



Rational Visceral Medicine between Gastroenterology and Surgery: Endoscopic Full-Thickness Over-The-Scope Clip (OTSC) Application in Ongoing Sepsis after Percutaneous Endoscopic Gastrostomy (PEG) Placement with Gastric Wall Perforation

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Abstract

Background: Gastrointestinal perforations without surgical repair may lead to peritonitis and sepsis with a high rate of mortality.

Materials and Methods: This case report describes the onset of sepsis after an anterior gastric wall perforation due to PEG insertion. Progredient pneumoperitoneum, hypotensive cardiocirculatory parameters, tachyarrhythmia and ongoing sepsis were diagnosed clinically and by means of serology, electrocardiography, and radiology.

Results: A prompt interdisciplinary procedure and an effective endoscopic intervention using the Over-the-Scope Clip (OTSC) technique were applied for perforation closure in combination with a calculated high-dosed antibiotic medication consisting of tigecycline, linezolid and fluconazole along with standard sepsis therapy. This non-invasive, conservative treatment led to normalization of cardiocirculatory parameters, prompt resolution of inflammatory response, and resorption of the pneumoperitoneum within 48 h and rapid remission of sepsis. This is the first case reporting an OTSC application in ongoing sepsis. It demonstrates the immediate changes of important clinical and laboratory parameters within hours after endoscopic perforation closure. However, such an interdisciplinary approach is only possible when all procedures, interventions, and intensive care medicine treatment interlock appropriately to avoid a lethal septic outcome and/or an immediate surgical procedure, respectively.

Conclusion: The application of this clip encompassing the full gastrointestinal wall (OTSC) provides an effective immediate treatment option in gastrointestinal perforations. The procedure should be performed early and is most likely successful if the perforation tissue is vital, fresh and may be grasped tightly. Thus, interventional endoscopists and surgeons should consider this treatment option, even in ongoing sepsis.

Keywords: Gastrointestinal perforation; Percutaneous Endoscopic Gastrostomy (PEG); Endoscopic management; Over-the-Scope Clip (OTSC); Sepsis treatment

Introduction

Untreated gastrointestinal perforations with escape of gastric acid, bile or stool into the abdomen lead to peritonitis and sepsis with a high mortality [1-3]. The outcome of perforations of the gastrointestinal tract is dependent on time to diagnosis of the perforation, its location, its etiology (spontaneous, traumatic, iatrogenic, malignant etc), time point of surgical intervention, patient conditions such as age and comorbidities [4-6].

For example, placement of Percutaneous Endoscopic Gastrostomy (PEG) yields a known risk of iatrogenic perforation of 0.5% to 4.5%, especially when multiple punctures are necessary or long procedure times occur. The 30-days-mortality after PEG insertion has been found up to 8% to 12% with a minority of patients developing progredient or persistent pneumoperitoneum with subsequent peritonitis or sepsis [7,8]. Known risk factors for iatrogenic perforation, increased mortality or complication rates after PEG insertion are low albumin levels, high c-reactive protein values, low BMI and age older than 65 years [7,8]. In the case of perforation after PEG placement with progredient pneumoperitoneum immediate surgery including perforation closure, abdominal drainage and lavage in combination with high-dose antibiotics are currently the standard of care. But surgery is associated with significant morbidity and mortality, requires general anesthesia, is unpopular for patients, and might entail a prolonged recovery [3-7].

The following report describes an effective endoscopic perforation closure after PEG insertion in a patient with onset sepsis using a full-thickness Over-the-Scope-Clip technique (OTSC, OVESCO endoscopy AG, Tübingen, Germany), which allows to apply a full-thickness, serosa-to-serosa apposition. OTSC is a minimal-invasive treatment option for gastrointestinal bleeding or perforation closure [4,6,9-11].

Case Presentation

A 52-year-old male patient after ventricular fibrillation due to myocardial infarction with hypoxic brain damage received a 9 Fr PEG under invasive ventilation on the intensive care unit.

Thirty hours after PEG insertion he developed an increase of the abdominal girth and onset of sepsis under continuous alimentation given *via* the PEG. The increase of the abdominal girth was about 4 cm and other sepsis parameters were found at that time point: Heart rhythm changed to tachyarrhythmia absolute (heart rate about 135 bpm, high-sensitive troponin I negative); blood pressure decreased from 138/89 mmHg to 108/68 mmHg, the temperature raised up to 38.9°C (Figure 1). Abdominal X-ray in left side position showed marked pneumoperitoneum. The patient soon developed further septic circulation depression to 92/58 mmHg, shock index was 1.46 (HR/systolic RR). Serologically, an increase of the creative protein up to 300 mg/l, of leucocytes up to 18000/μl with 92% granulocytes were observed along with a slight decrease of the thrombocyte- and prothrombine values (Figure 2).

Blood cultures were taken; the patient received 3,500 ml intravenous fluid substitution per 24 h and had a demand for a continuous norepinephrine application (5 mg/50 ml Perfusor) to support a stable circulation. The immediately calculated antibiotic medication given at onset of sepsis due to peritonitis was tigecycline (100 mg i.v. loading dose, 50 mg i.v. twice daily) because of its profound spectrum against gram-negative bacteria commonly encountered in the gastrointestinal tract (anaerobes, gram-negative bacteria, *Bacteroides* etc) except *Pseudomonas* species, linezolid (600 mg i.v.) for gram-positive germs, ciprofloxacin (400 mg i.v.) to target *Pseudomonas* and fluconazole (800 mg i.v.) as a mycological therapy [12].

An interdisciplinary consensus between visceral surgeon and endoscopist was found and the patient got emergency gastroscopy in the operating theatre under surgical standby: During endoscopy a 2 mm measuring leak directly next to the PEG tube could be identified

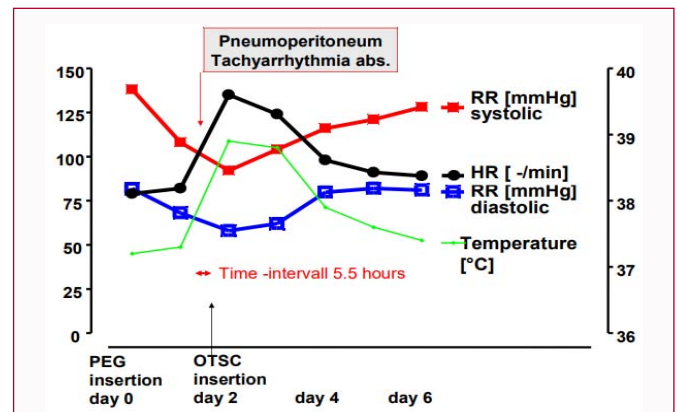


Figure 1: Cardiocirculatory parameters and body temperature at onset of sepsis in a patient with gastric anterior wall perforation after PEG insertion.

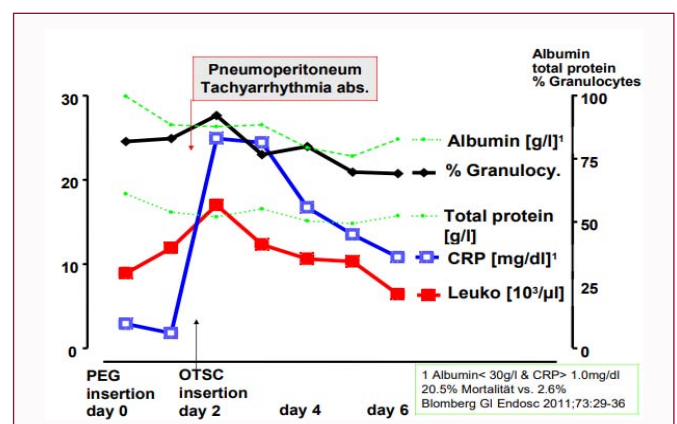


Figure 2: Serological and inflammatory parameters at onset of sepsis in a patient with gastric anterior wall perforation after PEG insertion.

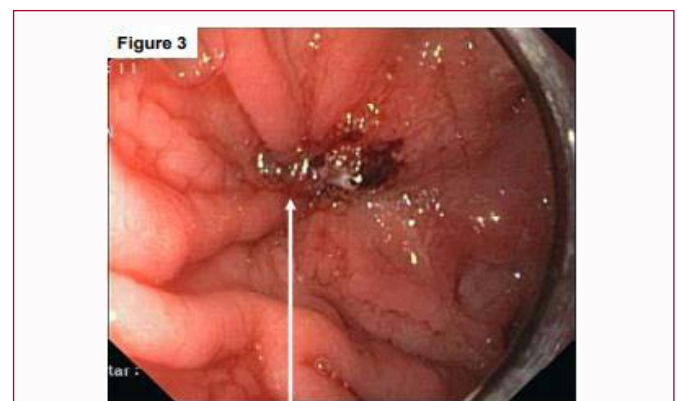
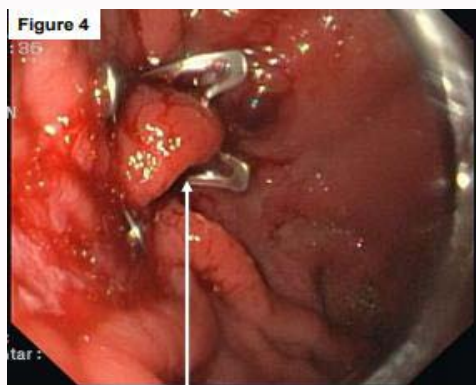


Figure 3: Endoscopic view of the perforation hole with visible in- and outflow of air at the anterior wall of the stomach.

in the anterior gastric wall (Figure 3). In- and outflow of air was visible as well as a backflow of nutrition fluid due to a deep iatrogenic incision reaching the gastric wall. Any other causes for perforation could be excluded. In a consensus decision between surgeon and endoscopist strict indication to either surgical or endoscopic closure was given [7,8].

To avoid emergency surgery, an endoscopic approach to close the



3) Application of an 11/6t OTSC using the tissue anchor for grasping enough tissue into the OTSC cap to achieve full-thickness wall closure at the perforation ostium

4) Aspiration of all air from the stomach and rapid termination of the endoscopy after clip application

Figure 4: Endoscopic view of the tightly applied OTSC.

Tissue around the perforation hole was grasped *via* the tissue anchor, tissue suctioned into the cap of the OTSC and then the clip released. This resulted in immediate closure of the perforation ostium and prompt resolution of sepsis parameters.

perforation was made. In the next step, endoscopically about 200 ml alimentary fluid was suctioned out from the peritoneal cavity. After preparation of the OTSC on the tip of the endoscope the PEG was cut off and the holder plate removed from the perforation ostium. Then, an 11/6t OTSC (Ovesco Endoscopy AG, Tübingen, Germany), diameter 8.5 mm to 11 mm for gastroscopy, was successfully applied *via* a tissue anchor to achieve a full-thickness, serosa-to-serosa apposition resulting in a tight closure of the perforation hole (Figure 4). A final visual control could find no further air in- or outflow, indicating definite closure. Thus, no further explorative laparotomy was necessary.

As shown in Figures 1 and 2, this combined intensified treatment led to an immediate definitive closure of the perforation ostium. Interestingly, even 6 h after the closure it came to cardiocirculatory stabilization with blood pressure normalization, lowered need for norepinephrine and restoration of the sinus rhythm. After 24 h, the inflammatory parameters also showed a significant decline, such as a decrease of CRP as well as normalized leucocytes (6400/ μ l), temperature and prothrombin time. A complete remission of the pneumoperitoneum was demonstrated after 72 h. As to our knowledge this is the first case reporting an OTSC application in ongoing sepsis with immediate clinical demonstration of successful treatment of peritonitis.

Discussion

This case report shows an onset of sepsis after an anterior gastric wall perforation due to PEG insertion because of a deep iatrogenic incision that led to a 2 mm gastric wall defect besides the actual puncture channel (Figure 1). As precisely documented in this patient, this iatrogenic perforation of the stomach induced profound signs of severe sepsis after PEG placement, such as lowered blood pressure, tachyarrhythmia, fever, systemic inflammatory response. Undoubtedly, there is a high probability that these pathological findings would have led to fatal sepsis unless surgical intervention or endoscopic therapy had been immediately performed [3-7,13,14]. While in the case of PEG placement, pneumoperitoneum in the sense of free intraabdominal air is frequently seen (up to 85%) and

not automatically associated with peritonitis, 0.5% to 4.5% of PEG patients may develop persistent or progredient pneumoperitoneum with the subsequent risk of peritonitis and/or sepsis [7,8,13-15].

Due to the availability of the OTSC a rapid endoscopic approach was initiated because of progredient pneumoperitoneum and ongoing septic shock. The OTSC is a device with a bear trap-like, large clip with a wingspan of 12 mm, that grasps much more tissue than conventional through-the-scope-clips in order to achieve a full thickness, serosa-to-serosa apposition [4,6,9-11]. However, due to the imminent septic life-threatening condition, intensive care medicine requires in such cases rapid interdisciplinary discussion between surgeons, endoscopists, anesthetists with accurate estimation of the prognosis for the further 6 h to 12 h to select the right appropriate approach for perforation closure [16]. While laparotomy with surgical suture is currently estimated as the treatment of choice for definitive closure, it harbors a high risk of morbidity and mortality in septic patients. Otherwise, endoscopic application of OTSC as a non-invasive method represents a promising technique, requires experience and technically feasible lesions which can be targeted with this full-thickness clip device [3,5,9-11]. However, an obligate prerequisite for success is the interdisciplinary assessment of the lesion, because endoscopist and surgeon must judge whether the perforation ostium and its borders are appropriate for grasping, are tight enough and the perforation not too large. Otherwise, an unsuccessful procedure with the OTSC approach may lead to enlargement of the perforation and rapid worsening of the clinical situation, requiring immediate surgery [2,5,9,16].

In this case, the endoscopic approach enabled us to evacuate air and nutritional fluid out of the peritoneal cavity, which appears to be an important early step to stop the inflammatory response of the peritoneum. Similarly, during a surgical procedure food residues and detritus are suctioned off and the peritoneal cavity will be rinsed out [16,17]. Therefore, we recommend that cleaning of the peritoneal cavity should be done as best as possible before definitive endoscopic closure of a perforation [4,6,16]. However, in certain situations this may be incomplete or insufficient, which may lead to failure of the endoscopic clipping approach.

In the patient under discussion, both cleaning of the peritoneal cavity and OTSC application could be successfully performed as important cornerstones to overcome sepsis. The procedure was done by the interventional endoscopist in presence of the surgeon and the intensive care physician to jointly critically decide whether the implemented interventions appear sufficiently effective in view of the beginning septic shock. However, further intensive observation of such a patient is mandatory and we were able to report the immediate changes of circulatory and inflammatory parameters, suggesting effective perforation closure (Figure 1 and 2). However, to overcome early sepsis in gastrointestinal perforations with endoscopic intervention, sufficient cleaning of the peritoneal cavity, definitive technical closure of the perforation, intensive care treatment of shock and circulatory parameters with parenteral fluid and catecholamines as well as a rationally calculated antibiotic regimen are simultaneously necessary within a short time period to avoid lethal shock [16,17].

Thus, the technical aspects of the OTSC application to potentially close the perforation definitely represent only one cornerstone in modern treatment of perforations and ongoing sepsis, but this favorable option should be aware for surgeons as it allows a relatively non-invasive procedure [3-5,9-11]. This is in agreement with other

publications who showed in prospective and retrospective multicentre trials that OTSC application has the potential to replace surgery as the first line treatment in case of acute iatrogenic gastrointestinal perforations in highly selected patients, in experienced centers and when using some important precautions [3,5,10]. For example, in the study by Voermans et al. [5] the mortality rate from perforations treated endoscopically by OTSC application was 3%, while the surgical management of perforations from pooled literature data was reported to be much higher with >7% [1,4,5,16]. Thus, together with our patient under discussion who showed highly unfavorable septic signs at manifestation of progredient pneumoperitoneum, and who was a poor candidate for surgery because of previous hypoxic encephalopathy, it is concluded that this OTSC technique might help in future to significantly reduce mortality from acutely diagnosed gastrointestinal perforations when combined intensive care measures, surgical and endoscopic experience are rapidly combined together with in a short time range [3-6,10,11,16,17].

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