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Endoscopic transluminal necrosectomy in patients with acute infected necrotizing pancreatitis. Experience of a specialized center

N. V. Puzyr[1,2], Y. M. Susak[1]

[1] Bogomolets National Medical University, Kyiv
[2] Kyiv City Clinical Emergency Hospital

✉ Nazar Puzyr: dr.puzyr@ukr.net

N. V. Puzyr, http://orcid.org/0009-0008-3878-0715
Y. M. Susak, http://orcid.org/0000-0002-5102-485X

Over the past decades, the treatment of acute infected necrotizing pancreatitis (AINP) has significantly improved due to a better understanding of the disease pathogenesis and the implementation of minimally invasive technologies. Endoscopic transluminal interventions occupy an important place among these techniques and continue to evolve, both technically and tactically.

Objective – to evaluate the results of ETN in the treatment of patients with acute infected necrotizing pancreatitis (AINP) and summarize the experience of our department, including technical and tactical aspects of the procedure.

Materials and methods. The study included 28 patients: 15 (53.6 %) men and 13 (46.4 %) women with a mean age of 52.6 ± 12.5 years, who underwent ETN between 2021 and 2024 due to a limited peri-/pancreatic necrotic collection in direct contact with the stomach and/or duodenum. AINP of moderate severity was diagnosed in 19 (67.9 %) patients, and a severe course – in 9 (32.1 %). The mean size of the walled-off pancreatic necrosis (WON) was 109.6 ± 32.9 mm. ETN outcomes were assessed as complete, partial, or no clinical success.

Results. The first ETN session was performed on average on day 36.2 ± 16.1 (range: 22 to 86 days) from the onset of the disease. A total of 48 ETN sessions were performed, from 1 to 4 per patient, most often a single session in 14 (50.0 %) patients. The intervals between subsequent sessions were mostly 6–7 days. Continuous lavage of the WON cavity was performed in 17 (60.7 %) patients. The duration of each procedure ranged from 60 to 90 minutes. The rate of intraoperative complications was 3.6 % (n = 1, profuse bleeding). Complete clinical success was achieved in 18 (64.3 %) patients, partial success – in 8 (28.6 %), and no clinical success – in 2 (7.1 %) patients. Overall, 25 (89.3 %) patients recovered, and the mortality rate was 10.7 % (3 cases).

Conclusions. In 64.3 % of cases, ETN can be the main treatment method in AINP when the indications for the procedure are observed. In 28.6 % of patients, it serves as a transitional stage before more invasive surgical procedures. Performing ETN with subsequent continuous lavage of the WON cavity increases the likelihood of achieving complete clinical success by 2.26 times compared to patients without lavage (RR 2.26; 95 % CI 1.01–5.10; p = 0.0485).

Keywords
acute pancreatitis, acute infected necrotizing pancreatitis, walled-off pancreatic necrosis, endoscopic transluminal necrosectomy, direct endoscopic necrosectomy.

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Acute pancreatitis (AP) typically manifests as an edematous type with a relatively mild, self-limiting course that is managed with supportive therapy and is associated with few long-term consequences [2]. As a progression of acute edematous pancreatitis, acute peripancreatic or pancreatic fluid collection may sometimes persist and develop into a pseudocyst after 4 or more weeks, resulting in pain syndrome and requiring drainage.

Acute necrotizing pancreatitis (ANP), as the severe form of AP, develops in 10–20 % of cases and is characterized by prolonged hospitalization, organ failure, infection, the need for intensive care and surgical interventions, complications, repeated hospitalizations, and long-term adverse outcomes. Mortality in ANP varies from 11 % to 39 %, depending on the presence of infection in the necrotic area [3].

Acute necrotic collection, which develops during ANP, usually persists and transforms into walled-off necrosis (WON) within 3–4 weeks. WON is characterized by the presence of a capsule and a mixture of fluid and necrotic debris. The wall of WON consists of an infiltration zone of immunocompetent cells, fibrin deposits, and the walls of adjacent organs surrounding the cavity.

Surgical treatment options for complicated forms of AP include percutaneous, endoscopic transluminal, laparoscopic, and open surgical interventions [3, 12]. Currently, minimally invasive techniques are the primary method of surgical management in ANP, as they significantly reduce mortality and complication rates and often help avoid or postpone open surgery [4].

Over the past 20 years, new minimally invasive techniques have emerged, including video-assisted retroperitoneal debridement (VARD) and endoscopic transluminal necrosectomy (ETN), which are considered among the most favorable approaches. In the English-language literature, ETN is also referred to as direct endoscopic necrosectomy (DEN), endoscopic transgastric necrosectomy, and endoscopic peroral necrosectomy.

The optimal intervention strategy for patients with suspected or confirmed infected necrotizing pancreatitis (INP) includes percutaneous drainage of the necrotic collection under imaging guidance (ultrasound or CT) or endoscopic transluminal drainage with subsequent endoscopic or surgical necrosectomy, if necessary [11].

The first direct endoscopic necrosectomy was described in 2000 by Seifert in three patients with infected WON who were in a critical condition and unsuitable for open surgery [8]. The researchers introduced a gastroscope transgastrically directly into the necrotic cavity and removed necrotic tissue using a basket designed for bile stone extraction. Since then, ETN has been increasingly used in Western countries and, since 2021, has been successfully implemented in our clinical practice.

Objective – to evaluate the results of ETN in the treatment of patients with acute infected necrotizing pancreatitis (AINP) and summarize the experience of our department, including technical and tactical aspects of the procedure.

Materials and methods

The study included 28 patients: 15 (53.6 %) men and 13 (46.4 %) women, with a mean age of 52.6 ± 12.5 years, who underwent ETN for AINP in our medical institution between 2021 and 2024.

Diagnostic methods included general and biochemical blood tests, microbiological analysis, ultrasound examination, esophagogastroduodenoscopy (EGD), contrast-enhanced computed tomography (CT) of the abdomen, or magnetic resonance imaging (MRI) of the abdomen. Given the complexity of the pathology, patient management was multidisciplinary, involving surgeons, endoscopists, anesthesiologists-intensivists, radiologists, interventional ultrasound specialists, and other related specialists (in some cases – internists, cardiologists, endocrinologists, and psychiatrists).

The indications for endoscopic transluminal intervention included:

- A walled-off necrotic peripancreatic/pancreatic collection (WON), which, according to CT or MRI data, was in direct contact with the stomach and/or duodenum.
- Disease duration of ≥ 4 weeks (28 days) from the first pain episode.
- Extrinsic compression of the stomach and/or duodenum identified by EGD.

Endoscopic Intervention

Patients underwent endoscopic treatment of necrotizing pancreatitis, which included the following technical and tactical aspects:

- A duodenoscope Olympus TJF-150 was used for transluminal access and drainage, and if direct necrosectomy was needed, a gastroscope Olympus GIF-Q150 with a distal transparent cap was employed.
- The procedures were performed under general anesthesia with endotracheal intubation to protect the airway from potential aspiration of infected WON content.
- The patient was placed in the supine position during the procedure to provide the most accurate positioning of the WON relative to the stomach/duodenum based on pre-procedural imaging (CT or MRI).
- The access point to the WON cavity (Fig. 1) was the site of the greatest bulging into the gastric lumen, usually along the posterior wall in the middle or lower third of the stomach body (in one case – in the upper third of the stomach body). In one patient, access to the WON cavity was achieved through an existing cystic duodenal fistula with a diameter of 1 mm along the inferior wall of the duodenal bulb, through which pus and necrotic debris were discharged.
- Access to the WON cavity was mainly created using an Optimos cystotome (TaeWoong Medical, South Korea) or a needle papillotome in the «blend» and «coagulation» modes of the electrosurgical unit to prevent bleeding, followed by the insertion of a guidewire. Subsequently, the created fistulous tract was dilated using the endo-balloon with a length of 50 mm and a diameter of 15–20 mm,

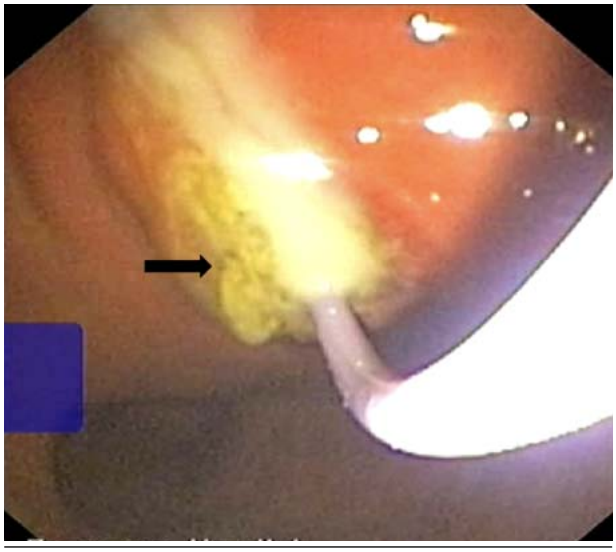


Figure 1. **Access to the walled-off necrosis (WON) cavity indicated by the arrow**

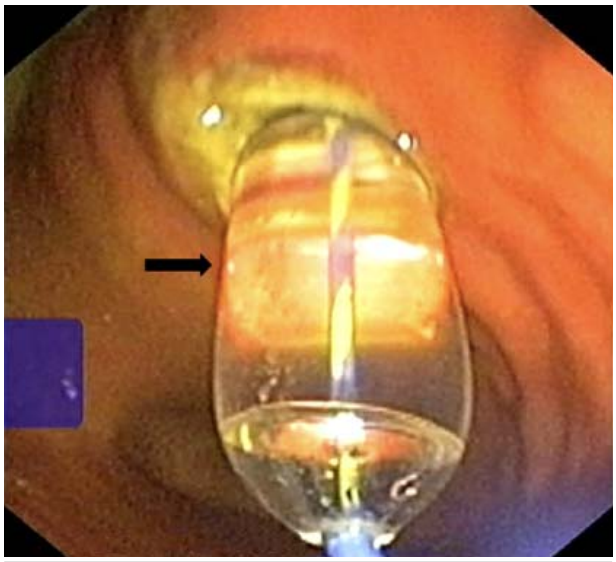


Figure 2. **Dilation of the created fistulous tract using a dilation endo-balloon, indicated by the arrow**

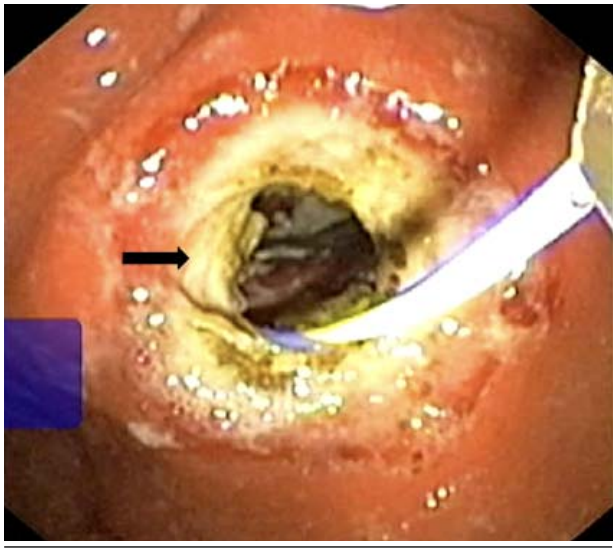


Figure 3. **View of the created transluminal fistulous tract, indicated by the arrow**

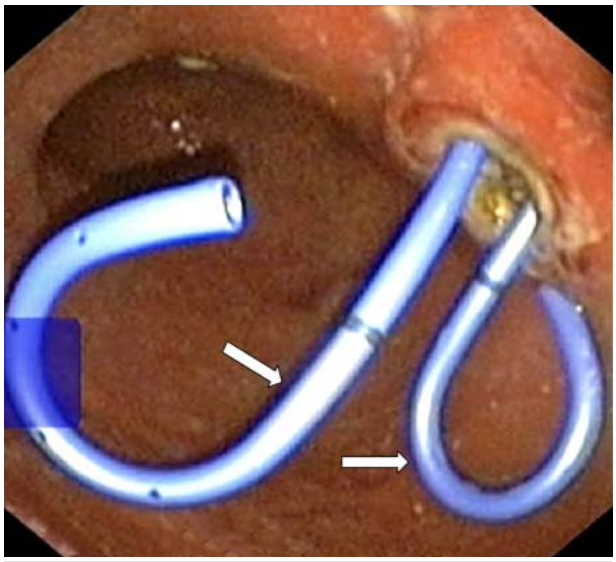


Figure 4. **Transluminally placed plastic double-pigtail stents, viewed within the stomach cavity (indicated by arrows)**

maintaining balloon inflation for 5–10 min to prevent bleeding (Fig. 2, 3).

• The contents of the WON cavity were collected for bacteriological examination.

• Subsequently, over the guidewire, 1–2 plastic double-pigtail stents (length 50 mm between loops, diameter 10 French) were placed (Fig. 4). The presence of at least one transluminal stent prior to direct endoscopic necrosectomy facilitates identification of the newly created fistula, which may be difficult to visualize between the gastric folds, particularly due to the presence of pus and debris from the WON cavity within the stomach. The placement of two transluminal stents ensures better long-term patency and lumen support for the fistulous tract compared to a single stent.

• A gastroscope with a distal cap was advanced into the WON cavity alongside the stents. To improve visualization and wash out pus and debris, the WON cavity was initially irrigated abundantly through the endoscope's working channel with a 1 % hydrogen peroxide solution, followed by aspiration of the contents. During a single necrosectomy session, cavity irrigation was performed several times to enhance the removal of necrotic debris and improve visualization. The average volume of irrigation solution used during one procedure ranged from 200 to 400 ml, depending on the cavity size.

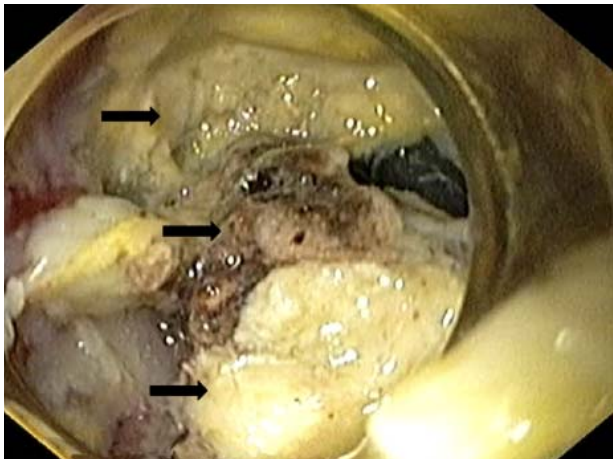


Figure 5. **Necrotic debris in the WON cavity during initial access (indicated by arrows)**

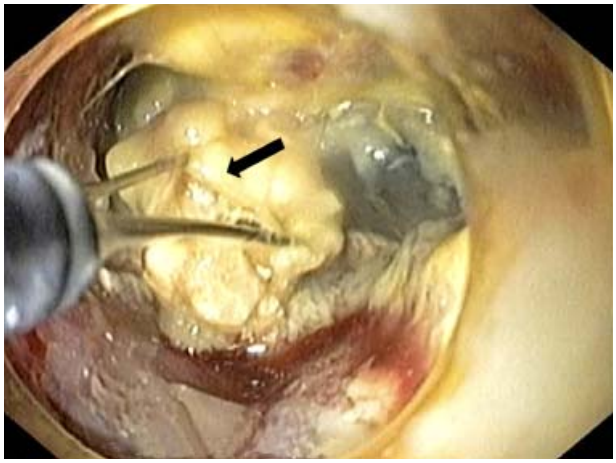


Figure 6. **Endoscopic transluminal necrosectomy, view inside the WON cavity (indicated by arrow)**

Figure 7. **View of the WON cavity after complete necrosectomy and lavage**

• Direct endoscopic necrosectomy (Fig. 5–7) through the created fistulous tract between the stomach/duodenum cavity and the WON cavity was performed using an endoscopic tripod (grasper). Necrotic sequestra lying freely within the cavity were removed and fragmented.

• During necrosectomy, aggressive removal of necrotic tissue with inadvertent capture of viable structures was avoided in order to prevent profuse bleeding; tightly adherent necrotic fragments were left for the next session to allow spontaneous detachment into the WON cavity.

• After each session, the presence of unremoved dense necrotic fragments in the WON cavity at the time of procedure completion was recorded in the surgical protocol to guide further treatment strategy and determine the need for additional sessions.

• To improve the conditions for cavity debridement between sessions, the principle of continuous lavage was applied. In patients with pre-existing percutaneous drainage of the WON cavity, antiseptic solutions were introduced through the drain, allowing pus and debris to be evacuated through the created transluminal fistula into the stomach. In patients where endoscopic intervention was the primary method of decompression, a 7 Fr transnasal catheter was placed into the WON cavity through the created fistula at the end of endoscopic session, enabling drip or intermittent irrigation.

• During the subsequent endoscopic necrosectomy session, if necessary, the fistula was re-dilated using a 15–20 mm dilation balloon; the stents remained in place.

• The decision to proceed with open surgical treatment was individualized by a multidisciplinary team of surgeons and endoscopists in cases of the patient's lack of significant improvement and the presence of a large volume of residual necrotic debris within the WON cavity.

Criteria for treatment effectiveness

The effectiveness of treatment using ETN was assessed based on the degree of clinical success, which was defined as complete, partial, or no clinical success. Obtaining access to the WON cavity determined the technical success of the procedure.

The main criterion for complete clinical success of ETN was the patient's discharge in satisfactory condition with no need for additional surgical interventions for necrosectomy or complications. Other criteria for complete treatment effectiveness at the time of discharge included:

• absence or significant reduction of symptoms associated with the primary disease (abdominal pain, hyperthermia, signs of compartment syndrome, including nausea, vomiting, digestive disorders);

• according to imaging studies (ultrasound, contrast-enhanced CT, or MRI), the absence of fluid collections or the presence of a cystic cavity < 3 cm that did not require surgical intervention.

The partial clinical success of ETN was defined as a decrease in pain syndrome, resolution of gastric and/or duodenal obstruction symptoms, and reduction of hyperthermia, but without significant improvement in the patient's condition, requiring open surgery within the step-up approach.

No clinical success was achieved in fatal cases, regardless of whether open surgery was performed within the step-up approach.

The procedure was technically successful when direct transmural access to the WON cavity was established, enabling subsequent dilation of the fistula created with an endo-balloon, stent placement, and the advancement of the endoscope into the WON cavity, regardless of the final clinical treatment result.

The complications were divided into two groups: those directly associated with necrosectomy (intraoperative) and those related to the disease course requiring surgical intervention (peritonitis, fistulas, and others).

Statistical analysis of the obtained data was performed using the IBM SPSS Statistics 22 software package. Descriptive statistics were used. Quantitative data are presented as arithmetic mean (M) ± standard deviation (SD), and for qualitative characteristics – absolute values (n) and percentages were used. Correlation analysis was performed using Spearman's rank correlation. The chi-square (χ^2) one-sample test assessed the correspondence between the observed and expected frequencies in categorical data. A comparison of quantitative variables was performed using the Mann–Whitney U test. The null hypothesis of variable equality was rejected at $p < 0.05$.

Results

Among 28 patients with ANP, 13 (46.4 %) were admitted directly to the specialized department, while 15 (53.6 %) were transferred from other hospitals or units. 23 (82.1 %) patients experienced primary hospitalization due to ANP, while 5 (17.9 %) underwent re-hospitalization, with $p = 0.001$. In most patients – 15 individuals (53.6 %; $p = 0.004$) – the duration of the disease history exceeded 72 hours upon admission.

Among the etiological factors of ANP, gallstone disease and alcohol consumption played a leading role in 92.9 % of cases ($p < 0.001$). According to the Atlanta Classification 2012 [2], moderate severity ANP was diagnosed in 19 (67.9 %) patients, while severe disease was recorded in 9 (32.1 %) patients ($p = 0.089$) (Table 1).

The initial session of ETN was performed on average at 36.2 ± 16.1 days (ranging from 22 to 86 days) after the first onset of symptoms. Among patients experiencing their first episode of ANP, the interval to ETN was 33.9 ± 12.9 days (22–80 days). For those who were rehospitalized, the interval was 47.0 ± 25.5 days (29–86 days), with no statistically significant difference ($p = 0.489$). In one case, ETN was performed as a «last resort» surgery on day 22 of the disease, earlier than the typically recommended ≥ 4-week interval for endoscopic transluminal interventions.

In the area of fluid/necrotic pancreatic collection, percutaneous drainage using a 9–12 Fr pigtail catheter under ultrasound guidance was performed in 14 patients (60.9%) on average by the 7th day from disease onset (range: 5–9 days), or, if necessary, at later stages of the disease. Furthermore, 15 (53.6 %)

Table 1. **Clinical characteristics of the studied patients (n = 28)**

Parameter	Value
Male	15 (53.6 %)
Fmale	13 (46.4 %)
Age, years (mean ± SD (min–max))	52.6 ± 12.5 (33–77)
Time to admission	
< 6 hours	5 (17.9 %)
6–24 hours	6 (21.4 %)
24–72 hours	2 (7.1 %)
> 72 hours	15 (53.6 %)
Hospitalization status	
First-time admission	23 (82.1 %)
Readmission	5 (17.9 %)
Etiology of pancreatitis	
Gallstone disease	15 (53.6 %)
Alcohol	11 (39.3 %)
Hypertriglyceridemia	1 (3.6 %)
Tumor (ampullary adenoma)	1 (3.6 %)
Severity of acute pancreatitis [2]	
Moderate	19 (67.9 %)
Severe	9 (32.1 %)
Patients without adequate initial management of acute pancreatitis	
Transferred from another department or hospital*	15 (53.6 %)

Note. *1 of 15 patients remained at home for about a month from the onset of the disease before being admitted to the clinic.

patients underwent abdominal cavity drainage due to pancreatic ascites, and 8 (28.6 %) patients had pleural cavity drainage for exudative pleuritis.

Before surgical intervention, patients exhibited fever (96.4 %), infection (positive bacteriological culture from WON aspirate) (96.4 %), abdominal pain (89.3 %), severe general weakness (78.6 %), signs of systemic inflammatory response syndrome (SIRS) (67.9 %), gastric outlet obstruction/vomiting (60.7 %), pancreatic ascites (53.6 %), nausea and loss of appetite (50.0 %), sleep disturbances (46.4 %), splenoportal thrombosis (28.6 %), and pleural effusion (28.6 %) (Fig. 8).

The average size of the WON was 109.6 ± 32.9 mm (Fig. 9), as assessed using imaging techniques such as contrast-enhanced abdominal CT (less frequently, abdominal MRI). Specifically, two maximum dimensions of the cavity (conventionally referred to as width and length) were measured separately in the axial and frontal planes; the four obtained measurements were then summed and divided by four.

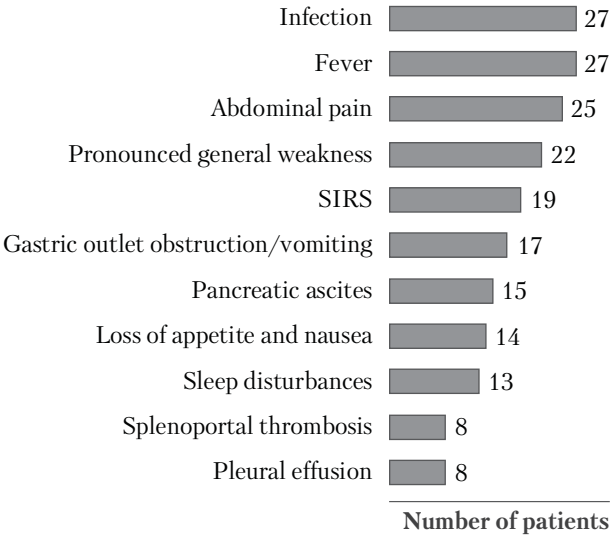


Figure 8. **Primary conditions and symptoms in patients with walled-off necrosis at the time of endoscopic transluminal necrosectomy (n = 28)**

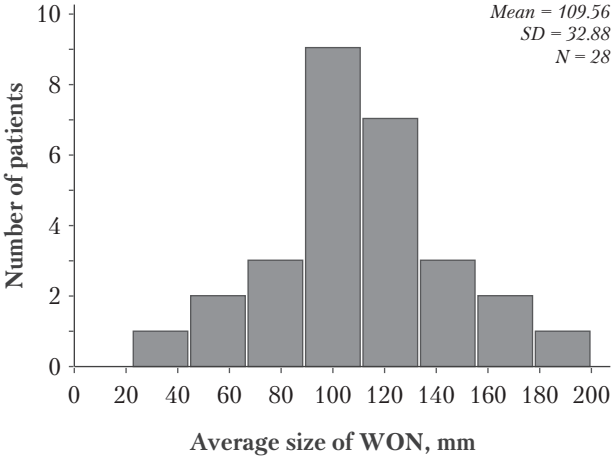


Figure 9. **Distribution of patients according to the average size of the walled-off necrosis (WON)**

A total of 48 endoscopic transluminal sessions were performed, most commonly one per patient (Table 2).

The average intervals between consecutive sessions (1–2, 2–3, 3–4) did not show statistically significant differences (Table 3).

Continuous lavage of the WON was performed in 17 (60.7 %) patients, including percutaneous lavage through an existing drain in 10 (58.8 %) patients and transnasal drainage installed endoscopically during the ETN session (and reinstalled on the subsequent sessions) in 7 (41.2 %) patients. Lavage was carried out three times a day, either fractionally or by drip. The antiseptics used included 1 % hydrogen peroxide solution and/or 1 % betadine solution; the volume of irrigation solution was 200–400 ml per day.

The procedure was considered technically successful in 28 (100.0 %) patients. One patient experienced gastric wall bleeding during the first session, which was stopped by balloon tamponade. No complications requiring surgical intervention were observed.

After performing ETN alone, complete clinical success was attained in 18 (64.3 %) patients, while 8 (28.6 %) patients presented with partial clinical success. No clinical success was recorded in 2 (7.1 %) patients. Among patients with partial clinical success, one patient died after open surgical intervention.

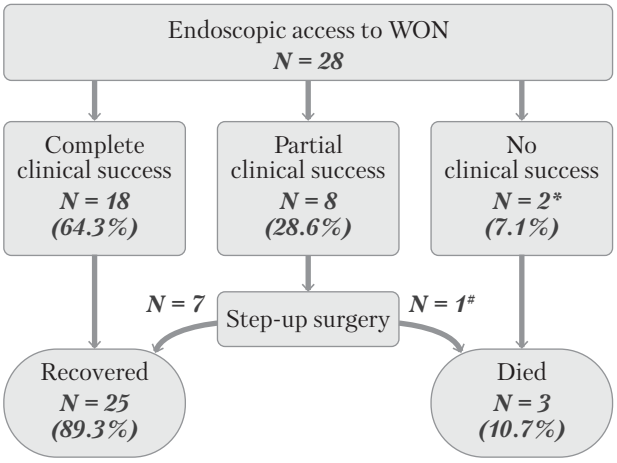
Table 2. **Distribution of patients by number of sessions (n = 28)**

Number of sessions	Number of patients
1	14 (50.0 %)
2	10 (35.7 %)
3	2 (7.1 %)
4	2 (7.1 %)

Table 3. **Average intersession intervals during treatment, days**

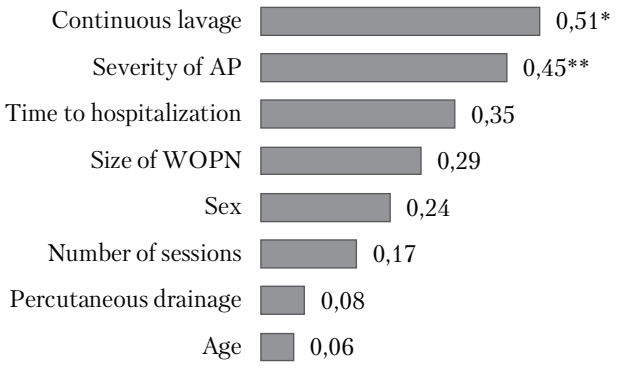
Sessions	Mean ± SD	Min–max
1st–2nd (n = 16)	7.0 ± 2.2	4–14
2nd–3rd (n = 4)	6.5 ± 1.0	6–8
3rd–4th (n = 2)	6.5 ± 0.7	9–7

Note. No statistically significant differences were found between intervals (p > 0.05).



* One patient was transferred from another department and was in critical condition before the procedure, with signs of multiple organ failure; the other patient had stayed at home for about a month from disease onset until admission to the clinic and was of advanced age (77 years).
# Fatal case due to progression of multiple organ failure; the WON cavity was of giant size (mean size – 185 mm) with extensive necrotic tissue; the patient was transferred from another department.

Figure 10. **Flowchart of treatment outcomes in patients from the study**



Statistical significance: * p = 0.006; ** p = 0.017.

Figure 11. **Correlation between the effectiveness of ETN and several parameters**

Thus, a total of 25 (89.3 %) patients recovered, and mortality was noted in 3 (10.7 %) cases (Fig. 10).

Achieving complete clinical success or complete+ partial clinical success necessitated 1 to 4 sessions (Table 4).

Complete clinical success was achieved within 1–2 sessions in 15 patients, which accounted for 53.6 % of the total number (n = 28) of treated patients. Complete+partial clinical success was achieved within 1–2 sessions in 21 patients (75.0 %). The mean length of hospital stay was 56.2 ± 27.2 days (ranging from 19 to 113 days).

Table 4. **Number of ETN sessions in patients with complete and complete+partial clinical success**

Number of sessions	Number of patients
Complete clinical success (n = 18)	
1	8 (44.4 %)
2	7 (38.9 %)
3	1 (5.6 %)
4	2 (11.1 %)
Complete + partial clinical success (n = 25)	
1	12 (48.0 %)
2	9 (36.0 %)
3	2 (8.0 %)
4	2 (8.0 %)

Table 5. **Frequency of achieving complete clinical success depending on the use of continuous lavage for WON**

Continuous lavage	Complete clinical success		Total
	Yes	No	
Yes	14 (82.4 %)	3 (17.6 %)	17 (100.0 %)
No	4 (36.4 %)	7 (63.6 %)	11 (100.0 %)
Total	18 (64.3 %)	10 (35.7 %)	28 (100.0 %)

Correlation analysis of the relationship between ETN effectiveness and several clinical parameters revealed significant correlations only for the severity of the patient's condition at admission and the use of continuous WON cavity lavage (Fig. 11).

Among the 17 patients who underwent continuous lavage of the WON cavity, complete clinical success was achieved in 14 (82.4 %), but only 4 (36.4 %) of the 11 patients who did not receive continuous lavage obtained the same outcome (p = 0.013; Table 5).

Thus, performing ETN followed by continuous lavage of the WON cavity increased the likelihood of achieving complete clinical success by 2.26 times compared to patients who did not undergo lavage (RR = 2.26; 95 % CI 1.01–5.10; p = 0.0485).

Discussion

Currently, the management of acute necrotizing pancreatitis is based on the following key principles: priority of minimally invasive interventions, the «step-up» approach, delayed interventions, and multidisciplinary management.

The choice of surgical strategy in ANP is made according to the internationally recognized «step-up approach», taking into account the timing of disease onset and the dynamics of the clinical course. This strategy involves a gradual transition from less invasive methods to more invasive procedures to minimize surgical trauma to the patient. Unlike open necrosectomy, the essence of the «step-up» approach lies primarily in controlling the infectious focus and alleviating sepsis symptoms, rather than in the complete removal of infected necrotic tissue [10]. There is convincing clinical evidence that the «step-up» strategy significantly reduces the number of complications, adverse long-term outcomes, and mortality in patients with ANP [4, 10], allowing for avoidance or postponement of surgical necrosectomy [4, 11].

Endoscopic transluminal interventions for ANP in Western countries have already occupied a significant niche among minimally invasive techniques and are being used with increasing frequency [1].

Despite the high effectiveness of this method, clinicians face several unresolved issues, such as determining the optimal frequency of interventions; choosing the endoscopic debridement strategy – initial endoscopic drainage alone or immediate endoscopic necrosectomy; selecting stents – plastic or self-expanding metal stents; developing innovative tools for necrosectomy; ensuring continuous lavage of the WON cavity with antiseptic or antibiotic solutions; and establishing criteria for transitioning to more invasive procedures. Currently, these aspects are addressed on an individual basis, relying on the experience and technical capabilities of a particular medical center, which highlights the need for further research.

Among the debatable issues is the performance of endoscopic transluminal access without an endoscopic ultrasound (EUS). The WON cavity compresses the wall of the stomach or duodenum in approximately 50–60 % of ANP cases, 4–6 weeks after the onset of the disease [4]. During diagnostic upper gastrointestinal endoscopy, an area of external compression or bulging into the lumen of the stomach or duodenum is usually visualized. Moreover, this site frequently displays inflammatory infiltration, indicating the WON's cavity direct attachment to the hollow organ's wall. In such cases, endoscopic transluminal interventions can be performed at the site of bulging without using of EUS as long as there are no signs of significant portal hypertension [5–7, 12]. It should also be noted that interventions through the greater and lesser curvatures of the stomach should be avoided due to the presence of large vessels in these areas, which may lead to fatal bleeding. Using an ultrasound endoscope to create access is preferable, as this device allows access to the WON cavity in up to 100 % of cases, even if typical bulging into the gastric lumen is absent, provided that the cavity is within the EUS visualization range [1].

Our study demonstrates that adherence to the indications (direct contact of the WON cavity with the stomach or duodenum according to CT/MRI data, external compression of the stomach/duodenum according to EGD findings, disease duration ≥ 4 weeks), as well as the patient's supine position during the procedure, allows for safe endoscopic transluminal interventions without EUS, with a minimal complication rate and 100 % technical success of accessing the cavity. For convenience during the procedure in the supine position, we used a 15 cm footrest for the endoscopist.

For better evacuation of purulent-necrotic contents from the WON cavity, it is crucial to create adequate access to the cavity. Plastic stents with a diameter of 10 French, which are considered the standard, become rapidly occluded with debris, and the evacuation of purulent-necrotic material occurs mainly through the space between the stents. Therefore, during the first intervention, transluminal drainage with plastic stents alone is insufficient. A fistula should be created using a dilation balloon up to 20 mm. In addition, during the initial procedure, endoscopic entry into the WON cavity is mandatory for the assessment of cavity size, the amount of necrotic debris, and its consistency – which will help determine the need for subsequent sessions.

According to our experience, soft-consistency necrotic masses can be removed by lavage; however, in most cases, dense sticky necrotic debris is present. It must be fragmented and removed using an endoscopic tripod (or other tools) into the lumen of the hollow organ over several sessions.

Performing daily continuous lavage of the WON cavity after establishing endoscopic access significantly improves treatment outcomes in these patients and may reduce the number of endoscopic sessions required.

The duration of a single ETN session should be limited. Prolonged necrosectomy sessions in patients under anesthesia and mechanical ventilation, weakened by a long-lasting intra-abdominal infectious-toxic process, may together exert significant pathophysiological stress on the patient's body. Based on our experience, the optimal duration of a single ETN session should be 60–90 minutes, which has also been reported in previous original studies [7].

Important factors predicting the clinical success of ETN include the size of the WON cavity and the extent of necrotic process spreading into paracolic

spaces [6]. Among the patients in our study, there was one female patient with necrosis spreading into the left paracolic gutter. In this case, complete clinical success was achieved after two ETN sessions combined with the placement of a «competing» percutaneous drain under ultrasound guidance into the left paracolic space, with active lavage through it.

A large WON size and extensive necrotic tissue, with paracolic extension of the necrotic process observed during endoscopic assessment, may indicate the need to transition to more invasive surgical intervention. However, the decisive factors in such situations are the general condition of the patient, the clinical response to transluminal intervention, and the expertise of the selected center.

Our findings confirm that ETN is an effective treatment method for acute infected necrotizing pancreatitis when the indications for the procedure are observed, demonstrating a low complication rate (3.6 %, n = 1, bleeding) and mortality (10.7 %, n = 3). When indicated, this technique, in combination with percutaneous drainage, can serve as the primary method for complete WON debridement in most cases (64.3 %). In 28.6 % of patients, it may be used as an intermediate stage before transitioning to more invasive surgical procedures.

The study has certain limitations due to the relatively small number of patients included and its single-center design.

Declaration of interests

The authors declare that they have no conflicts of interest.

Ethics approval and written informed consent statements

The study was conducted in accordance with the Helsinki Declaration of Ethics. The study protocol was approved by the ethics committee of Bogomolets National Medical University (protocol number of topic approval).

Authors contributions

N. V. Puzyr: investigation, statistical analysis, writing of the manuscript; Y. M. Susak: conceptualization, methodology, editing.

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Ендоскопічна транслюмінальна некрозектомія у пацієнтів з гострим інфікованим некротичним панкреатитом. Досвід спеціалізованого відділення

Н. В. Пузир [1, 2], Я. М. Сусак [1]

[1] Національний медичний університет імені О. О. Богомольця, Київ

[2] Київська міська клінічна лікарня швидкої медичної допомоги

За останні десятиліття лікування гострого інфікованого некротичного панкреатиту (ГІНП) суттєво покращилося завдяки поглибленню розуміння механізмів перебігу захворювання та впровадженню малоінвазивних технологій. Ендоскопічні транслюмінальні втручання посідають важливе місце серед цих методик і продовжують удосконалюватися як з технічної, так і з тактичної точки зору.

Мета — оцінити результати ендоскопічної транслюмінальної некрозектомії у пацієнтів з ГІНП та узагальнити досвід спеціалізованого відділення.

Матеріали та методи. В дослідження увійшло 28 пацієнтів: 15 (53,6 %) чоловіків та 13 (46,4 %) жінок, з середнім віком (52,6 ± 12,5) року, яким протягом 2021—2024 років виконано ендоскопічну транслюмінальну некрозектомію (ЕТН) з приводу обмеженого некротичного пері-/панкреатичного скупчення (ОНС), яке безпосередньо контактувало з шлунком та/або дванадцятипалою кишкою. ГІНП середнього ступеня тяжкості мали 19 (67,9 %) пацієнтів, тяжкий перебіг — 9 (32,1 %). Середній розмір ОНС становив 109,6 ± 32,9 мм. Результати ЕТН оцінювали як повний, частковий або відсутній клінічний успіх.

Результати. Перша сесія ЕТН виконана в середньому на 36,2 ± 16,1 добу (від 22 до 86 діб) від першого приступу захворювання. Всього виконано 48 ендоскопічних транслюмінальних сесій, від 1 до 4, найчастіше — одну на одного пацієнта у 14 (50,0 %). Інтервали між послідовними сесіями найчастіше становили 6—7 діб. Проточний лаваж ОНС здійснено 17 (60,7 %) хворим.

Тривалість маніпуляції становила від 60 хв. до 90 хв. Рівень інтраопераційних ускладнень становив 3,6 % (профузна кровотеча). Повного клінічного успіху досягнуто у 18 (64,3 %) пацієнтів, часткового — у 8 (28,6 %), у 2 (7,1 %) клінічного успіху не зафіксовано. Загалом одужало 25 (89,3 %) пацієнтів, летальність становила 3 випадки (10,7 %).

Висновки. ЕТН при ГІНП при дотриманні показів може бути основним методом лікування у 64,3 % пацієнтів, а також у частини пацієнтів (28,6 %) — як перехідний етап до більш інвазивних операцій. Виконання ЕТН з подальшим застосуванням проточного лаважу порожнини ОНС підвищує ймовірність досягнення повного клінічного успіху у 2,26 разу порівняно з пацієнтами, яким такий лаваж не проводився (RR = 2,26; 95 % ДІ 1,01—5,10; p = 0,0485).

Ключові слова: гострий панкреатит, гострий інфікований некротичний панкреатит, обмежене некротичне скупчення, ендоскопічна транслюмінальна некрозектомія, пряма ендоскопічна некрозектомія.

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