

Endoscopic drainage combined with percutaneous drainage in treatment of walled-off pancreatic necrosis – a single-center experience

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Abstract

Introduction: In last three decades we have been observing development of minimally invasive walled-off pancreatic necrosis (WOPN) treatment techniques. The choice of access to the necrosis and technique of treatment depends not only on the position and spread of necrosis, but in the first place on the experience of the medical center.

Aim: To assess the effectiveness and safety of combined endoscopic and percutaneous drainage of WOPN.

Material and methods: We performed a retrospective analysis of 64 consecutive patients with symptomatic WOPN, who underwent endoscopic treatment in our department between 2011 and 2013.

Results: Additional percutaneous drainage was executed during endoscopic treatment in 20/64 (31.25%) patients. Complications of treatment occurred in 4/20 (20%) patients. Complications of treatment occurred in 4/20 (20%) patients. All these complications were related to endoscopic treatment. No complications related to percutaneous drainage were noted. There were no deaths. Therapeutic success was achieved in all 20 patients. No patients required surgery. The average time of endoscopic drainage was 41.4 (11–173) days. The mean number of endoscopic procedures was 4.2 (2–12). The average time of percutaneous drainage was 11.3 (5–20) days. The median time of follow-up was 54 (48–64) months. During the observation the recurrence of WOPN was noted in 2/20 (10%) patients. Long-term success of combined drainage was achieved in 18/20 (90%) patients.

Conclusions: In selected patients with symptomatic WOPN combined endoscopic and percutaneous drainage enables a high success rate with a low procedure-related complication rate.

Introduction

In the course of acute necrotizing pancreatitis (ANP) it often leads to creation of pancreatic fluid collections (PFCs) [1, 2]. Necrosis of pancreatic parenchyma (as well as necrosis of peripancreatic tissues) in the first 4 weeks of ANP used to be described as acute necrotic collection (ANC), while after four weeks of disease it is named walled-off pancreatic necrosis (WOPN) [1, 2]. Walled-off pancreatic necrosis occurs in 49–58% of patients with ANP [3, 4].

The clinical suspicion or documented infection of pancreatic necrosis and clinical symptoms related to the presence of necrotic collection are the indications for the beginning of interventional WOPN treatment [5–7]. Utilization of minimally invasive techniques im-

proves the results of treatment of patients with WOPN [8]. Minimally invasive methods include procedures performed with an endoscope, laparoscope, and nephroscope that enable transperitoneal, retroperitoneal, transmural or transpapillary access to necrosis [5, 9, 10]. Percutaneous drainage (PCD) allows transperitoneal or retroperitoneal access to the collection of WOPN [5, 10]. Performance of PCD consists in insertion of a drain into the area of necrosis under ultrasonographic or computed tomography guidance [5, 10]. Thereafter the drain is flushed with saline solution [5, 10]. Percutaneous drainage was described for the first time in 1998 by Freeny *et al.*, who used this drainage technique in 34 patients [11]. A beneficial effect of treatment was obtained in 47% of patients with a complication rate of 71% and mortality of 12% [11]. Endoscopic treatment of WOPN



Figure 1. Fluoroscopic image shows endoscopic transmural drainage combined with percutaneous drainage in a patient with pancreatic necrosis

consists in transmural drainage (through the gastric or duodenal wall), transpapillary drainage or a combination of both methods of access to the necrotic cavity [12, 13]. In 1996 Baron *et al.* became the first in the world to describe the results of efficient endoscopic treatment (transmural and transpapillary) of 11 patients suffering from pancreatic necrosis [12]. In 2010 Ross *et al.* presented the outcomes from the treatment of 15 patients with WOPN, in whom combined endoscopic and percutaneous drainage was used [14]. The same group of authors named this method in later publications dual-modality drainage [15, 16].

Aim

The aim of this study was to assess the effectiveness and safety of combined endoscopic and percutaneous drainage of WOPN. Herein we introduce the results of treatment of 20 patients with symptomatic WOPN, who were treated between 2011 and 2013 in our medical center with use of percutaneous drainage.

Material and methods

Sixty-four consecutive patients with symptomatic WOPN underwent endoscopic treatment in our department between 2011 and 2013.

Endoscopic drainage of WOPN has been applied in our medical center since 2001 [17, 18]. Conventional drainage (without endoscopic ultrasonography – EUS) was performed between 2001 and 2011 [17, 18]. Then the fistula was created on the top of the largest bulge

into the gastric or duodenal wall. When the bulge was not visible enough, the location of the fistula was chosen on the basis of computed tomography and fluoroscopic images of the main pancreatic duct leak or the flow of contrast medium administered through the percutaneous drain. Percutaneous drainage during this time was most often (15 of 19 patients with PCD) exploited to administer the contrast through the drain and to show the necrotic collections in the fluoroscopic image in order to choose the best location of the fistula – particularly when the bulging of the necrotic collection was not visible endoscopically.

Since 2011 a fistula between the lumen of the gastrointestinal tract and the lumen of the necrotic collection has been performed under control of EUS (EUS-guided drainage) [18]. In our medical center percutaneous drainage was used for treatment of WOPN as an extra access to the necrotic collection during endoscopic treatment most intensively between 2011 and 2013. The development of endoscopic techniques of WOPN treatment has been significantly reducing the use of PCD since 2013. This paper presents a retrospective analysis of 20 patients with symptomatic WOPN, in whom percutaneous drainage was performed during the endoscopic treatment (Figure 1) between the years 2011–2013.

The qualification for minimally invasive treatment of pancreatic necrosis was based on the clinical picture and the results of contrast-enhanced computed tomography (CECT). The WOPN was diagnosed on the basis of the revised Atlanta classification issued in 2012 [1, 2]. The presence of necrotic debris in the EUS image and morphology of aspirated fluid taken from the collection (dark brown color and fragments of necrotic tissues) were used to confirm the diagnosis of WOPN.

Interventional treatment of WOPN was begun in each patient from the endoscopic drainage. Prior to it each patient received antibiotics (ciprofloxacin or ceftriaxone with metronidazole). Prophylactic antibiotic therapy was continued for 2 weeks. In the case of clinical symptoms indicating infection of the collection, antibiotic therapy was prolonged or modified on the basis of repeated microbial culture of fluid from the collection.

Endoscopic procedures were conducted using a Pentax ED3490TK duodenoscope and a Pentax EG387OUTK echoendoscope. In all patients an attempt of transmural drainage was made. The place of the transmural tract was chosen with the support of EUS guidance. Gastrostomy (or duodenostomy) was formed using a Giovanni cystostome (Wilson-Cook). The stoma made between the lumen of the gastrointestinal tract and necrotic cavity was dilated with an 8-mm or 20-mm balloon dilator (Boston Scientific). A 7 Fr or 8 Fr nasocystic drain (Bal-

ton or Wilson-Cook) and double-pigtail stents 7 Fr or 8.5 Fr (Wilson Cook or Mar Flow) were deployed within the necrotic cavity through the transmural tract.

After the endoscopic procedure the nasal drains were flushed with saline solution (60–200 ml) every 2 h during the first 48 h and thereafter every 4 h. The effect of endoscopic drainage was monitored every week, mainly using conventional ultrasonography. In the case of ineffective endoscopic drainage and spreading of necrosis outside the lesser omental sac, additional percutaneous drainage was performed.

Percutaneous drainage was made under ultrasonographic or computed tomography guidance. Retroperitoneal access to the necrosis was preferred. The transperitoneal approach was used in selected cases, when there was no technical opportunity to use the retroperitoneal approach. The site and method of PCD were chosen on the basis of the position and size of the WOPN. The tandem trocar technique was used for placement of the drains (6–10 Fr Wilson Cook or Boston Scientific). The access to the necrotic cavity was made by means of ultrasonographic or computed tomography guidance. The free-hand technique was used for placement of the drains into the lumen of the WOPN. One drain was used for each access site and the catheters were left for gravity drainage and irrigated with saline solution (50–100 ml 3–4 times a day). The percutaneous drain was removed before the end of endoscopic drainage. After clamping the percutaneous drain for 24 h and verification of the absence of relapse of fluid collection, contrast-enhanced CT was done to confirm complete regression of the necrotic collection. Active endoscopic drainage was finished after resolution of clinical symptoms and complete regression of the collection or decrease of the collection's diameter to less than 30 mm.

Therapeutic success was defined as a lack of symptoms and complete regression of the collection or the dimension of the collection less than 30 mm during a three-month follow-up from the end of active drainage. Recurrence of the collection was determined as the collection size > 30 mm or relapse of symptoms during a follow-up. Long-term success was defined as a lack of symptoms and complete regression of the collection or the dimension of the collection less than 30 mm during a follow-up.

Statistical analysis

All the statistical calculations were performed using the data analysis software system StatSoft Inc. (2011) Statistica version 10.0 (licensed for the Medical University of Gdansk). Quantitative variables were characterized by arithmetic means and minimal and maximal val-

ues (range), whereas qualitative data were presented as means of numbers and percentage.

Results

Sixty-four consecutive patients with symptomatic WOPN underwent endoscopic treatment in our department between 2011 and 2013. Additional percutaneous drainage was executed during endoscopic treatment in 20/64 (31.25%) patients (Figures 2 A–D). Demographic and clinical characteristics of this group of patients are presented in Table I.

The indications for the beginning of endoscopic WOPN treatment in the study group were as follows: gastrointestinal obstruction together with weight loss (13/20 patients), jaundice (3/20 patients), and clinical suspicion of infected WOPN (8/20 patients). At least 2 indications for the beginning of treatment were stated in 4 patients.

Walled-off pancreatic necrosis infection was diagnosed on the basis of positive microbial culture in all 8/20 (40%) patients in whom infection was suspected. The most common pathogens cultured in the necrotic contents were *Escherichia coli*, *Enterococcus faecalis* and *Staphylococcus epidermidis*. In 2/20 (10%) patients sepsis with positive blood culture was observed during drainage.

Endoscopic transmural access was used in 19/20 (95%) patients (gastric – 14, duodenal – 5). In 1 patient the transmural route was not used, because the distance between the gastrointestinal lumen and the necrotic cavity exceeded 15 mm. Transpapillary access was used in this patient.

All 20 patients underwent an extra percutaneous drainage. The average time from the start of endoscopic treatment to the performance of percutaneous drainage was 13.9 days (4–39). One percutaneous catheter was inserted in 19 patients and 2 drains were inserted in 1 patient (Figure 3). Percutaneous drainage from the retroperitoneal approach was performed in 14 patients, while the PCD was done from the transperitoneal access in 6 patients (including 1 patient with 2 drains). Mean size of the catheter was 7.1 Fr (6–10).

Complications of treatment occurred in 4/20 (20%) patients. All these complications were related to endoscopic treatment (2 patients – upper gastrointestinal bleeding treated conservatively with packed red blood cell transfusions, 1 patient – gastrointestinal perforation treated conservatively and 1 patient – migration of transmural stent into the lumen of the WOPN treated endoscopically). No complications related to percutaneous drainage were noted. Furthermore, there were no complications in the form of a pancreaticocutaneous fistula. Also there were no deaths.

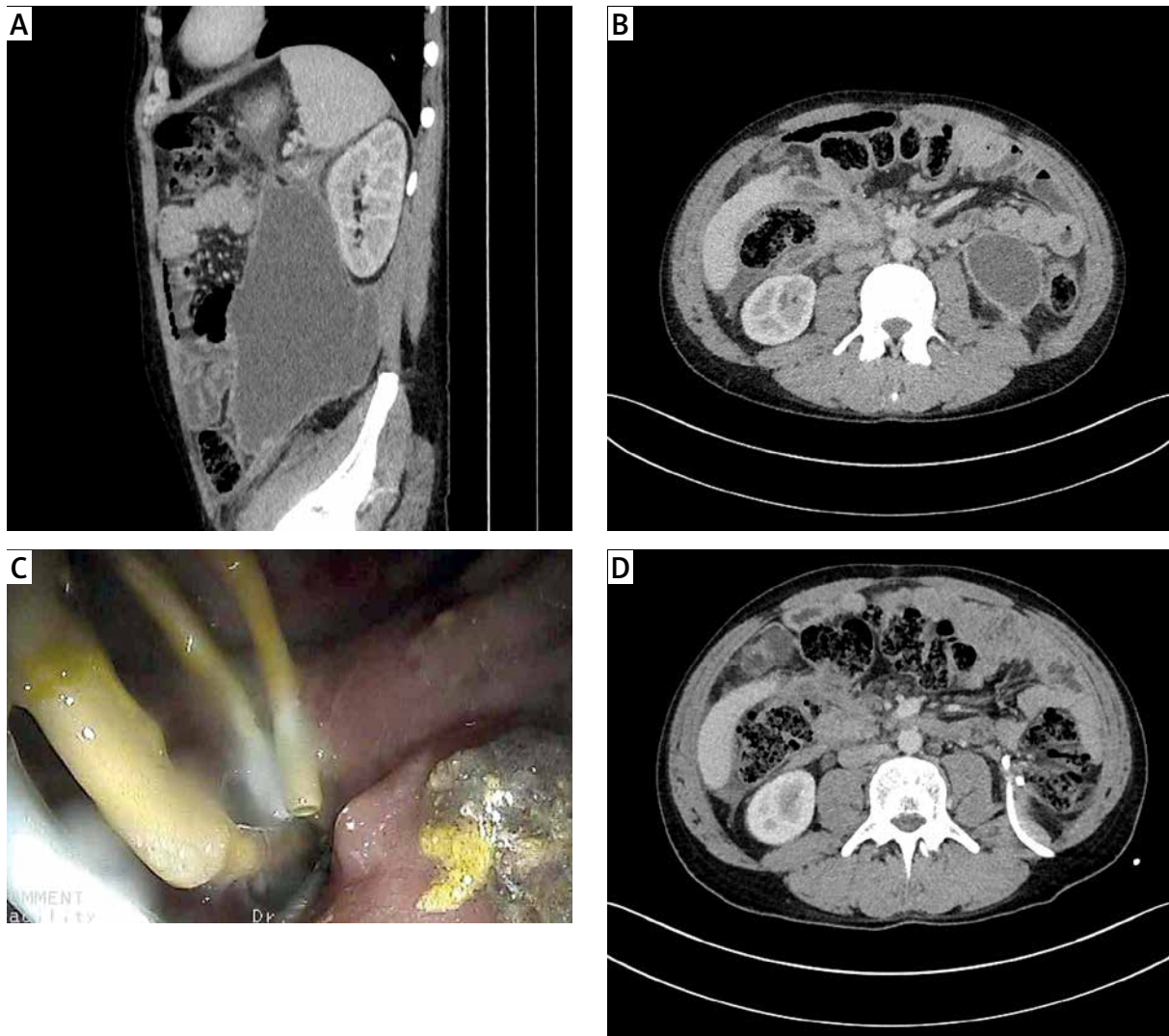


Figure 2. Contrast-enhanced computed tomography done before interventional treatment (A, B). Extensive WOPN collection is clearly visible. Endoscopic drainage (C) combined with percutaneous drainage was performed in this patient. Complete regression of necrosis was confirmed by CECT after 21 days of percutaneous drainage (D). Percutaneous catheter inserted retroperitoneally is visible on CT scan (D)

Therapeutic success was achieved in all 20 patients. No patients required surgery. The average time of endoscopic drainage was 41.4 days (11–173). The mean number of endoscopic procedures was 4.2 (2–12). The average time of percutaneous drainage was 11.3 days (5–20).

The medium time of follow-up was 54 (48–64) months. During the observation the recurrence of WOPN was noted in 2/20 (10%) patients. Long-term success of combined drainage was achieved in 18/20 (90%) patients.

Discussion

This retrospective study describes combined endoscopic and percutaneous drainage as a minimally inva-

sive approach to symptomatic WOPN. We obtained in this highly selected group of patients very good results of treatment with a low rate of complications and number of recurrent fluid collections. What is more, there were no lethal complications, no pancreaticocutaneous fistulas and, most importantly, no surgery.

In 2010 Ross *et al.* became the first in the world to publish the results of treatment of 15 patients suffering from symptomatic WOPN, in whom combined endoscopic and percutaneous drainage was executed [14]. Ross *et al.* obtained favorable clinical outcomes with low procedure-related morbidity [14]. No lethal complications were noted and no patient required surgery [14]. The same authors described combined endoscopic

Table 1. Characteristics of the patients with WOPN ($n = 20$)

Parameter	Value
Age, mean (range)	52.90 (33–79)
Sex, men, n (%)	13 (65)
Etiology, n (%):	
Alcoholic	12 (60)
Non-alcoholic	8 (40)
WOPN size, mean (range) [cm]	14.6 (6.5–25.3)
WOPN type, n (%)	
Pancreatic parenchymal necrosis alone	2 (10)
Both pancreatic and peripancreatic necrosis	18 (90)
Time from the acute bout of pancreatitis, mean (range) [weeks]	20.30 (4–60)

and percutaneous drainage as dual-modality drainage in their subsequent publication [15, 16]. In 2011 Gluck *et al.* proved that dual-modality drainage decreases the amount of radiological and endoscopic procedures in patients with pancreatic necrosis comparing to standard percutaneous drainage. It also reduces the time of hospitalization and time of treatment [15].

In 2014 Ross *et al.* presented the outcomes of treatment of 117 patients with symptomatic WOPN, in whom dual-modality drainage was performed [16]. This method was successful in 103/117 (88.03%) patients with complications in 6/117 (5.13%) of them and morbidity of 4/117 (3.4%) patients [16]. Four patients died from adverse events related to severe acute pancreatitis [16]. During the follow-up lasting 750 days recurrent fluid collections were noted in 8/103 (7.77%) patients [16]. In our study the efficacy of treatment was 90% (18/20) with a complication rate of 20% (4/20). No lethal complications were recorded and there was no need of surgical treatment. However, it is worth emphasizing that the better results in our publication are certainly related to the significantly lower number of patients who were treated this way.

The technique introduced in our paper differs (combined endoscopic and percutaneous drainage) from the method described as dual-modality drainage (DMD) [14–16]. First of all, the standard DMD consists in performance of percutaneous drainage, and endoscopic transmural drainage is done after it [14–16]. Herein endoscopic drainage is the basic treatment, and percutaneous drainage is done the next only in the case of lack of complete regression of WOPN. Furthermore, passive endoscopic drainage was used in the quoted studies [14–16]. It consisted in insertion of transmural stents

**Figure 3.** Image shows the patients with two percutaneous catheters guided transperitoneally into the area of WOPN

through the stoma, without a nasal drain [14–16]. Active endoscopic drainage which involves insertion of transmural endoprosthesis as well as a nasal drain in order to flush the necrotic collection is done in every patient with WOPN in our medical center. In this way our technique is more aggressive, since we flush both nasal and percutaneous drains with saline solution.

Van Baal *et al.* described complications in 21.2% of patients, including pancreaticocutaneous fistulas (53% of complications) and pancreaticoenteric fistulas (51.5% of complications) [19]. None of the previously mentioned complications (pancreatic fistulas) were recorded in any studies concerning dual-modality drainage [14, 16], including our paper. In our opinion, the lack of such complications results from the small diameter of the percutaneous catheter (average 7.1 Fr) and short time of percutaneous drainage (average 11.3 days). The lack of such complications in the study of Ross *et al.* was explained by the authors by the role of transmural endoscopic drainage [16]. Transmural endoprosthesis enable free outflow of pancreatic juice to the lumen of the gastrointestinal tract, reducing formation of pancreatic fistulas, particularly in patients with disconnected duct syndrome [16]. Transmural endoscopic drainage in our study might have been a key to success in prevention of creation of pancreatic fistulas in patients with WOPN, who were treated with combined endoscopic and percutaneous drainage.

This study has some limitations. The major ones are lack of randomization and the retrospective nature. Further limitations derive from the fact that it was conducted on the basis of a highly selected group of patients from a single medical center. The group of patients is also relatively small.

Nevertheless, endoscopic drainage combined with percutaneous drainage is an efficient method of treat-

ment of patients with WOPN with an acceptable rate of complications. This technique is an alternative to other minimally invasive methods of treatment. We hold the view that the technique introduced here is useful when endoscopic treatment fails and still before definitive surgical treatment. In order to assess the utility of this technique more accurately, further multicenter and prospective studies conducted on a larger number of patients are needed.

Conclusions

In selected patients with symptomatic WOPN, combined endoscopic and percutaneous drainage enables a high success rate with a low procedure-related complication rate.

Conflict of interest

The authors declare no conflict of interest.

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