

Bowel Injury After Laparoscopic Surgery

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The Case

A 30-year-old man presented to the hospital for a scheduled laparoscopic inguinal hernia repair with mesh placement. The patient had no significant past medical history and did not take any home medications. He was expected to stay a few hours after the surgery and then be released the same day.

The surgery went uneventfully, but after surgery, the patient continued to have high levels of pain at the surgical site. He was then admitted to the hospital for monitoring and pain control. As the team that performed the surgery had already left for the day, a resident physician who was unfamiliar with the patient provided overnight coverage. The night resident was called to the patient's bedside multiple times overnight by the charge nurse to address the patient's pain, and the resident ordered additional intravenous pain medication. When the primary surgical team arrived in the morning, they increased the patient's standing pain medication regimen and he was expected to be released that day or the next at the latest.

The patient remained in sustained pain and the surgical team was called to the bedside multiple times over the next 2 days. His physical examination was documented as unremarkable, and he was started on a patient-controlled analgesia (PCA) pump with hydromorphone. On postoperative day 2, the patient was weaned off the PCA and started on a clear liquid diet. However, the next day, he continued to have abdominal pain and became increasingly tachycardic with slight abdominal distention and a low-grade fever. A computed tomography scan of the abdomen was ordered, and the patient was found to have a bowel perforation. He was sent urgently back into the operating room in order to fix the perforation, and postoperatively required a lengthy stay in the intensive care unit due to septicemia. He did eventually recover and was discharged home.

The Commentary

Bowel injuries occur in around 0.13% of laparoscopic procedures.⁽¹⁾ This incidence is probably an underestimate due to the retrospective nature of most studies.⁽²⁾ These injuries may vary from serosal to full thickness injuries; the latter may lead to bowel perforation or transection.

The risk factors for bowel injuries include surgeon-related factors such as inexperience and early learning curve (3), previous abdominal surgery, adhesions, and obesity. The injury could be a result of direct injury during laparoscopic port insertion (access injury) or during handling the bowel with instruments. Thermal injuries to the bowel may occur because of equipment faults (e.g., damage to the insulation on a laparoscopic instrument) or improper use of an energy device (e.g., using an ultrasonic forceps as a grasper).

Bowel injuries can be prevented by adhering to some basic principles of laparoscopic surgery. While not conclusively proven, the use of the open technique to access the peritoneal cavity is considered to be safer than utilizing a Veress needle (a special type of needle to achieve pneumoperitoneum). Laparoscopic trocars must always be inserted under direct vision, and laparoscopic instrument changes should also be under direct vision at least early on in a surgeon's learning curve. Laparoscopy should be performed at the end of long, complex laparoscopic procedures, which are more likely to be associated with bowel injuries, to ensure that one has not occurred (e.g., after a laparoscopic anterior resection of gastrectomy where there has been considerable handling of the small intestine). Bowel that has been handled by the surgeon during procedures associated with the lysis of adhesions should always be examined systematically before removing the laparoscopic ports. Laparoscopic instruments should be regularly checked to ensure that there is no damage to the insulation. Surgeons using energy devices for the first time should be trained in their use. All these are in addition to the issues associated with training and credentialing in laparoscopic surgery. Credentialing in laparoscopic surgery involves the completion of a fellowship training program wherein fellows are required to perform a certain number of procedures, which varies depending on the specialty.

Early recognition is essential in preventing some of the adverse outcomes from iatrogenic bowel injuries. Delayed diagnosis is associated with a higher risk of septicemia (as seen in this case), the need for a laparotomy, high risk of multiple operations, stoma formation, prolonged hospital stay, and, most importantly, mortality. The estimated mortality rate for all laparoscopic bowel procedures is 3.6%.(1)

If an injury is recognized at the time of surgery, it can always be repaired, usually laparoscopically with minimum consequences. Ideally, experienced laparoscopic surgeons should perform the repair, as it involves laparoscopic suturing and knot tying, a complex technical task. However, a surgeon encountering this complication and lacking in experience in laparoscopic suturing should convert to an open laparotomy to repair the injury. In most circumstances, this would be safer than a poorly performed laparoscopic repair.

One advantage of laparoscopic surgery is that repeat laparoscopy can be performed without much trauma to patients. The policy of performing re-laparoscopy in patients who are not improving as they should is believed to be one reason for recent advances in early detection and management of anastomotic leaks in patients undergoing gastrointestinal surgery.(4)

It is likely that with the growing application of laparoscopic surgery to complex operations (e.g., gastrointestinal cancer surgery) and complex patients (e.g., those with high BMIs [body mass index] or who have undergone previous laparotomies), bowel injuries are likely to occur with increasing frequency.(1) In these circumstances, surgical teams will have to be vigilant for such complications and develop systems that can be applied rapidly. In this case, the unexpectedly severe pain experienced by a young patient who

had undergone a fairly routine operation on an outpatient basis should have prompted a number of systems responses at various stages in the postoperative period.

Although every surgeon wants to prevent surgical complications, the vagaries of individual patients mean that we are unlikely to ever reach the state of zero complications. Therefore, it is essential that we develop systems that rescue patients from surgical complications. *Failure to rescue*, a fairly new concept in hospital care, is a strong predictor of postoperative mortality.⁽⁵⁾ Research has shown that the difference between low mortality and high mortality surgical units is likely to be in their ability to rescue patients from surgical complications.⁽⁶⁾

For many years, the surgical community believed that postoperative outcomes were predicted by surgical technical skills alone. More recently we have come to appreciate the importance of leadership, communication, and teamwork.⁽⁷⁾ Often referred to as non-technical skills, these skills are fundamental to rescuing patients ⁽⁸⁾, and the effective application often predicts postoperative outcomes.^(9,10) A system that emphasizes the importance of non-technical skills and an overall culture of safety is likely to rescue these patients more effectively through a number of mechanisms. An organizational culture that emphasizes safety will work to flatten hierarchies, so that junior residents and nursing staff will be empowered to call on senior residents or attending physicians without any fear of ridicule or insult whenever they are concerned about a patient's postoperative progress. Strong leadership will promote a culture wherein senior surgeons are kept informed about the status of all patients under their care, both during and after rounds. Teamwork will lead to better communication between services, resulting in earlier recognition of complications and more aggressive diagnostic and therapeutic interventions when necessary. In many institutions, creating this kind of culture will require formal training in effective behaviors; such training is associated with lower mortality after surgery.⁽¹¹⁾ Teamwork training courses highlight the importance of teamwork, coordination, and communication in addition to emphasizing the role of briefings and checklists.⁽¹²⁾

Protocols and checklists are essential in postoperative care. In my institution as well as others, postoperative protocols include triggers that prompt review of the case by senior surgeons. In this case, such triggers would have included persistent pain and tachycardia. Other triggers that are relevant to postoperative patients (but perhaps not this case) include hypoxia and hypotension; in gastrointestinal surgery they may also include high volume of nasogastric aspirates and high drain outputs.

Protocol-based care is associated with not just shorter hospital stays but also a lower incidence of postoperative complications and death.^(13,14) In addition to standardizing postoperative care and ensuring that essential clinical processes are reliably undertaken, effective protocols and checklists nurture a softer sociotechnical dimension. They help teams develop a shared mental model of care (e.g., everyone knows what needs to be done at different stages), address some of the issues that invariably arise with shift work (where continuity of care is poor), and trigger responses to protocol deviations. It is most likely through these mechanisms that use of checklists leads to lower complications and mortality.

Take-Home Points

- Every precaution should be taken to prevent bowel injuries during laparoscopic surgery—access should preferably be through the open technique or through the use of optical entry trocars; all

trocars should be inserted under direct vision.

- Vigilance and early recognition are essential to rescuing patients from bowel injuries.
- Teamwork, communication, and leadership (human factors) skills are essential in ensuring that patients are rescued effectively with minimal morbidity and mortality.
- Postoperative care should be protocol-based and there should be triggers to escalate care.
- Patients whose progress deviates from the norm (i.e., go off-protocol) are likely to have complications. This should trigger a set of clinical and system responses, including reviews by senior clinicians.

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