CASE REPORT

Oesophageal stent placement to treat a massive iatrogenic duodenal defect after laparoscopic cholecystectomy

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SUMMARY

Iatrogenic duodenal injury occurring during laparoscopic cholecystectomy (LC) is managed surgically, though rarely a large, persistent fistula is refractory to surgical interventions. We present the case of a 40-year-old woman transferred to our centre following elective LC for a reported perforated duodenal ulcer. An uncontained leak was found to originate from a 1.5 cm duodenal defect, with no evidence of ulceration. A duodenostomy tube was placed. One month after abdominal closure, the patient continued to have a persistent, large duodenal fistula. A through-the-scope covered oesophageal stent was placed under endoscopic and fluoroscopic guidance. Five weeks later, it was successfully retrieved and no subsequent extravasation of contrast from the duodenum was noted. Unrecognised iatrogenic duodenal injuries sustained during LC can be catastrophic. In cases of massive duodenal defects and high-output biliary fistula uncontrolled after surgical intervention, endoscopic-guided and fluoroscopic-guided placement of a fully covered oesophageal stent may be lifesaving.

BACKGROUND

Laparoscopic cholecystectomy (LC) for the management of benign gallbladder disease is one of the most common general surgery operations in the USA, with over 750 000 cases performed per year.¹ Duodenal injury occurring during LC is an extremely rare event, usually caused by incomplete visualisation of surrounding structures during dissection and electrocautery injury.² If unrecognised, consequences of a duodenal injury can be devastating, including the development of sepsis, peritonitis, intra-abdominal abscess, enterocutaneous fistula and death.³

The most common treatment of a duodenal defect after LC is primary surgical repair. Duodenostomy tube placement or pyloric exclusion is also described. However, in rare cases a large duodenal fistula may prove to be refractory to surgical drainage or diversion procedures secondary to extraordinarily high enteric output. Endoscopic duodenal stenting was first introduced in the 1990s and is currently indicated to palliate malignant gastric outlet obstruction.⁴ However, few case reports have described employment of a self-expanding metal stent (SEMS) to manage duodenal fistulas from iatrogenic injury, severe pancreatitis or postoperative complications.^{2 5–7} We present

the case of SEMS placement as a salvage procedure to allow healing of a massive fistula secondary to duodenal injury during LC.

CASE PRESENTATION

A 40-year-old previously healthy woman was transferred to our university centre with a perforated duodenal ulcer following elective LC. Three days after her initial, and reportedly uneventful, operation at the referring facility, she underwent exploratory laparotomy and a Graham patch repair 3 days later for what was described as a postpyloric ulcer in the first portion of the duodenum. Secondary to haemodynamic instability and septic shock, the referring surgeons placed a temporary abdominal closure device and transferred the patient to our facility for a higher level of care. Upon arrival to the surgical intensive care unit, the patient was intubated and sedated, with a leucocytosis (white cell count 16 600) and acute renal failure (creatinine 4.38 mg/dL). Aggressive fluid resuscitation, vasopressor support and broad spectrum antibiotics were initiated. The patient was urgently transported to the operating room for abdominal exploration.

INVESTIGATIONS

An upper gastrointestinal (upper GI) study with contrast was used to evaluate the integrity of the previous duodenal repair and to discover a persistent duodenal perforation.

Oesophagogastroduodenoscopy (OGD) was used to endoscopically evaluate postsurgical anatomy and the extent of duodenal injury.

TREATMENT

During initial exploration, significant intra-abdominal contamination with bilateral subphrenic abscesses was found, though the Graham patch was found to be in place on the anterior surface of the duodenum with no gross bile spillage noted. Her abdomen was temporarily closed with an ABThera™ device to allow for a second look operation, secondary to her septic shock and ongoing haemodynamic instability. After drainage of her intra-abdominal abscesses and intravenous antibiotic administration, her clinical status improved with decreasing leucocytosis and resolution of septic shock. The patient underwent two additional exploratory laparotomies with temporary abdominal closure for washout of bilateral subphrenic

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abscesses. By the third operation at our facility and her fifth operation in total, she had developed a 'frozen abdomen' (dense adhesions of the small bowel and intra-abdominal organs, also known as a 'single abdominal organ'). This resulted in friability and fragility of her small bowel and an inability to lyse dense adhesions without causing further damage. As no evidence of bile or pus was noted and her Graham patch was in place, the peritoneum was irrigated with sterile saline and her abdominal fascia primarily closed during the third operation at our facility.

Over the following 5 days after primary closure, the patient continued to clinically improve. She received haemodialysis for treatment of acute renal failure and had a persistent though mild leucocytosis, though was afebrile, no longer required vasopressor support and her ventilator settings were weaned with plans to extubate. An upper GI series was obtained to evaluate the integrity of the previously performed Graham patch prior to initiation of enteral feeding. Contrast was noted to extravasate briskly from a defect in the proximal duodenum. The patient underwent urgent repeat exploratory laparotomy during which massive bile peritoneum was found. An uncontained leak was found to originate from a 1.5 cm duodenal defect, with no evidence of ulceration, in the area of the previous Graham patch, which was noted to have completely failed. A large Malecot tube was introduced through the defect and secured with a 2-0 PDS purse-string suture for biliary diversion via duodenostomy tube. Access to the pylorus to perform a pyloric exclusion could not be attained secondary to dense overlying omentum and impenetrable intra-abdominal adhesions. Similarly, a feeding jejunostomy could not be performed as the entirety of the small bowel was 'frozen' and overlying adhered omentum precluded access. Subsequent abdominal explorations were performed with the intent of controlling the biliary leak via wide surgical drainage. Despite placement of multiple abdominal drains and duodenostomy tube, the defect continued to expand in size, reaching a maximum diameter of 3 cm, resulting in free extravasation of bile throughout the peritoneum. Abdominal washouts were performed with the intent of source control and to place paraduodenal drains that would encourage the formation of a controlled duodenal fistula.

One month after abdominal closure with Vicryl mesh and subsequent visceral skin graft placement, the patient continued to have a persistent, large duodenal fistula, in addition to *Clostridium difficile* colitis, and multiorgan failure with need for haemodialysis and tracheostomy. Interventional radiology (IR) performed placement of a percutaneous jejunal feeding tube that traversed through the duodenal defect and allowed for the distal delivery of supplemental nutrition. During the same procedure, a 12 French, 40 cm internal/external biliary drain was placed that extended through the cystic duct remnant, through the common bile duct, through the duodenum and distally past the defect. The previously surgically placed paraduodenal sump tube adjacent to the second portion of the duodenum was exchanged over an Amplatz wire for a 20 French, 25 cm pigtail catheter. The patient tolerated the exchange of the surgical drains and tubes by IR, though continued to drain approximately 1 L of bilious fluid daily from the paraduodenal drain.

We consulted our gastroenterology colleagues to discuss the possibility of stent placement to allow healing of the fistula, though this had been described only once in the literature for a similar indication. A Taewoong fully covered 20 mm×100 mm oesophageal stent was placed under endoscopic and fluoroscopic guidance with a total of six endoclips placed at the proximal end to prevent stent migration (figure 1). Postprocedure, she tolerated clear liquids by mouth with significant decrease in bile

Figure 1 Through-the-scope self-expanding metal oesophageal stent placed over duodenal fistula in first portion of duodenum with anchoring clips to prevent distal migration.

output. She was discharged home 1 month after stent placement. At the time of discharge, abdominal X-ray confirmed the stent to be unchanged and in appropriate position (figure 2). She returned to the hospital 11 days later for planned stent removal (6 weeks status poststent placement) by the gastroenterology service, as well as internal/external biliary drain removal by IR. At the time of elective presentation, she reported a 5-day history of abdominal pain and nausea. Abdominal X-ray imaging demonstrated stent migration into the proximal jejunum. It was successfully retrieved during OGD and no subsequent extravasation of contrast from the duodenum was noted on fluoroscopy.

OUTCOME AND FOLLOW-UP

Five months later, the patient underwent successful abdominal wall reconstruction for a large ventral hernia repair with bilateral component separation and biological mesh. Ten months postoperatively, she was discharged from general surgery clinic, with recommendations to return as needed. The patient required haemodialysis for acute renal failure for the first 2 months of her initial hospitalisation, though her kidney function was noted to steadily improve throughout her clinical course. She continued to be followed up in outpatient nephrology clinic for chronic kidney disease, secondary hyperparathyroidism of renal origin and vitamin D deficiency. At her most recent clinic visit, her creatinine level appeared to have plateaued at 1.46 mg/dL. She reported increasing overall strength in the context of critical

Figure 2 Abdominal anteroposterior X-ray demonstrating the oesophageal stent covering a massive duodenal defect. Also shown is a transduodenal jejunal feeding tube and an internal/external biliary stent to allow for improved enteral nutrition and biliary drainage, placed by an interventional radiologist.

illness myopathy during her hospitalisation, as well as increased appetite and desired weight gain. By 1 year after her initial injury she returned to work.

DISCUSSION

Duodenal injury occurring during LC is a rare event, with only 74 published cases found in a recent systematic review and meta-analysis by Machado.³ The most common cause of injury is electrocautery, followed by injuries occurring during dissection and retraction. The second portion of the duodenum is most commonly affected and less than half of injuries (46%) are recognised at the time of operation. Primary surgical repair is the leading intervention, with further options including percutaneous drainage, tube duodenostomy, gastric resection or pyloric exclusion, and in extreme cases pancreaticoduodenectomy. A delay in diagnosis greater than 48 hours can lead to devastating and fatal complications, with an overall mortality rate of 10%. Duodenal fistula can result after failure of primary repair, likely secondary to oedematous and friable tissue, complicated by the massive and constant effluence of biliary and pancreatic fluids in the area of injury.

Cases of duodenal stent placement for benign indications have been historically rare in the literature though are increasingly reported. Duodenal stents are currently indicated for the relief of malignant gastroduodenal obstruction.⁸ Additionally, extensive knowledge exists regarding endoscopic management of oesophageal fistulae and anastomotic leak. The largest case series of stent placement for treatment of duodenal or jejunal biliary leaks after major abdominal surgery was published in 2016 and included six patients.⁷ All patients underwent stent placement after failure of primary surgical repair and/or percutaneous drainage. Four patients had persistent biliary leaks after pancreatic, renal or retroperitoneal malignant mass excision. One patient in this series was treated for a large duodenal defect after LC, after an abdominal drain eroded into the bowel wall. Because of the large diameter of the patient's duodenum, a colonic stent was placed in this case. One patient died from septic complications, while five patients had complete cessation of leakage. One complication of distal stent migration occurred. All stents were removed after 4–8 weeks after resolution of the fistula.

Additional indications for stent placement in benign disease are found in a small number of case reports and include massive fistulas resulting from infected pancreatic necrosis,⁵ retroperitoneal duodenal perforation occurring during endoscopic retrograde cholangiopancreatography (ERCP) and sphincterotomy,⁶ and perforated duodenal ulcers.¹⁰ Immediate stenting following a perforation during duodenoscopy or a spontaneous perforated ulcer has been discussed in the gastroenterology literature as an alternative to surgical intervention^{10 11} though at this time surgical consultation remains the current standard of care.

While duodenal stent placement covers the defect, permits normal flow of bile into the distal small bowel and allows initiation of oral nutrition after abdominal drain output decreases (2,6,7), the risks of the procedure must also be considered. The most frequent complication is distal migration of the stent, which occasionally can result in small bowel obstruction. Less frequently gastric outlet obstruction or stent fracture can occur.^{9 12} Measures to reduce the high migration rate include various anchoring techniques. In our case, we employed clips, though suture and percutaneous endoscopic gastrostomy (PEG)-based systems have also been described.² Our patient did have stent migration, though it was easily retrieved and the fistula had

resolved by the time of removal. While covered stents result in higher rates of migration compared with uncovered SEMS, they are removable, which is a desired feature in cases of temporary bridges to surgery¹³ or in cases such as our patient where the stent should be removed after fistula resolution. Additionally, the through-the-scope feature and length of the oesophageal stent was ideal in our patient's case to traverse the stomach and cover the entire length of the duodenum.

Unrecognised iatrogenic duodenal injuries sustained during LC, most commonly secondary to electrocautery, can be catastrophic. In cases of massive duodenal defects and high-output biliary fistula not controlled by duodenostomy tube placement or wide surgical drainage, a multidisciplinary approach, including surgical, endoscopic and IR expert, will increase the possibility of successful management. Specifically, endoscopic-guided and fluoroscopic-guided placement of a fully covered oesophageal stent may allow for delivery of enteral nutrition and provide a lifesaving option for this devastating complication.

Learning points

- ▶ Iatrogenic duodenal injury occurring during laparoscopic cholecystectomy presents a rare intraoperative complication and is most commonly secondary to electrocautery.
- ▶ While a rare complication, duodenal injury must be recognised early to avoid catastrophic complications such as septic shock, multiorgan failure and death.
- ▶ In the case of a massive duodenal defect and persistent bile fistula refractory to surgical intervention, placement of a fully covered oesophageal stent should be considered.
- ▶ While enteric stents also carry potential for complications, the risks and benefits should be carefully considered as a lifesaving procedure.

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