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**Early Selective Enteral Feeding in Treatment of a Patient with Acute Pancreatitis: A case report**

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**Abstract****BACKGROUND**

Early initiation of enteral feeding is recognized to play crucial role in improving the outcomes of treatment of acute pancreatitis. However, the method of administration of enteral nutrition remains debatable. We present the experience of treating a patient with moderate-severe acute pancreatitis, at high risk of progressing to a severe or fatal condition, using novel method of selective feeding with duodenal isolation.

**CASE SUMMARY**

A 27-year old female patient was presented to the emergency unit of the hospital with a typical manifestation of acute pancreatitis. Despite a conventional treatment, the patient's condition deteriorated by Day 2 of hospitalization. Using an endoscopic approach, a newly designed PandiCath catheter was placed to the duodenum of the patient, isolating its segment between the duodenal bulb and the ligament of Treitz. In the isolated area created, a negative pressure was applied, followed with introduction of early selective enteral feeding. The patient's condition had subsequently improved in a rapid manner, and no complications often associated with moderate-to-severe acute pancreatitis have developed.

**CONCLUSION**

Within 48 h of starting treatment with novel method it prevented the development of multiple organ failure and, when combined with minimally invasive drainage methods, helped prevent infection.

## **INTRODUCTION**

Acute pancreatitis ranks among the top five abdominal surgical diseases worldwide.<sup>1,2</sup> According to the international treatment recommendations for acute pancreatitis, intensive therapy should be complemented with gastric and intestinal drainage and early enteral feeding.<sup>3</sup> However, the method of administering nutrition, whether *via* oral, gastric, or intestinal routes, remains unresolved.<sup>4,5</sup> A new treatment method utilizing the novel catheter PandiCath® has been developed,<sup>6,7</sup> offering several potential treatment mechanisms, including selective enteral feeding. The device temporarily isolates and disconnects the duodenum from the stomach and proximal jejunum, preventing acidification of duodenal contents, as well as reflux of bacterial flora from the small intestine to the duodenum. Additionally, it creates a negative pressure area in duodenum to enhance drainage of biological fluids from the hepatic and pancreatic duct systems preventing bile reflux and reducing intraductal pressure. Finally, by delivering nutrients to the jejunum while draining the stomach, PandiCath® prevents the gastric outlet syndrome. We report a case where this approach has augmented a standard treatment of acute pancreatitis. Our finding provide insight to the new promising method of treatment of moderate-to-severe cases of acute pancreatitis.

## **CASE PRESENTATION**

### ***Chief complaints***

Female Patient, 27-year-old, was admitted to the hospital in an emergency on March 20, 2023. The clinical presentation of acute pancreatitis was typical. At the time of

examination, the patient complained of abdominal pain, nausea and vomiting. The intensity of the pain was assessed using the visual analog scale (VAS) was 10.<sup>13</sup>

### *History of present illness*

The patient reported experiencing these symptoms for the first time on March 19, 2023, after consuming alcohol and fatty food. Negative prognostic factors included type 2 diabetes diagnosed in October 2022 and being overweight (height - 172 cm, weight - 86 kg, BMI = 29.1).

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### *History of past illness*

No previous history.

### *Personal and family history*

No personal and family history.

### *Physical examination*

On physical examination, the heart rate was 88 beats per minute, blood pressure was 130/70 mmHg, respiratory rate was 16 per minute and body temperature was 36.8°C.

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### *Laboratory examinations*

Laboratory analyses did not show significant deviations: white blood cell count - 8.68, hematocrit - 39.9%, blood amylase - 151 IU/L, glucose - 18.39 mmol/L, C-reactive protein (CRP) - 78.3 mg/L, serum was lipemic.

### *Imaging examinations*

Abdominal ultrasound showed an enlargement of the pancreas with blurred contours. Chest X-ray revealed pleural effusion. Enhanced abdominal CT scan showed an enlargement of the pancreas up to 45 mm with formation of the para-pancreatic

infiltrate. No necrotic changes were observed in the pancreatic tissue. Accumulation of fluid was detected in the para-pancreatic and para-renal spaces with a thickness of 11 - 35 mm, as well as pleural effusion (Figure 1). According to the Computed Tomography Severity Index (CTSI) criteria, the patient's score was 6, and according to Modified Computed Tomography Severity Index (mCTSI), the score was 8, which corresponds to a moderate-severe or severe form of acute pancreatitis.<sup>14</sup>

### **FINAL DIAGNOSIS**

Acute pancreatitis, severe form; SIRS.

### **TREATMENT**

Within 24 h from disease onset (on March 20, 2023), the patient was admitted to the intensive care unit (ICU) and active fluid resuscitation therapy was initiated. On March 21, 2023, the patient's condition deteriorated, manifesting with somnolence and toxic encephalopathy - the patient appeared indifferent to the ongoing treatment, requested to be left alone, and expressed suicidal thoughts. Systemic Inflammatory Response Syndrome (SIRS) developed, with the following vital signs: heart rate - 116 beats per minute, respiratory rate - 21 per minute, receiving oxygen inhalation at a rate of 5 Liters per hour, SpO<sub>2</sub> (oxygen saturation) - 96%, body temperature - 37.3°C. Laboratory findings showed leukocytosis - 5.6, hematocrit - 35.2%, with a shift in the leukocyte formula towards band cells - 34%. The blood amylase level was 276 IU/L, glucose - 16.3 mmol/L, Ca (calcium) - 1.95 mmol/L, and CRP increased to 432.4 mg/L. The procalcitonin level was 0.41 ng/mL.

Based on the Bedside Index for Severity in Acute Pancreatitis (BISAP) scale, an increase in scores from 2 to 3 was observed, which corresponds to moderate-severe pancreatitis with an increased risk of mortality. Patient's RANSON score was 3, with an estimated risk of mortality of 15%.<sup>15</sup> The patient experienced severe pain with a VAS score of 10. On examination of the upper abdomen, an inflammatory infiltrate and positive peritoneal signs were identified. On a Focused Assessment with Sonography

for Trauma (FAST) ultrasound examination on March 21, abdominal effusion was detected in the subhepatic and intersigmoid spaces, predominantly on the right side, with a maximum thickness of up to 50 mm. Based on the clinical findings, it was decided to perform abdominal drainage under ultrasound guidance. A total of 600 mL of hemorrhagic effusion was obtained, with amylase activity measuring 2079 IU/L. A prolonged epidural anesthesia was applied at 11am on March 21<sup>st</sup>.

It was then decided that the patient fits to a prospective, parallel-group, open-label, multicenter, centrally randomized study that was conducted from October 2020 to May 2023. The two groups of the study included standard therapy *vs* standard therapy with the early selective feeding method. The randomization process followed pre-established patient distribution tables. The study protocol was approved by the local and independent ethics committees. Additional insurance for the patients participating in the study was arranged. The study included patients with their first episode of acute pancreatitis, presenting with non-mild forms of the disease of alimentary and biliary etiology without indications for endoscopic retrograde cholangiopancreatography (ERCP). The randomization occurred within 96 h from the onset of the pancreatitis episode. The objectives and purposes of the study were explained to each patient, who provided voluntary consent before being enrolled. After verifying all inclusion and exclusion criteria for the study and obtaining consent, the patient was assigned, according to the randomization table, to the study group combining standard therapy and early selective enteral feeding. Using an endoscopic approach, at 3 pm on March 21 the PandiCath® catheter was placed isolating a segment of the duodenum between the duodenal bulb and the ligament of Treitz (Figure 2). In the isolated area created, a negative pressure was applied at a level of 80 mmHg using a VAC pump, resulting in the evacuation of duodenal contents mixed with bile and pancreatic juice. Activity of lipase in evacuated biological fluid was 6502 IU/L. The correct placement of the catheter was verified radiologically (Figure 3).

#### **OUTCOME AND FOLLOW-UP**

Three hours after the catheter placement, intensity of the pain syndrome decreased and was assessed with a VAS score as 3. On March 22, 2023, it was noted that the patient's mental status improved, and the patient now understood the severity of their condition. Negative thoughts disappeared, and the patient no longer had suicidal thoughts, understanding that prolonged treatment lied ahead.

The administration of a glucose-saline mixture was initiated through the catheter in a selective manner (i.e. into the proximal part of jejunum) on March 22, 2023, one hour after catheter placement. It was followed three hours later by the introduction of enteral nutrition mixture rich with microfiber at 30 kcal/kg. Improvement in intestinal peristalsis was observed from March 22, as evidenced by the absence of evacuation of intestinal contents through the catheter.

On March 23, patient's peristalsis was fully restored, and physiological parameters were close to normal (heart rate - 80 beats per minute, blood pressure - 120/70 mmHg, respiratory rate - 16 breaths per minute). It was decided to discontinue active decompression of duodenum and to remove the catheter, transitioning the patient to oral feeding, which was well tolerated. The patient's vital signs improved, and the manifestations of SIRS disappeared. The CRP level decreased to 172.3 mg/L, and the concentration of immature forms of leukocytes reduced to 8%. The severity assessment using the Sequential Organ Failure Assessment (SOFA) score was 0. On March 24<sup>th</sup> patient's conditions continued to improve and they was transferred from ICU to a surgical ward.

On March 27<sup>th</sup>, a change of a drainage catheter was performed under ultrasound guidance to remove the remaining inflammatory effusion from the peritoneal cavity. Bacteriological analysis of the abdominal fluid was negative, indicating an aseptic course of acute pancreatitis. On April 5<sup>th</sup> the drainage catheter was removed.

A follow-up CT scan on the 16<sup>th</sup> day post-admission showed positive progress, with no evidence of necrotic changes in the pancreas, and no signs of infection (Figure 3).

The patient was discharged from the hospital on the 18<sup>th</sup> day of admission. Three months after discharge, the patient reported no recurrent acute pancreatitis attacks, no further hospitalizations, no abdominal pain and no fever. The patient experienced no limitations in their somatic status and had returned to normal work routine without any issues.

## **DISCUSSION**

Within 24 h of hospitalization, the patient receiving standard therapy developed SIRS with an a sharp increase in CRP level and other indicators pointing to a poor prognosis and an increased risk of mortality. However, after the addition of novel therapy, positive dynamics were observed within 48 h, despite initial presence of factors predisposing to the development of MODS.

This case demonstrates a favorable impact of the early selective enteral feeding on the patient's treatment outcome and highlights its potential benefits in preventing severe complications associated with acute pancreatitis. However, certain aspects of the treatment strategy remain subject to discussion, such as the need of peritoneal drainage and the duration of stay in the ICU and overall length of hospitalization. These decisions may vary depending on surgical traditions and treatment strategies adopted by different hospitals.

From a pathophysiological standpoint, proposed approach confers several therapeutic benefits. Temporarily isolating the duodenum prevents acidification and the entry of mucus and nutrients from the stomach. This effectively inhibits the activation of duodenal enterokinases and trypsinogen. Furthermore, decreased gastric chyme reduces secretion of secretin and cholecystokinin, key players in the development and progression of autolytic aseptic inflammation in the pancreas.<sup>8-12</sup> Preventing the reflux of contents from the small intestine to the duodenum ensures the maintenance of the appropriate composition of microbial flora in respective sections of gastrointestinal tract. Protection of duodenum from the passage of gastric and reflux of intestinal contents along with maintaining a negative pressure area in duodenum



prevents the elevation of intraduodenal pressure and stretching of intestinal wall, which otherwise could heighten the risk of enterocyte death compromising gut's barrier function and increasing the likelihood of bacterial translocation and para-pancreatic tissue infection. Creation of a negative pressure area in duodenum also facilitates the outflow of bile and pancreatic juice thus inhibiting premature activation of enzymes sustaining pancreatic inflammation.<sup>8-12</sup> During digestion, normal outflow of bile and pancreatic juice is facilitated by the coordinated peristalsis and motility of the duodenum and jejunum. However, these mechanisms are disrupted during an acute pancreatitis attack, leading to paresis, - which subsequently leads to the development of further severe complications.

Previous research on the impact of enteral feeding on the outcomes of treatment of acute pancreatitis did not reveal significant differences between the various methods of administering nutritional mixtures. Nonetheless, it is important to consider that when the passage of gastric juice, mucus, chyme and fluid continues through the duodenal lumen, it may trigger humoral stimulation mechanisms that could lead to the exacerbation and prolongation of the inflammatory process and autolysis of the pancreas.

In the case described, we used PandiCath® as a treatment tool but also for collecting a mixture of bile with pancreatic juice, which can be evaluated for various molecular markers. In particular, high activity (6502 IU/L) of lipase, a specific pancreatic enzyme was detected in this substrate. Thus, the ability of PandiCath® to efficiently collect significant volumes of biofluids could make it a useful diagnostic tool.

The proposed treatment method provides for a "humoral rest" of the pancreas, while at the same time local application of negative pressure re-creates normal physiological conditions, facilitating the drainage of bile and pancreatic juice. The essential role of early enteral feeding has been previously proven.<sup>3-5</sup> Application of the early selective enteral feeding aligns well with existing international standards for the treatment of AP and has the potential to improve it. Furthermore, the proposed method

can be complemented with targeted delivery of medicines into the isolated area of duodenum, potentially enhancing its effectiveness. Isolation of the duodenum is achieved by inflating catheter balloons with a liquid. Some authors suggested that applying local pancreatic hypothermia reduces severity of acute pancreatitis,<sup>16</sup> and we further suggest that using chilled liquid to inflate balloons of PandiCath® could also help achieve this goal.

## **CONCLUSION**

Overall, the novel treatment approach described in this report showed promise in improving patient's outcome and can potentially contribute to improving standard of care for acute pancreatitis. Further studies are necessary to validate and refine the proposed method for a broad clinical application.

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