

Endoscopic Negative Pressure Therapy (ENPT) of an Anastomotic Leakage after Total Gastrectomy with Open-Pore Polyurethane-Foam Drainages (OPD) and Open-Pore Film Drainage (OFD)

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Abstract

Introduction: Anastomotic leak is the most severe postoperative complication after total gastrectomy. Endoscopic negative pressure therapy (ENPT) in the upper gastrointestinal tract has been developed to treat transmural defects. For ENPT open-pore polyurethane-foam drainages (OPD) and open-pore film drainages (OFD) can be used to apply intracorporeal negative pressure. ENPT was used to treat an anastomotic leak after total gastrectomy in a 71 year old patient who underwent palliative total gastrectomy.

Material and method: Intracavitary variant of ENPT started 25 days after initial gastrectomy with placement of an OPD through the anastomotic defect into the extraluminal cavity. Negative pressure of -125 mmHg was applied with an electronic vacuum device. Simultaneously the cavity was drained, and defect closed. Drain was changed regularly after 3-4 days. After shrunken to a small channel the last period of treatment was done with a small-bore open-pore OFD. For construction a very thin double layered open-pore film (Suprasorb CNP, Drainage Film; Lohmann & Rauscher International GmbH & Co. KG, Rengsdorf, Germany) was used.

Results: Total time to treat the anastomotic leakage with ENPT (OPD and OFD) was 14 days. The anastomotic leak was closed completely only with ENPT. After starting the ENPT a laparotomy was performed because of peritonitis and an intraabdominal negative pressure therapy was applied after lavage of the abdominal cavity for 3 days. We also used the double layered open-pore film (Suprasorb CNP, Drainage Film; Lohmann & Rauscher International GmbH & Co. KG, Rengsdorf, Germany).

Conclusion: ENPT is an innovative endoscopic method in the treatment of anastomotic leaks of the upper gastrointestinal tract. Open-pore polyurethane-foam and small-bore open-pore film drainages can be used for the new endoscopic closure method for gastrointestinal defects. Compared to OPD one advantage of the novel OFD is its small diameter.

Keywords: Endoscopic vacuum therapy; Esophagus; Anastomotic insufficiency; Peritonitis

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Introduction

Anastomotic leakage after gastrointestinal resections is the most severe and life threatening complication. New endoscopic methods of treatment have been developed to close transmural gastrointestinal defects (anastomotic insufficiencies, perforation) [1,2]. In recent years Endoscopic Negative Pressure Therapy (ENPT) became of major interest for surgeons and gastroenterologist [3]. Up to now more than 200 patients with esophageal defects were treated with ENPT; a success rate of 90% is reported [4].

Until now ENPT was performed using **Open-pore Polyurethane foam Drainages (OPD)**. Disadvantage of this type of drainage is its diameter of 1, 5–3 cm. Therefore, insertion of the drain through small openings becomes difficult or is impossible. A new small-bore **Open-pore Film Drainage (OFD)** has been developed using a thin double-layered open-pore film for construction. Diameter of this type of drainage is 4-6 mm. The device can be inserted through small openings easily **Figure 1**. Herewith we report ENPT in a case of anastomotic leakage after total gastrectomy using OPD and small-bore OFD devices.

Patient

A 71 year old patient was sent to our surgical department for ENPT 25 days after palliative total gastrectomy for ENPT. In a complicated post-operative course with developing an anastomotic leakage of the gastro-jejunostomy the patient had undergone relaparotomy with lavage and drainage of the abdominal cavity. Endoscopically we found an anastomosis leakage of 25 mm in diameter opened into the abdominal cavity **Figures 2 and 3**. Tissue perfusion of the anastomotic region was uncompromised.

Material, Methods and Course of Treatment

We distinguish between extraluminal intracavitary and intraluminal ENPT [5,6]. In this case only intracavitary variant of therapy was used.

Intracavitary ENPT

Endoscopic Negative Pressure Therapy (ENPT) started with an **Open-pore Polyurethane-foam Drainage (OPD)**. A 3 cm short and 1, 5 cm in diameter open-pore polyurethane-foam (Suprasorb®CNP Wundschaum, Lohmann & Rauscher GmbH & Co. KG, Neuwied, Germany) was sutured at the tip of a gastric tube **Figure 1A**. The foam was grasped with forceps and pushed through the transmural defect of the anastomosis into the extraluminal cavity by endoscopic means. For material see **Table 1** and course of ENPT is shown in **Table 2**. The tube was led out nasally and vacuum applied with an electronic vacuum device (KCI V.A.C. Freedom®, KCI USA Inc., San Antonio, Texas, USA). We used our standard negative pressure for ENPT of – 125 mmHg, continuous suction, and high intensity. The extraluminal cavity collapsed with the foam and simultaneously the defect was closed.

After this initial endoscopic procedure and start of suction an additional laparotomy was performed because of the peritonitis.

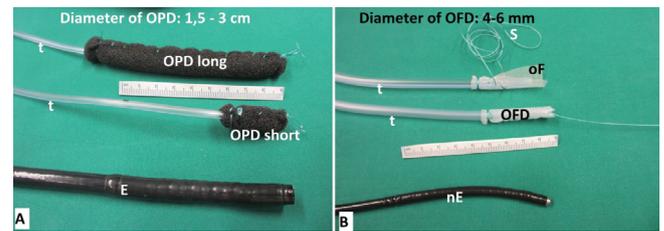


Figure 1 Different types of open-pore drainage which can be used for ENPT. **1a** Long and short open-pore polyurethane foam drainages (OPD), tube (t) and standard endoscope with a diameter of 9 mm; **1b** Open-pore film drainage (OFD), open-pore film (of) is wrapped surround the distal end of a drainage tube (t) and fixed with a suture (s), nasal endoscope with a diameter of 5 mm.

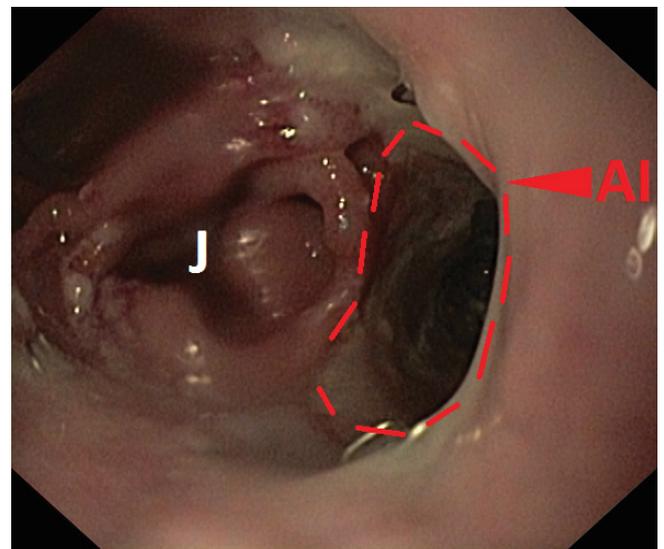


Figure 2 Day 0, Anastomotic leakage (Al) of esophago-jejunostomy, Jejunum (J).

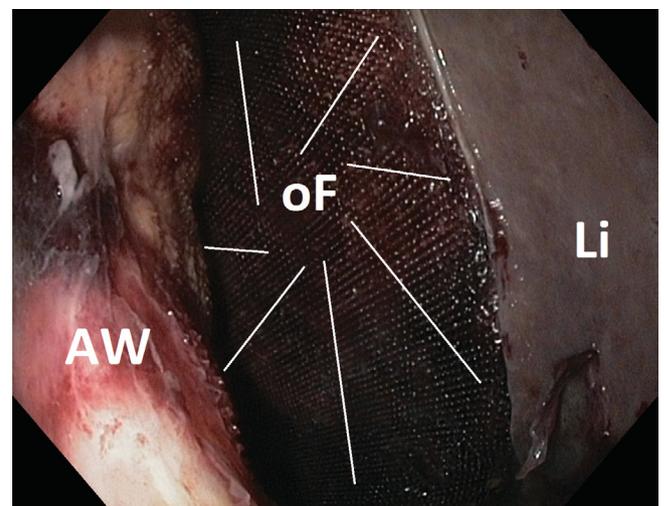


Figure 3 Day 3 of ENPT: Endoscopy through the leakage into the abdominal cavity, open-pore double layered film (oF) used for abdominal negative pressure therapy, abdominal wall (AW), liver (Li).

Table 1: Material which was used for Endoscopic Negative Pressure Therapy.

	OPD	OFD
	Open-pore Polyurethane foam Drainage	Open-pore Film Drainage
Open-pore material	polyurethane foam with multiple pores (Suprasorb®CNP Wundschaum, Lohmann&Rauscher GmbH & Co. KG, Neuwied, Germany)	Double layered film out of two perforated membranes with a small interspace (Suprasorb CNP, Drainage Film; Lohmann & Rauscher International GmbH & Co. KG, Rengsdorf, Germany)
Tube	Gastric tube (Ventrol, 12 Ch x 120 cm; Covidien Argyle, Dublin, Ireland)	Gastric tube (Ventrol, 12 Ch x 120 cm; Covidien Argyle, Dublin, Ireland)
Negative pressure device: KCI V.A.C. Freedom®, KCI USA Inc., San Antonio, Texas, USA	-125 mmHg, continuous, intensity 10	-125 mmHg, continuous, intensity 10
Diameter of open-pore drainage (distal end wrapped with foam or film)	15 mm	5 mm

Table 2: Course of ENPT, operative and supplementary treatments are shown (open-pore polyurethane- foam drainage (OPD), open-pore film drainage (OFD)).

Day of Treatment	Endoscopy	Operation	Feeding	Ventilation
Day 1	Intracavitary ENPT with OPD	Laparotomy, Lavage, abdominal negative pressure therapy with double layered film	Solely parenteral nutrition	General Anesthesia for procedures
Day 3	Intraoperative endoscopy with change of OFD in an endoscopic- operative rendezvous technique	Relaparotomy, lavage, removal of double layered film, end of abdominal negative pressure therapy, closure of abdominal wound, thoracic drainage because of a sero-pneumo thorax		Artificial respiration after procedures until day 11
Day 6	Control endoscopy showing OPD in correct position and function, closing the leakage, no change of OPD, transnasally insertion of an intestinal feeding tube		Start of intestinal feeding with feeding tube	
Day 10	Removal of OPD and change to OFD with additional nasally jejunal intestinal feeding tube			
Day 11				End of artificial respiration
Day 14	Removal of OFD, end of ENPT, renewing nasally intestinal feeding tube			
Day 15	Control endoscopy: small opening of leak		Intestinal feeding with tube and drinking water	
Day 18	Control endoscopy: clotted opening of leak			
Day 21	Control endoscopy: leakage is completely closed		Soft diet	
Day 30	Follow-up endoscopy, no stenosis, healed anastomosis			
6 Month	Follow-up endoscopy, no stenosis, regular anastomosis		No diet	

After lavage of the abdominal cavity it was also drained with negative pressure using the thin double layered open-pore film which had been designed for this indication (Suprasorb CNP, Drainage Film; Lohmann & Rauscher International GmbH & Co. KG, Rengsdorf, Germany). No additional operative treatment for closure of the leakage was made.

In a relaparotomy after three days the OPD was changed in an operative-endoscopic rendezvous procedure using pull-through technique. In endoscopy the anastomotic leakage was found to be coated with granulation tissue, already **Figure 4**. For pull-through changing maneuver of the OPD, the tip of a new OPD

was connected at the proximal end of the tube of the first OFD and pulled along the esophagus through the anastomotic defect. Again, no operative closing procedure was performed at the leakage side. Abdominal negative pressure therapy was ended, the abdominal wound was closed and treatment went on with ENPT solely.

On day 10 the anastomotic leakage was shrunken to a small fistula of 6 cm length and 12 mm in diameter. Because of the small opening it was impossible to renew the OPD. Therefore, ENPT went on with novel small-bore Open-pore Film Drainage (OFD). **Figure 5** For construction the distal end, length 5 cm, of

the gastric tube was wrapped in a small strip of the same thin double layered open-pore film material which had been used for abdominal negative pressure therapy (Suprasorb CNP, Drainage Film; Lohmann & Rauscher International GmbH & Co. KG, Rengsdorf, Germany). The film was fixed with a suture at the tube **Figure 1B** [7-12].

Results

ENPT ended after a total treatment time of 14 days. With OFD anastomotic leak was shrunken to a small channel of 5 mm in diameter. Tissue, in contact with the film, was covered with typical pimped pattern. These patterns are an important sign for correct function of therapy **Figure 6**. 4 days after end of treatment anastomotic leak was found closed and patient started with

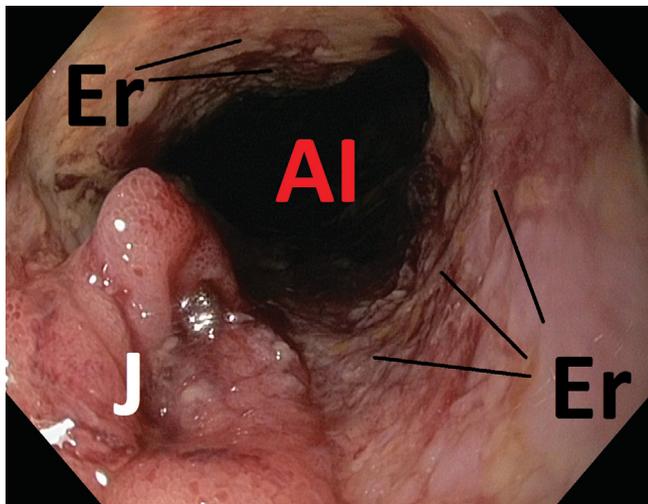


Figure 4 Day 3 of ENPT: Anastomotic leakage (AI) after removing the open-pore polyurethane foam drainage erosive pattern (Er) are found, AI opens into the abdominal cavity, jejunum (J).

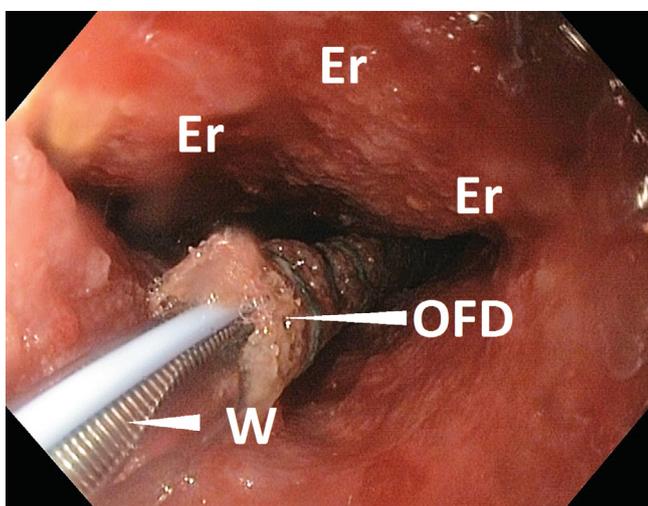


Figure 5 Day 10 of ENPT, Insertion of open-pore film drainage (OFD) into the shrunken leakage, erosion pattern after ENPT with OPD (Er), guidewire tube (W)

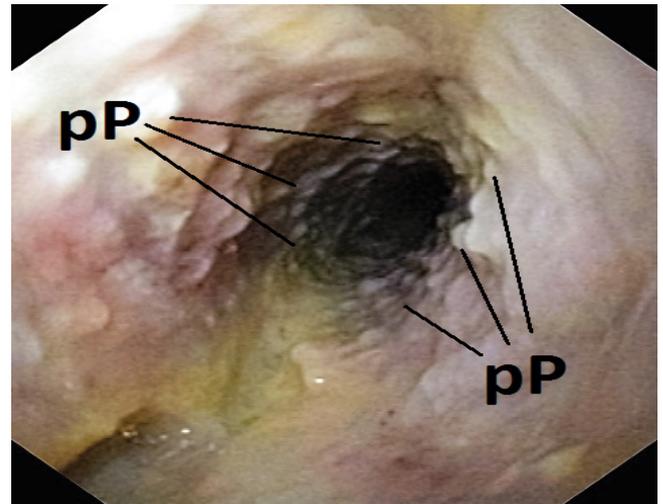


Figure 6 Day 14 of ENPT, End of ENPT, and endoscopy with nasal endoscope, pimpled pattern (pP) after removing the open-pore film drainage.

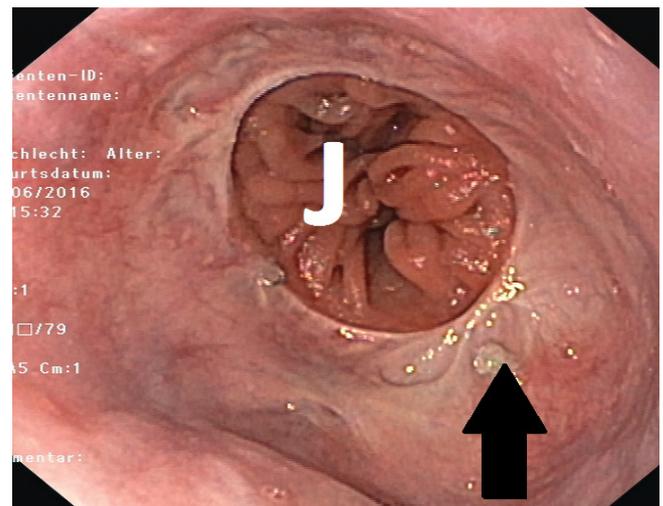


Figure 7 Follow-up 6 month after end of ENPT, control endoscopy shows complete closure of the defect with a tiny scare (arrow), jejunum (J).

soft diet. Follow up endoscopy after 6 months found a regular anastomosis without stenosis **Figure 7**.

Patient was ventilated for 8 days and stayed on intensive care unit for 23 days. Since day 6 of ENPT intestinal feeding was possible with an additional nasally inserted jejunal feeding tube. Details of the course of therapy are shown in **Table 2**.

Discussion

Up to now open-pore polyurethane- foams drainages were used for ENPT. One disadvantage of OPDs is the large diameter of the foam. Insertion through small opening can be very difficult or impossible. The new open-pore film drainage has a very

small diameter of 5 mm. This enables placement through small openings easily **Figure 5**. With both open-pore devices liquids are drained in an active manner along the negative pressure gradient. With OFD secrets are drained through the pores of the film and between a small interspace of the very thin double-layered membrane. Because of its open-porosity negative pressure is applied along the whole surface of the film which comes into a close contact to the tissue.

Conclusion

ENPT is a new endoscopic method in the treatment of anastomotic leaks [13]. Open-pore polyurethane foam and small-bore open-pore film drainage can be used for the new endoscopic closure method of ENPT. Advantage of the novel OFD is its small diameter of few millimeters therefore it can be placed through small openings. ENPT can be used as a complementary tool to

conventional operative procedures.

Conflict of Interest and Source of Funding

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