Complications in Colon and Rectal Surgery. Early Diagnosis and Management

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SUMMARY Background: Surgery for colon and rectum has significant complications. **Purpose:** This review article was undertaken to discuss the prevention, recognition, and management of the most common complications after colon and rectal surgery. **Results:** Some serious complications such as anastomotic leak and wound infection can be minimized with good bowel preparation, proper use of antibiotics, good technique, and judgment. Complications such as bladder dysfunction, and sexual dysfunction can also be minimized by the proper anatomic dissection which can avoid an unnecessary disruption of the pelvic nerves. Some complications can even be prevented: a splenic injury can be prevented by an adequate exposure, avoiding traction of the greater omentum, and first dividing the adhesions of omentum to the spleen before a full mobilization of the colon; necrosis and retraction of colostomy and ileostomy, especially in obese patients, can be prevented by an adequate mobilization to avoid tension and attention to the blood supply to the entire length of the ostomy limb. Some complications are unavoidable: massive life-threatening intraoperative pelvic bleeding from basivertebral veins requires a thumbtack occlusion; when to operate on patients with a prolongated postoperative small bowel obstruction requires a good judgment and skill. **Conclusions:** An appropriate knowledge of common and uncommon complications following colon and rectal surgery should permit a successful management

Key words: Colo-rectal surgery, complications.

RESUMEN Antecedentes: La cirugía colorrectal tiene complicaciones significativas. **Objetivo:** Este artículo de revisión se realizó para discutir la prevención, diagnóstico y manejo de las complicaciones más comunes posterior a cirugía colorrectal. **Resultados:** Algunas complicaciones serias, como fístula anastomótica e infección de herida, pueden disminuirse con una buena preparación del colon, uso apropiado de antibióticos, así como adecuada técnica y juicio. Complicaciones como disfunción vesical y disfunción sexual pueden también disminuirse con una apropiada disección anatómica que evite una ruptura innecesaria de los nervios pélvicos. Algunas complicaciones pueden incluso prevenirse: el daño esplénico puede evitarse con adecuada exposición, no realizando tracción del epiplón mayor, y dividiendo primero las adherencias del epiplón al bazo antes de la movilización completa del colon; la necrosis y retracción de ileostomías y colostomías, especialmente en pacientes obesos, puede prevenirse con una movilización adecuada para evitar tensión y atendiendo al aporte sanguíneo de la longitud total del asa del estoma. Algunas complicaciones son inevitables: la hemorragia pélvica masiva transoperatoria de las venas basivertebrales puede requerir oclusión con tachuelas especiales; el momento de operar pacientes con una obstrucción intestinal postoperatoria prolongada requiere de buen juicio y habilidad. **Conclusiones:** El conocimiento apropiado de las complicaciones comunes y poco comunes posteriores a cirugía colorrectal debe permitir un manejo exitoso.

Palabras clave: Cirugía colorrectal, complicaciones.

Colon and rectal surgery is prone to complications which reflect the physiologic and anatomical nature of the particular organ systems involved. Knowledge of these complications, both common and uncommon, is necessary for a successful management. The focus of this discussion will be on the prevention, recognition, and management of complications that are commonly seen or the complications that are uncommon but important ones.

OPERATIVE COMPLICATIONS

Presacral hemorrhage

During mobilization of the rectum, presacral bleeding can occur if the presacral fascia is stripped and the presacral vein (anterior external venous plexus) is torn. Although the bleeding is brisk, it usually can be controlled with packing, a stick tie, or electrocautery[1,2]. Bleeding from the spongy bone of the sacrum is usually mild and only a nuisance. On rare occasion, it can be massive and life-threatening.

A study by Wang et al.[3] revealed that in 15 percent of normal persons, the basivertebral vein connects between the presacral vein and the internal vertebral vein and is usually located at the level of S-3 to S-5 (Figure 1). Bleeding from this vein is not only massive, but also cannot be controlled by packing, electrocautery, stick tie, or occlusion with bone wax. The only effective method of temporarily stopping this type of bleeding is occluding the bleeding point with the index finger. For the permanent arrest of this type of hemorrhage, a thumbtack can be driven through the bleeding point into the sacrum to achieve occlusion[3,4,5] (Figure 2).

The diagnosis of bleeding from the basivertebral vein is not difficult. The location is almost always between S-3 and S-5. The bleeding point can be felt with the index finger as a dimple or an opening about 5 mm in size. This potentially fatal complication can be avoided by preserving the presacral fascia during
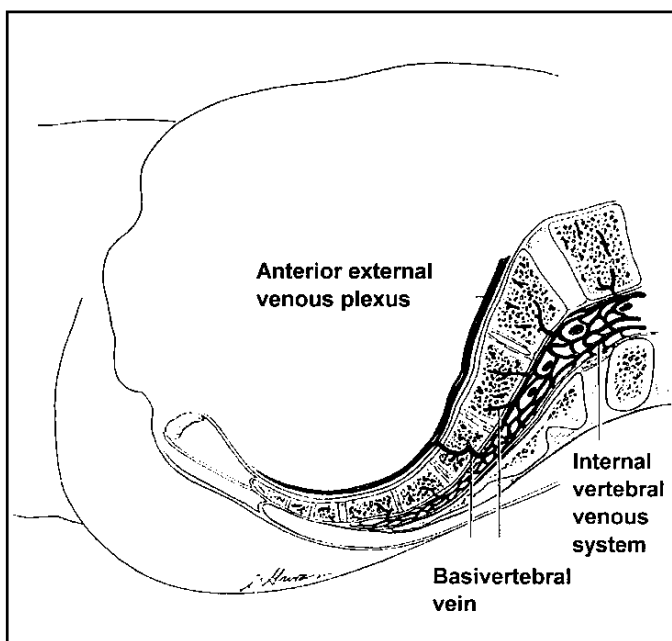

Figure 1. Venous system of sacrum. (From Nivatvongs, S., Fang, D.T. The Use of Thumbtacks to Stop Massive Presacral Hemorrhage. Dis Colon Rectum 1986; 29:589-590. Reproduced with permission).
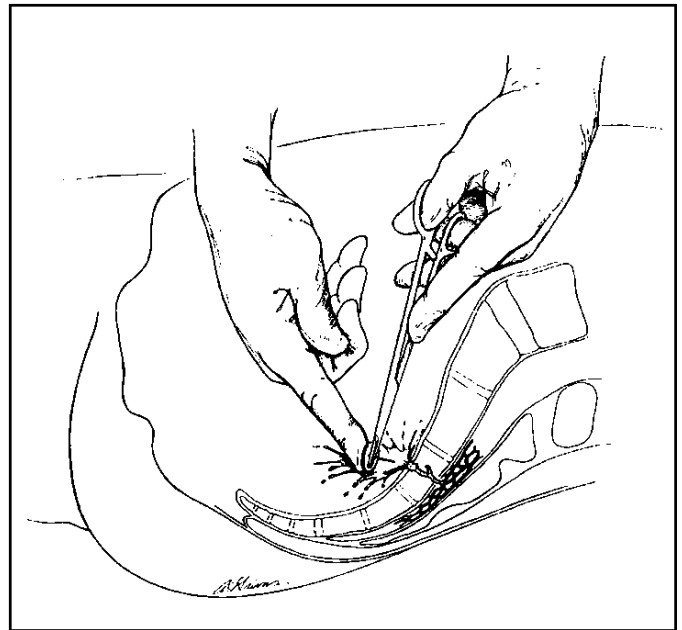

Figure 2. Technique of occluding basivertebral vein of sacrum with thumbtack. (From Nivatvongs, S., Fang, D.T. The Use of Thumbtacks to Stop Massive Presacral Hemorrhage. Dis Colon Rectum 1986; 29:589-590. Reproduced with permission).

mobilization of the rectum. Sharp dissection of the posterior rectum with scissors or electrocautery is recommended rather than conventional blunt dissection[6].

Splenic injury

Injury to the spleen due to avulsion of the splenic capsule is caused by vigorous traction on the omentum or by tearing the gastrosplenic, splenocolic, phrenicosplenic, or phrenicocolic ligaments. In one series of 237 splenectomies, 39 percent are performed because of iatrogenic injury during surgical procedures, the most common being left hemicolectomy[7]. In another series, half of the splenic injuries are caused by traction on an omental band leading to the spleen[8].

Prevention of splenic injury during colon and rectal surgery is first accomplished by providing adequate visualization with an appropriate incision. Mobilizing both the descending colon and the distal transverse colon will avoid excessive traction on the omentum and splenocolic ligament[8].

In keeping with the principles of traumatic splenic injury, preservation of the spleen after iatrogenic injury is advocated whenever possible. Not only is splenectomy associated with postsplenectomy sepsis but it may adversely affect the 5 year survival in patients with Dukes' C colorectal adenocarcinoma[9,10].

Ureteral injury

Iatrogenic ureteral injury during mobilization and excision of the rectum and sigmoid colon is well described with a reported incidence ranging from 0.5 to 6 percent[11,12,13]. The left ureter is more frequently injured than the right ureter and injury occurs more often during gynecologic operations than colon procedures. Surgical injuries are of four types: laceration, ligation, crush and devascularization. Unfortunately, 25 to 30% of these injuries are unrecognized at the time of surgery which increases the likelihood of additional morbidity[13].

Several maneuvers put the ureter at risk for injury during colorectal procedures: ligation of the inferior mesenteric artery, procedures performed near the cul-de-sac where the ureter crosses the vas deferens and at the sacral promontory, division of the lateral stalks of the rectum, and reperitonealization when the ureter may be included in ligatures[14]. Adequate exposure of the ureters during the course of the dissection is paramount. Routine prophylactic placement of ureteral catheters is not advocated, rather this modality should be reserved for patients at high risk for injury, specifically, patients with complicated diverticular abscess, advanced cancer of the sigmoid colon and rectum, or recurrent cancer in the pelvis and radiation to the pelvis[13].

Appropriate management depends on timing, type and location of the ureteral injury. Crush injuries are usually managed by temporary stenting (2-4 weeks) if the involved segment appears viable. When a segment of the ureter has been devitalized or excised above the pelvic brim, resection of this portion and end-to-end anastomosis over a double-J stent is performed. Ureteral division below the midpelvis is managed preferably by ureteroneocystostomy. Late discovery (days to weeks) of ureteral injury is managed by proximal urinary diversion and delayed repair[14].

POSTOPERATIVE COMPLICATIONS

Early postoperative small bowel obstruction

Mechanical small bowel obstruction can occur after any exploratory celiotomy, particularly procedures done below the transverse mesocolon. In the series reported by Stewart et al.[15], the incidence of early postoperative mechanical small bowel obstruction (within 30 days after operation) that requires reoperation after a right colectomy is 1.5 percent and for a left colectomy and resection of rectum is 3 percent. The diagnosis of early postoperative small bowel obstruction is difficult and usually impossible to differentiate from postoperative ileus. A typical patient with early postoperative small bowel obstruction is one who cannot tolerate removal of the nasogastric tube after seven days following the operation or one who has already started a liquid or soft diet and develops abdominal distention associated with nausea and vomiting. Typical signs and symptoms of early postoperative small bowel obstruction are nausea, vomiting, abdominal distention, and abdominal pain. Abdominal films are most valuable in confirming the diagnosis. Typically, the small bowel is dilated with or without air and fluid levels. In a complete or near-complete obstruction, the amount of air in the colon may be disproportionately less. Gastrointestinal barium studies are not always accurate and may not even be desirable in the early postoperative period. In the series reported by Pickleman and Lee[16], the interpretation of small bowel obstruction from gastrointestinal barium studies is correct in only 73 percent of patients. Ninety percent of postoperative small bowel obstructions occur during the first two weeks after the operation.

The management of an early postoperative small bowel obstruction is nasogastric suction and administration of fluid and electrolytes. An abdominal x-ray film should be taken once a day or every other day to follow the progress. The nasogastric suction can be continued as long as there is no increased distention of the abdomen, the abdominal cramps are not worse, and the body temperature and white blood count are not elevated. With careful monitoring, the obstruction can be treated with nasogastric decompression safely for 10-14 days[16]. In Pickleman and Lee series of 78 patients with small bowel obstruction treated by nasogastric compression, 70 percent resolved within one week, 26 percent within two weeks, and 4 percent within three weeks. Among 23 patients with obstruction who underwent exploratory celiotomy, 14 patients (61 percent) had obstructive bands, 7 patients (31 percent) had a phlegmon, 1 patient (4 percent) had an abscess, and 1 patient (4 percent) had intussusception. Three patients (13 percent) died after the operation, but none of the deaths were from strangulation or ischemia.

When to operate on patients with early postoperative small bowel obstruction is entirely based on clinical judgment. Generally, operation is decided on when the surgeon judges that the obstruction will not resolve with further nasogastric suction or when the surgeon is afraid that strangulation is occurring or may have occurred. A prospective study by Sarr et al.[17] shows that no lab tests have proven to be more

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sensitive than 52 percent, either when used alone or in combination.

Thromboembolism

Patients with inflammatory bowel disease are susceptible to thromboembolism due to abnormal platelet activity[18]. With a reported incidence of 1 to 7 percent and mortality rate associated with this complication as high as 25 percent, it is particularly important to colorectal surgeons[19,20,21].

Of the 92 thromboembolic episodes in a series by Talbot et al. 66 percent are peripheral or deep venous thromboses, pulmonary emboli, or both[20]. Predisposing factors include active inflammatory bowel disease, rectal versus colonic surgery, and postoperative wound infection[20,21].

The use of subcutaneous heparin, especially in high risk patients, is effective prophylaxis against deep vein thrombosis in general surgical patients and should be used in postoperative patients with inflammatory bowel disease[22]. In patients with severe deep venous thrombosis of the lower extremities, a caval filter should be considered before colonic resection is performed.

Anastomotic leak

A bowel anastomosis should heal per primum. The capacity of anastomotic healing is dependent on the patient's general and local condition. Conditions such as malnutrition, particularly hypoalbuminemia, diabetes, irradiation, shock, severe blood loss, and unprepared or poorly prepared bowel determine the risk involved in healing. Important technical factors that must be considered during bowel anastomosis include blood supply, tension, condition of bowel lumen, condition of bowel ends, and technique of anastomosis. When performed properly, the bowel anastomosis should heal well. There is no longer an issue of whether the anastomosis is done with one layer or two layers, with interrupted or continuous sutures, with a stapling device, or, most recently, with a biofragmentable anastomotic ring. These methods are all acceptable.

An anastomotic leak usually becomes apparent between five to seven days postoperatively. Early dehiscence (within 48 hours) is usually serious since adhesions have not developed. Fecal spillage gives rise to generalized peritonitis. If generalized peritonitis is obvious, along with other signs of sepsis, an urgent or emergent exploratory celiotomy is indicated. Any investigation to confirm the diagnosis is unnecessary and only delays treatment. Antibiotic coverage for

both aerobes and anaerobes should be started immediately. For an anastomotic leak that develops after 48 hours, pus or fecal material may be apparent if a drain is still in place. Plain abdominal films are useful in stapled anastomosis. If anastomotic dehiscence has occurred, the line or the ring of staples is broken. If the anastomotic leak is not apparent but is suspected, a gentle Gastrografin enema is the most accurate method of identifying the leak. A proctoscopy or flexible sigmoidoscopy may or may not be useful in identifying the dehiscence. A CT scan cannot be used to determine the location of an anastomotic leak, but the presence of accumulated fluid may suggest that a leak has occurred.

The management of anastomotic leak with generalized peritonitis should be directed at taking down the anastomosis, with the proximal end brought out as a colostomy or ileostomy and the distal end closed or brought out as a mucous fistula. For a left colon anastomosis, occasionally the inflammatory reaction is so dense that it becomes impossible to take down the anastomosis safely. In this situation, a diverting transverse colostomy or ileostomy and placement of a drain near the anastomosis should be performed. It is not appropriate to repair the anastomotic dehiscence or to reanastomose at this time. Numerous uncontrolled series have been published suggesting that the clinical leak rate is approximately 8 percent and when routine radiological examination is used, the rate doubles[23]. In a series reported by Pollard et al.[24], the overall leak rate for anterior and low anterior resections, including coloanal anastomosis, is about 7 percent. An anastomotic leak has serious consequences. Three of four patients with anastomotic leaks required reoperation and a colostomy. Although there are no deaths, all patients required a prolonged hospitalization, from 20-55 days.

Wound complications

The risk of the patient developing a wound infection is determined by the interaction of several factors including the type of bacterial contamination, the condition of the wound, the immunologic status of the patient, and the level of antibiotic agent present in the tissues at the time of contamination. The incidence of wound infection in a clean wound (type I) is relatively low at 1 to 3 percent, clean contaminated wounds (type II), contaminated wounds (type III) and dirty wounds (type IV), however, carry a risk of infection between 3 and 16 percent[2]. The appropriate use of mechanical bowel preparation and prophylactic antibiotics has

markedly reduced the incidence of wound infection and intra-abdominal abscess formation after colorectal operations[2]. Solla et al.[25] surveyed 500 clinically active, board-certified colorectal surgeons in the United States and Canada to obtain data regarding current methods of bowel preparation for elective surgery. All respondents used a mechanical preparation and some form of antibiotics. The favorite antibiotic regimen was oral antimicrobials combined with systemic antibiotics (88 percent). Concomitant administration of oral neomycin-erythromycin base and a systemic second generation cephalosporin active against both anaerobic and aerobic colonic bacteria, together with oral polyethylene glycol electrolyte mechanical colonic cleansing, is the most popular method of preoperative bowel preparation (58 percent)[25].

LONG TERM COMPLICATIONS

Urinary complications
Urinary tract dysfunction after rectal cancer surgery is reported between 7 and 70 percent and the incidence increases the more radical the cancer operation[26,27,28]. The etiology of voiding dysfunction includes areflexia, sphincter incompetence, outlet obstruction and reduction of bladder compliance. Loss of bladder sensation and the ability to void secondary to operative denervation of the bladder is the most common complication observed. This dysfunction is usually transitory, lasting only 2-3 weeks with measurable parameters of postoperative bladder capacity, sensation, and urinary flow rates improving over time in the majority of cases[26,27,29]. One exception is in the case of extended pelvic lymphadenectomy which results in complete division of the pelvic autonomic nerves and permanent urinary dysfunction[26].

The incidence of urinary dysfunction after low anterior resection is lower than after abdominoperineal resection. Fegiz et al.[30] reported bladder dysfunction in 20 percent of patients after abdominoperineal resection and 13 percent after low anterior resection in a series of 221 patients. Kinn and Öhman[27] reported impaired voiding in 7 of 22 men (32 percent) following catheter removal after rectal cancer surgery, but objective postoperative bladder disturbance is rare in their series. Symptoms of denervation are more commonly attributable to injury of sympathetic fibers (impairment of relaxation of the urinary sphincter) rather than parasympathetic fibers (lack of detrusor tone), possibly as a result of more energetic dissection in the anteroposterior plane than along the pelvic sidewalls[31].

In all patients with pelvic dissection, the Foley catheter is left in place for four to five days. The bladder dysfunction usually improves gradually. In some patients, the dysfunction persists when they are ready to be discharged. In this situation, instructions should be given for self-intermittent catheterization. A permanent bladder dysfunction is rare after a colorectal procedure. In symptomatic cases in men, the indication for prosthetic surgery should be liberal because even minor obstruction added to slight neurogenic detrusor muscle dysfunction can cause severe voiding difficulties[27].

Sexual dysfunction
Compared to other aspects of function and quality of life in colorectal cancer patients, sexual dysfunction, particularly in men, has received much attention in the literature. Dysfunctional erection and ejaculation are the main complications reviewed, although other parameters examined include libido, dyspareunia and orgasm[32]. The incidence of sexual dysfunction after treatment for rectal cancer ranges between 40 and 100 percent[26,27,33,34,35].

Paralleling urinary dysfunction, the incidence rises the older the patient and the more radical the dissection[26].

All available data to date focus on comparisons of sexual impairments after sphincter-saving versus sphincter-sacrificing surgical procedures. In general, nonstoma patients fare better than do stoma patients, however, very low anterior resections may result in long-term rates of impotence and ejaculatory dysfunction comparable with those after abdominoperineal resection (58 and 66 percent respectively)[33]. The same autonomic nerve trunks involved in preserving bladder function also preserve sexual function in males. Ejaculatory function depends on the sympathetic nerves (hypogastric nerves), and erectile function depends on the parasympathetic nerves (pelvic plexus). The hypogastric plexus is located very close to the rectum and is likely to be injured during upper rectal dissection. The pelvic plexus is located on the anteromedial side of the internal iliac vessels, more distant from the rectum and is usually preserved unless extended lateral dissection is performed[32].

Bowel dysfunction
There is abundant work regarding bowel function after low anterior resection. In the early postoperative period after anterior resection, bowel function often is compromised, with frequent bowel movements and

fecal incontinence. Bowel function improves over the ensuing 1 to 2 years after anterior resection, and these improvements correlate well with increasing capacity of the "neorectum"[36,37,38,39,40].

Examining the specific effects of postoperative chemoradiotherapy on bowel function, Kollmorgen et al. reviewed 109 patients who underwent uncomplicated low anterior resection. Forty-one patients who receive postoperative chemoradiotherapy after low anterior resection are compared to 59 who do not. Of those receiving adjuvant therapy, 39 percent occasionally and 17 percent frequently experience incontinence as compared with only seven and zero percent, respectively, of those not given chemotherapy and radiotherapy. The mean number of bowel movements per day is six in the adjuvant therapy group and two in the nonradiotherapy group[36].

In addition, patients who underwent irradiation experience "clustering" of bowel movements, more nighttime movements, increase need to wear protective pads, and an inability to defer defecation for more than 15 minutes with greater frequency than those patients treated with surgery alone. Patients are also more likely to experience stool of liquid consistency, perianal skin irritation, and the need to defecate an additional time within 30 minutes of a movement. Additionally, they report more frequent use of antidiarrheal medications, and the inability to differentiate stool from gas. Interestingly, long-term dysfunction (greater than two years) does not correlate with the level of anastomosis in this study[36] as it does in several other studies concerning bowel dysfunction after low anterior resection of the rectum[41,42,43,44].

It is likely that the clinical effects of postoperative radiation therapy are partly the result of decreased rectal capacity and compliance. However, changes in rectal motor and sensory function and changes to the surrounding soft tissues may also contribute. Changes in anal sphincter function may be reliant on the radiation fields employed. Finally, damage of small bowel by radiation may be relevant in explaining why nearly one third of the patients in the study by Kollmorgen et al. report passing liquid stools[36].

Preoperative radiation therapy may cause less long-term bowel dysfunction than postoperative therapy, because the neorectum is not irradiated, however, the surrounding tissues will still be exposed, potentially having some effect on bowel function. A study of preoperative intraluminal radiotherapy shows that those given high-dose preoperative radiation subsequently have decreased postoperative anal sphincter pressures and neorectal capacity with worse bowel function than those receiving low-dose or no preoperative radiotherapy[45].

Stomal complications

Stenosis, prolapse and peristomal hernias are the most common major complications related to ileostomy and colostomy formation with an overall incidence of 21 to 70 percent[46,47,48]. In one series of 203 patients with colostomies, the colostomy complication rate is 51 percent at 13 years. Hernia is the most common complication (37 percent). It is seen more frequently in the elderly and those with other abdominal hernias. The rate of prolapse (12 percent) is followed by stenosis, which is 7 percent. Locating the stoma through the belly of the rectus abdominis muscle does not reduce the risk of hernia, however, an extraperitoneal course has significantly lower risk of herniation when compared with a transperitoneal course. Additionally mesenteric fixation does not influence the rate of prolapse. Other colostomy complications include retraction, skin complications, and fistulas[46]. Although it is impossible to prevent a peristomal hernia, a well-constructed colostomy and ileostomy with good blood supply without tension will avoid the problems of necrosis, retraction and stenosis. Surgeons must spend time to mobilize the bowel and fashion the limb of the ostomy properly.

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