

## CHIRURGIE INTESTINALE PAR LAPAROSCOPIE

*Auteure : Carol Shack, infirmière autorisée, CPN(C), infirmière enseignante régionale, Winnipeg Regional Health Authority (WRHA).*

### RÉSUMÉ :

La chirurgie intestinale est effectuée quotidiennement dans grand nombre d'hôpitaux à travers le monde. Le développement de la chirurgie laparoscopique pendant les années 1990 a fait de la chirurgie intestinale par laparoscopie une option de plus à considérer par les patients. L'article passe en revue l'anatomie générale du gros intestin et identifie les indications, les contra-indications, les préparatifs à la chirurgie, et les faits préopératoires à considérer relatifs à la chirurgie intestinale par laparoscopie. Une brève description des divers types de résection intestinale par laparoscopie est présentée accompagnée des complications et des avantages de chacun. L'avenir de la chirurgie intestinale par laparoscopie est également discuté.

## LAPAROSCOPIC BOWEL SURGERY

*Author: Carol Shack, RN, CPN(C), Regional Perioperative Nurse Educator, Winnipeg Regional Health Authority (WRHA).*

### ABSTRACT

Bowel surgery is performed on a daily basis in many hospitals around the world. With the introduction of laparoscopic surgery in the 1990s, laparoscopic bowel surgery has become an option for patients to consider. This article will briefly review the anatomy of the large bowel and identify indications, contraindications, preoperative preparations, and intraoperative considerations for laparoscopic bowel surgery. A brief description of the various types of laparoscopic bowel resection procedures will be presented along with the advantages and complications. The future of laparoscopic bowel surgery will also be presented.

### INTRODUCTION

The technique for laparoscopic bowel surgery has been explored since 1991. The first published study of laparoscopic colectomy was in 1991 by Jacobs et al.<sup>1</sup> The procedure can be performed for an anterior resection, hemicolectomy, colostomy formation, colostomy closure, sigmoid colectomy, or abdominal perineal resection. To perform these procedures, a surgeon requires advanced skills in laparoscopic surgery. Surgeons are required to operate from multiple view points, recognize anatomy from unfamiliar aspects, be familiar with complex laparoscopic instrumentation and have dexterity in suturing.<sup>2</sup> In addition, surgeons need to identify the site of the lesion, mobilize the segment of the bowel, devascularize the bowel's mesenteric blood supply, and create a functional end-to-end anastomosis all without the use of tactile sensation. There is a long learning curve involved in becoming proficient in performing this procedure. The surgeon may need to perform 20-50 cases in order to become proficient. The technique of the surgeon is especially important when performing surgery for malignancies and can be perfected by performing surgery on patients with non-malignant tumours.

### ANATOMY

The large intestine begins at the ileocecal valve, terminates at the anus and consists of three parts: the colon, cecum, and rectum.<sup>3</sup> The cecum is attached to the ileum and includes a blind pouch that extends below the ileum. Attached to this blind pouch is the appendix.<sup>4</sup>

The colon is divided into the ascending colon, transverse colon, descending colon, and the sigmoid colon. The ascending colon extends from the ileocecal valve to the hepatic flexure. The upper portion of the ascending colon lies posterior to the right lobe of the liver and anterior to the right kidney. The transverse colon runs from the hepatic flexure to the splenic flexure. The transverse colon lies inferior to the stomach and is attached to the transverse mesocolon. The descending colon runs from the splenic flexure to just below the iliac crest. The sigmoid colon lies on the inner surface of the left iliac muscle. The sigmoid colon lies in both the abdomen and the pelvis. The S-curve of the sigmoid colon starts in the pelvis and ends at the rectum. The rectum

consists of circular and complete longitudinal muscle layers. The rectum is surrounded by the pelvic fascia and lies anterior to the sacrum and coccyx. It originates at the sigmoid and terminates in the anus. The superior mesenteric artery supplies blood to the ascending colon, hepatic flexure, transverse colon, and splenic flexure. The inferior mesenteric artery supplies blood to the descending colon, sigmoid colon, and rectum.<sup>4</sup>

### INDICATIONS

Indications for laparoscopic bowel surgery are the same as for traditional bowel surgeries. Indications are divided into benign and malignant.<sup>4,5</sup>

#### Benign

1. Polyps and familial adenomatous polyposis (growths in the large bowel that may advance to malignant lesions);
2. Localized inflammatory bowel disease such as Crohn's or colitis;
3. Cecal or Sigmoid volvulus;
4. Symptomatic arteriovenous malformation;
5. Diverticular disease that causes localized inflammation, bleeding, or stricture;
6. Closure of colostomy;
7. Ischemic colitis;
8. Rectal Prolapse; and
9. Constipation.

#### Malignant

Laparoscopic bowel resection for colon cancer may be performed on local lesions for cure or metastatic lesions for palliation. The literature suggests that at this time laparoscopic bowel surgery should only be offered to cancer patients who are in a randomized trial.<sup>6</sup> Data coming in indicates short-term benefits and further study is indicating that there may also be long-term benefits. In the treatment of cancer, reliable long-term benefit data is still unavailable. Early reports indicate an increase in port site recurrence or metastases compared to open surgery, but this may be incorrectly reported.<sup>5,7,8, 9,10,11,12,13,14</sup> Poor initial results regarding the use of this procedure for malignant tumours may be related to poor technique and proficiency. As mentioned earlier, proficiency can be improved by performing this surgery for non-malignant tumours.

### CONTRAINDICATIONS

Contraindications are divided into absolute and relative. Relative indications may not preclude the patient from surgery.<sup>4,6</sup>

#### Absolute

1. Intolerance to general anaesthetic as the patient would be unable to tolerate a laparotomy;
2. Tumors larger than 8 to 10 cm.
3. Diffuse fecal or purulent peritonitis. This would prevent the complete exploration, irrigation, drainage, or debridement of the abdominal cavity in a timely fashion;
4. Uncorrectable bleeding either active or that resulting in hypovolemia;
5. Extensive metastatic spread to one or more adjacent organs;
6. Extensive previous surgery with known adhesions;
7. Surgeon inexperience;
8. Massive abdominal distention; or
9. Colonic perforation and free peritonitis.

#### Relative

1. Inflammatory bowel disease with a friable bowel wall;
2. Morbid obesity;
3. Large abdominal aortic aneurysm;
4. Generalized peritonitis;
5. Advanced cardiopulmonary disease; or
6. Advanced pregnancy.

### PREOPERATIVE PREPARATION

Preoperatively the patient must undergo various tests and procedures. Because of the loss of tactile sensation it is extremely important that the exact locations of any tumours or polyps are identified. This can be done by means of an intraoperative ultrasound, a preoperative plain x-ray, or injection of India ink to mark the location of the lesion preoperatively. Preoperatively the patient will require a colonoscopy or barium enema to identify the lesion and have biopsies or specimens obtained and sent for microscopic analysis.<sup>5</sup> If the patient has cancer then Liver Function Test (LFT) and Carcinoembryonic Antigen (CEA) levels are drawn. Also for cancer patients, a computerized tomography (CT) of the abdomen and pelvis are done. Depending on the patient's age, an

## LAPAROSCOPIC BOWEL SURGERY (cont.)

electrocardiogram (EKG), chest x-ray, and serum creatine are done. Routinely glucose, electrolytes, hemoglobin, urea, a type and screen or a group and match are done and prothrombin time/partial thromboplastin time is drawn.<sup>4</sup>

The patient receives a bowel preparation preoperatively. Adverse effects of the bowel preparation may include serious hypocalcaemia, hyperphosphatemia, hypernatremia, hypokalemia, and metabolic acidosis. The patients with renal insufficiency or congestive heart failure, as well as frail and elderly patients are usually adversely affected by the use of two bottles of sodium phosphate as a bowel preparation. It is now recommended that no more than one bottle of sodium phosphate be used in a 24 hour period in order to prevent complications. Prophylactic antibiotics are given.

In the preop holding area it is important for the OR nurse to assess any of the patient's physical limitations that will affect positioning. The patient must not have anything to eat or drink. If the patient is diabetic, a blood sugar is checked using a glucometer. The nurse ensures that the patient has taken anti-hypertensive medication as scheduled. The circulating nurse should be prepared to assist with the insertion of an epidural and other invasive monitoring as determined by anaesthesia.

### INTRAOPERATIVE CARE

#### Room Set-up

The surgeon stands on the side of the patient that is opposite to that being operated on. For abdominal perineal resection, anterior resection, or sigmoid resection, the surgeon usually starts on the right side, but may move from side to side throughout the procedure. The assistant will stand opposite of the surgeon. The camera operator will stand at the top or at the bottom of the surgeon depending on the portion of bowel being operated on. Depending on the procedure the scrub nurse may stand between the patient's legs or on the opposing side of the surgeon.

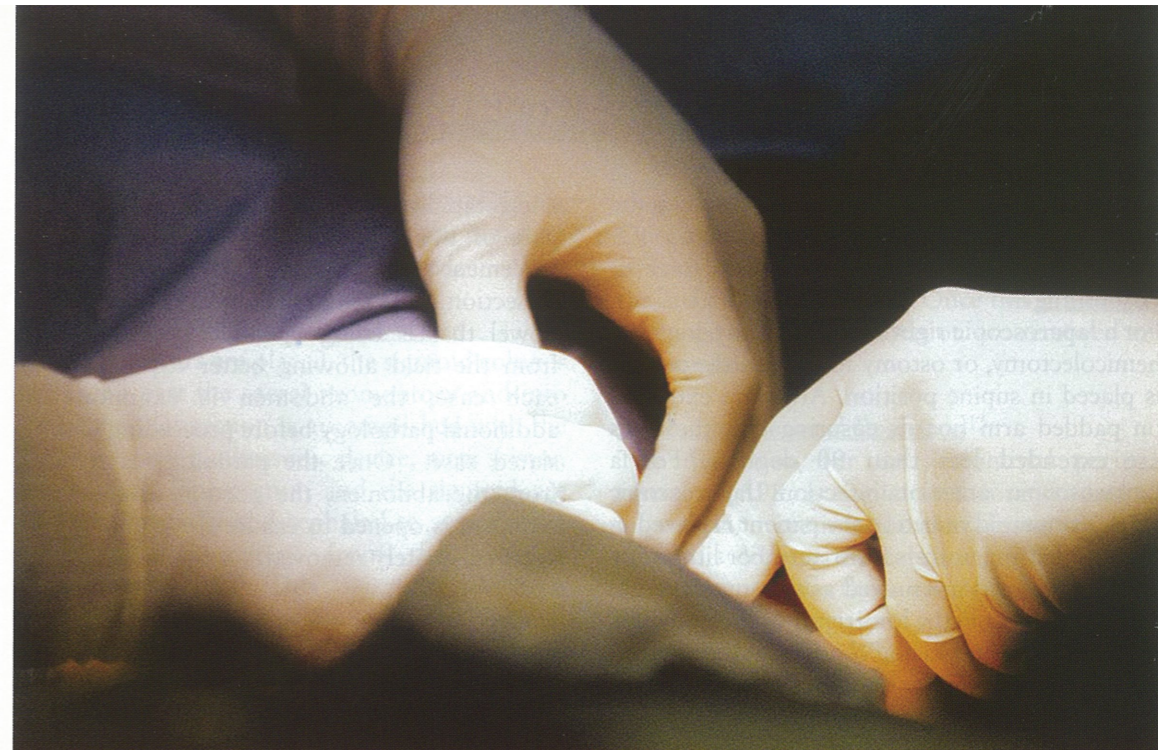
#### Equipment

Locate the main laparoscopic monitor on the side of the patient opposite to that being operated on.

Locate the secondary monitor on the opposing side. If the procedure is done in the supine position, the monitors are placed at the head of the bed. Depending on the segment of the bowel being operated on, it may be necessary to move the monitors to approximately halfway down the side of the bed. If the procedure is a laparoscopic Abdominal Perineal Resection (APR), anterior resection, or sigmoid resection done in the lithotomy position, the monitors are placed at the foot of the bed. The suspension arm may be used to elevate cables off of the floor if equipment boom arms and monitors are not available in the theater. This will prevent staff tripping over cables or accidentally running over them with tables. The cautery machine is placed at the top left of the patient and is plugged into the wall outlet separate from the other equipment and monitors. This prevents interference from the electrical equipment monitors and anaesthetic equipment. A cautery pencil with smoke evacuator is opened for use during the mini laparotomy or ostomy formation part of the surgery. The vessel sealing device is placed at the top of the bed. The site of the surgery will dictate where to place this equipment. It is placed on the same side as the surgeon. The ligasure, ultrasonic device, and cautery are not used simultaneously.

#### Instrumentation

It is imperative that the scrub nurse be familiar with the operation and function of all laparoscopic equipment and instrumentation. The scrub nurse will have laparoscopic instrumentation and cut down instruments on the surgical table. Open trays are available in the event that you need to open. A full count of instruments, miscellaneous supplies, and laparoscopic seals is done (laparoscopic instruments are not counted). A full count is performed at closure as a mini-laparotomy is made to remove the specimen for a bowel resection or anterior resection and the perineum is opened to remove the specimen for a laparoscopic APR. A laparoscopic bowel clamp is always used. Pneumoperitoneum is initiated by introducing a Hassan trocar. For an anterior resection, sigmoid resection, or abdominal perineal resection a 5mm ligasure or ultrasonic device is used for dissection. This may also be used for right hemicolectomy or colostomy



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formation. To transect the bowel low in the pelvis an Endo GIA stapler will be used.

### Positioning

For a laparoscopic right hemicolectomy, high left hemicolectomy, or ostomy formation the patient is placed in supine position. Arms are extended on padded arm boards ensuring that the arms are extended less than 90 degrees. For a Laparoscopic anterior resection, laparoscopic APR, or sigmoid resection the patient is placed in lithotomy using universal stirrups. For lithotomy cases, both arms are tucked as the surgical team will be working in the lower part of the body and will need to stand facing the feet of the patient. For all cases, compression stockings, tensors, or sequential compression stockings may be applied to aid in prevention of deep vein thrombosis. Some surgeons may request insertion of a nasogastric tube. A foley catheter is inserted and a warming blanket is applied.

### PROCEDURE<sup>2</sup>

The surgeon may request a sterile rigid sigmoidoscope, a flexible sigmoidoscope, or a colonoscope to identify the lesion intraoperatively. Additional instrumentation may include a laparoscopic doyen bowel clamp and a laparoscopic needle driver. Additional bowel clamps may be needed if any transaction takes place outside of the abdomen. Usually a Hassan trocar is the initial trocar followed by additional trocars of various sizes to allow for introduction of the various instruments. Usually 4-5 trocars are placed. A 10mm 30 degree telescope or a 5mm 30 degree telescope will be used. A wound protector is used when removing the specimen from the abdomen to prevent infection or to prevent the possibility of seeding if surgery is for a malignant lesion. If the surgery is being done for benign disease, the vessels are divided close to the bowel wall. If the surgery is being done for cancer, the vessels are transected as close to their origin as possible. This results in a wide mesenteric resection and long proximal and distal margins.<sup>12,14</sup> Placement of trocars is surgeon specific; however placement must ensure adequate access to all parts of the bowel.

### Right Hemicolectomy

The patient is placed in reverse trendelenberg

and rotated to the left or right depending on the part of the bowel being operated on. This placement allows for the best exposure during dissection. The liver is allowed to drop and the bowel that is being operated on is displaced from the field allowing better exposure. For each case, the abdomen is examined for additional pathology before proceeding with the slated case. Once the pathology is removed from the abdomen, the portion of the bowel removed is opened to ensure the pathology has been adequately removed.

Understanding of the anatomical positions of the right ureter, second and third portions of the duodenum, ascending colon, pancreas, and right kidney are important for a right hemicolectomy. Additional trocars may be inserted depending on the equipment required. The small bowel is examined from the ligament of Treitz to the ileocecal valve. Mobilization of the ascending colon begins at the cecum. Traction/counter traction and curved metz scissors are used to dissect the colon from the lateral peritoneal attachments. The distal ureter is usually identifiable as dissection approaches the hepatic flexure. Detachment of the omentum from the transverse colon facilitates colonic mobilization. The ileocecal and right branch of the middle colic vessels are divided with ligaclips, Ligasure, or an ultrasonic device. Some literature talks about dividing with a vascular stapler, but this adds substantial cost.

Following mobilization, the bowel may be transected outside of the abdomen via a mini-laparotomy or intracorporeally. The transaction is done with bowel clamps, blade, and/or a stapler. Anastomosis may also be done either externally or laparoscopic. A regular gastrointestinal anastomotic (GIA) stapler will be used if the anastomosis is done outside of the abdomen. If the anastomosis is done intracorporeally then an endo GIA stapler with cartridges will be used. If transaction and anastomosis is done outside the abdomen, a wound protector is used prior to pull the bowel segment through the mini laparotomy. After anastomosis is completed through the mini Laparotomy the bowel is reintroduced to the abdominal cavity and the fascial opening is

closed. Once the anastomosis is complete the abdomen is checked one last time, the ports are removed, and the port sites are closed.

### Sigmoid Colectomy/Anterior Resection

Once the trocars are placed, the sigmoid colon is mobilized past the sacral promontory and into the pelvis. Dissection is accomplished with the use of a ligasure, ultrasonic device, metz scissor, and cautery. The rectum and the sigmoid are retracted medially and cephalad to suspend the bowel and mesentery from the anterior abdominal wall.<sup>5</sup> This is done with a laparoscopic bowel clamp. The lateral ligaments are exposed and anterolateral ligaments are transected. The sigmoid colon and descending colon are mobilized and the ureter is identified. The sigmoid colon should be mobilized past the sacral promontory into the pelvis. A true low anterior resection removes all of the mesorectum and allows transection of the rectum at the top of the anal canal (5cm above the Dentate Line).<sup>5</sup> A GIA stapler, designed for use in laparoscopic procedures, with a 60mm x 3.5mm cartridge is required to transect the bowel in the pelvis. Usually one cartridge is adequate.

Once the bowel is transected distally, a mini laparotomy is made and the bowel is protected by the wound protector and brought up through the incision. The proximal end is transected outside of the abdomen with the use of bowel clamps and a 15 blade. The purse string suture is placed on the proximal end of the bowel. The anastomosis is accomplished with an intra luminal (IL) stapler. The anvil from the IL stapler is secured. Once the anvil is secured, the bowel and anvil are reintroduced to the abdomen and the peritoneum of the mini laparotomy is closed. At this point the surgery reverts back to the laparoscopic mode.

The bottom end surgeon inserts the handle portion of the EEA stapler into the rectum. Through laparoscopic visualization the top end surgeon attaches the anvil to the stapler. This is accomplished with the 10mm right angle. The EEA stapler is fired by the bottom end surgeon in the usual way. The surgeon may check the

anastomosis with the use of a sigmoidoscope. Once the anastomosis is complete the abdomen is visualized to ensure there is no bleeding and the anastomosis is intact. Once this is done, the telescope and instrumentation are removed and the ports are closed.

### Abdominal Perineal Resection<sup>15</sup>

The dissection for an abdominal perineal resection (APR) is similar to that mentioned for an anterior resection. Further dissection of the rectum is done to the cul-de-sac. The perineal dissection precedes the same as for an open case. The perineal incision is closed as for a conventional APR. While the perineal resection is taking place, the transected portion of the bowel is pulled up through the left rectus abdominus colostomy site and a colostomy is fashioned.<sup>5</sup> Drains are placed into the pelvis through the right lower port site. Ports are closed in the usual way.

### COMPLICATIONS

Several articles discuss the complications of laparoscopic bowel surgery.<sup>4,5,12,16</sup> Complications from these procedures may be related to pneumoperitoneum, position, instrumentation, or the surgery itself. Complications related to pneumoperitoneum, positioning, and instrumentation are common to all laparoscopic procedures. Perspective and technical limitations of laparoscopic bowel surgery make injury to the ureter, urinary bladder, and duodenum most likely.

#### Complications of pneumoperitoneum:

1. Hypercarbia, acidosis;
2. Ventilation/perfusion mismatching;
3. Hypertension;
4. Bradyarrhythmias;
5. Ventricular arrhythmias;
6. Gas Embolism;
7. Pneumothorax;
8. Pneumomediastinum;
9. Subcutaneous emphysema; and
10. Phlebothrombosis and pulmonary embolism.

#### Complications related to positioning:

1. Neuropathy;
2. Hypotension; and
3. Deep vein thrombosis.

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### Complications related to instrumentation:

1. Trocar and verres needle injuries of the intestine or major vessels;
2. Abdominal wall bleeding;
3. Trocar site hernia;
4. Electrocautery burns;
5. Wound infections; and
6. Retractor injury.

### Complications related to the surgery:

1. Trocar site recurrence in cancer patients.  
This is theorized to be caused by tumor cell spillage, specimen retrieval through port sites without wound protection, possible detrimental effects on the intraperitoneal immunity by CO<sub>2</sub>, mechanical inoculation from instruments, tissue trauma causing ischemia, gas turbulence, or leakage around trocar sites causing a chimney affect. Numbers are now indicating that abdominal wall recurrence is no more common in laparoscopic surgery than in open surgery; <sup>5,7,8,9,10,11,12,13,14</sup>
2. Bowel injury;
3. Ureteral injury related to difficulty in identification;
4. Anastomotic leak;
5. Duodenal injury;
6. Torsion of the bowel; and
7. Inability to identify exact location of the lesion.

### ADVANTAGES

Reported advantages include:<sup>4,5,6,10,11,12,13,14,17,18</sup>

1. Improved cosmesis;
2. Quicker return to normal bowel function;
3. Shorter hospital stay;
4. Decreased post-op ileus;
5. Decreased pain and therefore less use of narcotics and ease of movement;
6. Quicker return to normal daily activities;
7. Decreased number of adhesions related to a decreased inflammatory response. Bessler et al report that in a porcine model comparing adhesion formation, after 14 days only 9% of those having a laparoscopic assisted colectomy had adhesions whereas 82% developed adhesions post laparotomy;
8. Quicker ambulation; and
9. Better immune response. Some literature

suggests that the stress to the body's immune system is less resulting in stronger immune systems post laparoscopic surgery.<sup>5,7,8,12,14</sup> This could contribute to fewer infections, faster recovery, and better killing of circulating malignant tumor cells.

### CONCLUSION

Laparoscopic bowel surgery is appropriate for the treatment of benign disease. More studies need to be conducted relating to its effectiveness in the treatment of malignant disease as early indications of metastasis and seeding may have been wrongfully reported. Advantages for the patient are numerous allowing for a faster return to normal daily activities than for an open procedure. With increasing numbers of laparoscopic bowel surgeries being performed, and with improved techniques, future reports may indicate laparoscopic bowel surgery is the standard of practice.

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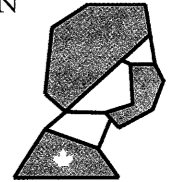
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