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## International Journal of Surgery Case Reports

journal homepage: [www.casereports.com](http://www.casereports.com)

# Proximal jejunal stoma as ultima ratio in case of traumatic distal duodenal perforation facilitating successful EndoVAC<sup>®</sup> treatment: A case report



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## ARTICLE INFO

### Article history:

Received 13 October 2017

Received in revised form

12 November 2017

Accepted 13 November 2017

Available online 16 November 2017

### Keywords:

Transstomal endoluminal vacuum therapy

Duodenal trauma

Duodenal perforation

EndoVAC and small bowel

## ABSTRACT

**INTRODUCTION:** During damage control surgery for blunt abdominal traumata simultaneous duodenal perforations can be missed making secondary sufficient surgical treatment challenging. Endoluminal vacuum (EndoVAC<sup>TM</sup>) therapy has been shown to be a revolutionary option but has anatomical and technical limits.

**PRESENTATION OF THE CASE:** A 59-year old man with hemorrhagic shock due to rupture of the mesenteric root after blunt abdominal trauma received damage control treatment. Within a scheduled second-look, perforation of the posterior duodenal wall was identified. Due to local and systemic conditions, further surgical treatment was limited. Decision for endoscopic treatment was made but proved to be difficult due to the distal location. Finally, double-barreled jejunal stoma was created for transstomal EndoVAC<sup>TM</sup> treatment. Complete leakage healing was achieved and jejunostomy reversal followed subsequently.

**DISCUSSION:** During damage control surgery simultaneous bowel injuries can be missed leading to life-threatening complications with limited surgical options. EndoVAC<sup>TM</sup> treatment is an option for gastrointestinal perforations but has anatomical limitations that can be sufficiently shifted by a transstomal approach for intestinal leakage.

**CONCLUSION:** In trauma related laparotomy complete mobilization of the duodenum is crucial. As ultima ratio, transstomal EndoVAC<sup>TM</sup> is a safe and feasible option and can be considered for similar cases.

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## 1. Introduction

Blunt abdominal traumata including complex mesenteric vascular injuries leading to hemorrhagic shock may require damage control surgery [1]. In these cases, simultaneous duodenal perforations of the posterior wall can be missed making secondary sufficient surgical treatment difficult if not impossible due to local inflammation [2]. Endoluminal vacuum (EndoVAC<sup>TM</sup>) therapy has been shown to be a revolutionary option in similar situations [3,4], but has anatomical and technical limits [5]. We propose that the creation of a stoma can sufficiently shift anatomical borders and facilitate successful EndoVAC<sup>TM</sup> treatment of the retroperitoneal duodenum if there is no surgical treatment alternative. Here we

describe how we used this approach in a complex patient. The work is reported in line with the SCARE criteria [6].

## 2. Presentation of the case

A 59-year old man with hemorrhagic shock due to blunt abdominal trauma was transferred to our tertiary hospital. Past medical history was unremarkable except thyroidectomy for low-grade papillary thyroid carcinoma one year before. During emergency laparotomy, rupture of the mesenteric root and its inflows as well as a ventral perforation of the duodenum (Pars III) were detected as the predominant injuries. Damage control treatment included massive transfusion, microsurgical re-vascularization of mesenteric veins including the superior mesenteric vein, and suturing of the ventral duodenum. Due to consumptive coagulopathy and a general edema of the small intestine, no further exploration but packing of the abdomen was performed. During abdominal wall closure a vicryl mesh was inserted in inlay position in order

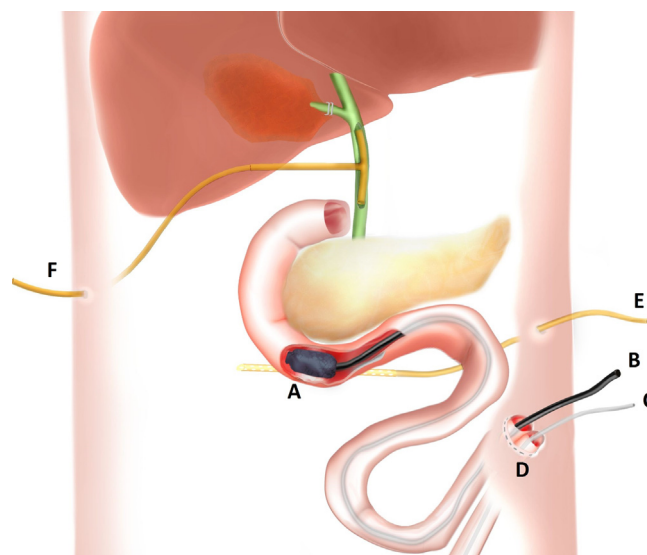
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to reduce the risk of abdominal compartment. Subsequently, the patient was transferred to the Intensive Care Unit (ICU).

Initial ICU treatment consisted of mechanical ventilation, differentiated norepinephrine and volume therapy, continuous hemodialysis, and coagulation management including massive transfusions of procoagulant factors. Within a scheduled second-look 48 h after damage control procedure and satisfactory overall stabilization, depacking was performed. During Kocher maneuver an additional 3 × 2 cm perforation of the preaortal posterior duodenal wall (Pars III) was also identified. Due to delayed detection, localized peritonitis and small bowel edema suturing was regarded insufficient. In addition, extended procedures as pyloric exclusion or partial duodenopancreatectomy were considered as too hazardous given the fact of the persistent compromised local and systemic condition of the patient. Therefore, the decision for less invasive endoscopic treatment was made. Using an intraoperative rendezvous approach, an EndoVAC™ sponge was placed into the distal duodenum covering the leak sufficiently. In addition, an intraabdominal surgical drainage was located next to the wound. Due to the distal location of the leak, transoral access, however, proved to be difficult. Subsequently, the following scheduled EndoVAC™ sponge replacement two days later took more than one hour. In order to achieve sufficient, atraumatic and recurrent EndoVAC™ changes, we decided to create a double-barreled jejunal stoma 20 cm distal of Treitz' enabling transstomal EndoVAC™ treatment through the afferent loop while a jejunofix catheter for enteral nutrition was placed into the efferent loop. From the patient's perspective, this procedure was executed as ultima ratio due to a persistent septic shock without further surgical options. Simultaneously, cholecystectomy with t-duct drainage of the common bile duct in order to deviate bile flow was performed (Fig. 1). Thus, sufficient sponge positioning could be easily achieved followed by slow closure of the 3 × 2 cm posterior duodenal leak. The tip of the sponge was placed beside the leak where a small mesenteric abscess occurred (Fig. 2A). Changes of the EndoVAC™ system took place every three days. Twenty-one days later, the mesenteric abscess decreased about 50% (Fig. 2B). In addition, a CT-scan two weeks after termination of EndoVAC™ therapy showed that the mesenteric fluid collection nearly disappeared (Fig. 2C). During transluminal contrast agent application six weeks after initial damage control treatment, no leak was detected anymore. In the meantime, abdominal wound closure was also achieved whereby

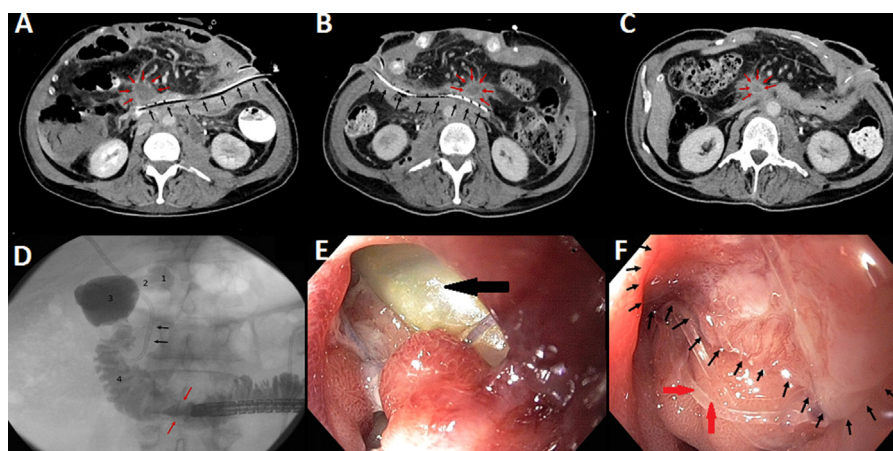


**Fig. 1.** Drawing of the anatomical and technical situation after transstomal EndoVAC™ implementation. (A – transstomal EndoVAC™ sponge at the duodenal perforation; B – transstomal EndoVAC™; C – jejunofix catheter; D – double-barreled jejunal stoma; E – surgical drain; F – t-duct drain of the common bile duct).

the further postoperative course was uneventful. All surgical and endoscopic procedures were performed by the same experienced interdisciplinary team. Two months after initial damage control procedure, the patient was discharged from ICU and jejunostomy reversal followed subsequently. Full recovery was achieved at the rehabilitation center afterwards.

### 3. Discussion

In recent years damage control surgery has been increasingly established for trauma related duodenal perforations while extended procedures as pyloric exclusion, duodenal diverticularization or partial duodenopancreatectomy have been rarely used [7,8]. Nevertheless, during damage control surgery simultaneous bowel injuries can be missed. In particular, missed duodenal perforations are life-threatening complications and can make surgical treatment extremely challenging or even impossible. Relating to



**Fig. 2.** A: Transstomal EndoVAC™ installation (black arrows). The tip of the sponge is placed beside the leak, where a small mesenteric abscess occurred (red arrows). B: 21 day later the mesenteric abscess decreased about 50% (red arrows). C: CT-scan 2 weeks after termination of EndoVAC™ therapy the mesenteric fluid collection nearly disappeared (red arrows). D: After six weeks during the transluminal contrast agent application no leak was found. 1. Pyloric antrum, 2. Pyloric canal, 3. Duodenal bulb, 4. Duodenum pars II; Black arrows: biliary drainage; red arrows: previous leakage position. E: Endoluminal view of the duodenal perforation. Behind the duodenal wall, a surgical drain is visible (black arrow). F: Endoluminal view of the closed duodenal perforation. Black arrows marking the border between normal duodenal mucosa a scar tissue. A small piece of transparent suture is visible (red arrows).

these high complex situations with septic shock there is little evidence about further approaches [9,10]. EndoVAC™ treatment proved to be a good option for gastrointestinal perforations but has anatomical and technical limitations as usually natural orifices are used for its placement [5]. Thinking outside the box lead us to the creation of a stoma as ultima ratio which sufficiently shifted these anatomical borders, facilitated successful EndoVAC™ treatment and could therefore be considered in similar cases. In addition, in this case transstomal EndoVAC™ therapy emerged to be a simplified and more comfortable approach for the patient as well as attending physicians and enabled an uncomplicated enteral nutrition through the aboral loop resulting in an increased intervention adherence in comparison to established transoral EndoVAC™ treatment.

#### 4. Conclusion

Even in the case of existing perforations of the anterior duodenal wall complete mobilization of the duodenum (Kocher maneuver) is crucial in trauma related laparotomy. As ultima ratio, a transstomal approach for EndoVAC™ is a feasible alternative in case of intestinal perforations. Nevertheless, no standard solutions for duodenal injuries and management of postoperative complications can be proposed. Most of these cases are challenging and may require a multidisciplinary approach.

#### Conflicts of interest

M.K., F.S., S.R., K.K., A.M., C.J., C.T.G., M.B. declare no conflict of interest and no financial support.

#### Funding

This study was not funded.

#### Ethical approval

After consultation of our ethics committee no ethical approval was necessary due to internal hospital guidelines.

#### Consent

Written consent has been obtained from the patient and will be provided if the Editor should ask to see it.

#### Author contribution

M.K. and F.S. collected data and wrote the manuscript. S.R., K.K., A.M., C.J., C.T.G., and M.B. reviewed/edited the manuscript and contributed to the discussion.

#### Guarantor

M.K. and F.S. accept full responsibility for the work.

#### References

- [1] M.F. Rotondo, C.W. Schwab, M.D. McGonigal, G.R. Phillips 3rd, T.M. Fruchterman, D.R. Kauder, et al., 'Damage control': an approach for improved survival in exsanguinating penetrating abdominal injury, *J. Trauma* 35 (3) (1993) 375–382, discussion 82–3.
- [2] S.M. Fakhry, D.D. Watts, F.A. Luchette, Current diagnostic approaches lack sensitivity in the diagnosis of perforated blunt small bowel injury: analysis from 275,557 trauma admissions from the EAST multi-institutional HVI trial, *J. Trauma* 54 (2) (2003) 295–306.
- [3] F. Seyfried, S. Reimer, A.D. Miras, W. Kenn, C.T. Germer, M. Scheurlen, et al., Successful treatment of a gastric leak after bariatric surgery using endoluminal vacuum therapy, *Endoscopy* 45 (Suppl. 2) (2013) 2, UCTN:E267–8.
- [4] N.R. Smallwood, J.W. Fleshman, S.G. Leeds, J.S. Burdick, The use of endoluminal vacuum (E-Vac) therapy in the management of upper gastrointestinal leaks and perforations, *Surg. Endosc.* 30 (6) (2016) 2473–2480.
- [5] T. Glatz, A. Fischer, J. Hoepfner, R. Thimme, C. Walker, H.J. Richter-Schrag, Vacuum sponge therapy using the pull-through technique via a percutaneous endoscopic gastrostomy to treat iatrogenic duodenal perforation, *Endoscopy* 47 (Suppl. 1) (2015) E567–8.
- [6] R.A. Agha, A.J. Fowler, A. Saeta, I. Barai, S. Rajmohan, Orgill DP The SCARE Statement: Consensus-based surgical case report guidelines, *Int. J. Surg.* (Lond. Engl.) 34 (2016) 180–186.
- [7] J. Mayberry, L. Fabricant, A. Anton, B. Ham, M. Schreiber, R. Mullins, Management of full-thickness duodenal laceration in the damage control era: evolution to primary repair without diversion or decompression, *Am. Surg.* 77 (6) (2011) 681–685.
- [8] C. Ordonez, A. Garcia, M.W. Parra, D. Scavo, L.F. Pino, M. Millan, et al., Complex penetrating duodenal injuries: less is better, *J. Trauma Acute Care Surg.* 76 (5) (2014) 1177–1183.
- [9] H.K. Bhattacharjee, M.C. Misra, S. Kumar, V.K. Bansal, Duodenal perforation following blunt abdominal trauma, *J. Emerg. Trauma Shock* 4 (4) (2011) 514–517.
- [10] N. Agarwal, N.K. Malviya, N. Gupta, I. Singh, S. Gupta, Triple tube drainage for difficult gastroduodenal perforations: a prospective study, *World J. Gastrointestinal Surg.* 9 (1) (2017) 19–24.

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