Right sided Colectomies: A stepwise approach

Ileocolic resection for Crohn’s disease

• Introduction

Ileocolic resection is the most common bowel operation performed for Crohn’s disease. Two randomised trials and two systematic reviews indicated the laparoscopic approach to be associated with a faster recovery and less morbidity. In a traditional care program patients who underwent laparoscopic surgery were discharged 2 days earlier compared to those having undergone open surgery. It is obvious that cosmesis is superior, and advantages such as easier (laparoscopic) re-resection for recurrent disease and lower risks on small bowel obstruction resulting from adhesions may be expected. In a traditional care program the laparoscopic approach must therefore be considered the procedure-of-choice; provided the laparoscopic expertise is sufficient. Other indications for ileocolic resection are: villous adenoma or polypoid lesions not amenable for endoscopic removal.

• (Relative) Contraindications:
  - Prior midline laparotomy (likelihood of adhesions).
  - Fixed mass on palpation. A large mass is difficult to mobilize. To exteriorise the specimen, a large incision has to be made.
  - Entero-enteric, enterovesical, enterovaginal, enterocutaneous and enterosigmoidal fistula.
  - Multiple strictures requiring multiple stricturoplastys or -resections

• Preoperative workup (imaging)

A thorough preoperative evaluation of the small bowel (small bowel series) is imperative to determine other small bowel strictures besides the ileocolic involvement. A colonoscopy must be performed to evaluate the presence and extent of Crohn’s colitis and colonic strictures.
If an abscess is suspected, a CT scan must be performed. Percutaneous drainage, resulting in resolution of the abscess and inflammatory mass, must precede a surgical intervention.

- **Peri-operative management**
  No bowel preparation is required prior to surgery. Patients can be prepared with one or two enemas. The patient can be positioned on a short bean-bag with the legs strapped in leg supports (French position); or lying on the table with the legs parallel and strapped to the table. The French position enables the surgeons to stand besides the table and in between the legs. At the same time, it is possible to advance a circular stapler through the anus in case a low anterior is required due to of possible enterosigmoidal fistula. The left arm of the patient must be positioned alongside the patient’s body. A zero degree optics may be used, a 30 degrees optics is however to be preferred. Antibiotic prophylaxis is given according to local protocol.

- **Operative strategy**
  Laparoscopic ileocolic resection is an operation facilitated using the laparoscopic technique. The right colon is mobilised laparoscopically, and exteriorised via a mini-laparotomy. The location of the extraction site determines how far the right colon must be mobilised. If the inflammatory mass is relatively small, it can be exteriorised through a small incision through the umbilicus. If the mass is relatively large, and a larger incision is required to exteriorise the specimen, a Pfannenstiehl incision may be preferred for optimal cosmesis. Other reasons for choosing a Pfannenstiehl incision may be the enterovesical, enterovaginal, or enterosigmoidal fistula. Mobilisation of the right colon can be done in three ways. It can be done using the lateral approach, the medial approach or hand-assisted approach. The extraction site and trocar position vary according to the method of choice. If a Pfannenstiehl is preferred for extraction, the right colonic flexure must be mobilised completely.
This can best be achieved using either a medial to lateral approach or using the hand-assisted technique. In the presence of an enterovesical, enterovaginal, or enterosigmoidal fistula, the Pfannenstiehl incision can be used assessing this problem prior to mobilising the right colon. A hand-port can be inserted trough the Pfannenstiehl incision to facilitate mobilizing the right colon, or it can be closed using a wound protector followed by laparoscopic mobilisation.

- **Operative technique:**
  1. Laparoscopic mobilisation of the right colon and terminal ileum.
     a. *Lateral to medial approach*
        
        The surgeon is positioned between the legs of the patient (French position) or on the left side of the patient, the first assistant stands on the left side. The left arm of the patient must be positioned alongside the body. A zero or 30 degrees optics is used.

        **Step I:** Establishment of pneumo-peritoneum using either the open-approach using a blunt tip trocar at the umbilical site, or using a Veress needle with proper technique.
        **Step II:** Three trocars are inserted: one at in the umbilical site (10 mm), one in the right or left lower abdomen (10 mm) and one in the suprapubic area (5 mm).
        **Step III:** The table is tilted both in Trendelenburg position and to the left side of the patient.
        **Step IV:** The small bowel is evacuated from the pelvis into the left upper abdomen. If the small bowel is fixed in the pelvis or attached to the sigmoid, an enteric (enterovesical/enterosigmoidal) fistula must be suspected.
        **Step V:** The assistant uses a 10 mm a-traumatic grasper inserted trough the umbilical port in order to gently retract the ileocolic corner.
        **Step VI:** The surgeon operates the zero degrees optic in the left hand, using a scissor with monopolar coagulation to loosen the lateral attachments of the colon.
Care must be taken to grasp the bowel only on the parts that will be removed, e.g. the mesentery or the fatty attachments. Since some retraction is required for having sufficient exposure, there is inherent danger of tearing the (diseased) bowel with subsequent bleeding or perforation.

The advantage of this approach is, however, that is very familiar to the route known from performing the open procedure.

Step VI: If the right colon is sufficiently mobilised, a trans-umbilical incision is made to exteriorise the right colon (specimen).

b. Medial to lateral approach

The mobilisation of the right colon is very similar to the first steps of a laparoscopic right colectomy for cancer. The surgeon is positioned between the legs of the patient (French position) or on the left side of the patient, the first assistant stands on the left site. The left arm of the patient must be positioned alongside the patients’ body. A zero or 30 degrees optics is used.

Step I: Establishment of pneumo-peritoneum using either the open-approach using a blunt tip trocar at the umbilical site, or using a Veress needle with proper technique.

Step II: Four trocars are inserted: one at the umbilicus (10 mm), one in the right lower or upper abdomen (5 mm), one in the suprapubic area (10 mm) and one in the left lower abdomen location.

Step III: The table is tilted both in Trendelenburg position and to the left side of the patient.

Step IV: The small bowel is evacuated from the pelvis to the left upper abdomen. If the small bowel is fixed in the pelvis or attached to the sigmoid, an enteric (enterovesical / enterosigmoidal) fistula must be suspected.

Step V: The assistant uses a 5 or 10 mm a-traumatic grasper, inserted trough the umbilical port to retract the mesentery of the small bowel at the level of the aortic bifurcation.
Step VI. The surgeon uses a 5 mm a-traumatic grasper in his left hand to gently lift the mesentery of the small bowel at the level of the ileocolic junction. In the surgeons’ right hand a monopolar scissors or ultrasonic dissector is inserted through the left lower 5 mm port.

Step VII. Incision of the peritoneum overlying the small bowel mesentery.

Step VIII. Creation of the sub-mesenteric tunnel. Identification of the duodenum. The assistant places the a-traumatic grasper in the tunnel, and lifts the mesentery cranially and medially. The sub-mesenteric tunnel is developed starting from the lower border of the duodenum upward towards the superior and lateral attachments of the transverse and right colon, respectively.

Step IX. Loosening of the lateral and superior attachments of the colon, operating from inferiorly to superiorly.

Step X. Exteriorisation of the right colon (specimen) either through a 5-6 cm Pfannenstiehl or transumbilical incision.

c. Hand-assisted approach

The surgeon stands on the left of the patient and the assistant in-between the legs (The French position is advised). The left arm of the patient must be positioned alongside the patient’s body. A zero or 30 degrees optics is used.

Step I: Skin incision in the suprapubic region with sufficient length to accommodate the size of the surgeon’s glove. Transverse incision of the external aponeurosa and up-and-down incision midline incision at the level of the rectal muscles.

Step II. Trendelenburg position and left lateral tilt. Evacuation of the small bowel out of the pelvis. If present, a enterosigmoidal / enterovesical fistula must be treated. An enterosigmoidal fistula is treated by excision of the fistula in an otherwise healthy sigmoid that can be closed subsequently. Enterovesical fistula is treated by dissecting the bowel away from the bladder, which is only drained if
the fistula is small. Otherwise, the fistula orifice is excised and closed; preferably with omental interposition.

Step III. A 10 mm umbilical trocar is inserted and a 5 mm trocar in the epigastric region.

Step IV. The hand port is inserted through the Pfannenstiehl. The surgeon inserts the left hand in the hand port. Optics are inserted through the umbilical port. Using the right hand, an ultrasonic dissector is introduced through the epigastric port.

Step V. At the level of the pyloric muscle, the omentum is transsected. The cleavage plane between the duodenum and transverse colon is opened. The dissection starts mediocranially towards the ascending colon, further down until the mesentery of the appendix the right colon are completely mobilised.

Step VI. The right colon (specimen) is exteriorised through the Pfannenstiehl incision after removal of the hand port.

2. Open ligation, transsection and anastomosis

Once the bowel is sufficiently mobilised, it can be exteriorised enabling open vascular ligation, transsection of the bowel and creation of the anastomosis. Often, the transumbilical incision is relatively tight (too small), hence making exteriorisation through this site difficult. Once the inflamed bowel with its thickened mesentery can be exteriorised, the mesentery itself has more space in the umbilical incision. Care must be taken that the abdominal muscles are relaxed, especially until the end of the operation, otherwise venous congestion might occur resulting from mobilisation through a small incisional opening, further stressed by heightened muscle tone. Once ligations, transsection and the anastomosis are done, the anastomosed bowel is carefully repositioned in the abdomen. The umbilical fascia is closed and the umbilical skin is reconstructed. Most of the incision will disappear in the shallow of the umbilicus.

The Pfannenstiehl incision may be enlarged to facilitate removal of a relatively large inflammatory mass without compromising cosmetics. The Pfannenstiehl incision is
closed in layers. It is important to close Scarpa´s fascia to align the skin layer superiorly and inferiorly of the incision properly.

Right colectomy for cancer

- **Introduction**
  
  It has been well established that segmental colectomy for cancer is feasible and safe with similar oncologic results when compared to open surgery. Institutional trials indicate even superior results for the laparoscopic approach.

- **(Relative) Contraindications:**
  
  - Prior midline laparotomy (likelihood of adhesions).
  - Fixed mass on palpation. A large fixed mass is an indication for abdominal wall invasion or tumour perforation with accompanying inflammatory mass.
  
  If exteriorisation of the tumour/mass requires a relatively large incision there might be no benefit of a laparoscopic approach.

- **Preoperative workup (imaging)**
  
  The precise location of the colonic cancer must be clear. If the tumour is localised using a colonoscopy, one must be sure that the coecum has been visualized. If not, the location is not reliably assessed. In these circumstances either a barium enema or a CT scan should be performed. If the tumour is relatively small, it must be localised either by colonoscopic tattooing or by performing a peroperative colonoscopy. In the elective setting, routine assessment for metastatic disease using abdominal CT-scan to assess liver metastasis and plain X-ray of the thorax to assess lung metastasis is mandatory. The CEA is taken preoperatively for later follow-up.

- **Perioperative management**
No bowel preparation is required prior to surgery. Patients can be prepared with one or two enemas. The patient can be positioned on a short bean-bag with the legs strapped in leg supports (French position); or lying on the table with the legs parallel and strapped to the operative table. The left arm of the patient is positioned alongside the patients’ body.

- **Operative strategy**

The right colectomy for cancer can be performed laparoscopic-assisted, hand-assisted or total laparoscopically. In the “assisted” procedure the right colon is de-vascularised, transsected and exteriorised followed by an open creation of the anastomosis. In the hand-assisted procedure the right colon is mobilised completely, and de-vascularisation, transsection and creation of the anastomosis are performed extra corporeally (like in open surgery). A total laparoscopic procedure including the laparoscopic creation of the anastomosis is possible in experienced hands.

I. **Laparoscopic-assisted right colectomy for cancer**

In dealing with cancerous lesion, most surgeons nowadays prefer the medial-to-lateral approach applying a vessels-first, no-touch technique. The procedure can be started creating the sub-mesenteric tunnel from below (inferior sub mesenteric approach), or by ligation of the ileocolic pedicle (anterior sub-mesenteric approach):

A.1. **Inferior sub-mesenteric approach**

The surgeon stands either in-between the legs of the patient (French) or on the left lower side of patients body. The assistant is standing on the left side.

Step I: Establishment of pneumo-peritoneum using either the open-approach using a blunt tip trocar at the umbilical site, or using a Veress needle with proper technique.

Step II: Four trocars are inserted: one in the umbilicus region (10 mm), one in the right lower or upper abdomen (5 mm), one in the suprapubic area (10 mm) and one in the left lower abdomen (11-12 mm).
Step III: The table is tilted both in Trendelenburg position and to the left side of the patient.
Step IV: The small bowel is evacuated from the pelvis into the left upper abdomen.
Step V: The assistant uses a 5 or 10 mm a-traumatic grasper inserted through the umbilical port, gently retracting the mesentery of the small bowel at the level of the aortic bifurcation.
Step VI: The surgeon uses a 5 mm a-traumatic grasper in the left hand to lift the mesentery of the small bowel at the level of the ileocolic junction. In the right hand an Ultrasonic dissector or Ligasure device is inserted through the left lower 11-12 mm port.
Step VII: Incision of the peritoneum overlying the small bowel mesentery.
Step VIII: Creation of the sub-mesenteric tunnel. Identification of the duodenum. The assistant places the a traumatic grasper in the tunnel and lifts the mesentery both cranially and medially. The sub-mesenteric tunnel is developed starting from the lower border of the duodenum downwards the superior and lateral attachments of the transverse and right colon, respectively.
Step IX: Opening of the peritoneum anteriorly at the level of the duodenum and inferiorly to the ileocolic pedicle. Dissection of the ileocolic pedicle.
Step X: Ligation of the ileocolic pedicle with either vascular stapler, clips or using the Ligasure sealing device.
Step XI: The assistant grasps the transverse mesocolon at the level of the middle colic artery bifurcation. The surgeon lifts the right part of the transverse colon. Dissection of the right branch of the middle colic artery. Ligation of right branch of middle colic artery and vein. Care must be taken not too severe the gastro duodenal vessels. If in doubt, the omentum must be transsected at the level of the bifurcation of the middle colic artery, and the bursa opened anteriorly to separate the stomach from the transverse colon.
Step X: Dissection of the mesocolon transversum up to the bowel. Transsection of the bowel using the endoscopic linear stapler.
Step XI. Dissection mesentery of terminal ileum. Transsection of terminal ileum 10 cm proximal to ileocolic junction.

Step XII. Transsection of lateral attachments of the right colon.

A.2. Anterior sub mesenteric approach

Surgeon is standing on the left side. The assistant in between the legs of the patient.

Step I: Establishment of pneumo-peritoneum using either the open-approach using a blunt tip trocar at the umbilical site, or using a Veress needle with proper technique.

Step II: Four trocars are inserted: one in the umbilicus (10 mm), one in the epigastric region (11-12 mm), one in the suprapubic region (midline, 5 mm) and one in the left lower abdomen (10 mm).

Step III: The table is tilted both in Trendelenburg position and to the left side of the patient.

Step IV: The small bowel is evacuated from the pelvis towards the left upper abdomen.

Step V. A 30 degrees optics is inserted in the left trocar. The assistant grasp the peritoneum overlying the ileocolic pedicle, and retracts it to anterior and laterally.

Step VI. The peritoneum alongside the root of the ileocolic artery is opened. The ileocolic pedicle is transected using staplers, clips or the Ligasure sealing device.

Step VII. Lifting of the transected ileocolic pedicle. The mesentery is mobilised from medial to lateral, using blunt dissection predominantly.

Step VIII. The mesentery is dissected towards the terminal ileum 10 cm proximal to the ileocolic junction. The small bowel is transsected using a linear Endostapler.

Step IX. Optics are inserted through the umbilical trocar. The assistant lifts the transverse colon at the level of the middle colic artery bifurcation using the epigastric trocar.

Step X. Dissection of the right branch of the middle colic artery. Ligation of right branch of middle colic artery and vein. Care must be taken not too severe the gastro duodenal vessels. If in doubt, the omentum must be transsected at the level of the
bifurcation of the middle colic artery and the bursa opened anteriorly to separate the stomach from the transverse colon.

Step XI. Dissection of the mesocolon transversum up to the bowel. Transsection of the bowel using the endoscopic linear stapler.

Step XII. Transsection of the lateral attachments of the right colon.

B. Exteriorisation, retrieval and anastomosis.

1. Handsewn anastomosis.

Step I. Exteriorisation of bowel in a retrieval bag, inserted through the sheathed wound protector.

Step II. Re-insufflation and establishment of the pneumo-peritoneum. Exteriorisation of the stapled small bowel and transverse colon ends. Care must be taken for the orientation of the mesentery. If necessary, the omentum must be freed from the transverse colon in order to enable tension free externalisation of the anastomotic ends.

Step III. Side to side or end to side anastomosis.

2. Double stapled anastomosis:

Step I. Anticipating a double stapled anastomosis, neither the large bowel nor the small bowel is transsected. The specimen is externalised through a wound protector.

Step II. Insertion of the 100 mm linear stapler in small bowel and large bowel ostomies. After firing, transsection of large and small bowel using a 100 mm linear stapler resecting the ostomies creating a side-to-side anastomosis.

II. Hand-assisted right colectomy (see also section A.)

The surgeon stands on the left of the patient and the assistant in-between the legs.
Step I: Skin incision suprapubic with a length accommodating the size of the surgeon’s glove. Transverse incision of the external aponeurosa and up and down incision midline incision at the level of the rectal muscles.

Step II. Position the patient in Trendelenburg position and establish left lateral tilt.

Removal of the small bowel out of the pelvis. If present, enterosigmoidal / enterovesical fistula must be treated. An entero-sigmoidal fistula is treated by excision of the fistula in an otherwise healthy sigmoid, which can be closed subsequently. An entero-vesical fistula is treated by dissecting the bowel away from the bladder, which is only drained if the fistula is small. Otherwise, the fistula orifice is excised and closed, preferably with omental interposition.

Step III. A 10 mm umbilical trocar is inserted and a 5 mm trocar in epigastrio.

Step IV The hand port is inserted in the Pfannenstiehl incision. The surgeon inserts the left hand in the hand port. The videoscope is inserted in the umbilical port. With the right hand, an ultrasonic dissector is introduced trough the epigastric port.

Step V. At the level of the pyloric muscle, the omentum is transsected and the cleavage plane between the duodenum and transverse colon is opened. Dissection is performed from mediocranially downwards the ascending colon and the mesentery of the appendix, so that the right colon is completely mobilised.

Step VI. The right colon is externalised through the Pfannenstiehl incision after removal of the hand port, and insertion of a wound protector

Step VII. Open vascular ligation, transsection and creation of the anastomosis according to surgeon’s preference.

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