



DIAGNOSIS AND MANAGEMENT OF DUODENAL PERFORATIONS: A NARRATIVE REVIEW

General Surgery

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ABSTRACT

Duodenal perforation is a rare, but potentially life-threatening injury. Multiple etiologies are associated with duodenal perforations such as peptic ulcer disease, iatrogenic causes and trauma. Diagnosis is usually made by history and clinical examination. Computed tomography with intravenous and oral contrast is the most valuable imaging technique to identify duodenal perforation. Conservative management seems to be feasible in stable patients with sealed perforations. Immediate surgery is required for patients presenting with peritonitis and/or intra-abdominal sepsis. Minimally invasive techniques are safe and effective alternatives to conventional open surgery in selected patients. Here we review the current literature on duodenal perforations and discuss the outcomes of different treatment strategies.

KEYWORDS

INTRODUCTION

Duodenal perforation represents rare but potentially life-threatening condition. The mortality rate ranges from 8% to 25% in published studies. The incidence of peptic ulcer disease has decreased in recent years. This can partly be explained by the use of proton pump inhibitors (PPIs) and eradication treatment for *Helicobacter pylori*. Iatrogenic duodenal perforations are becoming more common following the widespread use of endoscopic procedures, such as endoscopic retrograde cholangiopancreatography (ERCP). The first description of a perforated duodenal ulcer was made in 1688 by Muralto and reported by Lenepneau. In 1894, Dean reported the first successful surgical closure of a perforated duodenal ulcer. Surgery is still the mainstay of treatment for duodenal perforation. Many perforations are repaired using an omental patch, a technique that was first described by Cellan-Jones in 1929 and was later modified by Graham in 1937. The first laparoscopic repair for a perforated duodenal ulcer was reported in 1990.

Optimal methods for the management of duodenal perforations remain controversial. One area of controversy includes the role of non-operative management. In patients that need surgery, there is still ongoing debate regarding type of repair, open or laparoscopic technique and the role of gastric diversion procedures, such as pyloric exclusion.

In this review, we provide an overview of duodenal perforations and potential management strategies based on available data.

ETIOLOGY

Peptic ulcer disease is a leading cause of duodenal perforation. Acute perforations of the duodenum are estimated to occur in 2–10% of patients with ulcers. The two major causes of peptic ulceration and perforation are *H. pylori* infection and NSAIDs. In patients with recurrent ulcer hypersecretory states such as Zollinger-Ellison syndrome need to be considered.

Duodenal perforations can also occur in people with conditions such as duodenal diverticula, duodenal ischemia, impacted gallstones in the duodenum, infectious disease and autoimmune conditions, including Crohn's disease, scleroderma, abdominal polyarteritis nodosa, tumors and chemotherapy.

Endoscopic perforations

ERCP ranges from 0.09 to 1.67%. The Stapfer classification has been developed to categorize ERCP-related perforations. Type I perforations are large lateral or medial duodenal wall perforations usually caused by the endoscope itself. Type II perforations, also known as peri-Vaterian injuries, are related to the sphincterotomy.

Type III perforations represent distal bile duct injuries caused by wire or basket instrumentation, while type IV perforations are Upper endoscopy may lead to iatrogenic perforations to the duodenum. Risk factors for ERCP-related perforations have been reported to include old age, sphincter of Oddi dysfunction, intramural injection of contrast medium and anatomical abnormalities, such as Billroth II gastrectomy.

Operative injury

Duodenal injuries may be caused by surgical instrumentation. They may go unnoticed during the initial operation and manifest themselves several days later as a delayed perforation a consequence of coagulation necrosis of the duodenal wall. Laparoscopic cholecystectomy is one of the most common cause of iatrogenic injury. The mechanisms of injury were mainly related to thermal burns by electrocautery or by sharp or blunt dissection.

Trauma

Traumatic injuries to the duodenum are uncommon, representing less than 2% of all abdominal injuries. The majority of these traumatic lesions are due to penetrating mechanisms. Duodenal injuries often occur together with other organ injuries and damages to large vessels.

Foreign bodies

Ingested foreign bodies generally pass through the gastro-intestinal tract without complications. Implanted foreign bodies such as endoprosthesis or artificial vascular grafts can cause erosion into the duodenum leading to fistula and abscess formation or vasculo-enteric fistulas.

Spontaneous perforations

This type of perforation occurs in neonates. The underlying cause remains unknown.

DIAGNOSIS

Perforation of the duodenum is defined as a transmural injury to the duodenal wall. Perforation of the duodenum with spillage of intraluminal contents into the peritoneal cavity causes acute chemical peritonitis. This is followed by a systemic inflammatory response syndrome (SIRS), which can progress to secondary bacterial peritonitis and sepsis. Patients with retroperitoneal perforation may lack peritoneal signs. Diagnosis is usually made by history, clinical examination and radiological investigation (x ray abdomen erect & x ray chest).

Double-contrast computed tomography (CT) scan is the most valuable method for diagnosing duodenal perforation. CT features of perforation include discontinuity of the duodenal wall and the presence of extraluminal air or extravasated oral contrast. Other CT findings include duodenal wall thickening, fat stranding and periduodenal fluid collection.

Treatment

Management of duodenal perforations includes conservative, endoscopic and surgical strategies. The main goals of treatment are resuscitation, control of infection, nutritional support and restoration of gastrointestinal tract continuity.

Conservative treatment

Initial conservative management consists of nil per os, intra-venous fluid therapy, broad-spectrum antibiotics, intravenous PPIs, nasogastric tube insertion and *H. pylori* eradication. The added value of somatostatin remains controversial. However, there are some data to support the benefit of somatostatin for enterocutaneous fistula closure. Non-operative management of perforated duodenal ulcers is feasible in selected patients. Perforated ulcers may seal spontaneously with fibrin, omentum or by fusion of the duodenum to the underside of the liver between the gallbladder and the falciform ligament. Approximately, 50–70% of patients with perforated peptic ulcers respond to conservative treatment without surgery. For patients undergoing conservative treatment, a gastroduodenogram may be performed soon after admission to investigate if there is any contrast extravasation.

Operative management is usually recommended if there is free leakage of contrast medium into the peritoneal cavity.

In high-risk patients, who cannot tolerate surgical treatment, conservative management may also include percutaneous drainage of fluid collections.

Endoscopic management

Endoscopic treatment is an attractive treatment modality due to its minimally invasive nature. Early endoscopic closure (<24 h) is considered to be technically easier because the inflammatory changes are less pronounced.

TTSC

Through-the-scope clips (TTSC) can be used for endoscopic closure of small duodenal perforations. Linear perforations <1 cm are most suitable for the use of TTSC.

OTSC

In contrast to common endoscopic clips, the over-the-scope clips (OTSC) are able to compress larger quantities of tissue. The OTSC system is shaped like a bear trap to enable a full-thickness closure of the tissue. The OTSC technique can be used for perforations ranging from 1 to 3 cm.

Endoloop with clips

A combined technique using TTSC and an endoloop can be used if the OTSC technique is unavailable.

SEMS

Self-expandable metal stents (SEMS) are alternative endoscopic treatment options for duodenal perforations.

Surgical treatment

The choice of surgical treatment depends on the size and site of perforation, the viability of the duodenal walls, the degree of local contamination and underlying etiology.

Simple surgical repair

The main surgical treatment is simple repair of the perforation site. This can be performed as a primary closure with or without the addition of an omental patch. A pedicled omental flap (Cellan-Jones repair) or free omental plug (Graham patch) can be sutured into the perforation. Surgical repair can be performed either with conventional open surgery or with laparoscopy. The results of a recent meta-analysis including seven randomized controlled trials showed a significant benefit for the laparoscopic approach for the treatment of perforated peptic ulcer disease with a significant reduction in postoperative complications and hospital stay.

Sutureless techniques have also been developed using a gelatin sponge and fibrin glue to seal off the perforation. There seem to be no significant differences in terms of postoperative morbidity and mortality rates when comparing primary closure, omentopexy or timentation (without closure).

The routine placement of abdominal drains after surgical repair is controversial. The literature suggests no benefit in preventing

postoperative fluid collections or abscesses. Furthermore, drains may be associated with increased morbidity and wound site infection.

The Jejunal Serosal Patch Procedure:-

The management of the leaking omental patch is very difficult and need urgent exploration and surgical expertise. Literature suggests different methods of closure of leaked repair. Closure of these defect by serosal patching can result in decreased morbidity and mortality. James and Santa in 1965 reported the first clinical application of a Serosal Patch in repair of a Duodenal Fistula in a 55 years old male patient.

The procedure is described as follows

After opening the previous surgical wound, the intra abdominal collection was sucked out and the operation site approached. The duodenal perforation site was identified after gently dissecting through the adhesions. Once identified, all the debris and obvious necrotic tissues were debrided. If the adhesions allow, the second part of the duodenum was mobilized, then a loop of jejunum, 40-60cm away from the ligament of Treitz was brought over the colon and sutured over the duodenal defect serosa-to-serosa with interrupted sutures of 2-0 silk. About 2-3 cms away from the perforation site a feeding jejunostomy should also be performed.

Repair of perforated duodenal ulcers with a falciform ligament patch

Repair of perforated duodenum with falciform ligament is suitable alternative to omental patch especially during laparoscopic management. Reexploration after leak when the omentum is sloughed and adhered, falciform ligament of liver can be mobilised and placed over the perforation with three interrupted sutures.

Repair Through RAM pull in Flap

Repair of the leaked perforation and large duodenal fistula can be done through Rectus Abdominis Muscle Pull In Flap, based on superior epigastric artery. In moribund patients this procedure can be done in local anaesthesia. RAM is detached from its superior attachment and pulled in through the nasogastric tube in to the perforation and fixed through interrupted sutures. In most of the cases the fistula get closed in 3-5 days.

Management of duodenal perforation caused by ERCP

ERCP related perforation occur in about 1% patients. Patient present with undue pain and fever. CT is used to confirm the diagnosis. Management is initially conservative. In case of large perforation associated with generalised peritonitis, tension pneumothorax and subcutaneous emphysema operative management is preferred. Surgical procedure include primary repair, gastrojejunostomy with pyloric exclusion and retroperitoneal drainage with T tube placement in the CBD.

Reconstructive Surgery

For large duodenal perforations, a duodeno-duodenostomy may be necessary. In case of recurrent duodenal perforation antrectomy with HSV (Highly selective vagotomy) was done frequently in the past. Nowadays where surgical expertise is not a constraint a Roux-en-Y duodenojejunostomy and Billroth II operation is performed over the perforation. If the duodeno-pancreatic head complex is destroyed, a pancreaticoduodenectomy may be necessary.

Tube duodenostomy

Tube duodenostomy is a damage control procedure for large duodenal perforations when there is the lack of surgical expertise for complex reconstruction. The perforation is sutured around a catheter inserted into the perforation to enhance directed fistulation of the perforation. The catheter is removed after a minimum of 6 weeks. A feeding jejunostomy may be placed for enteral nutritional support.

Prognostic factors

The main prognostic factor remains the time interval between the perforation and treatment. Mortality increases when the delay is greater than 24 h. Other prognostic factors have been reported but are mainly related to clinical signs of sepsis, such as increased Acute Physiology and Chronic Health Evaluation II (APACHE II) score. Old age and comorbidity are also strong adverse prognostic factors.

CONCLUSION

Duodenal perforation is caused by a variety of different mechanisms. Some duodenal perforations can be managed conservatively, while others require prompt surgical treatment. The type of treatment should be individualized and depends on the mechanism of injury, the timing, location and extent of the injury and

the clinical state of the patient. Open surgery is still the gold standard for patients that need surgical intervention and most duodenal perforations can be managed with a simple repair of the defect. Laparoscopic approach for the treatment of perforated peptic ulcer disease is associated with a significant reduction in postoperative complications and hospital stay.

Gastric diversion procedures such as pyloric exclusion have been used for many years to treat duodenal perforations, but there is little evidence to support any benefit. Minimally invasive treatments are slowly emerging as alternative methods to open surgery in the treatment of duodenal perforation.

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