


Vacuum Endoscopic Therapy for the Treatment of Perforated Gastric Ulcer: A Case Report and Literature Review

Laís Yumi Takaoka, Tauane de Lima Fiorillo,
Vanessa Costa Muniz , Willian Chaves,
Adriano Silvério da Paixão, Ana Caroline C. da Silva,
Daniel Salerno Muzilli, Bárbara Esteves Silva,
Lara Godela Delatore

Abstract: Vacuum endoscopic therapy (VET) has been widely studied and utilized as an innovative technique in the treatment of defects in the anterior intestinal wall. This therapeutic approach, based on creating a closed environment of negative pressure around the wound, has demonstrated promising clinical outcomes. Endoscopic use of negative pressure therapy was first described in 2004 and has since been applied in the treatment of anastomotic leaks, spontaneous perforations, and other gastrointestinal wall defects. Based on scientific evidence and favorable clinical results, VET has established itself as an important clinical tool, particularly in specialized centers in Europe. The technique promotes contraction, containment, cleaning, and healing of the infected wound area, with mechanisms of action that include collapse of the wound cavity, drainage of infected fluids, removal of debris and microorganisms, reduction of interstitial edema, and promotion of microcirculation. In the case of the perforated gastric ulcer described in this article, VET was successfully applied, resulting in significant clinical improvement and proper ulcer healing. The patient underwent wound area cleaning, application of vacuum dressing, and was kept on a nil per os (NPO) diet. After three days, there was improvement in symptoms and inflammatory parameters, and a follow-up esophagogastroduodenoscopy (EGD) confirmed improvement in the perforated area.

Introduction

Vacuum endoscopic therapy (VET) has been widely studied and utilized as an innovative technique in the treatment of defects in the anterior intestinal wall. This therapeutic approach is based on creating a closed environment of negative pressure, where the wound compartment is subjected to a pressure lower than atmospheric pressure. This process requires the use of a suction pump and a hermetic seal, which allows the isolation of the wound area from the atmosphere.

The endoscopic use of negative pressure therapy was initially described in 2004 by Weidenhagen et al., in a study involving anastomotic leaks following rectal resection. However, more comprehensive clinical data was only published in 2008 when a series of 29 patients treated with VET was described (1).

Based on promising clinical outcomes and increasing scientific evidence [2-5], VET has established itself as an important clinical tool. Especially in specialized centers, primarily in Europe, VET has evolved as the standard treatment for defects in the anterior intestinal wall.

In this case report, we will describe a case of perforated gastric ulcer successfully treated using vacuum endoscopic therapy. Furthermore, we will provide a current literature review on the subject, aiming to provide a comprehensive overview of this innovative therapeutic technique and its clinical applications.

Case Presentation

We present the case of a 41-year-old female patient who sought medical attention due to complaints of epigastric and right hypochondrium pain, accompanied by nausea, hyporexia, and vomiting lasting for one week. Upon admission, the patient had vital signs within the normal range, but the abdomen was tender to deep palpation in the epigastric region. No signs of peritonitis were observed. Laboratory tests revealed leukocytosis and elevated levels of C-reactive protein (CRP), while the other tests did not show significant alterations.

An abdominal ultrasound was performed, which revealed the presence of cholelithiasis (gallstones). Additionally, an abdominal computed tomography (CT) scan was performed, revealing lymphadenopathy



(enlarged lymph nodes) and a blur near the 3rd portion of the duodenum.

Based on the clinical and radiological findings, an upper gastrointestinal endoscopy (UGIE) was requested, which revealed the presence of an ulcer transitioning from the 2nd to the 3rd portion of the duodenum. The edges of the ulcer were erythematous, edematous, and the center had a thick layer of fibrin, indicating signs of perforation and purulent content drainage. The area was cleansed with 0.9% saline solution, and an endoscopic vacuum dressing was applied. The patient was kept on absolute fasting during the treatment.

Three days after the procedure, the patient showed complete improvement of symptoms and inflammatory markers, as evidenced by laboratory tests. A follow-up UGIE was performed, revealing an improvement in the appearance of the duodenal perforation site compared to the previous examination.

Granulation tissue was observed, and the ulcer orifice had decreased. At this point, the vacuum dressing was removed, and a nasoenteral tube (NET) was inserted past the perforation site for enteral feeding.

After 24 hours, the patient was discharged from the hospital with a recommendation to maintain an exclusive enteral diet for 14 days, along with antibiotic therapy. During outpatient follow-up, the patient remained asymptomatic. A follow-up abdominal CT scan performed seven days after discharge showed only mild residual blur in the mesenteric fat near the duodenum.

After 14 days, a repeat UGIE was performed, revealing the presence of a convergence of folds in the transition from the 2nd to the 3rd portion of the duodenum, without the presence of the perforated ulcer. The NET was removed, and the patient demonstrated good acceptance of an oral diet



Image 1: Admission abdominal CT scan.



Image 2: Admission EGD, prior to VET procedure.



Image 3: Follow-up EGD, 3 days post-procedure

Discussion:

Vacuum endoscopic therapy (VET) has shown to be a promising treatment option for leaks and perforations in the upper gastrointestinal tract. The indications for VET in these cases encompass a wide range of defects in the transmural wall of the esophagus and esophagogastric junction, including suture line leaks following oncological resections, bariatric procedures, iatrogenic perforations, and even spontaneous ruptures such as in Boerhaave's syndrome. Published evidence has mainly focused on the treatment of postoperative leaks and has demonstrated encouraging results (6-8).

The basic principle of VET is to create a negatively pressurized environment that promotes contraction, containment, cleaning, and healing of the infected wound area. The application of negative pressure causes the wound compartment to collapse, a phenomenon known as "macrodeformation." Studies have shown that the application of negative pressure at 125 mmHg can reduce the volume of a polyurethane sponge by up to 80%. This collapse of the wound cavity is essential for promoting proper healing (9-12).

In addition to the collapse of the wound cavity, VET also has other mechanisms of action. It allows for drainage of infected fluids, removal of debris and microorganisms, as well as reduction of interstitial edema. Furthermore, there is growing evidence that VET promotes microcirculation and oxygen saturation through angiogenesis induced by modulated expression of vascular endothelial growth factor (13,14).

VET is becoming increasingly popular as a treatment option for leaks in the upper gastrointestinal tract, especially in Central Europe. Its indications have expanded from anastomotic fistulas to spontaneous or iatrogenic perforations. While success rates vary across studies, published series report rates ranging from 78% to 100%. However, it is important to note that many of these series are based on highly heterogeneous populations and evaluate both intraluminal and intracavitary VET together (15,16).

The growing popularity of VET as a therapeutic option for leaks and perforations in the upper gastrointestinal

tract highlights the need for further well-designed and standardized studies. It is essential to obtain robust evidence that specifically assesses different patient subgroups and the best techniques for VET application. With a better understanding of the mechanisms of action and more accurate evaluation of outcomes, VET may establish itself as a standard treatment for these conditions, offering significant benefits to patients, such as higher success rates, lower morbidity, and faster recovery.

Conclusion:

Vacuum endoscopic therapy (VET) has emerged as a promising and effective approach for the treatment of perforated gastric ulcers. By creating a negative pressure environment around the wound, VET promotes successful healing and recovery of these lesions. With encouraging clinical outcomes and growing scientific evidence, VET is establishing itself as a viable therapeutic option, offering faster recovery and reduced morbidity for patients with perforated gastric ulcers.

References:

- Weidenhagen R, Gruetzner KU, Wiecken T, Spelsberg F, Jauch KW (2008) Endoscopic vacuum-assisted closure of anastomotic leakage following anterior resection of the rectum: a new method. *Surg Endosc* 22:1818–1825
- Smallwood NR et al (2016) The use of endoluminal vacuum (E-Vac) therapy in the management of upper gastrointestinal leaks and perforations. *Surg Endosc* 30(6):2473–2480
- Pournaras DJ et al (2018) Endoluminal vacuum therapy (E-Vac): a treatment option in oesophagogastric surgery. *World J Surg* 42(8):2507–2511
- Newton NJ et al (2017) Systematic review of the use of endoluminal topical negative pressure in oesophageal leaks and perforations. *Dis Esophagus* 30(3):1–5
- Rausa E et al (2018) Comparison of endoscopic vacuum therapy versus endoscopic stenting for esophageal leaks: systematic review and meta-analysis. *Dis Esophagus* 31(11):1–8
- Virgilio E, Ceci D, Cavallini M (2018) Surgical endoscopic vacuum-assisted closure therapy (EVAC) in treating anastomotic leakages after major resective surgery of esophageal and gastric cancer. *Anticancer Res* 38(10):5581–5587
- Archid R et al (2020) Endoscopic vacuum therapy for staple line leaks after sleeve gastrectomy. *Obes Surg* 30(4):1310–1315
- Jung DH et al (2021) Endoscopic vacuum therapy in patients with transmural defects of the upper gastrointestinal tract: asystematic review with meta-analysis. *J Clin Med* 10(11):2346. <https://doi.org/10.3390/jcm10112346>
- Kairinos N, Solomons M, Hudson DA (2009) Negative-pressure wound therapy I: the paradox of negative-pressure wound therapy. *Plast Reconstr Surg* 123(2):589–598
- Scherer SS et al (2008) Wound healing kinetics of the genetically diabetic mouse. *Wounds* 20(1):18–28
- Borgquist O, Ingemansson R, Malmso M (2011) The influence of low and high pressure levels during negative-pressure wound therapy on wound contraction and fluid evacuation. *Plast Reconstr Surg* 127(2):551–559
- Morykwas MJ et al (2006) Vacuum-assisted closure: state of basic research and physiologic foundation. *Plast Reconstr Surg* 117(7 Suppl):121S-126S
- Sogorski A et al (2018) Improvement of local microcirculation through intermittent negative pressure wound therapy (NPWT). *J Tissue Viability* 27(4):267–273
- Shah A et al (2019) Incisional negative pressure wound therapy augments perfusion and improves wound healing in a swine model pilot study. *Ann Plast Surg* 82(4S Suppl 3):S222–S227
- Bludau M, Fuchs HF, Herbold T, et al. Results of endoscopic vacuum-assisted closure device for treatment of upper GI leaks. *Surg Endosc*. 2018;32(4):1906–1914.
- Kuehn F, Loske G, Schiffmann L, et al. Endoscopic vacuum therapy for various defects of the upper gastrointestinal tract. *Surg Endosc*. 2017;31(9):3449–3458