

Case Report

Endoscopic Vacuum Therapy in the Repair of Upper GI Perforations and Leaks: A Case Series

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Abstract

Endoscopic Vacuum Therapy (EVT) is a novel approach in the non-surgical management of upper GI perforations. We present 4 cases of EVT employed to close post-surgical upper GI leaks. A wound vacuum sponge was affixed to a NG tube, endoscopically guided/placed at the perforation, and placed to suction until there was radiographic or clinical evidence of resolved perforation. 1 case involved a duodenal perforation. 2 cases involved an anastomotic leak. 1 case involved esophageal leak following gastric bypass surgery. Duration of EVT ranged from 7 to 35 days (average: 21.75 days). The sponge was exchanged in 3 cases 7 to 15 days after initiation of therapy (average: 10.67 days). In all cases, the perforation was successfully closed. No complications associated with EVT itself were noted. Our case series demonstrates the viability of EVT in repair of upper GI perforations/leaks and supports its earlier consideration in the management of such cases.

Keywords: Anastomotic Leak; Duodenum Endoscopy; Endoscopic Vacuum Therapy; Perforation; Post-Surgical Complication

Introduction

Upper GI perforations are associated with high mortality rates and remain one of the most serious complications of any GI procedures or surgeries; esophageal perforations, for example, are associated with an overall mortality rate of 18% [1]. Surgical management remains the primary treatment modality but advances in non-surgical interventions such as stents and over-the-scope clips (OTSC) have been increasingly utilized as alternatives to surgery with promising results [2,3]. Endoscopic Vacuum Therapy (EVT) has emerged as a novel approach in the non-surgical management of GI perforations and leaks. Though initially employed for management of lower GI injuries, multiple case reports over the last decade have noted its use in the treatment of esophageal or gastric injury following a surgical procedure such as esophagectomy/gastrectomy, paraesophageal hernia repair, or anastomosis creation [4-6]. More recently, EVT has begun to be employed in more distal areas of the upper GI tract, including duodenal injuries [7-10]. We

present 4 cases in which EVT was successfully employed to repair upper GI anastomotic leak or duodenal leak following the failure of other, more established methods of repair including surgical and/or other endoscopic techniques.

Materials and Methods

All the upper GI EVT experiences of a group of endoscopists employed at 2 Southern California hospitals over a 1.5 year period were included in our series. The general technique employed was as follows: a wound vacuum sponge (KCI-V.A.C. Granufoam) was affixed to the distal end of an NG tube (Covidien) with 2-0 sutures (Covidien) (Figure 1). The sponge was then inserted intra-nasally, endoscopically guided to the perforation/leak over a guidewire, and either placed within the perforation or adjacent to the perforation where it was affixed with hemoclips and/or sutures (Figure 2). The NG tube was placed on low to medium continuous suction (30 or 100mmHg) until the primary endpoint was reached; that is, until either the abdominal drain output was 0 or until radiographic studies demonstrated contained perforation or complete resolution of the perforation. During this period, the sponge/NGT was replaced every 7 to 15 days to ensure that the

effectiveness of EVT was not hampered by degraded or damaged sponges. All patients were followed as outpatient for at least 30 days following discharge to confirm perforation resolution and to monitor for post-procedural complications.



Figure 1: Example of the wound vacuum sponge affixed to the distal end of a nasogastric tube.



Figure 2: The sponge/nasogastric tube placed within the duodenal perforation of Case 1. In each case, the sponge/nasogastric tube was either placed within the perforation or intraluminally adjacent to the perforation.

Results

In total, our endoscopists utilized EVT to assist in the closure of upper GI perforations/leaks in 4 cases; an overview of each case can be seen in Table 1. In each case, the upper GI perforation was a post-surgical complication. 1 case involved a D2 duodenal leak following surgical resection of a retroperitoneal tumor with adhesions to the duodenum (Case 1). Two cases involved a leak of an anastomosis (esophago-jejunal or pancreaticojejunal anastomoses) that had been created following resection of tumor

(Case 2 and 3). One case involved an esophageal leak directly above the GE junction following gastric bypass surgery (Case 4). The duration of EVT ranged from 7 to 35 days, with an average of 21.75 days. The sponge was exchanged once in Cases 1, 3, and 4, occurring between 7 to 15 days after initiation of therapy with an average of 10.67 days. In all cases, the primary endpoint was successfully reached. No complications associated with EVT itself were noted. Given the intricacies of the cases, a short description of each case follows.

Case	Age/Sex	Indication for EVT	Management Techniques Prior to EVT	Sponge Placement	# of Sponge Changes	Duration of therapy
1	58 M	Duodenal leak after tumor resection	Serosal patch, endoloop, OTSC	Within perforation	1 (15 days after initiation of EVT)	28 days
2	62 F	Esophageal-jejunal anastomotic leak	Endoscopic sutures, OTSC	Within perforation	0	7 days
3	37 M	Pancreatico-jejunal anastomotic leak	Surgical revision of anastomosis	Intraluminally over perforation though noted to be malpositioned on subsequent imaging	1 (7 days after initiation of EVT)	35 days
4	48 F	Esophageal leak	OTSC, esophageal stent placement x2	Intraluminally over perforation	1 (10 days after initiation of EVT)	17 days

Table 1: Summary of the included cases.

In Case 1, a 58 year old male developed a persistent duodenal leak after surgical resection of a 20cm retroperitoneal hemangiopericytoma that had significant adhesions to the 2nd portion of the duodenum resulted in an enterotomy. The injury was repaired primarily at the time of surgery but the repair broke down with alternative measures (including surgical placement of a serosal patch, an endoloop with clips, and an OTSC) failing to close the 15mm defect. EVT with a 1.3x2.5cm sponge affixed to a 16Fr NG tube was placed on post-op day (POD) 21 with the sponge being placed within the perforation itself. The NG tube was kept at low continuous suction and was replaced once 15 days following initial placement. Contrast studies demonstrated leak closure and the sponge was removed on POD49. CT on POD73 confirmed complete resolution of the leak.

In Case 2, a 62 year old female with history of stage 3 gastric adenocarcinoma underwent successful laparoscopic total gastrectomy with creation of esophago-jejunal anastomosis. Postoperative course was complicated by an intraabdominal abscess associated with the anastomosis, and subsequent percutaneous drain placement into the abscess cavity demonstrated output consistent with anastomotic leak. Unsuccessful endoscopic repair of a 1.2cm defect was attempted via sutures and OTSC (Ovesco12/6) on POD29; repeat EGD demonstrated a persistent 0.6cm defect. EVT was utilized via placement of a 3x1.5cm sponge affixed to a 12Fr NG tube into the defect on POD 33. The NG tube was kept at low continuous suction for 7 days after which a repeat contrast study confirmed a contained perforation. The sponge was removed and a further 3 endoclips were placed over the site of the defect. Subsequent imaging confirmed resolution of the leak.

In Case 3, a 37 year old male with history of a resected retroperitoneal liposarcoma underwent successful resection of new recurrent tumors involving the abdominal wall and the 2nd part of the duodenum, which required a pancreaticoduodenectomy. On POD7, the patient’s RUQ drain had an abrupt increase in bilious output with CT imaging demonstrating a displaced pancreatic stent and free fluid in the abdomen suggestive of complete disruption of the pancreaticojejunostomy. Surgical revision of the pancreatico-jejunal anastomosis was undertaken on POD6 but did not resolve the leak. EVT was initiated on POD11 with placement of a 5cm sponge affixed to a 16Fr NG tube intraluminally adjacent to the leak to help promote drainage through the enterotomy. The NG tube was placed to low continuous suction. It was noted on subsequent imaging that the EVT affixed to the NG tube migrated out of position almost immediately; however, it was felt that the continuous suction still helped to promote intraluminal drainage of pancreatic fluid. On POD18, a 10Fx5cm double pigtail plastic stent and a 0.8x6cm fully covered metal biliary stent (ConMed Viabil) were placed across the fistula. The rationale was to keep the enterotomy from closing completely. The sponge was also replaced by a 6cm vacuum sponge affixed to the distal end of an 18Fr NG tube; the replacement was inserted into the G-tube tract and placed intraluminally over the fistula. This was placed to continuous suction at 100mmHg. Again, subsequent imaging demonstrated immediate out-migration of the sponge. It was thus unclear how long the sponge was able to provide suction during this time period, although bilious output was noted within the wound vacuum container. Subsequent CT imaging did note a decrease in the size of the abdominal fluid collection, but it was

difficult to ascertain how much the sponge contributed to leak closure. However, given our previous successes, the decision was made to maintain the sponge in the hopes that appropriate repositioning would contribute to faster fistula closure. He was discharged to home with outpatient follow up. The sponge/NG tube was removed on POD 46 as he had minimal drain output with no contrast extravasation into the retroperitoneum noted during EGD and follow-up CT.

In Case 4, a 48 year old female underwent successful gastric bypass surgery with postoperative course complicated by a 2cm leak above the GE junction. During EGD on POD20, an OTSC, two 18x123mm partially covered metal stents, and a 18x123mm fully covered metal stent were placed into the esophagus/gastric pouch with improvement of abdominal drain output. However, repeat contrast study on POD35 demonstrated persistent leak with a 4mm opening noted near the OTSC. A 5x1.5cm sponge mounted at the distal end of a 12Fr NG tube was placed intraluminally over the leak. The NG tube was kept on low continuous suction and replaced once on POD 52. Subsequent contrast studies showed gradually decreasing amounts of contrast in the external drain. On POD59, the NG tube and sponge were removed as drain output had ceased. Follow-up CT abdomen/pelvis on POD81 confirmed resolution of the leak.

Discussion

The use of Endoscopic Vacuum Therapy (EVT) in repairing upper GI perforations has grown over the past decade since its introduction by Loske, et al. [7]. The technique follows the principle that negative pressure over an open wound will accelerate healing by virtue of improving blood flow, removing inflammatory material, and promoting granulation [4]. It involves the placement of a polyurethane sponge into the site of perforation/leakage with subsequent application of negative pressure via a gastric tube [4]. The appeal of the technique lies in its minimally invasive nature, its ease of use, and avoidance of expensive and/or difficult-to-use tools such as endoscopic clips and stents. Furthermore, placement of a sponge at the distal end of the nasogastric tube reduces the risk of tissue/vascular injury that can be caused by bare nasogastric tubes. The technique does have its limitations; it cannot be employed in free perforations (i.e. perforations resulting in free intra-abdominal air) and there are anatomic limits, as more distal regions of the upper GI tract would be difficult to reach via a nasogastric pathway. However, the use of pre-existing G-tube tract, as demonstrated in Case 3, or the creation of proximal jejunal stoma as demonstrated by Kelm, et al. [10] suggest that circumventing these anatomic restrictions are possible. The reported success rate varies from paper to paper, with review articles suggesting anywhere between 70-100% [4,5]. A retrospective study comparing stents with EVT demonstrated significantly higher rate of fistula closure with EVT

(53.8% vs 84.4%, respectively) [11]. A separate retrospective study compared EVT to surgical management and stents in the setting of anastomotic leaks and noted that EVT patients had significantly lower mortality rates than those treated with stents or surgical interventions [12]. Our case series supports EVT's reported efficacy in the management of upper GI anastomotic leaks [4,5] and provides evidence for its role in the management of duodenal perforation repair, an area in which EVT is not as well studied; a PubMed search demonstrated only several other case reports utilizing EVT in the repair of duodenal perforation [7-10]. It is not possible to definitively state whether EVT was absolutely necessary in the management of the aforementioned cases as there are no large-scale studies examining the extent of EVT's effect on perforation healing; it is possible that the perforations would have closed in time without vacuum therapy. However, placement of the sponge did significantly reduce drain output in the above cases, supporting the idea that at the very least, EVT ensured swifter closure of the wound. Based on our experiences and other similar studies in the literature, we believe EVT is a viable alternative to surgical closure, OTSC, or covered metal stent placement in the repair of upper GI perforations/leaks and as such deserves earlier consideration when approaching such cases.

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