Tonna McCutcheon, MSN, APRN-BC, CGRN

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The Ileus and Oddities After Colorectal Surgery

ABSTRACT

Colorectal surgery is a necessity for many disease processes such as diverticulitis, ulcerative colitis, Crohn disease, and colorectal cancers as well as for the many complications of such conditions. The incidence of overall complications related to colorectal surgery has been reported to be between 10% and 30%. Prevention is the necessary key to avoid complications and this may be improved by adequate selection of appropriate procedures for the patient, good surgical technique, and good postoperative care. Nevertheless, complications do occur intraoperatively or postoperatively and must be managed in a timely manner to improve overall patient outcomes. Such complications include paralytic ileus, anastomotic leak, abdominal sepsis, acute mesenteric ischemia, anastomotic bleeding and hemorrhage, wound infection, anastomotic dehiscence and fistula formation, small bowel obstruction, and genitourinary complications.

Colorectal surgery is a necessity for many disease processes as well as for the many complications that accompany such conditions. The incidence of overall complications related to colorectal surgery has been reported to be between 10% and 30% (Ruis-Tovar, Morales-Castinerias, & Lobo-Martinez, 2010). The American Society of Colorectal Surgeons (ASCRS) reported that over an 8-year period (1988–1994), the mortality rate for patients undergoing colorectal surgery was 1.4% if the procedure was performed by a board-certified colorectal surgeon as compared with a 7.3% mortality rate when performed by other surgeons (ASCRS, 1996). Prevention of complications may be improved by adequate selection of appropriate procedures for the patient, good surgical technique, and good postoperative care. Nevertheless, complications do occur intraoperatively and/or postoperatively and must be managed in a timely manner to improve overall patient outcomes.

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About the author: *Tonna McCutcheon, MSN, APRN-BC, CGRN, is Colorectal Acute Care Nurse Practitioner, Vanderbilt Medical Center, Nashville, Tennessee.*

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Correspondence to: *Tonna McCutcheon, MSN, APRN-BC, CGRN, Vanderbilt Medical Center, 1121 21st Ave. S, S-5410 MCN, Nashville, TN 37232 (tonna.mccutcheon@vanderbilt.edu).*

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Postoperative Ileus

A postoperative ileus is defined as a temporary paralysis of a portion of the intestines after abdominal surgery. This paralysis is a normal physiological response most often involving the sigmoid colon and resolves in 2–3 days postoperatively. Fifty percent of major abdominal surgeries result in a postoperative ileus (Senagore, 2007). If paralysis persists, it is known as a paralytic or adynamic ileus and is then considered a complication of surgery. A paralytic ileus occurs after intraperitoneal, retroperitoneal, or extra-abdominal surgery but colonic surgery has the highest rate of paralytic ileus with laparoscopic colon surgery having lower occurrence than open colonic procedures (Cagir, 2013).

Causes

In general, an ileus causes backup of gas and fluids in the colon and may occur because of activation of inhibitory spinal reflex arcs. Long reflexes involving the spinal cord are linked and spinal anesthesia, abdominal sympathectomy, or cutting of nerves may lead to a temporary paralysis of the bowel. Another thought is a surgical stress response that causes inflammatory and endocrine mediators to be released, thus leading to bowel paralysis. Other reported causes of an ileus include medications (warfarin [Coumadin], opioids, antacids, amitriptyline, and chlorpromazine),

hypokalemia, hyponatremia, hypomagnesemia, anemia, intra-abdominal inflammation or peritonitis, surgical manipulation of the intestine, effects of anesthesia, and retroperitoneal hematomas (Oncel & Remzi, 2003). Resolution of an ileus is from the proximal or right colon to the distal or left colon. Normally the small bowel regains function within hours whereas it may take 3–5 days for the colon to regain function.

Signs and Symptoms

Signs and symptoms of a paralytic ileus include mild abdominal pain and bloating, nausea, vomiting, poor appetite, distended and tympanic abdomen, constipation, obstipation, absent or hypoactive bowel sounds, and passing flatus or stool. Bowel sounds should be auscultated to help differentiate paralytic ileus from a mechanical ileus. Continued absence of bowel sounds suggests paralytic ileus whereas hyperactive bowel sounds may indicate a mechanical ileus (Ruis-Tovar et al., 2010).

Differential Diagnoses

Differential diagnoses for a paralytic ileus include mechanical bowel obstruction and pseudo-obstruction. Mechanical bowel obstruction is defined as a complete or partial obstruction of the bowel due to a physical blockage. It is more common in the small intestine than in the colon and may be caused by neoplasm, adhesions from previous surgeries, volvulus, hernia, Crohn disease, foreign bodies, and intussusceptions. Mechanical obstruction of the large intestine may be caused by stricture, impacted feces, volvulus, diverticulitis, or colon cancer (Mayo Clinic, 2012).

Signs and symptoms include severe abdominal cramping, constipation, obstipation, nausea, vomiting, anorexia, borborygmi (rumbling sounds caused by gas moving throughout the intestine), high pitched tinkling sounds heard upon auscultation, abdominal distention, and localized tenderness may be present on physical examination. If the patient is thin, peristaltic waves may be observed as well. If a complete obstruction is present, the patient may present with constipation, obstipation, vomiting (depending on the ileocecal valves ability to prevent reflux), and peritoneal signs if strangulated obstruction or perforation has developed. Diagnosis of a mechanical obstruction is most often made with the use of contrast imaging such as a computed tomographic (CT) scan that will suggest enlarged bow shaped loops of small bowel in a step like pattern, a colonic gas pattern distal to the lesion, presence of air-fluid levels, and a mildly elevated diaphragm (Cagir, 2013). Treatment for a partial mechanical obstruction includes bowel rest and a low-residue diet. If the obstruction does not resolve or complete obstruction is present, surgical intervention may be indicated and includes removal of obstruction, repair of hernias, lysis of adhesions, and resection of any ischemic bowel (Ansari, 2012).

Pseudo-obstruction is the acute marked distention of the large bowel in the absence of definable mechanical pathology (National Digestive Diseases Information Clearinghouse, 2013) and is most often limited to and occurs in the right colon. Causes and risk factors for development of a pseudo-obstruction include elderly bedridden patients, trauma patients, medications, sepsis, electrolyte imbalance, and aerophagia (swallowing of too much air). Signs and symptoms include abdominal distention without pain or tenderness, nausea, vomiting, constipation, obstipation, anorexia, hypoactive or hyperactive bowel sounds, local tenderness, borborygmi, and abdominal distention.

Diagnosis is made from plain abdominal x-ray films, which will indicate isolated proximal large bowel dilatation and an elevated diaphragm. A cecal diameter of greater than 12 cm indicates a high risk for cecal perforation, which has a subsequent mortality rate of 50% if ischemic bowel develops, leading to perforation. Contrast imaging is also helpful in distinguishing a pseudo-obstruction from a mechanical obstruction as mentioned earlier. Treatment for a pseudo-obstruction includes hydration, nasogastric (NG) tube placement, possible rectal tube placement, correction of electrolyte imbalance, discontinuation of medications that may promote immotility, or decompression by way of a colonoscopy. Another treatment is the administration of intravenous (IV) neostigmine, which will resolve a pseudo-obstruction within 10–30 minutes; however, it must be given under cardiac monitoring because there is a high risk of bradycardia. Surgery is indicated if peritonitis, ischemia, or perforation is present and an exploratory laparotomy with bowel resection and placement of an ostomy is the procedure of choice.

Laboratory Data

Abnormal laboratory values that are seen in a patient experiencing a paralytic ileus include hypokalemia, hyponatremia, and hypomagnesemia. Leukocytosis may be present; however, it is nonspecific and may be due to an infectious causes or hemoconcentration. Serum amylase may increase and hypoproteinemia can also be present (Ruis-Tovar et al., 2010).

Radiographic Data

Diagnosis of a paralytic ileus is made from plain abdominal films or a CT scan. Plain films will indicate dilatation of the small and large bowel as well as elevation of the diaphragm. Serial abdominal films are done daily to evaluate for worsening of the ileus. Most often a paralytic ileus will resolve over time with

supportive treatment that includes hydration and bowel rest with NG tube placement. If a continued or protracted ileus develops, a mechanical ileus must be ruled out and evaluation of electrolyte imbalance is indicated as well.

Treatment

Treatment of a paralytic ileus is the same as mentioned previously for a pseudo-obstruction and involves bowel rest and possible NG tube placement. Nasogastric tube placement is beneficial only if the patient experiences vomiting or abdominal distention. The tube should be removed when there is 100 ml or less output after clamping the tube for 4 hours (Oncel & Remzi, 2003).

Medications that slow down motility are discontinued and narcotic pain medications can be switched to nonsteroidal anti-inflammatory drugs, which will help with local inflammation and, in turn, may help resolve the ileus. Side effects of nonsteroidal anti-inflammatory drugs, however, are worrisome and include platelet abnormalities and gastric ulceration. Ruis-Tovar et al. (2010) also report that Gastrografin enemas may be therapeutic.

Delay of reintroduction of food is advisable until the ileus totally resolves; however, this does not preclude enteral feeding, which can be done as a postpyloric feeding directly into the small bowel. The formula is given at a quarter to half strength, at a slow rate, and advanced slowly. Oncel and Remzi (2003) note that allowing oral intake earlier in the postoperative period does not affect overall bowel recovery; therefore, starting a postoperative patient on clear liquids on postoperative Day 1 is acceptable rather than awaiting return of bowel function to begin feedings.

Gum chewing is also an acceptable method to help resolve an ileus because this promotes gastrointestinal motility and has been shown to reduce the amount of time for return of bowel function postoperatively, reducing the overall length of a hospital stay after colorectal surgery (Hocevar, Robinson, & Gray, 2010). Ambulation is thought to help resolve a paralytic ileus, but there is currently no literature to support this theory. Ambulation seems only to help prevent pneumonia, deep vein thrombosis, and atelectasis.

Studies have indicated epidural blockade with local anesthetics, especially bupivacaine alone or in combination with an opioid, can improve postoperative ileus. Other studies have also indicated that continuous IV administration of lidocaine intraoperatively and postoperatively may decrease the length of a postoperative ileus by blocking the inhibitory reflexes and efferent sympathetic responses thus preventing paralysis of the bowel. Opioid antagonists such as Entereg and Relistor inhibit peripheral μ-opioid receptors that inhibit adverse gastrointestinal effects of an opioid. These medications do not cross the blood-brain barrier and thus do not hinder the analgesic effect of the opioid (Cagir, 2013).

Other agents such as bisacodyl have been of some benefit with improving a paralytic ileus, and perioperative administration of a low dose of celecoxib has also been shown to reduce development of an ileus. Erythromycin is not helpful with resolution of an ileus despite its use for gastroparesis; Reglan has been shown to worsen an ileus (Cagir, 2013).

If there is no resolution in a paralytic ileus within 48–72 hours, the patient reports an increase or worsening of symptoms, or serial abdominal films suggest worsening of bowel dilation, an exploratory laparotomy is done. Early surgical intervention allows for better outcome so surgery most often is done prior to 7 days of obstructive symptoms. After 7–10 days, the intestine has an increased risk of being edematous or necrotic. Recurrent paralytic ileus is uncommon; however, cardiac, renal, urinary, vascular, and pulmonary complications are frequent (Ruis-Tovar et al., 2010).

Case Study

A 70-year-old man underwent an elective laparoscopic right hemicolectomy for a cecal polyp without difficulty or complication. Postoperatively, his pain was well controlled; however, his bowel function was slow to return. On postoperative Day 4, he developed nausea and vomiting and a CT scan was obtained, which revealed contrast throughout the bowel with evidence of a partial small bowel obstruction. A NG tube was placed and the patient reported onset of flatus and small bowel movements. On physical examination, however, the patient remained distended.

A peripherally inserted central catheter was placed and total parenteral nutrition (TPN) was started. Serial abdominal films showed no change or resolution of the partial obstruction. On postoperative Day 12, a second CT scan was obtained revealing decompressed bowel after a transition point in the ileocolic region. It was decided to take the patient back to the operating room (OR) for an exploratory laparotomy.

During surgery, a thin adhesion was found near the anastomosis and was removed. The patient recovered well from the exploratory laparotomy; however, his bowel function continued to be slow to return to baseline. For this reason, he was kept on TPN to maintain his nutritional status. On postoperative Day 21, the patient was found stable for discharge after he reported flatus, a bowel movement, and his abdominal distension was resolving without an NG tube in place. The patient was discharged on TPN to progress his diet slowly, as tolerated.

Anastomotic Leak

An anastomotic leak is a major complication of colorectal surgery and may result in peritonitis, abscess formation, increased risk of local cancer recurrence, increased length of hospital stay, decreased functional outcomes, increased risk for a permanent ostomy, and death (Whiteford, 2013). In 2011, an estimated risk of an anastomotic leak after colorectal surgery was a reported 3%–6% when performed by experienced surgeons. Overall, a low pelvic anastomosis (coloanal anastomosis) had a risk of 10%–20% for an anastomotic leak as compared with a high anastomosis (small bowel and ileocolic anastomosis), which had a 1%–3% leak rate (Boushey & Williams, 2013; Dietz, 2011).

Risk Factors

Risk factors for an anastomotic leak include patients with comorbidities such as malnutrition, diabetes mellitus, anemia, chronic obstructive pulmonary disease, or patients treated with corticosteroids. Patients with a history of neoadjuvant therapy or patients undergoing ileal pouch anal anastomosis with the use of greater than 40 mg daily of prednisone and taking biologic agents such as infliximab are also at an increased risk for an anastomotic leak (Dietz, 2011). Boushey and Williams (2013) reported a retrospective study from 1980 to 1995 that looked at low colorectal anastomosis less than 5 cm from the anal verge. The study indicated that obese patients had an increased risk (33%) of developing an extraperitoneal anastomotic leak as compared with nonobese patients (15%). They also found that men undergoing a low pelvic resection for rectal cancer with an anastomosis less than 5 cm from the anal verge were more likely to experience an extraperitoneal anastomotic leak as compared with female patients. The thought was that the narrow pelvis of the male lends to more difficult dissection (Boushey & Williams, 2013).

Neither gender nor obesity factors into an increased risk of development of an anastomotic leak for intraperitoneal anastomosis creation. Other risk factors include the patient's age, abnormal serum albumin, elevated liver function studies, abnormal prothrombin times, the need for transfusions, presence of inflammation of the bowel, emergent surgery versus elective surgery, prolonged operative time, inadequate blood supply, tension on the area of anastomosis, and a hand-sewn ileocolic anastomosis as compared with a stapled ileocolic anastomosis. There was no noted increase in leak found with a hand-sewn colorectal anastomosis (Boushey & Williams, 2013).

Neoadjuvant radiation therapy has been reported to have a positive effect, inconclusive effect, and no effect on the development of anastomotic leaks. The use of drains is also inconclusive as a risk factor, and there have been no reported differences in rates of anastomotic leaks in patients undergoing an open colorectal resection for cancer versus a laparoscopic procedure.

The use of a stoma to prevent anastomotic leaks is controversial. Boushey and Williams (2013) indicated studies that, in fact, found a decrease in the number of leaks in patients with a stoma as compared with patients without a stoma. However, another study was also referenced, which indicated that the rate of anastomotic leaks was similar in patients with and without a stoma.

Signs and Symptoms

Anastomotic leaks may become symptomatic as early as 5–7 days postoperatively. Fifty percent will present after the patient is discharged home and another 12% will occur after 1 month postsurgery. Anastomotic leaks present as an asymptomatic leak, a subtle leak, or a dramatic early leak as indicted by Whiteford (2013).

Asymptomatic leaks in which the leak was found incidentally on CT scan weeks to months postoperatively are often walled off sinuses and most often no treatment is necessary.

Subtle leaks usually occur 5–14 days postoperatively and present with what seems to be normal postoperative symptoms such as low-grade fevers, ileus, and mild leukocytosis whereas dramatic early leaks will present with acute abdominal pain, prolonged ileus, abdominal distention, fevers, tachycardia, oliguria, purulent drainage, diffuse peritonitis, and possible shock. These symptoms indicate an uncontained leak (Whiteford, 2013).

Radiographic Data

Fluid- or gas-containing collections will be seen on radiography (x-ray); however, small contained leaks that present later in the postoperative period are often hard to distinguish from a postoperative abscess radiographically. If the CT scan indicates an abscess less than 3 cm and contained, the patient may be managed with antibiotics (Whiteford, 2013). In general, once an anastomotic leak has been identified on a CT scan or Gastrografin enema, IV hydration and broad-spectrum antibiotics should be initiated. Further treatment involving antibiotics with observation versus percutaneous drain placement versus exploratory laparotomy is determined by the clinical stability of the patient (Whiteford, 2013).

Treatment

Patients who present with localized peritonitis, low-grade sepsis, and a CT scan indicating a free intraperitoneal leak should undergo an exploratory laparotomy with surgical management of the leak. Intraoperatively,

gross enteric spillage and anatomic breakdown of the anastomosis will be seen. If the anastomotic defect (ischemia and/ or necrosis) is greater than 1 cm or greater than one third the circumference of the anastomosis, the options are resection of the anastomosis with the creation of an end stoma with possible mucous fistula or resection of the anastomosis with proximal diversion with a loop ileostomy (Boushey & Williams, 2013). If the CT scan indicates a large abscess greater than 3 cm, multiple fluid collections, or multiloculated fluid collections and the patient is clinically stable, the patient should undergo a percutaneous (PERC) drain placement. Leaks managed with CT-guided PERC drain insertion may heal spontaneously or may develop an enterocutaneous fistula with accompanying anastomotic stricture. Surgery for this issue is usually delayed approximately 6 months to allow for resolution of inflammation (Dietz, 2011).

Case Study

A 56-year-old man underwent a laparoscopic total abdominal colectomy with ileostomy for ulcerative colitis. His postoperative course was unremarkable and he was discharged home on postoperative Day 4. Approximately 2 weeks later, the patient was readmitted to the hospital for tachycardia and leukocytosis with concern for a possible bowel perforation.

A CT scan was obtained, which indicated a moderate amount of free intraperitoneal air as well as a small amount of free intraperitoneal fluid within the left para-colic gutter with uncertainty as to whether this represented postoperative air versus an anastomotic leak. The patient was treated with antibiotics and symptoms were resolved.

Two weeks later, the patient presented to the colorectal clinic with the complaint of lower abdominal pain and drainage from the ileostomy. A repeat CT scan indicated multiple intra-abdominal fluid collections and a 2-week course of oral antibiotics was given because the patient refused PERC drainage at that time. The patient then developed malaise, nausea, left lower quadrant pain, and purulent drainage from the ileostomy, and had poor oral intake. A complete blood cell count indicated leukocytosis, and a repeat CT scan indicated an interval increase in the size of multiple intra-abdominal and pelvic abscesses as well as a slight increase in the parastomal abscess as compared with prior studies.

The patient was admitted, placed on IV ciprofloxacin and metronidazole, and underwent a CT-guided PERC drain insertion. Cultures were taken and indicated growth of methicillin-resistant *Staphylococcus aureus* and alpha streptococcus. An infectious disease consultation was obtained, and antibiotics were switched to IV ertapenem, vancomycin, and Diflucan (fluconazole).

The patient was discharged home with continued treatment with IV antibiotics. One week later, the patient informed the colorectal clinic that his drain "fell out." A repeat CT scan was done, which indicated persistence of the multiple intra-abdominal fluid collections and a second CT-guided PERC drain was inserted. The patient remained on IV antibiotics for 4 weeks per recommendation of the infectious disease consultant. A follow-up CT scan indicated resolution of the intra-abdominal abscesses and the drain was removed.

Abdominal Sepsis

Abdominal sepsis is caused by the release of bacteria from the intestinal lumen during a bowel resection with an increase in risk in emergent cases with no bowel preparation. Abdominal sepsis can be either localized or generalized peritonitis as well as enterocolitis, septicemia, abscess, or phlegmon.

Symptoms

The most common symptom is pain. If this pain is located at the location of the anastomosis, it becomes concerning for abscess formation. In general, symptoms of abdominal sepsis include fever, tachycardia, and tachyphemia. Sepsis related to gram-negative bacteria can present with hypotension, hypothermia, and bradycardia. Tachyphemia may suggest a pulmonary origin such as a pulmonary embolis (Ruis-Tovar et al., 2010).

Laboratory and Radiographic Data

Laboratory data will indicate leukocytosis with neutrophilia and at times an increase in C-reactive protein and erythrocyte sedimentation rate. Wound cultures with sensitivity should be done. Chest radiography is usually done to rule out pneumonia, atelectasis, and pleural effusion. A urinalysis with culture and sensitivity is also done to rule out a urinary tract infection, which may only present with disorientation, agitation, or other behavioral changes in the elderly. Abdominal films may also be done to evaluate for pneumoperitoneum, which is not uncommon (in small amounts) for up to 2 weeks postoperatively. Dilation of the bowels seen on plain films may suggest paralytic ileus secondary to mechanical injury or peritonitis. An abdominal CT scan is the best diagnostic tool to determine intra-abdominal fluid collections and for evaluation of the anastomosis and presence of intraluminal air.

Treatment

If a fluid collection is observed, a PERC drain can be placed under CT guidance. Management of mild or localized infection includes supportive care with fluids, correction of electrolyte imbalance, and initiation of antibiotics. Cases with intra-abdominal contamination

or with hemodynamic instability require surgical intervention with drainage and abdominal washout, possible colon resection of the infected area, lysis of adhesions, and creation of an ostomy because an anastomosis is impossible in the setting of infection. Most of these patients do not undergo primary closure of the surgical wound initially and may return to surgery in 48 hours for primary closure. Often, retention sutures are placed because the risk of evisceration is high (Ruis-Tovar et al., 2010).

Acute Mesenteric Ischemia

Acute mesenteric ischemia is a condition that causes an inadequate blood circulation to the mesentery leading to intestinal ischemia and eventual gangrene of the bowel. Dang and Giebel (2013) report that the incidence of acute mesenteric ischemia is approximately 0.1% of all hospital admissions. This condition is seen more often in patients older than 50 years; however, there are no sex or racial predilections. Prognosis for acute mesenteric ischemia is poor with a range of 59%–93% mortality rate. If a bowel wall infarction occurs, the mortality rate increases to 90% (Dang & Giebel, 2013). Early recognition and treatment can reduce morbidity/mortality rates, especially if treated less than 12 hours from the onset of symptoms. However, Dang and Giebel (2013) reported that patients might still suffer complications related to the reduced amount of intestine mucosal surface needed for absorption.

Causes

Acute mesenteric ischemia may be caused by either a venous or arterial obstruction and, in general, causes may include cardiac emboli, atherosclerotic vascular disease, aortic aneurysm or dissection, congestive heart failure, decreased cardiac output from suffering a myocardial infarction, sepsis, severe renal or liver disease, cardiac or abdominal surgery, vasopressive drugs, cocaine, hypercoagulability, tumor causing venous compression, intra-abdominal infection (diverticulitis, abscess, appendicitis), venous congestion from cirrhosis, venous trauma from accidents, increased intra-abdominal pressure from a pneumoperitoneum from laparoscopic surgery, pancreatitis, or decompression sickness (Dang & Giebel, 2013).

Signs and Symptoms

The most common symptom of acute mesenteric ischemia is pain, which is disproportionate to the physical examination and may be severe to moderate, constant, diffuse, nonlocalized, and at times described as "colicky." Other symptoms are nausea, vomiting, diarrhea, obstipation, abdominal distention, gastrointestinal bleeding, and signs of sepsis (tachycardia, tachyphemia, hypotension, altered level of consciousness, and fever).

Radiographic Data

Unless the patient is medically unstable, plain films should be done to evaluate for free air, ileus, obstruction, volvulus, or intussusception. A CT scan should be done with the use of oral and IV contrast if the cause of symptoms is not apparent on the plain films. Angiography may also be done to pinpoint the site of an arterial occlusion, but is less sensitive for venous occlusion and cannot demonstrate nonocclusive disease secondary to low cardiac output or hypovolemia.

Treatment

Treatment is resection of the necrotic bowel; however, before surgery, the patient's cardiovascular status should be improved as much as possible with IV fluid resuscitation and oxygenation. Prophylactic antibiotics are also administered. Most often the patient will return to surgery in 24–48 hours for a second look to reevaluate bowel circulation (Dang & Giebel, 2013).

Acute Mesenteric Ischemia Case Study

A 76-year-old woman was admitted to the hospital and underwent an elective exploratory laparotomy with sigmoid colectomy for recurrent diverticulitis. Her postoperative course included a postoperative ileus. However, on postoperative Day 6, she developed acute abdominal pain for which a CT scan of the abdomen was performed. Imaging revealed pneumatosis and portal venous gas consistent with ischemic bowel or acute bowel injury. She was taken immediately to the OR for exploratory laparotomy. Findings at that time included widespread dusky bowel with an area in the midjejunum consistent with full-thickness necrosis. This area was resected, the bowel was left in discontinuity, and she was transported to the surgical intensive care unit (SICU) for further resuscitation.

At this point, the patient required multiple vasopressors and dobutamine for maintenance of her blood pressure. A Swann Ganz catheter was placed on admission to the SICU and her hemodynamic parameters were consistent with severe cardiogenic shock. She underwent resuscitation with fluid and blood products, and a dobutamine drip was started for inotropy. The patient was noted to have a large increase in her troponins and cardiology was consulted.

Echocardiography revealed severe anterior wall hypokinesis concerning for myocardial infarction. A cardiac catheterization was performed with no evidence of coronary lesion. The diagnosis was stress-induced cardiomyopathy. She returned to the SICU in

a critical condition, requiring vasopressor support and dobutamine.

The patient returned to the OR at which point widespread necrosis of her entire small bowel and colon was noted. This, again, was thought to be secondary to a low flow state from her severe cardiomyopathy. The family was notified of the situation and that these findings would be incompatible with survival. They elected to pursue comfort care measures. The patient expired shortly thereafter.

Anastomotic Bleeding/Hemorrhage

Anastomotic bleeding is common and usually self-limited; however, anastomotic hemorrhage is infrequent, occurs in 0.5%–1% of cases, and will usually stop spontaneously (Ruis-Tovar et al., 2010). A small amount of intra-abdominal bleeding is normal after colorectal surgery and is easily reabsorbed within the peritoneum if no infection is present. Surgery is indicated for a large or continuous hemorrhage.

Risk Factors

Risk factors for anastomotic bleeding/hemorrhage are most often related to tension at the anastomosis, stapler malfunctions during surgery, ischemia, or poor technique of the surgeon. Other factors that are patient related include radiation exposure, malnutrition, immunosuppression, obesity, and local sepsis.

Signs and Symptoms

Signs and symptoms of hemorrhage are tachycardia, decrease in urinary output, hypotension, and decrease in hemoglobin with or without obvious signs of bleeding because hemorrhage may be intra-abdominal and may lead to abdominal distention.

Treatment

Management of bleeding begins with supportive care to maintain hemodynamic stability including replacement of intravascular volume with crystalloids and colloids along with transfusion of packed red blood cells, plasma, and platelets. More severe bleeding is managed with epinephrine and saline retention enemas. If the cause of the hemorrhage is found to be a contained hematoma, surveillance is indicated, the hematoma will most often spontaneously reabsorb, and no surgical intervention is necessary (Dietz, 2011; Ruis-Tovar et al., 2010). If there is no indication of infection, a drain may be inserted to help drain the hematoma, especially in patients who are elderly or are poor repeat surgical candidates. However, if the patient becomes hemodynamically unstable or the hematoma enlarges (a sign of active bleeding), the patient is taken immediately to the OR for exploratory laparotomy (Dietz, 2011; Ruis-Tovar et al., 2010).

Wound Infection

A postoperative superficial wound infection is one of the most common complications of colorectal surgery. Whiteford (2013) suggests that colorectal incisions are described as clean contaminated and the incidence of a superficial infection is 5%–10%.

Risk Factors

Risk factors include age greater than 60 years, diabetes mellitus, malnutrition, immunosuppression, fecal contamination, intraoperative hypothermia, extensive surgery, prolonged length of hospital stay prior to surgery, and the American Society of Anesthesia score greater than 2. Postoperative infections usually occur around the fifth postoperative day.

Signs and Symptoms

Signs and symptoms of a wound infection include erythema, tenderness, drainage, induration, fever, and tachycardia. The infection may manifest as cellulitis, an abscess, or both. If a fluid collection is found, the area is opened and drained. A culture can be obtained to help determine sensitivity if antibiotic treatment is necessary such as in the case of cellulitis.

Treatment

Most often, opening the wound and allowing it to heal by secondary intention with packing or wound vacuum placement is all that is necessary (Whiteford, 2013). Necrotizing wound infections most often develop the first couple of days after surgery and may be the result of *Clostridium perfringens* or beta-hemolytic *Streptococcus*, which could be potentially life-threatening. The wound is usually very painful and a thin gray drainage is present. These patients are taken back to the OR for wound debridement and broad-spectrum antibiotics with high-dose penicillin are given intravenously (Dietz, 2011).

A project known as the Surgical Care Improvement Project was developed to help decrease the incidence of surgical site infections in colorectal surgery patients. This improvement project measures appropriate use of antibiotics, administration of antibiotics within 1 hour of incision, cessation of antibiotics within 24 hours of surgery, and maintenance of patient normothermia during surgery. The efficacy of this project has been debated and is an ongoing project (Dietz, 2011).

Wound Dehiscence

Wound dehiscence, or the opening of a surgical wound with fascia intact, occurs in 0.5%–3% of all abdominal surgeries and is associated with up to a 20% mortality rate as reported by Oncel and Remzi (2003). Wound dehiscence is caused by tissue necrosis, sutures tied too tightly or placed too close to the edge of the

wound, or wound disruption caused by increased intra-abdominal pressure.

An increase in intra-abdominal pressure may be caused by edema or ischemia of the intestines, intra-abdominal abscess or infection process, shock, positive pressure ventilation, prolonged surgical time, and large volume transfusions. This, in turn, leads to cardiac, renal, and pulmonary function failure, which affects the splanchnic circulation and leads to abdominal compartment syndrome and decreased blood flow to the abdominal wall (Oncel & Remzi, 2003).

If the patient is suspected of having an increase in intra-abdominal pressure, primary closure of the abdominal wall is avoided. The wound is left open with application of wet-to-dry dressings and a delayed wound closure is planned. Retention sutures may be used if the only concern is wound dehiscence with no indication of increase in intra-abdominal pressure (Oncel & Remzi, 2003).

Wound Evisceration

Wound evisceration or opening of a wound with opening of fascia and protrusion of the abdominal organs occurs in approximately 2% of all abdominal surgeries and is more often noted in elderly or obese patients. Evisceration is related to other complications such as wound infections, wound hematomas, ileus, and fistula formation (Ruis-Tovar et al., 2010). Once a wound evisceration is confirmed, the patient is returned to surgery for repair of the opening and placement of retention sutures (Ruis-Tovar et al., 2010).

Conclusion

Complications of colorectal surgery continue to be an existing concern and, at times, make diagnosis difficult because of the presentation of complications mimicking one another. This, in turn, can result in the inability to diagnose and treat complications in a timely manner and subsequently affects patient outcomes. Limiting or avoiding risk factors for such complications as well as having experienced colorectal surgeons provide appropriate surgical interventions will not only improve outcomes but also bring forth an overall decrease in mortality and morbidity rates. Astute nursing care with a particular awareness of the potential negative outcomes related to colorectal surgery can make the difference in quick diagnosis and management of untoward complications. ✪

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