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Single Case

Vacuum-Sponge Therapy Placed through a Percutaneous Gastrostomy to Treat Spontaneous Duodenal Perforation

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Duodenal ulcer · Duodenal perforation · Postoperative leakage · Endoscopic management · Vacuum-sponge therapy

Abstract
Duodenal perforation is rare and associated with a high mortality. Therapeutic strategies to address duodenal perforation include conservative, surgical, and endoscopic measures. Surgery remains the gold standard. However, endoscopic management is gaining ground mostly with the use of over-the-scope clips and vacuum-sponge therapy. A 67-year-old male patient was admitted to the emergency room for persistent epigastric pain, melena, and signs of sepsis. The physical assessment revealed reduced bowel sounds, involuntary guarding, and rebound tenderness in the upper abdominal quadrant. A contrast-enhanced computed tomography (CT) scan confirmed the suspicion of ulcer perforation. The initial laparoscopic surgical approach required conversion to laparotomy with overstitching of the perforation. In the postoperative course, the patient developed signs of increased inflammation and dyspnea. A CT scan and an endoscopy revealed a postoperative leakage and pneumonia. We placed an endoscopic duodenal intraluminal vacuum-sponge therapy with endoscopic negative pressure for 21 days. The leakage healed and the patient was discharged. Most experience in endoscopic vacuum-sponge therapy for gastrointestinal perforations has been gained in the area of esophageal and rectal transmural defects, whereas only few reports have described its use in duodenal perforations. In our case, the need for further surgical management could be avoided in a patient with multiple comorbidities and a reduced clinical status. Moreover, the pull-through

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technique via PEG for sponge placement reduces the intraluminal distance of the Eso-Sponge tube by shortcutting the length of the esophagus, thus decreasing the risk of dislocation and increasing the chance of successful treatment.

Introduction

Duodenal perforation is a rare pathology. Despite best management, it results in a substantial mortality between 8 and 25% [1]. Peptic ulcer disease (PUD) is the major cause for duodenal perforation with 2–10% perforations occurring among patients with PUD [2]. *Helicobacter pylori* infection and nonsteroidal anti-inflammatory drugs (NSAIDs) are mostly responsible for PUD [1]. While incidence of PUD tends to decrease due to the use of proton pump inhibitors and *H. pylori* eradication, iatrogenic duodenal perforations become more common as a consequence of the widespread use of endoscopic procedures, for example, endoscopic retrograde cholangiopancreatography [3].

Therapeutic strategies for duodenal perforation include conservative, surgical, and endoscopic measures. Overall, surgery remains the gold standard [4]. However, endoscopic management is gaining ground mostly with the use of over-the-scope clips and vacuum-sponge therapy [5]. The use of vacuum-sponge or endoscopic negative pressure therapy (ENPT) is mostly popular in esophageal and rectal transmural defects, whereas only few reports have described its use in duodenal perforations.

We present the case of a patient with NSAIDs-associated duodenal ulcer perforation primarily treated with surgical direct overstitching. Because of a postoperative leakage associated with a clinical deterioration and pneumonia, an endoscopic vacuum-sponge therapy through a PEG-system was performed with a successful outcome.

Case Report

We report the case of a 67-year-old male patient, admitted to the emergency room with persistent epigastric pain and melena for a week. He was treated for chronic obstructive pulmonary disease, arterial hypertension, alcohol overconsumption, active smoking, and chronic diffuse articular disease with regular intake of NSAIDs. The patient presented with sepsis (Sequential organ failure assessment score of 4). The physical assessment revealed reduced bowel sounds, involuntary guarding and rebound tenderness in the upper abdominal quadrants. The laboratory showed elevated leucocytes at 14.6 G/L, a C-reactive protein of 2,861 nmol/L, and a normal hemoglobin of 133 g/L with 37% hematocrit. The arterial blood gas analysis showed a metabolic lactic acidosis with respiratory compensation (pH 7.45, lactate 6.1 mmol/L, pCO2 21.9 mm Hg). A contrast-enhanced abdominal computed tomography (CT) scan raised the suspicion of a gastroduodenal perforation (see Fig. 1a, b). The patient immediately received antibiotics and fluid resuscitation and underwent emergency surgery.

The initial laparoscopy had to be converted to a laparotomy, due to biliary peritonitis in all abdominal quadrants with fibrinous deposits. After aspiration of 3 L of biliary ascites, a perforation involving 7/8th of the circumference of the pars superior duodeni, 2 cm distal from the pylorus, was observed. The stomach and the biliary system were intact. A direct overstretching of the perforation in combination with a cholecystectomy and a peritoneal lavage was performed. Two drainages were placed in the region of the perforation, and a jejunostomy

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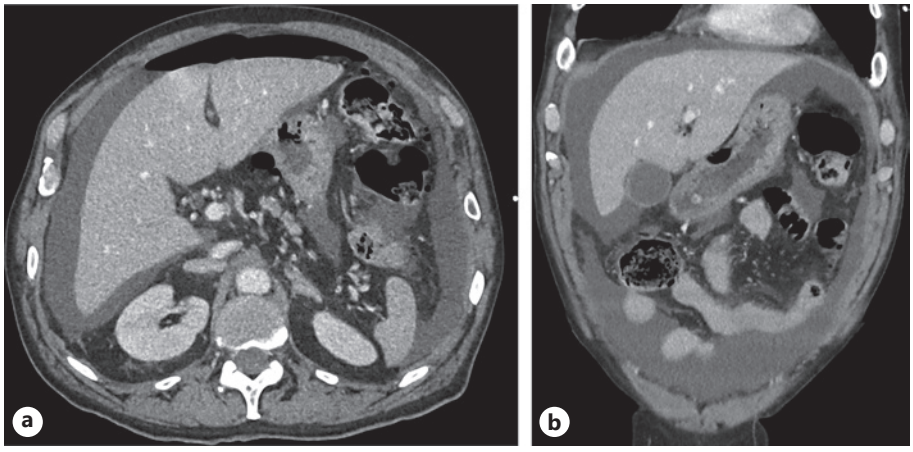

Fig. 1. a, **b** Image of a contrast-enhanced CT with pneumoperitoneum and bowel wall thickening.

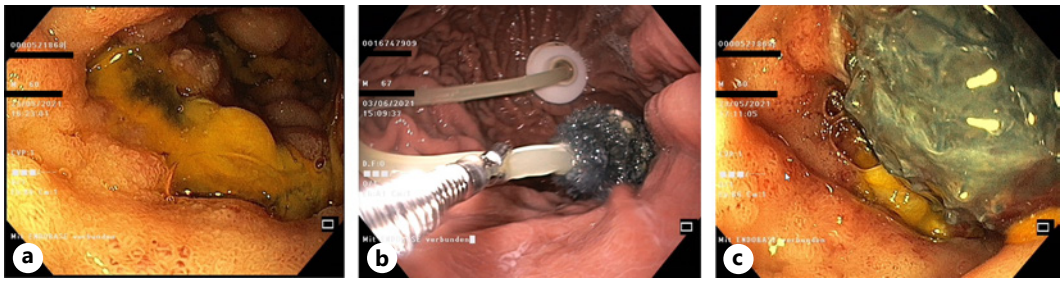

Fig. 2. a Image of the duodenal ulceration taking 50% of the circumference of the duodenal bulb. **b** Image of the Eso-sponge placed near the ulceration and leakage site.

and gastrostomy for nutrition and decompression were created. Pathological examination of the lesion excluded malignancy. The general status of the patient improved quickly, as systemic inflammation decreased. He was extubated 1 day after the operation and transferred to the regular ward after withdrawal of the vasoactive support 2 days after the surgery.

On postoperative day 6, the patient developed cough, dyspnea, and increased inflammatory parameters (leucocytes 20 G/L and CRP 2190 nmol/L). A new contrast-enhanced thoracoabdominal CT showed an infiltrate at the right lower lobe of the lung compatible with pneumonia. Furthermore, there were postoperative changes in the abdomen with distended bowels, some intraperitoneal fluid and air bubbles without signs of an abscess or a mechanical ileus.

To confirm a suspected insufficiency of the duodenal overstitching, we performed an upper gastrointestinal endoscopy with minimal CO2-insufflation. We observed a duodenal ulceration involving 50% of the circumference of the duodenal bulb (see Fig. 2a). To confirm the suspicion of leakage, we injected contrast under fluoroscopy. Because of the reduced pulmonary status of our patient and the presence of abdominal drainage, we favored a non-invasive approach, following on-site interdisciplinary discussion, and initiated a treatment with a vacuum Eso-Sponge.

Firstly, we converted the surgical gastrostomy to a 20 CH percutaneous endoscopic gastrostomy (PEG) with an internal bumper using a pull-through technique. We then introduced a surgical thread through the PEG-tube into lumen of the stomach, recovered the thread with a grasper, and pulled it through the mouth. Thereafter, the thread was stitched to the distal part of the Eso-Sponge. Subsequently, we used the pull-through technique to advance the Eso-Sponge into the gastric stomach, pulling the tube through the gastrostomy. Finally, the

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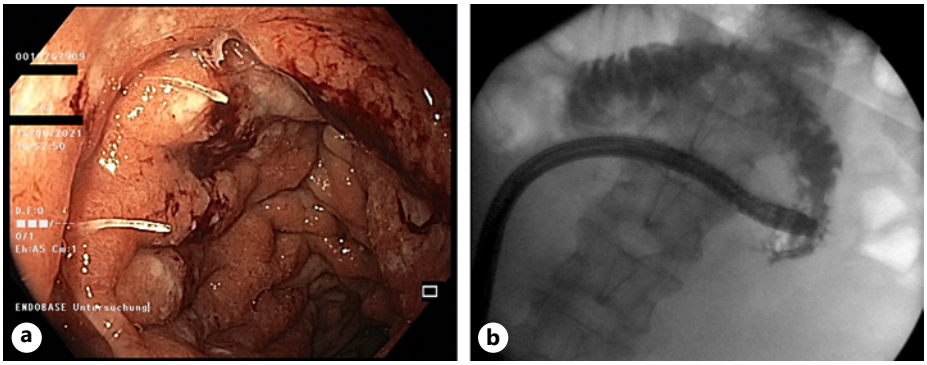

Fig. 3. a Image of the postoperative site with no more signs of ulceration or leakage endoscopically. **b** Image of the postoperative by fluoroscopy and injection of contrast. There is no sign of leakage.

Eso-Sponge was placed on the area of the perforation at the bulb using an endoscopic forceps (see Fig. 2b). Subatmospheric therapy was then initiated with a continuous aspiration of 125 mm Hg. The Eso-sponge was changed every 3–4 days and after 3 weeks we could confirm the healing of the leakage endoscopically and radiologically (see Fig. 3a, b). The patient was discharged and transferred for pulmonary rehabilitation.

Discussion

PUD includes both gastric and duodenal ulcers. It is a frequent pathology with a high morbidity and a substantial mortality. Although the incidence of PUD has decreased due to the use of proton pump inhibitors (PPI) and the eradication of *Helicobacter pylori*, the widespread use of NSAIDs as well as the increasing use of low-dose aspirin in the ageing population are important causes of ulcers, with probably a higher risk of major complications such as bleeding and perforation [6].

To reduce morbidity, early recognition of PUD-related symptoms prior to the development of complications is of utmost importance. Patients with PUD typically experience epigastric pain, fullness, bloating, and nausea. Epigastric pain due to duodenal ulcers is typically worse at night and in the fasting state. However, chronic ulcers can be asymptomatic particularly when NSAIDs-associated. In these cases, hemorrhage or perforation may be the first manifestation of the disease [7]. The diagnosis of PUD is best made through endoscopy, demonstrating a mucosal break of at least 5 mm or more with a fibrin cover.

Perforation of PUD usually presents with sudden abdominal pain accompanied by localized or generalized peritonitis. In one-third of the patients, there is a lack of peritoneal signs, which can also occur in the case of retroperitoneal duodenal perforations. Leukocytosis and metabolic acidosis are typically observed in the laboratory tests although they are non-specific. In case of a high suspicion of complicated PUD, patients should undergo a contrast-enhanced abdominal CT scan to confirm the diagnosis. CT scan findings are intraperitoneal fluid, pneumoperitoneum, bowel wall thickening, and extra-luminal water-soluble contrast [8].

The gold standard management of perforated PUD is surgical, especially in patients with signs of peritonitis. Emergency surgery is crucial as delays are associated with worse surgical outcomes and increased mortality [9]. Laparoscopy is appropriate when feasible [10]. Conservative management must be limited to a narrow selection of patients.

In the last decade, endoscopic therapies for spontaneous and iatrogenic upper gastrointestinal perforations, such as over-the-scope clips and ENPT, have been developed [11]. The use

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of these methods has not been standardized yet, but experience has been increasing over the last years.

The idea of ENPT resulted from the development of negative pressure therapy for external wound healing. Large-pore polyurethane foam is inserted into a wound to enhance regional perfusion, reduce wound edema, drain secretions and debride the surface of the wound [12].

ENPT for upper gastrointestinal defects was developed in 2006 in Germany and was used for the first time to treat anastomotic leak after gastrectomy [13]. In the following years, more than 420 patients were reported worldwide with a success rate of 87%, mostly with esophageal defects, but only few with duodenal or pancreatic lesions or complications after bariatric surgery [14].

A few cases of ENPT for duodenal leaks were published. In some, a surgical access for gastrostomy or jejunostomy was also used to simplify the access and placement of the sponge. As in our case, the sponge was placed into the lumen with a rapid healing of the defect in a few days [14].

The overtube of the Eso- SPONGE ® manufactured by Brau is 56 cm long.

Because of the long distance and several angles, there is a high risk for dislocation of the sponge when it is placed in the duodenum intraluminally and drawn out nasally.

The use of the pull-through technique via PEG for sponge placement and necessary changes during treatment reduces the intraluminal distance of the Eso-Sponge tube by short-cutting the length of the esophagus and part of the stomach, allowing for a placement of the sponge without tension, thus lowering the risk of dislocation, and increasing the chance of successful treatment. Moreover, the PEG can still be used as a mean of decompression of the stomach.

In conclusion, perforated duodenal ulcers are still associated with a substantial morbidity and mortality. The gold standard management remains surgical but vacuum-sponge or ENPT can be an efficient add-on therapy in case of persistent postoperative leakage in selected patients.

Statement of Ethics

All procedures were performed in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Written informed consent was obtained from the patient for publication of this case report and any accompanying images. It is the policy of the Institutional Review Board (IRB) of the University Hospital of Bern that a "single case report" or "limited case series" does not require review by the IRB. The IRB approval was waived for this case report.

Conflict of Interest Statement

None of the authors has any financial or nonfinancial conflicts of interest to declare. All authors have confirmed that the article is not under consideration for review by any other journal.

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Author Contributions

Maude Martinho and Riad Sarraj were involved in the writing of the case report and literature research. All authors were involved in the clinical decisions and follow-up of the patient. All authors reviewed critically and corrected the manuscript.

Data Availability Statement

Data are available upon request.

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