Fatal Intestinal Ischemia after Laparoscopic Correction of Incisional Hernia

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ABSTRACT

Background and Objectives: Intestinal ischemia is a very rare complication of laparoscopic procedures. In this report, we describe the first case of fatal large bowel ischemia in the aftermath of laparoscopic incisional hernia repair.

Methods: A literature search using PubMed was performed to identify all published cases of intestinal ischemia following laparoscopic procedures.

Results: Our search revealed 13 cases of intestinal ischemia following various laparoscopic procedures. Including this one, 10 of 14 cases reported on so far had impaired cardiovascular, hepatic or renal function or atherosclerosis. None of these patients-at-risk survived. In this series, no indications of faulty operative technique could be identified.

Conclusion: Patient-related risk factors seem to play the most important role in the development of this rare but devastating complication. Preventive measures and methods to identify patients at risk for developing intestinal ischemia during and after laparoscopy are not completely clear. Patient selection, an optimal hydration status, an optimized technique with lowest insufflation pressure possible, and intermittent decompressions of the abdomen when the procedure is lengthy are the measures that have a potential to prevent this complication. Whatever laparoscopic procedure has been performed, intestinal ischemia should be considered in any patient with non-specific abdominal symptoms.

Key Words: Laparoscopy, Complications, Hernia, Ventral, Ischemia, Intestines, Blood supply.

INTRODUCTION

Intestinal ischemia is a rare complication following laparoscopic procedures. It has been described after laparoscopic cholecystectomy, inguinal hernia repair, gynecologic myolysis, and fundoplication. Laparoscopic repair of ventral and incisional hernia (LRVIH) is gaining popularity due to its low recurrence rate, short hospital stay, and low complication rate. In this report, we describe a case of fatal intestinal ischemia following LRVIH.

CASE REPORT

A 47-year-old obese woman (BMI of 42) with a large incisional hernia at midline laparotomy was referred for laparoscopic correction. Her medical history was significant for hypertension, transabdominal gynecologic surgery, peripheral vascular disease, and included multiple angioplasties of the iliac arteries.

Carbon dioxide was used to create pneumoperitoneum. Intraabdominal pressure was maintained at 12 mm Hg throughout the laparoscopy. Laparoscopic correction was uneventful but lengthy (240 min) due to extensive adhesiolysis. A 15-minute break that included decompression of the abdomen was made halfway through the operation. This is locally a common practice during long operations and was not triggered by any specific adverse event. The total duration of the pneumoperitoneum was 215 minutes. Blood pressure remained stable throughout the procedure. The hernia defect measured 20 cm x 16 cm and correction required application of two 30cmx20cm expanded polytetrafluoroethylene meshes (DualMesh, WL Gore, Flagstaff, AZ, USA). The meshes were fixed both with tackers (ProTack, TycoUS$, Norwalk, CT, USA) and transabdominal sutures.

Initially, recovery was uneventful. On postoperative day 3, the patient developed a paralytic ileus without localized tenderness. A plain abdominal x-ray and ultrasound showed a distended bowel. C-reactive protein was significantly raised. To evaluate the possibility of a missed bowel lesion, we decided on a relaparoscopy. Intraabdominal pressure was maintained at 12 mm Hg throughout this short procedure that took not more than 12 minutes. Upon exploration, only bowel disten-
sion was found with no signs of contamination, perforation, or ischemia. Given these findings, no action was undertaken.

Postoperatively, the patient developed systemic inflammatory response syndrome, respiratory insufficiency, and required transfer to the intensive care unit. Within the next few days, the patient slowly stabilized, required less and less support, and experienced no apparent infection. On postoperative day 9, she produced bloody diarrhea that prompted us to perform a colonoscopy. Examination revealed severe ischemic colitis in the transverse colon. Mesenteric angiography was performed showing an occluded superior mesenteric artery and a compensatory distended inferior mesenteric artery with a pinpoint stenosis at its origin. Balloon angioplasty (Figure 1) successfully dilated this stenosis, the patient was placed on anticoagulants and, afterward, the patient steadily improved. However, 5 days later, her situation suddenly deteriorated. Another colonoscopy was performed that showed multiple perforations of the ischemic transverse colon. At subsequent laparotomy, a fecal peritonitis due to multiple perforations of the ischemic ascending and transverse colon was found. Resection of the ischemic colon was performed and both contaminated meshes were removed. Postoperatively, the patient deteriorated further and died the next day, 16 days after the first operation. Histological examination of resected bowel showed extensive ischemia with multiple transmural ulcerations and perforations. The family of the patient did not agree to an autopsy.

DISCUSSION

Acute mesenteric ischemia is the result of a sudden reduction in intestinal blood flow that is insufficient to meet the metabolic demands of the bowel. Specific risk factors include advanced age, atherosclerosis, low cardiac output states, cardiac arrhythmias, severe cardiac valvular disease, administration of medications known to reduce intestinal perfusion (such as diuretics, digoxin, alpha-adren-
ergic agonists), various forms of shock, septicemia, dehydration, hypotension, and others.\textsuperscript{14}

Surgical intervention by itself also carries a potential for compromising bowel perfusion. Although a few cases of fatal bowel ischemia are described after open cholecystectomy,\textsuperscript{15} various cardiac\textsuperscript{16} and peripheral vascular procedures,\textsuperscript{17} cystectomy,\textsuperscript{18} esophagectomy,\textsuperscript{19} and others, the incidence of postoperative bowel ischemia is extremely low. This indicates that the effects of surgery on bowel perfusion are usually well tolerated and have no clinical consequences.

A number of physiologic changes during laparoscopy create an additional risk of compromised mesenteric circulation. The intraabdominal hypertension created by the pneumoperitoneum reduces mesenteric perfusion, cardiac output, and mesenteric outflow.\textsuperscript{20,21} The reverse Trendelenburg position, frequently used in laparoscopy, exaggerates the above effects.\textsuperscript{22} Direct absorption of insufflated carbon dioxide into the circulation may also lead to mesenteric vasoconstriction.\textsuperscript{23} However, all these adverse physiological effects of pneumoperitoneum are obviously well tolerated in the vast majority of patients, because a clinically manifested bowel ischemia after laparoscopic procedures is an extremely rare complication. A literature search using PubMed revealed only 13 case reports before the present one\textsuperscript{1–13} (Table 1). Once it occurs though, intestinal ischemia following a laparoscopic procedure is a devastating complication. Eleven of 14 patients including this one died as a consequence, creating an overall mortality of 79%.

Rapid diagnosis is essential to prevent the catastrophic events associated with mesenteric ischemia. Because early signs and symptoms are nonspecific, the diagnosis depends mostly on a high clinical suspicion. However, given the negligible incidence of intestinal ischemia amid the large number of laparoscopic procedures performed, the diagnosis is as a rule missed or delayed. In only one reported case was the diagnosis established clinically and relatively early.\textsuperscript{9} This patient was treated with high-dose anticoagulants and recovered. In all other reported cases, the diagnosis was established either at laparotomy for acute abdomen or at autopsy.

The risk seems to be particularly high in patients with impaired hepatic or renal function or atherosclerosis. Including this one, 10 of 14 patients (71%) reported on so far had at least one of the previously mentioned risk factors present,\textsuperscript{1,2,4,5,7,8,10,12,13} None of these patients-at-risk survived. Two of 3 patients who survived were very young.

| Author | Age (years) | Risk factors | Operation | OR Time* (m) | IAP* (mmP) | Symptoms† (day) | Diagnosis* | Outcome |
|--------|-------------|--------------|-----------|--------------|------------|----------------|------------|---------|
| Paul\textsuperscript{1} | 68 | + | Cholecystectomy | 85 | 15 | 4 | At laparotomy | Death |
| Jaffe\textsuperscript{2} | 76 | + | Cholecystectomy | 70 | NS | 3 | At laparotomy | Death |
| Dwerryhouse\textsuperscript{3} | 36 | − | Cholecystectomy | 50 | 15 | 2 | At laparotomy | Recovery |
| Schorr\textsuperscript{4} | 62 | + | Cholecystectomy | 40 | NS | 3 | At autopsy | Death |
| Andrei\textsuperscript{5} | 72 | + | Cholecystectomy | 50 | 15 | 8 | At laparotomy | Death |
| Leduc\textsuperscript{6} | 57 | − | Cholecystectomy | 120 | 15 | 3 | At autopsy | Death |
| Sternberg\textsuperscript{7} | 60 | + | Cholecystectomy | NS | 14 | 8 | At laparotomy | Death |
| Thiele\textsuperscript{8} | 87 | + | Cholecystectomy | NS | NS | 4 | NS | Death |
| Klugewitz\textsuperscript{9} | 41 | − | Cholecystectomy | NS | NS | 1 | Endoscopy | Recovery |
| Bandyopadhyay\textsuperscript{10} | 78 | + | Inguinal hernia | 22 | 10 | 1 | At autopsy | Death |
| Hasson\textsuperscript{11} | 34 | − | Gynecological | 75 | 15 | 4 | At laparotomy | Recovery |
| Mitchell\textsuperscript{12} | 55 | − | Nissen | 55 | NS | 1–4 | At laparotomy | Death |
| Garcia Diaz\textsuperscript{13} | 20 | + | Nissen | 105 | 14 | 7 | At laparotomy | Death |
| Wassenaar | 47 | + | Incisional hernia | 215 | 12 | 3 | Endoscopy | Death |

* NS = not specified; IAP = intraabdominal pressure.
† Symptoms = post-operative day of onset of symptoms.
It has been previously stated that the risk is higher when the laparoscopic procedure is lengthy. Although in this case intestinal ischemia developed after an indeed very lengthy procedure, data from the literature do not provide strong support of that view. Of 13 previously published reports, duration of surgery was specified in 10 of them; on average equaling 67.5 minutes (median, 62.5, range 22 to 120), which is quite usual for procedures that were performed.

Intermittent decompression of gas during pneumoperitoneum has been suggested as a wise preventive measure.1 We used decompression once halfway through this long procedure, but it did not prevent development of fatal intestinal ischemia.

It is probably a futile endeavor to precisely determine the specific role of laparoscopy in the cascade of events that led to mortality in the patient we describe. Long laparoscopy in the patient at risk with unknown preexisting compromised mesenteric circulation definitely carried a potential to further compromise bowel perfusion. It is also possible that development of postoperative ileus in combination with systemic inflammatory response syndrome played a triggering role in the development of this complication. No signs of intestinal ischemia at relaparoscopy and a relatively long clinical course in our patient might offer certain support to this second possibility.

To the best of our knowledge, this is the first reported case of intestinal ischemia following LVH and the only one we have experienced in a series of 401 LVH performed so far (incidence of 0.25%). Carbajo et al,24 reporting earlier on their experience with LVH, mentioned in brief among postoperative complications “a case of a small bowel leakage due to ischemia” but did not provide any further details on this issue.

Patient selection, an optimal hydration status, an optimized technique using the lowest insufflation pressure possible, and intermittent decompressions of the abdomen when the procedure is lengthy are the measures that have a potential to prevent this rare complication. Whatever a laparoscopic procedure has been performed, intestinal ischemia should be considered in any patient with nonspecific abdominal symptoms.

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