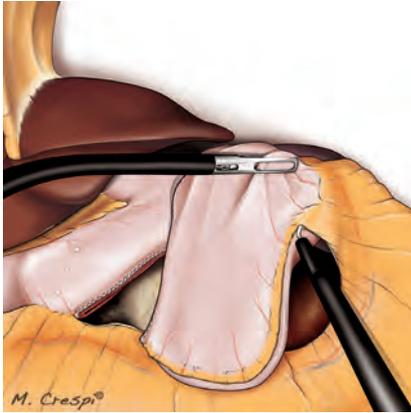
The 11-mm trocar is replaced with a reusable 13-mm trocar (if the 12-mm non-reusable trocar is inserted at the beginning, this replacement is not needed), in order to accommodate an articulating linear stapler. The 10-mm scope is exchanged for a 5-mm, 30° long scope, which is inserted through the 6-mm flexible trocar at the 2 o'clock position (Figure 13).

The linear stapler is placed at the antrum with its distal tip close to the terminations of the gastric vessels on the lesser curvature. The first firing is performed, as well as the second. Before the third firing of the stapler, an orogastric bougie is inserted by the anesthesiologist to reach the first two firings of stapler (Figure 14). Other firings of the linear stapler are placed along the lesser curvature of the stomach, staying just lateral to the orogastric bougie. During this maneuver, the bicurved grasping forceps secure the lateral part

of the stomach (which will be resected) by using moderate tension (Figure 14).

Before the last two firings of the linear stapler, the operating room table is adjusted with a right-sided tilt, and the angle of His is freed from bottom to top, creating a retrogastric tunnel by a straight grasping forceps (Figure 15). The last firings of the linear stapler are performed (Figures 16, 17).

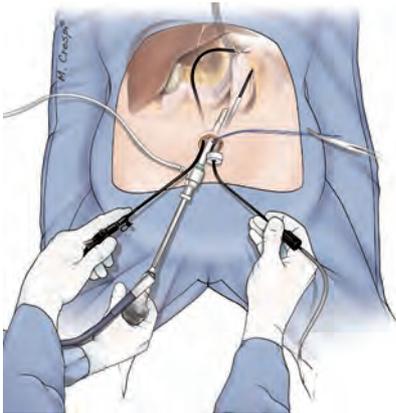
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The 13-mm trocar is replaced by the 11-mm trocar, together with the exchange of the scope to 10-mm. The resected stomach is freed from the greater omentum using the monocurved coagulating hook (Figure 18), or the monocurved bipolar forceps and scissors.

Because of the curves of the instruments, there is no conflict between the instruments' tips inside the abdomen (Figure 18) or between the surgeon's hands outside the abdomen (Figure 19).

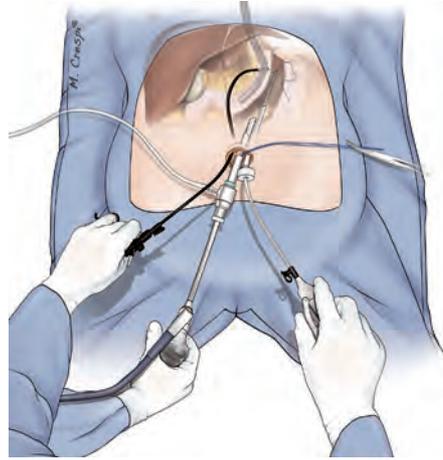
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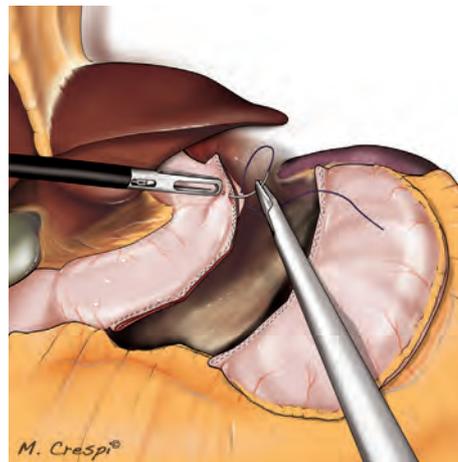
The surgeon places some intracorporeal Vicryl 2/0 sutures between the firings of linear stapler, using the bicurved grasping forceps and the monocurved needle holder (Figures 20, 21).

To perform the leak-test, the operating room table is placed in the Trendelenburg position and left-sided tilt. The gastric surface is immersed in physiologic solution using the monocurved suction and irrigation cannula. Air is insufflated through the bougie by the anesthesiologist (Figure 22).

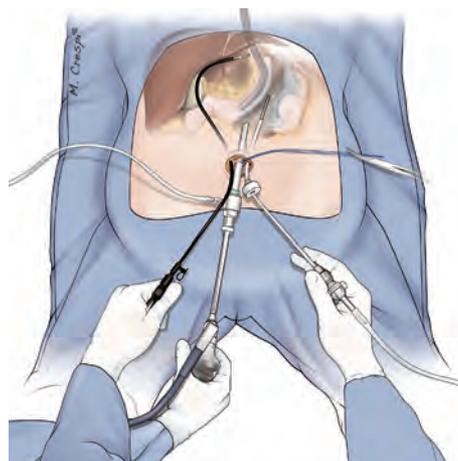
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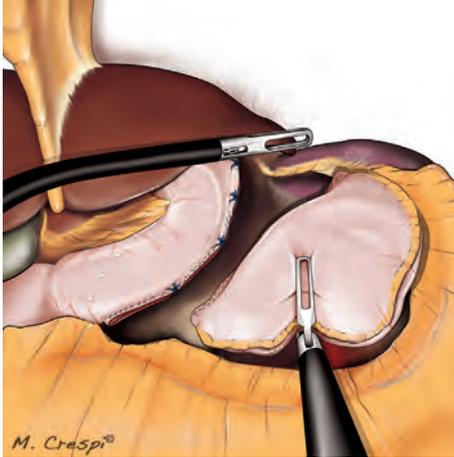
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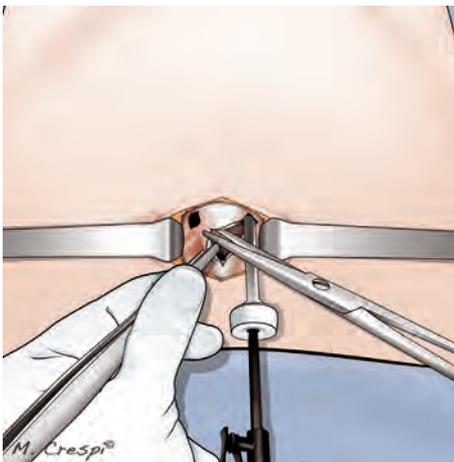
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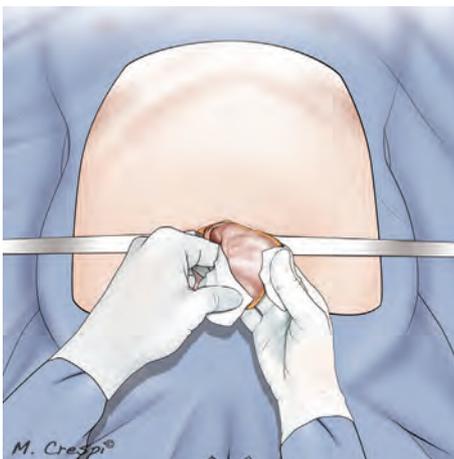
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Then, the operative room table is placed in a reverse Trendelenburg position. The orogastric tube is removed and a nasogastric tube is positioned under laparoscopic view by the anesthesiologist. No drain is left in the abdominal cavity. The resected stomach is grasped by the straight grasping forceps (Figure 23).

The operating room table is positioned as it was at the beginning of the procedure, without any Trendelenburg position and tilt.

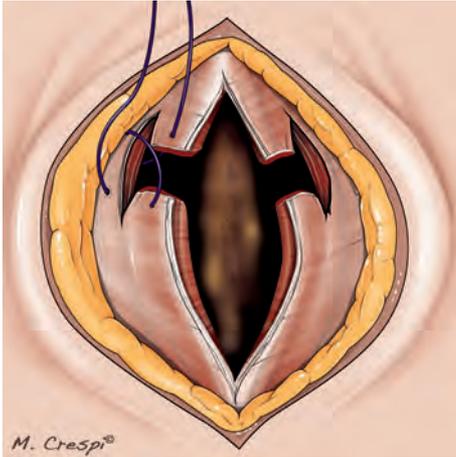
The bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

After having removed the central trocar, the umbilical purse-string suture, and the 6-mm flexible trocar, all the fascia openings are joined together (Figure 24), and the specimen is extracted transumbilically (Figure 25).

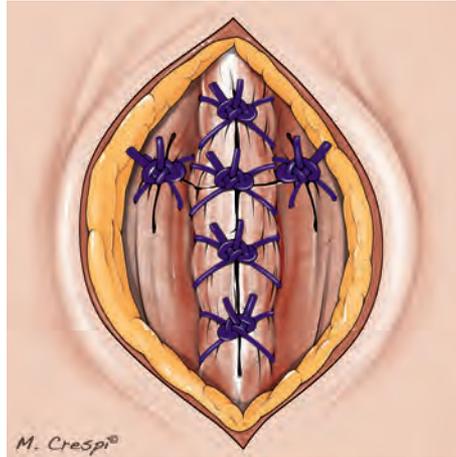
Vicryl 1 sutures are placed using a figure 8 pattern to close the access, taking care to close the separate fascia opening for the bicurved grasping forceps and for the flexible trocar (Figures 26,

27, 28). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 29).

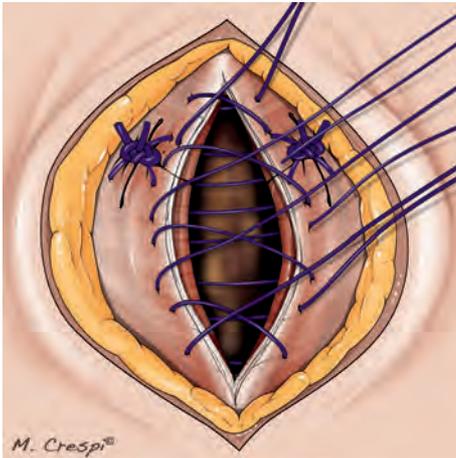
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Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

Antibiotic prophylaxis is prescribed if necessary and TVP prophylaxis is continued until the discharge of the patient from the hospital. The nasogastric tube is maintained in place for the first 24 hours. The patient is allowed to drink water on the 2nd post-operative day and to tolerate a liquid diet from the 3rd post-operative day. If there are no complications, the patient can be discharged.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1 month, and then every 3 months for the 1st year, every 6 months for the 2nd year, and one time per year thereafter, together with the nutritionist and psychologist.

3.5 ULCER REPAIR

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Post-operative Care

3.5 ULCER REPAIR

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

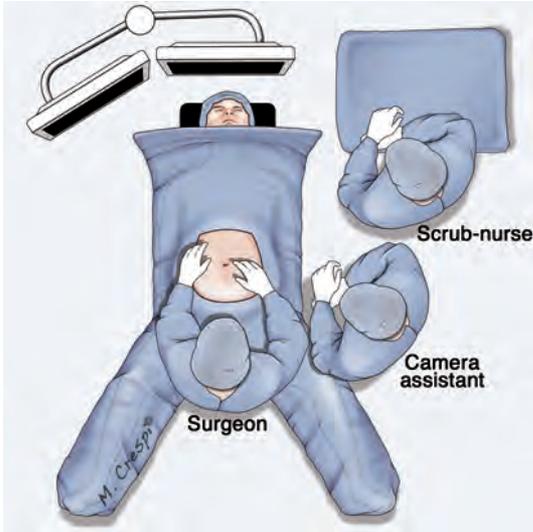
General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after intubation.

Antibiotic and TVP prophylaxis are applied as well.

Tools

- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needle-holders, two tissue forceps, two Farabeuf retractors, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), one Polyamide 2/0 (Ethilon 2/0, straight needle, 60 mm), four Polyglactin 2/0 (Vicryl 2/0, round tip, 1/2c, 36 mm), four Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable rigid mandril of 6-mm trocar
- one straight 10-mm, 30° regular length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps I)
- one reusable monocurved suction and irrigation cannula
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved scissors (DAPRI scissors)
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one nasogastric tube

1



Patient and Team Positioning

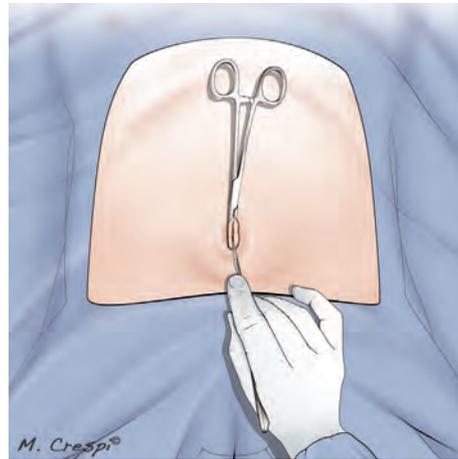
The patient is placed in a supine position, with the arms alongside the body and the legs apart. The patient's arms, ankles, and legs are secured and protected.

The surgeon stands between the patient's legs, and the camera assistant to the patient's left. The scrub-nurse stands to the patient's left and to the camera assistant's right. The video monitor is placed in front of the surgeon and camera assistant ([Figure 1](#)).

Technique

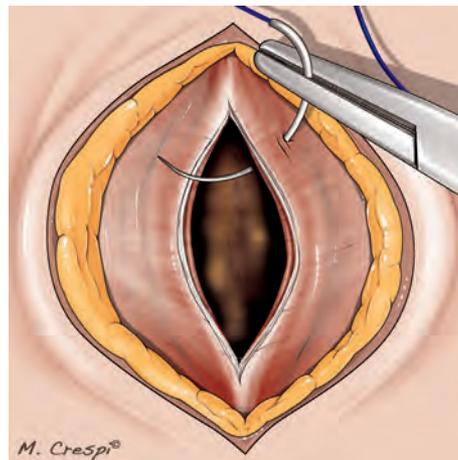
The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base using a Pean-Rochester curved forceps (Figure 2). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 3, 4). This suture is kept externally by a Pean-Rochester curved forceps.

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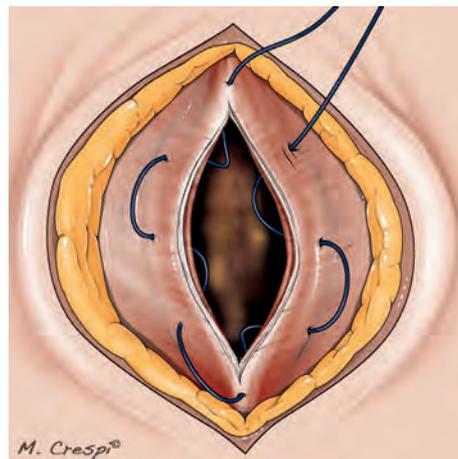


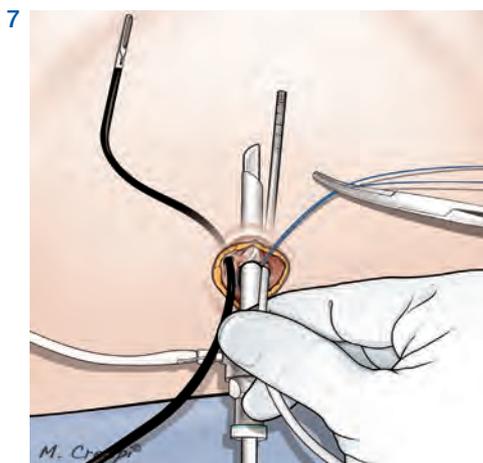
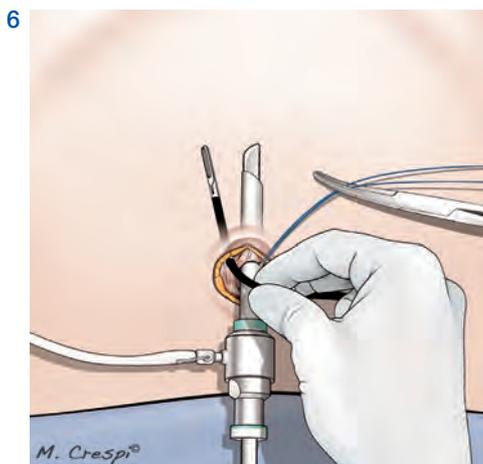
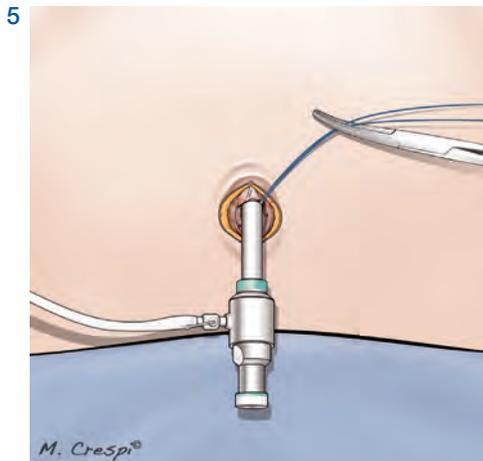
[Click to watch the corresponding video](#)
Ulcer Repair

3



4





An 11-mm trocar is introduced into the peritoneal cavity inside the purse-string suture, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar, and curved instruments are inserted into the abdomen through the umbilical scar without trocars.

The bicurved grasping forceps is inserted through a separate fascia window, created by a mandril of 6-mm trocar, approximately 5 mm outside the purse-string suture at 10 o'clock position with respect to the patient's head (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

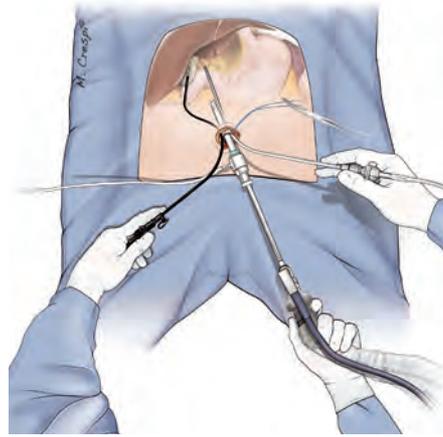
The other instruments, like the monocurved suction and irrigation cannula, the monocurved needle holder, and the monocurved scissors are introduced on the other side of the bicurved grasping forceps at the 3 o'clock position, parallel to the 11-mm trocar and inside the purse-string suture (Figure 7).

The suture is adjusted to maintain a tight seal around the 5-mm tools and the 11-mm trocar, and opened only for exchanging instruments.

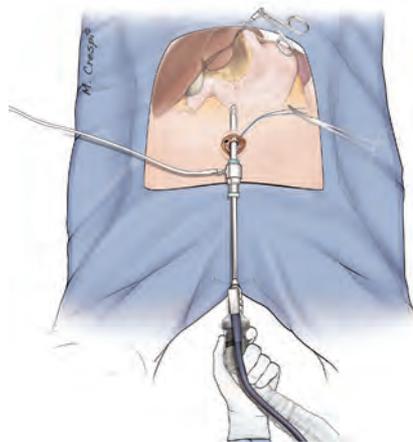
The operating room table is placed in a reverse Trendelenburg position with left-sided tilt.

The abdominal cavity is checked for localization of the gastric perforation. The free fluid under the right liver lobe is taken for a bacteriological sample using the monocurved suction cannula (Figure 8). If necessary to improve exposure of the gastric region, a percutaneous suture supported by a straight needle (Ethilon 2/0) is passed from the left hypochondrium to the right, under the round hepatic ligament, and taken externally by two Pean-Rochester curved forceps. Another option is to insert percutaneously a straight 1.8-mm trocarless grasping forceps, through a skin puncture (created by a Veress needle) under the xyphoid access, placing the distal tip under the left and part of right liver lobes (Figures 9, 10).

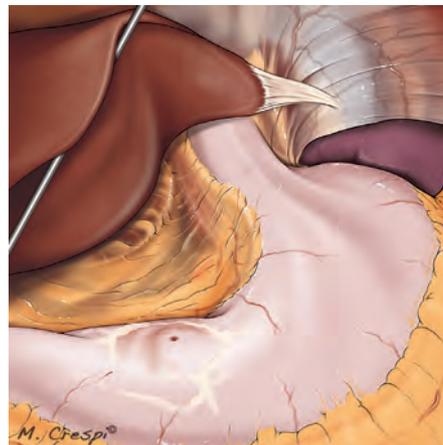
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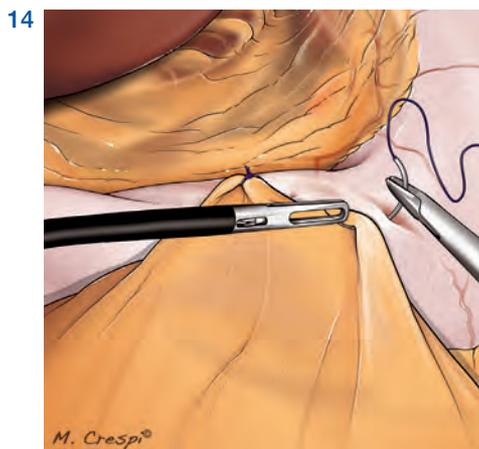
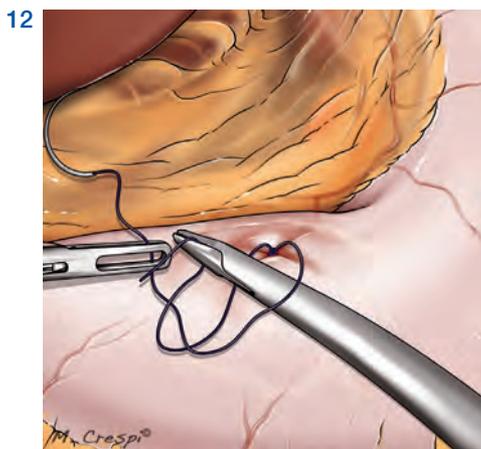
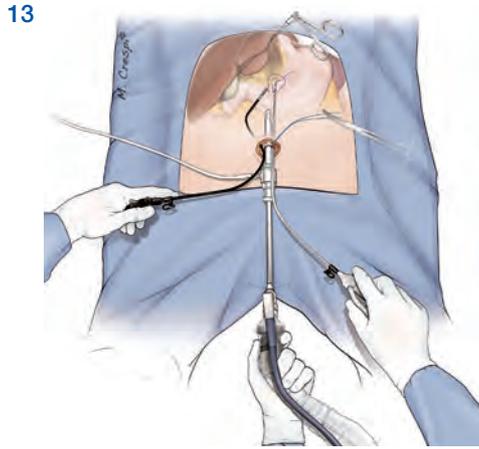
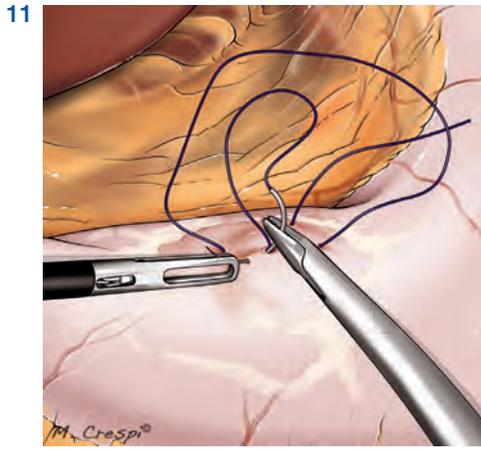


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The gastric perforation is therefore sutured using figure 8 sutures. Usually 1 or 2 Vicryl 2/0 sutures are enough to close the defect (Figure 11). Intracorporeal sutures and knotting technique are used (Figure 12), and the surgeon continues

to work under comfortable ergonomic positions (Figure 13).

An omentoplasty is also performed, placing some Vicryl 2/0 sutures (Figure 14).

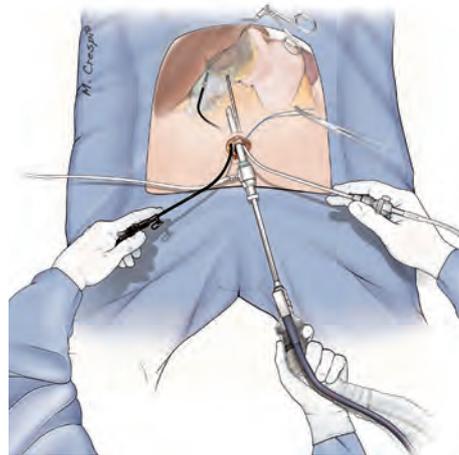
A nasogastric tube is positioned under laparoscopic view by the anesthesiologist.

The peritoneal cavity is cleaned with a minimum of 4 litres of physiologic solution (Figure 15), taking care to clean the Douglas' pouch as well (Figure 16). For this latter maneuver, the operating room table is placed in the Trendelenburg position, the bicurved grasper is removed following its curves at 45° with respect to the abdominal wall, and the monocurved suction and irrigation cannula is inserted at the 9 o'clock position, parallel to the 11-mm trocar and inside the purse-string suture.

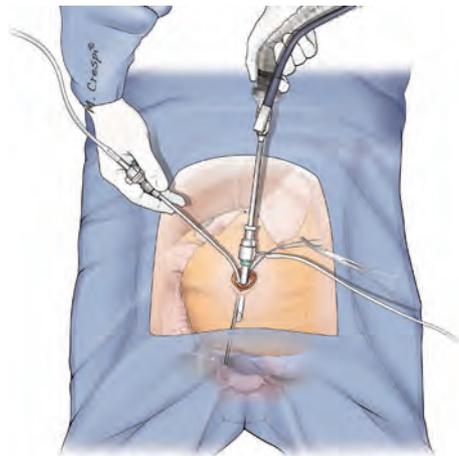
No drain is left in the abdominal cavity. The operating room table is positioned as it was at the beginning of the procedure, without any tilt and Trendelenburg position.

If the temporary percutaneous Ethilon 2/0 suture or 1.8 mm trocarless grasping forceps have been placed at the beginning, they are removed under view. All the remaining instruments inserted in the abdomen are removed as well.

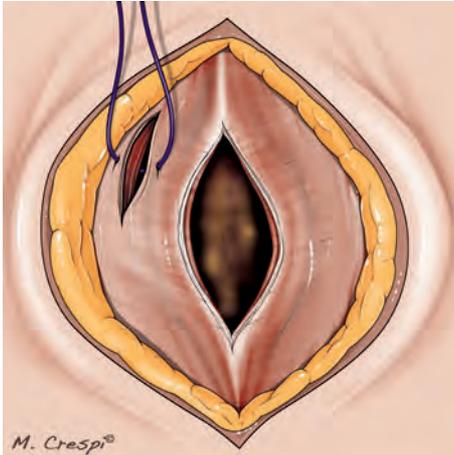
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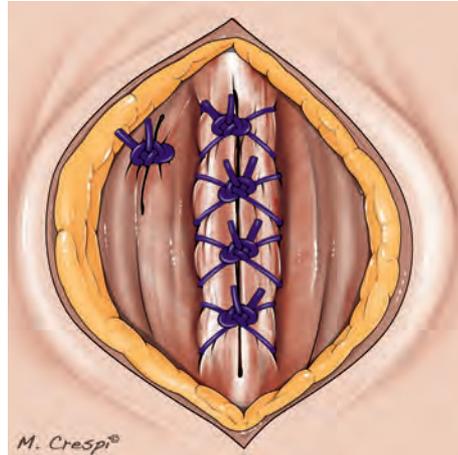
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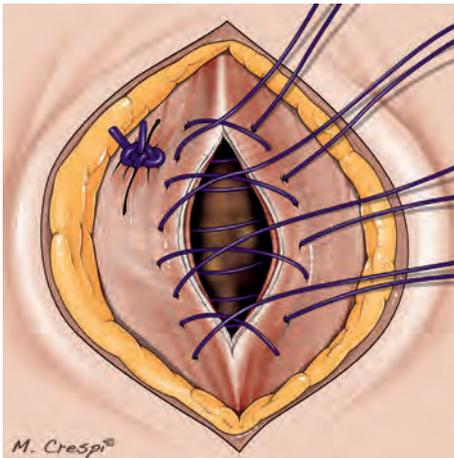
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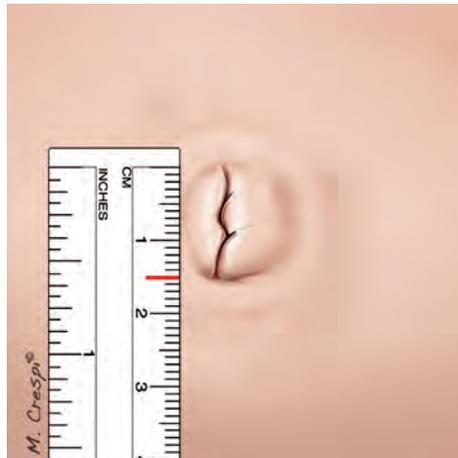
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After having removed the 11-mm trocar and the umbilical purse-string suture, Vicryl 1 sutures are used to close the access. First, the separate fascia opening accommodating the bicurved grasping forceps is closed (Figure 17). Then, the

main access is closed using figure 8 sutures (Figures 18, 19). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 20).

Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

Antibiotic prophylaxis is prescribed for 5 days and the TVP prophylaxis until the discharge of the patient from the hospital. The nasogastric tube is maintained in place (under smooth suction) until the 3rd post-operative day. The patient is allowed to drink water on the 4th post-operative day and to tolerate a cold liquid diet the day after. If there are no complications, the patient can be discharged.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6 and 12 months after the procedure.

A gastroscopic control is realized at 6 weeks postoperatively.

SECTION 4

SMALL BOWEL AND APPENDIX

4.1 SMALL BOWEL RESECTION

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Different Intracorporeal Anastomoses

Post-operative Care

4.1 SMALL BOWEL RESECTION

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after intubation.

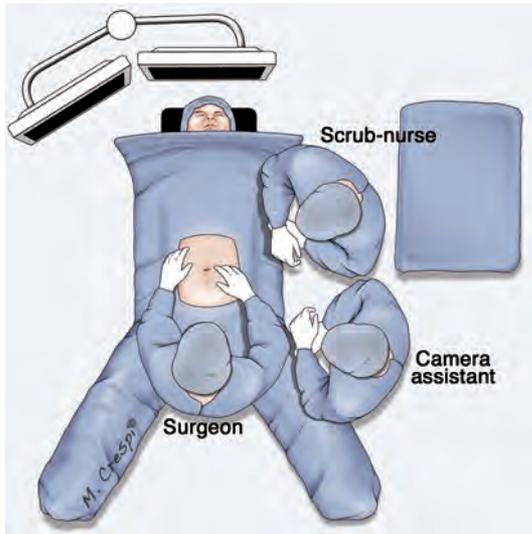
Antibiotic and TVP prophylaxis are applied as well.

A urinary catheter is inserted.

Tools

- one scalpel, two tissue forceps, one monopolar electrode, two Farabeuf retractors, two Kocher-Ochsner curved forceps, one Mayo scissors, two Mayo-Hegar needle-holders, two Pean-Rochester curved forceps, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), five Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), three Polydioxanon 2/0 (PDS 2/0, round tip, 1/2c, 26 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable 13-mm rigid trocar or one non-reusable 12-mm trocar
- two reusable 6-mm flexible trocars and rigid mandrils (DAPRI flex trocars)
- one straight 10-mm, 30° regular length scope
- one straight 5-mm, 30° long length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps I)
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved dissecting forceps (DAPRI dissecting forceps)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable straight 5-mm clip applier
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one non-reusable articulating 45 linear stapler
- one non-reusable plastic wall protector

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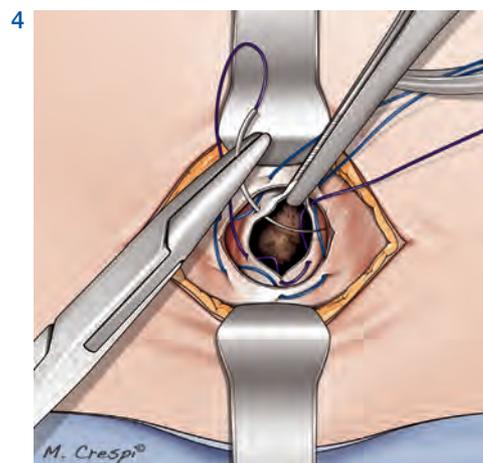
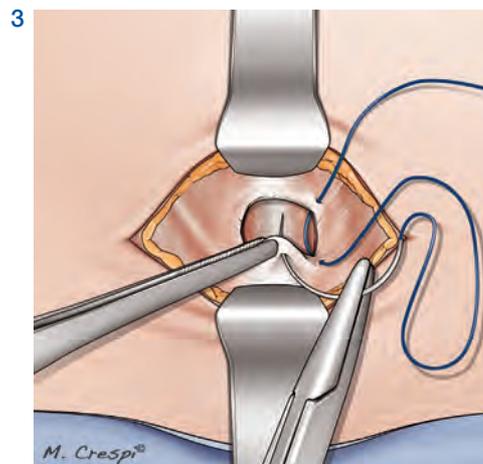
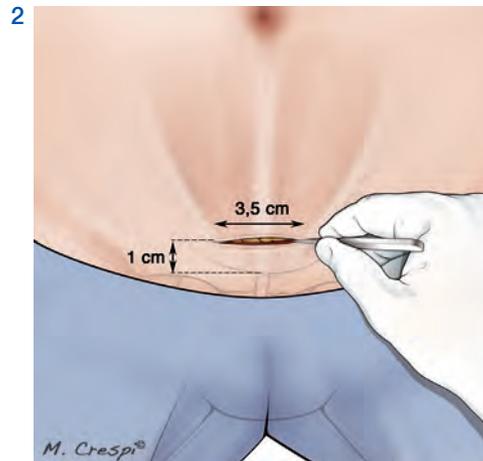
Patient and Team Positioning

The patient is placed in a supine position, with the arms alongside the body and the legs apart. The patient's arms, ankles, and legs are secured and protected.

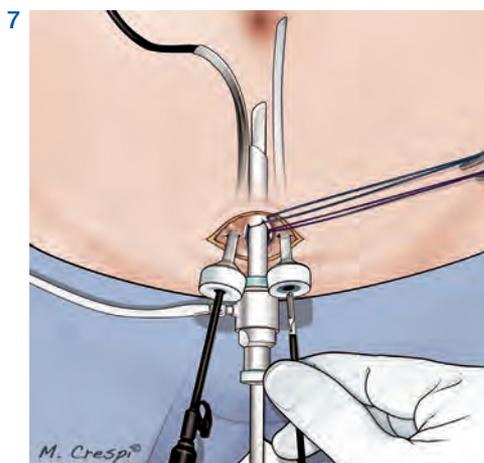
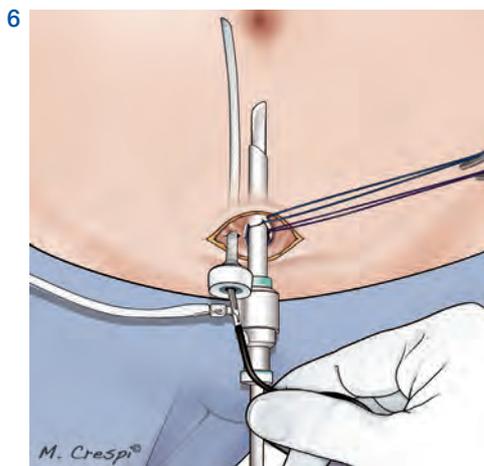
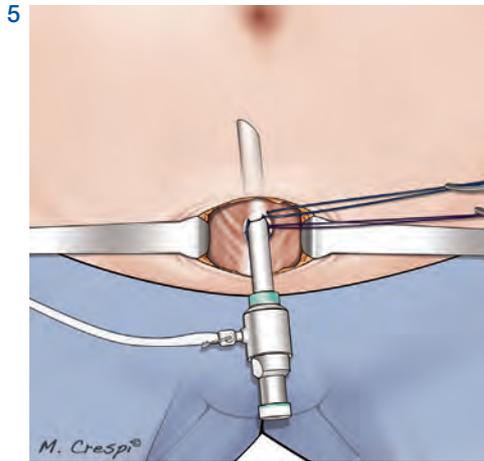
The surgeon stands between the patient's legs, and the camera assistant to the patient's left. The scrub-nurse stands to the patient's left and to the camera assistant's right. The video monitor is placed in front of the surgeon and camera assistant ([Figure 1](#)).

Technique

A 3.5-cm transverse skin incision is made in the midline, 1 cm above the pubic symphysis (Figure 2). The underlying fascia is divided in a transverse fashion for 1.5 cm, until the rectus abdominis muscle is exposed. Anterior and posterior flaps are developed in the avascular plane separating the fascia from the underlying muscle. A purse-string suture using PDS 1 is placed in the fascia (Figure 3), going inside and outside respectively at the 1, 5, 6, 7, 11 and 12 o'clock positions (Figure 4). The peritoneal sheet is entered through the midline via a 1 cm incision. A new purse-string suture is placed using Vicryl 1, going inside and outside respectively at the 1, 5, 6, 7, 11 and 12 o'clock positions (Figure 4). Both sutures are kept externally by Pean-Rochester curved forceps.



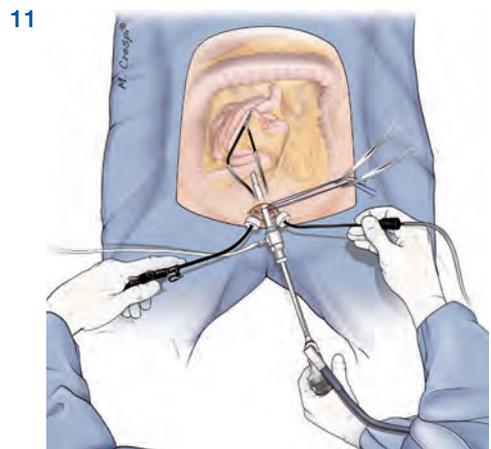
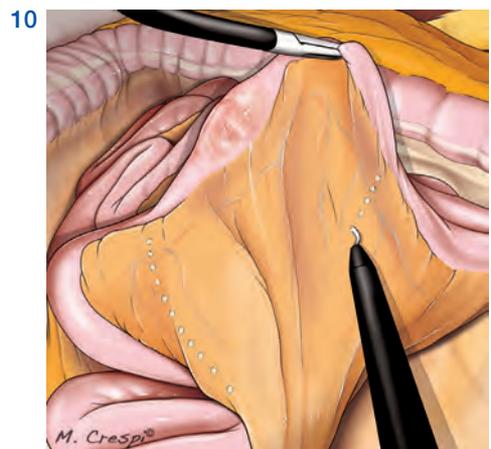
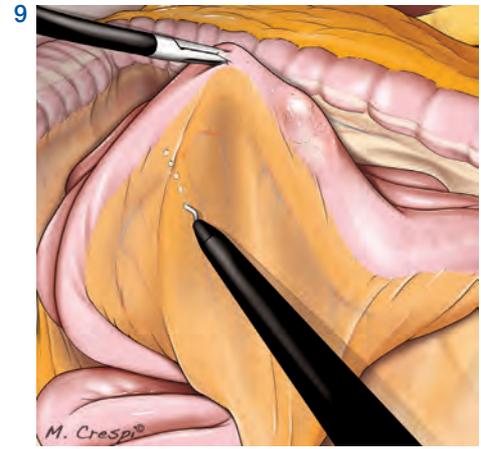
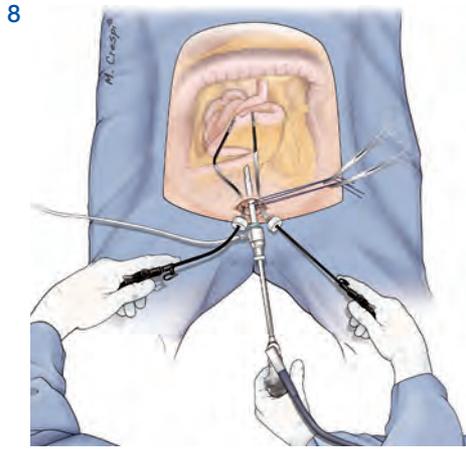
[Click to watch the corresponding video](#)
Small Bowel Resection



An 11-mm trocar (or a 12-mm non-reusable trocar) is introduced into the peritoneal cavity inside the purse-string sutures, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar.

A 6-mm flexible trocar is inserted at the 9 o'clock position with respect to the patient's head, outside the purse-string sutures, for insertion of the bicurved grasping forceps (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

Another 6-mm flexible trocar is inserted at the 3 o'clock position with respect to the patient's head, outside the purse-string sutures, for insertion of the other instruments (Figure 7), such as the monocurved grasping forceps, the monocurved coagulating hook, the monocurved dissecting forceps, the monocurved bipolar forceps and scissors, the straight 5-mm clip applier, the monocurved scissors, the monocurved needle holder, the monocurved suction and irrigation cannula, and the straight grasping forceps.

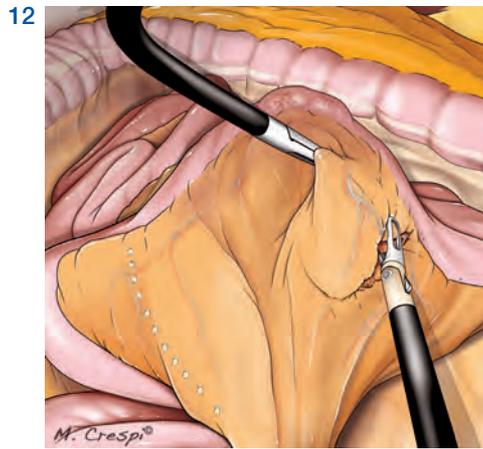


The abdominal cavity is explored to rule out the presence of peritoneal metastases, superficial hepatic lesions and free ascites.

The operating room table is placed in a moderate Trendelenburg position.

The transverse colon is exposed by reflecting the greater omentum. The small bowel is gently swept out of the right quadrants of the abdomen, until the last bowel loop is identified. The small bowel loops are ruled out between the bicurved grasping forceps and the monocurved grasping forceps, from the ileocecal valve to the angle of Treitz (Figure 8). The small bowel loop to be resected is identified, and the mesentery of this loop is scored by the monocurved coagulating hook, from the bowel to the root of the mesentery (Figures 9, 10).

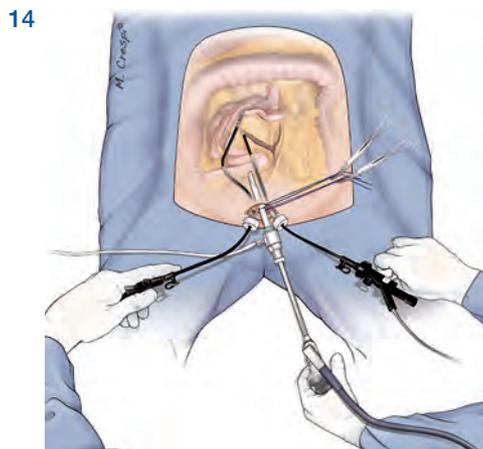
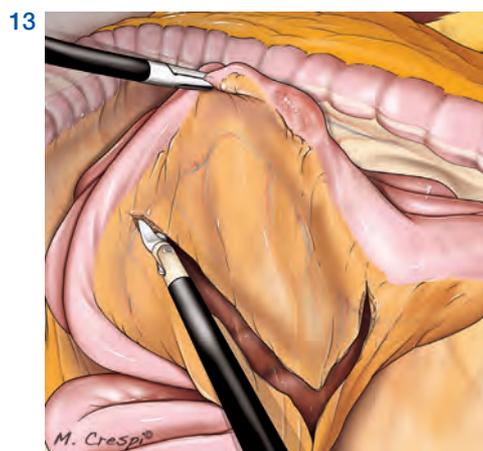
The surgeon works under comfortable ergonomics, with satisfactory intracorporeal triangulation (Figure 11).



The mesentery is first controlled by the monocurved coagulating hook, then by the monocurved bipolar forceps and scissors (Figures 12, 13). The monocurved dissecting forceps is useful for preparing the dissection of each vessel. Some 5-mm clips are applied using the 5-mm clip applicator, and the vessels are cut by the monocurved scissors.

The surgeon is able to create optimal triangulation, which allows work without crossing hands or clashing the instruments' tips (Figure 14).

If the operative field's exposure is not sufficient, a straight 1.8-mm trocarless grasping forceps will be inserted percutaneously via a skin puncture (created by a Veress needle) under the left 12th rib, helping in the retraction and countertraction of the viscera.

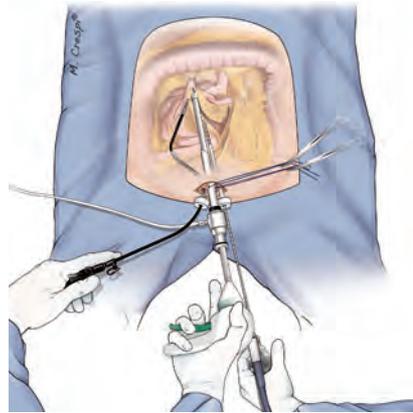


Once the mesenteric dissection is finished, the small bowel loop to be resected appears devascularized over its length.

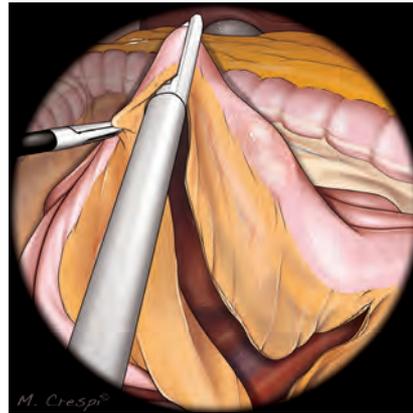
The 11-mm trocar is replaced by a reusable 13-mm trocar (if the 12-mm non-reusable trocar is inserted at the beginning, this replacement is not needed) in order to accommodate an articulating linear stapler. The 10-mm scope is exchanged for a 5-mm, 30° long scope, which is inserted into the 6-mm flexible trocar at the 3 o'clock position (Figure 15). The small bowel is sectioned by firings of the linear stapler (Figures 16, 17).

Different types of intracorporeal anastomosis can be performed, but usually a completely manual end-to-end is realized.

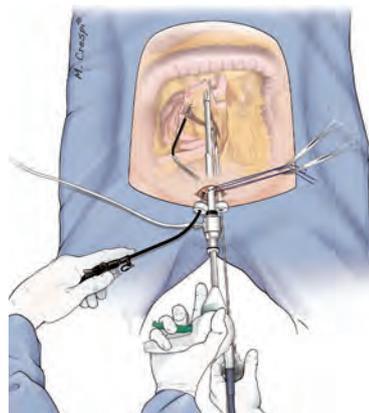
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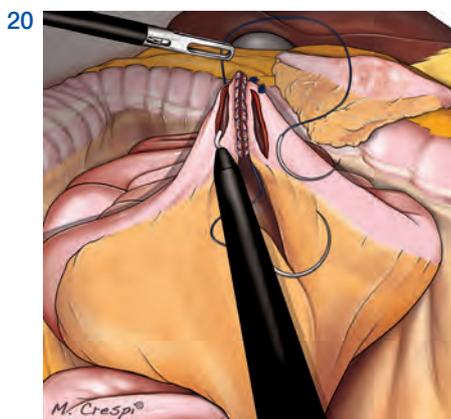
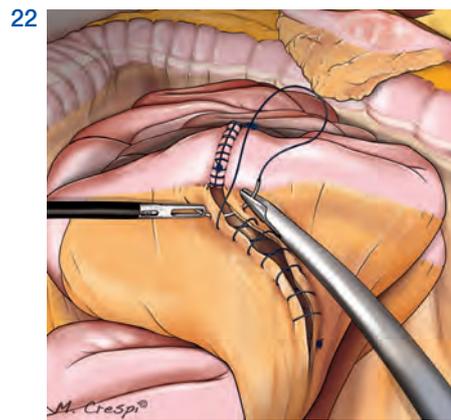
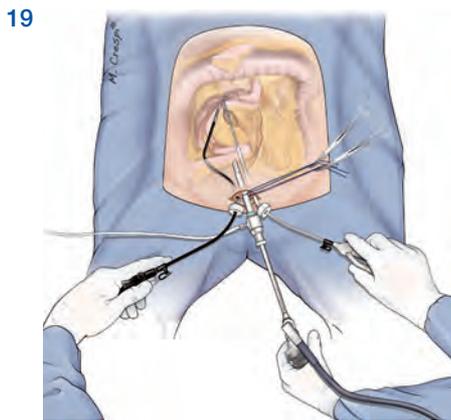
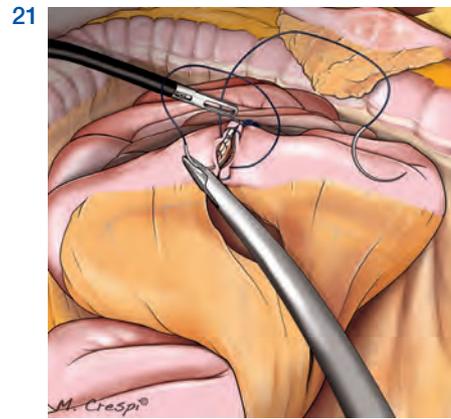
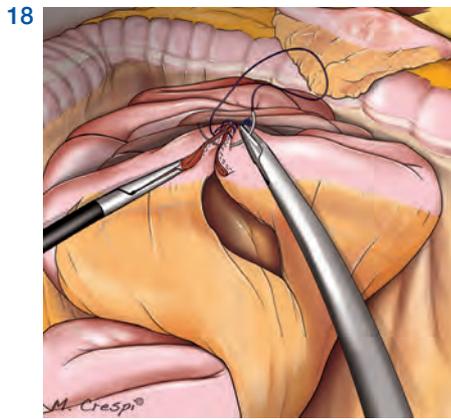


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Different Intracorporeal Anastomoses

1) Completely Manual End-To-End Anastomosis

The 13-mm trocar is replaced by the 11-mm trocar, together with an exchange of the scope for a 10-mm. The two extremities of the small bowel are placed close to one another, and a PDS 2/0 running suture (posterior wall of the anastomosis), with a preformed knot at one

extremity, is used to join the two bowel segments together (Figure 18).

The surgeon works with the bicurving grasping forceps and the monocurved needle holder, without crossing hands and without conflict with the camera assistant's hands (Figure 19). Then, a new PDS 2/0 running suture (anterior wall of the anastomosis), with a preformed knot at one extremity, is started at the superior corner of the anastomosis. After having passed the first bite, both bowel segments are held open by a monocurved coagulating hook (Figure 20). The first running suture (the posterior one) is used to reinforce the inferior corner of the anastomosis, continuing for some bites on the anterior layer (Figure 21). Finally, the two running sutures are joined together at the inferior part of the anterior layer of the anastomosis (Figure 22). The mesenteric window (formed by the mesentery of the two bowel loops) is closed by a PDS 2/0 running suture (Figure 22) (a preformed knot at its extremity is useful to gain operative time).

2) Completely Manual End-To-Side Anastomosis

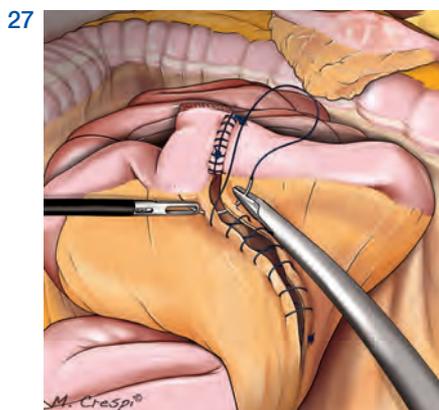
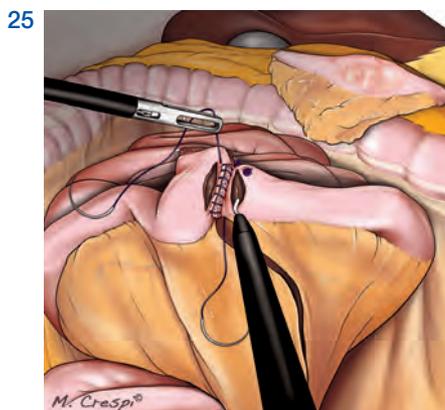
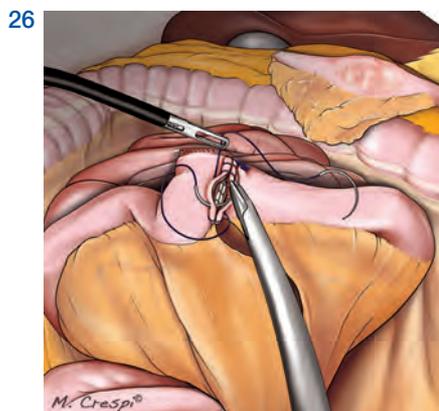
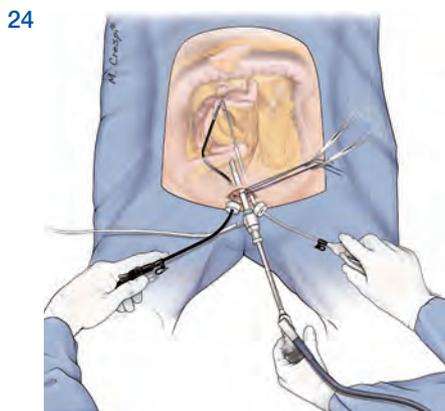
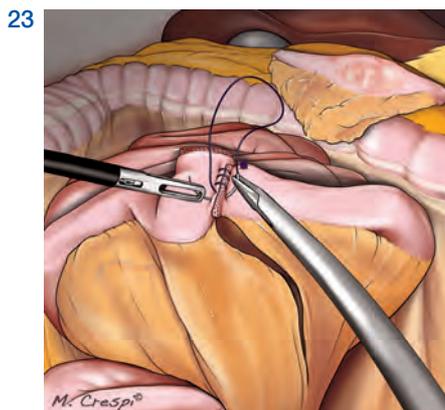
This type of anastomosis is preferred when the small bowel proximal to the tumor is dilated.

The 13-mm trocar is replaced by the 11-mm trocar, together with an exchange of the scope for a 10-mm. The proximal extremity of the small bowel is placed at 90° against the distal extremity. A PDS 2/0 running suture with a preformed knot at one extremity is used to join both viscera

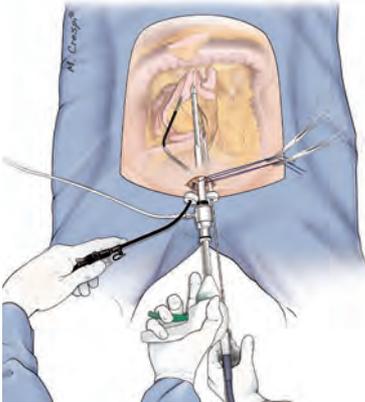
together, forming the posterior wall of the anastomosis (Figure 23).

The surgeon continues to work without any conflict with the hands or instruments' tips (Figure 24).

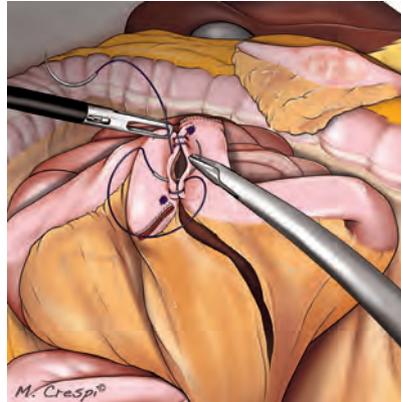
A new PDS 2/0 running suture for the anterior wall of the anastomosis, with preformed knot at one extremity, is started at the superior corner of the latter. After having passed the first bite, both viscera are opened by the monocurved coagulating hook (Figure 25). Then, the posterior running suture is used to reinforce the inferior corner of the anastomosis, continuing for some bites on the anterior layer (Figure 26). Finally, the two running sutures are joined together at the inferior part of the anterior layer of the anastomosis (Figure 27), and the mesenteric window is closed by a PDS 2/0 running suture (Figure 27) (a preformed knot at its extremity is useful to gain operative time).



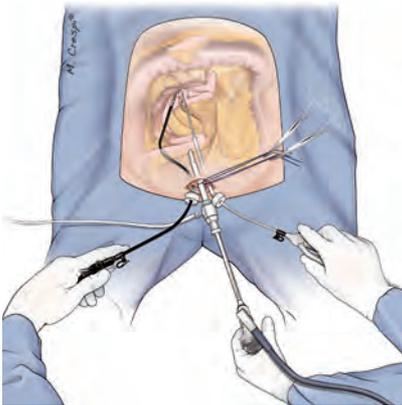
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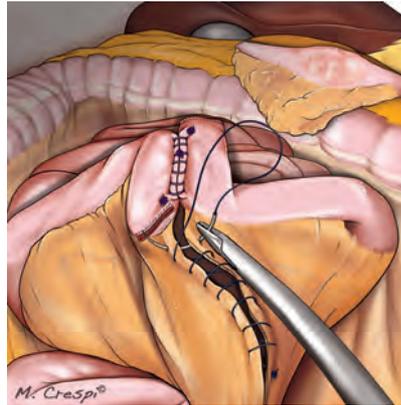
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3) Linear Mechanical Side-To-Side Anastomosis

The two extremities of the small bowel are placed next each other. A 1 cm opening is made in each lumen using the monocurved coagulating hook. A linear stapler is inserted and fired (Figure 28). The 13-mm trocar is replaced by the 11-mm trocar, together with an exchange of the scope for a 10-mm. The enterotomy is closed using the bicurved grasping forceps and the monocurved needle holder.

The surgeon works in ergonomic positions (Figure 29). Two PDS 2/0 running sutures, with a preformed knot at one extremity, are used (Figures 30, 31). The mesenteric window (formed by the two small bowel segments) is closed by a PDS 2/0 running suture (Figure 32) (a preformed knot at its extremity is useful to gain operative time).

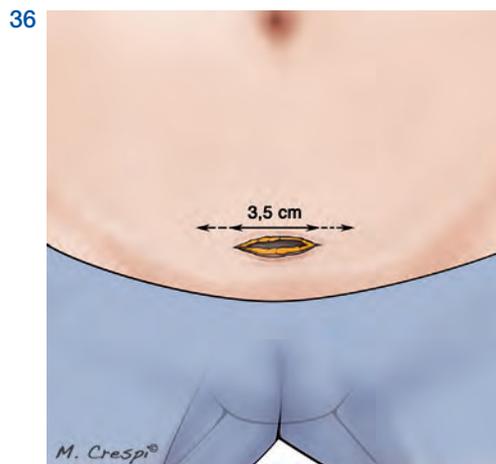
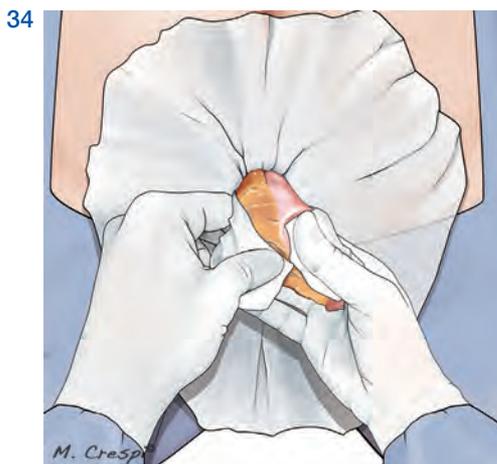
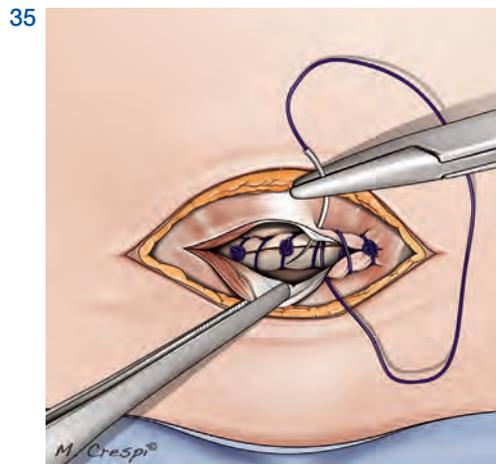
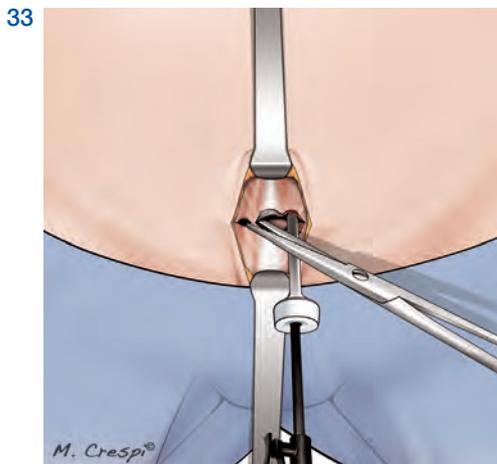
At the end of the anastomosis, the operating room table is returned to the position it was at the beginning of the procedure, without any Trendelenburg position.

No drain is left in the abdominal cavity. The specimen is kept by the straight grasping forceps. The bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

Both purse-string sutures are retrieved together with the three trocars. The three trocar openings on the rectus abdominis muscle fascia are joined

together (Figure 33), and the plastic wall protector is inserted into the peritoneal cavity at the access site. The specimen is removed inside the plastic protector (Figure 34).

The peritoneal sheet and the rectus abdominis muscle fascia are meticulously and separately closed by converging Vicryl 1 running sutures (Figure 35). The cutaneous scar is joined by Monocryl 4/0 intradermic sutures, and the final incision length depends on the size of the specimen retrieved (Figure 36).



Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

The urinary catheter is removed on the 1st postoperative day.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

Antibiotic prophylaxis is prescribed if necessary and TVP prophylaxis until the discharge of the patient from the hospital. The patient is allowed to drink water on the 1st post-operative day, and to tolerate a light diet on the 3rd post-operative day. If there are no complications, the patient can be discharged on the 4th post-operative day.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed. Office visits are scheduled at 10 days, 1, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the gastroenterologist/oncologist.

4.2 APPENDECTOMY

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Post-operative Care

4.2 APPENDECTOMY

Pre-operative Preparation and General Anesthesia

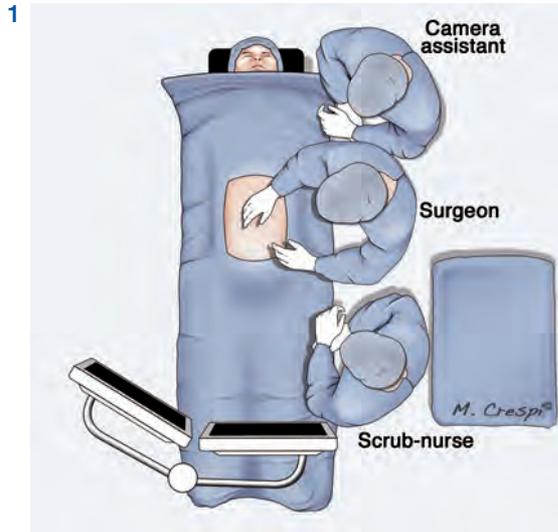
Patient is asked not to eat at least 8 hours prior to the procedure.

General anesthesia is induced by rapid sequence induction using 2 mg/kg etomidate and 1 mg/kg succinylcholine. After tracheal intubation, anesthesia is maintained with 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium.

Antibiotic prophylaxis is applied as well.

Tools

- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needleholders, two tissue forceps, two Farabeuf retractors, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), two Polyglactin 0 preformed knots (endoloops), four Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable rigid mandril of 6-mm trocar
- one straight 10-mm, 30° regular length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps I)
- one reusable monocurved suction and irrigation cannula
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable straight 5-mm endloop device
- one reusable monocurved scissors (DAPRI scissors)
- one reusable straight grasping forceps
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one non-reusable custom-made plastic bag



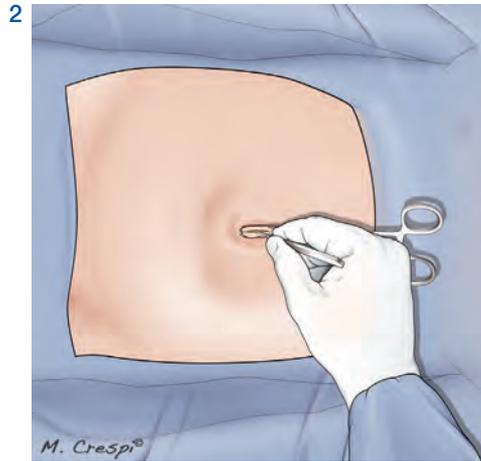
Patient and Team Positioning

The patient is placed in a supine position, with the arms alongside the body and the legs straight. The patient's arms, the ankles, and legs are secured and protected.

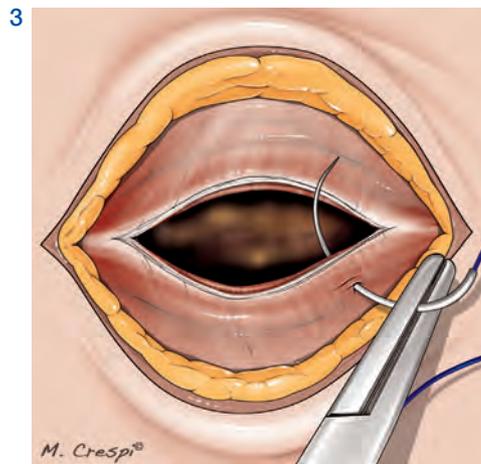
The surgeon stands to the patient's left, and the camera assistant to the surgeon's right. The scrub-nurse stands to the patient's left and to the surgeon's left. The video monitor is placed in front of the surgeon and camera assistant (Figure 1).

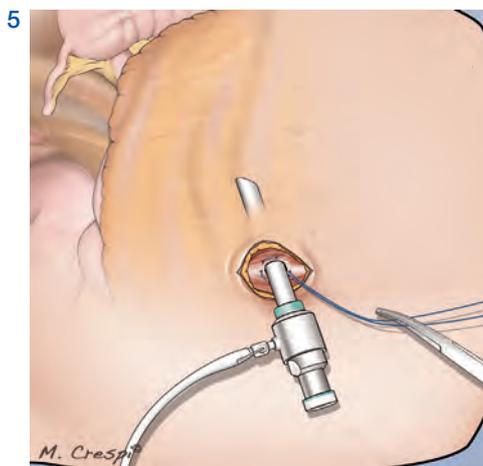
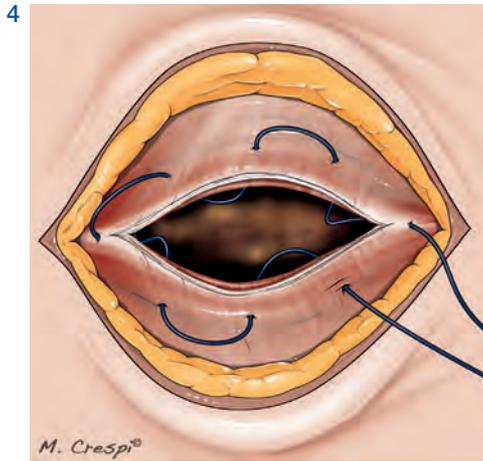
Technique

The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (Figure 2). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the peritoneum using a full-thickness method, going inside and outside respectively at the 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 3, 4).



[Click to watch the corresponding video](#)
[Appendectomy](#)





This suture is kept externally using a Pean-Rochester curved forceps.

An 11-mm trocar is introduced into the peritoneal cavity inside the purse-string suture, and the pneumoperitoneum is created (Figure 5).

The 10-mm, 30° scope is advanced through the 11-mm trocar, and curved instruments are inserted into the abdomen through the umbilical scar without trocars.

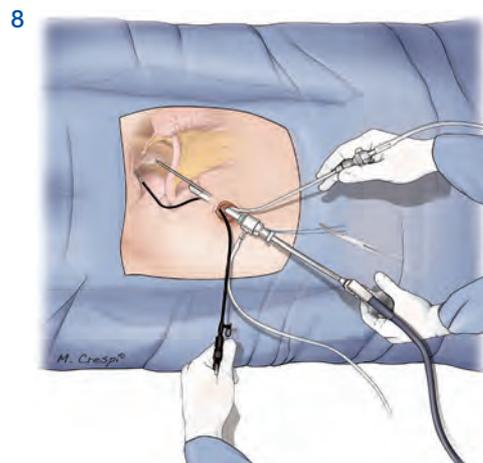
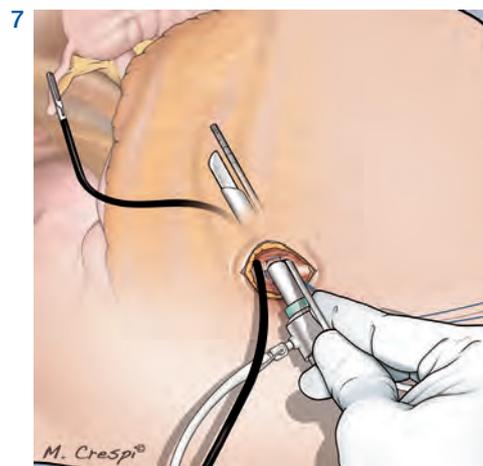
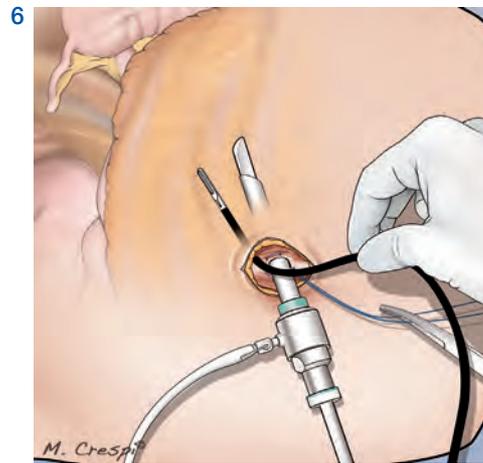
The bicurved grasping forceps is inserted through a separate fascia window, created by a mandril of 6-mm trocar, approximately 5 mm outside the purse-string suture at the 7 o'clock position with respect to the patient's head (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

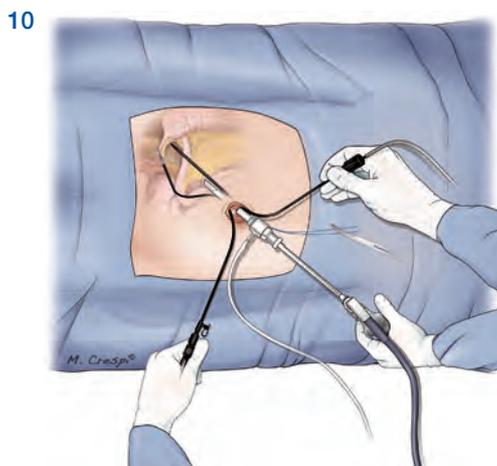
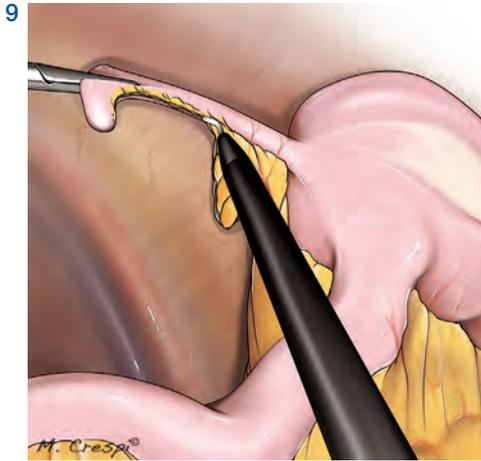
The other instruments, including the monocurved suction and irrigation cannula, the monocurved coagulating hook, the monocurved bipolar forceps and scissors, the straight 5-mm endoloop device, the monocurved scissors, the straight grasping forceps and the monocurved grasping forceps are introduced on the other side of the bicurved grasping forceps at the 12 o'clock position, parallel to the 11-mm trocar and inside the purse-string suture (Figure 7).

The suture is adjusted to maintain a tight seal around the 5-mm tools and the 11-mm trocar, and open only for exchanges of instruments and evacuation of any smoke created during dissection.

The operating room table is placed in a moderate Trendelenburg position with left-sided tilt.

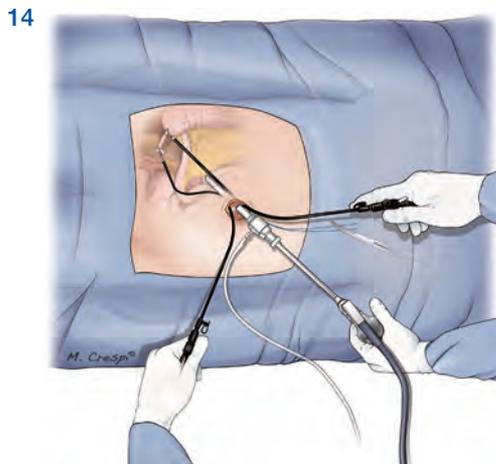
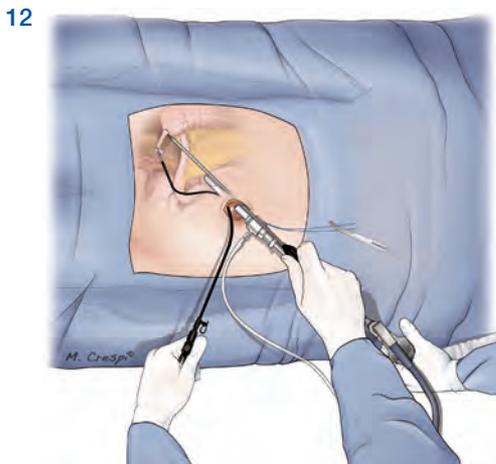
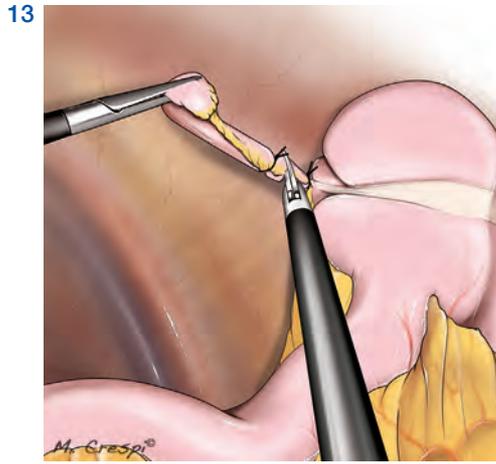
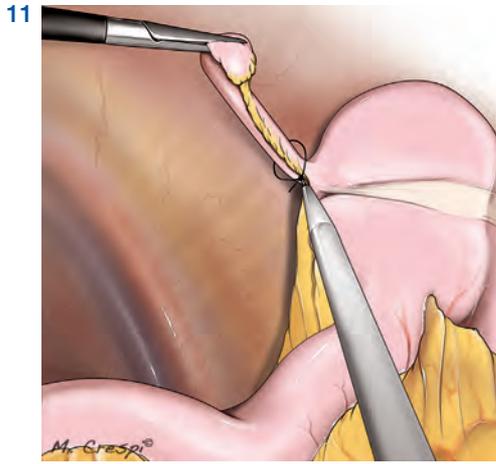
The abdominal cavity is checked for the presence of free fluid, and a bacteriological sample is obtained by the monocurved suction cannula (Figure 8).





The appendix is exposed using the bicurved grasping forceps and the mesentery is controlled by the monocurved coagulating hook, starting at its extremity, going at its base (Figure 9), or by the monocurved bipolar forceps and scissors.

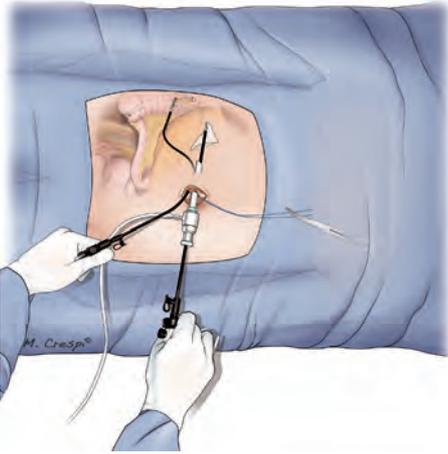
Thanks to the curves of the instruments, no conflict between the instruments' tips inside the abdomen or between the surgeon's hands outside the abdomen is apparent (Figure 10).



Two preformed knots (endoloops) are placed at the base of the appendix using the straight 5-mm endoloop device (Figures 11, 12). Subsequently, the appendicular base is sectioned by the

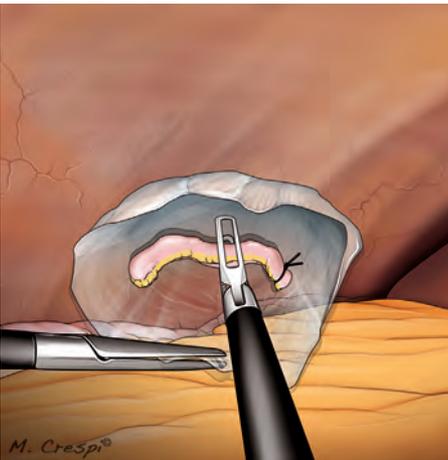
monocurved scissors (Figure 13). The surgeon continues to work with an intra-abdominal triangulation and satisfactory external ergonomics, thanks to the curves of the instruments (Figure 14).

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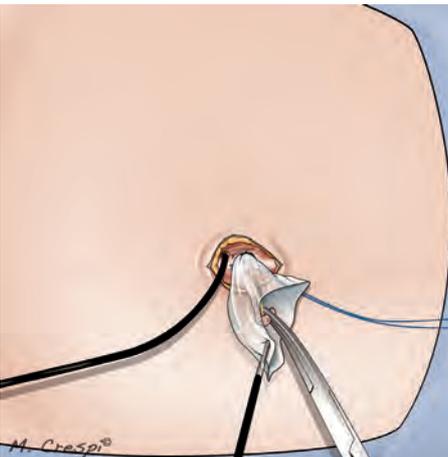


Then, the appendix is temporarily held by the bicurved grasper and a custom-made plastic bag is introduced into the abdominal cavity through the 11-mm trocar by the straight grasping forceps (Figure 15). The appendix is placed inside the bag using the bicurved grasping forceps and the straight grasping forceps, moving the bag in the direction of the right liver lobe (Figure 16). The appendix is removed from the abdomen through the umbilicus, using the straight grasping forceps (Figure 17).

16



17



The small bowel is moved aside using the bicurved grasping forceps and the monocurved grasping forceps in order to check for the presence of eventual Meckel's diverticula (Figures 18, 19).

The operative field is cleaned with physiologic solution, using the monocurved suction and irrigation cannula. No drain is left in the abdominal cavity.

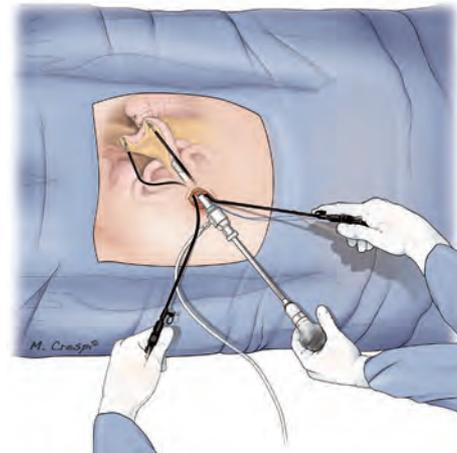
The operating room table is returned to the position it was in at the beginning of the procedure, without any tilt and Trendelenburg position.

All the instruments are removed from the abdomen under view, and the bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

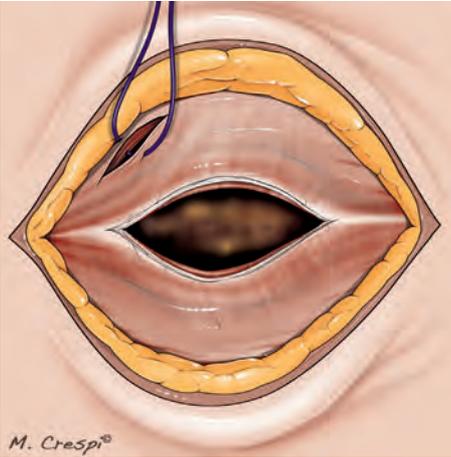
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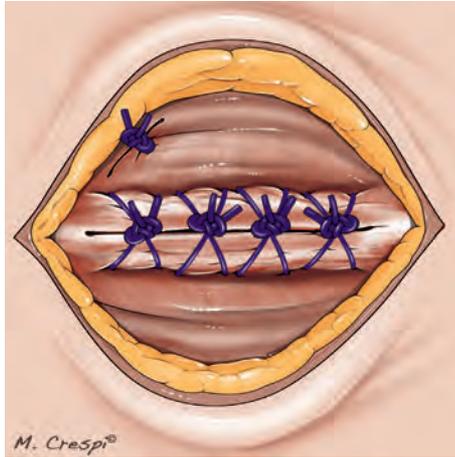
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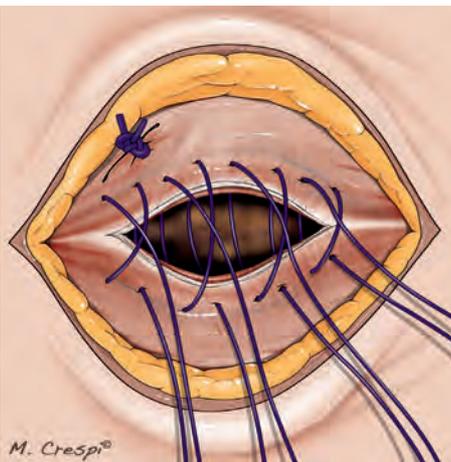
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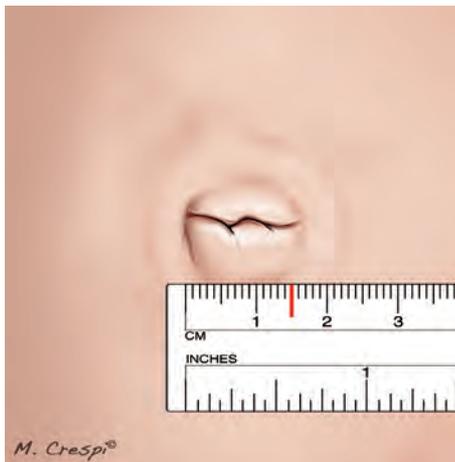
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After having removed the 11-mm trocar and the umbilical purse-string suture, Vicryl 1 sutures are placed in a figure 8 shape to close the umbilical access, including the separate fascia opening

used for the bicurved grasping forceps (Figures 20, 21, 22). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 23).

Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

The patient is allowed to tolerate a liquid diet after 24 hours, and light diet after 48 hours. If there are no complications, the patient is discharged on the 2nd post-operative day. Antibiotic prophylaxis is prescribed if necessary.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6 and 12 months after the procedure.

SECTION 5

COLORECTAL

5.1 RIGHT COLECTOMY

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Different Intracorporeal Anastomoses

Post-operative Care

5.1 RIGHT COLECTOMY

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

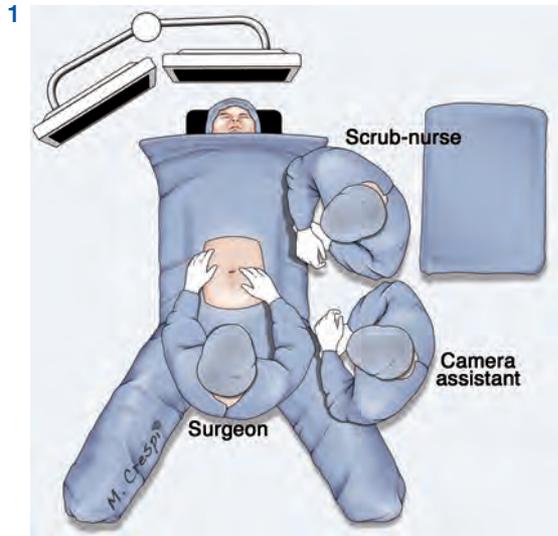
General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and after the intubation a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered.

Antibiotic and TVP prophylaxis are applied as well.

A urinary catheter is inserted.

Tools

- one scalpel, two tissue forceps, one monopolar electrode, two Farabeuf retractors, two Kocher-Ochsner curved forceps, one Mayo scissors, two Mayo-Hegar needle-holders, two Pean-Rochester curved forceps, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), five Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), three Polydioxanon 2/0 (PDS 2/0, round tip, 1/2c, 26 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable 13-mm rigid trocar or one non-reusable 12-mm trocar
- two reusable 6-mm flexible trocars and rigid mandrils (DAPRI flex trocars)
- one straight 10-mm, 30° regular length scope
- one straight 5-mm, 30° long length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps I)
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved dissecting forceps (DAPRI dissecting forceps)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable straight 5-mm clip applier
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one non-reusable articulating 45 linear stapler
- one non-reusable plastic wall protector



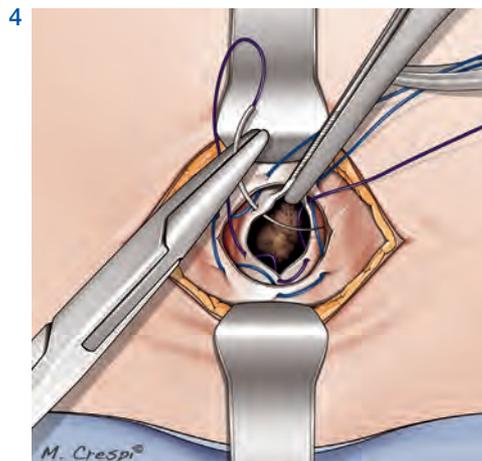
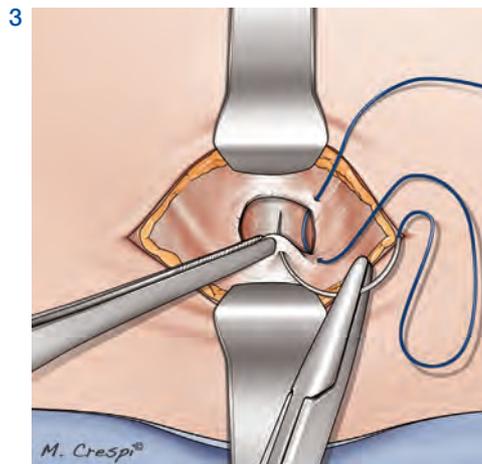
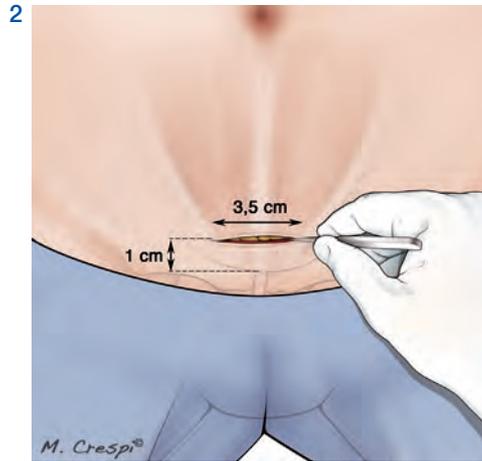
Patient and Team Positioning

The patient is placed in a supine position, with the arms alongside the body and the legs apart. The arms, ankles, and legs are secured and protected.

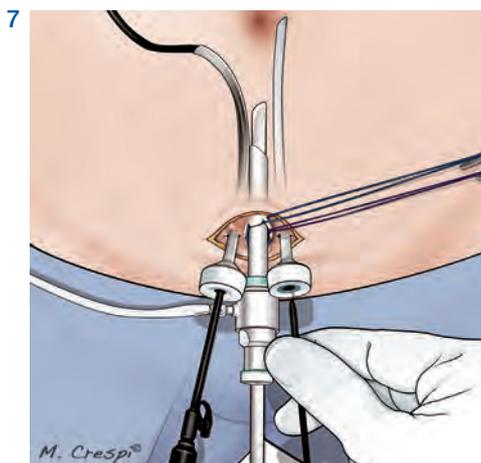
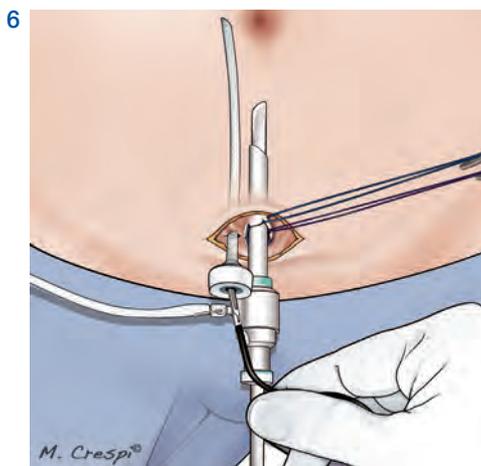
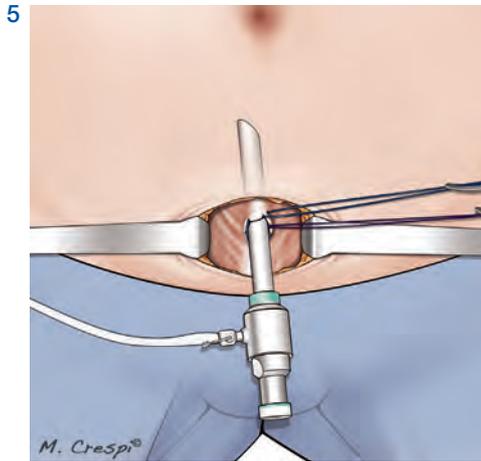
The surgeon stands between the patient's legs, and the camera assistant to the patient's left. The scrub-nurse stands to the patient's left and to the camera assistant's right. The video monitor is placed in front of the surgeon and camera assistant ([Figure 1](#)).

Technique

A 3.5-cm transverse skin incision is made in the midline, 1 cm above the pubic symphysis (Figure 2). The underlying fascia is divided in a transverse fashion for 1.5 cm until the rectus abdominis muscle is exposed. Anterior and posterior flaps are developed in the avascular plane separating the fascia from the underlying muscle. A purse-string suture using PDS 1 is placed in the fascia (Figure 3), going inside and outside respectively at the 1, 5, 6, 7, 11 and 12 o'clock positions (Figure 4). The peritoneal sheet is entered at the midline through a 1 cm incision, and a new purse-string suture is placed using Vicryl 1, going inside and outside respectively at the 1, 5, 6, 7, 11 and 12 o'clock positions (Figure 4). Both sutures are kept externally by Pean-Rochester curved forceps.



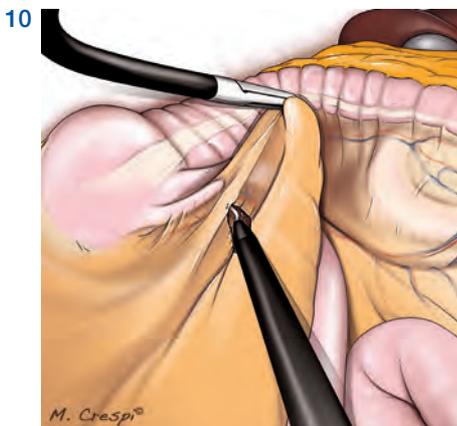
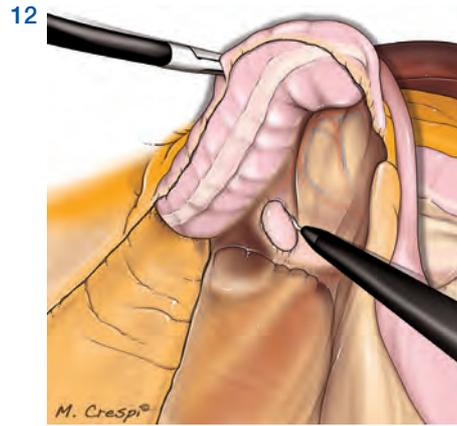
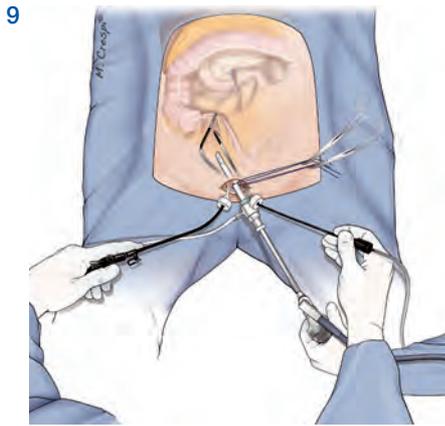
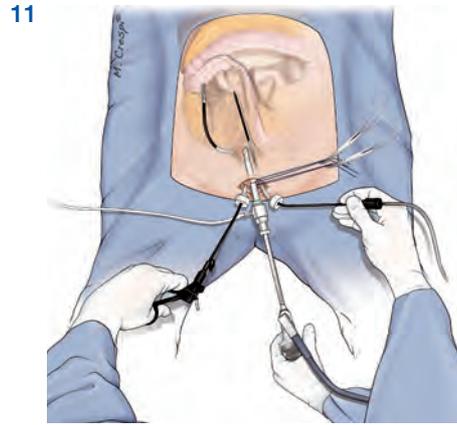
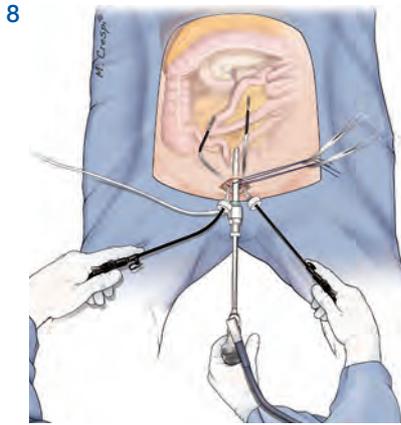
 [Click to watch the corresponding video](#)
[Right Colectomy](#)



An 11-mm trocar (or a 12-mm non-reusable trocar) is introduced into the peritoneal cavity inside the purse-string sutures, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar.

A 6-mm flexible trocar is inserted at the 9 o'clock position with respect to patient's head, outside the purse-string sutures, for insertion of the bicurved grasping forceps (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

Another 6-mm flexible trocar is inserted at the 3 o'clock position with respect to the patient's head, outside the purse-string sutures, for insertion of the other instruments (Figure 7), like the monocurved grasping forceps, the monocurved coagulating hook, the monocurved dissecting forceps, the monocurved bipolar forceps and scissors, the straight 5-mm clip applicator, the monocurved scissors, the monocurved needle holder, the monocurved suction and irrigation cannula, and the straight grasping forceps.

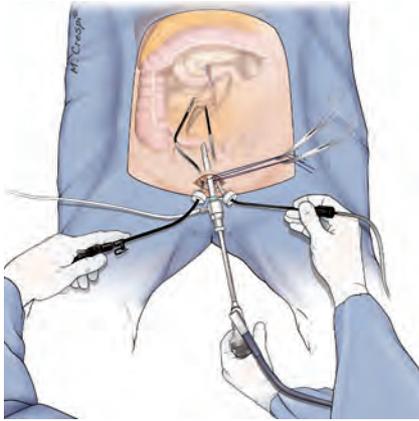


The abdominal cavity is explored to rule out the presence of peritoneal metastases, superficial hepatic lesions and free ascites.

The operating room table is placed initially in a moderate Trendelenburg position with left-sided tilt.

The cecum and the last bowel loop are identified by moving some bowel loops to the right quadrants of the abdomen with the bicurved grasping forceps and the monocurved grasping forceps (Figure 8). The last bowel loop is grasped using the bicurved grasping forceps, and the mesentery is separated from the peritoneal sheet using the monocurved coagulating hook (Figures 9, 10). The ileocecal valve is freed from the parietal peritoneal sheet, and the right mesocolon is dissected using a lateral-to-medial approach. This dissection is carried superiorly, respecting the Gerota's fascia, until the 2nd and 3rd portion of the duodenum are identified (Figures 11, 12).

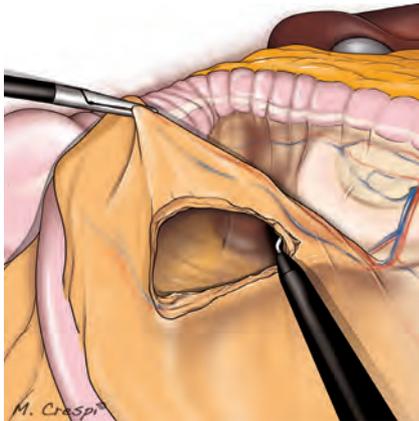
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For the mesocolon dissection, the operating room table is positioned without any Trendelenburg and tilt. By grasping the mesentery and the right mesocolon with the bicurved grasping forceps, sufficient tension is applied for section, using the monopolar coagulating hook, the monopolar bipolar forceps and scissors, respecting the limit of the superior mesenteric vein.

The surgeon is able to create optimal triangulation, which allows work without crossing hands or interference among the instruments' tips (Figures 13, 14).

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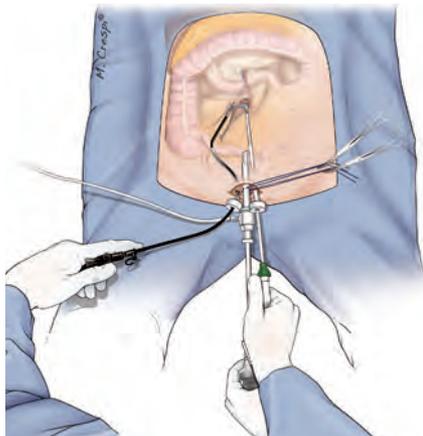


The ileocecal vessels are exposed at their root and dissected using the monopolar dissecting forceps.

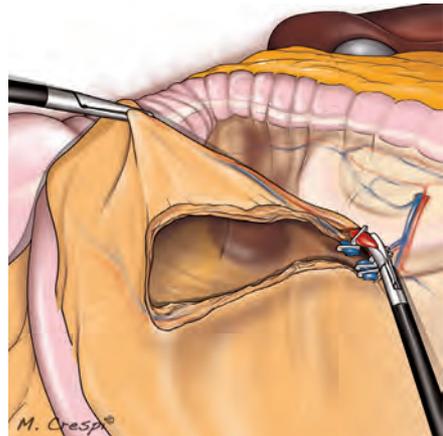
These vessels are individually clipped at their root, using a 5-mm straight clip applicator (Figures 15, 16), and divided with the monocurved scissors (Figures 17, 18). Similarly, the right colic vessels (if present), and the right branch of the middle colic vessels are individually clipped at their root, and divided (Figure 19).

If the operative field's exposure has to be improved or some peri-operative complications occur, a straight 1.8-mm trocarless grasping forceps can be inserted percutaneously by a skin puncture (created by a Veress needle) under the left 12th rib, helping in the retraction and countertraction of the viscera.

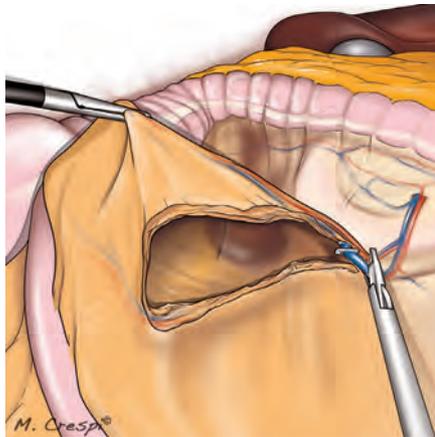
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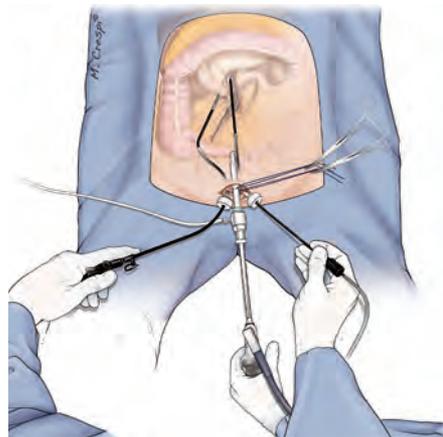
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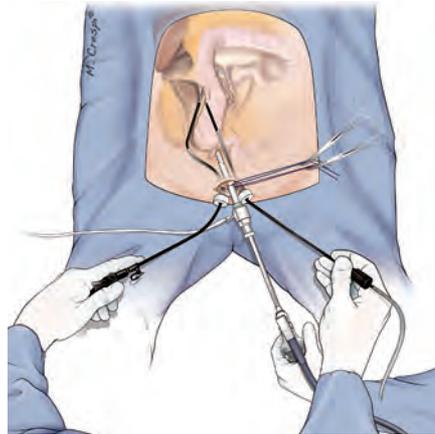
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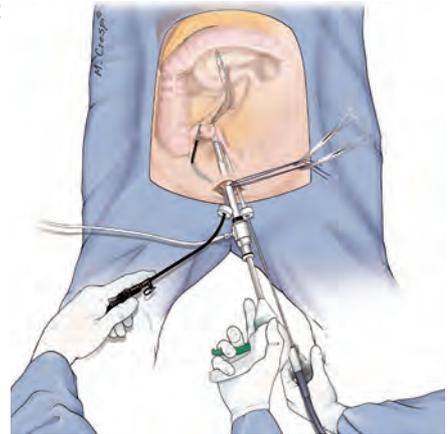
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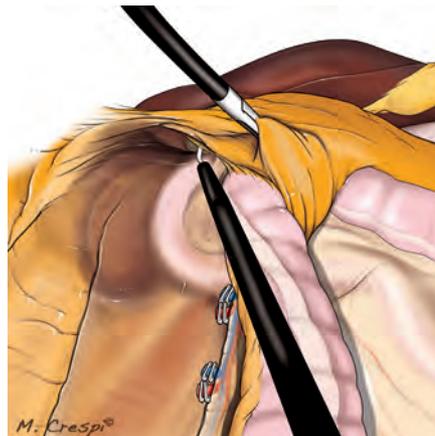
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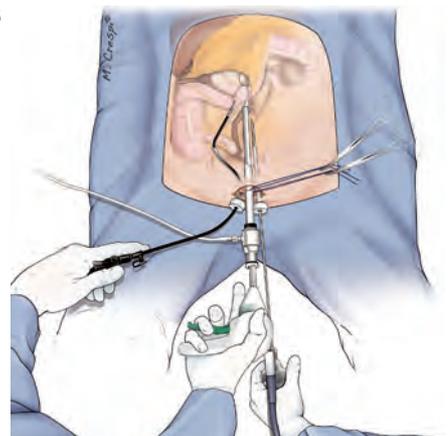
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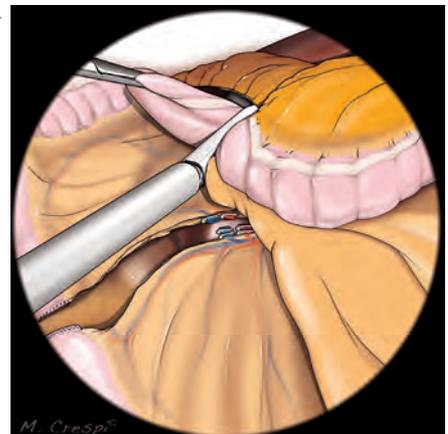
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For mobilization of the hepatic flexure, the patient is placed in a reverse Trendelenburg position with left-sided tilt. The hepatic flexure attachments are dissected using a lateral-to-medial approach (Figures 20, 21). The portion of the omentum attached to the proximal transverse colon is also dissected.

For the anastomosis, the operating room table is placed in a Trendelenburg position with right-sided tilt. The 11-mm trocar is replaced by a reusable 13-mm trocar (if the 12-mm non-reusable trocar is inserted at the beginning, this replacement is not needed), in order to accommodate an articulating linear stapler. The 10-mm scope is switched into a 5-mm, 30° long scope, which is inserted into the 6-mm flexible trocar at 3 o'clock position (Figure 22). The small bowel is divided by a firing of the linear stapler, and the proximal transverse colon is divided by two firings of the linear stapler (Figures 23, 24).

Different types of intracorporeal ileocolic anastomosis can be performed.

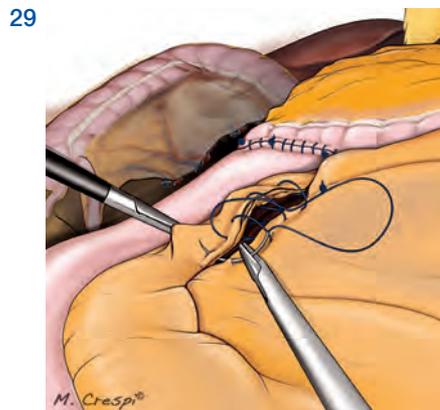
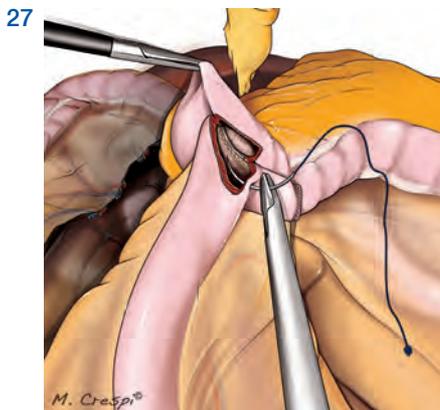
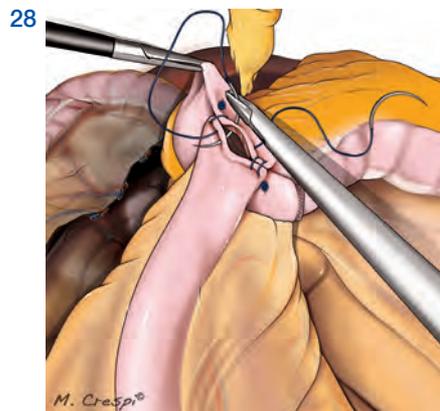
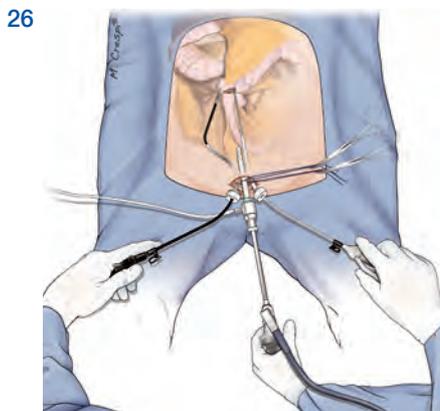
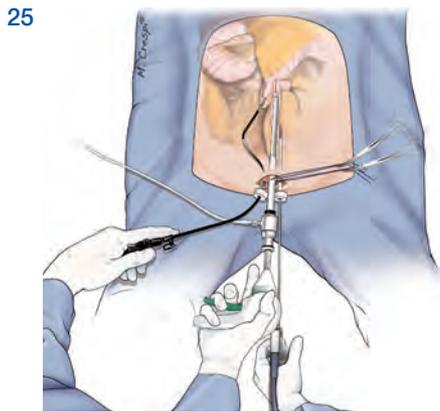
Different Intracorporeal Anastomoses

1) Linear Mechanical Side-To-Side Anastomosis

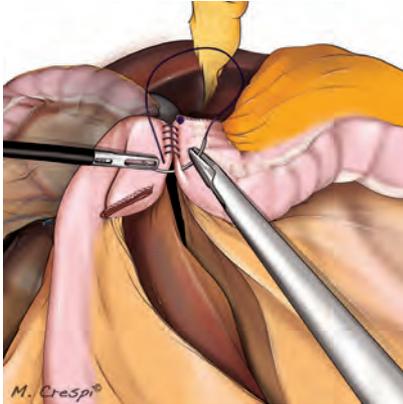
The remnant transverse colon and the small bowel are placed next to one another. A 1 cm opening is made in each lumen with the monocurved coagulating hook. A linear stapler is inserted and fired (**Figure 25**). The 13-mm

trocar is replaced by the 11-mm trocar, together with the change of scope to 10-mm.

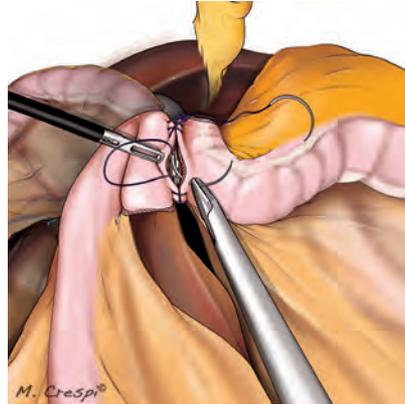
The enterocolotomy is closed by running sutures using the bicurved grasping forceps and the monocurved needle holder, under ergonomic positions for the surgeon (**Figure 26**). Two converging PDS 2/0 running sutures (with preformed knot at one extremity) are started at the opposite sides of the enterocolotomy (**Figures 27, 28**) and joined together (**Figure 29**). The mesenteric window (formed by the transverse mesocolon and the small bowel mesentery) is closed by a PDS 2/0 running suture (**Figure 29**) (a preformed knot at its extremity is useful to gain operative time).



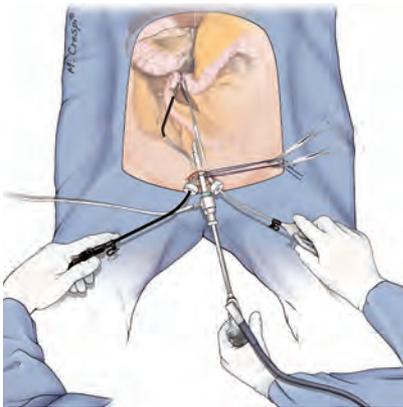
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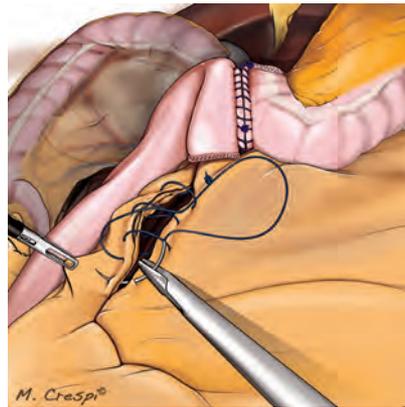
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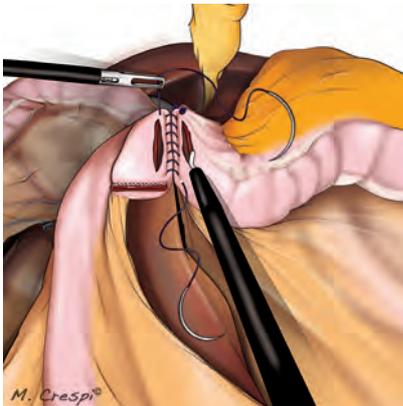
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2) Completely Manual Side-To-Side Anastomosis

The 13-mm trocar is replaced by the 11-mm trocar, as well as an exchange of the scope to 10-mm. The extremity of the small bowel and transverse colon are placed close to one another.

A PDS 2/0 running suture (posterior wall of the anastomosis) with preformed knot at one extremity, is used to join together both viscera (Figure 30). The surgeon works with the bicurved

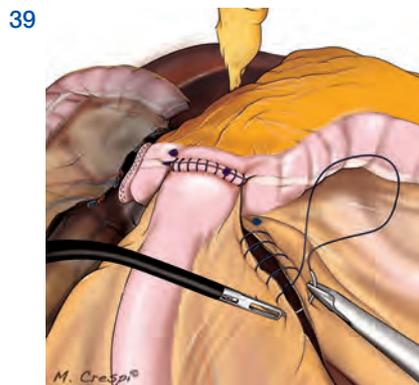
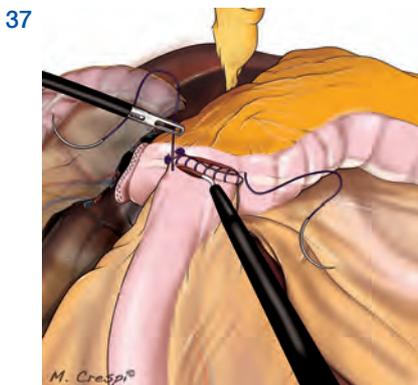
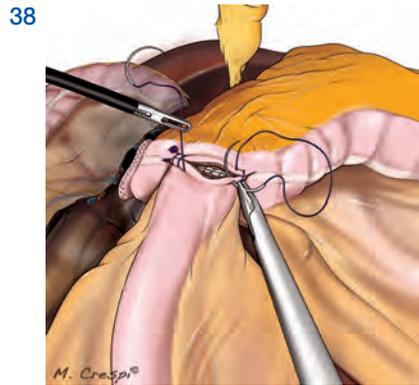
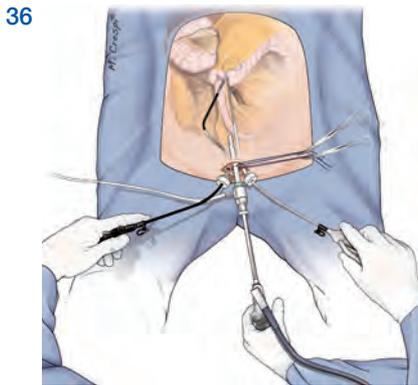
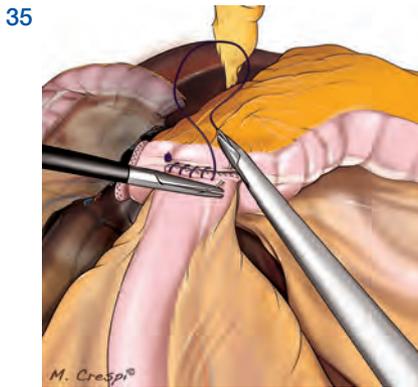
grasping forceps and the monocurved needle holder, without crossing hands and without interference with the camera assistant's hand (Figure 31). A new PDS 2/0 running suture (anterior wall of the anastomosis), with preformed knot at one extremity, is started at the superior corner of the anastomosis. After having passed the first bite, both viscera are opened using the monocurved coagulating hook (Figure 32). Then, the first running suture (the posterior one) is used to reinforce the inferior corner of the anastomosis and continues for several bites on the anterior layer (Figure 33). Finally, the two running sutures are joined together at the inferior part of the anterior layer of the anastomosis (Figure 34). The mesenteric window is closed by a PDS 2/0 running suture (Figure 34) (a preformed knot at its extremity is useful to gain operative time).

3) Completely Manual End-To-Side Anastomosis

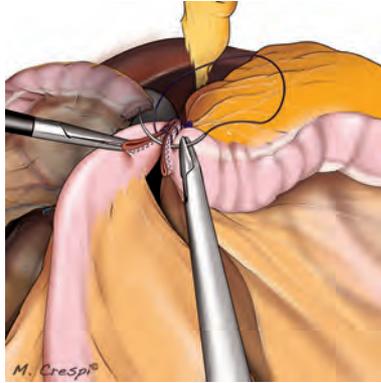
The 13-mm trocar is replaced by the 11-mm trocar, together with an exchange of the scope into a 10-mm. The extremity of the small bowel is placed at 90° with the transverse colon.

A PDS 2/0 running suture (with preformed knot at one extremity) is used to join together both viscera, forming the posterior wall of the anastomosis (Figure 35). The surgeon continues to work

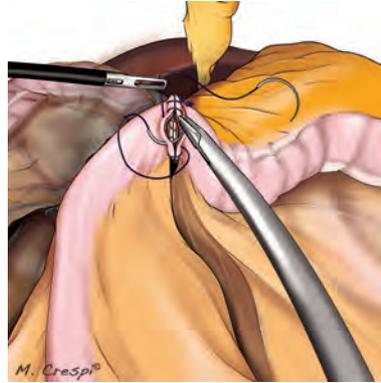
without interference between the hands or instruments' tips (Figure 36). A new PDS 2/0 running suture (anterior wall of the anastomosis), with preformed knot at one extremity, is started at the superior corner of the anastomosis. After having passed the first bite, both viscera are opened with the monocurved coagulating hook (Figure 37). Then, the posterior running suture is used to reinforce the inferior corner of the anastomosis, continuing for some bites on the anterior layer (Figure 38). Finally, the two running sutures are joined together at the inferior part of the anterior layer of the anastomosis (Figure 39), and the mesenteric window is closed by a PDS 2/0 running suture (Figure 39) (a preformed knot at its extremity is useful to gain operative time).



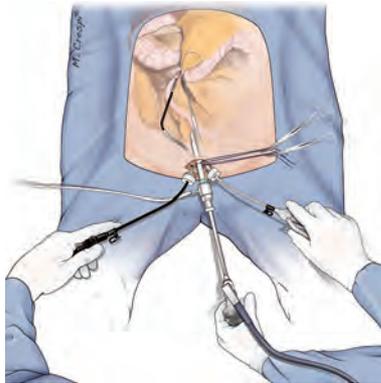
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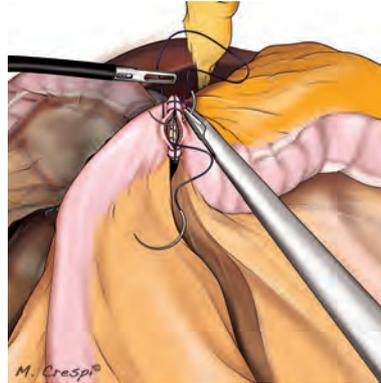
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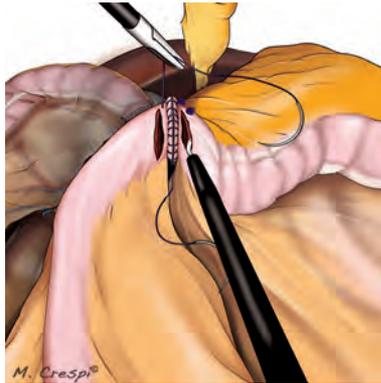
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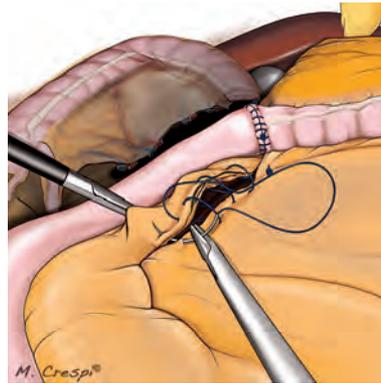
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4) Completely Manual End-To-End Anastomosis

This type of anastomosis is preferred when the small bowel is dilated and presents a diameter similar to the transverse colon. The technique is the same as the two described above for manual anastomosis. It consists of creating a posterior wall with a PDS 2/0 running suture (Figures 40, 41); opening both viscera after having passed the first bite of the anterior PDS 2/0 running suture (Figure 42); reinforcing the inferior corner of

the anastomosis by the posterior running suture (Figure 43); continuing with the anterior running suture (Figure 44) to join the posterior running suture for the knot on the anterior layer of the anastomosis (Figure 45). The mesenteric window is closed by a PDS 2/0 running suture (Figure 45) (a preformed knot at its extremity is useful to gain operative time).

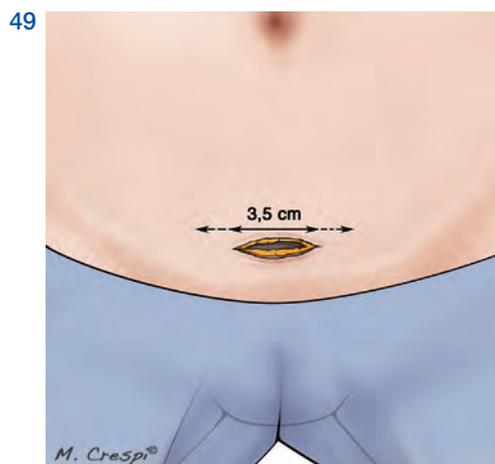
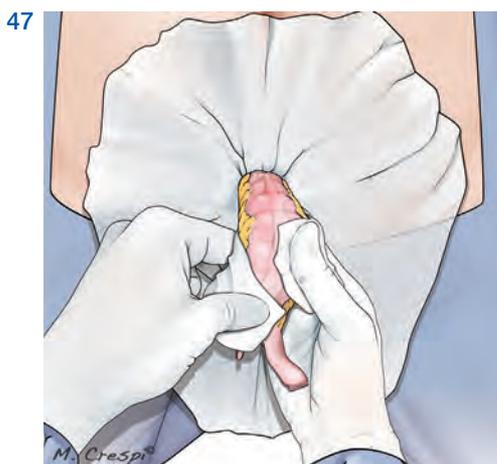
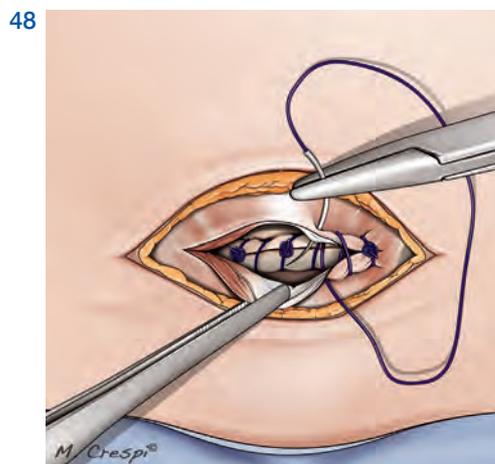
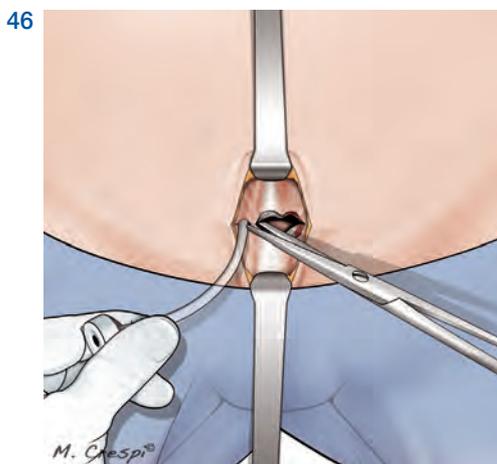
At the end of the ileocolic anastomosis, the operating room table is positioned without any Trendelenburg and tilt.

No drain is left in the abdominal cavity. The specimen is held with the straight grasping forceps. The bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

Both purse-string sutures are retrieved together with the three trocars. The three trocar openings on the rectus abdominis muscle fascia are joined

together (Figure 46), and a plastic wall protector is inserted into the peritoneal cavity at the access site (Figure 47). The specimen is removed through the suprapubic incision (Figure 47).

The peritoneal sheet and the rectus abdominis muscle fascia are meticulously and separately closed with converging Vicryl 1 running sutures (Figure 48). The cutaneous scar is joined by Monocryl 4/0 intradermic sutures, and the final incision length depends on the specimen's size (Figure 49).



Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

The urinary catheter is removed on the 1st postoperative day.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

Antibiotic prophylaxis is prescribed if necessary and TVP prophylaxis until the discharge of the patient from the hospital. The patient is allowed to drink water 24 hours after the procedure, and to tolerate a light diet on the 3rd post-operative day. If there are no complications, the patient can be discharged on the 4th post-operative day.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, and 1, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the gastroenterologist/oncologist.

5.2 LEFT COLECTOMY

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Different Intracorporeal Anastomoses

Post-operative Care

5.2 LEFT COLECTOMY

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after intubation.

Antibiotic and TVP prophylaxis are applied as well.

A urinary catheter is inserted.

Tools

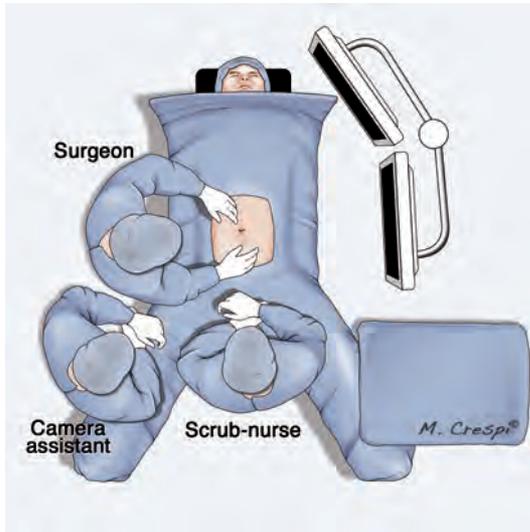
Abdominal table:

- one scalpel, two tissue forceps, one monopolar electrode, two Farabeuf retractors, two Kocher-Ochsner curved forceps, one Mayo scissors, two Mayo-Hegar needle-holders, two Pean-Rochester curved forceps, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), five Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Polypropylene 2/0 (Prolene 2/0, round tip, 1/2c, 26 mm), one Polyglactin 2/0 (Vicryl 2/0, round tip, 1/2c, 36 mm), two Polydioxanon 2/0 (PDS 2/0, round tip, 1/2c, 26 mm), two Polydioxanon 3/0 (PDS 3/0, round tip, 1/2c, 22 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable 13-mm rigid trocar or one non-reusable 12-mm trocar
- two reusable 6-mm flexible trocars and rigid mandrils (DAPRI flex trocars)
- one straight 10-mm, 30° regular length scope
- one straight 5-mm, 30° long length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps I)
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved dissecting forceps (DAPRI dissecting forceps)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable straight 5-mm clip applier
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one non-reusable articulating 45 linear stapler
- one non-reusable plastic wall protector

Perineal table:

- one non-reusable circular stapler
- one rectal tube and syringe

1



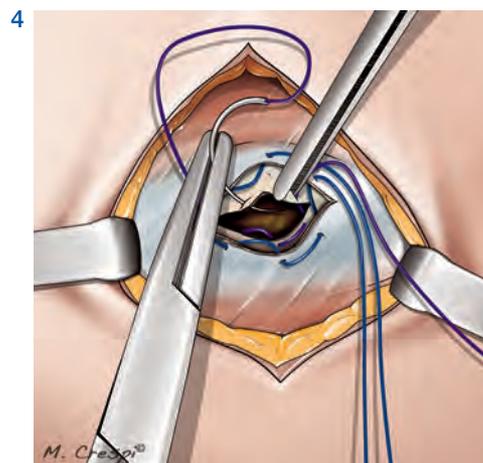
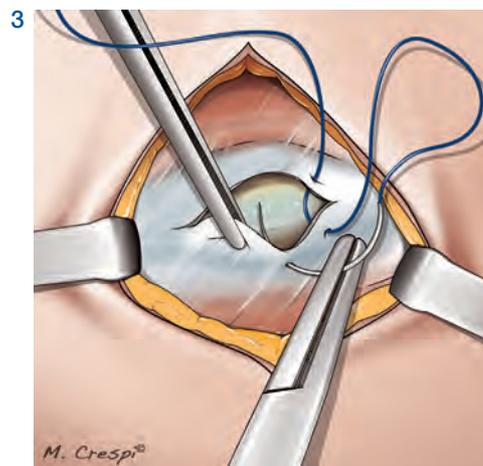
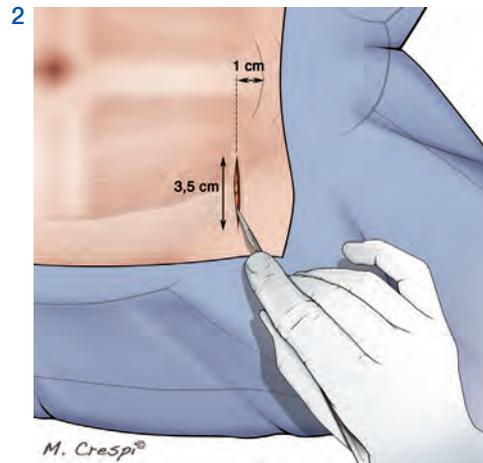
Patient and Team Positioning

The patient is placed in a supine position, with the arms alongside the body and the legs apart. The arms, ankles, and legs are secured and protected. These latter are well-secured to the operating table, and the left leg is positioned further up.

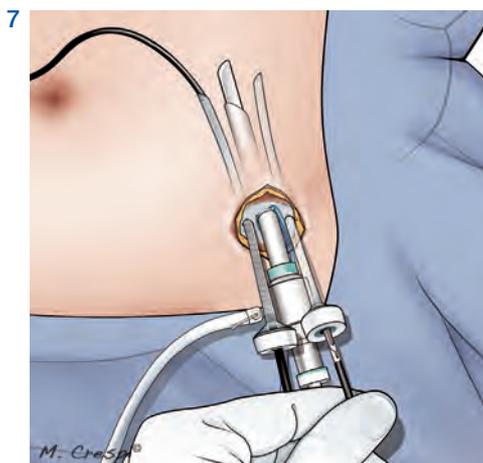
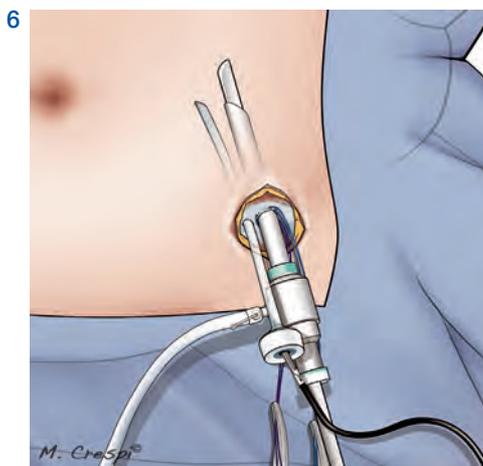
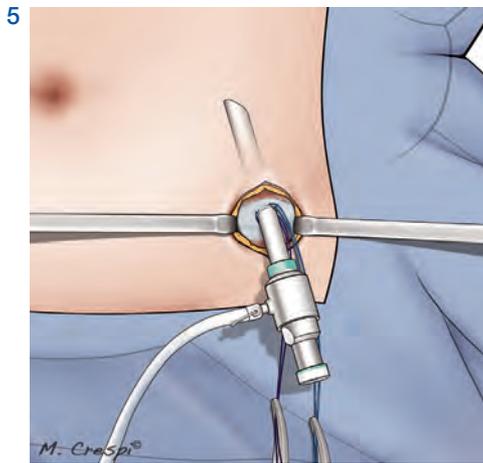
The surgeon stands to the patient's right, and the camera assistant to the surgeon's right. The scrub-nurse stands between the patient's legs. The video monitor is placed in front of the surgeon and camera assistant ([Figure 1](#)).

Technique

A 3.5 cm transverse skin incision is made 1 cm above the pubic symphysis on the right side of the rectus abdominis muscle (Figure 2). The underlying fascia is vertically divided in a pararectal fashion for 1.5 cm, which exposes the rectus abdominis muscle. The muscle is medially retracted and a purse-string suture using PDS 1 is placed in the fascia (Figure 3), going inside and outside respectively at the 5, 7, 9, 11, 1, and 3 o'clock positions (Figure 4). The peritoneal sheet is entered through a 1 cm vertical incision, and a new purse-string suture using Vicryl 1 is placed, going inside and outside respectively at the 5, 7, 9, 11, 1, and 3 o'clock positions (Figure 4). Both sutures are kept externally using a Pean-Rochester curved forceps.



Click to watch the corresponding video
Left Colectomy



An 11-mm trocar (or a 12-mm non-reusable trocar) is introduced into the peritoneal cavity inside the purse-string sutures, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar.

A 6-mm flexible trocar is inserted at the 12 o'clock position with respect to the patient's head, outside the purse-string sutures and on the same vertical line of the previous trocar, for insertion of the bicurved grasping forceps (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

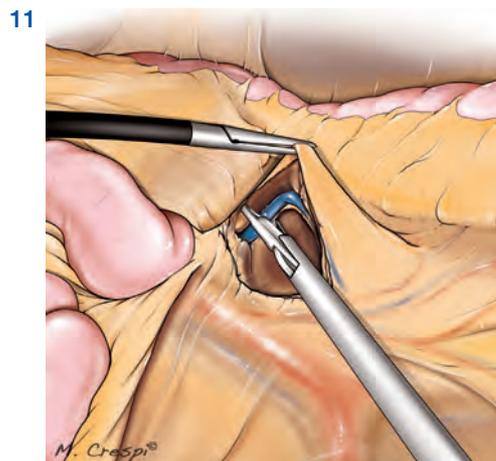
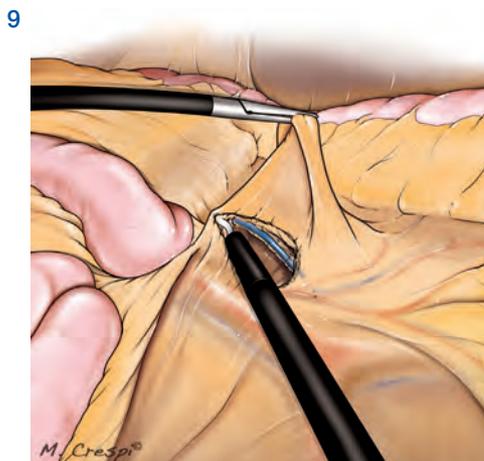
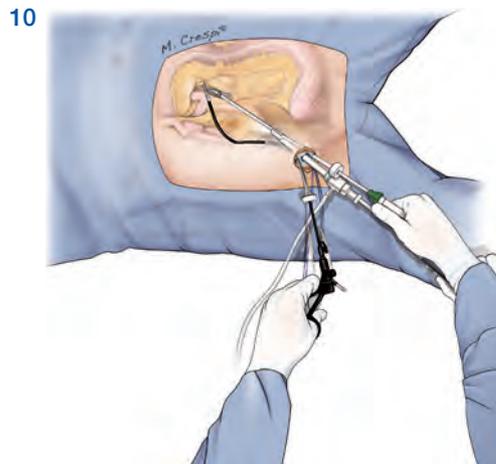
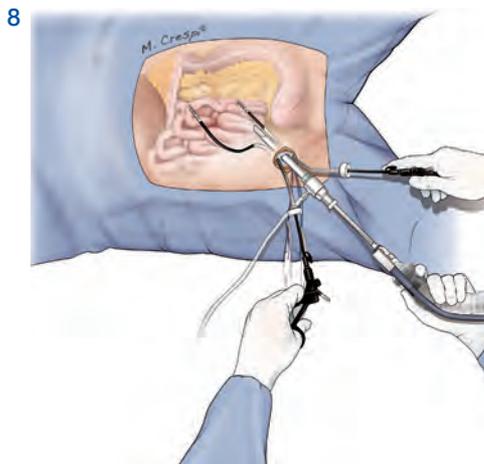
Another 6-mm flexible trocar is inserted at the 6 o'clock position with respect to the patient's head, outside the purse-string sutures and on the same vertical line of the previous trocars, for insertion of the other instruments (Figure 7), such as the monocurved grasping forceps, the monocurved coagulating hook, the monocurved dissecting forceps, the monocurved bipolar forceps and scissors, the straight 5-mm clip applier, the monocurved scissors, the monocurved needle holder, the monocurved suction and irrigation cannula, and the straight grasping forceps.

The abdominal cavity is explored and examined to rule out the presence of peritoneal metastases, superficial hepatic lesions and free ascites.

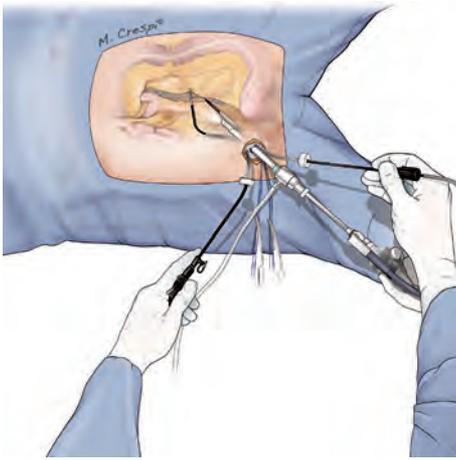
The operating room table is placed in an accentuated Trendelenburg position with right-sided tilt.

The small bowel is moved into the right abdominal quadrants and above the right liver lobe, using the bicurved and monocurved grasping forceps (Figure 8). The ligament of Treitz is identified

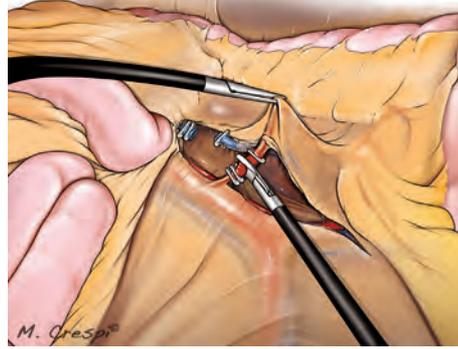
in order to expose the root of the inferior mesenteric vein. The peritoneal sheet covering the root of this vein is incised by the monocurved coagulating hook (Figure 9) until the Toldt's fascia is reached. The inferior mesenteric vein is isolated using the monocurved dissecting forceps and clipped by the 5-mm straight clip applicator (Figures 10, 11). The left mesocolon is separated from the Toldt's fascia in an avascular plane using the monocurved coagulating hook or the monocurved suction cannula.



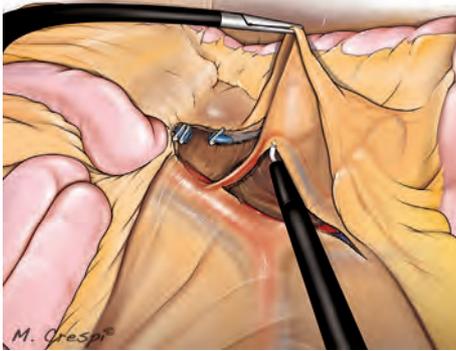
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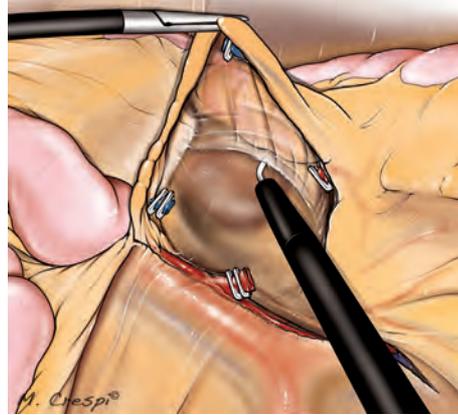
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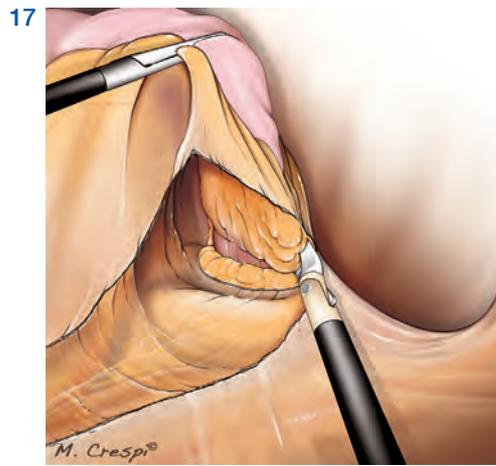
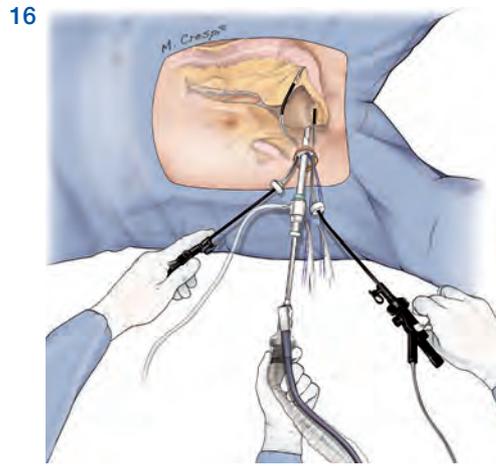
The surgeon works with curved instruments without crossing hands and without interfering with the camera assistant's hand (Figure 12).

The peritoneal sheet is incised along the abdominal aorta by the monocurved coagulating hook, reaching the origin of the inferior mesenteric artery (Figure 13). The root of the artery is freed using the monocurved coagulating hook and the monocurved dissecting forceps, clipped by the 5-mm straight clip applicator, and divided by the monocurved scissors (Figure 14).

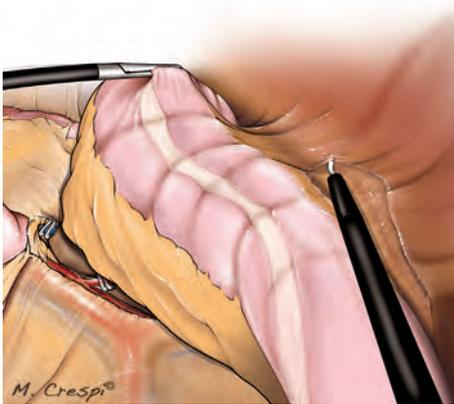
The left mesocolon is freed from the Toldt's fascia (Figure 15), respecting the left Gerota's fascia and going in the direction of the pancreatic tail.

If the operative field's exposure must be improved or some peri-operative complications occur, a straight 1.8-mm trocarless grasping forceps can be inserted percutaneously via a skin puncture (created by a Veress needle) in the left flank, helping in retraction and countertraction of the viscera.

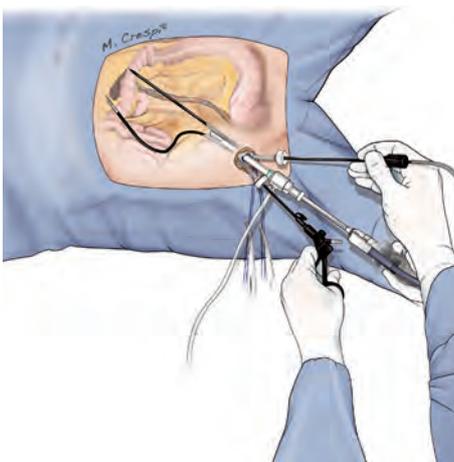
The procedure is continued by sectioning the left mesocolon until the promontory is reached (Figure 16). The upper mesorectum is incised and dissected from the presacral fascia in an avascular plane using the monocurved coagulating hook and the monocurved bipolar forceps and scissors. Once the level of the rectal resection is chosen, the rectum is circumferentially freed from the fatty tissue by the monocurved coagulating hook and the monocurved bipolar forceps and scissors (Figure 17).



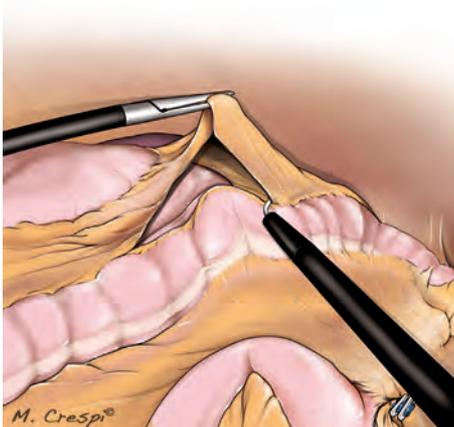
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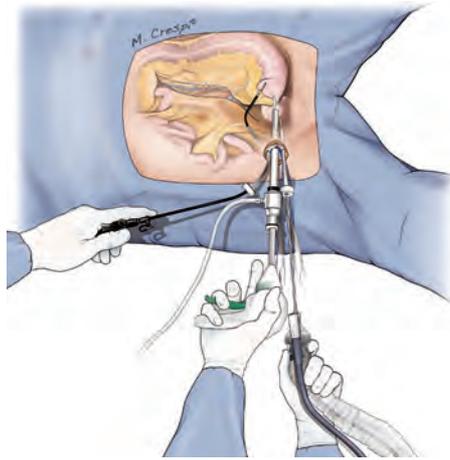


The sigmoid and left colons are freed from the peritoneal attachments by the monocurved coagulating hook or scissors (Figure 18). The pancreatic surface is separated from the left mesocolon using a lateral-to-medial approach, whereas the greater omentum adhering to the distal transverse colon is freed from the latter using a medial-to-lateral approach (Figures 19, 20). Both monocurved coagulating hook and monocurved bipolar forceps and scissors are used during this step. Finally, the splenic flexure is able to be downloaded.

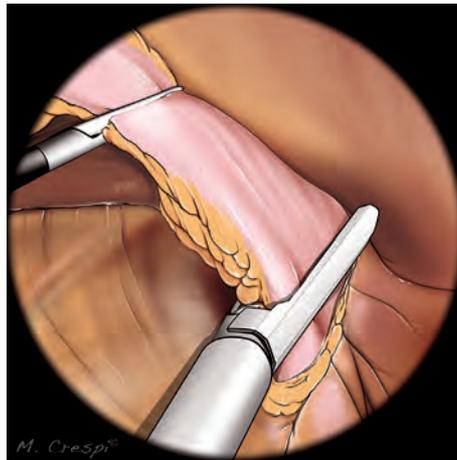
The left mesocolon is sectioned inside the abdomen, after having chosen the level of the colic transection.

For the rectal sectioning, the 11-mm trocar is replaced by a reusable 13-mm trocar (if the 12-mm non-reusable trocar is inserted at the beginning, this replacement is not needed), in order to accommodate an articulating linear stapler. The 10-mm scope is switched into a 5-mm, 30° long scope, which is inserted into the 6-mm flexible trocar at 6 o'clock position (Figure 21). The linear stapler encircles the freed upper rectum and it is fired (Figure 22). Usually two firings are enough to complete the rectal section.

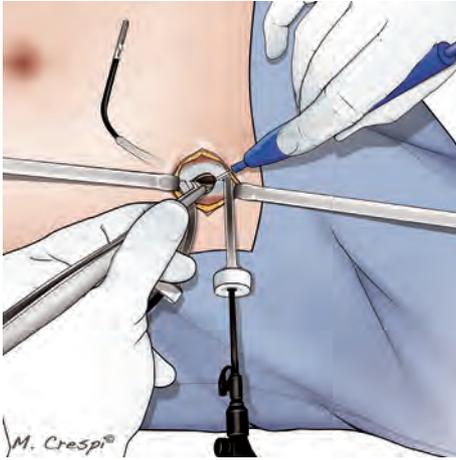
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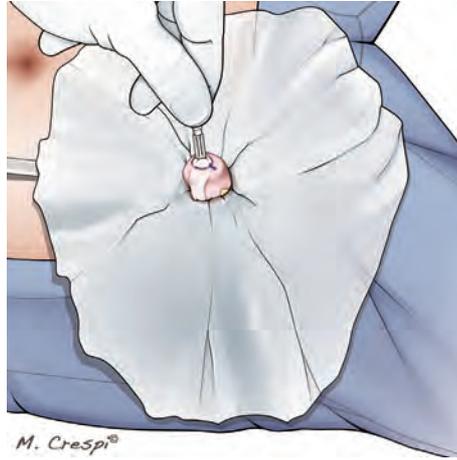
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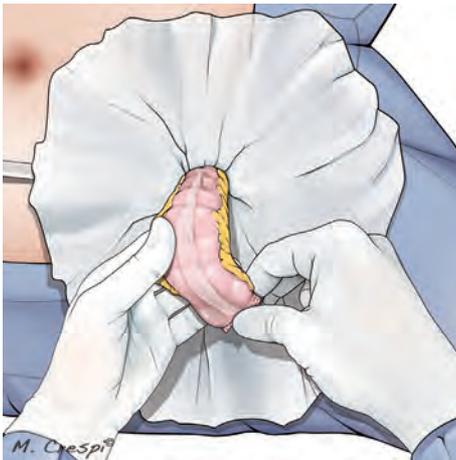
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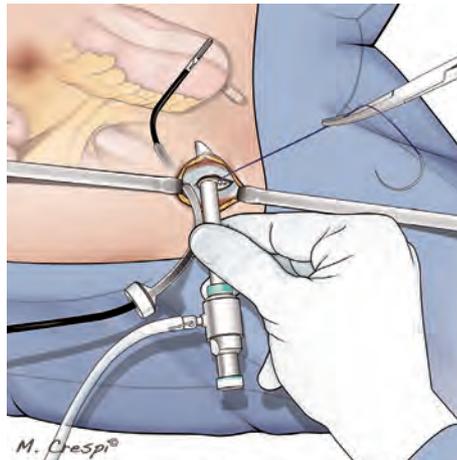
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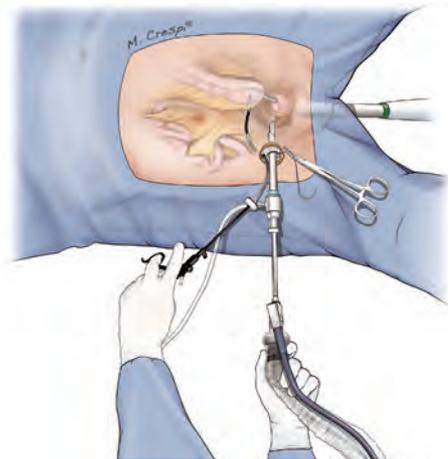
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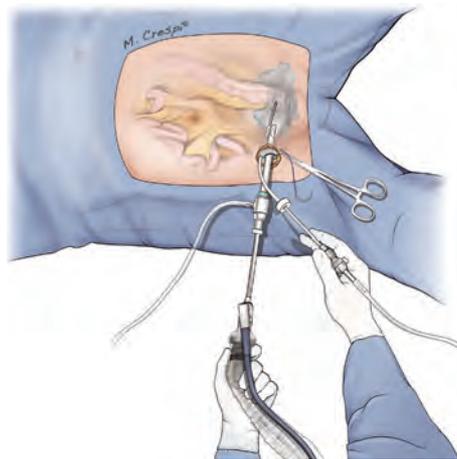
The specimen is kept by the straight grasping forceps and the 6-mm flexible trocar at the 6 o'clock position is retrieved together with the 13-mm trocar and both purse-string sutures. The two fascial openings for the trocars are joined together (Figure 23), enlarging the access. A plastic wall protector is inserted into the peritoneal cavity (Figure 24). The specimen is removed inside the plastic protector (Figure 24). The correct level of the left colon transection is

found and sectioned by scissors. The anvil of the circular stapler is inserted into the lumen, and a Prolene 2/0 purse-string suture is used to close the colic lumen around the anvil spike (Figure 25). The anvil is introduced into the abdominal cavity, and the peritoneal sheet as well as the muscular fascia are partially closed by Vicryl 1 sutures, permitting introduction of the 11-mm trocar into the abdominal cavity (Figure 26). The 10-mm scope is reused.

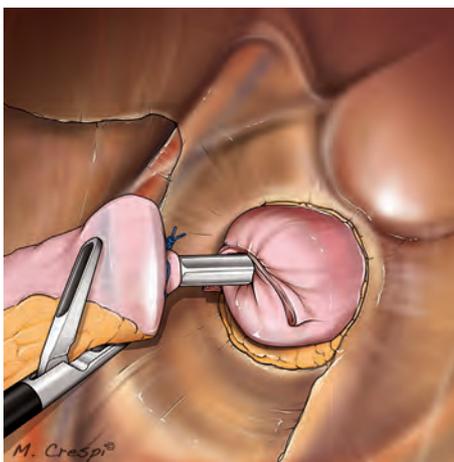
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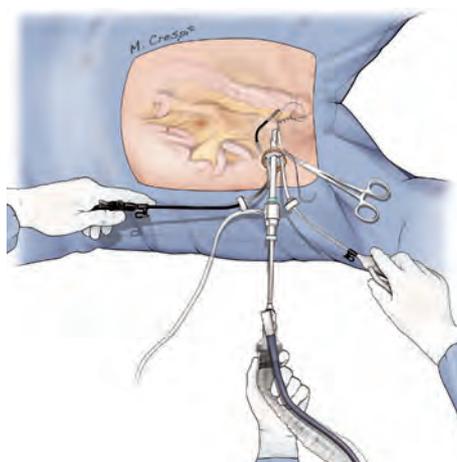
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The circular stapler is introduced through the anus into the rectum, and the stapler spike is pushed out the rectal stump, staying in the middle of the previous staple line (Figure 27). The bicurved grasper is used to position the anvil in the circular stapler (Figure 28); the stapler is closed and fired.

The monocurved suction and irrigation cannula is introduced and the pelvis is immersed under physiologic solution (Figure 29). A leak-test of the anastomosis, using insufflated air through the anus, is performed.

The mesocolic window (formed by the descending mesocolon and promontory-aortic plane) is closed by a Vicryl 2/0 running suture, using the bicurved

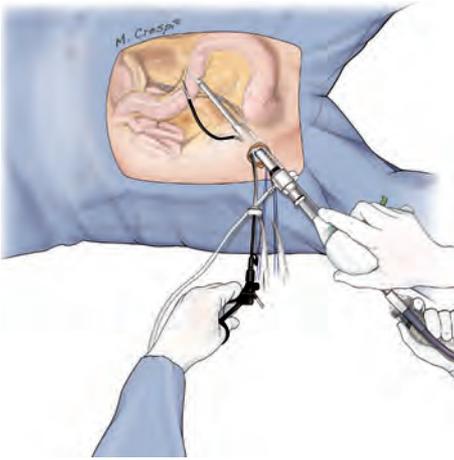
grasping forceps and the monocurved needle holder (Figure 30).

The operating room table is re-positioned without any Trendelenburg or tilt, and the small bowel is gently moved out of the right abdominal quadrants and over the left colon. No drain is left in the abdominal cavity.

The curved instruments are retrieved following the curves at 45° with respect to the abdominal wall.

The flexible trocars and the 11-mm trocar are removed, and the previous sutures of the peritoneal sheet and muscular fascia closure are used to completely close the access site.

31

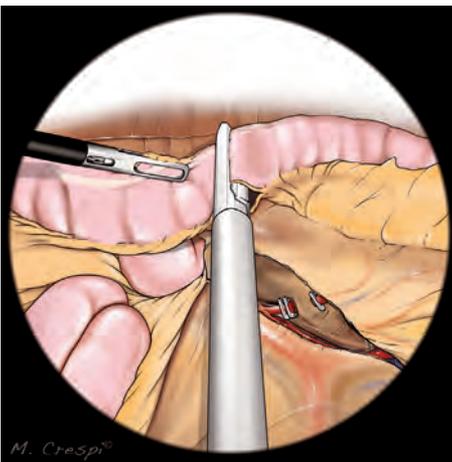


Different Intracorporeal Anastomoses

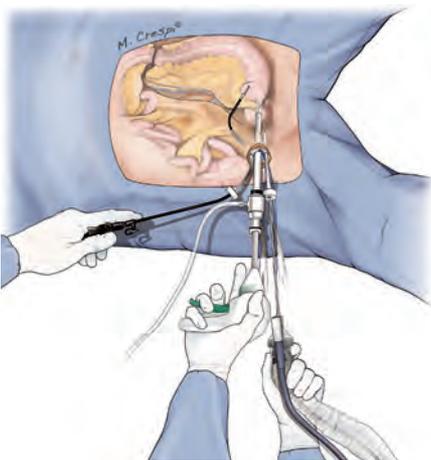
Completely Manual Mono- or Double-Layer Anastomosis

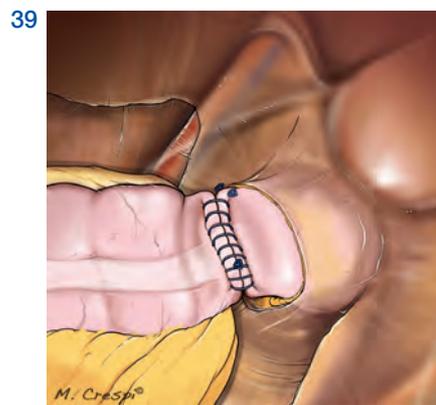
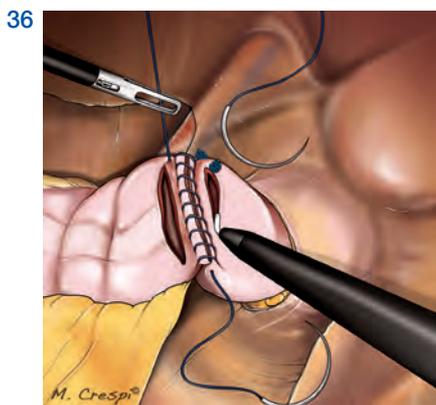
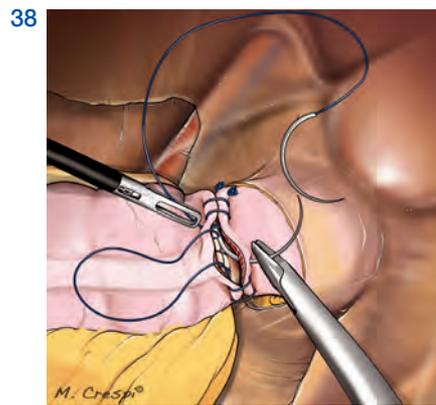
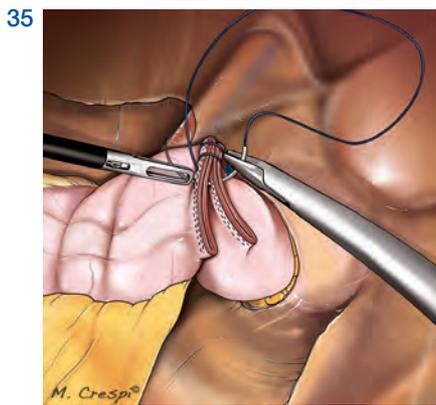
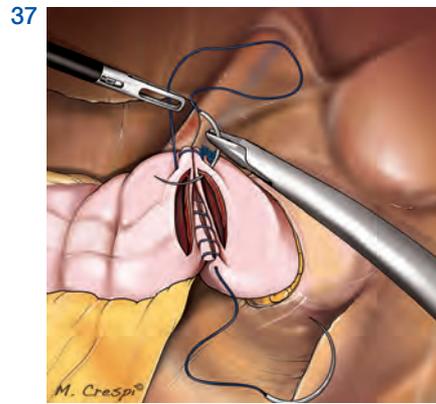
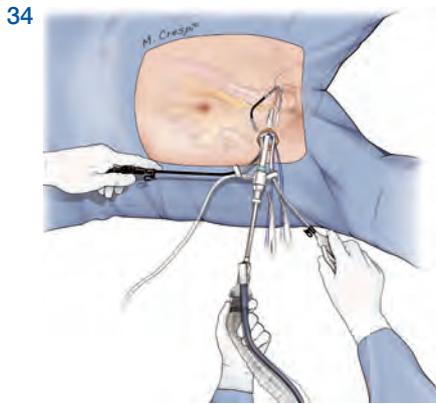
Another option is to perform a completely manual colorectal anastomosis. In order to perform this anastomosis, prior to the rectal transection step, the left colon is intracorporeally sectioned at the chosen level by firings of linear stapler (Figures 31, 32). Then, the rectum is transected (Figure 33).

32



33



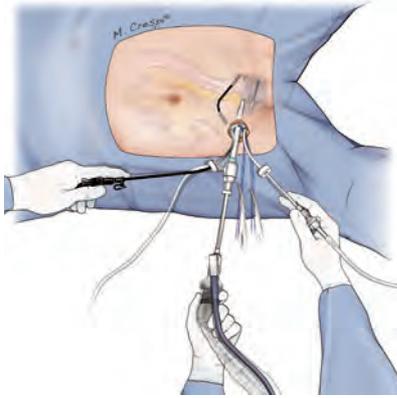


The intracorporeal manual anastomosis is completed using the bicurved grasping forceps and the monocurved needle holder (Figure 34) in a mono- or double-layer fashion. All the sutures have a preformed knot at one extremity to gain operative time.

For the mono-layer method, a PDS 2/0 running suture is used to join the left colon and the upper rectum, creating the posterior wall of the anastomosis (Figure 35). Then, a new PDS 2/0 running suture is started at the corner and,

after have passed the first bite, both viscera are opened using the monocurved coagulating hook (Figure 36). During this time, the surgeon is able to work with comfortable ergonomics without interference of the hands or instruments' tips. The anterior surface of the anastomosis is closed (Figure 37), taking care to close the inferior corner with some bites of the posterior running suture (Figure 38). Both running sutures are joined together on the anterior layer of the anastomosis (Figure 39).

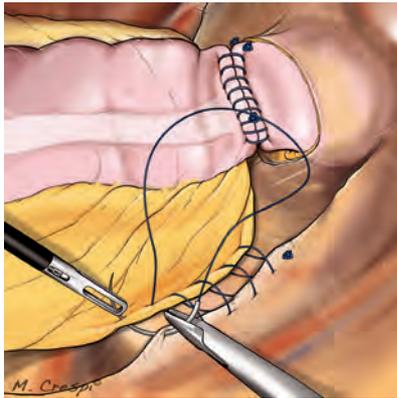
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The leak-test is performed (Figure 40), and the mesocolic window is closed by a Vicryl 2/0 running suture (Figure 41) (a preformed knot at its extremity is useful to gain operative time).

For the double-layer method, the only difference with regard to the mono-layer is that the internal layer is performed with two PDS 3/0 running sutures.

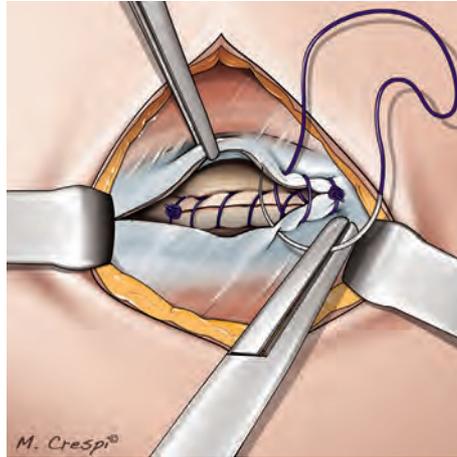
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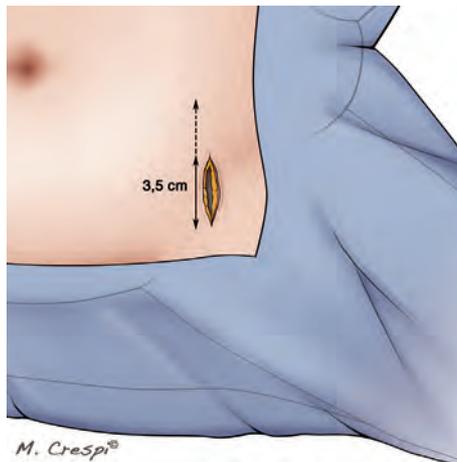
At the end of the manual anastomosis, the specimen is held by the straight grasping forceps and extracted, after having removed both purse-string sutures, protected the wall and having enlarged the access by joining together the three trocars' fascia openings. The peritoneal sheet and the rectus abdominis muscle fascia are meticulously and separately closed by converging Vicryl 1 running sutures (Figure 42).

The procedure finishes with closure of the cutaneous scar by Monocryl 4/0 intradermic sutures. The final incision length depends on the specimen's size (Figure 43).

42



43



Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

Antibiotic prophylaxis is prescribed if necessary and TVP prophylaxis until the discharge of the patient from the hospital. The urinary catheter is removed on the 1st postoperative day. The patient is allowed to drink water after 24 hours as well, and to tolerate a light diet on the 3rd post-operative day. If there are no complications, the patient is discharged on the 5th post-operative day.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the gastroenterologist/oncologist.

5.3 UP-TO-DOWN RECTAL RESECTION

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Post-operative Care

5.3 UP-TO-DOWN RECTAL RESECTION

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure. A colic preparation is prescribed in the days before.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after the intubation.

Antibiotic and TVP prophylaxis are applied as well.

An arterial catheter, a central line and a urinary catheter are placed.

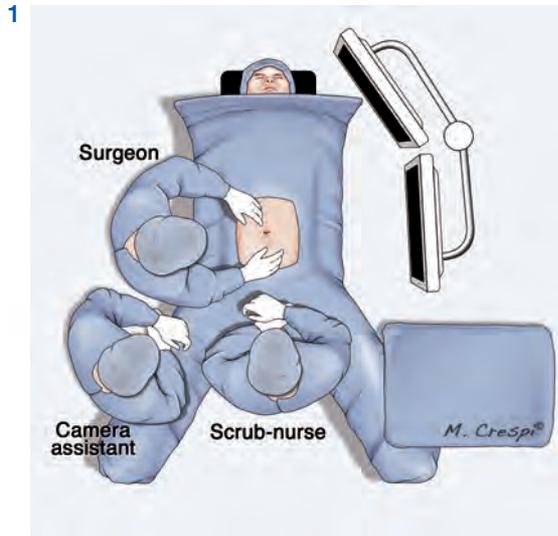
Tools

Abdominal table:

- one scalpel, two tissue forceps, one monopolar electrode, two Farabeuf retractors, two Kocher-Ochsner curved forceps, one Mayo scissors, two Mayo-Hegar needle-holders, two Pean-Rochester curved forceps, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), five Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), three Polyamide 2/0 (Ethilon 2/0, straight needle, 60 mm), one Polypropylene 2/0 (Prolene 2/0, round tip, 1/2c, 26 mm), three Polyglactin 2/0 (Vicryl 2/0, round tip, 1/2c, 36 mm), four Polyglactin Rapid 3/0 (Vicryl Rapid 3/0, triangular tip, 1/2c, 22 mm)
- one reusable 11-mm rigid trocar
- one reusable 13-mm rigid trocar or one non-reusable 12-mm trocar
- two reusable 6-mm flexible trocars and rigid mandrils (DAPRI flex trocars)
- one straight 10-mm, 30° regular length scope
- one straight 5-mm, 30° long length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps I)
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved dissecting forceps (DAPRI dissecting forceps)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable straight 5-mm clip applier
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one non-reusable articulating 45 linear stapler
- one non-reusable plastic wall protector
- one drain
- one ileostomy set

Perineal table:

- one non-reusable circular stapler
- one rectal tube and syringe

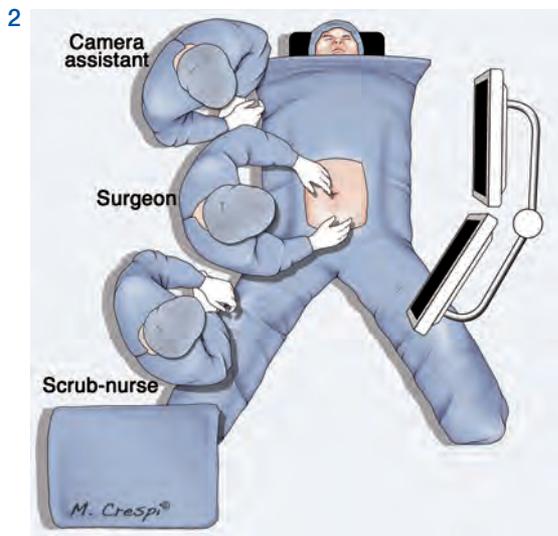


Patient and Team Positioning

The patient is placed in a supine position, with the arms alongside the body and the legs apart. The arms, ankles, and legs are secured and protected. These latter are well secured to the operative table, and the left leg is positioned further up.

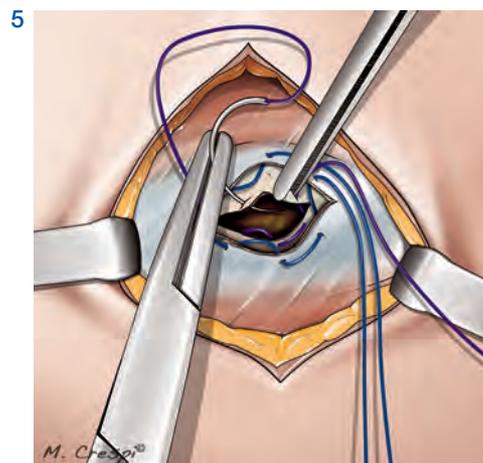
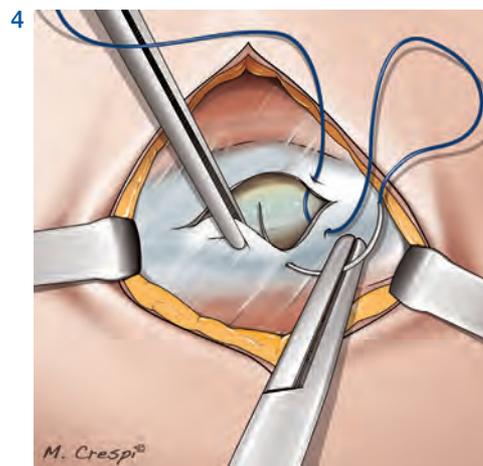
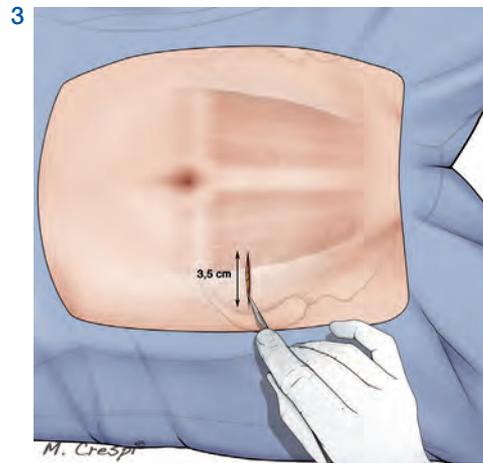
For the first part of the procedure, the surgeon stands to the patient's right, and the camera assistant to the surgeon's right. The scrub-nurse stands between the patient's legs. The video monitor is placed in front of the surgeon and camera assistant (Figure 1).

After the mesocolic mobilization is made, the camera assistant moves to the surgeon's left, and the scrub-nurse to the surgeon's right (Figure 2).

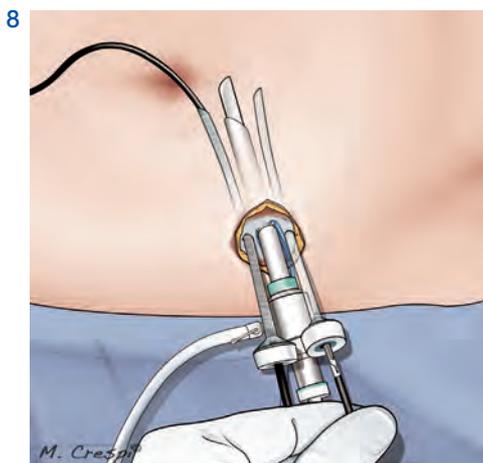
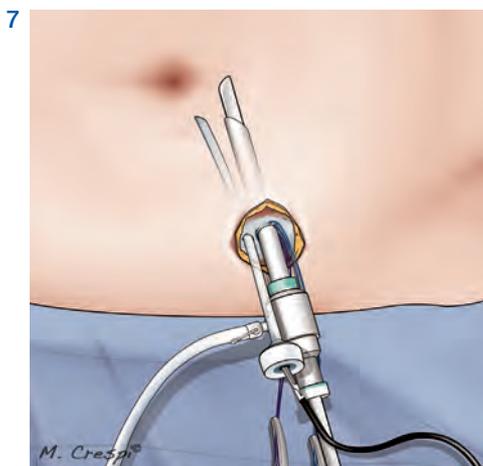
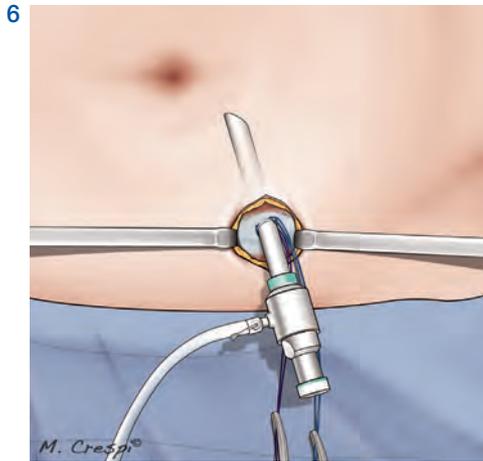


Technique

A 3.5 cm transverse skin incision is made in the right flank, adjacent to the right rectus abdominis muscle and between the umbilicus and the superior right iliac spine (Figure 3). The underlying fascia is divided in a pararectal fashion for 1.5 cm, which exposes the rectus abdominis muscle. The muscle is medially retracted and a purse-string suture using PDS 1 is placed in the fascia (Figure 4), going inside and outside respectively at the 5, 7, 9, 11, 1, and 3 o'clock positions (Figure 5). The peritoneal sheet is entered through a 1 cm vertical incision, and a new purse-string suture using Vicryl 1 is placed, going inside and outside respectively at the 5, 7, 9, 11, 1, and 3 o'clock positions (Figure 5). Both sutures are kept externally with a Pean-Rochester curved forceps.



[Click to watch the corresponding video](#)
[Up-To-Down Rectal Resection](#)



An 11-mm trocar (or a 12-mm non-reusable trocar) is introduced into the peritoneal cavity inside the purse-string sutures, and the pneumoperitoneum is created (Figure 6). The 10-mm, 30° scope is advanced through the 11-mm trocar.

A 6-mm flexible trocar is inserted at the 12 o'clock position with respect to the patient's head, outside the purse-string sutures and on the same vertical line as the previous trocar, for insertion of the bicurved grasping forceps (Figure 7). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

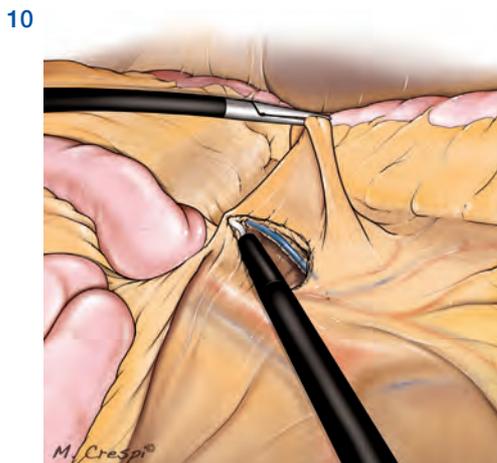
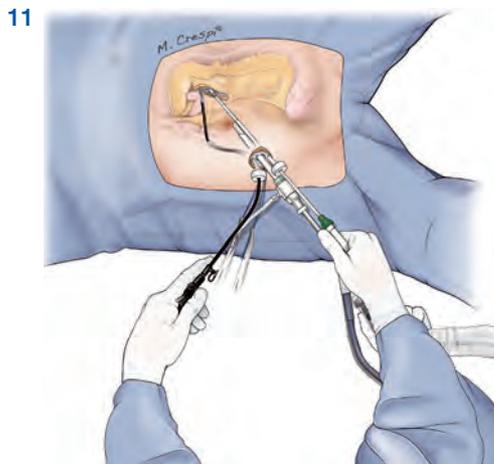
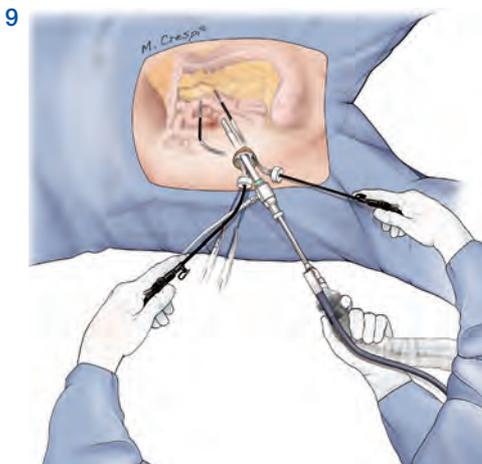
Another 6-mm flexible trocar is inserted at the 6 o'clock position with respect to the patient's head, outside the purse-string sutures and on the same vertical line as the previous trocars, for insertion of the other instruments (Figure 8), such as the monocurved grasping forceps, the monocurved coagulating hook, the monocurved dissecting forceps, the monocurved bipolar forceps and scissors, the straight 5-mm clip applier, the monocurved scissors, the monocurved needle holder, the monocurved suction and irrigation cannula, and the straight grasping forceps.

The abdominal cavity is explored and examined to rule out the presence of peritoneal metastases, superficial hepatic lesions and free ascites.

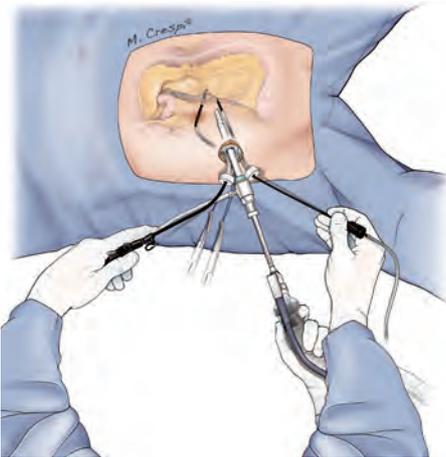
The operating room table is placed in an accentuated Trendelenburg position with right-sided tilt.

The small bowel is moved into the right abdominal quadrant and above the right liver lobe using the bicurved and monocurved grasping forceps (Figure 9).

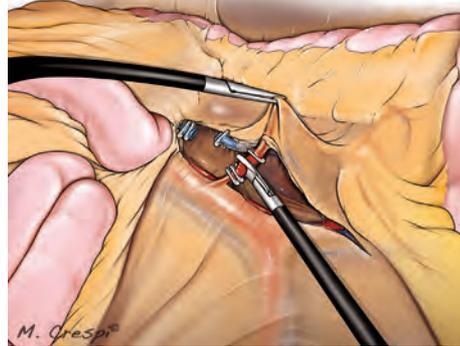
The ligament of Treitz is identified in order to expose the root of the inferior mesenteric vein. The peritoneal sheet covering the root of this vein is incised with the monocurved coagulating hook (Figure 10) until the Toldt's fascia is reached. The inferior mesenteric vein is isolated using the monocurved dissecting forceps and clipped by the 5-mm straight clip applier (Figures 11, 12).



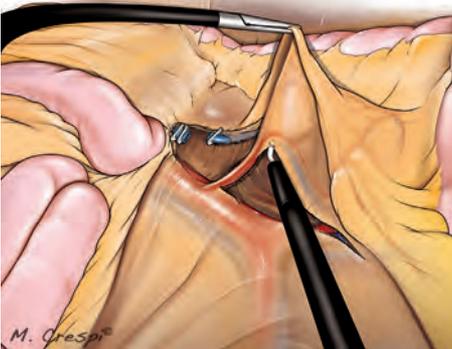
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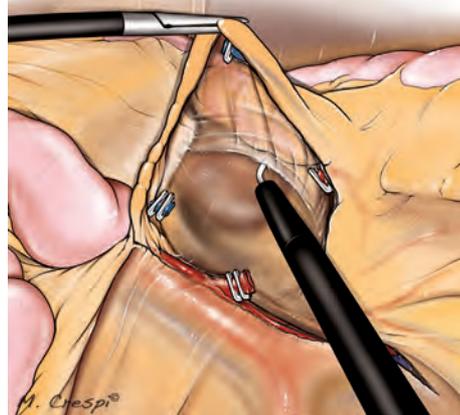
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The left mesocolon is separated from the Toldt's fascia in an avascular plane using the monopolar coagulating hook or the monopolar suction cannula.

The surgeon works with curved instruments without crossing hands and without interference with the camera assistant's hand (Figure 13).

The peritoneal sheet is incised along the abdominal aorta with the monopolar coagulating hook, reaching the origin of the inferior mesenteric artery (Figure 14). The root of the artery is freed using the monopolar coagulating hook and the

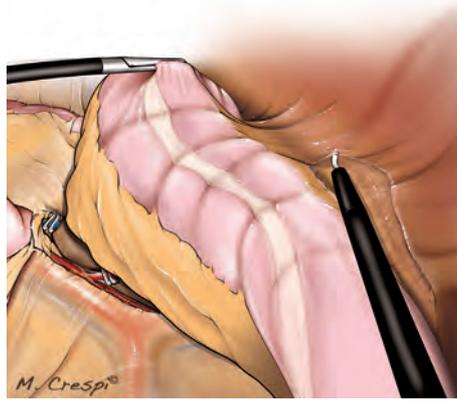
monopolar dissecting forceps, clipped by the 5-mm straight clip applier, and divided by the monopolar scissors (Figure 15).

If necessary to improve the operative field's exposure, a straight 1.8-mm trocarless grasping forceps can be inserted percutaneously via a skin puncture (created by a Veress needle) in the left suprapubic area. At the end of the procedure, this hole can be used for drain placement.

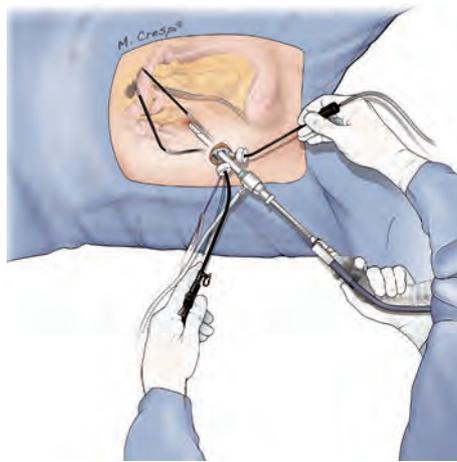
The left mesocolon is freed from the Toldt's fascia (Figure 16), respecting the left Gerota's fascia and going in the direction of the pancreatic tail.

The sigmoid and left colons are mobilized from the peritoneal attachments, using the monocurved coagulating hook or scissors (Figure 17), until reaching the splenic flexure, which is mobilized by a medial-to-lateral approach (Figures 18, 19).

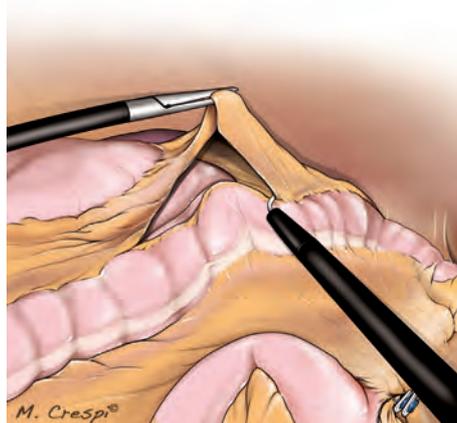
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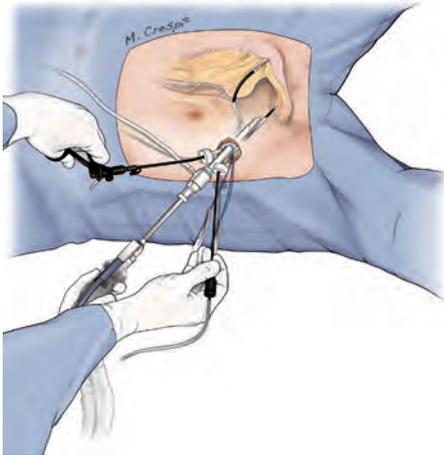
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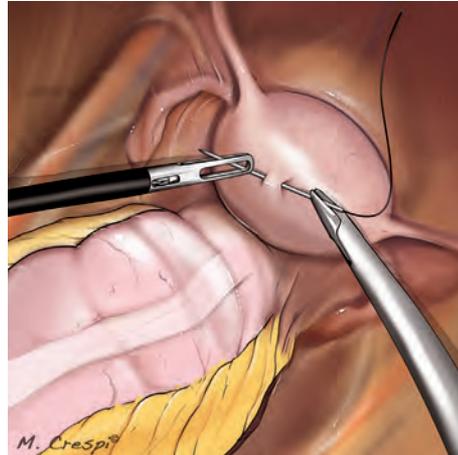
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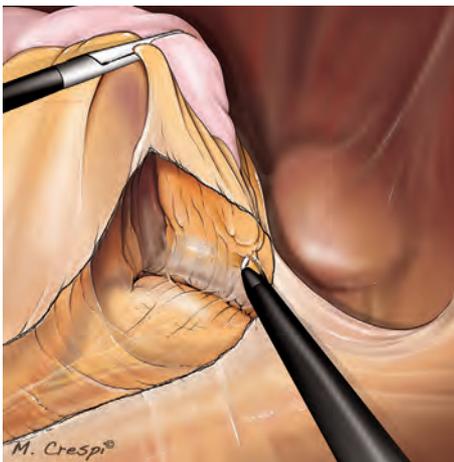
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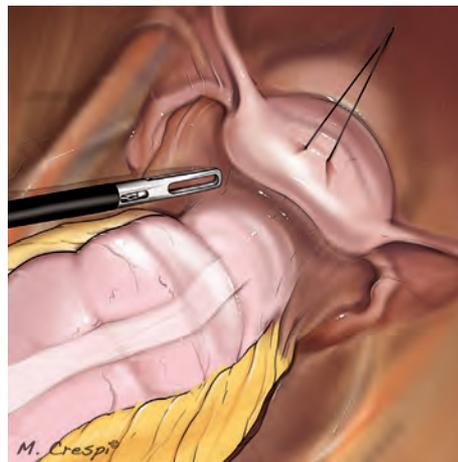
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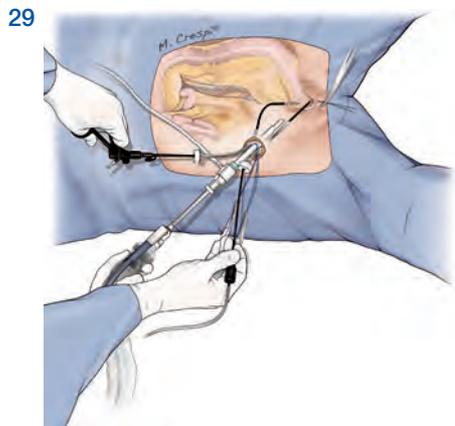
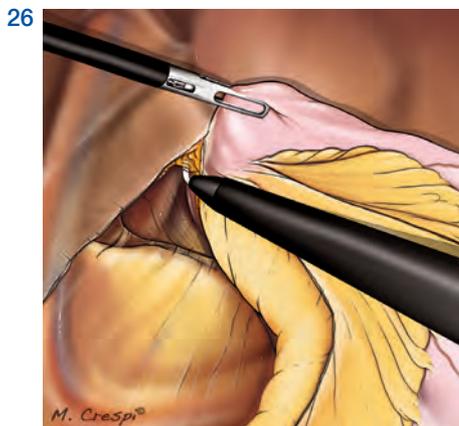
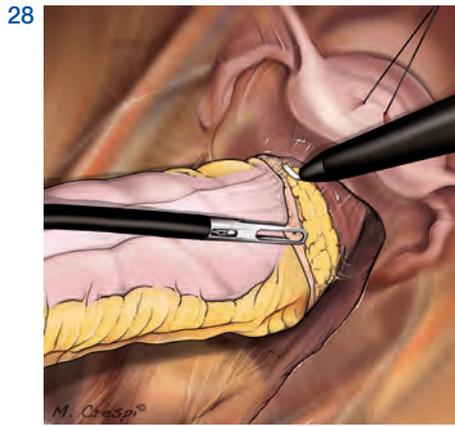
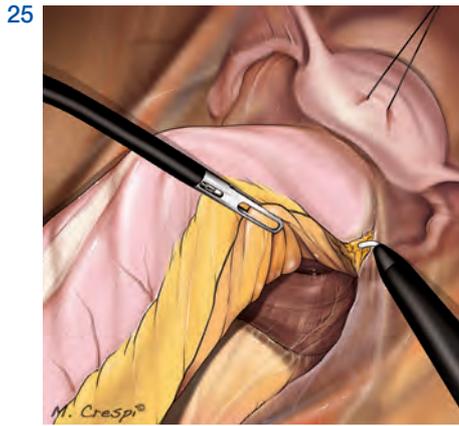
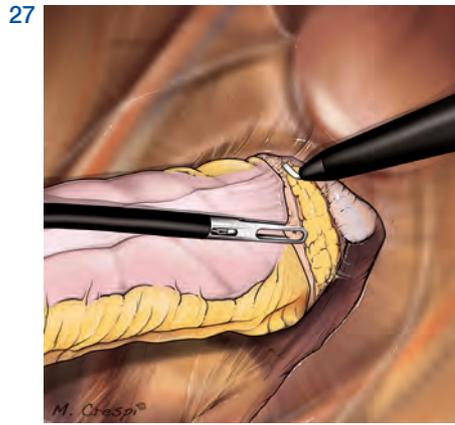
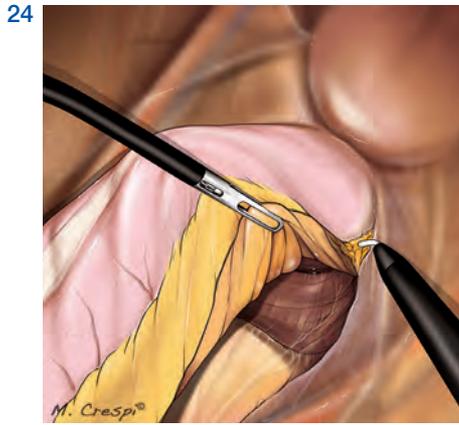
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The procedure is continued with mobilization of the left mesocolon until the promontory is reached (Figure 20). The upper mesorectum is incised and dissected from the presacral fascia in an avascular plane using the monopolar coagulating hook, and the monopolar bipolar forceps and scissors (Figure 21).

For the rest of the total mesorectal excision (TME), the camera assistant moves to the surgeon's left, and the scrub-nurse to the surgeon's right (Figure 2). The total mesorectal excision is performed from up-to-down, alternatively using the monopolar coagulating hook and

the monopolar bipolar forceps and scissors. To improve the pelvic field's exposure, one temporary percutaneous suture using a straight Ethilon 2/0 needle is passed from the suprapubic area into the uterine fundus (female) (Figures 22, 23). Moreover, for the recto-sigmoid colon retraction, if the straight 1.8-mm trocarless grasping forceps is already inserted it can be used, otherwise another straight Ethilon 2/0 needle is passed in the pericolic fatty tissue and kept externally by a Pean-Rochester curved forceps.

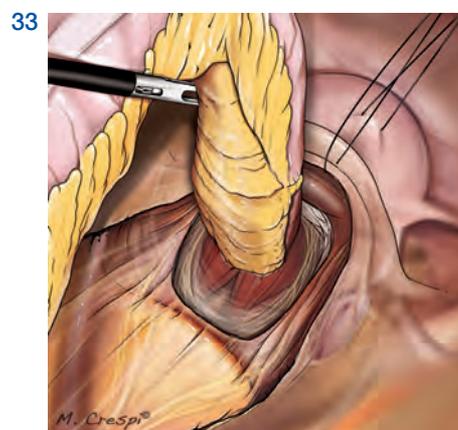
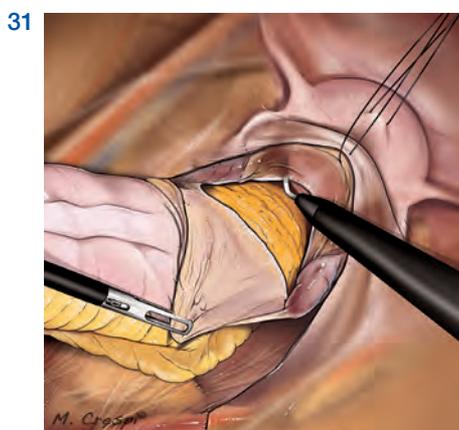
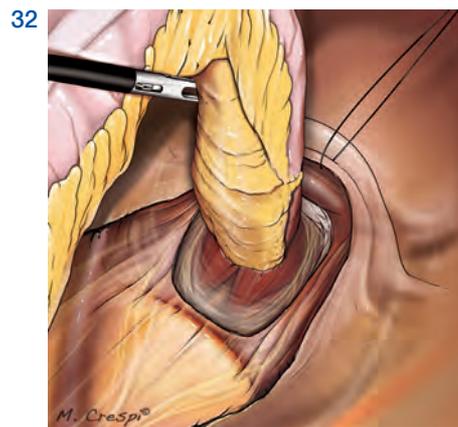
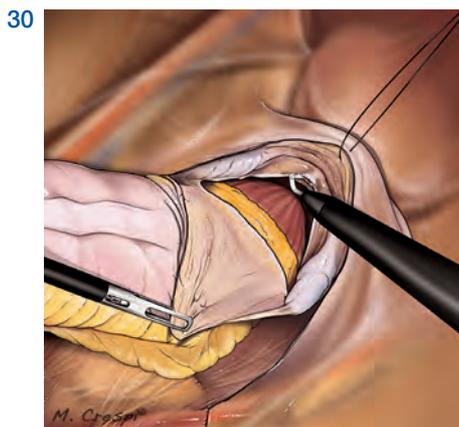


Once the upper mesorectum is freed, the dissection continues with mobilization of the middle and low mesorectum, going first posteriorly, then laterally, and finally anteriorly, using both coagulating hook and bipolar instruments (Figures 24, 25, 26). The anterior peritoneal sheet is opened with the monocurved

coagulating hook and the plane anteriorly to the rectum and posteriorly to the seminal vesicles/rectoprostatic septum (male) (Figure 27) or uterine cervix/rectovaginal septum (female) (Figure 28) is dissected. The surgeon continues to work under satisfied ergonomomy (Figure 29).

At this step in both male and female patients, a temporary suprapubic percutaneous suture (straight Ethilon 2/0 needle) is passed into the pelvic peritoneal reflexion (Figures 30, 31). Once the lower mesorectum is reached, the

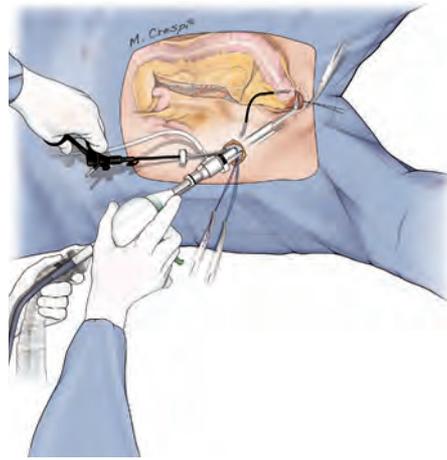
dissection continues, first posteriorly to reach both the levator ani muscles, and then laterally and anteriorly (Figures 32, 33). Monocurved bipolar forceps and scissors are continuously used and exchanged during this step.



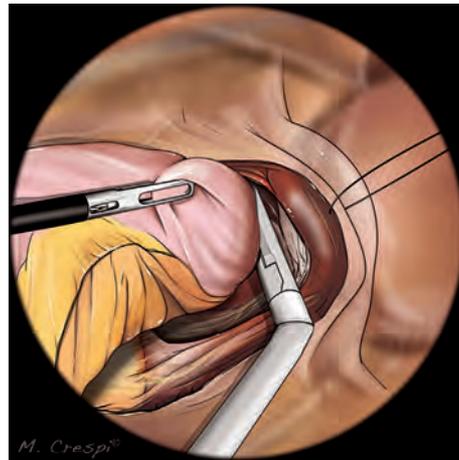
The level of the left colon transection is chosen, and the mesocolon is dissected from this level going in the direction of the inferior mesenteric vein root, using the monocurved coagulating hook and bipolar tools.

For rectal sectioning, the 11-mm trocar is replaced by a reusable 13-mm trocar (if the 12-mm non-reusable trocar is inserted at the beginning, this replacement is not needed), in order to accommodate an articulating linear stapler. The 10-mm scope is switched into a 5-mm, 30° long scope, which is inserted into the 6-mm flexible trocar at the 6 o'clock position (Figure 34). The linear stapler encircles the freed lower rectum and is fired (Figure 35). Usually two or three firings are enough to complete the rectal section (Figure 36).

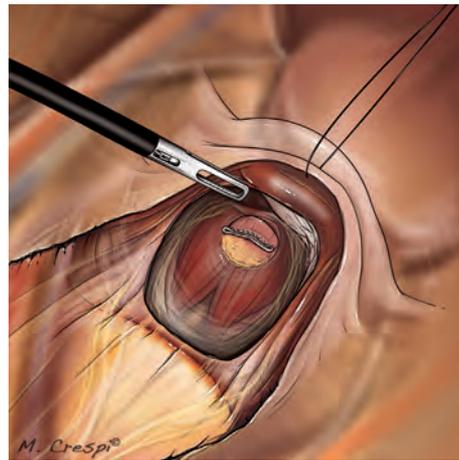
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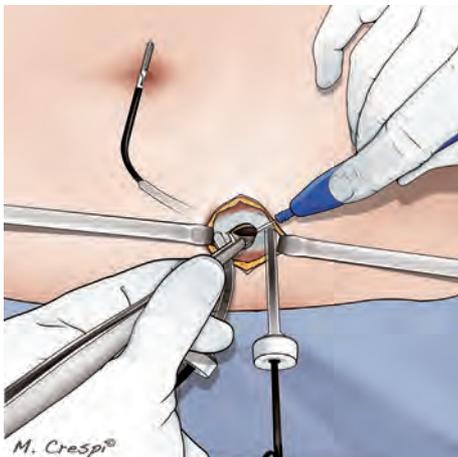
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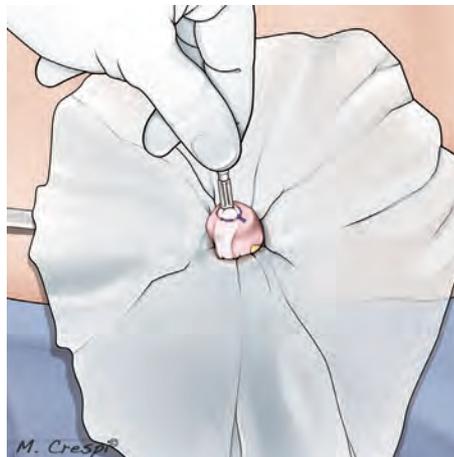
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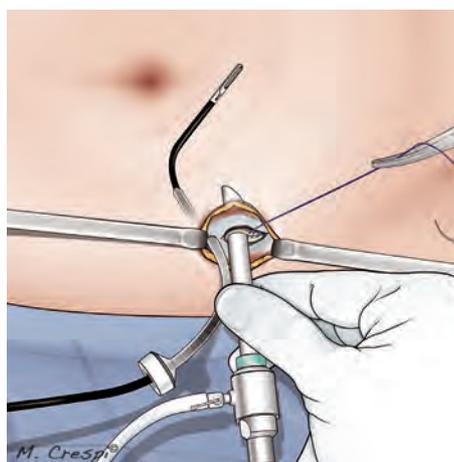
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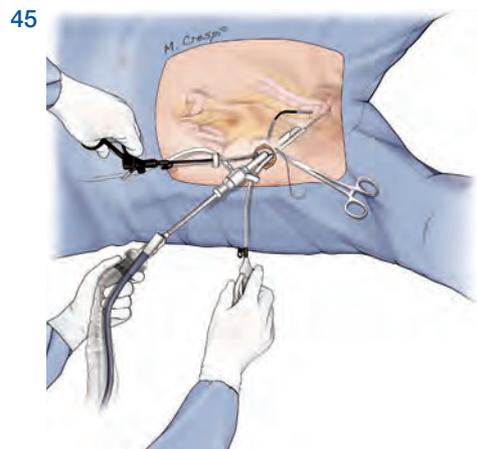
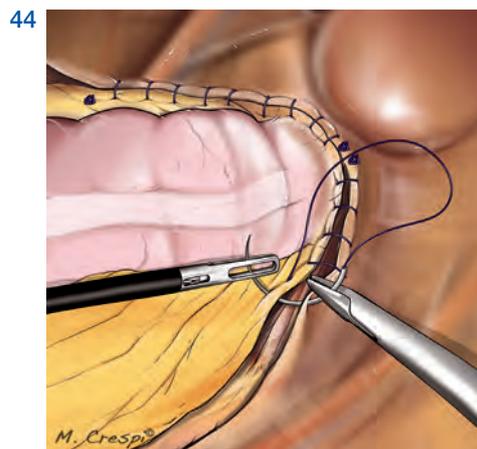
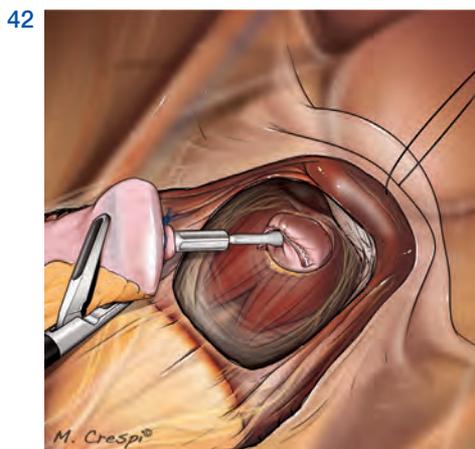
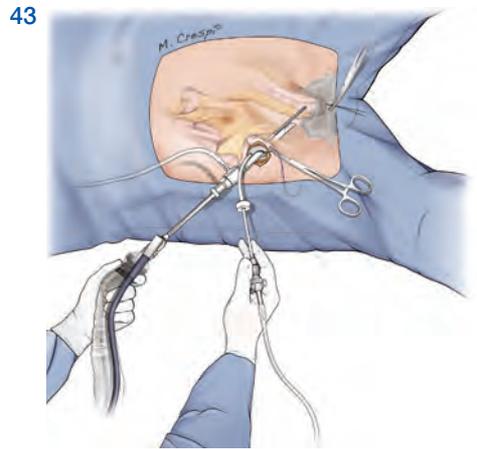
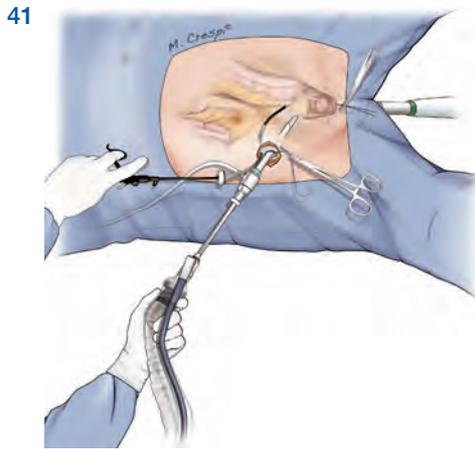


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The specimen is held by the straight grasping forceps, and the 6-mm flexible trocar at the 6 o'clock position is retrieved together with the 13-mm trocar and both purse-string sutures. The two fascial openings for the trocars are joined together (Figure 37), enlarging the access. A plastic wall protector is inserted into the peritoneal cavity (Figure 38). The specimen is removed inside the plastic protector (Figure 38). The correct level of the left colon transection is found

and sectioned by scissors. The anvil of the circular stapler is inserted into the lumen, and a Prolene 2/0 purse-string suture is used to close the colic lumen around the anvil spike (Figure 39). The anvil is introduced into the abdominal cavity, and the peritoneal sheet as well as the muscular fascia are partially closed by Vicryl 1 sutures, permitting introduction of the 11-mm trocar into the abdominal cavity (Figure 40). The 10-mm scope is reused.

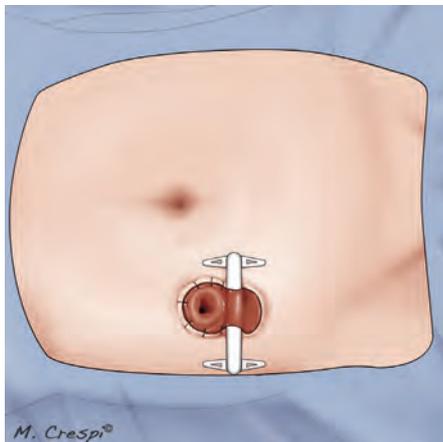


The circular stapler is introduced through the anus into the rectum, and the stapler spike is pushed out the rectal stump, staying in the middle of the previous staple line (Figure 41). The bicurveded grasper is used to fit the anvil into the circular stapler (Figure 42); the stapler is closed and fired.

The monocurved suction and irrigation cannula is introduced and the pelvis is immersed under physiologic solution (Figure 43). A leak-test of the anastomosis, using insufflated air through the anus, is performed.

The temporary percutaneous Ethilon 2/0 sutures are removed. The parietal pelvic peritoneum is closed and attached to the left colon by Vicryl 2/0 running sutures (Figure 44) (a preformed knot at its extremity is useful to gain operative time), using the monocurved needle holder and the bicurved grasping forceps (Figure 45). The left mesocolic window is closed as well by a Vicryl 2/0 running suture. If necessary, a suprapubic drain is placed into the pelvis.

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The operating room table is positioned without any Trendelenburg or tilt, and the small bowel is gently moved out of the right abdominal quadrants and over the left colon.

The distal bowel loop as well as the ileocecal valve are searched. A loop, roughly 20 cm before the ileocecal valve, is grasped and extracted at the level of the abdominal access, together with the trocars' removal. A temporary ileostomy is performed, placing the ileum outside the access (Figure 46), and closing the fascia and the peritoneal sheet by Vicryl 1 sutures. The ileum is open, and mucocutaneous sutures using Vicryl Rapid 3/0 are positioned (Figure 46). An ileostomy set is finally placed.

Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

The arterial catheter is removed in the recovery room.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

Antibiotic prophylaxis is prescribed if necessary and TVP prophylaxis until the discharge of the patient from the hospital. The urinary catheter is removed after 5 days. The patient is allowed to drink water after 24 hours, and to tolerate a light diet from the 3rd post-operative day. The management of the ileostomy is started after 48 hours. If there are no complications, the patient is discharged on the 6th post-operative day, after the abdominal drain (if used) and central line have been removed.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1 and 2 months. Usually the patient is scheduled for closure of the temporary ileostomy after 2 months. Then, the patient is followed-up by the surgeon and gastroenterologist/oncologist.

5.4 DOWN-TO-UP RECTAL RESECTION

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

ColoRectal Anastomosis

ColoAnal Anastomosis

Post-operative Care

5.4 DOWN-TO-UP RECTAL RESECTION

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure. A colic preparation is prescribed in the days before.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after the intubation.

Antibiotic and TVP prophylaxis are applied as well.

An arterial catheter, a central line and a urinary catheter are placed.

Tools

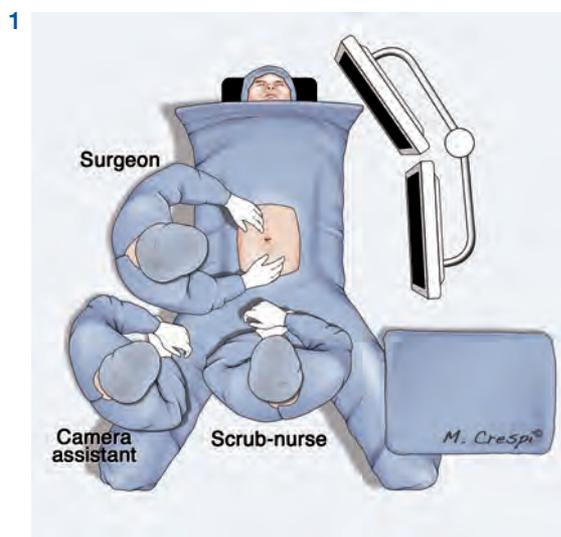
Abdominal table:

- one scalpel, two tissue forceps, one monopolar electrode, two Farabeuf retractors, two Kocher-Ochsner curved forceps, one Mayo scissors, two Mayo-Hegar needle-holders, two Pean-Rochester curved forceps, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), two Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Polyamide 2/0 (Ethilon 2/0, straight needle, 60 mm), three Polyglactin 2/0 (Vicryl 2/0, round tip, 1/2c, 36 mm), four Polyglactin Rapid 3/0 (Vicryl Rapid 3/0, triangular tip, 1/2c, 22 mm)
- one reusable 11-mm rigid trocar
- two reusable 6-mm flexible trocars and rigid mandrils (DAPRI flex trocars)
- one straight 10-mm, 30° regular length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps I)
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved dissecting forceps (DAPRI dissecting forceps)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable straight 5-mm clip applier
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle

- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one drain
- one ileostomy set

Perineal table:

- one monopolar electrode, two tissue forceps, one Mayo-Hegar needle-holder, one Mayo scissors, two Farabeuf retractors
- sutures: three silk 0 (silk 0, round tip, 1/2c, 26 mm), three Polypropylene 2/0 (Prolene 2/0, round tip, 1/2c, 26 mm), three Polyglactin Rapid 3/0 (Vicryl Rapid 3/0, triangular tip, 1/2c, 22 mm)
- one non-reusable anal retractor
- one reusable transanal D-Port (DAPRI-Port)
- one straight 10-mm, 30° regular length scope
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one reusable straight grasping forceps
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable monocurved suction and irrigation cannula
- one reusable monocurved anvil grasping forceps (DAPRI anvil grasping forceps)
- one non-reusable plastic protector
- one non-reusable circular stapler
- Lidocaine 1% solution and syringe
- one rectal tube and syringe



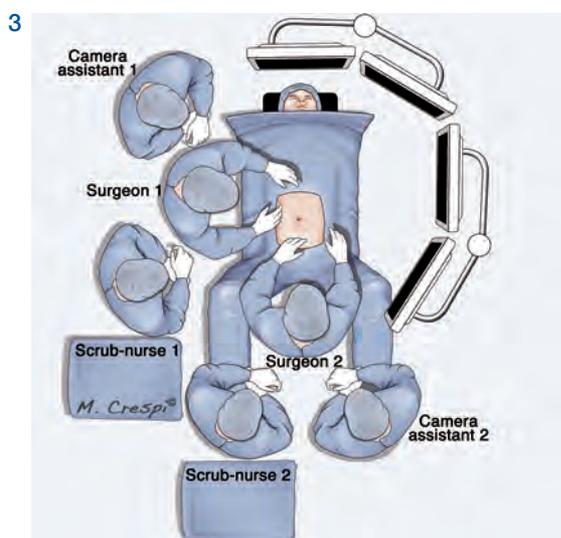
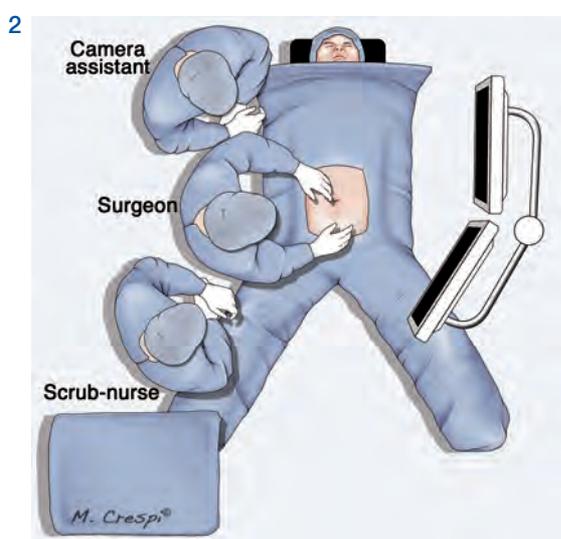
Patient and Team Positioning

The patient is placed in a supine position, with the arms alongside the body and the legs apart. The arms, ankles, and legs are secured and protected. These latter are well secured to the operative table, and the left leg is positioned further up.

For the first part of the procedure, the surgeon stands to the patient's right and the camera assistant to the surgeon's right. The scrub-nurse stands between the patient's legs. The video monitor is placed in front of the surgeon and camera assistant (Figure 1).

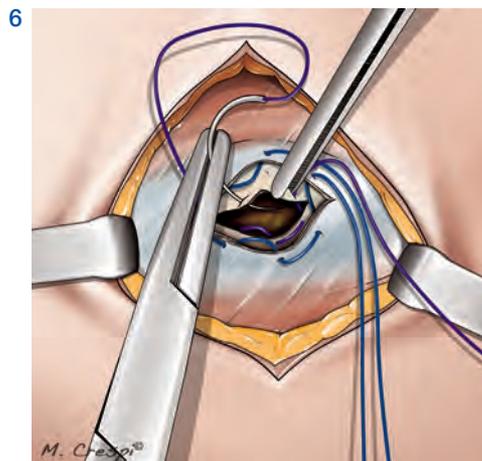
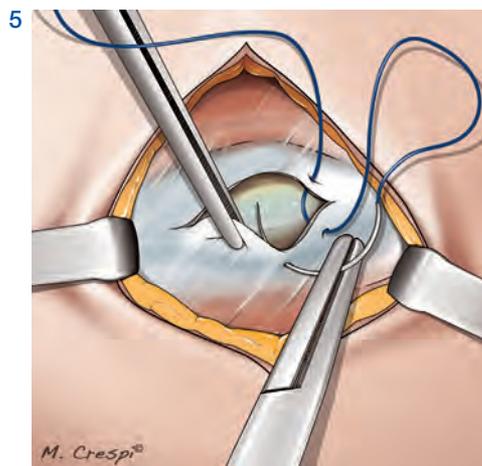
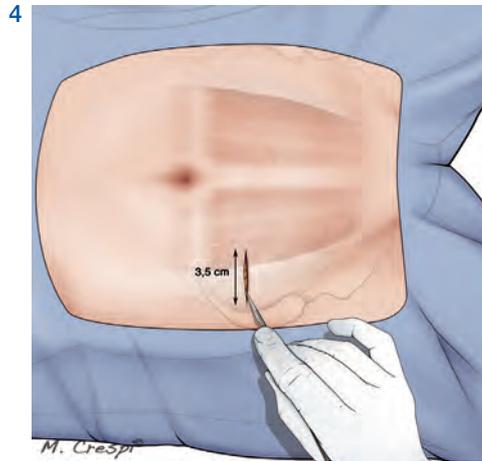
After the mesocolic mobilization is made, the camera assistant moves to the surgeon's left, and the scrub-nurse to the surgeon's right (Figure 2).

During the perineal dissection, the surgeon stands between the patient's legs, the camera assistant to the surgeon's right and the scrub-nurse to the surgeon's left. The video monitor is placed in front of the surgeon and camera assistant (Figure 3).

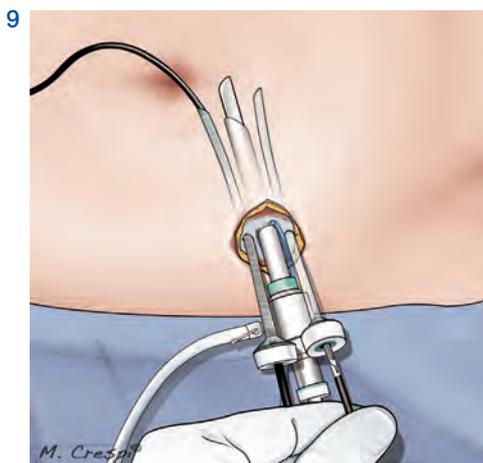
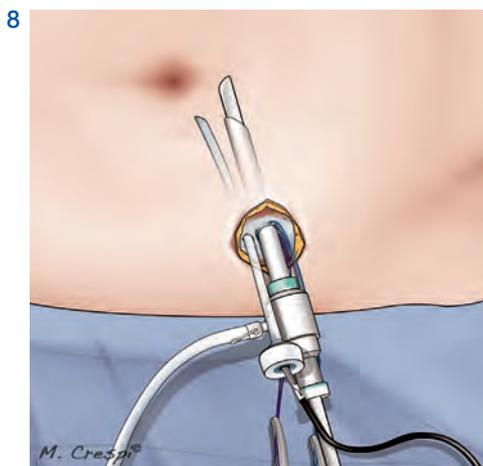
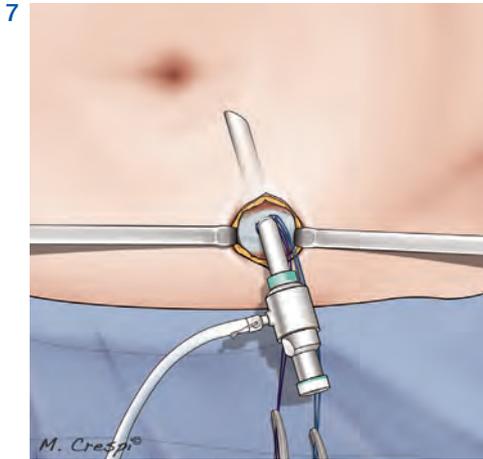


Technique

A 3.5 cm transverse skin incision is made in the right flank, adjacent to the right rectus abdominis muscle and between the umbilicus and the superior right iliac spine (Figure 4). The underlying fascia is divided in a pararectal fashion for 1.5 cm, which exposes the rectus abdominis muscle. The muscle is medially retracted and a purse-string suture using PDS 1 is placed in the fascia (Figure 5), going inside and outside respectively at the 5, 7, 9, 11, 1, and 3 o'clock positions (Figure 6). The peritoneal sheet is entered through a 1 cm vertical incision, and a new purse-string suture using Vicryl 1 is placed, going inside and outside respectively at the 5, 7, 9, 11, 1, and 3 o'clock positions (Figure 6). Both sutures are kept externally with Pean-Rochester curved graspers.



[Click to watch the corresponding video](#)
[Down-To-Up Rectal Resection](#)



An 11-mm trocar is introduced into the peritoneal cavity inside the purse-string sutures, and the pneumoperitoneum is created (Figure 7). The 10-mm, 30° scope is advanced through the 11-mm trocar.

A 6-mm flexible trocar is inserted at the 12 o'clock position with respect to the patient's head, outside the purse-string sutures and on the same vertical line as the previous trocar, for insertion of the bicurved grasping forceps (Figure 8). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

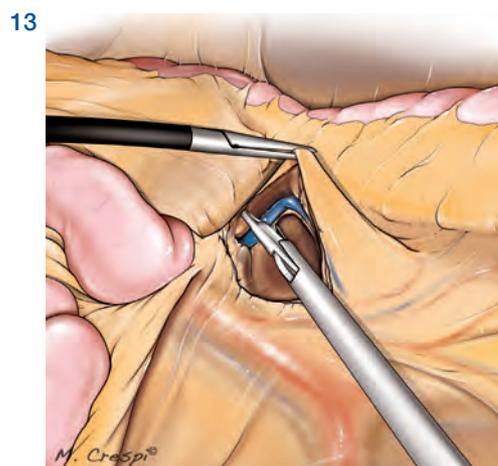
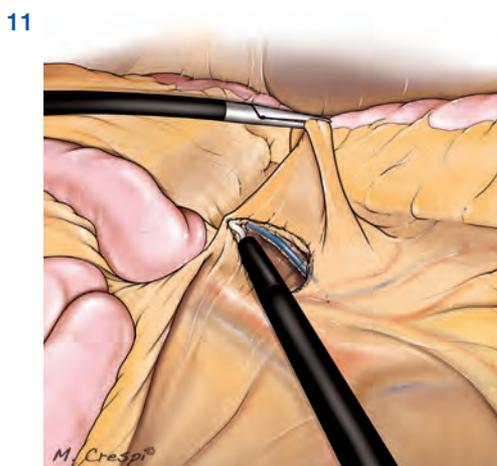
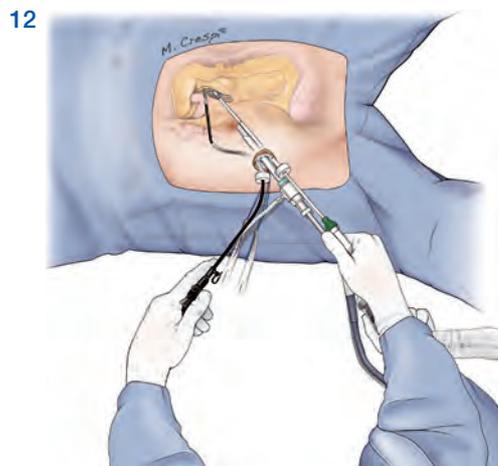
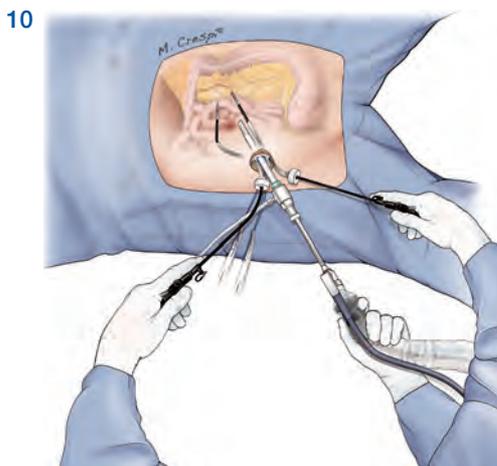
Another 6-mm flexible trocar is inserted at the 6 o'clock position with respect to the patient's head, outside the purse-string sutures and on the same vertical line as the previous trocars, for insertion of the other instruments (Figure 9), such as the monocurved grasping forceps, the monocurved coagulating hook, the monocurved dissecting forceps, the monocurved bipolar forceps and scissors, the straight 5-mm clip applier, the monocurved scissors, the monocurved needle holder, the monocurved suction and irrigation cannula, and the straight grasping forceps.

The abdominal cavity is explored and examined to rule out the presence of peritoneal metastases, superficial hepatic lesions and free ascites.

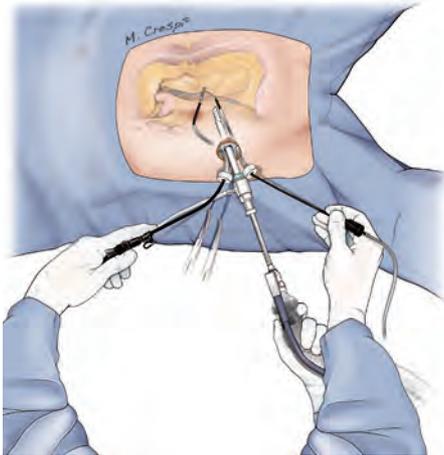
The operating room table is placed in an accentuated Trendelenburg position with right-sided tilt.

The small bowel is moved into the right abdominal quadrants and above the right liver lobe using the bicurved and monocurved grasping forceps (Figure 10).

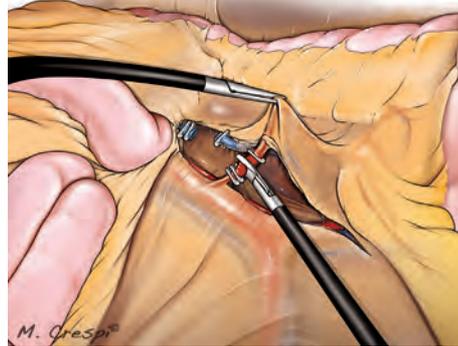
The ligament of Treitz is identified in order to expose the root of the inferior mesenteric vein. The peritoneal sheet covering the root of this vein is incised with the monocurved coagulating hook (Figure 11) until the Toldt's fascia is reached. The inferior mesenteric vein is isolated using the monocurved dissecting forceps and clipped by the 5-mm straight clip applier (Figures 12, 13).



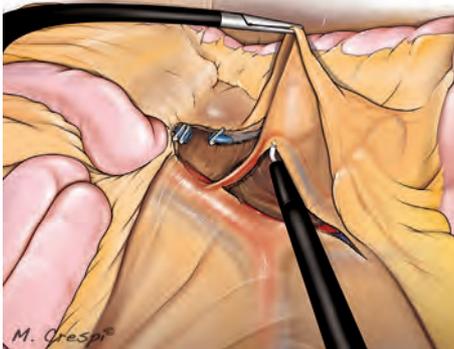
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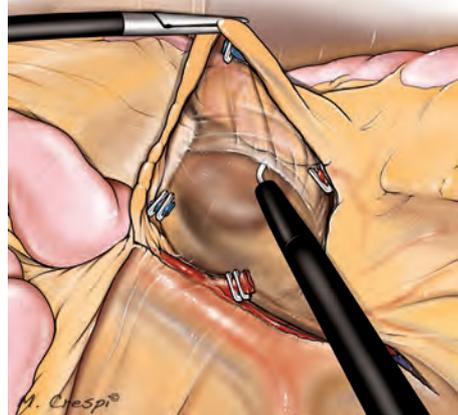
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The left mesocolon is separated from the Toldt's fascia in an avascular plane using the monocurved coagulating hook or the monocurved suction cannula.

The surgeon works with curved instruments without crossing hands and without interference with the camera assistant's hand (Figure 14).

The peritoneal sheet is incised along the abdominal aorta using the monocurved coagulating hook, until the origin of the inferior mesenteric artery is reached (Figure 15). The root of the artery is freed using the monocurved coagulating hook

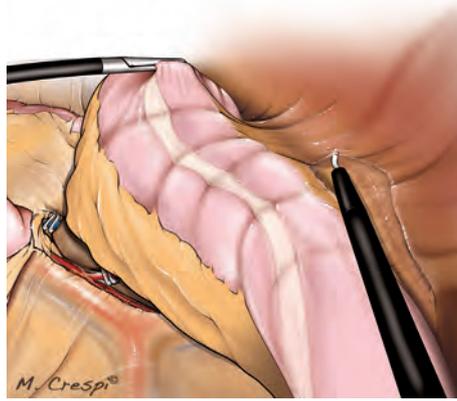
and the monocurved dissecting forceps, clipped by the 5-mm straight clip applicator, and divided using the monocurved scissors (Figure 16).

If necessary to improve the operative field's exposure, a straight 1.8-mm trocarless grasping forceps can be inserted percutaneously via a skin puncture (created by a Veress needle) in the left suprapubic area. At the end of the procedure, this hole can be used for drain placement.

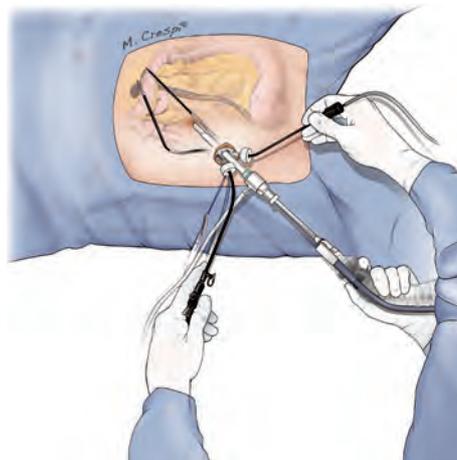
The left mesocolon is freed from the Toldt's fascia (Figure 17), respecting the left Gerota's fascia and going in the direction of the pancreatic tail.

The sigmoid and left colons are moved away from the peritoneal attachments using the monocurved coagulating hook or scissors (Figure 18) until reaching the splenic flexure, which is downloaded using a medial-to-lateral approach (Figures 19, 20).

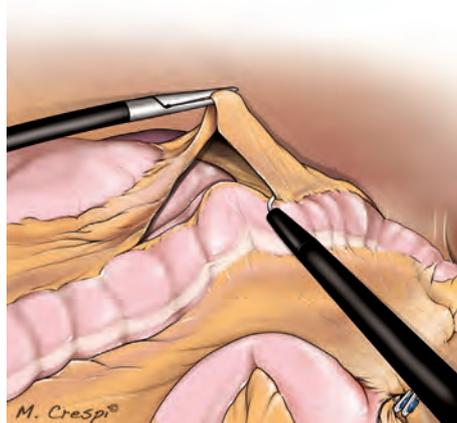
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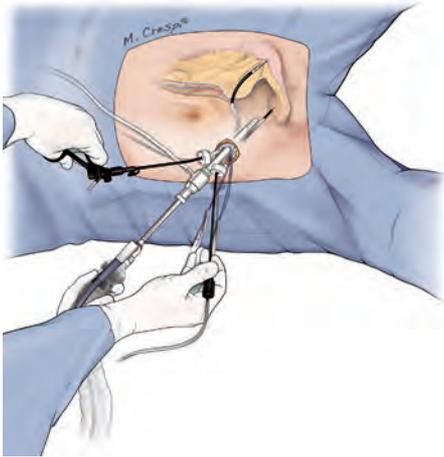
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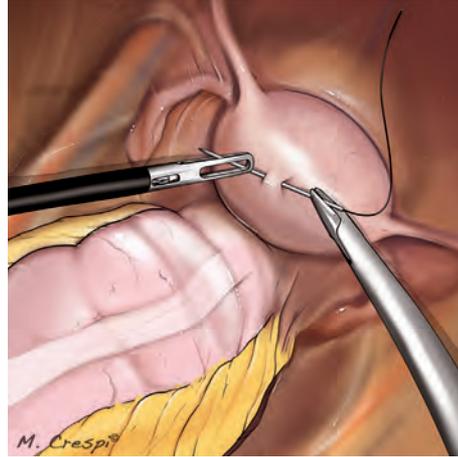
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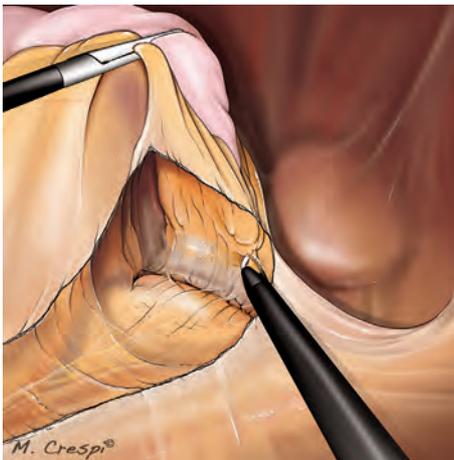
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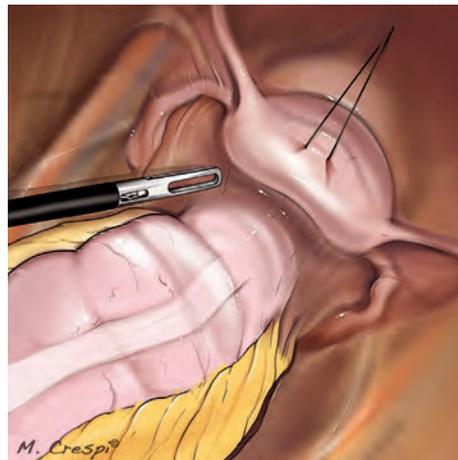
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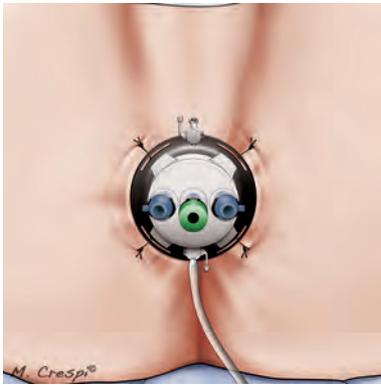
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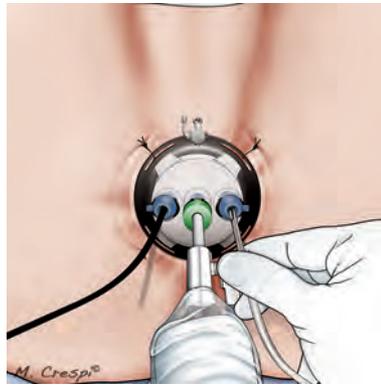
The procedure is continued by moving the left mesocolon until the promontory is reached (Figure 21). The upper mesorectum is incised and dissected from the presacral fascia in an avascular plane using the monopolar coagulating hook and the monopolar bipolar forceps and scissors (Figure 22). The level of the left colon transection is chosen and the mesocolon is dissected from this level going in the direction of the inferior mesenteric vein root, using the

monocurved coagulating hook and bipolar tools. In female patients, a temporary percutaneous suture, using a straight Ethilon 2/0 needle, is placed in the uterine fundus to improve the operative field's exposure (Figures 23, 24). The procedure continues with the total mesorectal excision (TME) performed from down-to-up. The operating room table is placed in a reduced Trendelenburg position and reduced right-sided tilt.

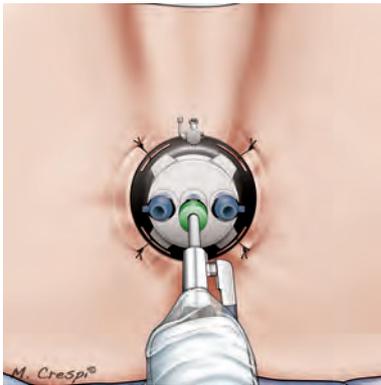
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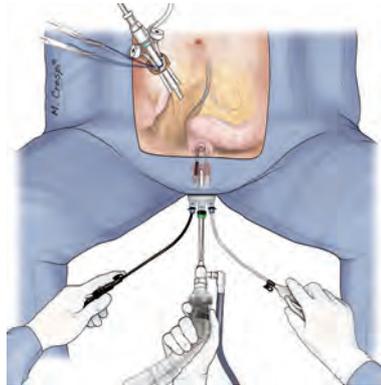
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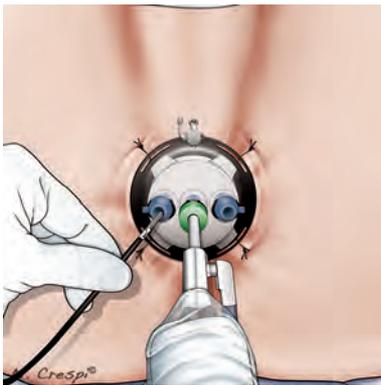
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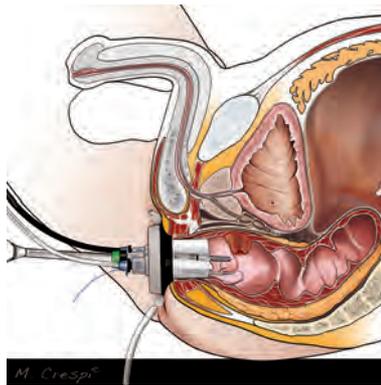
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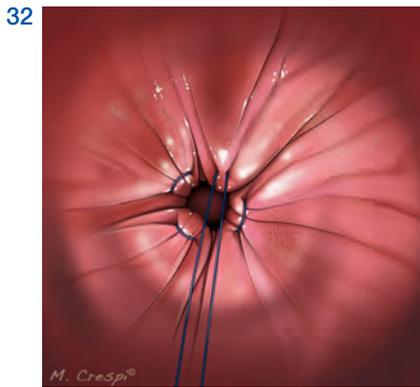
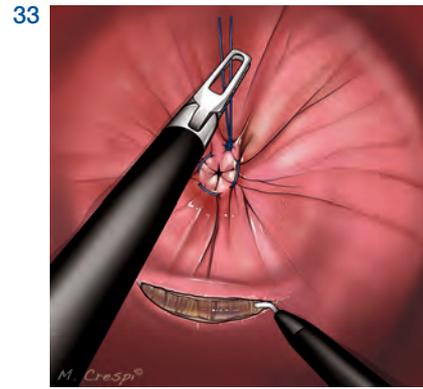
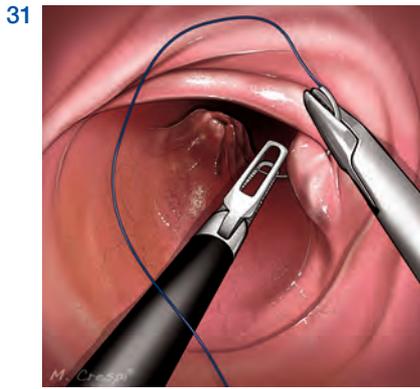
TransAnal Dissection, Specimen Extraction and ColoRectal Anastomosis

Both patient's legs are positioned upwards (gynecologic positioning). The D-Port is inserted into the anal canal and fixed to the skin by four silk 0 sutures (Figure 25). A 10-mm, 30° scope is inserted in the middle opening of the D-Port (Figure 26), and the rectal lumen is checked to identify the rectal tumor. A gauze pad is pushed beyond the rectal tumor. The monocurved grasping forceps and the monocurved anvil

grasping forceps are inserted at the 9 o'clock opening of the D-Port (Figure 27). The other instruments, such as the straight grasping forceps, the monocurved needle holder, the monocurved scissors, the monocurved coagulating hook, the monocurved bipolar forceps and scissors, the monocurved suction and irrigation cannula, are inserted at the 3 o'clock opening of the D-Port (Figures 28, 29, 30).

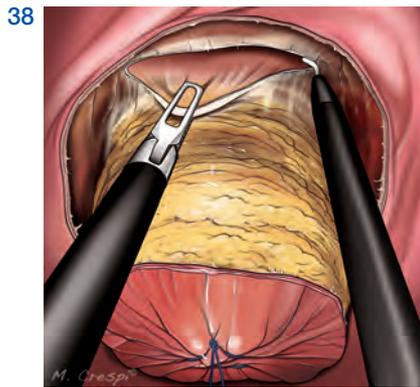
A safe margin, distally from the tumor, is chosen and a purse-string suture using Prolene 2/0 is placed into the rectal mucosa, using the monocurved grasping forceps and the monocurved needle holder (Figures 31, 32). The suture is tight extracorporeally, the knot is pushed intraluminally and cut by the monocurved

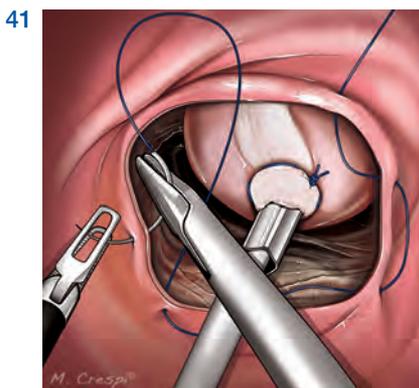
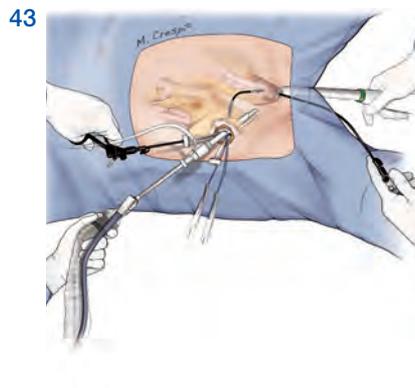
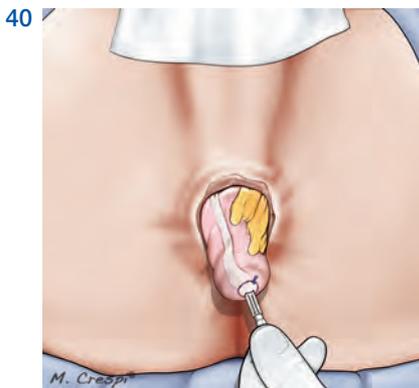
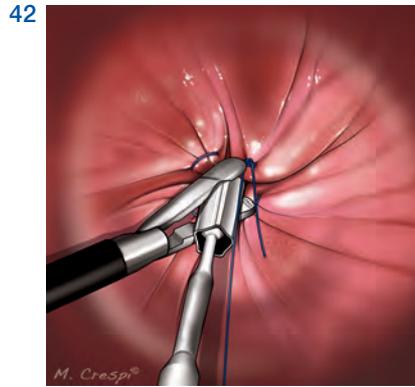
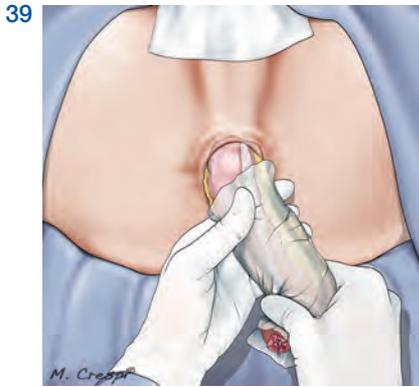
scissors. Then, the mucosa just under the purse-string suture is incised until to pass the entire rectal wall and reaching the perirectal fatty tissue (Figure 33). The total mesorectal excision is performed from bottom to top, going first posteriorly (Figure 34).



Then, the mobilization of the rectum is completed, going laterally on the left (of the patient) (Figure 35) and right side (of the patient) (Figure 36). The dissection is finally performed anteriorly, taking care to dissect the correct plane between the rectum and the prostate (male), or the vagina (female). The dissection is continued up, respecting the presacral fascia posteriorly (Figure 37), until

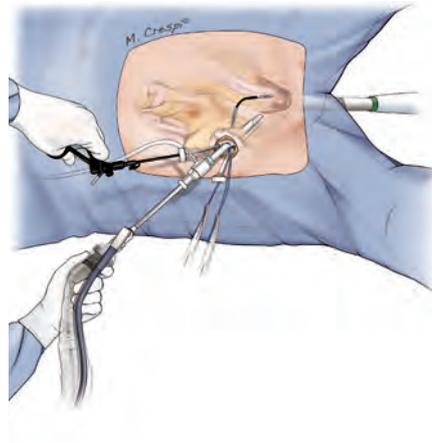
reaching the seminal vesicles (male) or the uterine cervix (female) anteriorly, using both monocurved coagulating hook and monocurved bipolar scissors (Figure 38). Finally, the transanal dissection joins the previous dissection started at the level of the promontory through the laparoscopic abdominal access, opening the Douglas' pouch (Figure 38).



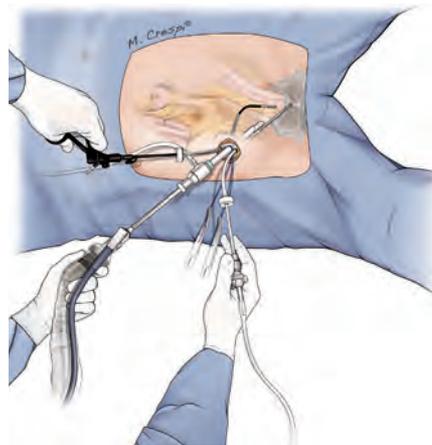


The rectal-sigmoid colon is encircled by a plastic protector and removed transanally, after having removed the D-Port (Figure 39). The level of the colic transection is found and the left colon is sectioned and the specimen removed. The anvil of the circular stapler is introduced into the colic lumen, closing the latter with a Prolene 2/0 purse-string suture (Figure 40). The colon and anvil are pushed inside the pelvis and the D-Port is repositioned. The rectal stump is closed transanally with a Prolene 2/0 purse-string suture, using the monocurved grasping forceps and the monocurved needle holder (Figure 41). Then, the monocurved anvil grasping forceps keeps the anvil (Figure 42), while the suture is tight by extracorporeal knot, pushed intraluminally and cut by the monocurved scissors. The D-Port is removed again, and the circular stapler is introduced transanally. The anvil is attached to the circular stapler by the monocurved anvil grasping forceps, under abdominal laparoscopic control (Figure 43).

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The stapler is closed and fired (Figure 44). Through the abdomen, the monocurved suction and irrigation cannula is introduced and the pelvis is immersed under physiologic solution. A leak-test of the anastomosis, using insufflated air through the anus, is performed (Figure 45).

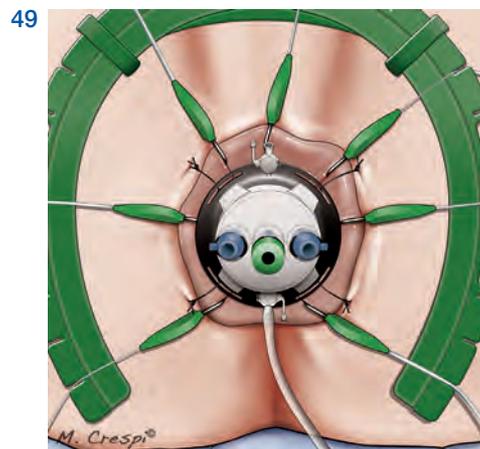
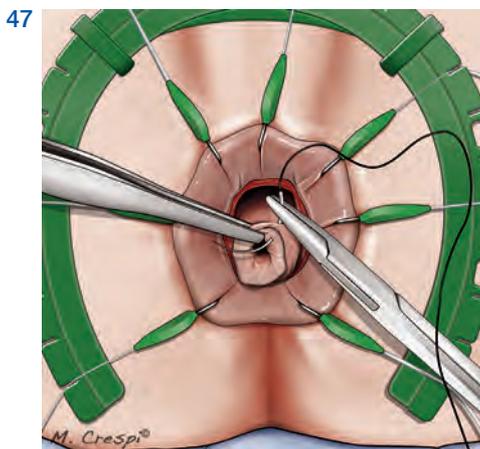
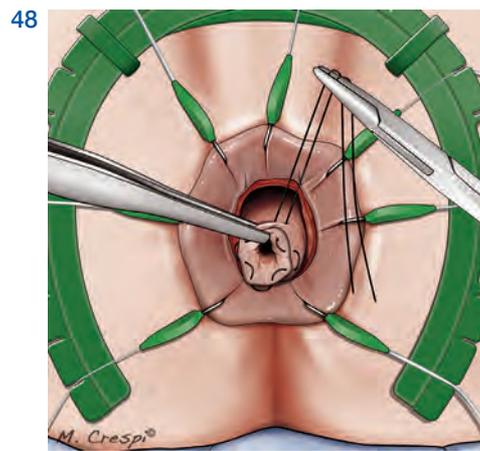
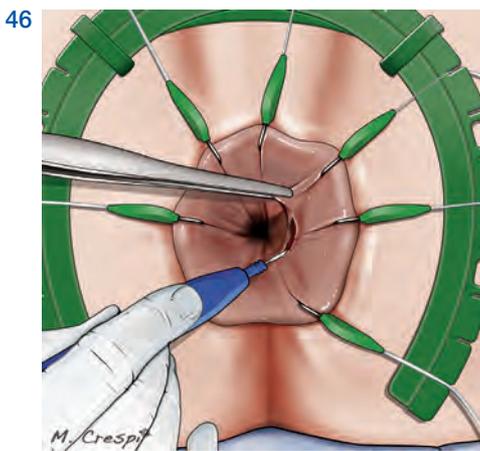
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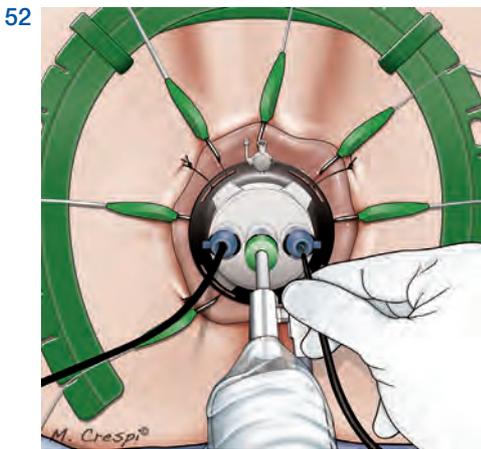
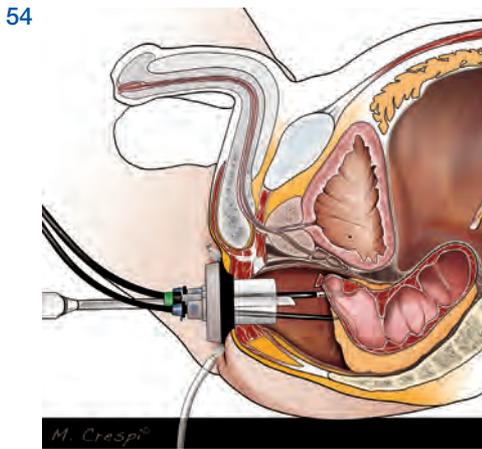
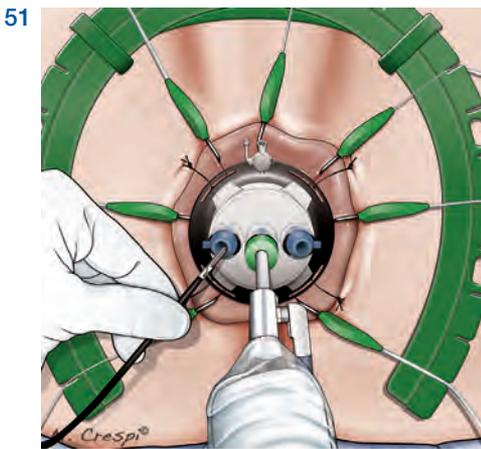
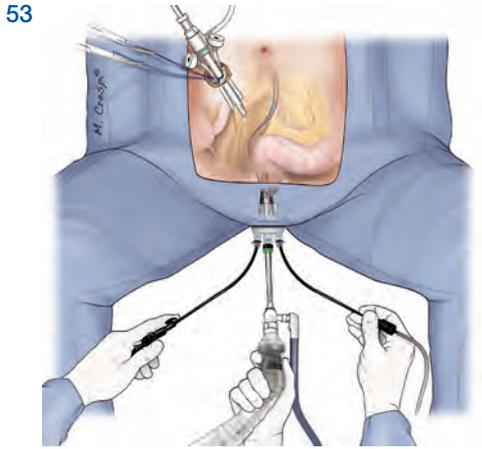
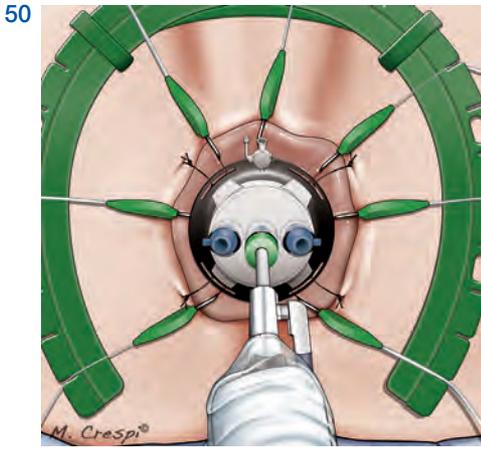
TransAnal Dissection, Specimen Extraction and ColoAnal Anastomosis

Both patient's legs are positioned upwards (gynecologic positioning). A gauze pad is inserted in the anal canal to avoid potential fecal contamination. The anal retractor is positioned and the anal mucosa is injected with Lidocaine 1%. The pectineal line is incised using the monopolar electrode (Figure 46). Once freed

circumferentially, the anal mucosa is closed by a silk 0 purse-string suture (Figures 47, 48). The anal canal is dissected until to reach the low rectum into the pelvis.

The D-Port is inserted and fixed to the skin by four silk 0 sutures (Figure 49).

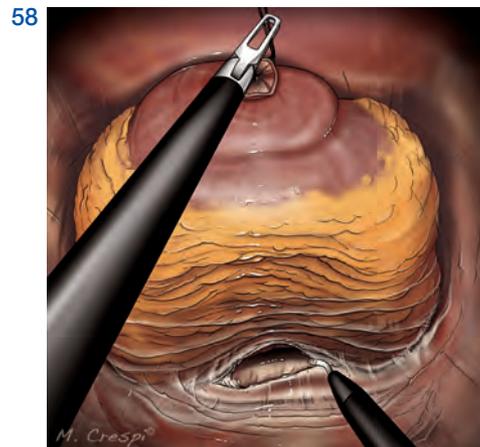
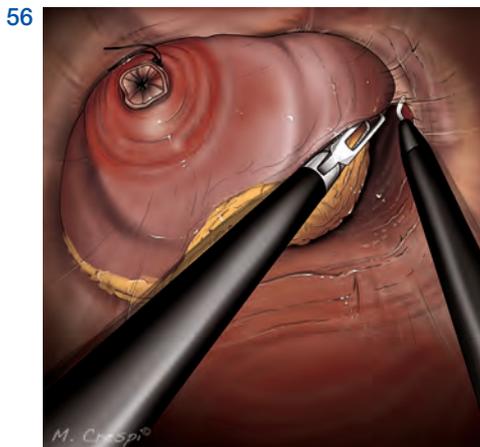
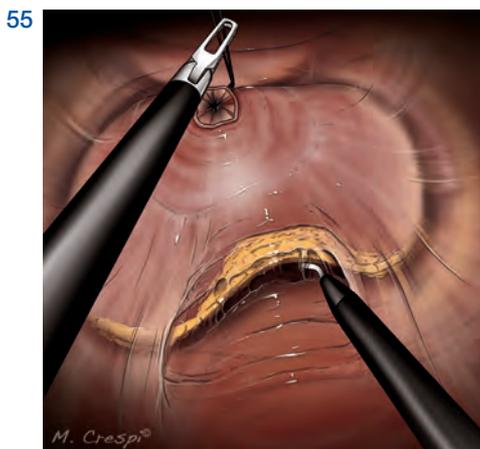




A 10-mm, 30° scope is inserted in the middle opening of the D-Port (Figure 50). The monopolar grasping forceps is inserted at the 9 o'clock opening of the D-Port (Figure 51). The other instruments, such as the monopolar coagulating hook, the monopolar bipolar forceps and scissors, the monopolar suction and irrigation cannula, are inserted at the 3 o'clock opening of the D-Port (Figures 52, 53, 54).

The lower rectum is mobilized circumferentially from down-to-up, going first posteriorly (Figure 55), to the left side (of the patient) (Figure 56), to the right side (of the patient) (Figure 57), and finally anteriorly, using the monocurved coagulating hook and the monocurved grasping forceps. The dissection is performed anteriorly finding the correct plane between the rectum and the

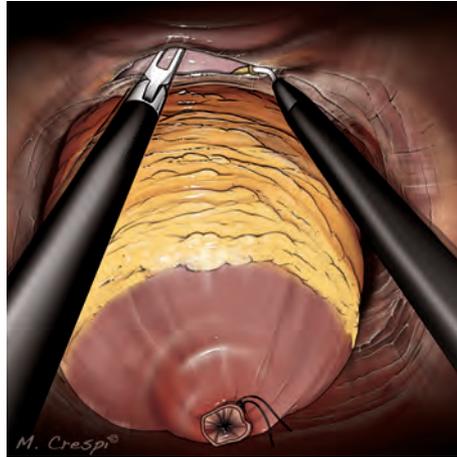
prostate (male) or the vagina (female). The middle rectum is freed, taking care to respect the presacral fascia posteriorly (Figure 58), and to find the correct plane between the rectum and the seminal vesicles (male), or uterine cervix (female) anteriorly. Both the monocurved coagulating hook and the monocurved bipolar scissors are used.



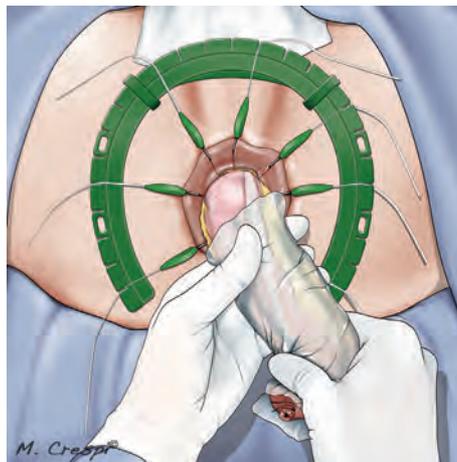
Finally, the transanal dissection joins the previous dissection started at the level of the promontory through the laparoscopic abdominal access, opening the Douglas' pouch (Figure 59).

The rectal-sigmoid colon is encircled by a plastic protector and removed transanally, after having removed the D-Port (Figure 60). The level of the colic transection is found and the left colon is sectioned, removing the specimen. A coloanal anastomosis is created using Vicryl Rapid 3/0 sutures (Figure 61). The anal retractor is taken out.

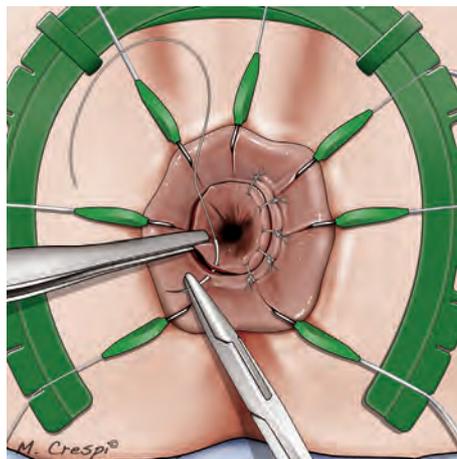
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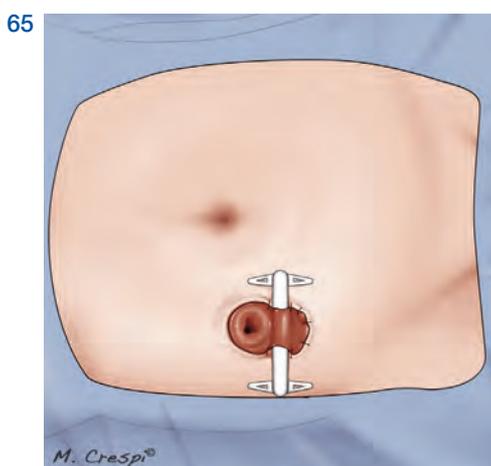
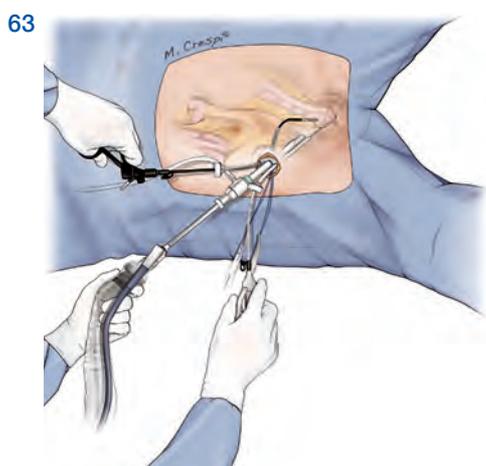
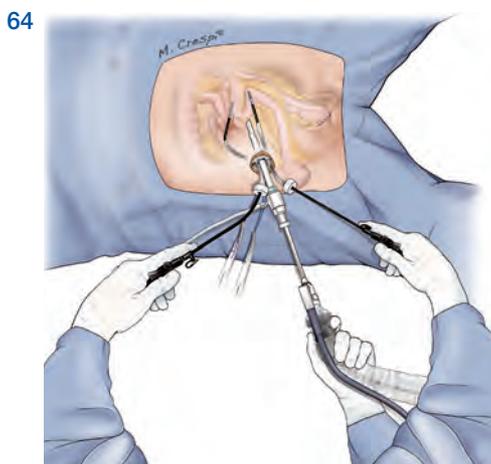
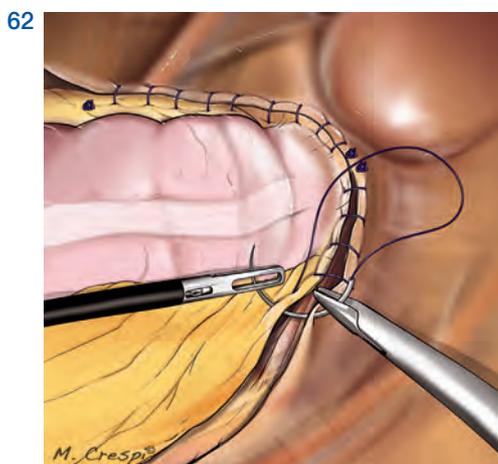


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End of Both Procedures and Temporary Ileostomy

Through the abdomen, the pelvic parietal peritoneum is closed and attached to the left colon by Vicryl 2/0 running sutures (Figure 62) (a preformed knot at its extremity is useful to gain operative time), using the monocurved needle holder and the bicurved grasping forceps (Figure 63). Then, the temporary percutaneous Ethilon 2/0 suture (female) is removed. The left mesocolic window is closed as well by a Vicryl 2/0 running suture. If necessary, a suprapubic drain is placed into the pelvis.

The operating room table is positioned without any Trendelenburg and tilt, and the small bowel

is gently moved out of the right abdominal quadrants and over the left colon.

The distal bowel loop together with the ileocecal valve are searched. A loop, roughly 20 cm before the ileocecal valve, is grasped (Figure 64) and extracted at the level of the abdominal access, together with the trocars' removal and purse-string sutures. A temporary ileostomy is performed, placing the ileum outside the access (Figure 65), and closing the fascia and the peritoneal sheet by Vicryl 1 sutures. The ileum is open, and mucocutaneous sutures using Vicryl Rapid 3/0 are positioned. An ileostomy set is finally placed.

Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

The arterial catheter is removed in the recovery room.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

Antibiotic prophylaxis is prescribed if necessary and TVP prophylaxis until the discharge of the patient from the hospital. The urinary catheter is removed after 5 days. The patient is allowed to drink water after 24 hours, and to tolerate a light diet from the 3rd post-operative day. The management of the ileostomy is started after 48 hours. If there are no complications, the patient is discharged on the 6th post-operative day, after having removed the abdominal drain (if used) and the central line.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1 and 2 months. Usually the patient is scheduled for closure of temporary ileostomy after 2 months. Then, the patient is followed-up by the surgeon and gastroenterologist/oncologist.

5.5 ABDOMINOPERINEAL RESECTION

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Post-operative Care

5.5 ABDOMINOPERINEAL RESECTION

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after the intubation.

Antibiotic and TVP prophylaxis are applied as well.

An arterial catheter, a central line and a urinary catheter are placed.

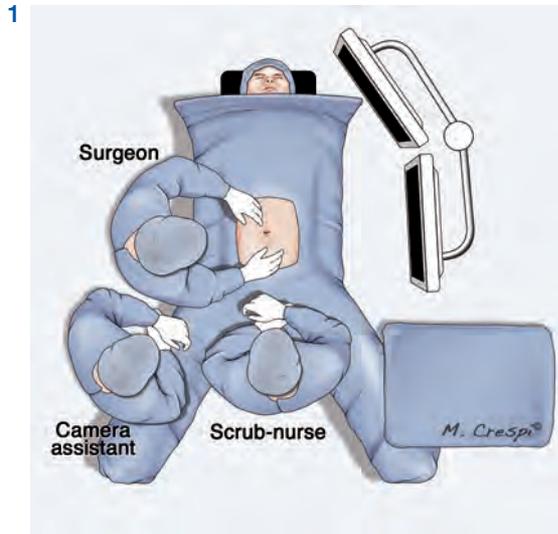
Tools

Abdominal table:

- one scalpel, two tissue forceps, one monopolar electrode, two Farabeuf retractors, two Kocher-Ochsner curved forceps, one Mayo scissors, two Mayo-Hegar needle-holders, two Pean-Rochester curved forceps, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), five Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), three Polyamide 2/0 (Ethilon 2/0, straight needle, 60 mm), three Polyglactin 2/0 (Vicryl 2/0, round tip, 1/2c, 36 mm), one Polyglactin 3/0 (Vicryl 3/0, round tip, 1/2c, 26 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm), four Polyglactin Rapid 3/0 (Vicryl Rapid 3/0, triangular tip, 1/2c, 22 mm)
- one reusable 11-mm rigid trocar
- one reusable 13-mm rigid trocar or one non-reusable 12-mm trocar
- two reusable 6-mm flexible trocars and rigid mandrils (DAPRI flex trocars)
- one straight 10-mm, 30° regular length scope
- one straight 5-mm, 30° long length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps I)
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved dissecting forceps (DAPRI dissecting forceps)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable straight 5-mm clip applier
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one non-reusable articulating 60 linear stapler
- one colostomy set

Perineal table:

- one Mayo-Hegar needle-holder, two tissue forceps, one Mayo scissors, two Pean-Rochester curved forceps, one scalpel, one monopolar electrode, two Farabeuf retractors, one Beckman retractor, two Doyen retractors
- sutures: one silk 0 (silk 0, round tip, 1/2c, 26 mm), four Polyglactin 2/0 (Vicryl 2/0, round tip, 1/2c, 36 mm), three Polyamide 2/0 (Ethilon 2/0, straight needle, 60 mm)
- two suction drains



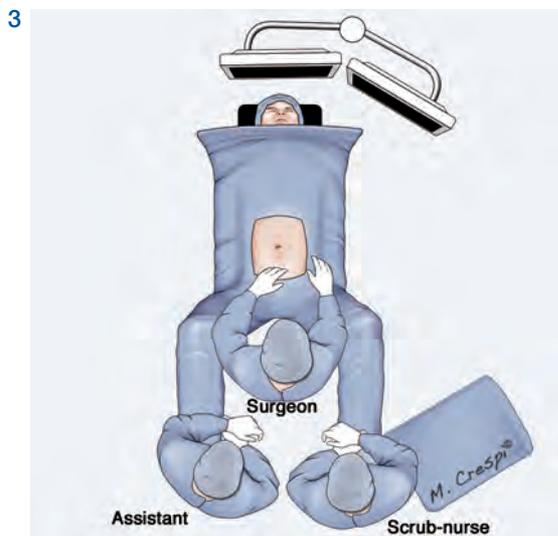
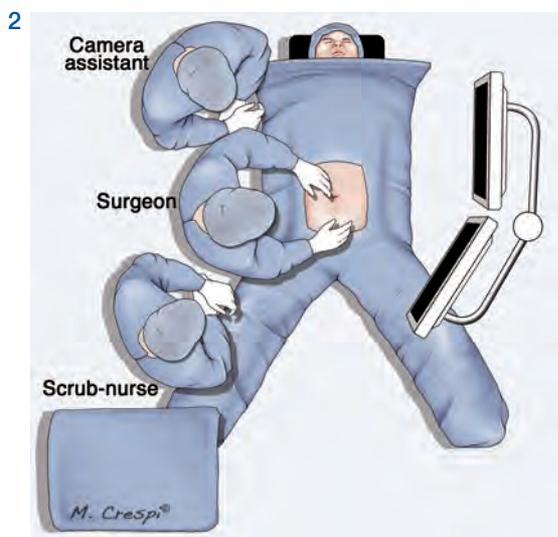
Patient and Team Positioning

The patient is placed in a supine position, with the arms alongside the body and the legs apart. The arms, ankles, and legs are secured and protected. These latter are well secured to the operative table, and the left leg is positioned further up.

For the first part of the laparoscopic procedure, the surgeon stands to the patient's right and the camera assistant to the surgeon's right. The scrub-nurse stands between the patient's legs. The video monitor is placed in front of the surgeon and camera assistant (Figure 1).

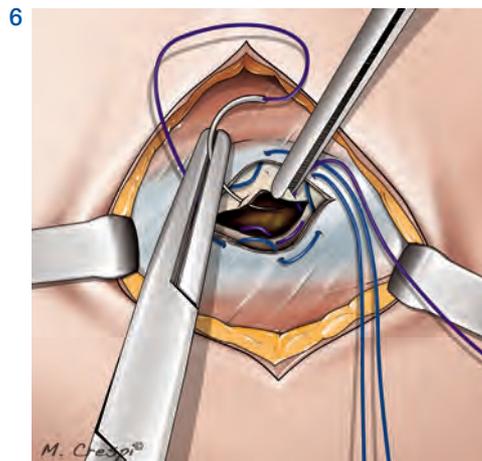
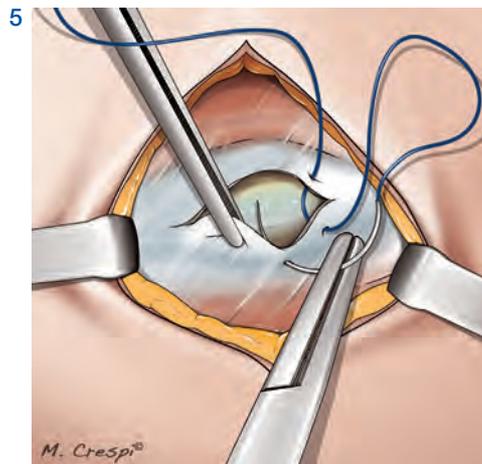
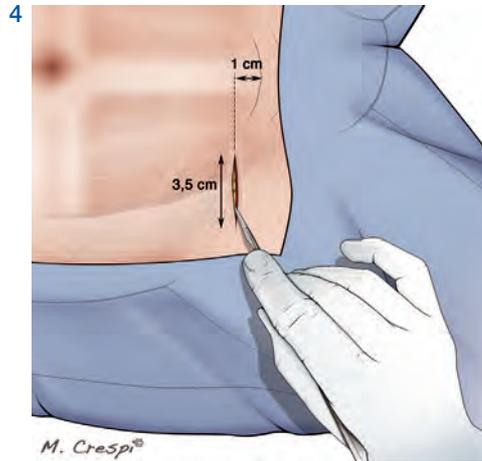
Following the mesocolic mobilization, the camera assistant moves to the surgeon's left and the scrub-nurse to the surgeon's right (Figure 2).

During the perineal dissection, the surgeon stands between the patient's legs, the assistant to the surgeon's left and the scrub-nurse to the surgeon's right. The video monitor is placed in front of the surgeon and assistant (Figure 3).

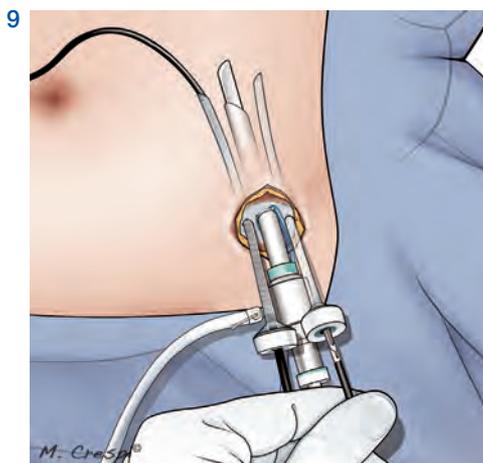
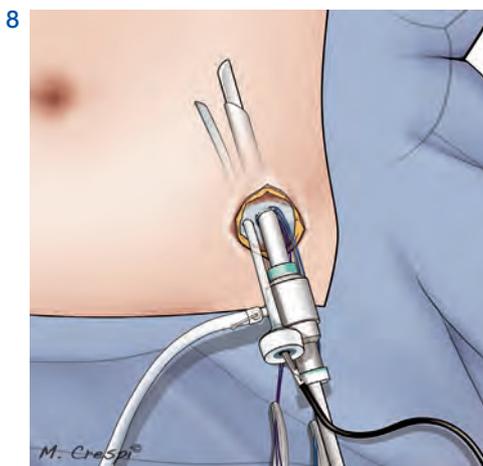
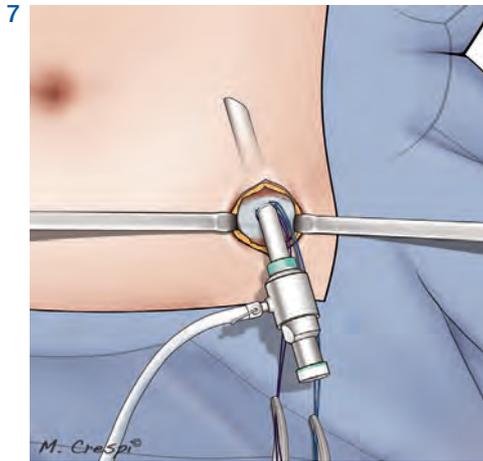


Technique

A 3.5 cm transverse skin incision is made 1 cm above the pubic symphysis on the right side of the rectus abdominis muscle (Figure 4). The underlying fascia is vertically divided in a pararectal fashion for 1.5 cm, which exposes the rectus abdominis muscle. The muscle is medially retracted and a purse-string suture using PDS 1 is placed in the fascia (Figure 5), going inside and outside respectively at the 5, 7, 9, 11, 1, and 3 o'clock positions (Figure 6). The peritoneal sheet is entered through a 1 cm vertical incision, and a new purse-string suture using Vicryl 1 is placed, going inside and outside respectively at the 5, 7, 9, 11, 1, and 3 o'clock positions (Figure 6). Both sutures are kept externally with Pean-Rochester curved forceps.



[Click to watch the corresponding video](#)
AbdominoPerineal Resection



An 11-mm trocar (or a 12-mm non-reusable trocar) is introduced into the peritoneal cavity inside the purse-string sutures, and the pneumoperitoneum is created (Figure 7). The 10-mm, 30° scope is advanced through the 11-mm trocar.

A 6-mm flexible trocar is inserted at the 12 o'clock position with respect to the patient's head, outside the purse-string sutures and on the same vertical line as the previous trocar, for insertion of the bicurved grasping forceps (Figure 8). The grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

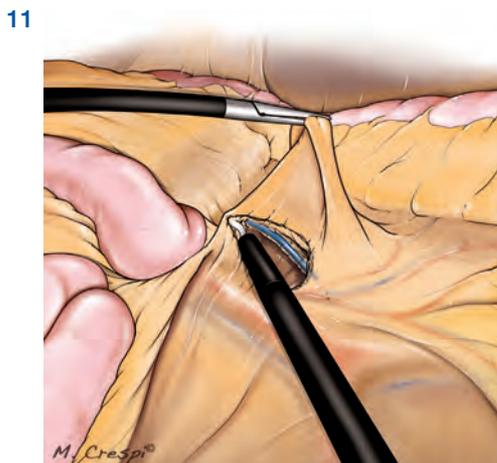
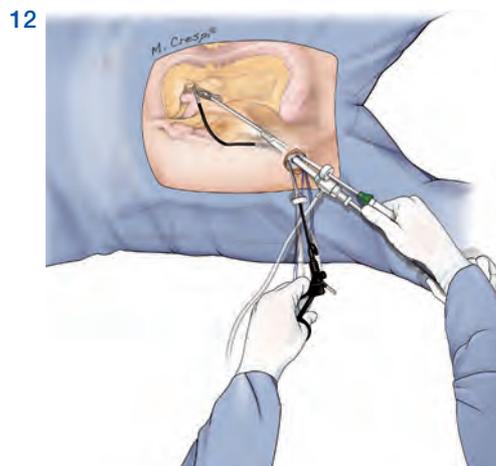
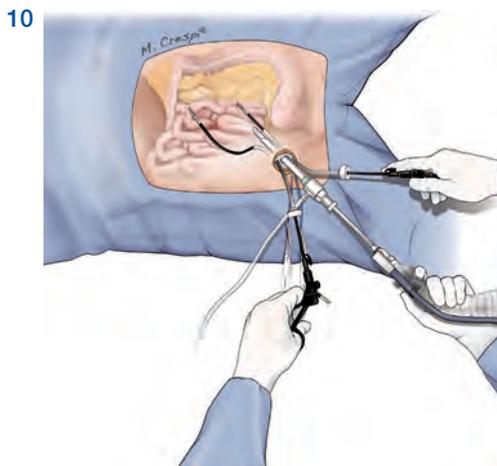
Another 6-mm flexible trocar is inserted at the 6 o'clock position with respect to the patient's head, outside the purse-string sutures and on the same vertical line as the previous trocars, for insertion of the other instruments (Figure 9), such as the monocurved grasping forceps, the monocurved coagulating hook, the monocurved dissecting forceps, the monocurved bipolar forceps and scissors, the straight 5-mm clip applier, the monocurved scissors, the monocurved needle holder, the monocurved suction and irrigation cannula, and the straight grasping forceps.

The abdominal cavity is explored and examined to rule out the presence of peritoneal metastases, superficial hepatic lesions and free ascites.

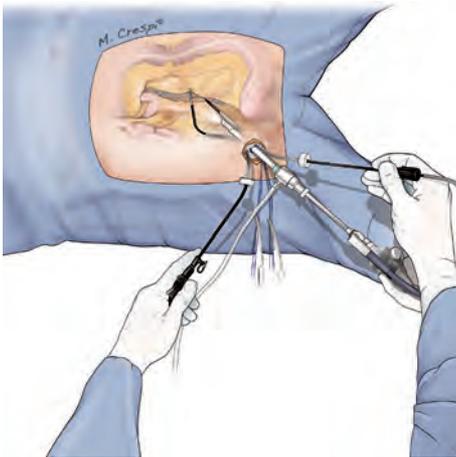
The operating room table is placed in an accentuated Trendelenburg position with right-sided tilt.

The small bowel is moved into the right abdominal quadrants and above the right liver lobe, using the bicurved and the monocurved grasping forceps (Figure 10).

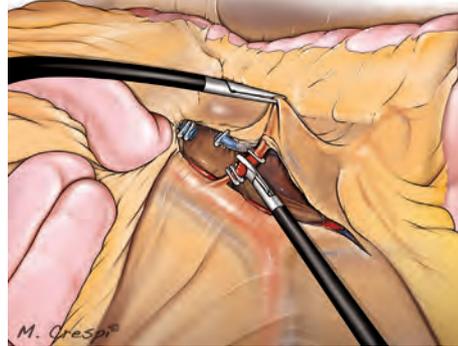
The ligament of Treitz is identified in order to expose the root of the inferior mesenteric vein. The peritoneal sheet covering the root of this vein is incised by the monocurved coagulating hook (Figure 11) until the Toldt's fascia is reached. The inferior mesenteric vein is isolated using the monocurved dissecting forceps and clipped by the 5-mm straight clip applier (Figures 12, 13).



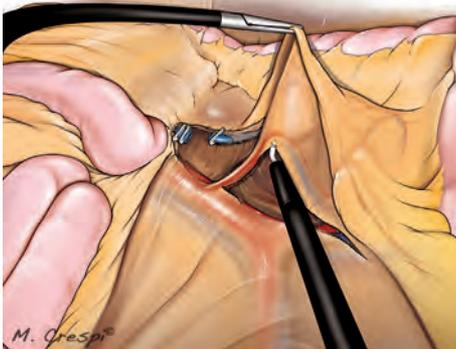
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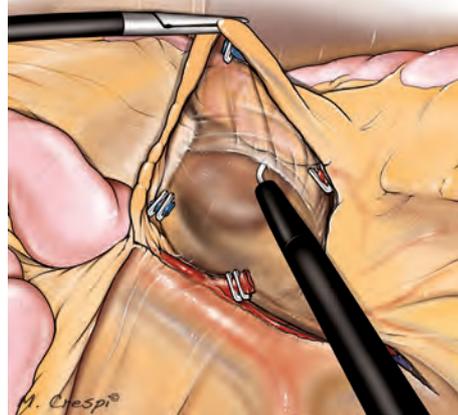
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The left mesocolon is separated from the Toldt's fascia in an avascular plane using the monocurved coagulating hook or the monocurved suction cannula.

The surgeon works with curved instruments without crossing hands and without interference with the camera assistant's hand (Figure 14).

The peritoneal sheet is incised along the abdominal aorta by the monocurved coagulating hook, reaching the origin of the inferior

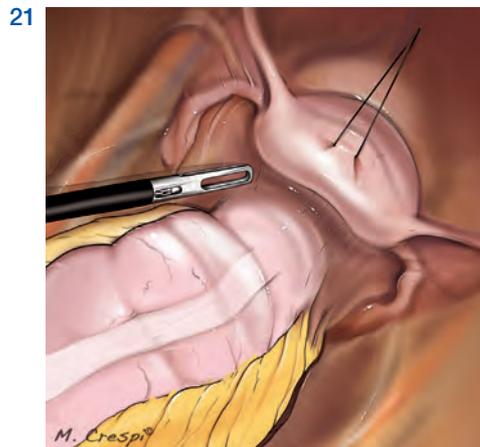
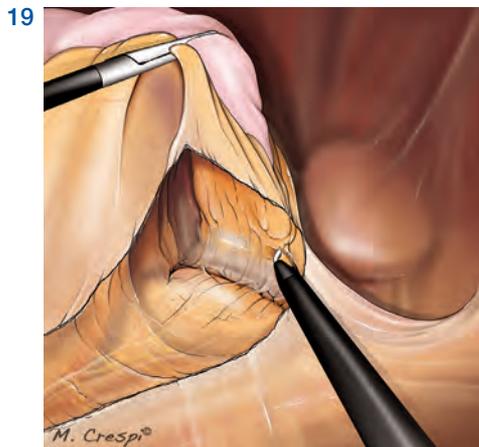
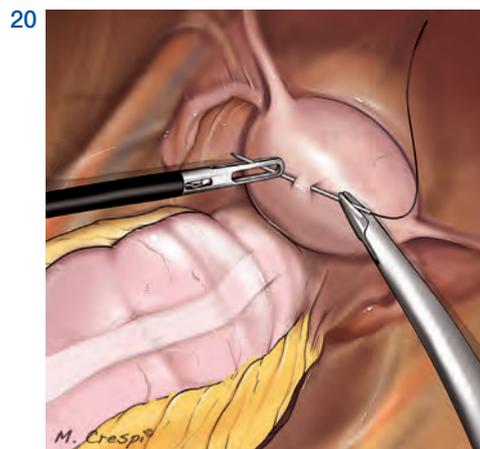
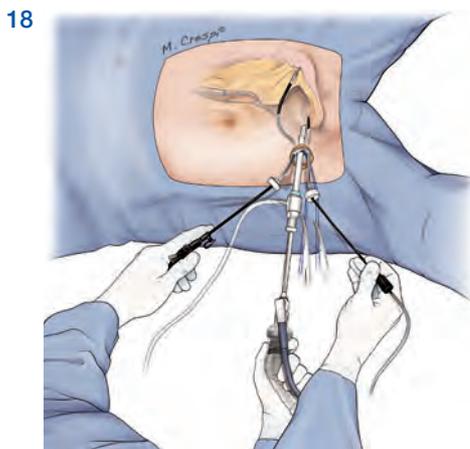
mesenteric artery (Figure 15). The root of the artery is freed using the monocurved coagulating hook and the monocurved dissecting forceps, clipped by the 5-mm straight clip applier, and divided by the monocurved scissors (Figure 16).

The left mesocolon is freed from the Toldt's fascia (Figure 17), respecting the left Gerota's fascia and proceeding in the direction of the pancreatic tail.

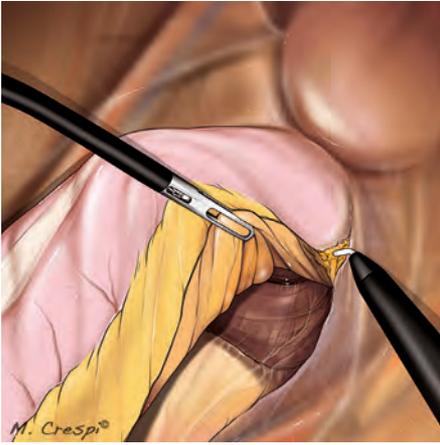
The procedure is continued with mobilization of the left mesocolon reaching the promontory (Figure 18). The upper mesorectum is incised and dissected from the presacral fascia in an avascular plane, using the monocurved coagulating hook and the monocurved bipolar forceps and scissors (Figure 19).

For the rest of the total mesorectal excision (TME), the camera assistant moves to the surgeon's left, and the scrub-nurse to the surgeon's right (Figure 2). To improve the pelvic field's exposure,

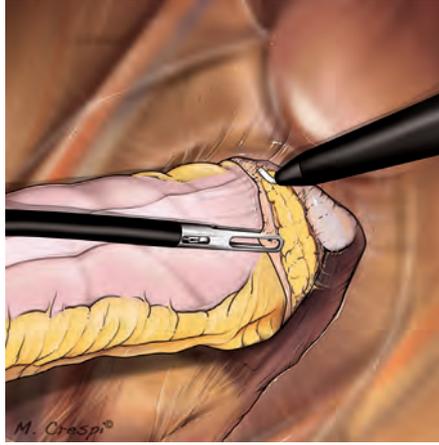
one temporary percutaneous suture using a straight Ethilon 2/0 needle is passed from the suprapubic area into the uterine fundus (female) (Figures 20, 21). Moreover, a straight 1.8-mm trocarless grasping forceps can be inserted percutaneously by a skin puncture (created by a Veress needle) in the left flank, or another straight Ethilon 2/0 needle can be passed in the pericolic fatty tissue, helping in the recto-sigmoid colon retraction.



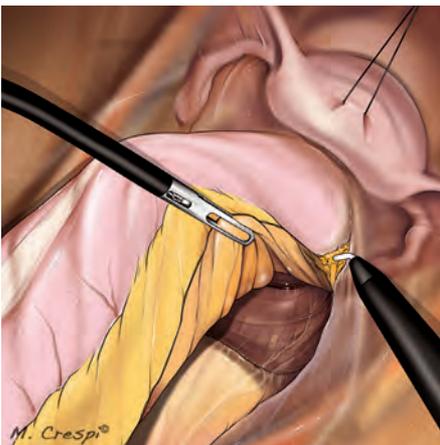
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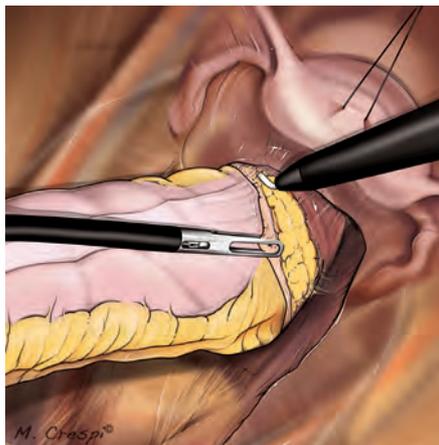
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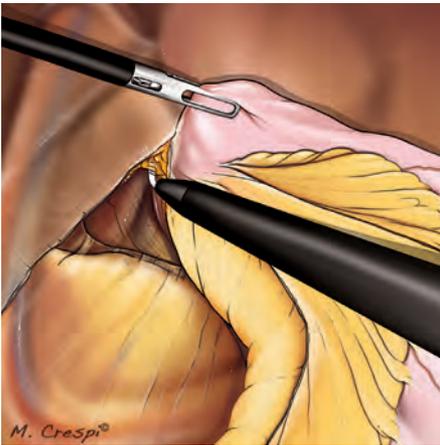
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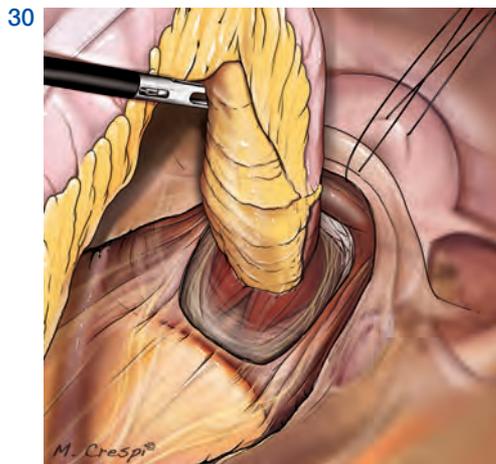
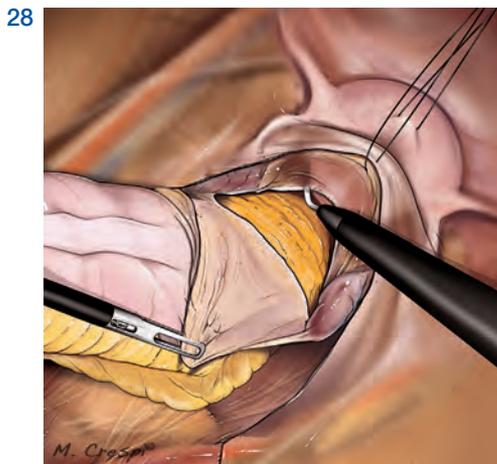
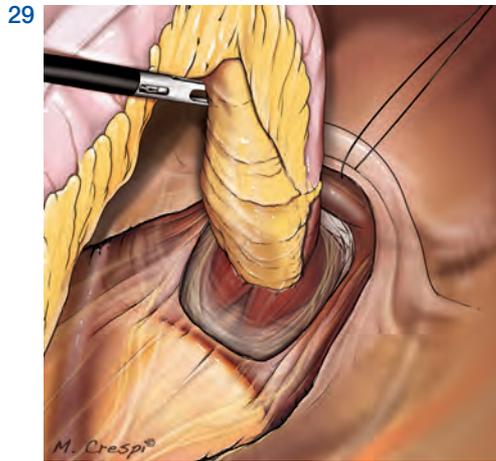
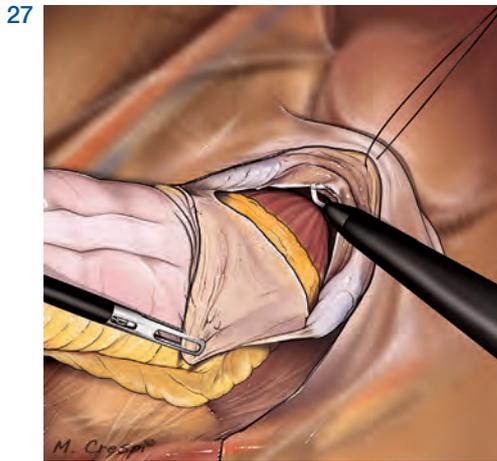
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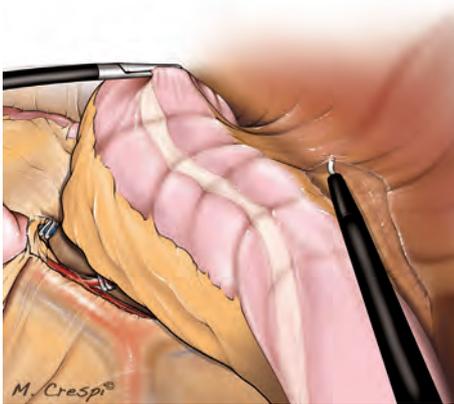
The middle mesorectum is dissected posteriorly and then laterally, using both the coagulating hook and bipolar instruments (Figures 22, 23, 24). The anterior peritoneal sheet is opened by the monopolar coagulating hook, and the plane anterior to the rectum and posterior to the seminal vesicles/rectoprostatic fascia (male) (Figure 25) or uterine cervix (female) (Figure 26) is dissected.



At this step in both male and female patients, a temporary suprapubic percutaneous suture (straight Ethilon 2/0 needle) is passed into the pelvic peritoneal reflexion (Figures 27, 28) and kept externally by a Pean-Rochester curved forceps. Once the lower mesorectum is reached, the

dissection continues, first posteriorly to reach both the levator ani muscles, and then laterally and anteriorly (Figures 29, 30). Monocurved bipolar forceps and scissors are continuously used and exchanged during this step.

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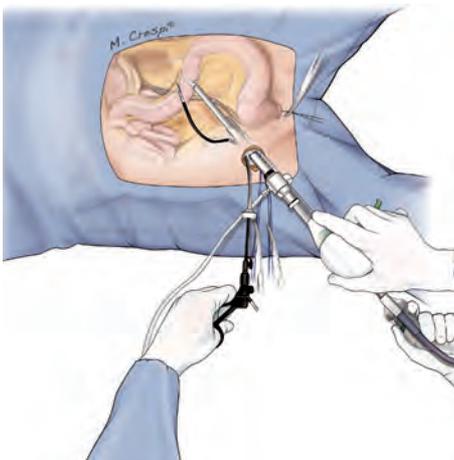


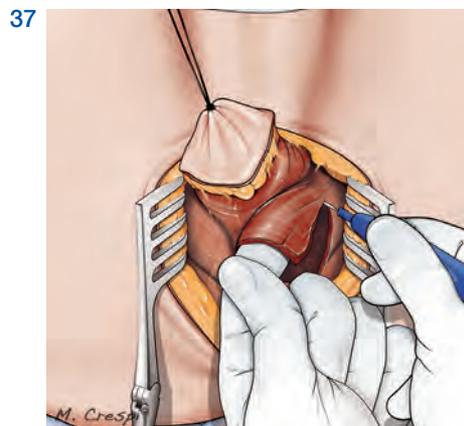
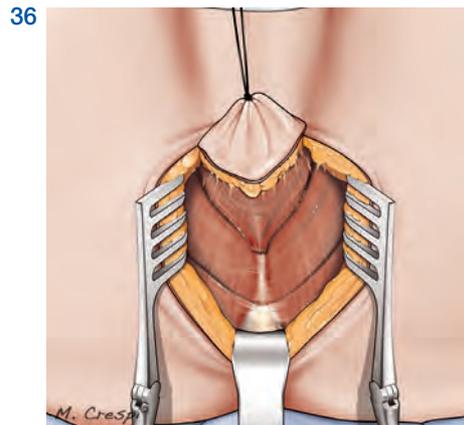
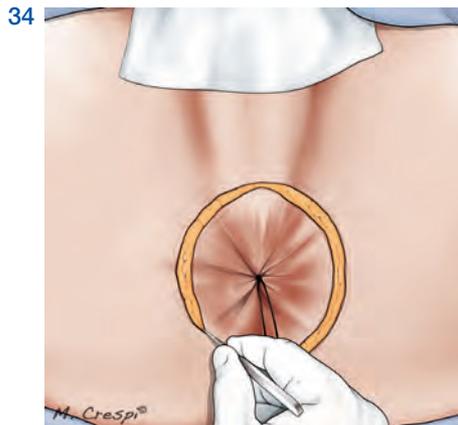
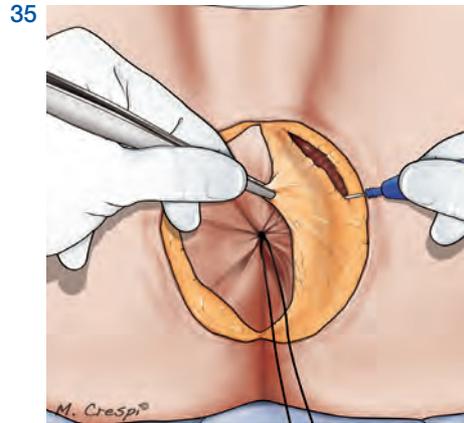
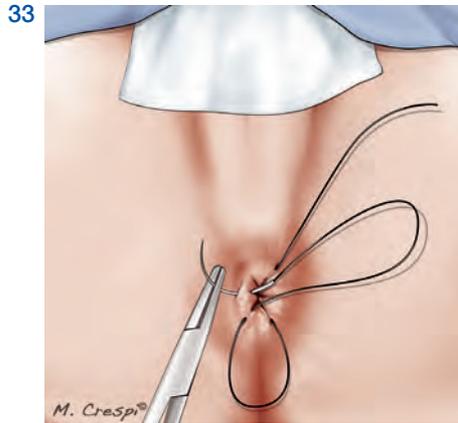
The procedure continues with mobilization of the sigmoid and left colons from the peritoneal attachments, using the monocurved coagulating hook or scissors (Figure 31). The camera assistant returns to the surgeon's right, and the scrub-nurse to between the patient's legs (Figure 1). Usually it is not necessary to mobilize the splenic colic flexure.

The level of the left colon transection is chosen and the mesocolon is dissected from this level going in the direction of the inferior mesenteric vein root, using the monocurved coagulating hook and bipolar tools.

For the left colon sectioning, the 11-mm trocar is replaced by a reusable 13-mm trocar (if the 12-mm non-reusable trocar is inserted at the beginning, this replacement is not needed), in order to accommodate an articulating linear stapler. The 10-mm scope is switched for a 5-mm, 30° long scope, which is inserted into the 6-mm flexible trocar at the 6 o'clock position (Figure 32). The linear stapler encircles the left colon and is fired (Figure 32).

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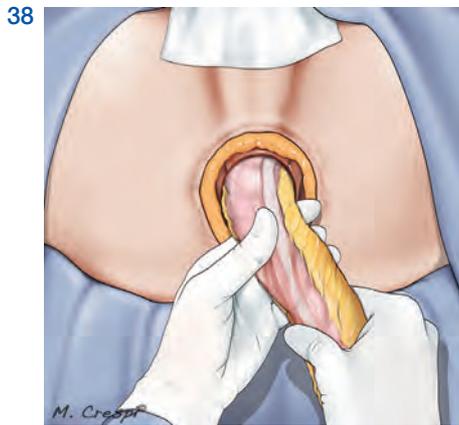


Perineal Dissection and Specimen Extraction

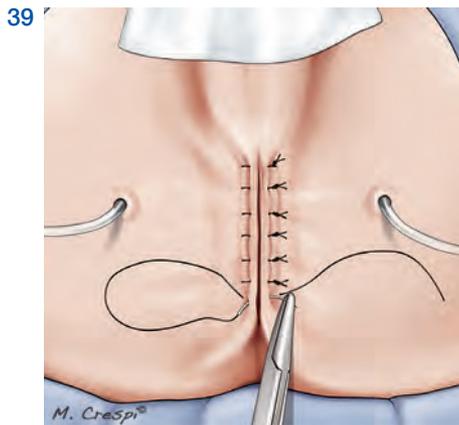
Both patient's legs are positioned upwards (gynecologic positioning). The cutaneous ani has already been closed by a purse-string suture using silk 0 (Figure 33), once the patient was positioned on the operative table and anesthetized and before placing any sterile towels. In this way, the risk of any infection is avoided.

After having performed the laparoscopic abdominal step, the skin around the anus is incised in an ellipse pattern (Figure 34). The fatty tissue is dissected until the muscular plane of the levator ani is reached (Figures 35, 36). The dissection is performed starting on the left side, then on the right side, and finally inferiorly and anteriorly. Once the levator ani plane is exposed (Figure 36), an incision anteriorly to the coccyx is made, going deeply in the previous plane dissected by laparoscopy.

A dissection in the levator ani muscles is performed on the left side (Figure 37), and then on the right side, staying laterally to the anal sphincter. Finally, the anterior muscle plane is freed.



Once the anal piece is completely freed, the recto-sigmoid colon is removed transanally (Figure 38). Two perineal drains are positioned in the pelvic space (Figure 39). The perineal fatty tissue is closed by Vicryl 2/0 sutures, and the skin by Ethilon 2/0 sutures (Figure 39).



End of Procedure and Colostomy

The monocurved needle holder is introduced beside the bicurved grasping forceps (Figure 40). The parietal pelvic peritoneum is closed by a running suture using Vicryl 2/0 (Figure 41) (a preformed knot at its extremity is useful to gain operative time), after having removed the temporary percutaneous Ethilon 2/0 sutures.

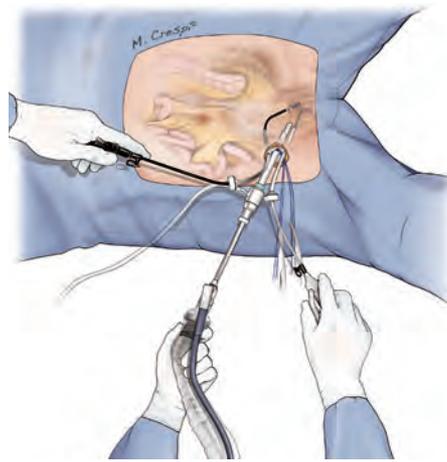
The distal left colon is taken-up by the bicurved grasping forceps in the direction of the chosen colostomy site. The peritoneal sheet from the parietal wall until the chosen colostomy site is dissected, and fixed by a Vicryl 2/0 running suture to the left colon, in order to cover this latter in part.

The skin, at the chosen colostomy site, is incised and both fascia and peritoneal sheet opened. The colic stump (maintained closed) is fixed to the posterior and anterior abdominis muscle fascia by Vicryl 3/0 sutures.

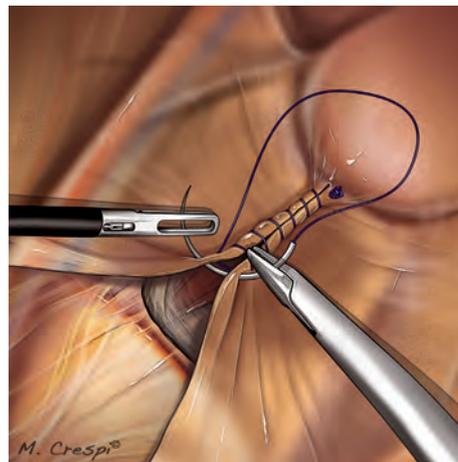
The operating room table is positioned without any Trendelenburg and tilt, and the small bowel is gently moved out of the right abdominal quadrants and over the left colon. No drain is left in the abdominal cavity.

The curved instruments are retrieved following the curves at 45° with respect to the abdominal wall.

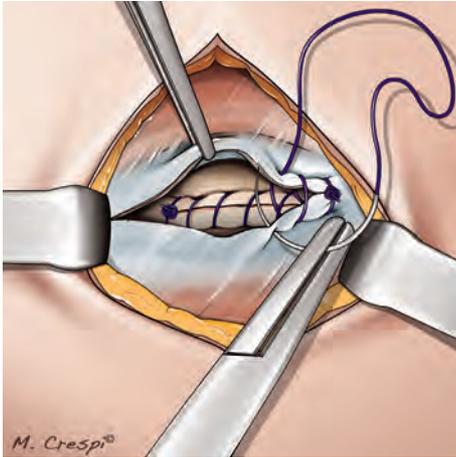
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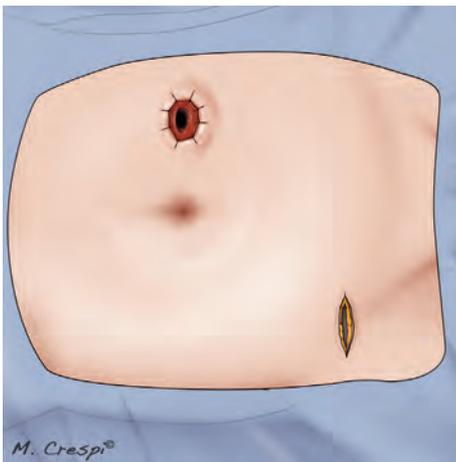
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42



43



Both purse-string sutures are retrieved together with the three trocars. The peritoneal sheet and the rectus abdominis muscle fascia are meticulously and separately closed by converging Vicryl 1 running sutures (Figure 42). The suprapubic cutaneous scar is joined by Monocryl 4/0 intradermic sutures.

The colic stump in the left flank is opened, fixing the mucosa to the skin by Vicryl Rapid 3/0 (Figure 43). The colostomy set is placed.

Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

The arterial catheter is removed in the recovery room.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

Antibiotic prophylaxis is prescribed if necessary and TVP prophylaxis until the discharge of the patient from the hospital. The urinary catheter and the central line are removed after 5 days. The patient is allowed to drink water after 24 hours, and to tolerate a light diet from the 3rd post-operative day.

The management of the colostomy is started after 48 hours. If there are no complications, the two perineal drains are removed on the 7th post-operative day, and the patient can be discharged.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the gastroenterologist/oncologist.

SECTION 6

HEPATOBIOLIOPANCREATIC AND SOLID ORGANS

6.1 CHOLECYSTECTOMY

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Post-operative Care

6.1 CHOLECYSTECTOMY

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after the intubation.

Antibiotic prophylaxis is applied as well.

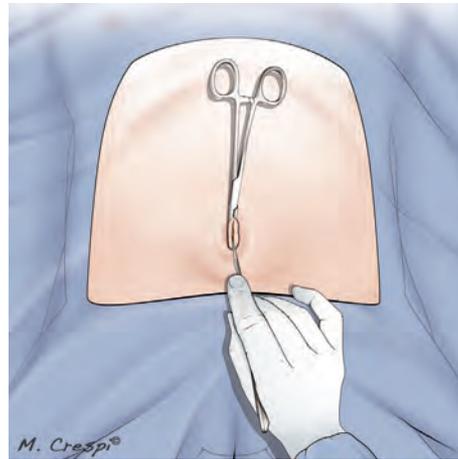
Tools

- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needle-holders, two tissue forceps, two Farabeuf retractors, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), one Polydioxanon 4/0 (PDS 4/0, round tip, 3/8c, 22 mm), four Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable rigid mandril of 6-mm trocar
- one straight 10-mm, 30° and regular length scope
- one reusable tricurved grasping forceps (DAPRI grasping forceps II)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved dissecting forceps (DAPRI dissecting forceps)
- one reusable straight 5-mm clip applier
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one reusable bicurved grasping forceps (DAPRI grasping forceps III)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one non-reusable custom-made plastic bag

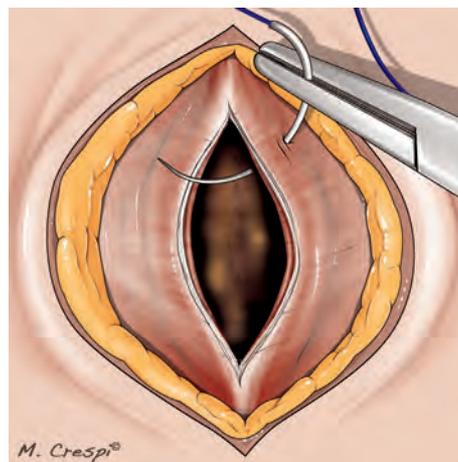
Technique

The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (Figure 2). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at the 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 3, 4). This suture is kept externally with a Pean-Rochester curved forceps.

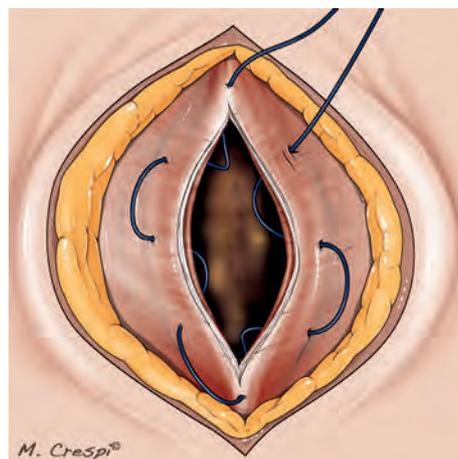
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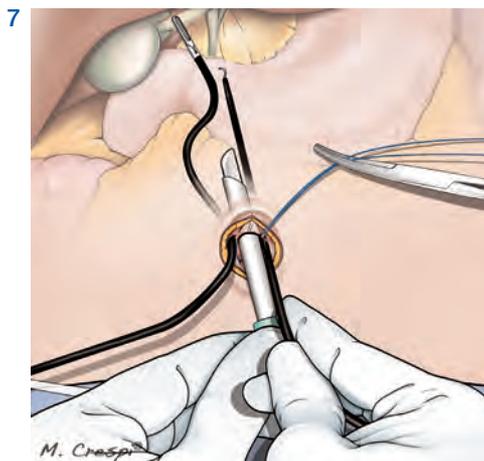
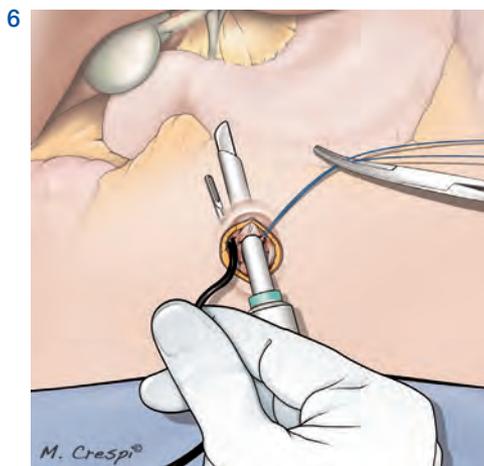
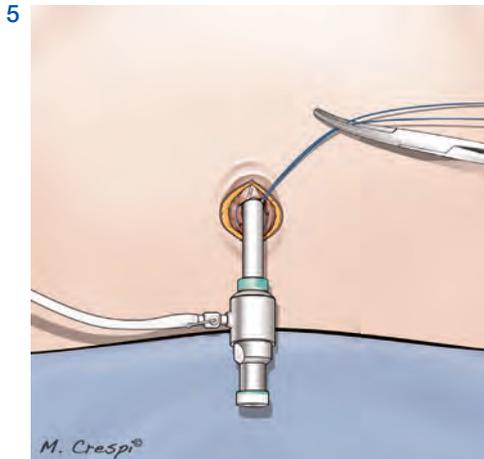
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4



Click to watch the corresponding video
Cholecystectomy



An 11-mm trocar is introduced into the peritoneal cavity inside the purse-string suture, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar, and curved instruments are inserted into the abdomen through the umbilical scar without trocars.

The tricurved grasping forceps is inserted through a separate fascia window, created by a mandril of 6-mm trocar, approximately 5 mm outside the purse-string suture at the 10 o'clock position with respect to the patient's head (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

The other instruments, such as the monocurved coagulating hook, the monocurved dissecting forceps, the straight 5-mm clip applier, the monocurved scissors, the monocurved bipolar forceps and scissors, the monocurved suction and irrigation cannula, and the straight grasping forceps are introduced on the other side of the tricurved grasping forceps at the 3 o'clock position, parallel to the 11-mm trocar and inside the purse-string suture (Figure 7).

The suture is adjusted to maintain a tight seal around the 5-mm tools and the 11-mm trocar, and is opened only for exchanges of instruments and evacuation of the smoke created during the dissection.

The operating room table is placed in a reverse Trendelenburg position with a moderate left-sided tilt.

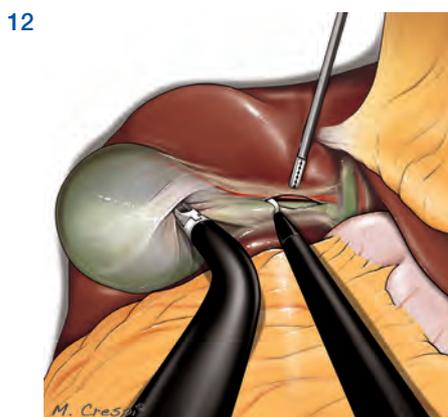
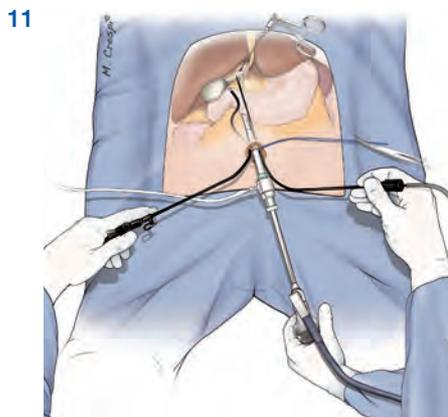
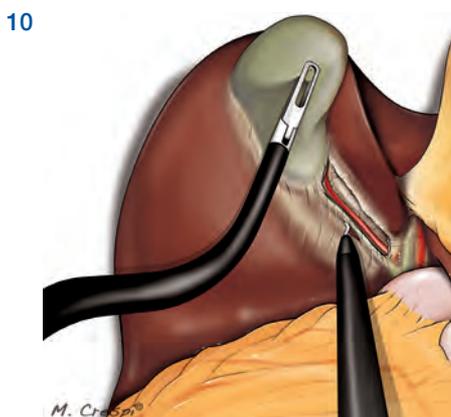
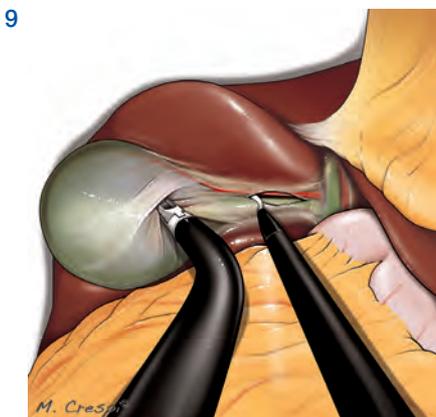
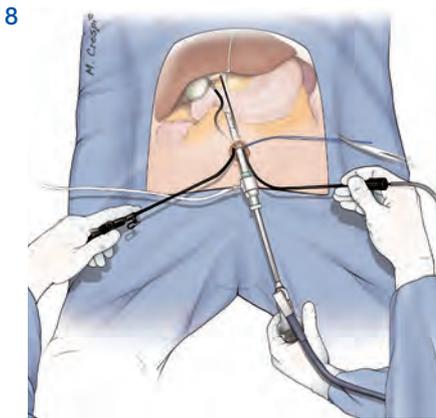
The gallbladder is grasped at its infundibulum by the tricurved grasping forceps (Figure 8). Traction of the gallbladder permits exposure of the Calot's triangle, and the monocurved coagulating hook is used to isolate the cystic duct and artery (Figures 9, 10).

Thanks to the three curves of the grasper, no interference between this instrument

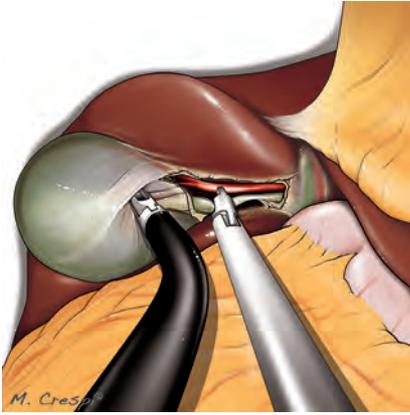
and the scope is apparent internally or externally (Figure 8).

If necessary, the monocurved dissecting forceps is used to dissect the cystic duct and artery.

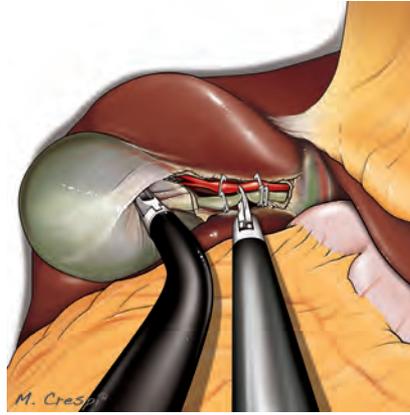
However, if good exposure of the Calot's triangle cannot be achieved or some peri-operative complication like bleeding occurs, the 1.8-mm trocarless grasping forceps is used and inserted under the right costal margin (Figure 11), its tip placed against and under the segments 4 and 5 of the liver (Figure 12).



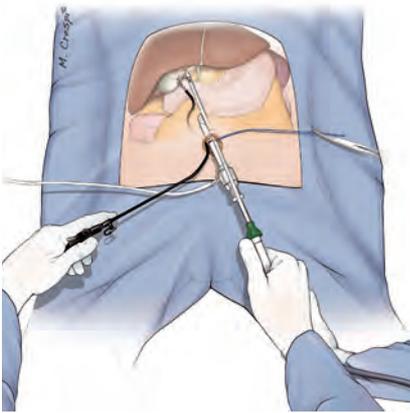
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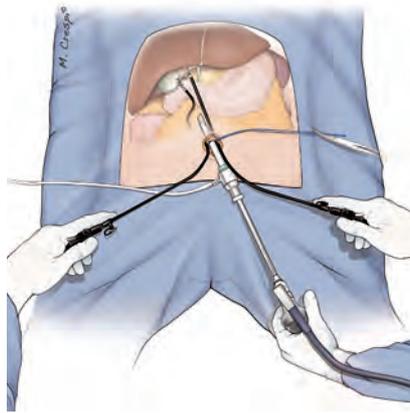
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16



The cystic duct is clipped and two 5-mm clips are placed at its base, parallel to the common bile duct (Figures 13, 14). Thereafter, the monocurved scissors are used to section the cystic duct (Figures 15, 16).

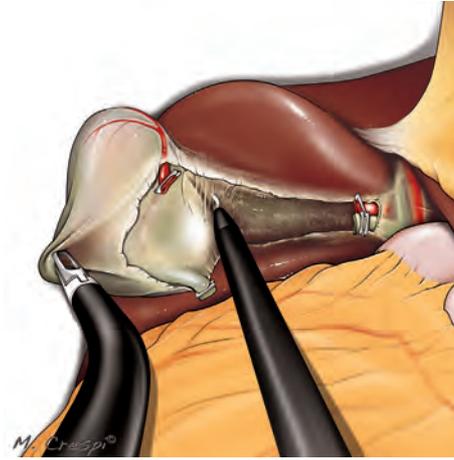
Because of the curves of the instruments, the scope never appears to conflict with the instruments

tips, and interference between the surgeon's hands is avoided, allowing the surgeon to work in ergonomic positions.

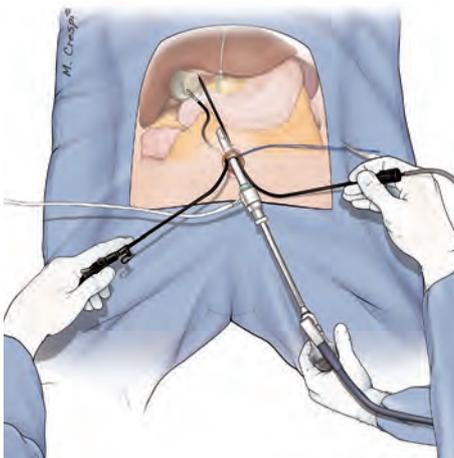
The cystic artery is coagulated if it presents millimetric in size, otherwise it is sectioned between clips (one for the base) (Figure 15) and successively divided by the monocurved scissors.

The procedure continues with mobilization of the body and fundus of the gallbladder from the liver, using the monocurved coagulating hook (Figures 17, 18) or the monocurved bipolar forceps and scissors.

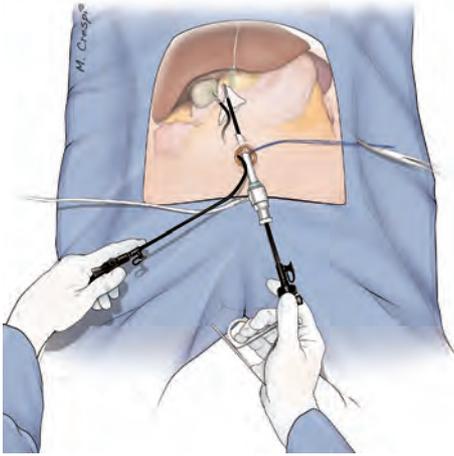
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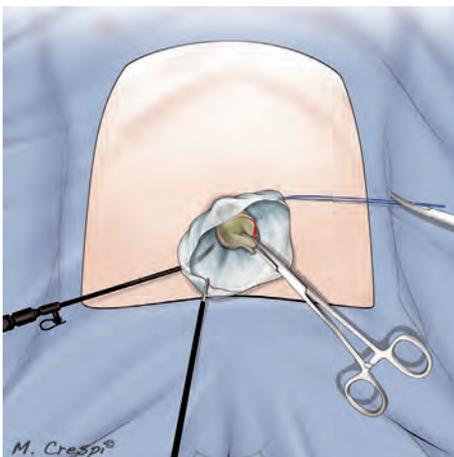
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21



A custom-made plastic bag is introduced into the abdominal cavity through the 11-mm trocar using a straight grasping forceps (Figure 19). The gallbladder is placed into the bag using the tricurved grasping forceps and the straight grasping forceps (Figure 20). The specimen is finally removed transumbilically (Figure 21).

The operative field is checked for bleeding or biliary leak and cleaned by the monocurved suction and irrigation cannula. If a biliary leak is found, a repair is performed using PDS 4/0 sutures with a bicurved grasping forceps and a monocurved needle holder.

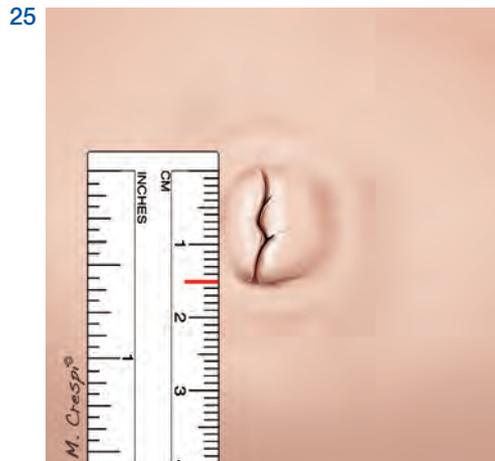
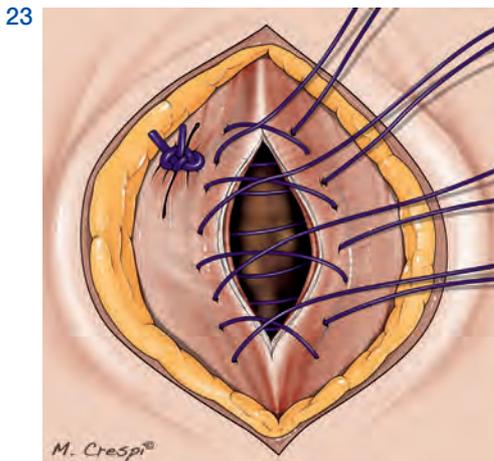
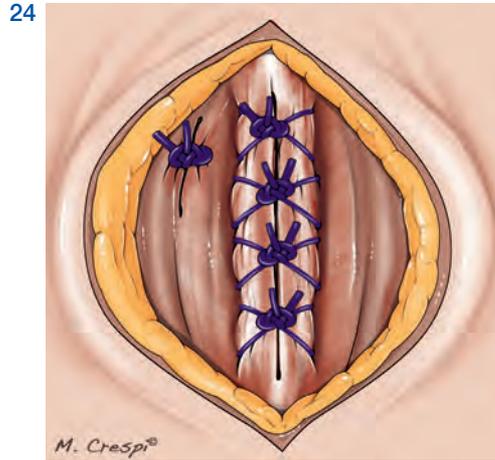
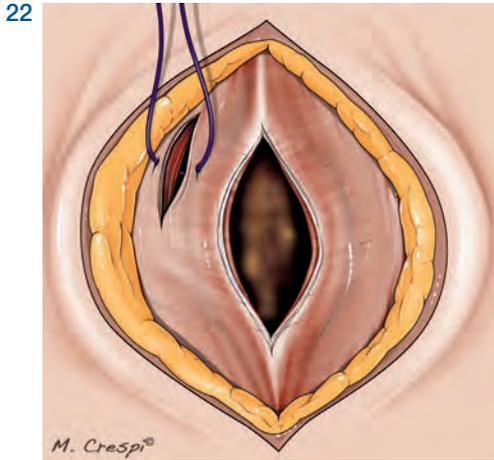
No drain is left in the abdominal cavity but, in case of biliary leak repair, the cutaneous scar used for the 1.8-mm trocarless grasping forceps accommodates this latter.

The operating room table is re-positioned as it was at the beginning of the procedure, without any tilt and Trendelenburg position.

All instruments are removed from the abdomen under view, and the tricurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

After having removed the 11-mm trocar and the umbilical purse-string suture, Vicryl 1 sutures are used to close the access. First, the separate fascia opening accommodating the tricurved grasping forceps is closed (Figure 22). Then,

the main access is closed using a figure 8 pattern of sutures (Figures 23, 24). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 25).



Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

The patient is allowed to drink water after 12 hours, and to tolerate a light diet after 24 hours. If there are no complications, the patient can be discharged.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6 and 12 months after the procedure.

6.2 LIVER RESECTION

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Left Lobectomy

Wedge Resection

Cyst Unroofing

Post-operative Care

6.2 LIVER RESECTION

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v.

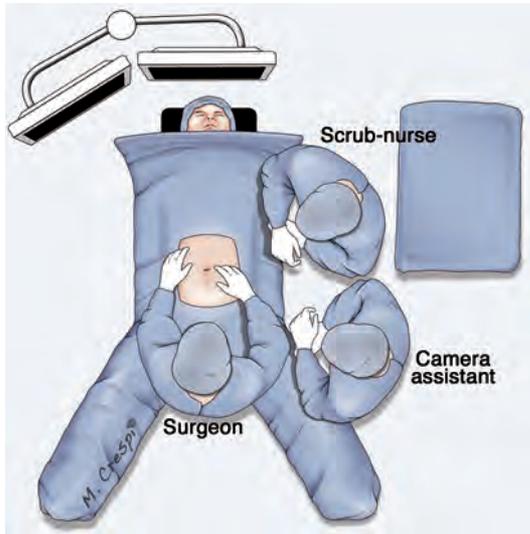
Antibiotic and TVP prophylaxis are applied as well.

An arterial catheter, a central line and a urinary catheter are placed.

Tools

- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needle-holders, two tissue forceps, two Farabeuf retractors, one purse-string suture device (DAPRI purse-string suture device), one monopolar electrode
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), two Polypropylene 4/0 (Prolene 4/0, round tip, 3/8c, 22 mm), five Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable 13-mm rigid trocar or one non-reusable 12-mm trocar
- one reusable 6-mm flexible trocar and rigid mandril (DAPRI flex trocar)
- one straight 10-mm, 30° regular length scope
- one straight 5-mm, 30° long length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps III)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one non-reusable straight 5-mm harmonic shears or other similar devices
- one reusable straight 5-mm and 10-mm clip appliers
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved dissecting grasping forceps (DAPRI dissecting grasping forceps)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one non-reusable articulating 45 linear stapler
- one non-reusable custom-made plastic bag
- one ultrasound probe

1



Patient and Team Positioning

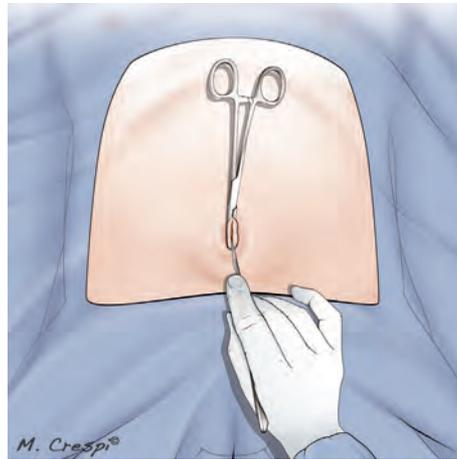
The patient is placed in a supine position, with the arms alongside the body and the legs apart. The arms, ankles, and legs are secured and protected.

The surgeon stands between the patient's legs, and the camera assistant to the patient's left. The scrub-nurse stands to the patient's left and to the camera assistant's right. The video monitor is placed in front of the surgeon and camera assistant ([Figure 1](#)).

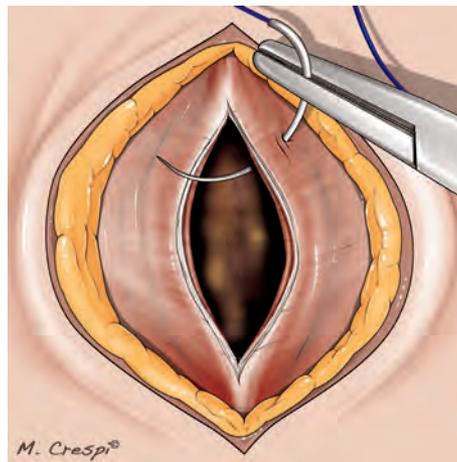
Technique

The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (Figure 2). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at the 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 3, 4). This suture is kept externally using a Pean-Rochester curved forceps.

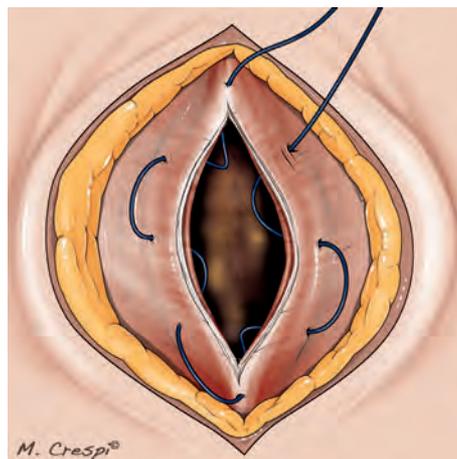
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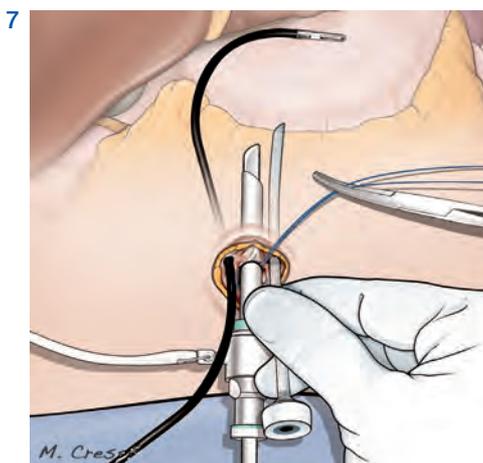
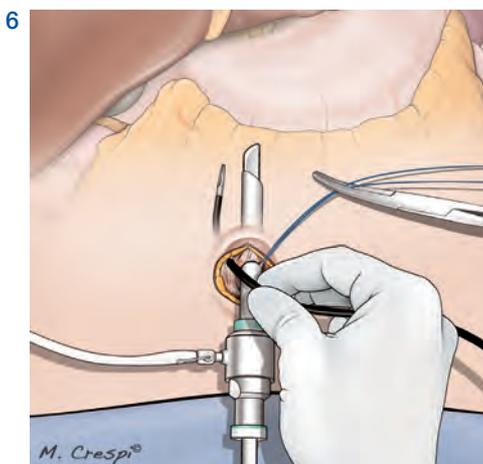
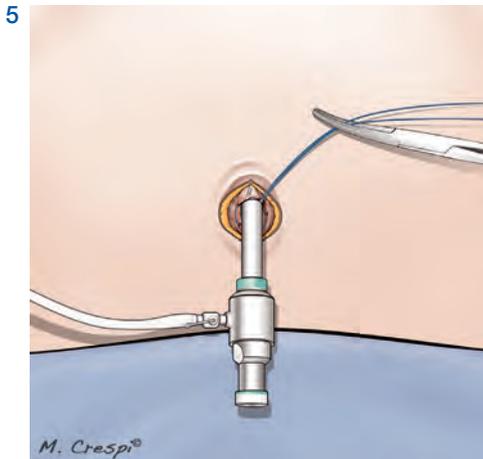
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4



Click to watch the corresponding video
Liver Resection



An 11-mm trocar (or a 12-mm non-reusable trocar) is introduced into the peritoneal cavity inside the purse-string suture, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar.

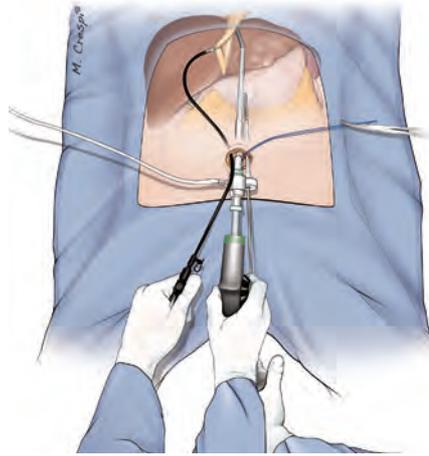
The bicurved grasping forceps is inserted without trocar through a separate fascia window, created by a mandril of 6-mm trocar, approximately 5 mm outside the purse-string suture at the 10 o'clock position with respect to the patient's head (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

The other instruments, such as the monocurved bipolar forceps and scissors, the straight 5-mm harmonic shears or other similar devices, the straight 5-mm clip applier, the monocurved scissors, the monocurved dissecting forceps, the monocurved coagulating hook, the monocurved needle holder, the monocurved suction and irrigation cannula, and the straight grasping forceps are introduced through a 6-mm flexible trocar positioned at some of outside the purse-string suture at the 2 o'clock position with respect to the patient's head (Figure 7).

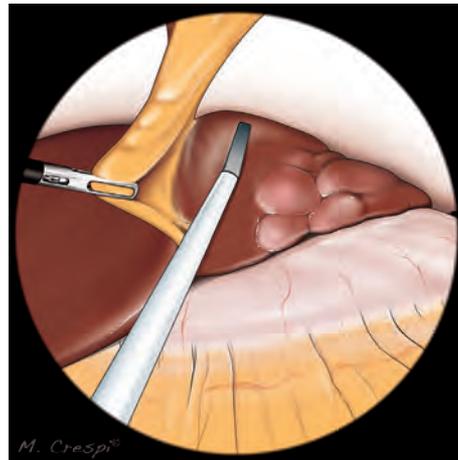
The procedure starts with the exploration of the peritoneal cavity. The peri-operative ultrasonography of the liver is performed. Therefore, the 10-mm scope is exchanged for a 5-mm, 30° long scope, which is inserted through the 6-mm flexible trocar at the 2 o'clock position, and the ultrasound probe is introduced through the 11-mm (or the 12-mm non-reusable trocar) (Figures 8, 9). At the end of this step, the 5-mm scope is replaced by the 10-mm scope and inserted into the 11-mm trocar.

The operating room table is positioned in a moderate reverse Trendelenburg position.

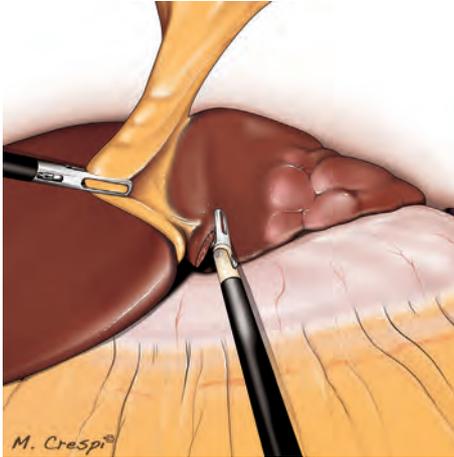
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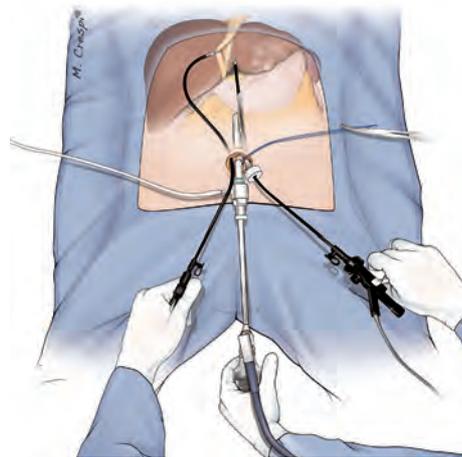
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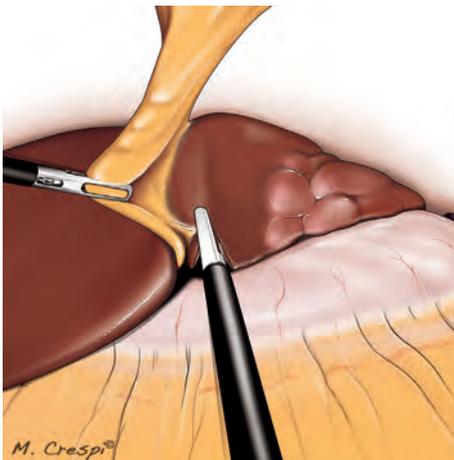
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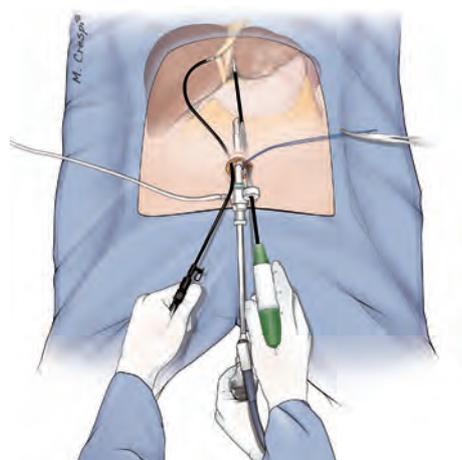
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11



13



Left Lobectomy

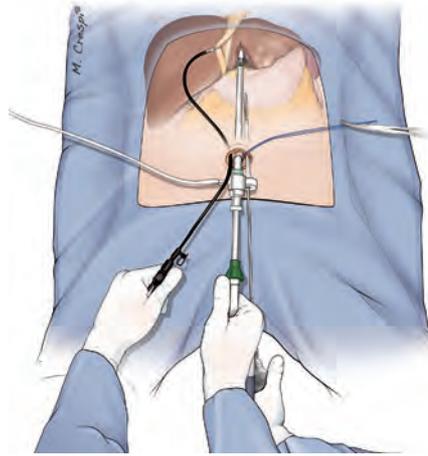
The round ligament of the liver is grasped by the bicuspid grasping forceps and the monopolar bipolar forceps and scissors are used for the hepatic parenchyma transection (Figure 10). Alternatively, the straight 5-mm harmonic shears or other similar devices can be used as well (Figure 11), besides the monopolar suction and irrigation cannula, and the straight 5-mm clip applier. The main difference in using these

various other devices is that the use of curved instruments (Figure 12) allows surgeon to work without interference between the hands externally, like instead appears with the straight tools (Figure 13).

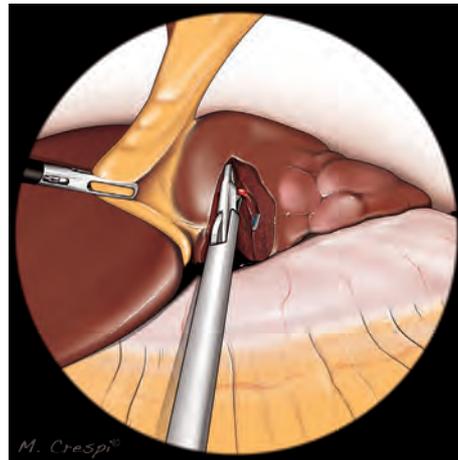
The hepatic parenchyma is sectioned from inferiorly to superiorly, staying laterally to the lesion (Figures 10, 11).

The main hepatic vessels for segment 3 are dissected by the monocurved dissecting forceps and transected by the straight 5-mm harmonic shears or other similar devices. If necessary, supplementary 10-mm clips are applied with the exchange of the scope as during peri-operative ultrasonography (Figures 14, 15). Dissection of the parenchyma is continued using the monocurved bipolar forceps (Figure 16).

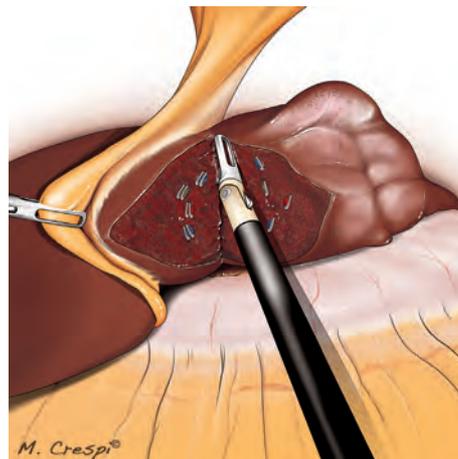
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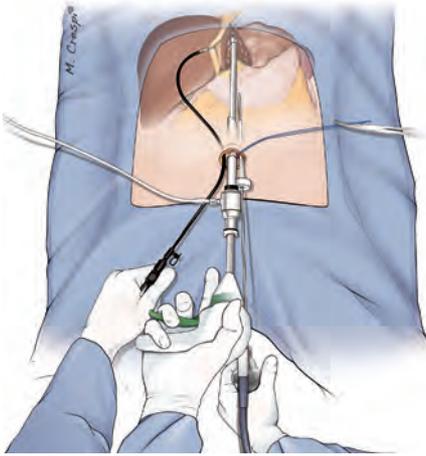
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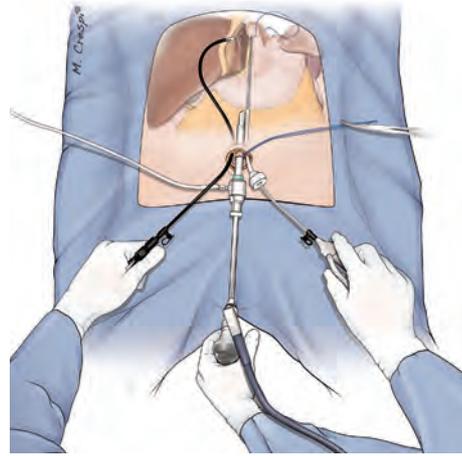
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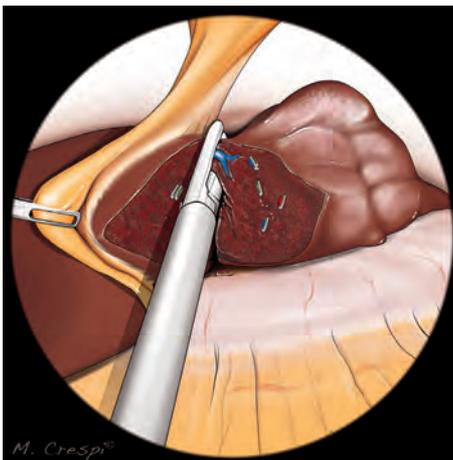
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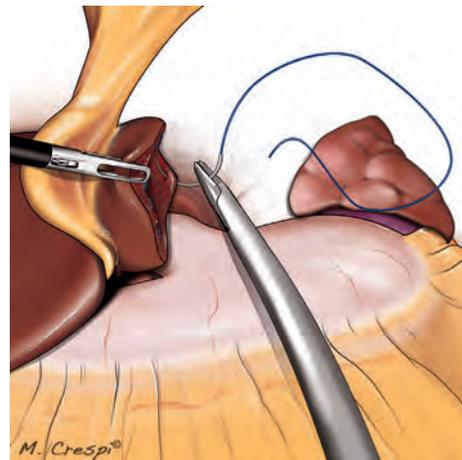
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18



20



Once the hepatic parenchyma is completely transected and the left hepatic vein is exposed, the 11-mm trocar is replaced by the 13-mm trocar (if the 12-mm non-reusable trocar is inserted at the beginning, this replacement is not needed) in order to accommodate the articulating linear stapler. The 10-mm scope is again exchanged for a 5-mm, 30° long scope and inserted into the 6-mm flexible trocar (Figure 17). The linear stapler is applied, and the left hepatic vein is sectioned (Figure 18).

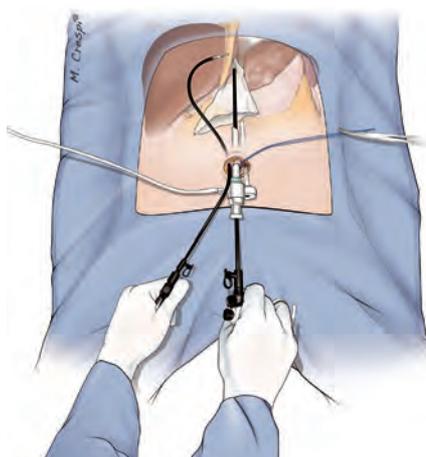
The 11-mm trocar is reinserted centrally and the scope is changed. The operative field is cleaned by the monocurved suction and irrigation cannula. If the hepatic parenchyma has to be sutured, the monocurved needle holder is inserted and Prolene 4/0 sutures are performed with intracorporeal knotting sutures.

The surgeon works in considerable ergonomics (Figure 19) with established internal working triangulation (Figure 20).

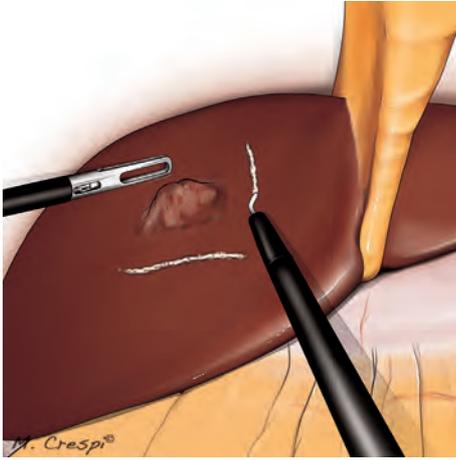
A custom-made plastic bag is finally introduced into the abdominal cavity through the 11-mm trocar using a straight grasping forceps (Figure 21).

21

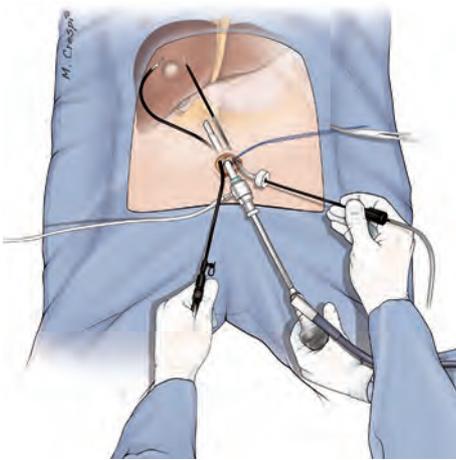
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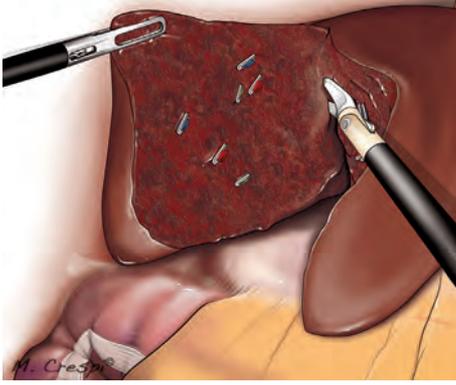


Wedge Resection

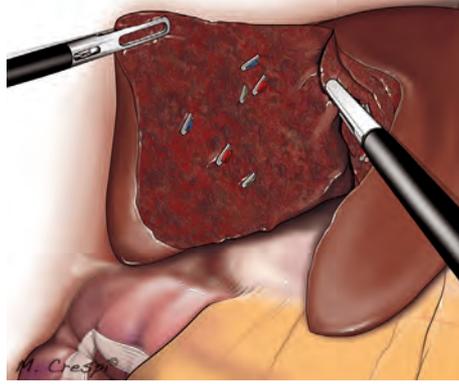
The operating room table is increased with regard to its tilt (e.g. left-sided tilt) and maintained in the reverse Trendelenburg position.

The hepatic parenchyma around the lesion is scored by the monopolar coagulating hook (Figure 22), maintaining the correct ergonomics externally (Figure 23).

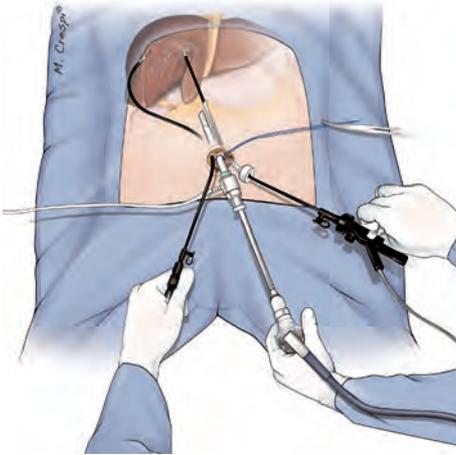
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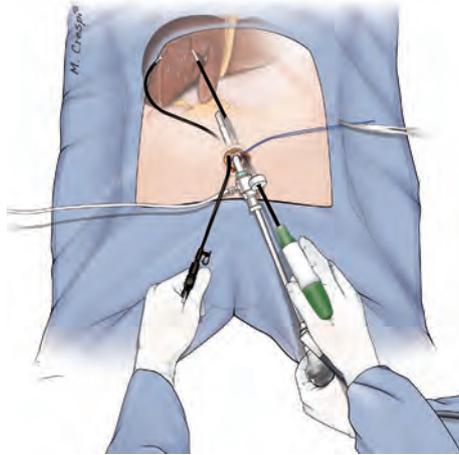
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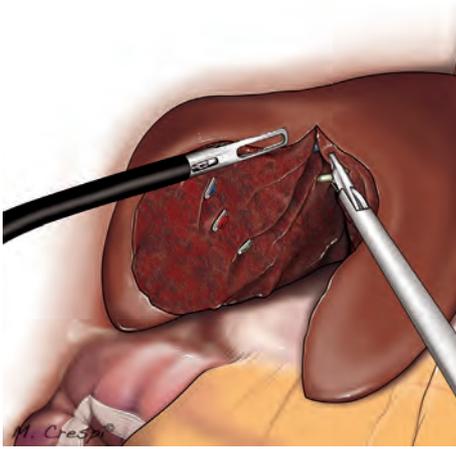
27



The hepatic lesion is resected using the monopolar curved bipolar forceps and scissors

(Figures 24, 25) or the other straight 5-mm devices (Figures 26, 27).

28



Alternatively, when necessary, the straight 5-mm clip applicator is introduced, applied (Figures 28, 29), and sectioned between the monopolar scissors.

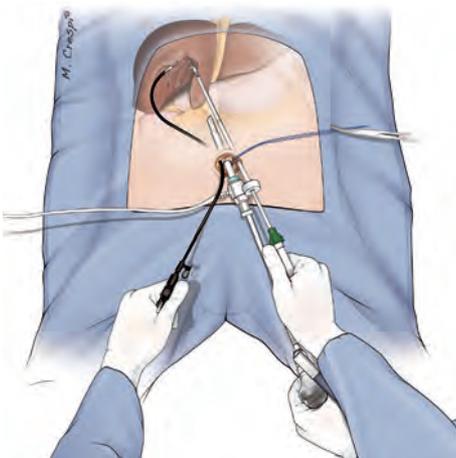
The operative field is cleaned by the monopolar suction and irrigation cannula, and hemostasis is controlled with the monopolar bipolar forceps.

If a biliary leak is found, an intracorporeal suture is performed as described above (Figures 19, 20).

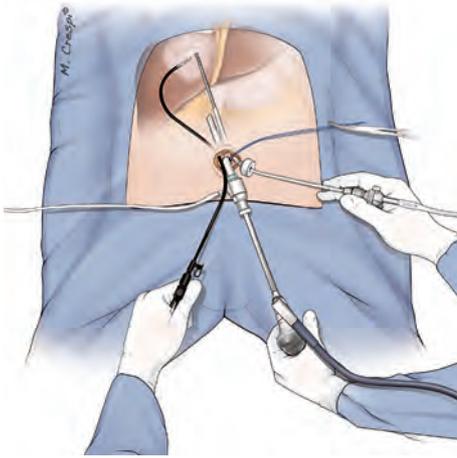
A custom-made plastic bag is introduced into the abdominal cavity through the 11-mm trocar using a straight grasping forceps (Figure 21).

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29



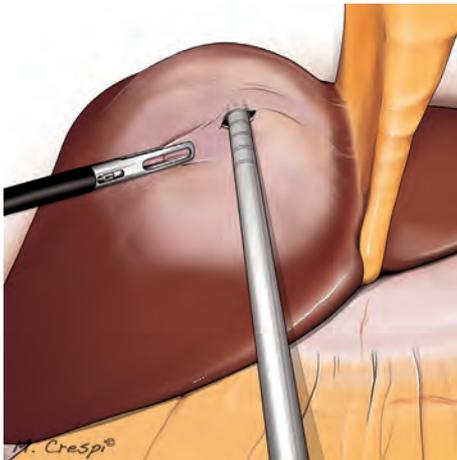
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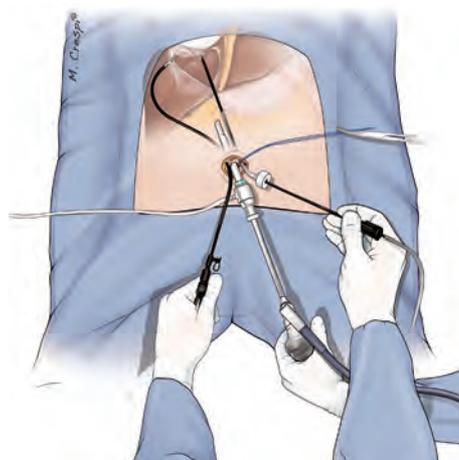
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31



33



Cyst Unroofing

The operating room table is maintained in a moderate reverse Trendelenburg position. The cystic dome is identified and the monopolar suction and irrigation cannula is inserted into the cyst, emptying the latter (Figures 30, 31). A bacteriological sample is taken in case of suspected cyst. The superficial wall of the cyst is resected using the monopolar coagulating hook (Figure 32).

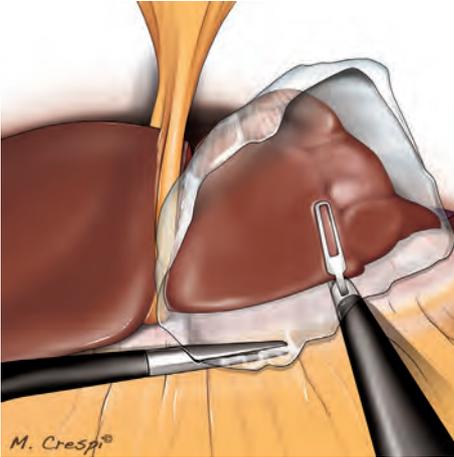
Thanks to the curves of the instruments, the surgeon is able to work under comfortable

ergonomy without interference among the instruments' tips or crossing of the hands (Figure 33).

Care is taken during the dissection, staying far from the hepatic parenchyma margin, to avoid excessive bleeding (Figure 32).

A custom-made plastic bag is introduced into the abdominal cavity through the 11-mm trocar using a straight grasping forceps (Figure 21).

34



End of All Procedures

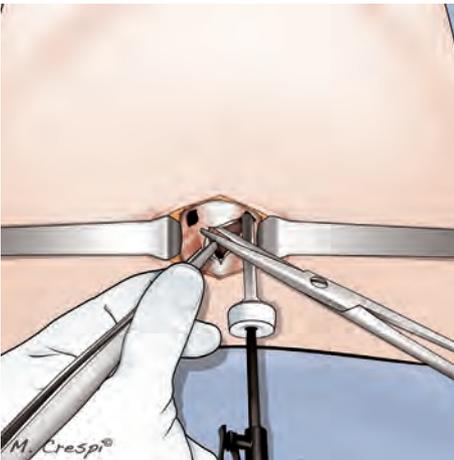
At the end, the resected liver parenchyma or the cystic dome are placed inside the bag using the bicurved grasping forceps and the straight grasping forceps (Figure 34). The bag is kept closed using the straight grasping forceps. No drain is left in the abdominal cavity.

The operating room table is repositioned as it was in the beginning of the procedure, without any Trendelenburg position and tilt.

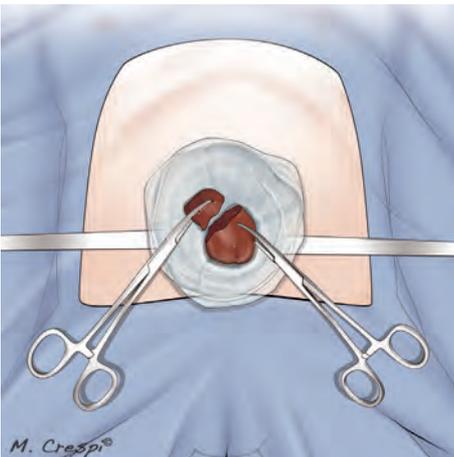
The bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

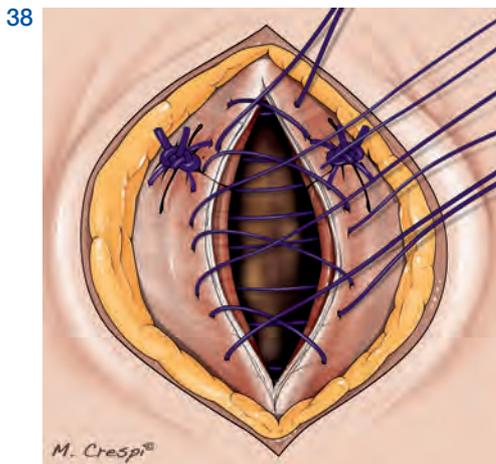
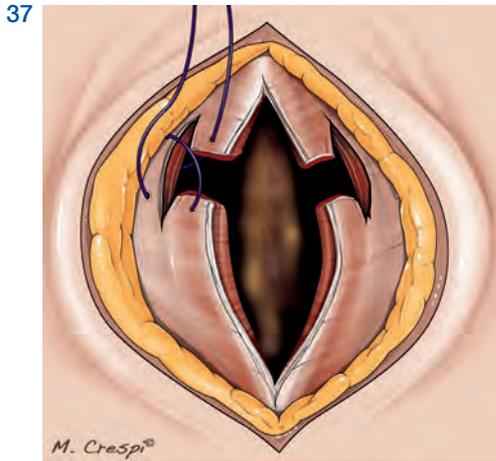
After having removed the central trocar, the umbilical purse-string suture and the 6-mm flexible trocar, the different fascia openings at the umbilicus are joined together (Figure 35), and the specimen is extracted (Figure 36).

35



36





Vicryl 1 sutures are placed in a figure 8 pattern to close the umbilical access, taking care to close the separate fascia openings for the bicurved grasping forceps and for the flexible

trocar (Figures 37, 38, 39). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 40).

Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 100 mg tramadol i.v. is administered; for VAS greater than 4, 1 mg piritamide i.v. is used.

The arterial catheter is removed in the recovery room.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 100 mg tramadol administered i.v. if VAS is between 1 and 3, and morphine in patient controlled analgesia (PCA) infusion for VAS greater than 4.

TVP prophylaxis is prescribed until the discharge of the patient from the hospital. The patient is allowed to drink water on the 1st post-operative day and to tolerate a liquid diet on the 2nd post-operative day, and a light diet on the 3rd post-operative day.

The urinary catheter is removed on the 1st post-operative day. If there are no complications, the patient is discharged on the 4th post-operative day, after removal of the central line.

Upon discharge, 50 or 100 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, and 1, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the gastroenterologist.

6.3 PANCREATIC SURGERY

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Staging Laparoscopy

Gastrojejunal Bypass

Distal Pancreatectomy

Post-operative Care

6.3 PANCREATIC SURGERY

Pre-operative Preparation and General Anesthesia

Patient is asked not to eat for at least 8 hours prior to the procedure.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane.

In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v.

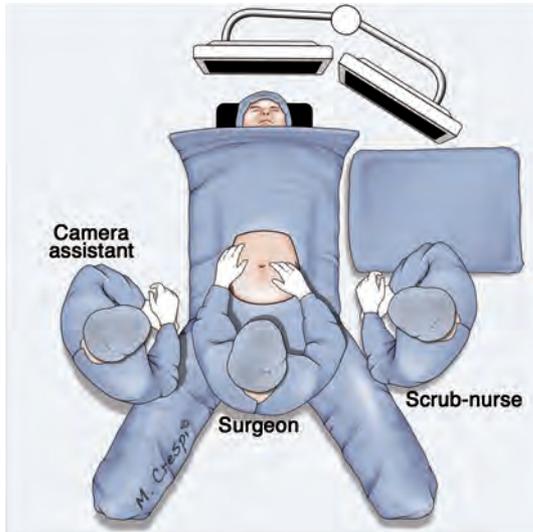
Antibiotic and TVP prophylaxis are applied as well.

An arterial catheter, a central line and a urinary catheter are placed.

Tools

- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needle-holders, two tissue forceps, two Farabeuf retractors, one purse-string suture device (DAPRI purse-string suture device), one monopolar electrode
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), one Polyglactin 2/0 (Vicryl 2/0, round tip, 1/2c, 36 mm), two Polydioxanon 2/0 (PDS 2/0, round tip, 1/2c, 26 mm), one Polypropylene 2/0 (Prolene 2/0, round tip, 1/2c, 26 mm), five Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable 13-mm rigid trocar or one non-reusable 12-mm trocar
- one reusable 6-mm flexible trocar and rigid mandril (DAPRI flex trocar)
- one straight 10-mm, 30° regular length scope
- one straight 5-mm, 30° long length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps I)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable dissecting grasping forceps (DAPRI dissecting grasping forceps)
- one reusable straight 5-mm clip applier
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one non-reusable articulating 60 linear stapler
- one non-reusable custom-made plastic bag
- one nasogastric tube
- one drain
- one ultrasound probe

1



Patient and Team Positioning

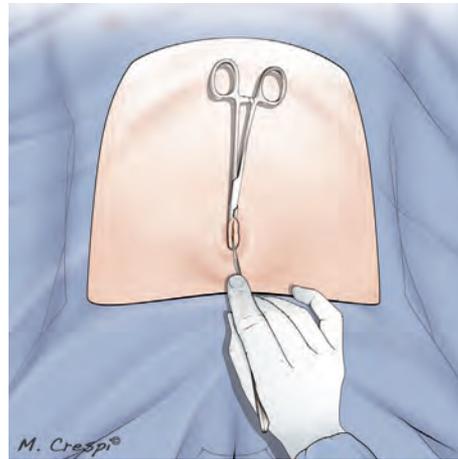
The patient is placed in a supine position, with the arms alongside the body and the legs apart. The arms, ankles, and legs are secured and protected.

The surgeon stands between the patient's legs, and the camera assistant to the patient's right. The scrub-nurse stands to the patient's left. The video monitor is placed in front of the surgeon and camera assistant ([Figure 1](#)).

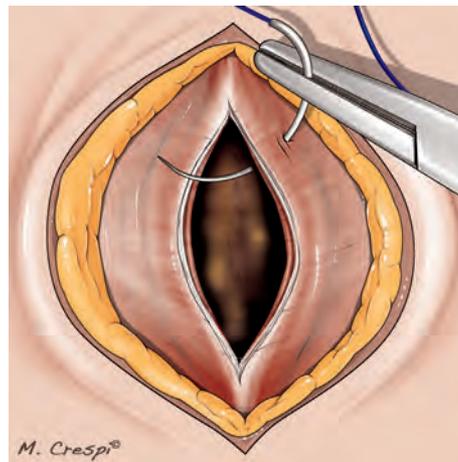
Technique

The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (Figure 2). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at the 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 3, 4). This suture is kept externally using a Pean-Rochester curved forceps.

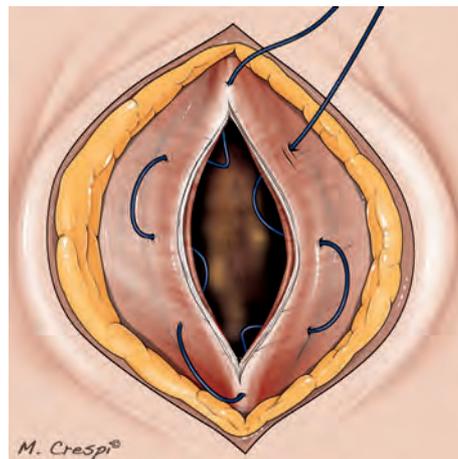
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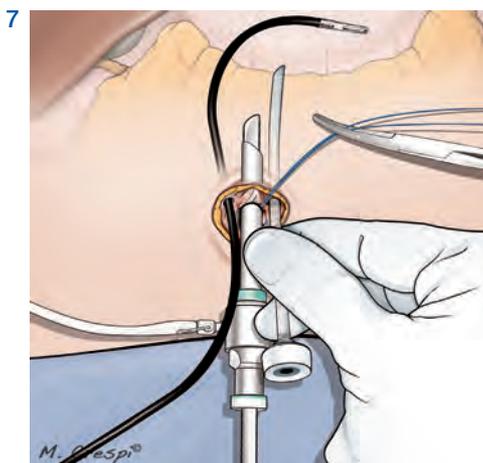
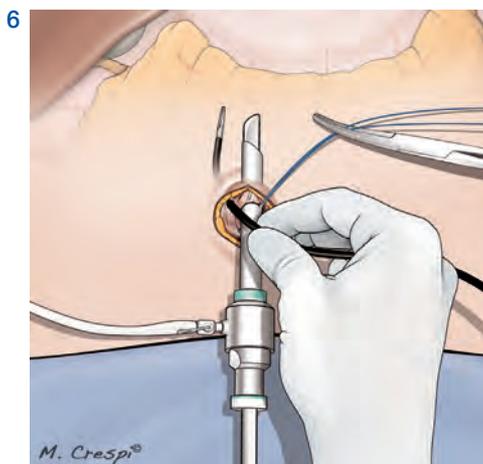
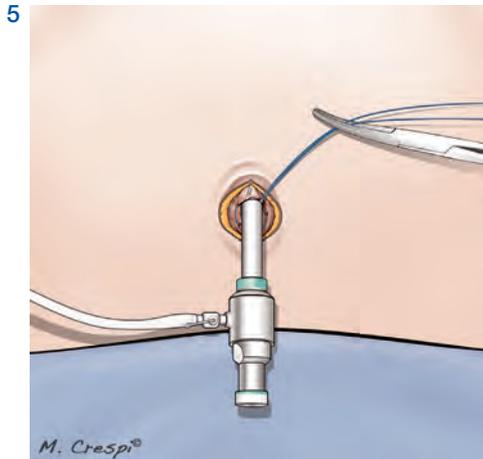
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Click to watch the corresponding video
Pancreatic Surgery

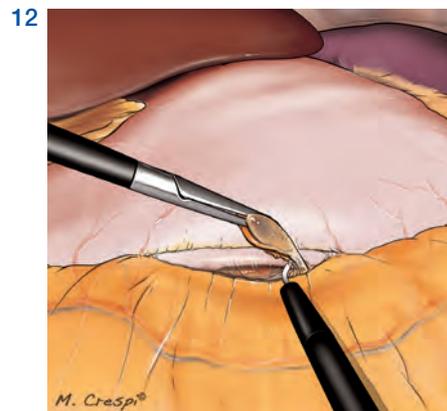
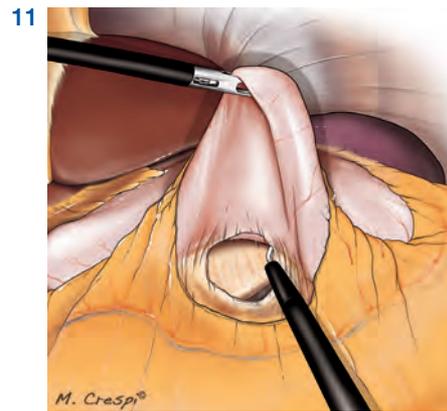
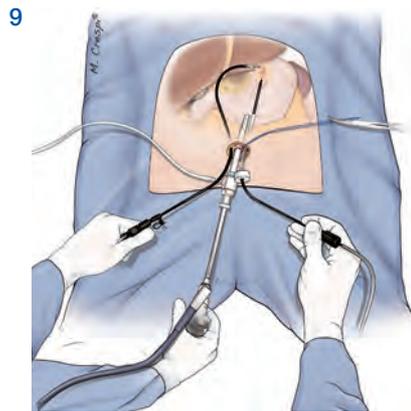
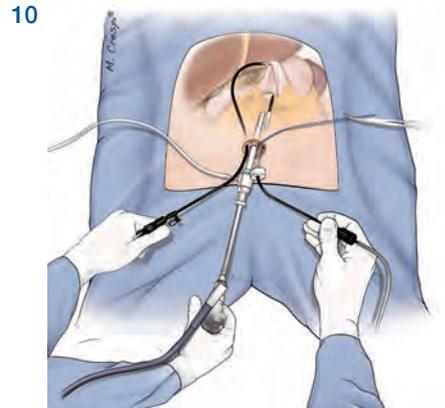
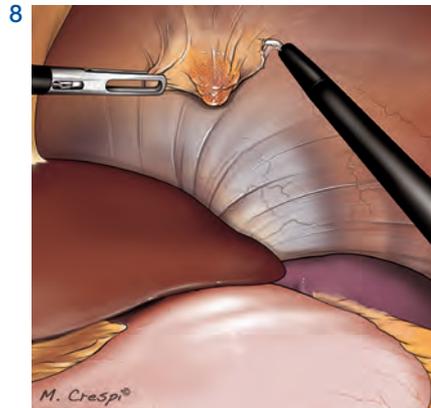


An 11-mm trocar (or a 12-mm non-reusable trocar) is introduced into the peritoneal cavity inside the purse-string suture, and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar.

The bicurved grasping forceps is inserted without trocar through a separate fascia window, created by a mandril of 6-mm trocar, approximately 5 mm outside the purse-string suture at the 10 o'clock position with respect to the patient's head (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

The other instruments, such as the monocurved coagulating hook, the monocurved suction and irrigation cannula, the straight grasping forceps, the monocurved grasping forceps, the monocurved needle holder, the monocurved scissors, the monocurved bipolar forceps and scissors, the monocurved dissecting grasping forceps, and the straight 5-mm clip applier, are introduced through a 6-mm flexible trocar positioned at some of approximately 5 mm outside the purse-string suture at the 2 o'clock position with respect to the patient's head (Figure 7).

The operating room table is positioned in a moderate reverse Trendelenburg position.



Staging Laparoscopy

The procedure begins with exploration of the peritoneal cavity and examination for peritoneal metastasis. If a lesion is found, it is resected using the monocurved coagulating hook and the bicurved grasping forceps (Figure 8).

Thanks to the distinctive shape of the curved instruments, the scope never appears to be in conflict with the instruments' tips, and interference between the surgeon's hands and the scope is avoided (Figure 9).

The lesser sac is open, sectioning for a little the gastrocolic ligament and the pancreas is exposed (Figures 10, 11). If a suspected lymph node is found, a biopsy is performed (Figure 12).

The 11-mm trocar (or the 12-mm non-reusable trocar) is used to accommodate the ultrasound probe. The 10-mm scope is exchanged for a 5-mm, 30° long scope, which is inserted into the 6-mm flexible trocar at the 2 o'clock position (Figure 13). Peri-operative ultrasonography of the pancreas is performed (Figure 14), as well as the exploration of the liver (Figure 15).

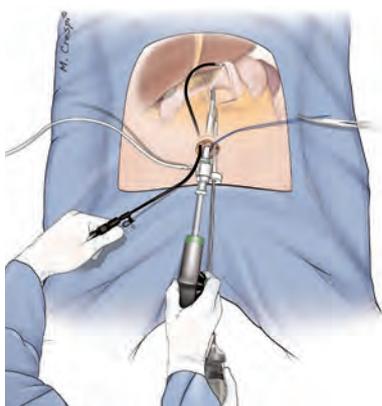
Then, the 5-mm scope is replaced by the 10-mm scope and inserted into the 11-mm trocar. A lavage of the peritoneal cavity is performed

using the monocurved suction and irrigation cannula in order to acquire a cytologic sample.

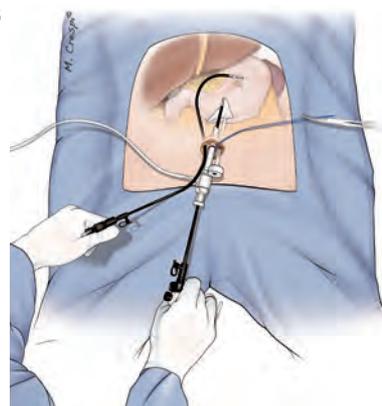
A custom-made plastic bag is introduced into the abdominal cavity through the 11-mm trocar using a straight grasping forceps (Figure 16) to gather the specimen. The lesions are placed into the bag using the bicurved grasping forceps and the straight grasping forceps (Figure 17). Once in the bag, the specimen is retrieved transumbilically (Figure 18).

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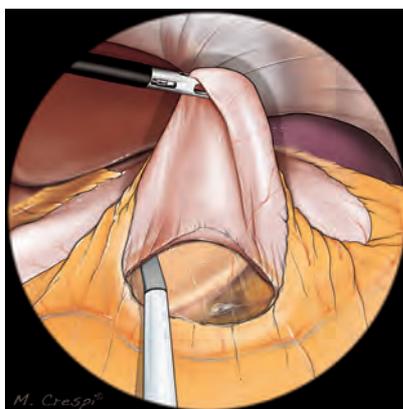
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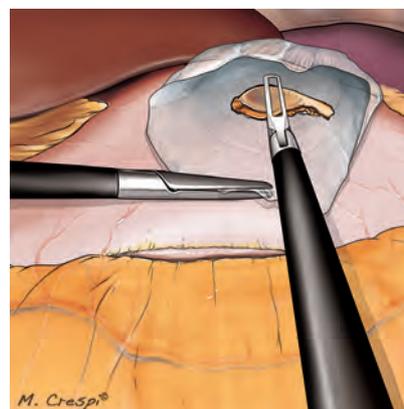
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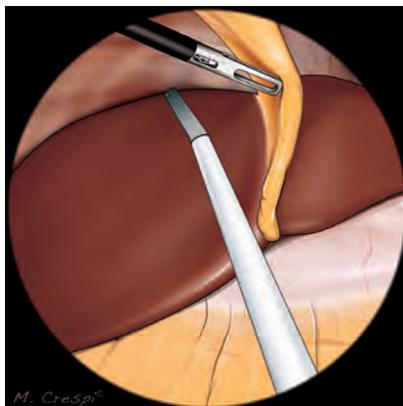
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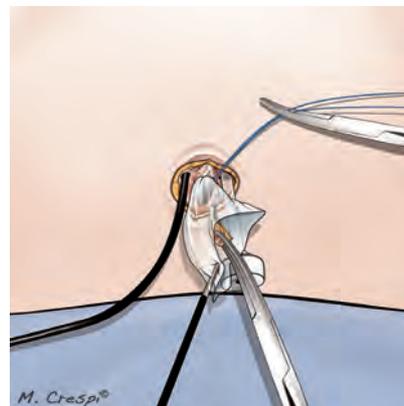
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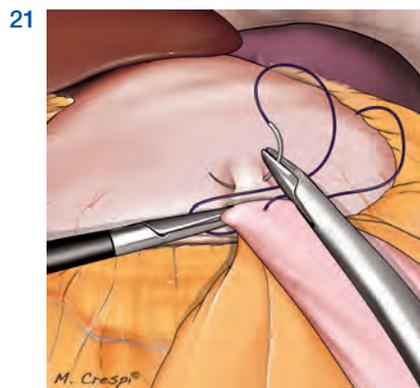
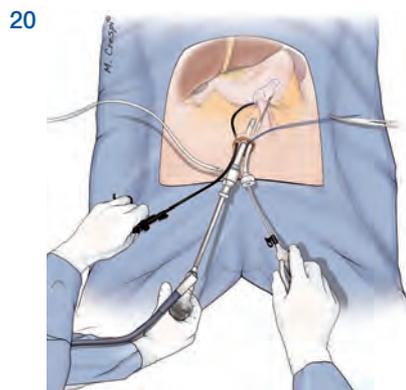
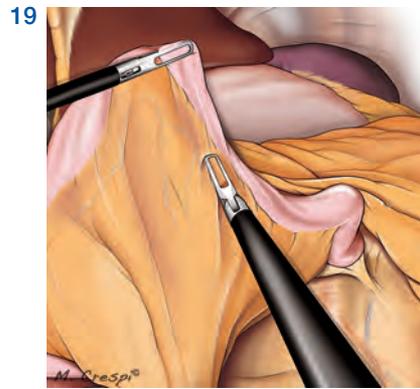


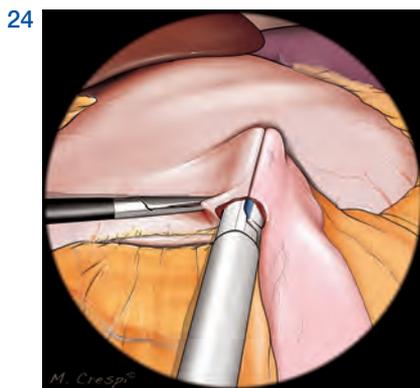
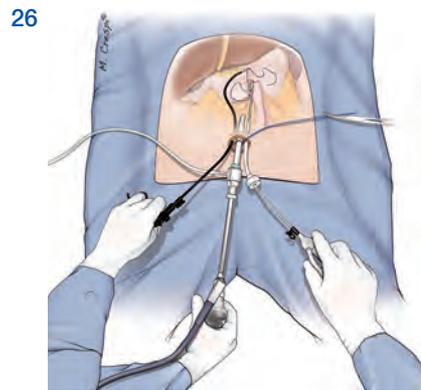
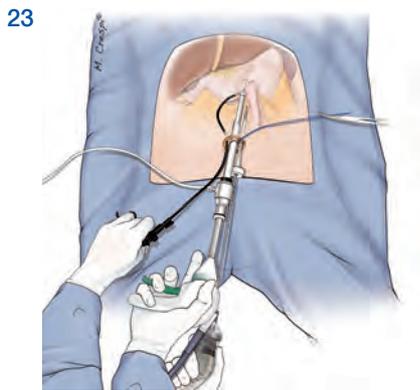
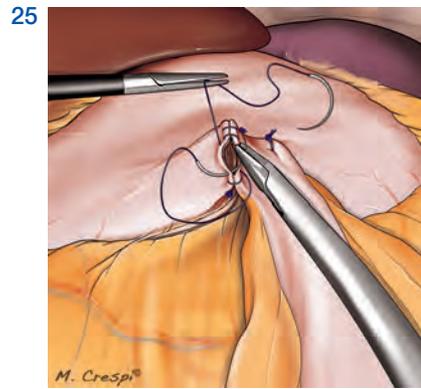
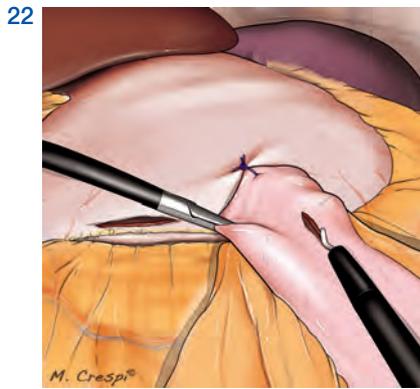
Gastrojejunal Bypass

This procedure can be performed in case of non-resectable occludent pancreatic head lesion. Staging laparoscopy with peri-operative ultrasonography is performed as described above.

Then, the operating room table is placed in a moderate Trendelenburg position and the ligament of Treitz is exposed, using the bicurved grasping forceps and the monocurved grasping forceps (Figure 19). The small bowel is separated from the ligament of Treitz until a loop is identified that reaches the stomach without any traction.

A Vicryl 2/0 suture is placed to anchor the selected small bowel loop to the gastric surface, using the bicurved grasping forceps and the monocurved needle holder (Figures 20, 21). Then, the suture is cut by the monocurved scissors.





The inferior gastric surface on the greater curvature and the small bowel loop are opened with the monocurved coagulating hook (Figure 22).

The 11-mm trocar is replaced by a reusable 13-mm trocar (if the 12-mm non-reusable trocar is inserted at the beginning, this replacement is not needed), in order to accommodate an articulating linear stapler. The 10-mm scope is exchanged for a 5-mm, 30° long scope, which is inserted into the 6-mm flexible trocar at the 2 o'clock position (Figure 23). The linear stapler is inserted into both viscera, assisted by the bicurved grasping forceps, and it is fired (Figure 24).

The 13-mm trocar is replaced by the 11-mm trocar, together with the exchange of the scope into 10-mm. The gastroenterotomy is closed by two converging PDS 2/0 running sutures using the bicurved grasping forceps and the monocurved needle holder (Figure 25).

The surgeon continues to work under ergonomic conditions without conflicts of the instruments' tips or crossing of the hands (Figure 26).

At the end of the anastomosis (Figure 27), a nasogastric tube is placed precisely across the latter.

End of Staging Laparoscopy and Gastrojejunal Bypass

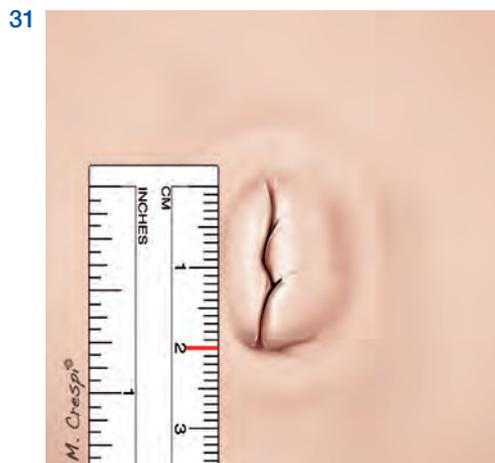
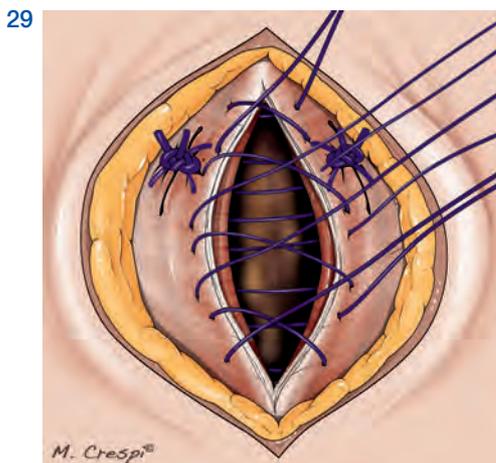
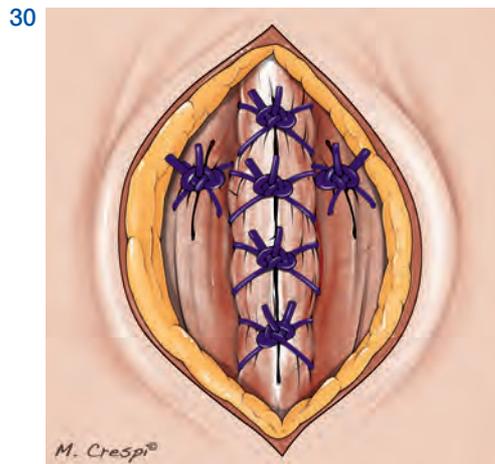
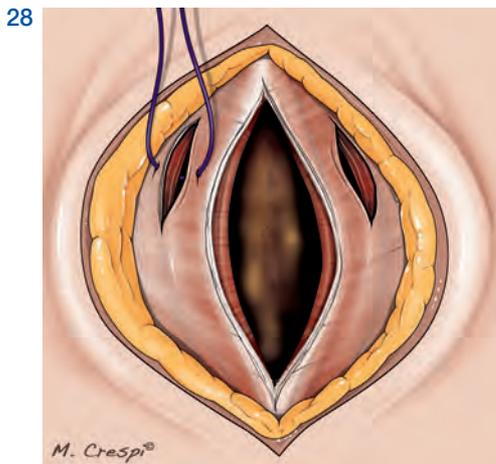
No drain is left in the abdominal cavity. The operating room table is repositioned as it was at the beginning of the procedure, without any Trendelenburg position and tilt.

The bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

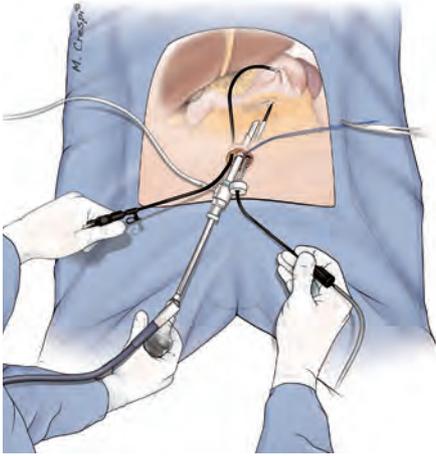
All the trocars are removed together with the umbilical purse-string suture.

Vicryl 1 sutures are placed in figure 8 pattern to close the umbilical access, taking care to close the separate fascia openings for the bicurved grasping forceps and for the flexible trocar (Figures 28, 29, 30).

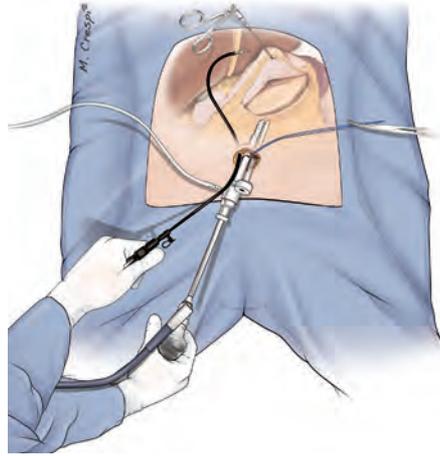
The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 31).



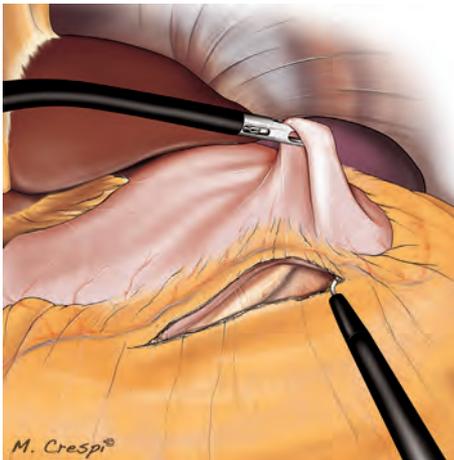
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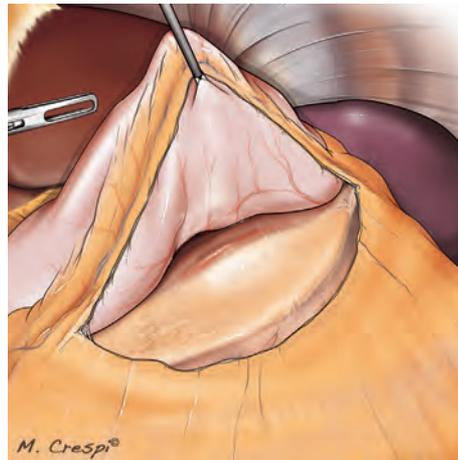
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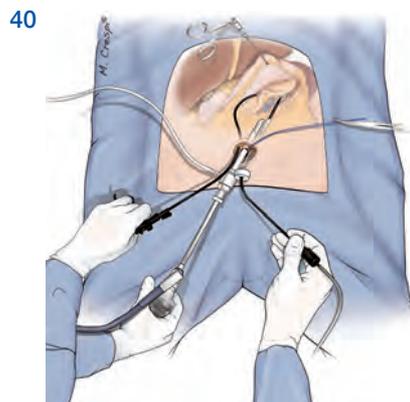
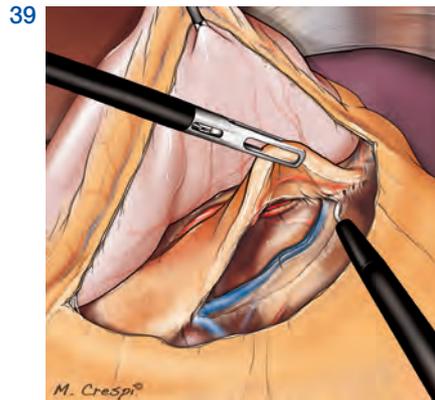
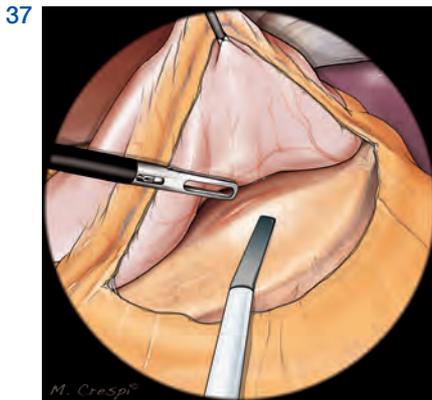
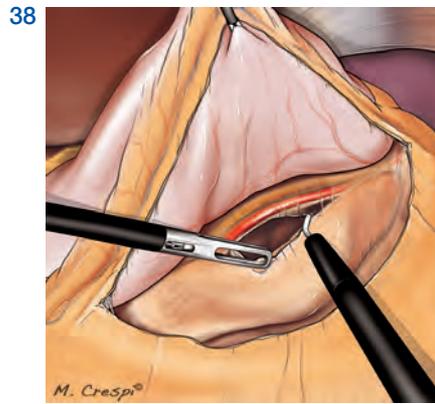
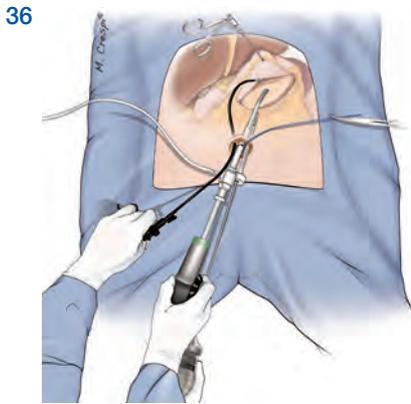
Distal Pancreatectomy

The operating room table is increased with regard to its reverse Trendelenburg position and right-sided tilt.

The gastrocolic ligament is opened using the monocurved coagulating hook and the bicurved grasping forceps from medial-to-lateral, until the pancreatic body and tail

are exposed. The short gastric vessels are preserved (Figures 32, 33).

A straight 1.8-mm trocarless grasping forceps is inserted percutaneously via a skin puncture (created by a Veress needle) centrally under the 12th left rib, to retract the stomach (Figures 34, 35).



A peri-operative ultrasonography evaluation is then performed. The 10-mm scope is exchanged for a 5-mm, 30° long scope, and inserted into the 6-mm flexible trocar at the 2 o'clock position. An ultrasound probe is inserted into the abdomen through the 11-mm trocar (or the 12-mm non-reusable trocar) (Figure 36). Peri-operative ultrasonography allows evaluation of the pancreatic lesion locally (Figure 37), as well as the hepatic parenchyma for secondary lesions. Then, the scope is re-changed for a 10-mm and inserted through the 11-mm trocar.

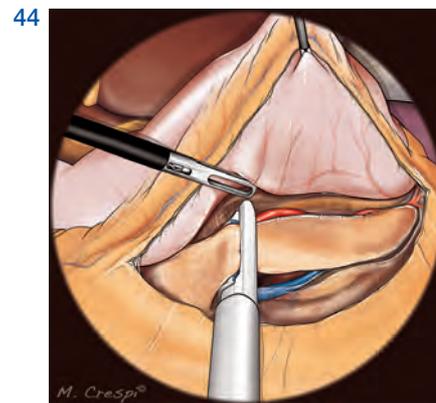
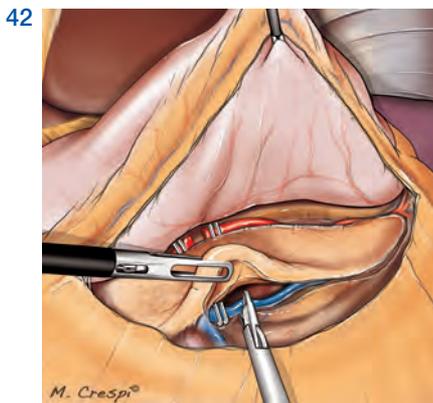
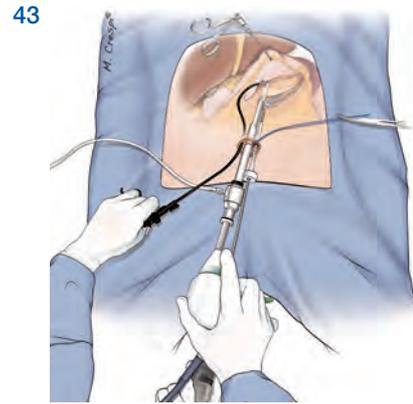
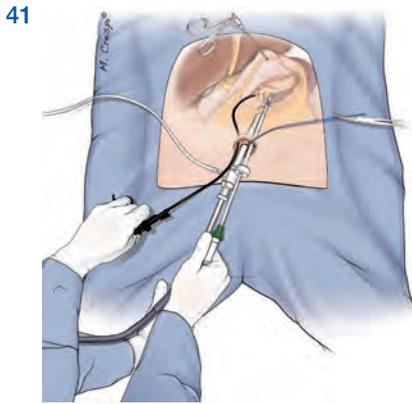
The procedure continues with the mobilization of the pancreas; the monopolar coagulating

hook is used alternatively with the monopolar bipolar forceps and scissors. The main splenic artery and vein are freed along the pancreatic body and tail in the direction of the splenic hilum (Figures 38, 39). Frequently, the monopolar dissecting grasping forceps is used to perform this dissection.

Because of the curves of the instruments, there is no conflict between the instruments' tips internally or between the surgeon's hands externally (Figure 40).

Then, the pancreatic body and tail are mobilized from the posterior attachments. If during the mobilization it appears necessary to section the main splenic artery and vein, a straight 5-mm clip applier is inserted and clips are applied, staying in the direction of the splenic hilum as well as of the pancreatic head (Figures 41, 42). Once the entire pancreatic piece is freed, the parenchyma has to be sectioned. At this point,

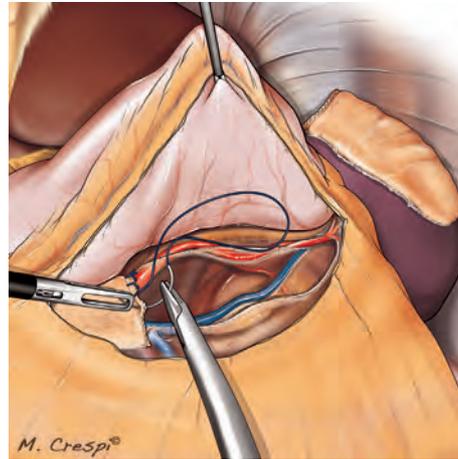
the 11-mm trocar is replaced by the 13-mm trocar (if the 12-mm non-reusable trocar is inserted at the beginning, this replacement is not needed) in order to accommodate the articulating linear stapler, besides the exchange of the 10-mm scope for a 5-mm, 30° long scope (Figure 43). The pancreatic parenchyma is sectioned (Figure 44).



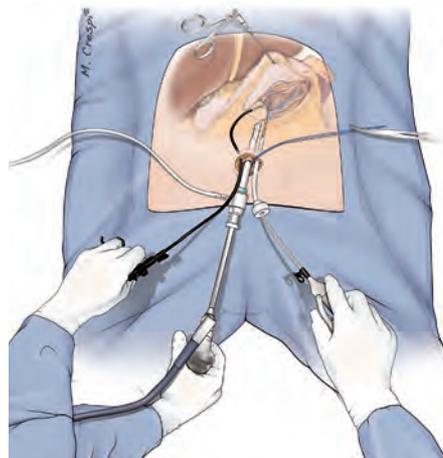
The 5-mm scope is replaced by the 10-mm scope and inserted, after having replaced the 13-mm trocar with the 11-mm trocar. The pancreatic stump or the only pancreatic duct are sutured with Prolene 2/0 sutures (Figure 45), using the monocurved needle holder and the bicurved grasping forceps (Figure 46).

The cavity is cleaned using the monocurved suction and irrigation cannula. An abdominal drain is left close to the pancreatic stump using the previous scar of the straight 1.8-mm trocarless grasping forceps.

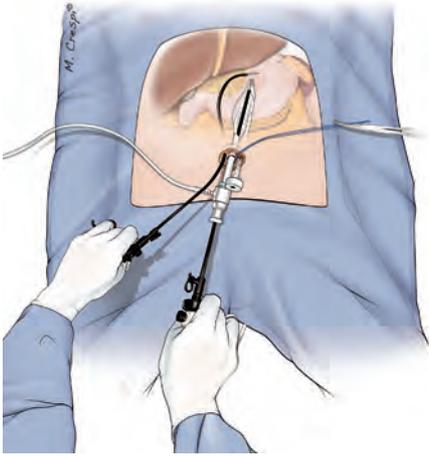
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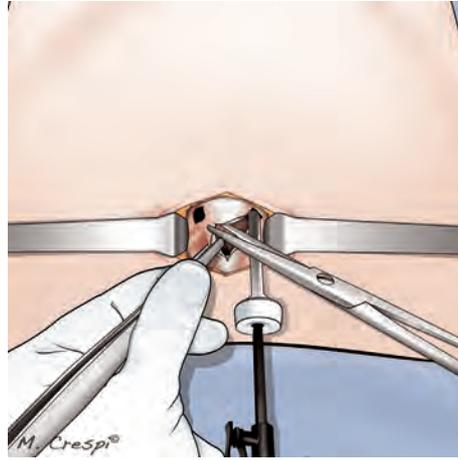
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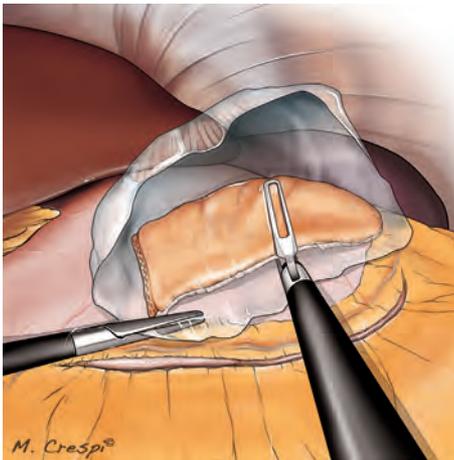
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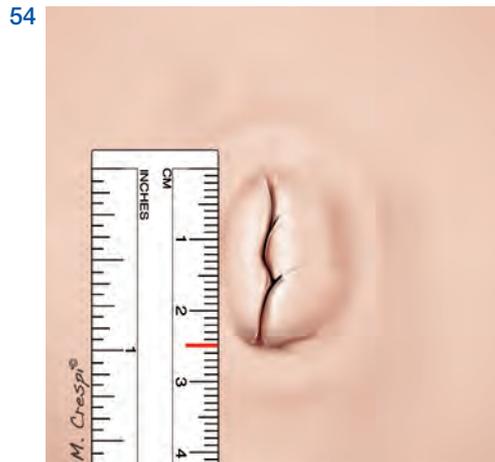
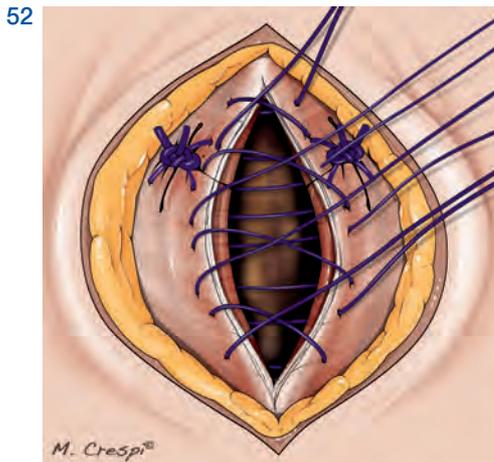
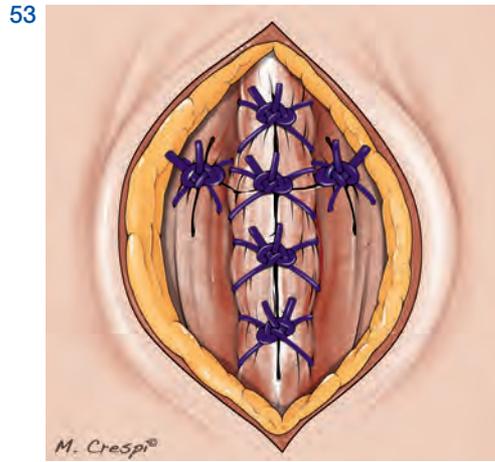
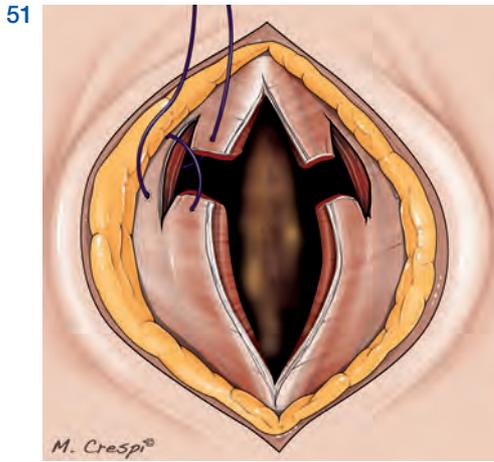
A custom-made plastic bag is introduced into the abdominal cavity through the 11-mm trocar using a straight grasping forceps (Figure 47). The specimen is placed inside the bag using the bicurved grasping forceps and the straight grasping forceps (Figure 48). The bag is kept closed using the straight grasping forceps. The operating room table is returned to the position it was at the beginning of the procedure,

without any Trendelenburg position and tilt. The bicurved grasping forceps is retrieved, following its curves at 45° with respect to the abdominal wall.

The central trocar, the umbilical purse-string suture and the 6-mm flexible trocar are removed. The different fascia openings at the umbilicus are joined together (Figure 49) and the specimen is extracted (Figure 50).

Vicryl 1 sutures are placed using a figure 8 pattern to close the umbilical access, taking care to close the separate fascia openings for the bicurved grasping forceps and for

the flexible trocar (Figures 51, 52, 53). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 54).



Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented. The arterial catheter is removed in the recovery room.

Once the patient leaves the recovery room, pain is assessed every 6 h, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

Antibiotic prophylaxis is prescribed if necessary and TVP prophylaxis until the discharge of the patient from the hospital.

Staging Laparoscopy: the urinary catheter is removed in the recovery room. The patient is allowed to tolerate a liquid diet on the 1st post-operative day and, if there are no complications, the patient is discharged on the 2nd post-operative day.

Gastrojejunal Bypass: a nasogastric tube is maintained under smooth suction until the appearance of intestinal peristalsis. Then, a liquid diet is started and, if there are no complications, the patient is discharged on the following post-operative days. The urinary catheter is removed during the post-operative course.

Distal Pancreatectomy: the patient is allowed to drink water on the 2nd post-operative day and to tolerate a liquid diet from the 3rd post-operative day. The urinary catheter is removed on the 2nd post-operative day and the central line on the 5th post-operative day. If there are no complications, the patient is discharged on the 5th post-operative with the abdominal drain in place, which will be removed during the office visits.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, at 1, 2, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the gastroenterologist/oncologist.

6.4 SPLENECTOMY

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Post-operative Care

6.4 SPLENECTOMY

Pre-operative Preparation and General Anesthesia

Vaccine prophylaxis is performed preoperatively, and the patient is asked not to eat for at least 8 hours prior to the procedure.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after the intubation.

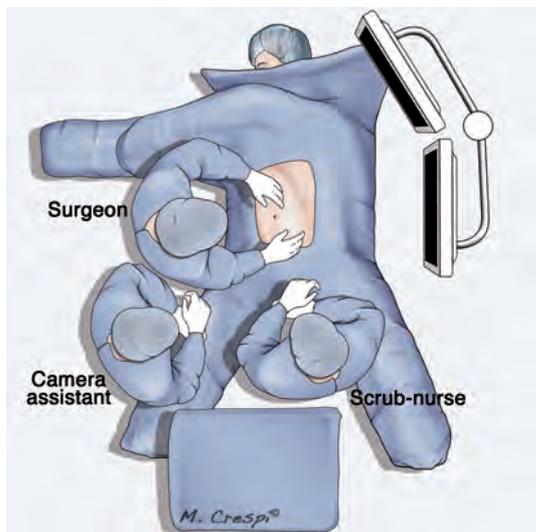
Antibiotic and TVP prophylaxis are applied as well.

An arterial catheter, a central line and a urinary catheter are placed.

Tools

- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needle-holders, two tissue forceps, two Farabeuf retractors, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), one silk 2/0 (silk 2/0, round tip, 1/2c, 26 mm), five Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable rigid mandril of 6-mm trocar
- one straight 10-mm, 30° and regular length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps III)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved dissecting forceps (DAPRI dissecting forceps)
- one reusable straight 5-mm clip applier
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one non-reusable custom-made plastic bag
- one non-reusable cannula for morcellator

1



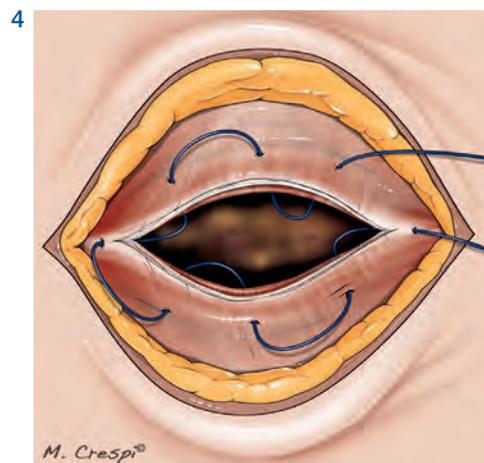
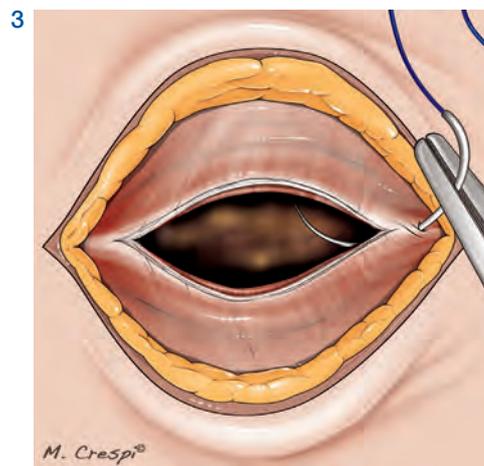
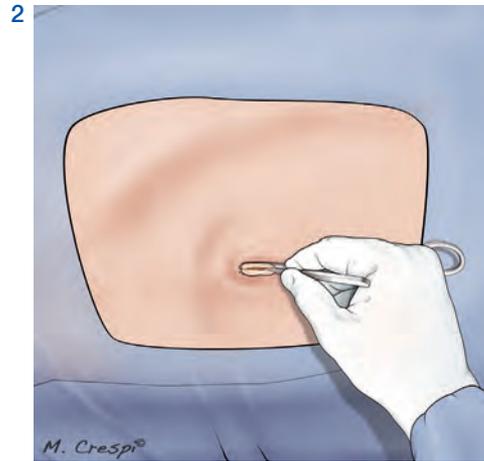
Patient and Team Positioning

The patient is placed in a right-sided semilateral decubitus, with the legs apart. The right arm, right ankle, and legs are secured and protected.

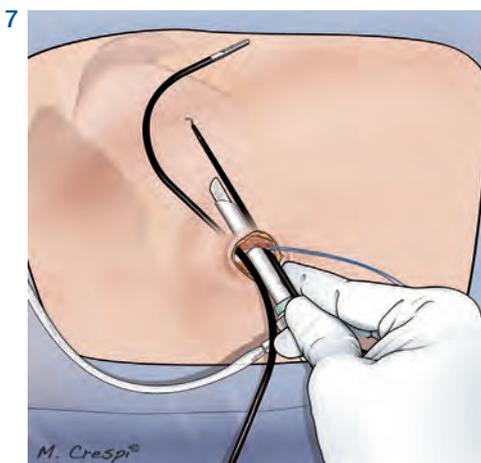
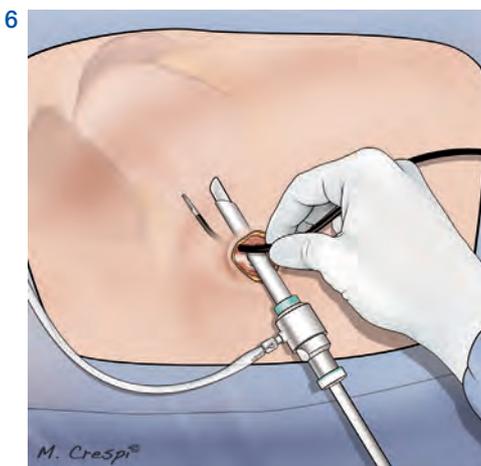
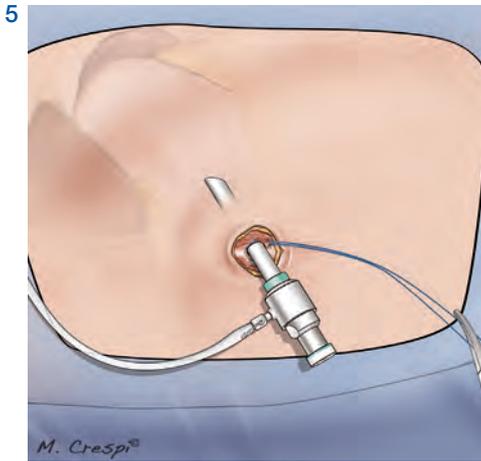
The surgeon stands to the patient's right, and the camera assistant to the surgeon's right. The scrub-nurse stands between the patient's legs. The video monitor is placed in front of the surgeon and camera assistant (Figure 1).

Technique

The umbilicus is everted by a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (Figure 2). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at the 6, 7, 9, 11, 12, 1, 3 and 5 o'clock positions (Figures 3, 4). This suture is kept externally with a Pean-Rochester curved forceps.



Click to watch the corresponding video
Splernectomy



An 11-mm trocar is inserted inside the purse-string suture and the pneumoperitoneum is created (Figure 5). The 10-mm, 30° scope is advanced through the 11-mm trocar, and curved instruments are inserted into the abdomen through the umbilical scar without trocars.

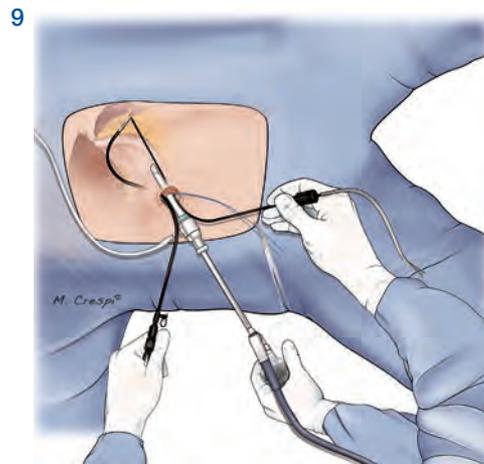
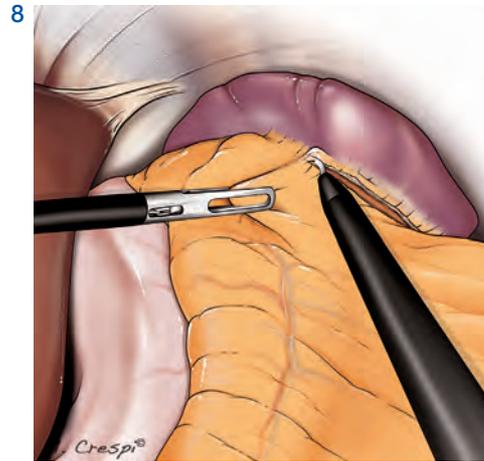
The bicurved grasping forceps is advanced through a separate fascia opening created by a mandril of 6-mm trocar approximately 5 mm outside the purse-string suture at the 1 o'clock position with respect to the patient's head (Figure 6). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

The other instruments, such as the monocurved coagulating hook, the monocurved bipolar scissors and forceps, the monocurved dissecting forceps, the straight 5-mm clip applier, the monocurved scissors, the monocurved needle holder, the monocurved suction and irrigation cannula, and the straight grasping forceps are introduced on the other side of the bicurved grasping forceps at the 6 o'clock position, parallel to the 11-mm trocar and inside the purse-string suture (Figure 7).

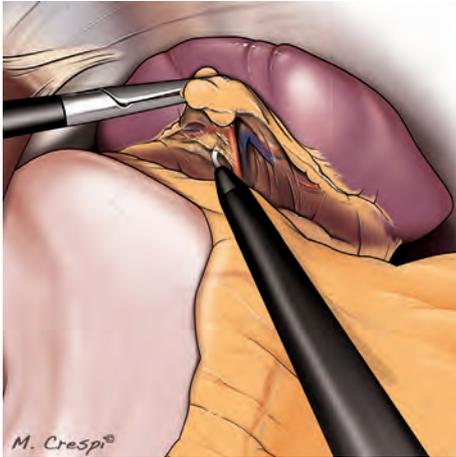
The suture is adjusted to maintain a tight seal around the 5-mm tools and the 11-mm trocar, and is opened only for exchanges of the instruments and evacuation of smoke created during the dissection.

The operating room table is positioned in a reverse Trendelenburg position with a moderate right-sided tilt.

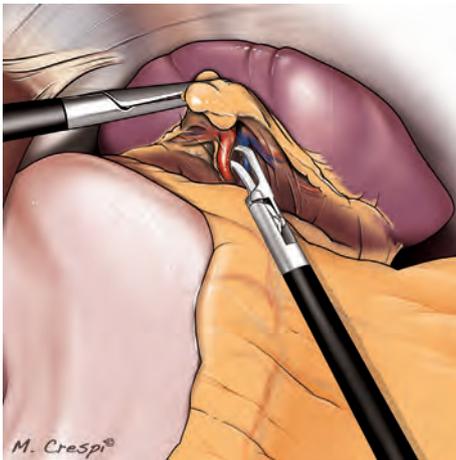
The splenocolic ligament is exposed and the gastrosplenic ligament is sectioned as well (Figures 8, 9). The short gastric vessels are sectioned using the monocurved coagulating hook, or the monocurved bipolar scissors. Accidental peri-operative bleeding is controlled with the monocurved bipolar forceps. If necessary, the operative field's exposure can be improved by insertion of a straight 1.8-mm trocarless grasping forceps percutaneously via a skin puncture (created by a Veress needle) under the 12th left rib.



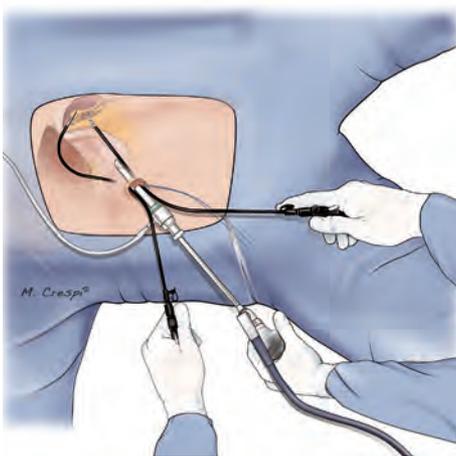
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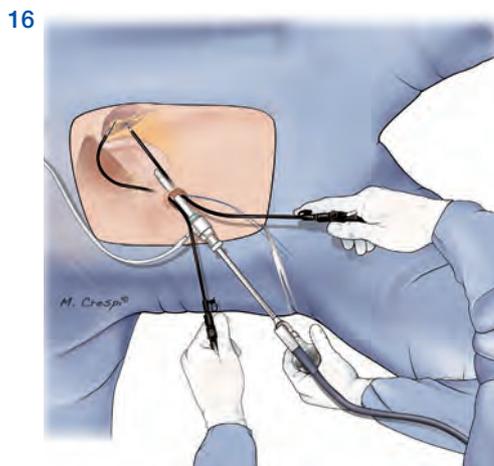
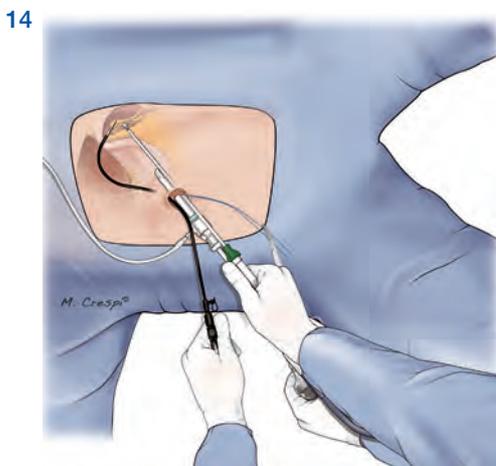
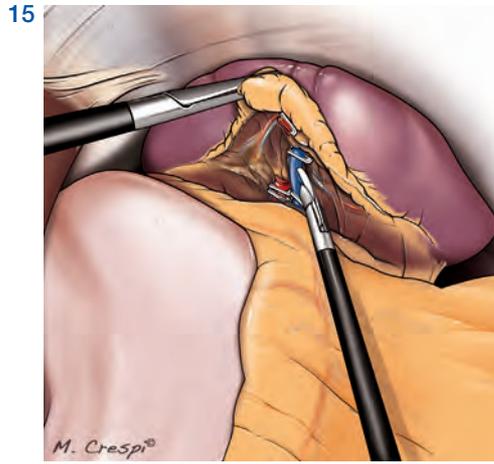
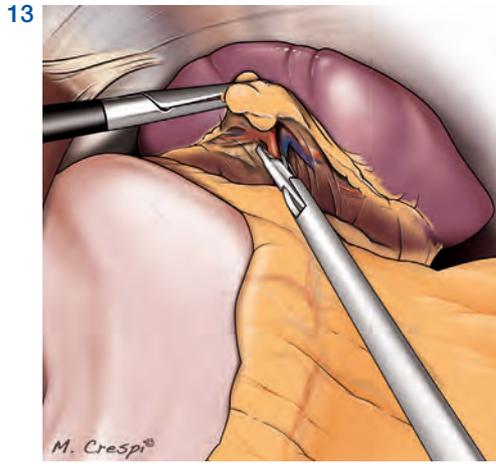


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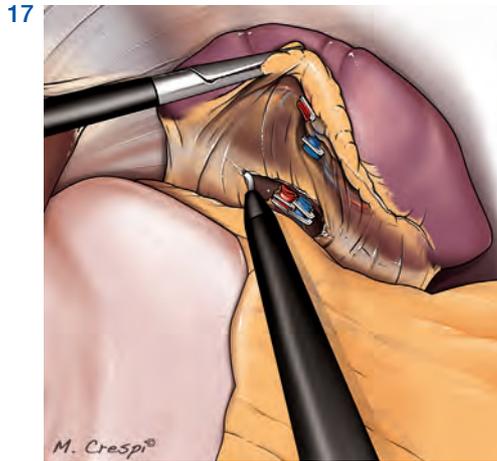
The main splenic artery is dissected and isolated from the main splenic vein at the level of the splenic hilum using the monocurved coagulating hook (Figure 10). The monocurved dissecting forceps can be used as well (Figure 11).

Because of the curves of the instruments, a working triangulation is established extracorporeally as well as intracorporeally (Figure 12).

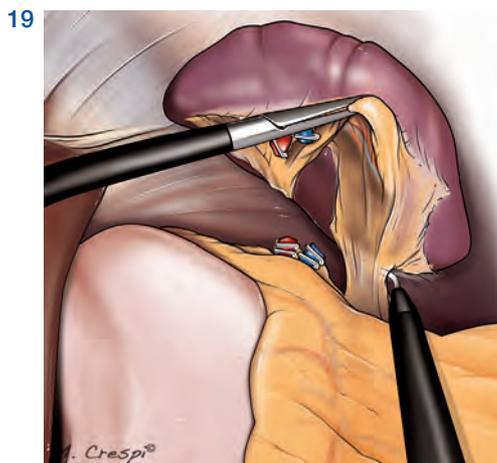
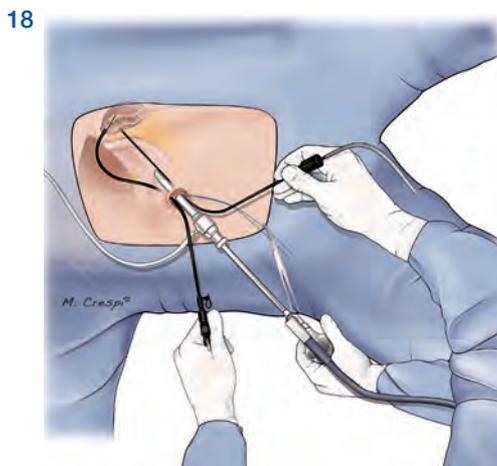


The artery is sectioned separately from the vein between 5-mm clips (Figures 13, 14). Then, the main splenic vein is clipped between 5-mm clips and divided using the monocurved scissors

(Figures 15, 16). If necessary, the diameter of the vein can be reduced before clipping, placing silk 2/0 sutures using the monocurved needle holder together with the bicurved grasping forceps.



The procedure continues with the mobilization of the superior and inferior splenic lobes from the peritoneal attachments using the monocurved coagulating hook. The dissection is performed at first by going cephalad from the hilum (Figures 17, 18), and later proceeding caudal (Figure 19).



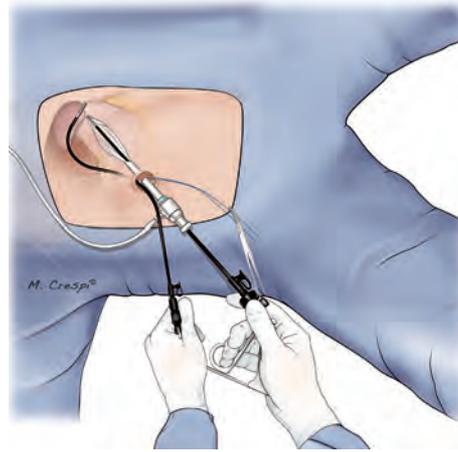
A custom-made plastic bag is introduced into the abdominal cavity through the 11-mm trocar using a straight grasping forceps (Figure 20), to gather the specimen. The spleen is placed into the bag using the bicurved grasping forceps and the straight grasping forceps (Figure 21). Once in the bag, the specimen is retrieved at the umbilicus and morcellated at this site between Pean-Rochester curved forceps and the morcellator cannula, taking care to do not tear the bag (Figure 22).

Finally, the abdominal cavity is checked for bleeding and cleaned with the monocurved suction and irrigation cannula. No drain is left in the abdominal cavity.

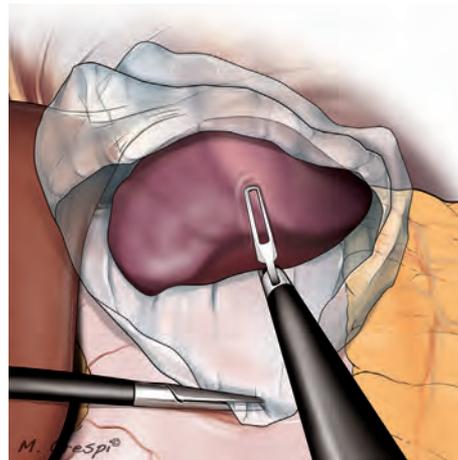
The operating room table is returned to the position it was in the beginning of the procedure, without any tilt and Trendelenburg position.

All the instruments are removed from the abdomen under view, and the bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

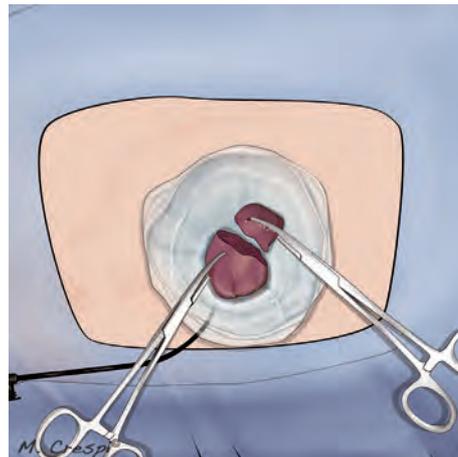
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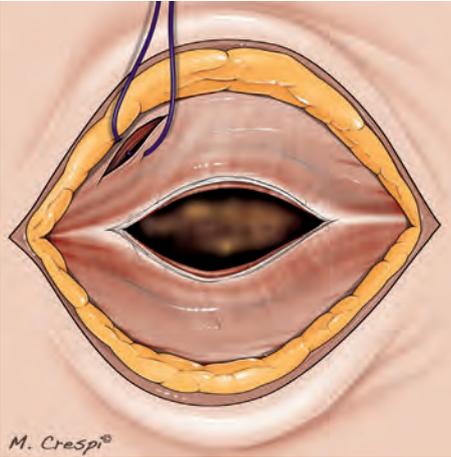
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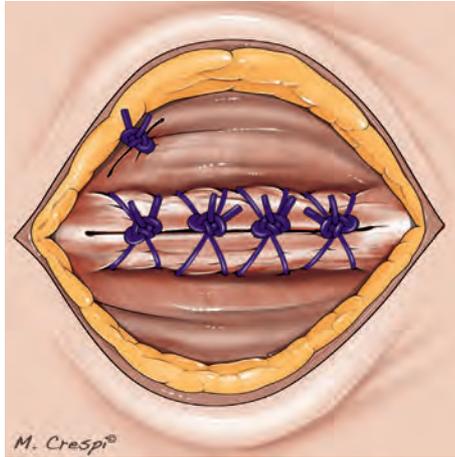
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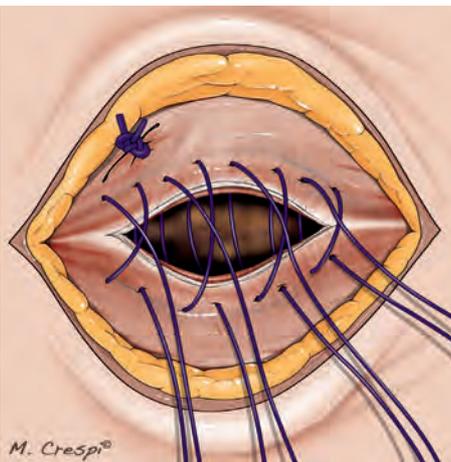
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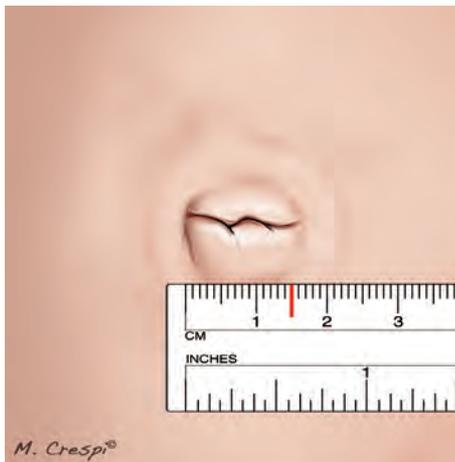
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After having removed the 11-mm trocar and the umbilical purse-string suture, Vicryl 1 sutures are used to close the access. First, the separate fascia opening accommodating the bicurved grasping forceps is closed (Figure 23). Then,

the main access is closed using a figure 8 pattern of sutures (Figures 24, 25). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 26).

Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

The urinary and arterial catheters are removed in the recovery room.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

TVP prophylaxis is prescribed until the discharge of the patient from the hospital. Aspirin prophylaxis is prescribed only if necessary and antibiotic prophylaxis, for the successive two weeks, if the patient has not received any vaccine preoperatively. The patient is allowed to drink water after 24 hours, and to tolerate a light diet after 48 hours. If there are no complications, the patient is discharged on the 3rd post-operative day, after removal of the central line.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the hematologist.

6.5 ADRENALECTOMY

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Left

Right

Post-operative Care

6.5 ADRENALECTOMY

The single-incision laparoscopic technique preferred is the transumbilical anterior approach.

Pre-operative Preparation and General Anesthesia

The patient is asked not to eat for at least 8 hours prior to the procedure.

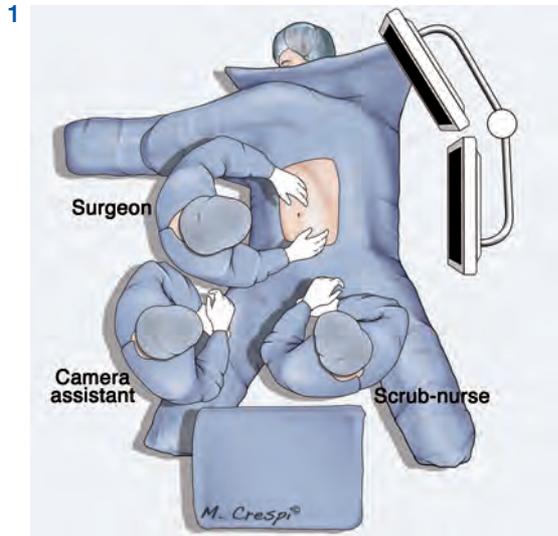
General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v.

Antibiotic and TVP prophylaxis are applied as well.

An arterial catheter, a central line and a urinary catheter are placed.

Tools

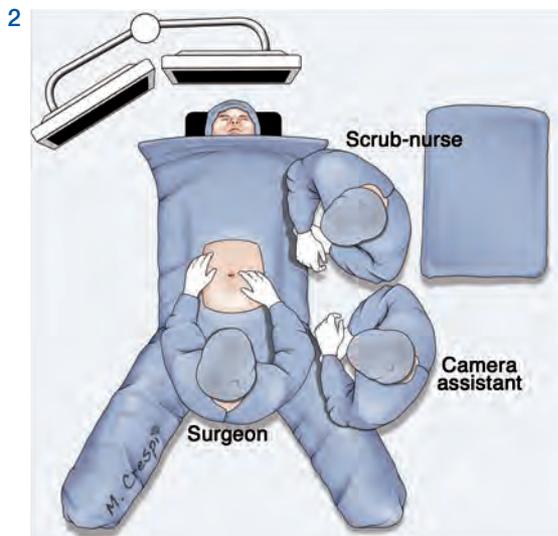
- two Kocher-Ochsner curved forceps, two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Mayo-Hegar needleholders, two tissue forceps, two Farabeuf retractors, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), four Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable rigid mandril of 6-mm trocar
- one straight 10-mm, 30° regular length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps III)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved RoBi® bipolar grasping forceps (DAPRI bipolar grasping forceps)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable monocurved dissecting forceps (DAPRI dissecting forceps)
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one reusable straight 5-mm clip applier
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one non-reusable custom-made plastic bag
- one non-reusable cannula for morcellator



Patient and Team Positioning

The position of the patient and team are dependent upon the side of the adrenal gland to be removed, adhering to the laparoscopic principle of alignment between surgeon's head, operative field and video monitor.

If the procedure to be performed is a left adrenalectomy, the patient is placed in a right-sided semilateral decubitus, with the legs apart. The right arm, right ankle, and legs are secured and protected. The surgeon stands to the patient's right, and the camera assistant to the surgeon's right. The scrub-nurse stands between the patient's legs. The video monitor is placed in front of the surgeon and camera assistant (Figure 1).

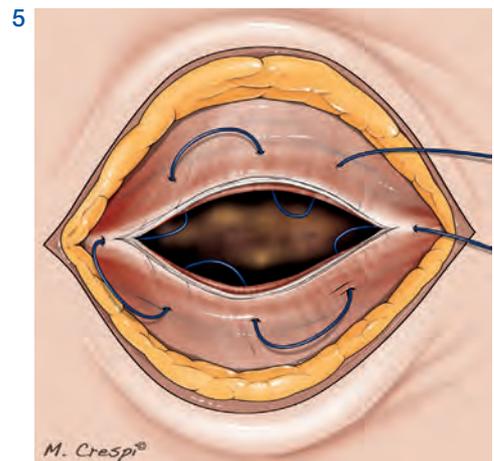
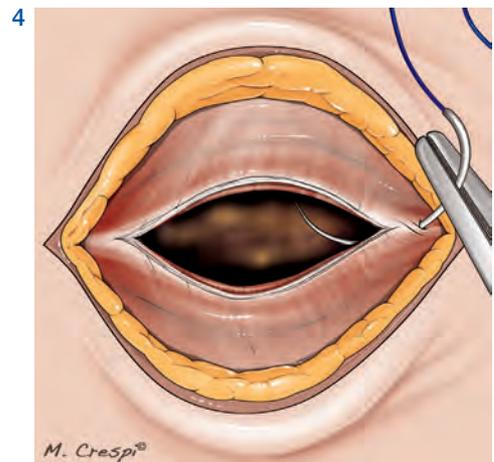
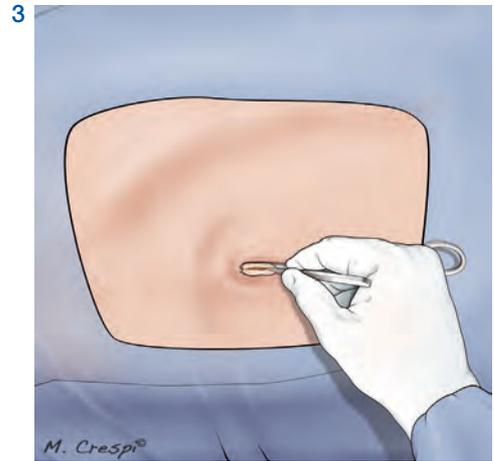


If the procedure to be performed is a right adrenalectomy, the patient is placed in a supine position, with the arms alongside the body and the legs apart. The arms, ankles, and legs are secured and protected. The surgeon stands between the patient's legs, and the camera assistant to the patient's left. The scrub-nurse stands to the patient's left and to the camera assistant's right. The video monitor is placed in front of the surgeon and camera assistant (Figure 2).

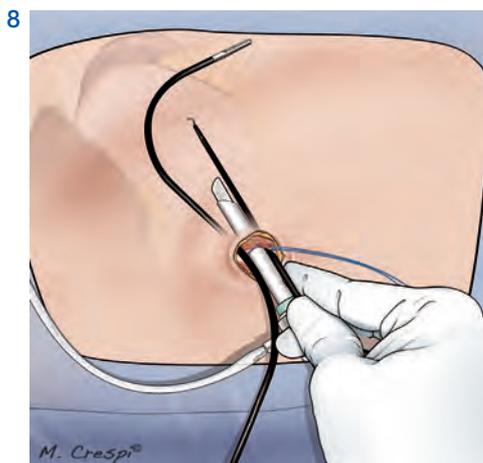
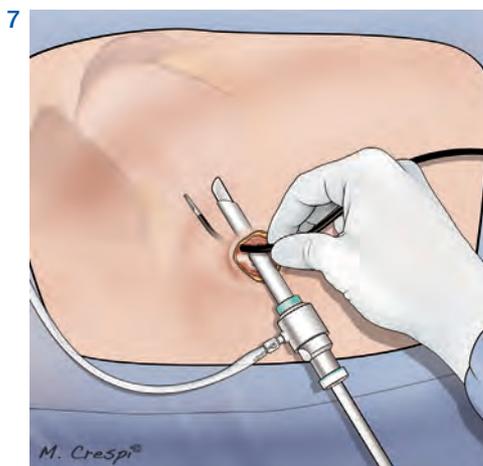
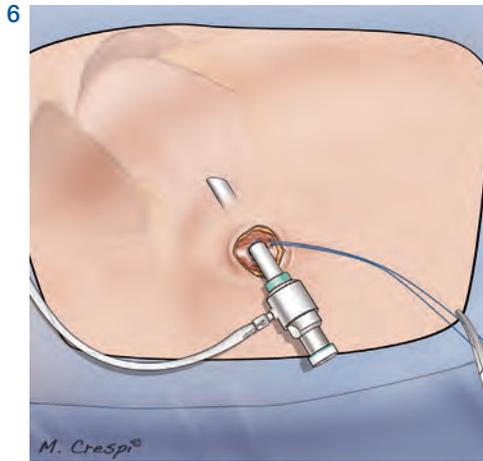
Technique

Left

The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (**Figure 3**). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at the 6, 7, 9, 11, 12, 1, 3 and 5 o'clock positions (**Figures 4, 5**). This suture is kept externally with a Pean-Rochester curved forceps.



Click to watch the corresponding video
Left Adrenalectomy

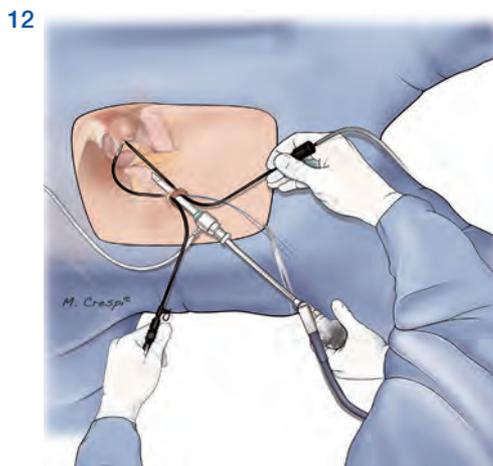
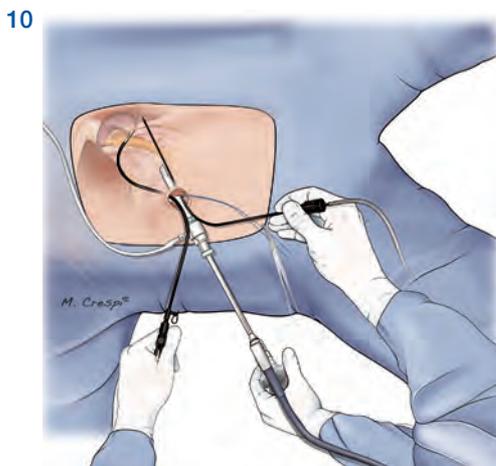
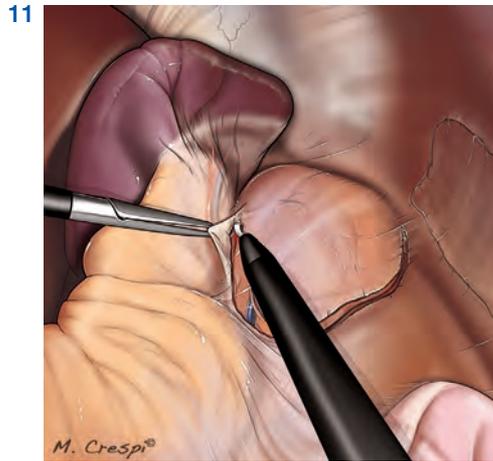
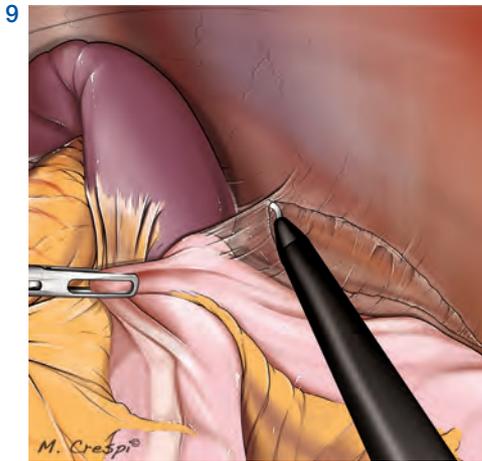


An 11-mm trocar is inserted inside the purse-string suture, and the pneumoperitoneum is created (Figure 6). The 10-mm, 30° scope is advanced through the 11-mm trocar, and curved instruments are inserted into the abdomen through the umbilical scar without trocars.

The bicurved grasping forceps is advanced through a separate fascia opening created by a mandril of 6-mm trocar, approximately 5 mm outside the purse-string suture at the 1 o'clock position with respect to the patient's head (Figure 7). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

The other instruments, such as the monocurved coagulating hook, the monocurved bipolar forceps and scissors, the monocurved dissecting forceps, the monocurved grasping forceps, the straight 5-mm clip applier, the monocurved scissors, the monocurved suction and irrigation cannula, and the straight grasping forceps are introduced on the other side of the bicurved grasping forceps at the 6 o'clock position, parallel to the 11-mm trocar and inside the purse-string suture (Figure 8).

The suture is adjusted to maintain a tight seal around the 5-mm tools and the 11-mm trocar, and is opened only for exchanges of instruments and evacuation of smoke created during the dissection.



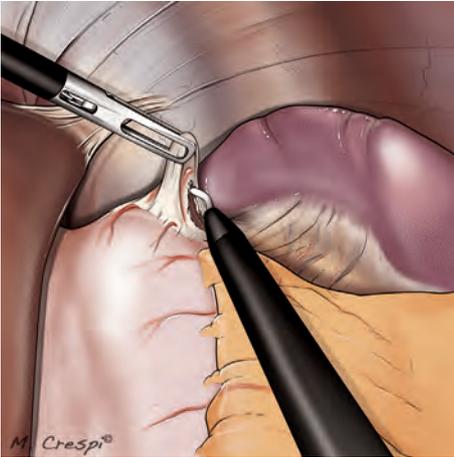
The operating room table is positioned in a reverse Trendelenburg position with a moderate right-sided tilt.

The splenicocolic ligament is opened from lateral-to-medial (Figures 9, 10), until the first fibres of the gastrocolic ligament, downloading the splenic colic flexure. Then, the parietal peritoneal sheet adherent to the inferior splenic pole is incised and the dissection is performed going cephalad

in the direction of the left crus. At the same time, the dissection also goes medially in order to take up in one bloc the spleen and the pancreatic tail (Figures 11, 12). Because the dissection is performed totally in the retroperitoneal space, the plane has to appear as completely avascular.

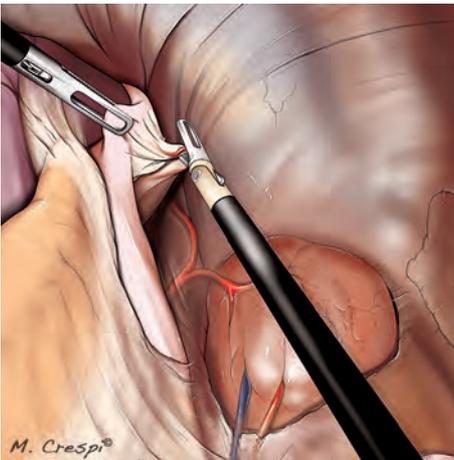
Thanks to the curves of the instruments, the internal working triangulation is established as well as the external surgeon's ergonomics.

13

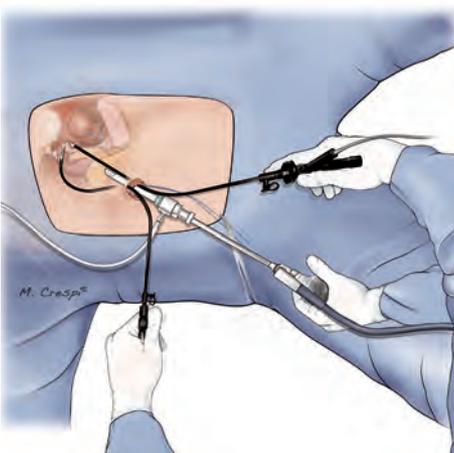


Once the left crus is reached, the first two short gastric vessels can be sectioned in order to free the superior pole of the spleen. The first vessel is controlled with a medial-to-lateral approach by the monocurved coagulating hook (Figure 13), or the monocurved bipolar forceps and scissors. The second short gastric vessel is controlled just “à la demande” with a lateral-to-medial approach (Figures 14, 15).

14

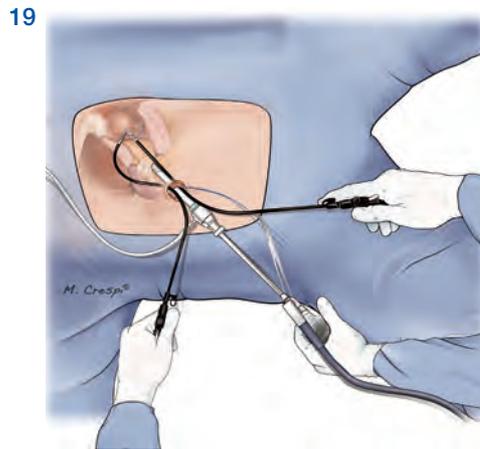
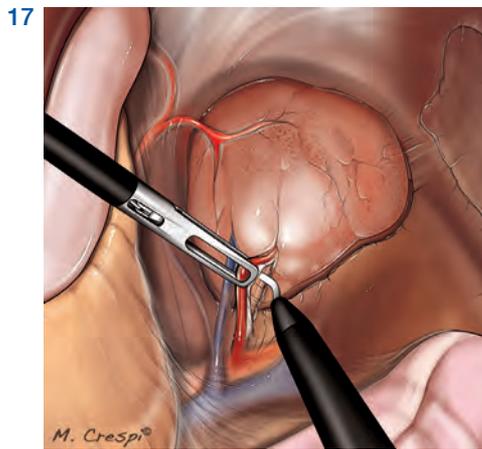
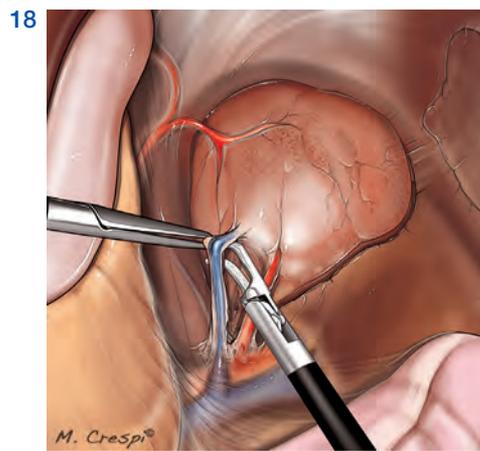
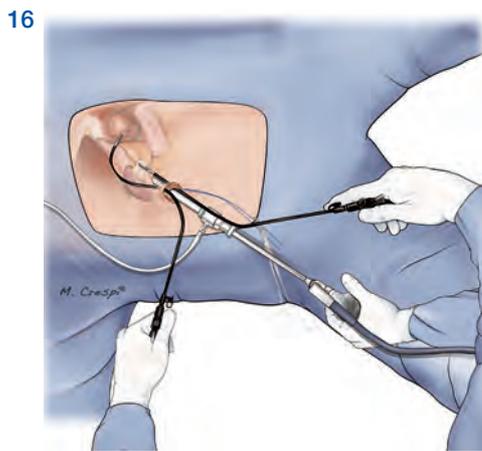


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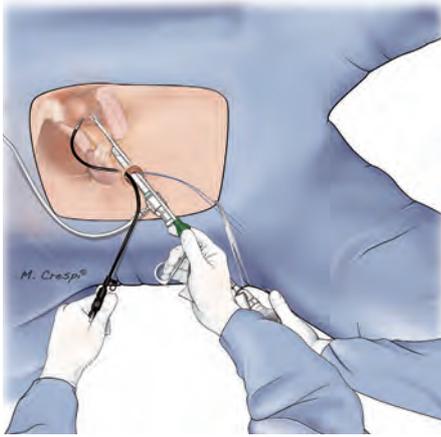


Once the splenopancreatic bloc is completely mobilized, it is positioned medially under the left and right liver lobes using the monocurved grasping forceps (Figure 16). The left adrenal gland is now quite evident.

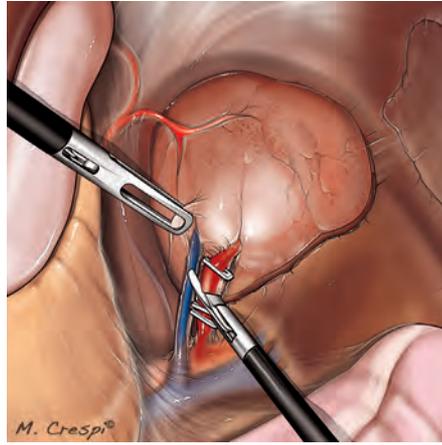
The inferior adrenal vein and artery are identified, freed (Figure 17) and dissected by the monocurved dissecting grasping forceps (Figures 18, 19).



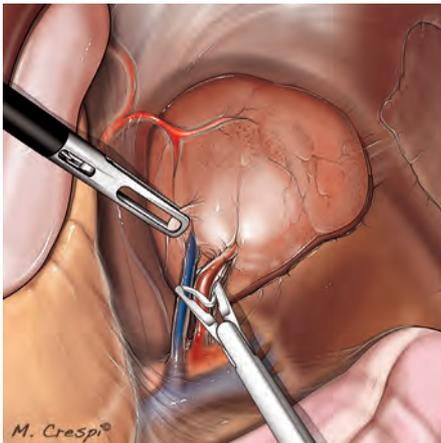
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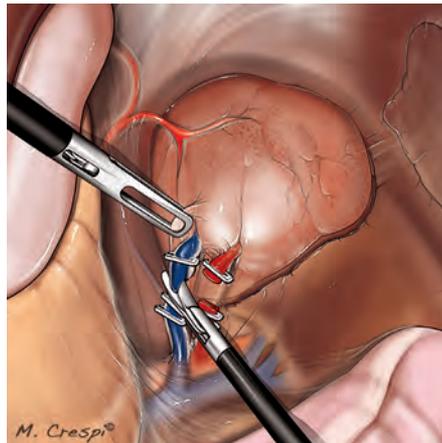
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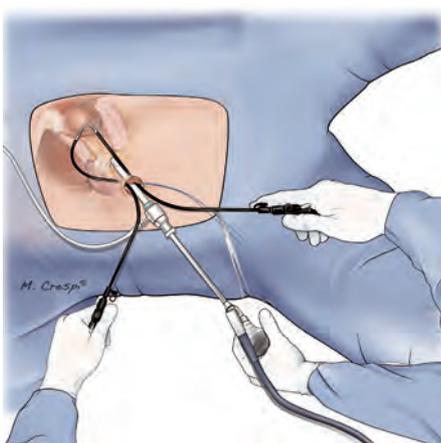
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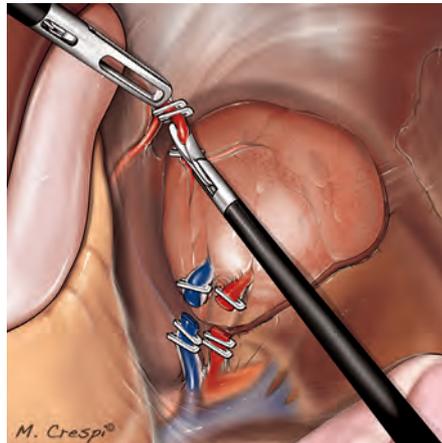
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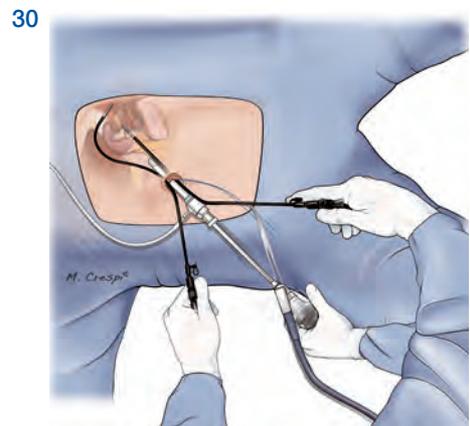
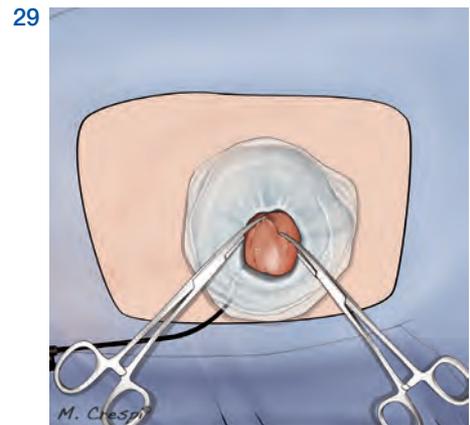
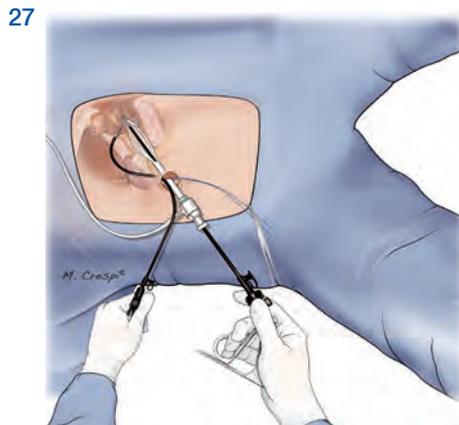
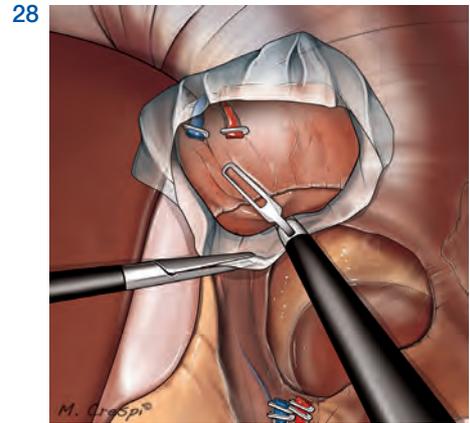
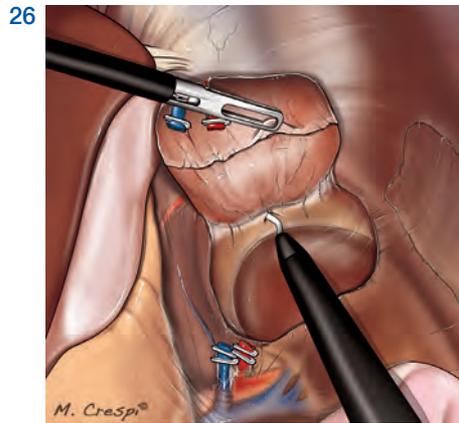


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The straight 5-mm clip applicator is introduced for the placement of clips at the root of each vessel (Figures 20, 21). Monocurved scissors are used to cut the artery as well as the vein

(Figures 22, 23, 24). Then, the middle artery and vein (if present) are dissected and clipped as well (Figure 25).



Finally, the adrenal gland is freed from the superior vessels, and from the posterior attachments (Figure 26).

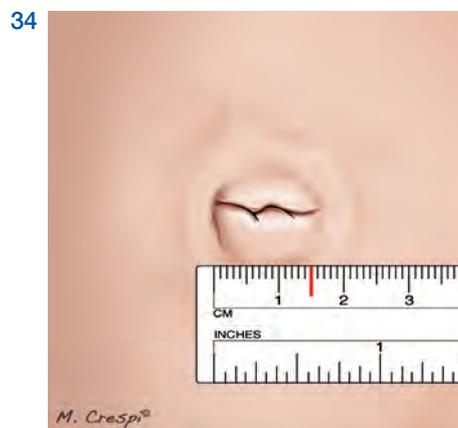
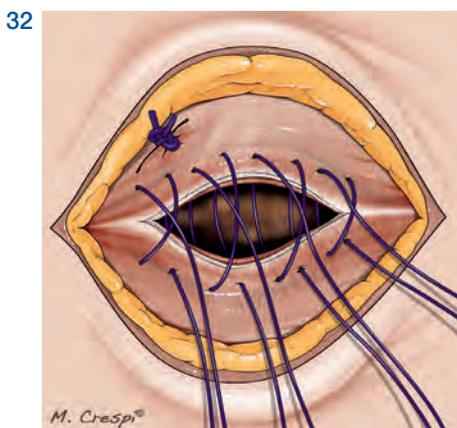
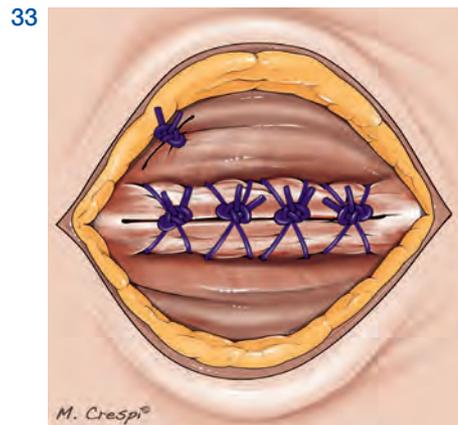
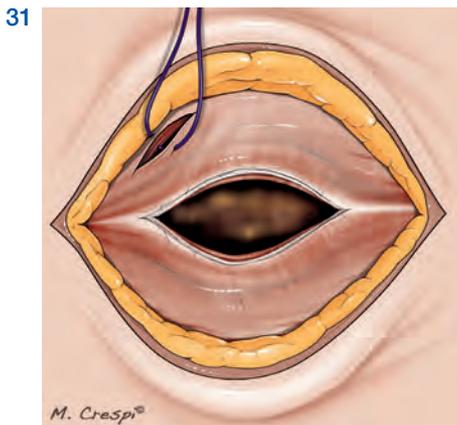
A custom-made plastic bag is introduced into the abdominal cavity through the 11-mm trocar using a straight grasping forceps (Figure 27), to gather the specimen. The adrenal gland is placed into the bag using the bicurved grasping forceps and the straight grasping forceps (Figure 28). The specimen is retrieved at the umbilicus and morcellated at this site between Pean-Rochester curved forceps and the morcellator cannula, taking care do to not tear the bag (Figure 29). No drain is left in the abdominal cavity.

The operating room table is repositioned as it was at the beginning of the procedure, without any tilt and Trendelenburg position. The splenopancreatic bloc is repositioned in the original anatomy using the monocurved grasping forceps (Figure 30).

All the instruments are removed from the abdomen under view, and the bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

After having removed the 11-mm trocar and the umbilical purse-string suture, Vicryl 1 sutures are used to close the access. First, the separate fascia opening accommodating the bicurved grasping forceps is closed (Figure 31). Then,

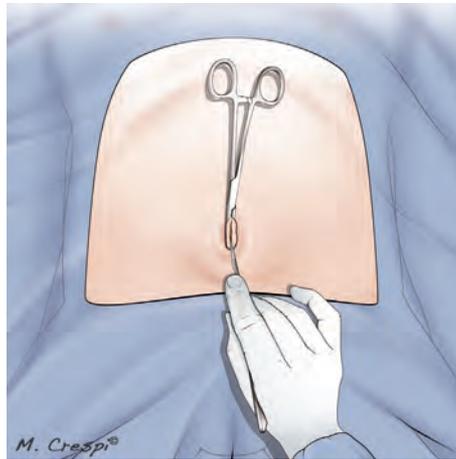
the main access is closed using a figure 8 pattern of sutures (Figures 32, 33). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 34).



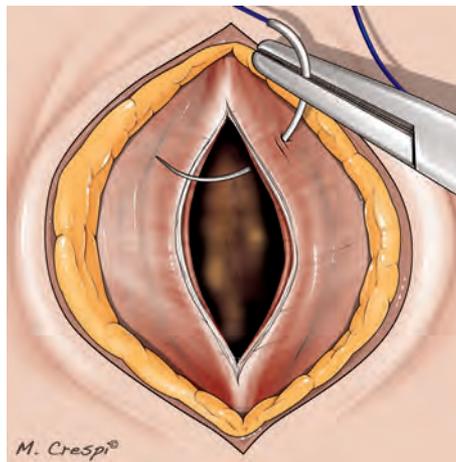
Right

The umbilicus is everted using a Kocher-Ochsner curved forceps, temporarily closing its base with a Pean-Rochester curved forceps (Figure 35). The skin is incised inside the umbilical scar and the fascia is exposed. The central circular fatty tissue inside the fascia is searched and opened by scissors, permitting access to the peritoneal cavity. A purse-string suture using PDS 1 is placed in the umbilical fascia and peritoneum using a full-thickness method, going inside and outside respectively at the 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 36, 37). This suture is kept externally using a Pean-Rochester curved forceps.

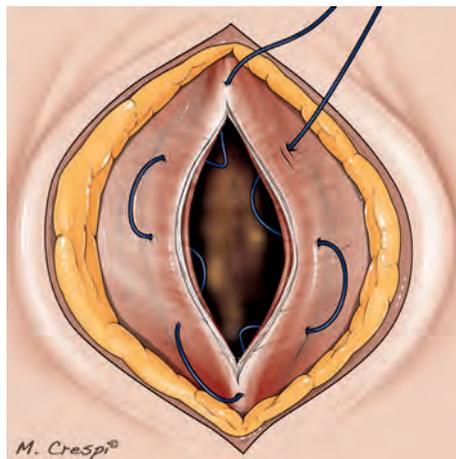
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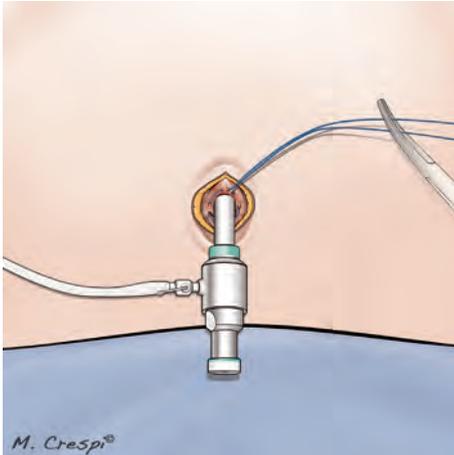


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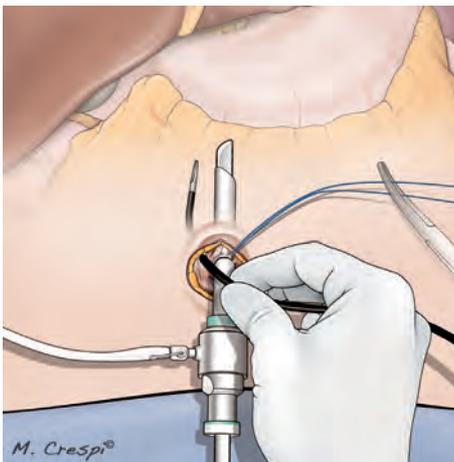


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[Right Adrenalectomy](#)

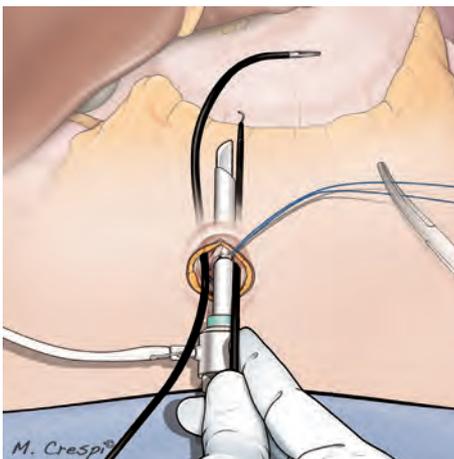
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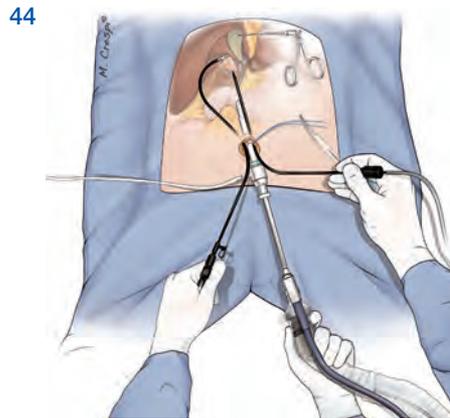
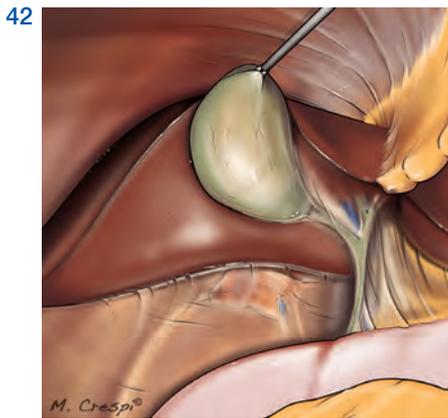
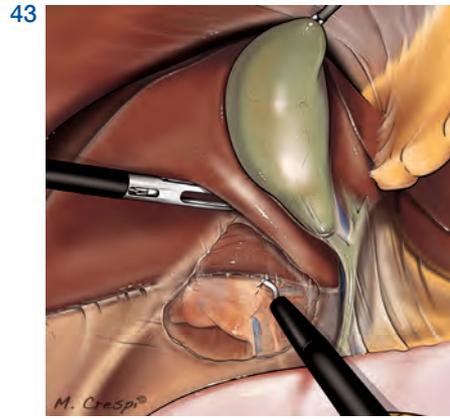
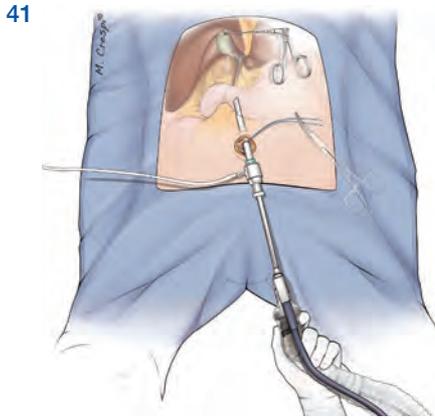


An 11-mm trocar is introduced into the peritoneal cavity inside the purse-string suture, and the pneumoperitoneum is created (Figure 38). The 10-mm, 30° scope is advanced through the 11-mm trocar, and curved instruments are inserted into the abdomen through the umbilical scar without trocars.

The bicurved grasping forceps is inserted through a separate fascia window, created by a mandril of 6-mm trocar approximately 5 mm outside the purse-string suture at the 10 o'clock position with respect to the patient's head (Figure 39). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

The other instruments, like the monopolar coagulating hook, the monopolar bipolar forceps and scissors, the monopolar dissecting forceps, the straight 5-mm clip applier, the monopolar scissors, the monopolar suction and irrigation cannula, and the straight grasping forceps are introduced on the other side of the bicurved grasping forceps at the 3 o'clock position, parallel to the 11-mm trocar and inside the purse-string suture (Figure 40).

The suture is adjusted to maintain a tight seal around the 5-mm tools and the 11-mm trocar, and is opened only for exchanges of instruments and evacuation of smoke created during the dissection.



The operating room table is positioned in a reverse Trendelenburg position with a left-sided tilt.

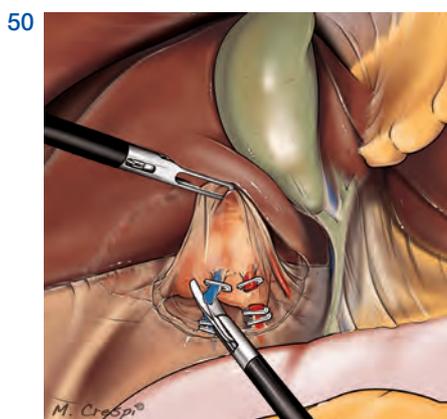
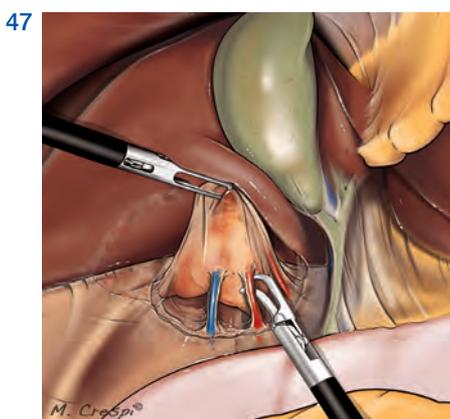
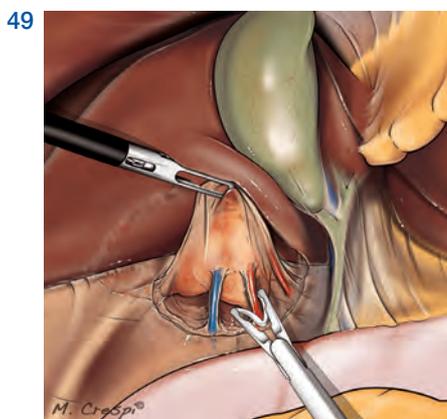
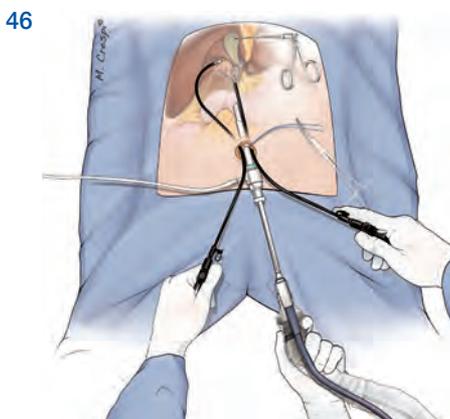
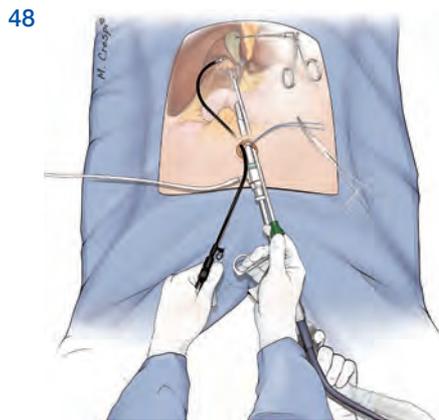
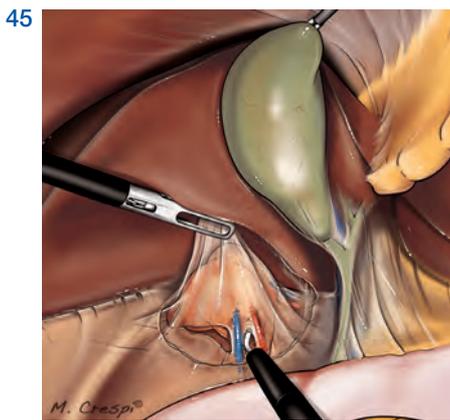
A straight 1.8-mm trocarless grasping forceps is always inserted percutaneously via a skin puncture (created by a Veress needle) under the right 12th rib, grasping the gallbladder fundus with the distal tip (Figures 41, 42). The retraction of the gallbladder, together with the right liver lobe, permits exposure of the right adrenal region. The posterior parietal peritoneal sheet covering

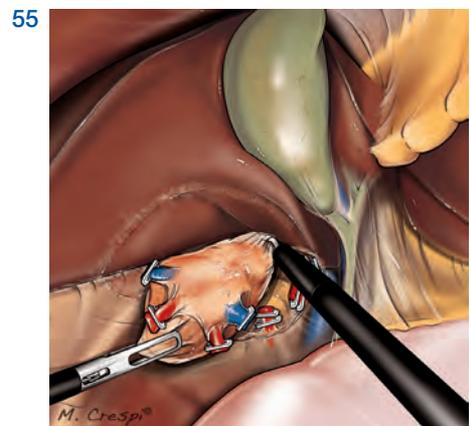
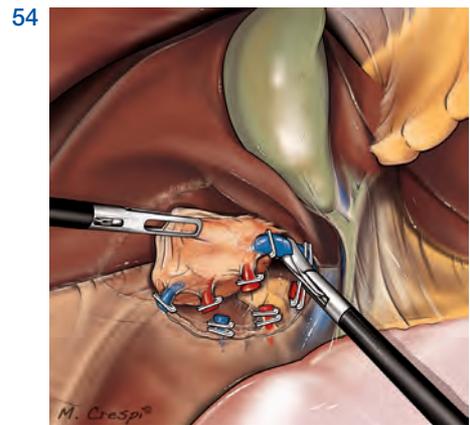
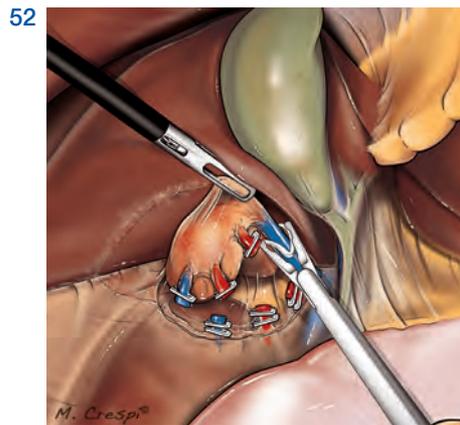
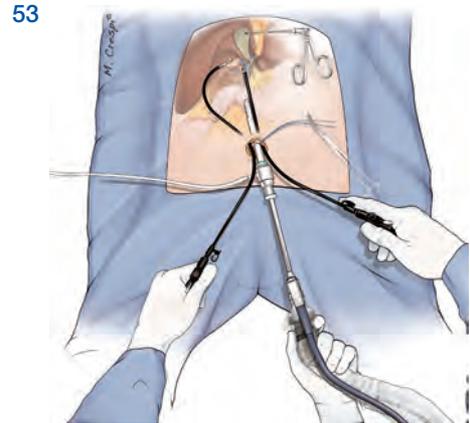
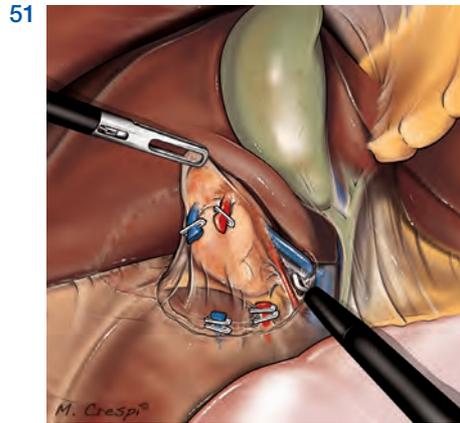
the right adrenal gland, above the right Gerota's fascia, is incised, separating the hepatic capsule from the latter (Figure 43). The monocurved coagulating hook along with the bicurved grasping forceps are useful for this dissection.

Thanks to the curves of the instruments, the surgeon is able to work in comfortable ergonomics without interference between the instruments' tips or crossing of the hands (Figure 44).

The adrenal gland, together with the periadrenal fatty tissue, is exposed. The mobilization of the gland starts from inferiorly going cephalad, staying laterally to the inferior vena cava (Figure 45). The monocurved coagulating hook, as well as the monocurved bipolar forceps and scissors, are used to dissect the different vessels around the inferior

edge of the gland. The monocurved dissecting forceps can be used to improve this dissection (Figures 46, 47). Then, the straight 5-mm clip applicator is introduced for placement of the clips at the root of each vessel (Figures 48, 49). The vessels are sectioned by the monocurved scissors (Figure 50).



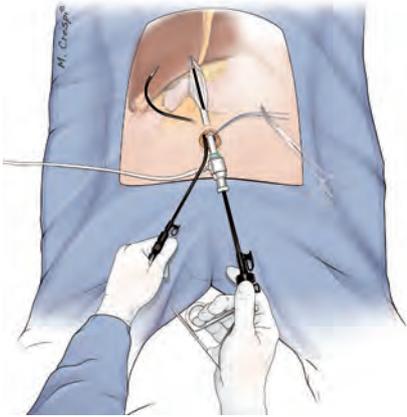


The procedure continues with the identification of the middle adrenal artery and vein, which are localized superiorly, medially and closer to the vena cava. The root of the middle adrenal vein, usually short, is freed (Figure 51). Then, it is clipped (Figure 52) and divided by the monopolar scissors (Figures 53, 54).

Finally, the superior edge of the gland is freed from the surrounding fatty tissue using the monopolar coagulating hook (Figure 55).

Once the adrenal gland is completely free, it is temporarily moved down to the hepatic colic flexure, and the operative field is cleaned by the monopolar suction and irrigation cannula.

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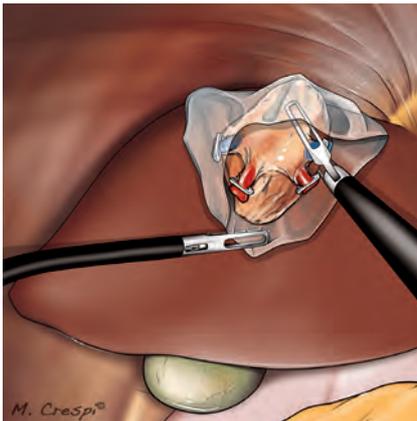


A custom-made plastic bag is introduced into the abdominal cavity through the 11-mm trocar using a straight grasping forceps (Figure 56). The adrenal gland is placed into the bag, using the bicurved grasping forceps and the straight grasping forceps (Figure 57). The specimen is finally removed transumbilically (Figure 58) and morcellated at this site between Pean-Rochester curved forceps and the morcellator cannula, taking care do to not tear the bag. No drain is left in the abdominal cavity.

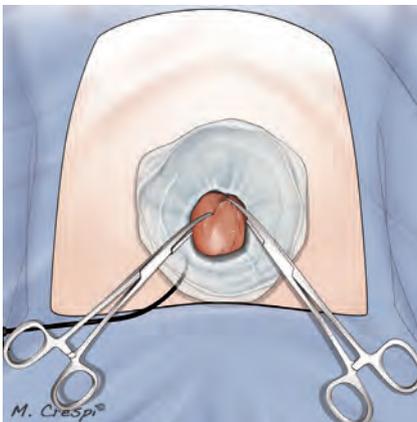
The operating room table is repositioned as it was in the beginning of the procedure, without any tilt and Trendelenburg position.

All the instruments are removed from the abdomen under view, and the bicurved grasping forceps is retrieved following its curves at 45° with respect to the abdominal wall.

57

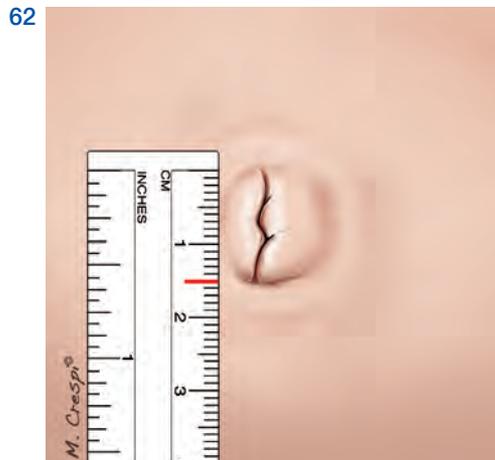
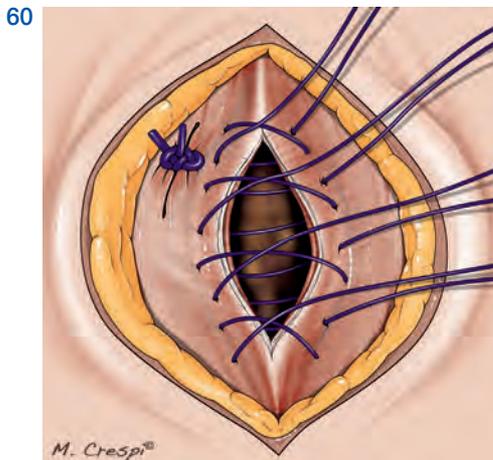
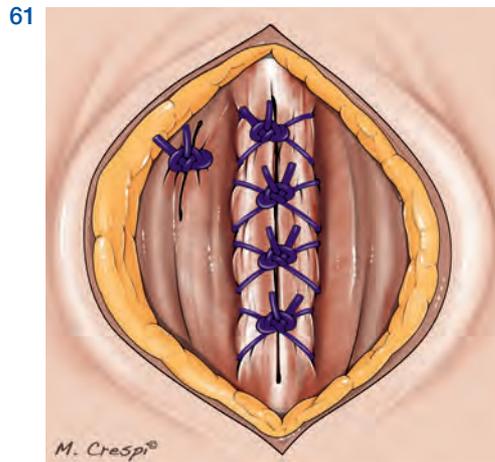
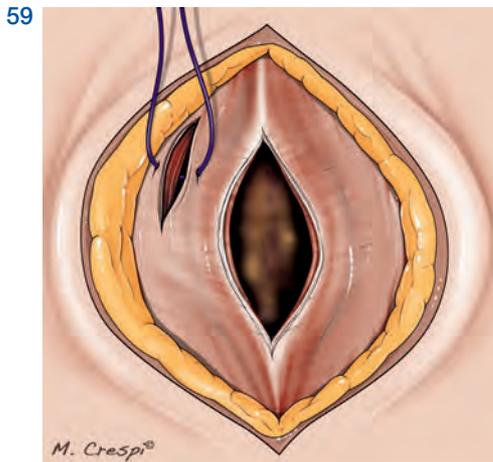


58



After having removed the 11-mm trocar and the umbilical purse-string suture, Vicryl 1 sutures are used to close the access. First, the separate fascia opening accommodating the bicurved grasping forceps is closed (Figure 59). Then,

the main access is closed using a figure 8 pattern of sutures (Figures 60, 61). The redundant cutaneous scar is removed and intradermic sutures using Monocryl 4/0 are placed (Figure 62).



Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

The urinary and arterial catheters are removed in the recovery room.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

TVP prophylaxis is prescribed until the discharge of the patient from the hospital. The patient is allowed drink water after 24 hours, and to tolerate a light diet after 48 hours. If there are no complications, the patient is discharged on the 3rd post-operative day, after removal of the central line.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6, and 12 months after the procedure. Then, the patient is followed-up by the endocrinologist.

SECTION 7

ABDOMINAL WALL

7.1 INGUINAL HERNIA REPAIR (TEP)

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Right

Left

Post-operative Care

7.1 INGUINAL HERNIA REPAIR (TEP)

The single-incision laparoscopic technique preferred is the totally extraperitoneal prosthesis placement (TEP). Moreover, if the patient presents with a bilateral hernia, the right side dissection is performed before the left side.

Pre-operative Preparation and General Anesthesia

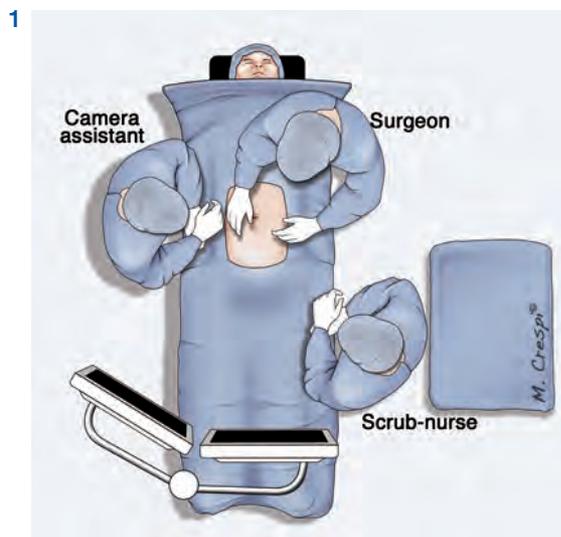
Patient is asked not to eat for at least 8 hours prior to the procedure, and to have an empty bladder before admittance to the OR.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after the intubation.

Antibiotic prophylaxis is applied as well.

Tools

- two Pean-Rochester curved forceps, one scalpel, one Mayo scissors, two Farabeuf retractors, two Kocher-Ochsner curved forceps, two Mayo-Hegar needle-holders, two tissue forceps
- sutures: two Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), one Polyglactin 0 preformed knot (endoloop), one Polyglactin 2/0 (Vicryl 2/0, round tip, 1/2c, 36 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one straight 10-mm, 0° regular length scope
- one reusable monocurved grasping forceps (DAPRI grasping forceps IV)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one reusable Veress needle
- one reusable straight 1.8-mm trocarless grasping forceps (DAPRI trocarless grasping forceps)
- one reusable straight 5-mm endoloop device
- one reusable monocurved needle holder (DAPRI needle holder I)
- one reusable monocurved scissors (DAPRI scissors)
- one non-reusable straight 5-mm tack device
- one/two meshes

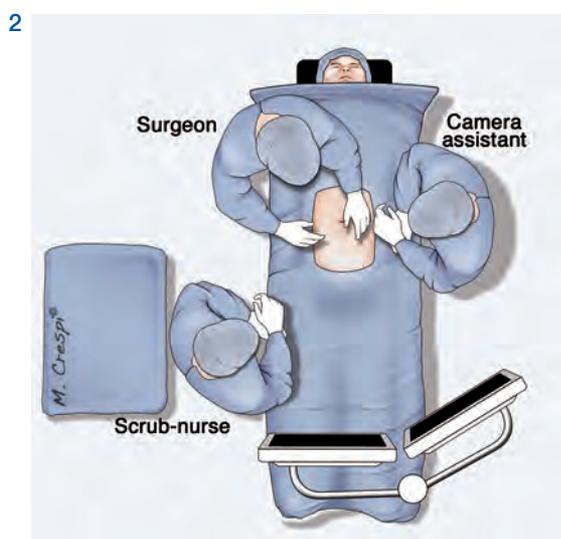


Patient and Team Positioning

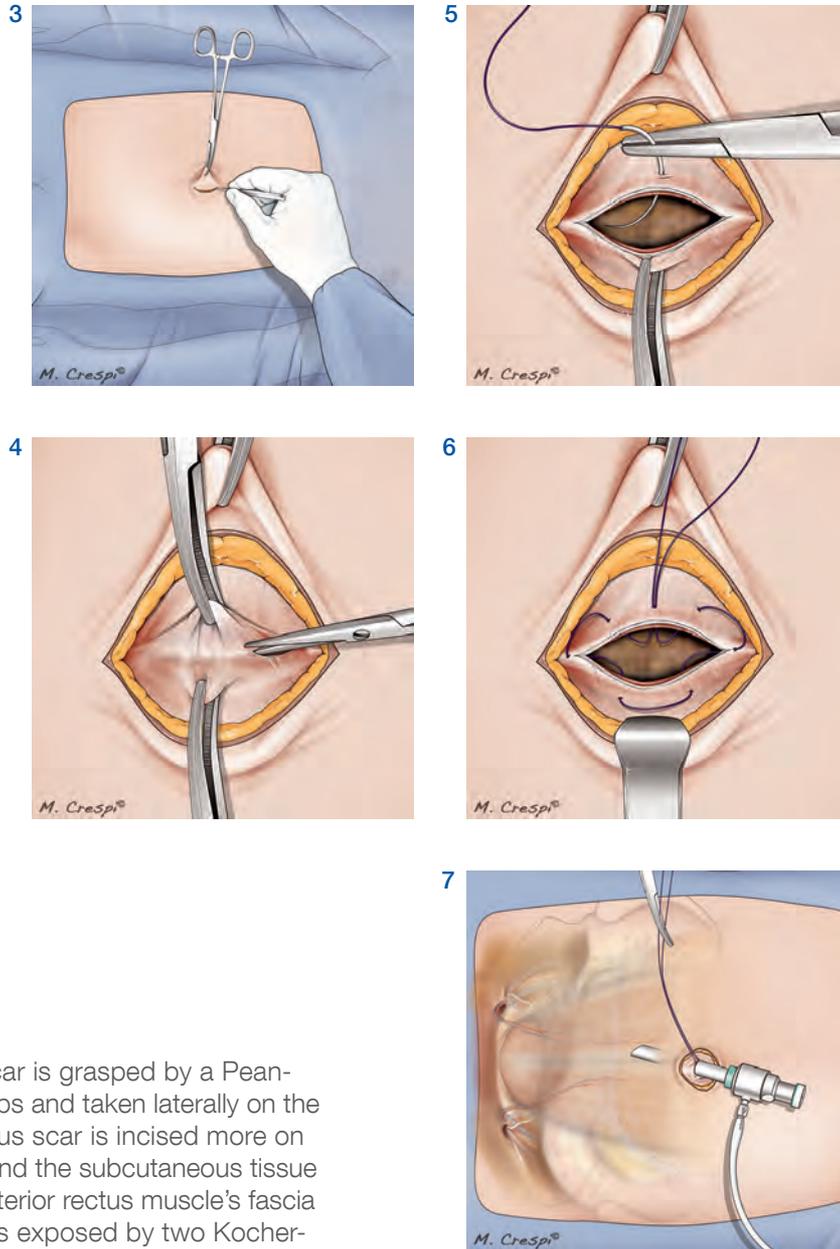
The patient is placed in a supine position, with the arms alongside the body and the legs straight. The arms, ankles, and legs are secured and protected.

The position of the team and the choice of abdominal incision are dependent upon the localization of the hernia defect, adhering to the laparoscopic principle of alignment between the surgeon's head, operative field and video monitor.

If the hernia defect is on the right inguinal region, the surgeon stands to the patient's left, and the camera assistant to the patient's right. The scrub-nurse stands to the patient's left and to the surgeon's left. The video monitor is placed in front of the surgeon and camera assistant at the feet of the patient ([Figure 1](#)).



If the hernia defect is on the left inguinal region, the surgeon stands to the patient's right, and the camera assistant to the patient's left. The scrub-nurse stands to the patient's right and to the surgeon's right. The video monitor is placed in front of the surgeon and camera assistant at the feet of the patient ([Figure 2](#)).



Technique

Right

The central umbilical scar is grasped by a Pean-Rochester curved forceps and taken laterally on the right side. The cutaneous scar is incised more on the left side (Figure 3) and the subcutaneous tissue is dissected until the anterior rectus muscle's fascia is reached. The fascia is exposed by two Kocher-Ochsner curved forceps and opened (Figure 4). A purse-string suture using Vicryl 1 is placed at the 9, 10, 12, 2, 4, 6, 8 and 9 o'clock positions, going inside and outside respectively (Figures 5, 6). This suture is kept externally with a Pean-Rochester curved forceps. The left rectus muscle fibres are retracted laterally and an 11-mm trocar is introduced behind the rectus muscle fibers and above the posterior fascia into the pre-peritoneal space (Figure 7).



Click to watch the corresponding video
[Inguinal Hernia Repair \(TEP\)](#)

The 10-mm, 0° scope is advanced through the 11-mm trocar, and the pre-peritoneal space is insufflated.

The operating room table is placed in a moderate Trendelenburg position with more left-sided tilt.

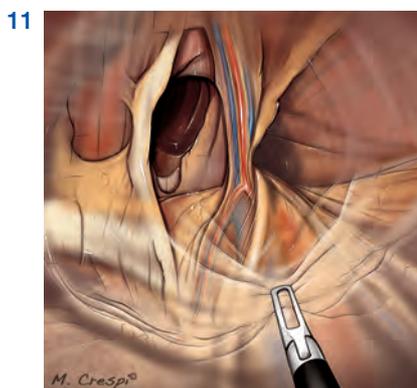
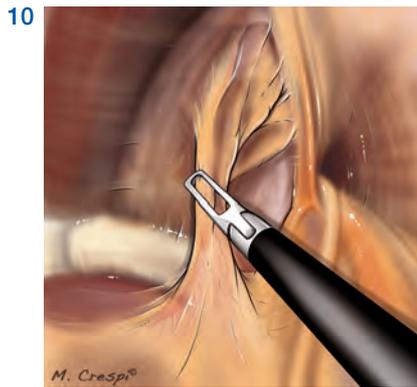
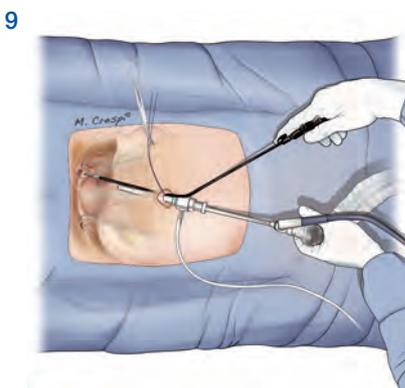
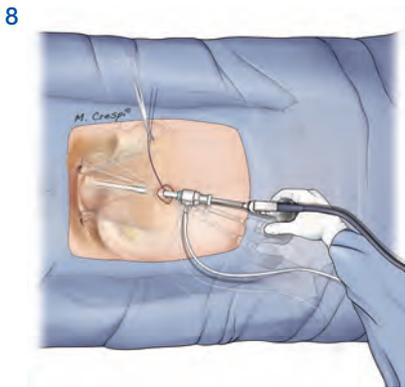
The scope is used to dissect the pre-peritoneal space. It is first pushed against the pubic bone and then laterally, creating a medial-to-lateral dissection; this movement is similar to a “rowing the boat” (Figure 8). The scope has to go laterally, staying first behind the epigastric vessels and then behind to the transversalis fascia.

The curved instruments, like the monocurved grasping forceps, the monocurved suction and irrigation cannula, and the straight 5-mm tack device are inserted parallel to the 11-mm trocar and inside the purse-string suture at

the 9 o'clock position (Figure 9). The suture is adjusted to maintain a tight seal around the 5-mm tool and the 11-mm trocar, and is opened only for exchanges of instruments.

The insertion of the monocurved grasping forceps is performed when the hernia sac has to be retracted (Figure 10). This grasper also helps to complete the retraction of the posterior peritoneal sheet in the direction of the patient's head (Figure 11). The deferent duct (male) or the round ligament (female), and the spermatic vessels (male) are freed from the peritoneal sheet (Figure 11).

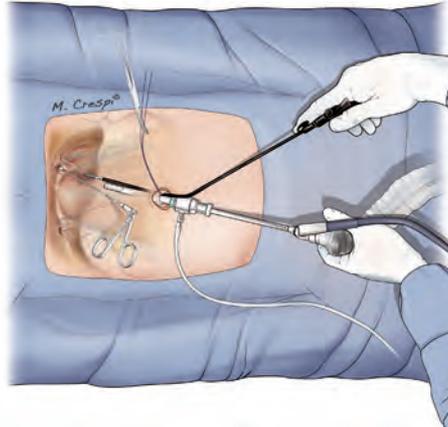
Because of the curve of the grasping forceps, there is no conflict between the hands of the surgeon and those of the camera assistant outside the abdomen (Figure 9).



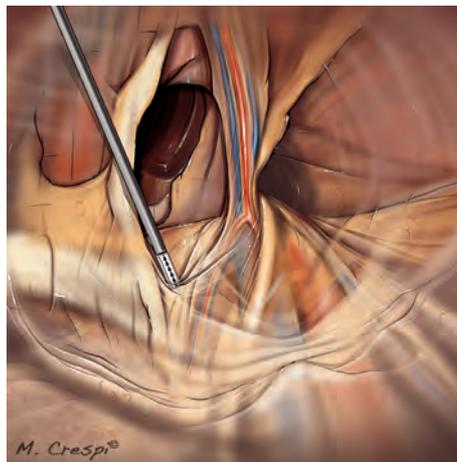
If the inguinal hernia is direct, the monocurved grasping forceps is sufficient to retract the hernia sac. If the inguinal hernia is indirect, a 1.8-mm trocarless grasping forceps must sometimes be inserted on the linea alba between the umbilicus and the pubic bone, helping in the traction and countertraction (**Figures 12, 13**).

If a peritoneal tear occurs, a suture by a preformed knot (endoloop) using the straight 5-mm endoloop device and the 1.8-mm trocarless grasping forceps can be used, or a Vicryl 2/0 suture using the monocurved needle holder and the 1.8-mm trocarless grasping forceps can be performed. At the end, the suture is cut by the monocurved scissors.

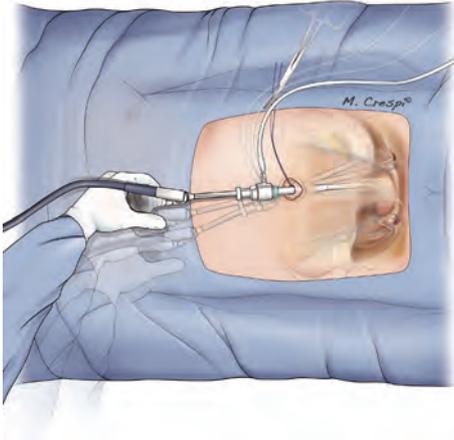
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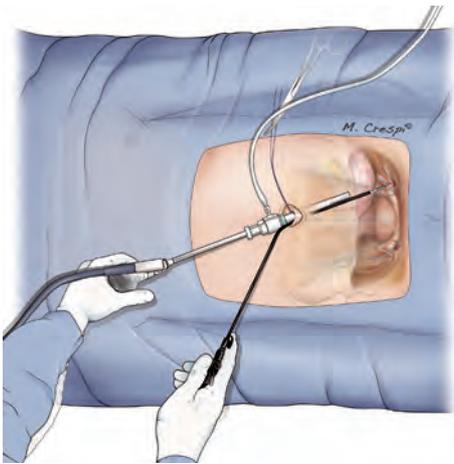
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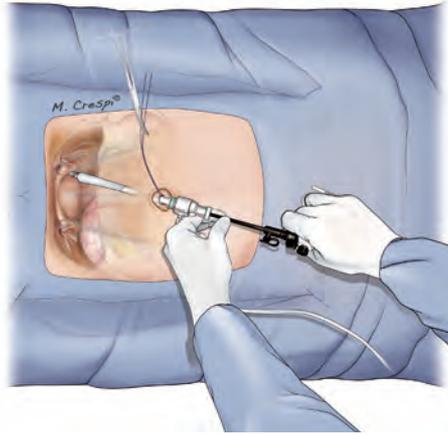


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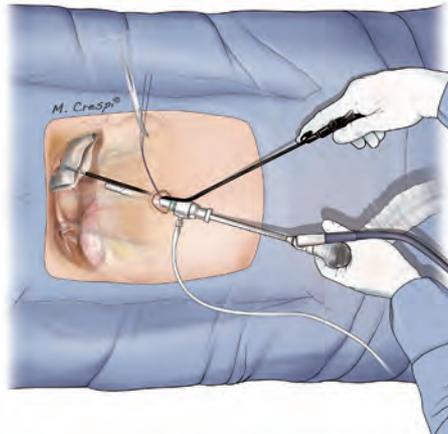


If the patient presents a bilateral hernia, the left pre-peritoneal space is prepared before insertion of the mesh on the right space. After that, the scope is used to dissect the left pre-peritoneal space (Figure 14) and, if necessary, the monocurved grasping forceps is inserted to retract the hernia sac (Figure 15).

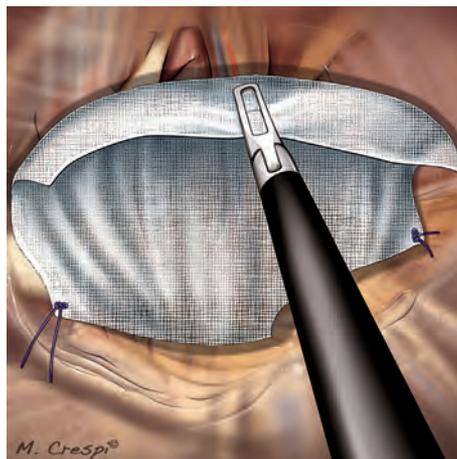
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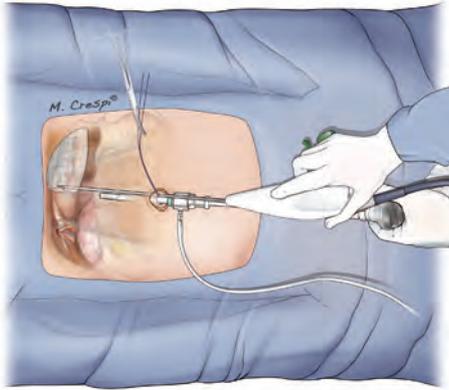


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A mesh is chosen. Two sutures using Vicryl 1 are placed at the inferior corners of the mesh, before its insertion: one at the medial corner (long suture), and another at the lateral corner (short). These sutures are helpful in orientating the mesh, once it is in the pre-peritoneal space. The mesh is rolled tightly in order to be inserted through the 11-mm trocar into the pre-peritoneal space using the straight grasping forceps (Figure 16). Then, it is opened using the monocurved grasper and well placed in the pre-peritoneal space (Figure 17), positioning the two inferior corners (sutures) in the correct location (Figure 18).

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If necessary, the mesh is fixed by 2/3 tacks on the pubic bone, using the straight 5-mm tack device (Figure 19).

Continued on page 307.

Left

The central umbilical scar is grasped by a Pean-Rochester curved forceps and taken laterally on the left side. The cutaneous scar is incised more on the right side (similar to Figure 3) and the subcutaneous tissue is dissected until the anterior rectus muscle's fascia is reached. The fascia is exposed by two Kocher-Ochsner curved forceps and opened (similar to Figure 4). A purse-string suture using Vicryl 1 is placed at the 9, 10, 12, 2, 4, 6, 8 and 9 o'clock positions, going inside and outside respectively (similar to Figures 5, 6). This suture is kept externally using a Pean-Rochester curved forceps.

The right rectus muscle fibres are laterally retracted, and an 11-mm trocar is introduced behind the rectus muscle fibers and above the posterior fascia into the pre-peritoneal space (similar to Figure 7).

The 10-mm, 0° scope is advanced through the 11-mm trocar, and the pre-peritoneal space is insufflated.

The operating room table is placed in a moderate Trendelenburg position with more right-sided tilt.

The scope is used to dissect the pre-peritoneal space. It is first pushed against the pubic bone and then laterally, creating a medial-to-lateral dissection; this movement is similar to a "rowing the boat" (Figure 14). The scope has to go laterally, staying first behind the epigastric vessels and then behind to the transversalis fascia.

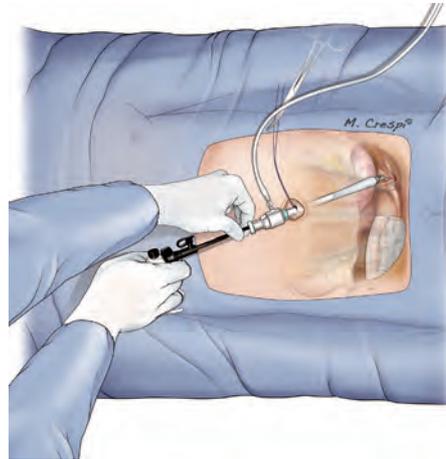
The curved instruments, like the monocurved grasping forceps, the monocurved suction and irrigation cannula, and the straight 5-mm tack device are inserted parallel to the 11-mm trocar and inside the purse-string suture at the 9 o'clock position (Figure 15). The suture is adjusted to maintain a tight seal around the 5-mm tool and the 11-mm trocar, and is opened only for the exchange of instruments.

The monocurved grasping forceps is inserted when the hernia sac has to be retracted (similar to Figure 10). This grasper also helps to complete retraction of the posterior peritoneal sheet in the direction of the patient's head (similar to Figure 11). The deferent duct (male) or the round ligament (female), and the spermatic vessels (male) are freed from the peritoneal sheet (similar to Figure 11).

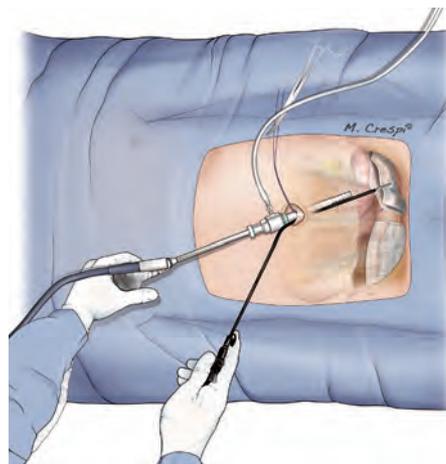
Because of the curve of the grasping forceps, there is no conflict between the hands of the surgeon and those of the camera assistant outside the abdomen (Figure 15).

If the inguinal hernia is direct, the monocurved grasping forceps is sufficient to retract the hernia

20



21

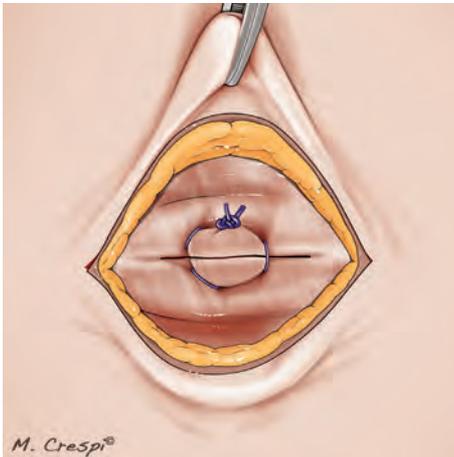


sac. If the inguinal hernia is indirect, a 1.8-mm trocarless grasping forceps must sometimes be inserted on the linea alba between the umbilicus and the pubic bone, helping in the traction and countertraction (similar to Figures 12, 13).

A mesh is chosen. Two sutures using Vicryl 1 are placed at the inferior corners of the mesh before its insertion: one at the medial corner (long suture), and another at the lateral corner (short). These sutures are helpful in orientating the mesh once it is in the pre-peritoneal space.

The mesh is rolled tightly in order to be inserted through the 11-mm trocar into the pre-peritoneal space using the straight grasping forceps (Figure 20). Then, it is opened with the monocurved grasper and well placed in the pre-peritoneal space, positioning the two inferior corners (sutures) in the correct location (Figure 21). If necessary, the mesh is fixed by 2/3 tacks on the pubic bone, using the straight 5-mm tack device (similar to Figure 19).

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End of Both Procedures

If necessary, the operative field is cleaned at the end of the procedure with the monocurved suction and irrigation cannula, and no drain is left in the inguinal region.

The operating room table is repositioned as it was in the beginning of the procedure, without any tilt and Trendelenburg position.

All the instruments are removed, and the preperitoneal space is deflated under view of the mesh. The purse-string suture (placed at the beginning of the procedure) on the rectus muscle fascia is tight (Figure 22) and, if required, other Vicryl 1 sutures are placed as well. The cutaneous scar is closed by Monocryl 4/0 intradermic sutures (Figure 23).

23



Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

The patient is allowed to drink water after 12 hours. If there are no complications, the patient is discharged within 24 hours.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6, 12 and 24 months after the procedure.

7.2 INCISIONAL AND PRIMARY ABDOMINAL WALL HERNIA REPAIR

Pre-operative Preparation and
General Anesthesia

Tools

Patient and Team Positioning

Technique

Defect on Midline or Right Abdominal Quadrants

Defect on Left Abdominal Quadrants

Post-operative Care

7.2 INCISIONAL AND PRIMARY ABDOMINAL WALL HERNIA REPAIR

Pre-operative Preparation and General Anesthesia

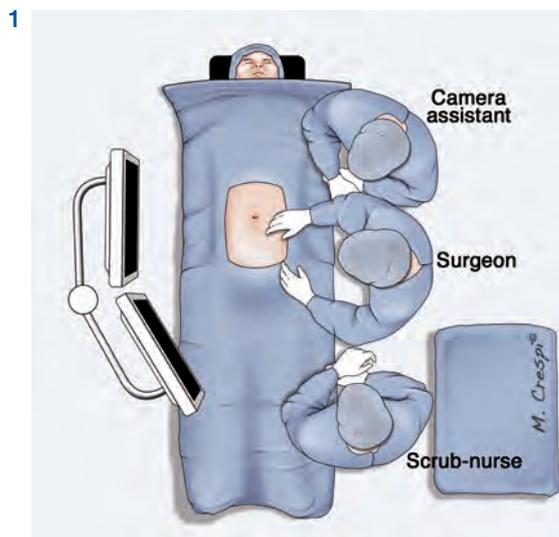
Patient is asked not to eat for at least 8 hours prior to the procedure.

General anesthesia is induced intravenously (i.v.) with 0.2 lg/kg sufentanyl, 2 mg/kg propofol, and 0.6 mg/kg rocuronium or 0.15 mg/kg cisatracurium. After tracheal intubation, anesthesia is maintained with 5-6% desflurane or 2% sevoflurane. In case of rapid sequence induction, 2 mg/kg etomidate or 2 mg/kg propofol and 1 mg/kg succinylcholine are used i.v., and a 0.2 lg/kg sufentanyl and 0.1 mg/kg rocuronium are administered after the intubation.

Antibiotic prophylaxis is applied as well.

Tools

- one scalpel, two tissue forceps, one Mayo scissors, two Farabeuf retractors, two Kocher-Ochsner curved forceps, two Mayo-Hegar needle-holders, two Pean-Rochester curved forceps, one purse-string suture device (DAPRI purse-string suture device)
- sutures: one Polydioxanon 1 (PDS 1, round tip, 1/2c, 36 mm), three Polyglactin 1 (Vicryl 1, round tip, 1/2c, 27 mm), two Polyamide 2/0 (Ethilon 2/0, straight needle, 60 mm), one Poliglecaprone 4/0 (Monocryl 4/0, triangular tip, 3/8c, 16 mm)
- one reusable 11-mm rigid trocar
- one reusable rigid mandril of 6-mm trocar
- one straight 10-mm, 30° regular length scope
- one reusable bicurved grasping forceps (DAPRI grasping forceps I)
- one reusable monocurved coagulating hook (DAPRI coagulating hook)
- one reusable monocurved scissors (DAPRI scissors)
- one reusable monocurved RoBi® bipolar scissors (DAPRI bipolar scissors)
- one reusable monocurved suction and irrigation cannula
- one reusable straight grasping forceps
- one non-reusable straight 5-mm tack device
- one dualface mesh
- four straight needles

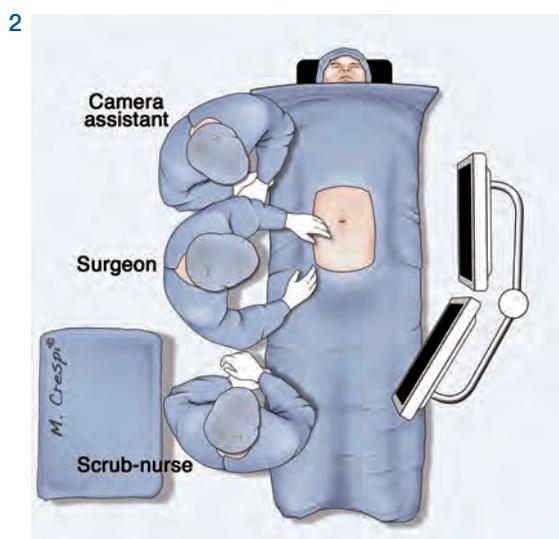


Patient and Team Positioning

The patient is placed in a supine position, with the arms alongside the body and the legs straight. The arms, ankles, and legs are secured and protected.

The position of the team and the choice of the abdominal incision are dependent upon the localization of the hernia defect, adhering to the laparoscopic principle of alignment between surgeon's head, operative field and video monitor.

If the hernia defect is on midline or right abdominal quadrants, the surgeon stands to the patient's left, and the camera assistant to the surgeon's right. The scrub-nurse stands to the patient's left and to the surgeon's left. The video monitor is placed in front of the surgeon and camera assistant (Figure 1).

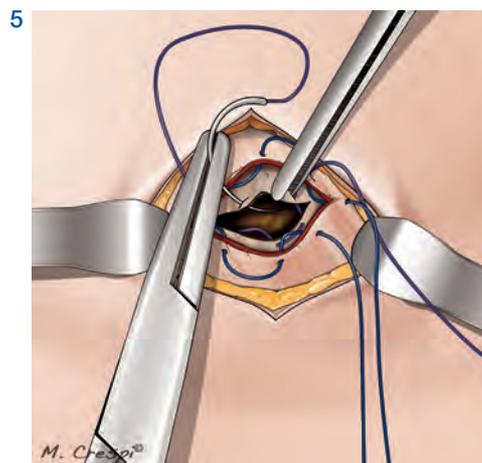
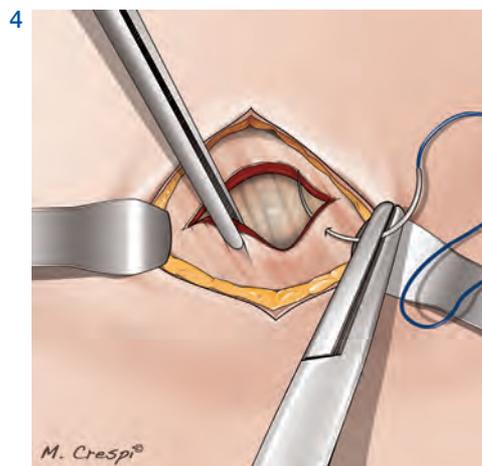
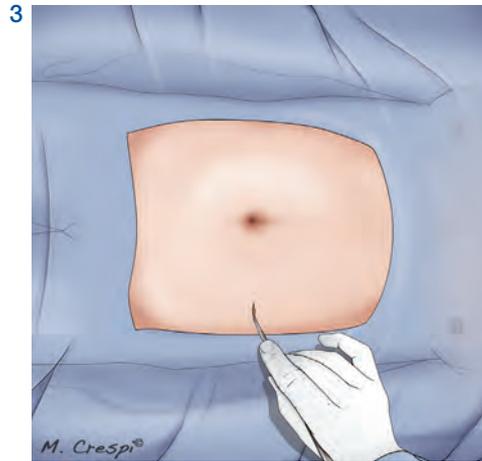


If the hernia defect is on left abdominal quadrants, the team stands to the patient's right, with the camera assistant to the surgeon's left and scrub-nurse to the surgeon's right. The video monitor is placed in front of the surgeon and camera assistant (Figure 2).

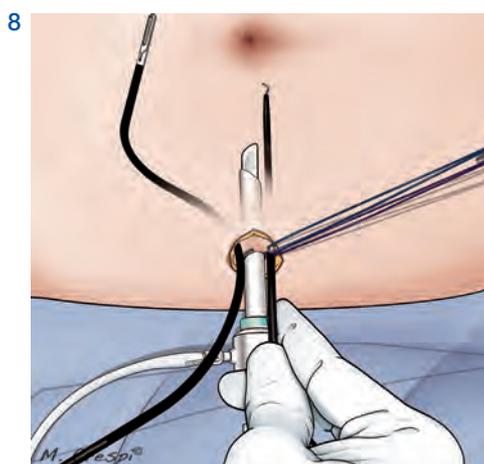
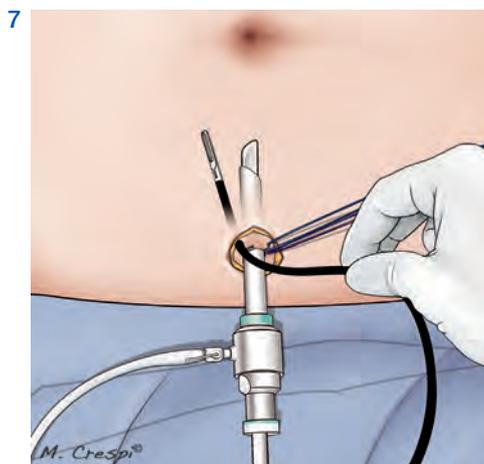
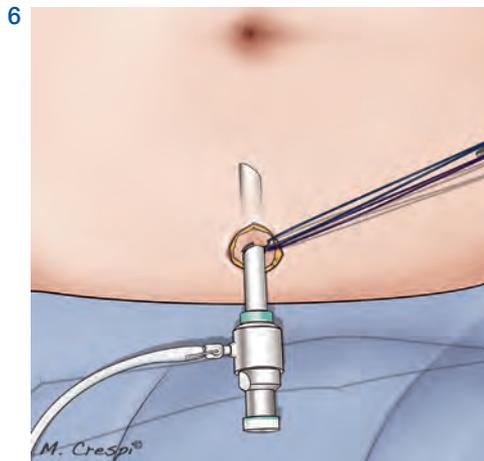
Technique

Defect on Midline or Right Abdominal Quadrants

The incision is always performed in the left flank (Figure 3). After having incised the skin, the anterior muscle fascia is exposed by two Kocher-Ochsner curved forceps and opened. A purse-string suture using PDS 1 is placed in the fascia, going inside and outside respectively at the 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figures 4, 5). The rectus muscle is separated into its fibres and the posterior muscle's fascia is exposed and incised as well. A Vicryl 1 purse-string suture is placed in the posterior fascia and peritoneal sheet, going inside and outside respectively at the 1, 3, 5, 6, 7, 9, 11 and 12 o'clock positions (Figure 5). These sutures are kept externally by Pean-Rochester curved forceps.



Click to watch the corresponding video
Incisional and Primary Abdominal Wall
Hernia Repair



The 11-mm trocar is introduced into the peritoneal cavity inside the purse-string sutures, and the pneumoperitoneum is created (Figure 6). The 10-mm, 30° scope is advanced through the 11-mm trocar, and curved instruments are inserted into the abdomen through the abdominal scar without trocars.

If it is necessary, the bicurved grasping forceps is used. This grasper is inserted through a separate fascia window created by a mandril of 6-mm trocar approximately 5 mm outside the purse-string suture at the 7 o'clock position with respect to the patient's head (Figure 7). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

The other instruments, like the monocurved coagulating hook, the monocurved scissors, the monocurved bipolar scissors, the monocurved suction and irrigation cannula, the straight grasping forceps, and the straight 5-mm tack device are introduced parallel to the 11-mm trocar and inside the purse-string suture at the 12 o'clock position (Figure 8).

The sutures are adjusted to maintain a tight seal around the 5-mm tools and the 11-mm trocar, and opened only for the exchange of instruments and evacuation of smoke created during the dissection.

The operating room table is placed in a moderate Trendelenburg position with right-sided tilt.

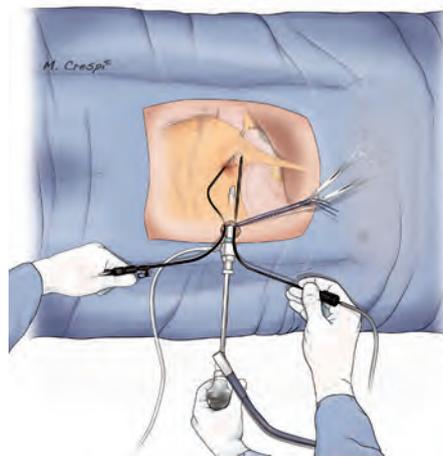
The hernia defect is identified and freed from the greater omentum (if adherent) and always from the fatty tissue covering the parietal peritoneal sheet (Figure 9).

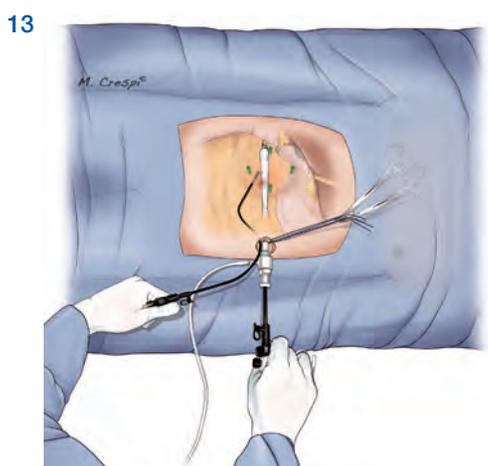
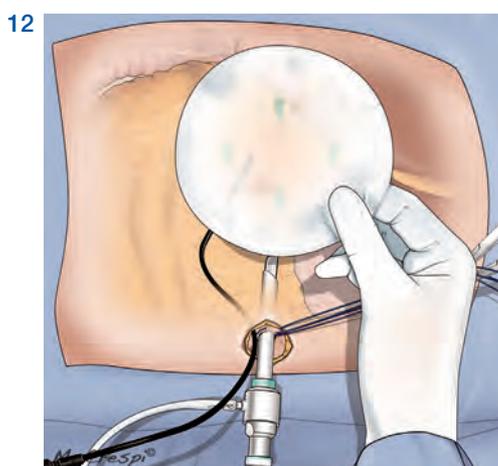
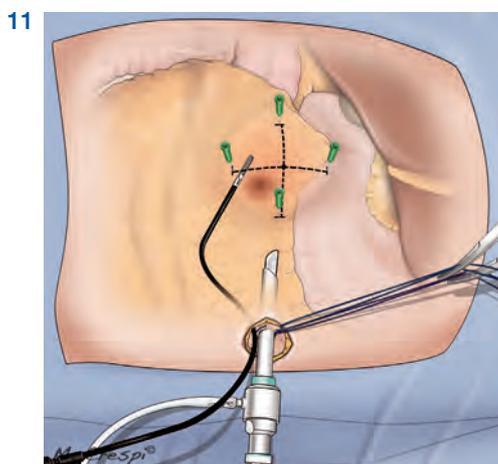
Because of the curves of the instruments there is no interference between the instruments' tips internally or between the surgeon's hands externally (Figure 10).

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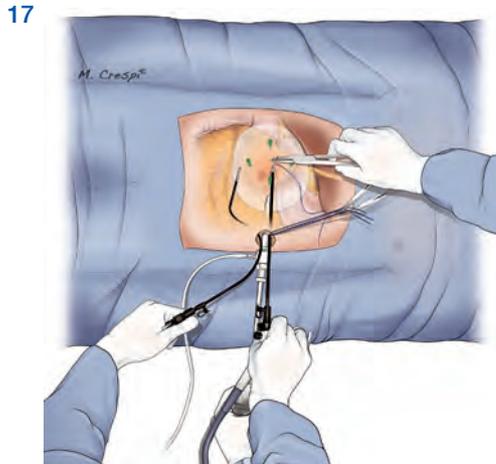
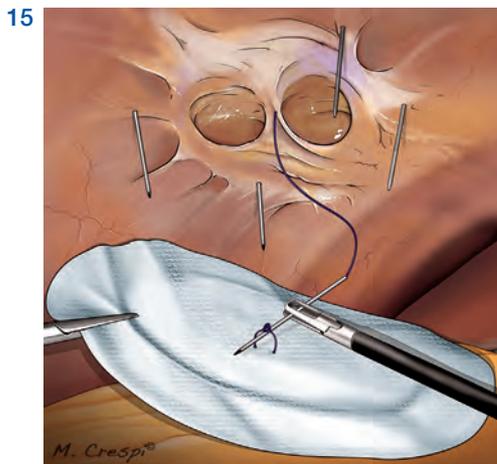
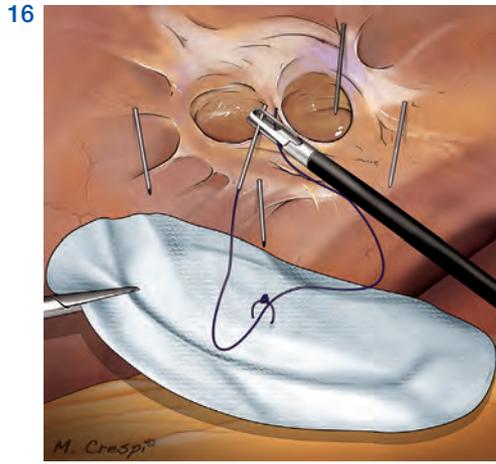
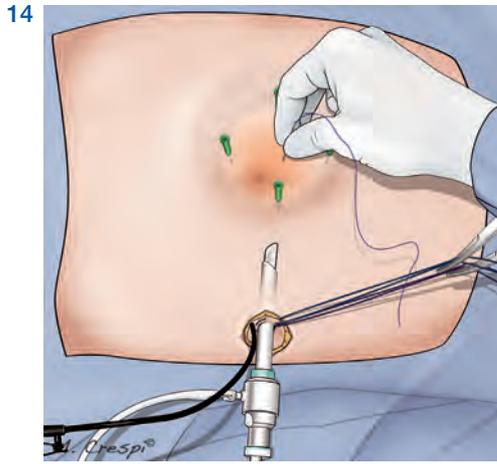


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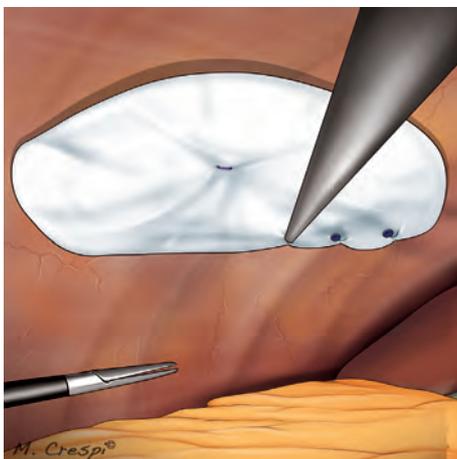
Peri-operative estimation of the hernia defect size using four percutaneous straight needles (Figure 11) enables appropriate mesh size selection, resulting in a minimal overlap of 3 cm in all directions (Figure 12). The dualface mesh is rolled tightly to be introduced into the cavity through the 11-mm trocar using the straight grasping forceps (Figure 13).



Percutaneous sutures (Ethilon 2/0), supported by straight needles are temporarily used to affix the mesh to the parietal wall (one in the middle of the mesh for small mesh and two at the cardinal points for bigger mesh). The straight needle is passed through the abdominal wall

into the peritoneal cavity (Figure 14), then into the mesh at the preformed suture (Figure 15), and finally it is pushed once again outside the abdominal cavity (Figures 16, 17). The four straight needles are removed.

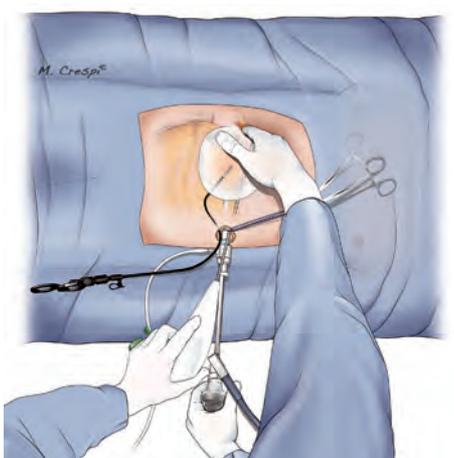
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Absorbable tacks are used to fix the mesh to the abdominal wall with a double-crown technique (Figure 18), while the surgeon applies an appropriate level of manual pressure externally (Figure 19). At the end of the mesh fixation, the temporary percutaneous sutures are removed (Figure 20).

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Defect on Left Abdominal Quadrants

The incision is always performed in the right flank ([similar to Figure 3](#)). After having incised the skin, the anterior muscle fascia is exposed by two Kocher-Ochsner curved forceps and opened. A purse-string suture using PDS 1 is placed in the fascia, going inside and outside respectively at the 7, 9, 11, 12, 1, 3, 5 and 6 o'clock positions ([Figures 4, 5](#)). The rectus muscle is separated into its fibres and the posterior muscle's fascia is exposed and incised as well. A Vicryl 1 purse-string suture is placed in the posterior fascia and peritoneal sheet, going inside and outside respectively at the 7, 9, 11, 12, 1, 3, 5 and 6 o'clock positions ([Figure 5](#)). These sutures are kept externally by Pean-Rochester curved forceps.

The 11-mm trocar is introduced into the peritoneal cavity inside the purse-string sutures, and the pneumoperitoneum is created ([Figure 6](#)). The 10-mm, 30° scope is advanced through the 11-mm trocar, and curved instruments are inserted into the abdomen through the abdominal scar without trocars.

If it is necessary, the bicurved grasping forceps is used. This grasper is inserted through a separate fascia window created by a mandril of 6-mm trocar approximately 5 mm outside the purse-string suture at the 1 o'clock position with respect to the patient's head ([Figure 7](#)). This grasping forceps is inserted following its curves at 45° with respect to the abdominal wall.

The other instruments, like the monocurved coagulating hook, the monocurved scissors, the monocurved bipolar scissors, the monocurved suction and irrigation cannula, the straight grasping forceps, and the straight 5-mm tack device are introduced parallel to the 11-mm trocar and inside the purse-string suture at the 6 o'clock position ([Figure 8](#)).

The sutures are adjusted to maintain a tight seal around the 5-mm tools and the 11-mm trocar, and opened only for the exchange of instruments and evacuation of smoke created during the dissection.

The operating room table is placed in a moderate Trendelenburg position with left-sided tilt.

The hernia defect is identified and freed from the greater omentum (if adherent) and always from the fatty tissue covering the parietal peritoneal sheet ([similar to Figure 9](#)).

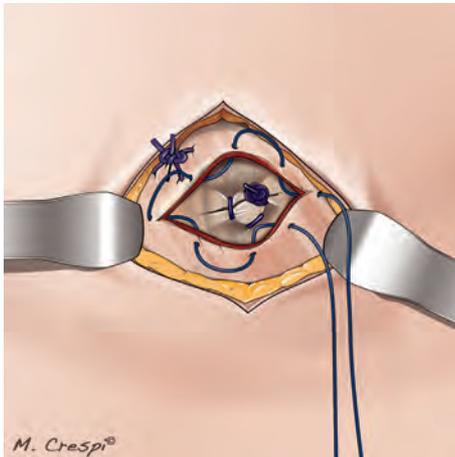
Because of the curves of the instruments there is no interference between the instruments' tips

internally or between the surgeon's hands externally ([similar to Figure 10](#)).

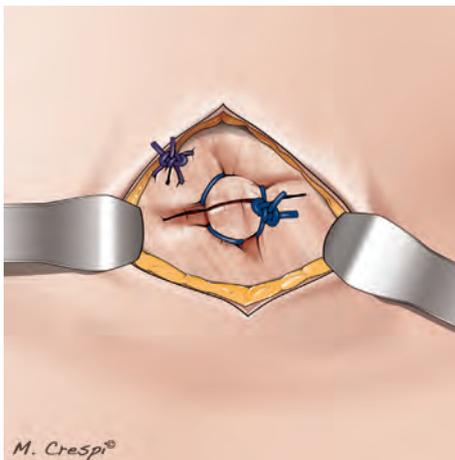
Peri-operative estimation of the hernia defect size using four percutaneous straight needles ([similar to Figure 11](#)) enables appropriate mesh size selection, resulting in a minimal overlap of 3 cm in all directions ([similar to Figure 12](#)). The dualface mesh is rolled tightly to be introduced into the cavity through the 11-mm trocar with the straight grasping forceps ([similar to Figure 13](#)). Percutaneous sutures (Ethilon 2/0) supported by straight needles are temporarily used to affix the mesh to the parietal wall (one in the middle of the mesh for small mesh and two at the cardinal points for bigger mesh). The straight needle is passed through the abdominal wall into the peritoneal cavity ([similar to Figure 14](#)), then into the mesh at the preformed suture ([similar to Figure 15](#)), and finally it is pushed once again outside the abdominal cavity ([similar to Figures 16, 17](#)). The four straight needles are removed.

Absorbable tacks are used to fix the mesh to the abdominal wall in a double-crown technique ([similar to Figure 18](#)), while the surgeon applies an appropriate level of manual pressure externally ([similar to Figure 19](#)). At the end of the mesh fixation, the temporary percutaneous sutures are removed ([similar to Figure 20](#)).

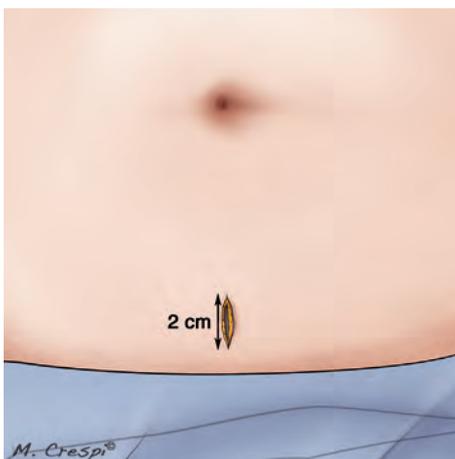
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End of Both Procedures

If necessary, the operative field is cleaned at the end of the procedure using the monocurved suction and irrigation cannula, and no drain is left in the hernia defect.

The operating room table is repositioned as it was in the beginning of the procedure, without any tilt and Trendelenburg position.

All the instruments are removed from the abdomen under view of the mesh, and the bicuspid grasping forceps (if used) is retrieved following its curves at 45° with respect to the abdominal wall.

After having removed the 11-mm trocar for the scope, the separate fascia opening for the bicuspid grasping forceps is closed by Vicryl 1 suture, and the two purse-string sutures (placed at the beginning of the procedure) are tied (Figures 21, 22). If required, other simple Vicryl 1 sutures are placed as well. The cutaneous scar is closed by Monocryl 4/0 intradermic sutures (Figure 23).

Post-operative Care

One gram paracetamol is given i.v. at the end of the surgical procedure. Post-operative analgesia is given following the WHO visual analog pain scale (VAS). In the recovery room, the following scheme is followed: for VAS between 1 and 3, 1 g paracetamol i.v. is administered; for VAS between 4 and 8, 100 mg tramadol i.v. is used; for VAS greater than 8, 1 mg piritamide i.v. is incremented.

Once the patient leaves the recovery room, pain is assessed every 6 hours, with 1 g paracetamol administered i.v. if VAS is between 1 and 3, and 100 mg tramadol administered i.v. if VAS is between 4 and 8.

The patient is allowed to drink water on the 1st post-operative day, and to tolerate a light diet after 24 hours. If there are no complications, the patient can be discharged.

Upon discharge, 1 g paracetamol perorally or 50 mg tramadol perorally are prescribed only if needed.

Office visits are scheduled at 10 days, 1, 3, 6, 12 and 24 months after the procedure.

