DOI: 10.15825/1995-1191-2023-4-139-149

A RARE CASE OF ACUTE DESTRUCTIVE PANCREATITIS IN A PATIENT WITH CHRONIC KIDNEY DISEASE ON PERITONEAL DIALYSIS: DIAGNOSTIC AND TREATMENT CHALLENGES

V.A. Stepanov, O.N. Vetchinnikova

Vladimirsky Moscow Regional Research and Clinical Institute, Moscow, Russian Federation

Patients with chronic kidney disease are susceptible to developing acute pancreatitis. We present a rare clinical case of acute pancreatitis with the formation of pancreatic necrosis in a patient on peritoneal dialysis (PD), debuted with PD–associated peritonitis. On hospitalization, there were no diagnostic criteria for acute pancreatitis; treatment for dialysis peritonitis was ineffective. Repeated ultrasound examination revealed signs of diffuse changes in the pancreas and multi-chamber formation of the small pelvis. Refractory peritonitis, inadequate ultrafiltration, and unclear nature of formation in the pelvic were the grounds for diagnostic laparoscopy and removal of the peritoneal catheter. Abdominal inspection revealed spots of stearin necrosis over the entire surface of the peritoneum and the greater omentum; in the pelvis there were adhesions between the uterus and the rectum. Development of pancreonecrosis was confirmed by abdominal CT scan. Treatment of acute pancreatitis was without effect, type 2 myocardial infarction developed, and with increasing symptoms of multiple organ failure, death occurred. Possible reasons for the development of destructive pancreatitis and the features of its course in the PD patient are discussed. Caution is necessary regarding this disease when dialysis peritonitis occurs.

Keywords: acute pancreatitis, peritoneal dialysis-associated peritonitis, continuous ambulatory peritoneal dialysis, chronic kidney disease.

INTRODUCTION

PD is a universally recognized method of renal replacement therapy (RRT) for stage 5 chronic kidney disease (CKD). In Russia, the PD program started in 1995 and over the past decades, thousands of CKD patients have received and are receiving treatment with this method [1]. PD patients are exposed to a variety of homeostatic disorders and complications peculiar to CKD and caused by the PD technique itself. Acute pancreatitis (AP) is one such rare but life-threatening complication.

The first description of two cases of AP in PD patients dates to 1985, and the authors suggested that the disease was a complication of PD [2]. AP incidence and severity in CKD patients, including those receiving replacement therapy (dialysis), remain unknown. Between 1985 and 2011, only 94 cases with 133 AP episodes in PD patients were reported [3]. In subsequent years, only single cases of AP in patients with CKD, including those who have undergone kidney transplantation, have been published [4, 5]. It is now generally recognized that patients with pre-dialysis and dialysis CKD are at higher risk of developing AP than the general population. There are also indications that AP is more common in CKD patients undergoing PD than hemodialysis (HD) patients, although not all researchers agree with this statement [6–8].

The duration of the PD program before the development of the first episode of AP varies, ranging from a few months to several years [3]. One of the first national studies of the incidence and severity of AP, based on the results of a questionnaire survey of dialysis centers in Germany, found a significantly higher incidence compared to the general population. Comparison of the two groups of dialysis patients showed that AP was more common in the PD group (266 per 100,000 per year, 67 per 100,000 per year in HD patients, 19.7 per 100,000 per year in the general population) and more severe, with half of them developing pancreonecrosis. Considering the methodology of the study, the authors do not exclude a higher incidence of AP among dialysis patients [8]. Analysis of the incidence and severity of AP in 67,078 patients with end-stage renal disease, who initiated dialysis between 1999 and 2007 in Taiwan, found that the cumulative incidence rates of AP were 0.6, 1.7, 2.6, 3.4, and 4% at 1, 3, 5, 7 and 9 years, respectively; patients on HD and PD had an AP incidence of 5.11 and 5.86 per 1000 person-years, respectively. Severe AP occurred in 44.9% of the HD patients and in 36% of the PD patients. According to the authors, CKD patients on PD were at a higher risk for AP than those on HD [9].

PD patients may have the same causes of AP as the general population [10, 11]. However, they have many

Corresponding author: Olga Vetchinnikova. Address: 61/2, Shchepkina str., Moscow, 129110, Russian Federation. Phone: (916) 532-49-00. E-mail: olg-vetchinnikova@yandex.ru

additional factors that make the pancreas highly susceptible to inflammation [3, 12]. First, autopsies have revealed an increased prevalence of structural pancreatic abnormalities in deceased patients who had been on HD for a long time. Second, these patients exhibit a variety of metabolic disorders accompanying CKD (hyperglycemia, hypercalcemia, hypertriglyceridemia, etc.), whose involvement in the genesis of AP has been documented. Finally, the PD modality itself may predispose the patient to AP. Various explanations have been proposed for the negative impact of the PD procedure on the pancreas, but the question of whether this modality increases the risk of the disease remains open and controversial. Fig. 1 shows the main pathophysiologic mechanisms of AP development in CKD patients undergoing PD.

AP diagnosis in PD patients is difficult due to the presence of CKD and the peculiarities of the dialysis modality. In particular, the diagnostic accuracy of blood amylase enzyme activity is limited. This is because in CKD, increased blood amylase resulting from decreased urinary excretion is more common than in the general population, and the use of glucose polymer icodextrin in the PD program, on the contrary, decreases the activity of this enzyme. Often the development of AP in PD patients is masked by the clinical and laboratory picture of PD-associated peritonitis [3, 12].

The surgical community has witnessed a clear trend towards an increase in the frequency of the destructive form and the development of complications of AP in the general population over the past few years and the absence of a marked decrease in overall and postoperative mortality in this pathology, despite the use of modern detoxification techniques, development of new surgical intervention methods, and improvement in drug therapy [13]. Mortality from AP in the dialysis patient population is high, 8–58%; risk factors include severe disease, male gender, elderly age, and diabetes mellitus [3, 7–9, 12].

We present a rare clinical observation of the development of the first episode of AP with the formation of pancreatic necrosis in a CKD patient on PD, which debuted with PD-associated peritonitis and caused difficulties in early diagnosis and treatment.

CLINICAL CASE REPORT

1. Diagnosis and treatment of peritoneal dialysis-associated peritonitis

Patient V., female, 59 years old, was admitted to the intensive care unit for emergency indications with

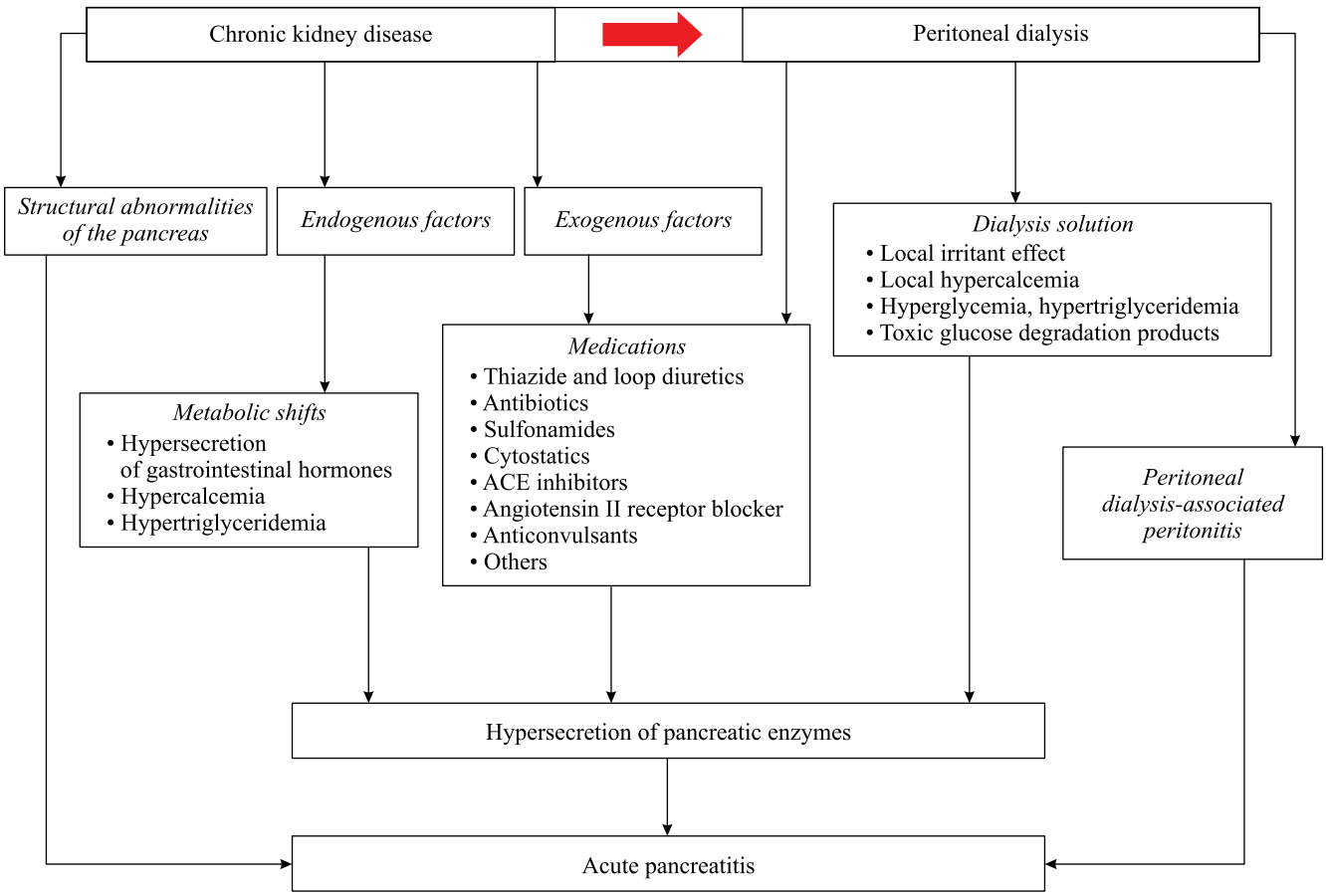

Fig. 1. Pathophysiologic mechanisms of acute pancreatitis in patients with chronic kidney disease on peritoneal dialysis treatment [3, 11, 12]

complaints of sharp abdominal pain without clear localization.

The patient has, for a long time, been suffering from CKD resulting in chronic glomerulonephritis (without histological verification). Renal replacement therapy (PD) has been ongoing for three years. A day before admission to the hospital, sharp abdominal pain without clear localization occurred and the dialysis solution turned cloudy.

Life history without peculiarities. Epidemiological anamnesis was absent. Harmful habits denied. Past diseases: childhood infections, acute respiratory diseases, and COVID-19 in 2021. No episodes of PD-associated peritonitis were recorded.

The patient was conscious, correctly oriented in place and time. Normosthenic physique, satisfactory nutrition. Skin and mucous membranes are of normal color, no peripheral edema. Respiratory rate 16/min, vesicular on auscultation. Heart rate 75/min, blood pressure 120/70 mmHg. The abdomen was not enlarged in size, was symmetrical, and participated in the act of breathing to a limited extent. On palpation, the abdomen was tense, more in the lower parts. There was pain, predominantly in the hypogastrium. Positive symptoms of peritoneal irritation. The liver was not enlarged. The external part of the dialysis catheter was located to the right of the umbilicus, the skin around it was not changed. Stool without pathologic impurities. Rectal examination: perianal area without changes; ampulla was empty; there was a trace of light brown feces on the glove. Kidneys were not palpable. Anuria.

The patient was undergoing PD in a continuous outpatient PD mode, 8 l/day (4 exchanges of 2 l each) solutions Physioneal (6 l) and Icodextrin (2 l). The PD program was adequate, he denied having episodes of PD-associated peritonitis and other complications.

The results of laboratory and instrumental examinations on the day of admission are presented in Table 1.

Table 1

Results of laboratory and instrumental examination of patient V. upon admission to the intensive care unit

Method	Result
Complete blood count	Red blood cells 3.7×10^{12}/l, hemoglobin 123 g/l, white blood cells 16.5×10^{9}/l, neutrophils 89.5%, platelets 288×10^{9}/l.
Biochemistry blood test	ALT 14 U/L, AST 12 U/L, alpha-amylase 87 U/L (norm 25–125), glucose 5.5 mmol/L, urea 14.8 mmol/L, creatinine 836 μmol/L, bilirubin (total) 5, 2 μmol/L, C-reactive protein 288 mg/L, procalcitonin ≥2 μg/L, fibrinogen 6.8 g/L, aPTT 31.6 s, prothrombin time 17.7 s.
Antibodies to Coronavirus (SARS-CoV-2)	IgM 3 (norm <2), IgG 446 (norm <10)
Dialysis fluid analysis	The color is grayish yellow. Cytosis 7128 ($\times 10^{6}$ per L), neutrophils 94%, lymphocytes 2%, monocytes 4%, erythrocytes 36×10^{6}/L
Abdominal ultrasound imaging	Intestinal pneumatization. The liver is not enlarged. The contours are clear and even. Echogenicity is increased. Sound conductivity is not reduced. The structure is homogeneous. Focal formations are not visualized. Intrahepatic bile ducts are not dilated. The portal vein and hepatic veins are not dilated and are passable. Gallbladder is not enlarged, 64 × 20 mm, the walls are not thickened 2 mm, homogeneous, anechogenic content in the cavity. No paravesical infiltration was revealed. The hepaticocholedochus is not dilated – 6 mm, located fragmentarily. The pancreas is visualized fragmentarily, head 25 mm, body 19 mm, tail 22 mm. Echogenicity is increased in the areas accessible for examination, the structure is homogeneous without focal changes. Wirsung duct is not dilated. Peripancreatic tissue is not infiltrated. Spleen is not enlarged, contours are smooth, structure is homogeneous without focal changes, echogenicity is average. Intestinal loops are not dilated, walls are not thickened, they are peristaltic. Free fluid is visualized in all sections. In the right subphrenic space 18 mm thick, in the subhepatic space 30 mm thick, in the subphrenic area on the left 15 mm thick, near the spleen 15 mm thick, along the lateral canals 40 mm thick, in the lesser pelvis 60 mm thick. Conclusion. Echo signs of free fluid in the abdominal cavity (peritoneal dialysis) and diffuse changes in the liver and pancreas
Chest X-ray	A chest X-ray in direct projection did not reveal focal or infiltrative shadows. The pulmonary pattern is not changed. The roots of the lungs are structural and not expanded. The heart shadow and mediastinum are not expanded. The contour of the diaphragm dome is clear and even. Sinuses are free.
Abdominal Plain radiography	There were no signs of violation of the integrity of the hollow abdominal organ. Single horizontal fluid levels in the intestinal lumen are determined.
Electrocardiography	Sinus rhythm. Heart rate 80 beats/min. PQ 0.12; QRS 0.08; QT 0.35. Deviation of the electrical heart axis to the left. Block of the left anterior branch of the bundle of His.
Dialysis solution sent for microbiological examination	

Based on the results of clinical and laboratory examination, the patient was diagnosed with PD-associated peritonitis. The following antibacterial and symptomatic therapy was prescribed:

- *Ampicillin / Sulbactam (1000 mg + 500 mg) intravenously, 3 times a day;*
- *Cefepin 500 mg (intraperitoneally) into dialysis solution, 4 exchanges per day;*
- *Sodium chloride 0.9% 1000 ml intravenously, 2 times per day;*
- *Tramadol 100 mg intramuscularly (as indicated).*

Three days later, the patient's condition improved slightly. The intensity of pain became less with localization in the umbilical region. Body temperature was normal. Pastosity appeared on the legs and eyelids. Lungs and heart without changes, BP 125/80 mm Hg. The abdomen participated in the act of breathing, soft on palpation. Local abdominal tension was determined in the peri-umbilical region, and there was limited pain on palpation. Symptoms of peritoneal irritation were negative. Stools tended to be constipated, brown in color. Turbidity of the dialysis solution became a little less, but there was no full transparency. The result of bacteriological examination of the dialysis solution was that there was no microflora growth. Leukocytosis, high level of C-reactive protein and procalcitonin remained (Table 2). Systemic antibacterial therapy was changed: tigecycline 100 mg intravenously twice a day was prescribed; intraperitoneal administration of cefepime 1.0 g at each exchange, infusion and symptomatic therapy (enoxaparin sodium 4000 anti-Xa IU subcutaneously, once a day, rabeprazole 20 mg intravenously once a day) were continued. The PD program was increased to 10 L/day (2 liters, 5 exchanges).

In the following days, the patient's condition remained severe with negative dynamics. Moderate pain in the umbilical region persisted. There were no symptoms of peritoneal irritation. A persistent syndrome of systemic inflammatory reaction was registered: blood leukocytosis with a shift of the leukocytic formula to the left, high concentrations of C-reactive protein and procalcitonin, although the level of the latter became lower. There was decreased total protein, increased hepatic transaminase activity by one and a half times and alpha-amylase activity by two times, and hypokalemia. The PD programs were inadequate for ultrafiltration (negative despite the correction performed). Dialysis solution remained turbid (on repeated negative cultures) with high leukocyte titers (Table 2).

The intraperitoneal antibiotic was changed to vancomycin 1.0 g twice a day and imipenem/cilastatin 500 mg three times a day.

Esophagogastroduodenoscopy and dynamic ultrasound imaging (DUI) of the abdominal cavity and lesser pelvis were performed. Conclusion of esophagogastroduodenoscopy: superficial gastritis; hemorrhagic duodenitis; axial cardiac hiatal hernia. Conclusion of ultrasound imaging of abdominal cavity and lesser pelvis: Echo signs of free fluid in the abdominal cavity (peritoneal dialysis), diffuse changes in the liver, pancreas and multi-chamber pelvic mass (in the projection of uterine appendages) with total dimensions of 90 × 45 mm.

Table 2

Dynamics of laboratory parameters of patient V. before diagnostic laparoscopy and removal of the peritoneal catheter

Parameter	Hospital stay	
	Day 3	Day 8
Complete blood count		
Red blood cells ($\times 10^{12}$/L)	3.65	3.44
Hemoglobin (g/L)	121	109
White blood cells ($\times 10^{9}$/L)	10.4	13.5
Band neutrophils (%)	7	2
Segmented neutrophils (%)	80	83
Platelets ($\times 10^{9}$/L)	246	257
Biochemistry blood test		
Total bilirubin (μmol/L)	4.2	5.4
– direct bilirubin (μmol/L)	2.4	2.6
– indirect bilirubin (μmol/L)	1.8	2.8
Glucose (mol/L)	4.8	5.4
ALT (U/L) (norm 5–34)	12	46
AST (U/L) (norm 5–31)	13	47
Alpha-amylase (U/L) (norm 25–125)	70	249
Total protein (g/L)	61	41
Alkaline phosphatase (U/L)	95	152
C-reactive protein (mg/L)	317	99
Procalcitonin (μg/L)	≥10	7
Creatinine (μmol/L)	764	730
Urea (mmol/L)	17.3	23.5
Triglycerides (mmol/L)	1.7	–
Parathyroid hormone (pg/mL)	287	–
Blood electrolytes		
Sodium (mmol/L)	130	132
Potassium (mmol/L)	4.0	3.6
Ionized calcium (mmol/L)	1.31	1.25
pH	7.39	7.24
Bicarbonate (mmol/L)	24	23
Dialysis solution analysis		
Color	Purulent	Yellow
Transparency	Turbid	Incomplete
Cytosis (cl. $\times 10^{6}$/L)	5076	318
Red blood cells (cl. $\times 10^{6}$/L)	4	227
Neutrophils (%)	96	74
Monocytes (%)	2	2
Lymphocytes (%)	2	24
Bacteriological examination of dialysis solution	No growth	No growth

2. Diagnosis and treatment of acute pancreatitis

There were no changes in the patient's condition against the background of complex conservative treatment. PD-associated peritonitis had a refractory course. The PD program was inadequate for ultrafiltration (negative). The nature of the pelvic mass was not clear according to DUI results. A decision was made to perform diagnostic laparoscopy [10] and remove the peritoneal catheter with transfer of the patient to HD.

Operation protocol. *Abdominal revision revealed no damage to the hollow organs; fibrin threads and stearin necrosis spots were found on the entire surface of the peritoneum and the greater omentum. The latter was vitreous edematous, with areas of bluish tint in the transverse colon area (Fig. 2). Intraoperative biopsy of the most altered area of the greater omentum was performed (histological examination showed fibrous-fatty tissue with necrosis).*

In the pelvic area, large serous cysts of both ovaries and adhesions between the uterus and a section of the rectum were detected (Fig. 3). There was a myomatous nodule on the uterus with a diameter of 3 cm. The abdominal cavity had residual turbid dialysis solution. The intestines were slightly distended, peristalsis was present. The abdominal cavity was washed with antiseptic solution, sanitized, fibrin was removed as much as possible. The peritoneal catheter was isolated and removed from a separate incision 3 cm above the projection of the internal cuff.

Laparoscopy results, as well as the negative dynamics of laboratory parameters (increasing leukocytosis, level of C-reactive protein, liver enzymes, alpha-amylase) before the operation, indicated acute destructive pancreatitis in the patient. In the postoperative period, abdominal CT scan was performed with bolus intravenous injection of 100 ml of Ultravist 370 at the rate of 4 ml per second. Conclusion. Postoperative condition. CT signs of peripancreatic cell thickening (parapancreatitis) and infiltrative changes in the retroperitoneal tissue in all sections with a tendency to the formation of delimited fluid accumulations:

- *along the posterior layer of the perirenal fascia on the right side with a layer up to 11 mm thick, approximate dimensions 38 × 68 mm;*
- *along the anterior layer of the perirenal fascia on the right side with a layer up to 20 mm thick, approximate dimensions 63 × 154 mm;*
- *along the lateral surface of the ascending colon with a layer up to 23 mm thick, approximate dimensions 64 × 131 mm;*
- *in the area of the greater omentum on the right side with approximate dimensions of 42 × 137 × 89 mm;*

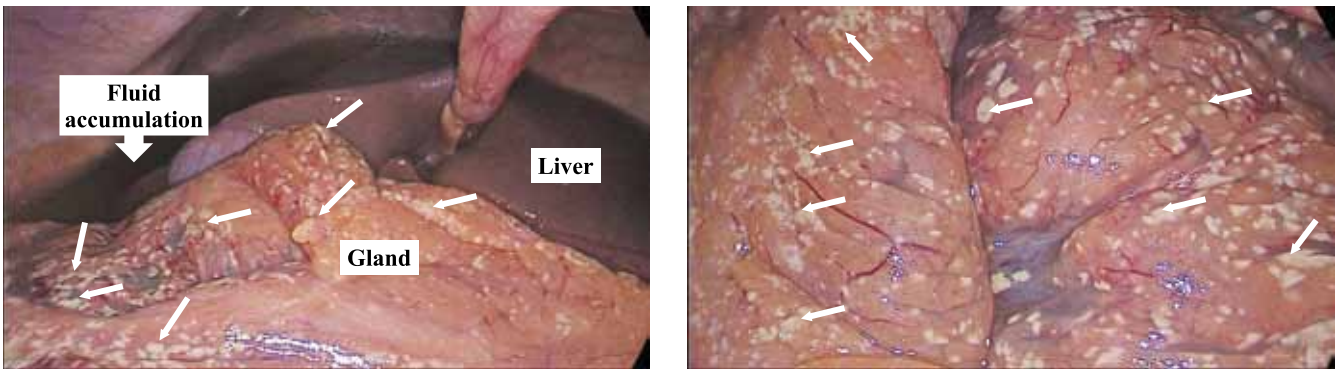

Fig. 2. Foci of stearin necrosis in the greater omentum during diagnostic laparoscopy in patient B.

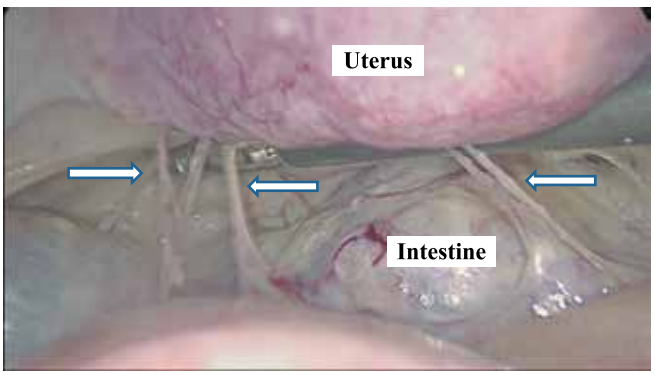

Fig. 3. Adhesions between the uterus and Intestine during diagnostic laparoscopy in patient B.

- *in the perinephric cellular tissue on the left side with a layer up to 30 mm thick, approximate size 61 × 64 mm;*
- *along the greater curvature of the stomach body with a layer up to 35 mm thick, approximate dimensions 53 × 53 mm.*

The patient was transferred to the intensive care unit for further treatment. On day 2 after surgery, she was bothered by pain in the postoperative wound area. The patient's general condition remained severe. Indicators of the system of integral assessment of the severity of the condition: APACHE II 16 points, SOFA 5 points. The patient was correctly oriented in space, time and person;

fully conscious, Glasgow Coma Scale: 15 points. Skin is pale, with normal moisture and reduced turgor. The lower limbs are pasty. Body temperature 36.5 °C. Breathing spontaneously; FIO_2: 21%; SPO_2: 94%. Respiratory rate: 18/min. On auscultation, breathing is rigid, no wheezes. Heart sounds are rhythmic, heart rate 90/min, blood pressure 110/60 mmHg. The abdomen was not swollen, participated in the act of breathing, soft on palpation, painful in the postoperative wound site; sluggish intestinal peristalsis was heard on auscultation; there were no symptoms of peritoneal irritation. In the area where the central vein catheter was installed, there were no signs of inflammation. The postoperative dressing was dry. There was 500 ml of serous-hemorrhagic discharge through the drainage. At laboratory examination, pronounced blood leukocytosis with a shift of leukocytic formula to the left, high levels of C-reactive protein and procalcitonin were all still present, increased blood bilirubin and severe hypoalbuminemia were noted; blood enzymes returned to normal levels (Table 3).

The patient continued multicomponent therapy, which included:

- *Daily hemofiltration sessions;*
- *Intravenous administration of antibiotics (Linezolid 1.2 g/day, Imipenem 1.0 g/day);*
- *Infusion therapy;*
- *Correction of hypoalbuminemia (albumin 25% 100 ml/day intravenously);*
- *Anti-ulcer and gastroprotective therapy (Rabeloc 20 mg/day intravenously);*
- *Parenteral nutrition (Dipeptiven 100 ml intravenously);*

Table 3

Dynamics of laboratory parameters of patient V. after diagnostic laparoscopy

Методика исследования	After diagnostic laparoscopy and peritoneal catheter removal		After sanitation re-laparoscopy
	Day 2	Day 5	
Complete blood count			
Red blood cells ($\times 10^{12}$/L)	3.4	2.4	3.3
Hemoglobin (g/L)	111	79	98
White blood cells ($\times 10^{9}$/L)	28.2	16.6	19.2
Neutrophils (%)	91	86	90
Platelets ($\times 10^{9}$/L)	71	150	70
Biochemistry blood test			
Total bilirubin (μmol/L)	31.7	41.4	24.7
– direct bilirubin (μmol/L)	14.1	9.1	6.5
– indirect bilirubin (μmol/L)	17.6	32.4	18.2
Glucose (mol/L)	4.4	2.7	2.1
ALT (U/L) (norm 5–34)	11	12	20
AST (U/L) (norm 5–31)	40	44	33
Alpha-amylase (U/L) (norm 25–125)	60	45	73
Albumin (g/L)	16.6	30	31
Alkaline phosphatase (U/L) (normal 30–112)	–	264	–
C-reactive protein (mg/L)	303	240	147
Procalcitonin (μg/L)	27	560	167
aPTT (s)	52.3	52.1	41.2
Prothrombin timem (s)	31.0	24.1	14.3
Fibrinogen (g/L)	4.3	3.1	1.9
Creatinine (μmol/L)	449	539	275
Urea (mmol/L)	13.8	19.6	22.8
Blood electrolytes			
Sodium (mmol/L)	128	128	131
Potassium (mmol/L)	4.0	4.5	4.7
Ionized calcium (mmol/L)	1.21	1.12	0.93
pH	7.23	7.21	7.34
Bicarbonate (mmol/L)	20	17	15
Microbiological examination			
Blood	No growth	No growth	
Sputum	*Streptococcus viridans* 10^{4}/mL Sensitivity: aztreonam, amikacin, imipenem	*Streptococcus viridans* 10^{6}/mL Sensitivity: aztreonam, amikacin	

– *Correction of blood electrolyte composition (intravenous injection of potassium chloride 4%);*
– *Correction of anemia (Erythropoietin 2500 IU/day, subcutaneously);*
– *Pain therapy (tramadol 200 mg/day, ketoprofen 200 mg/day, intravenously);*
– *Anticoagulant therapy (enixum 0.4 ml/day, subcutaneously);*
– *Treatment aimed at optimizing the gastrointestinal tract (metoclopramide 2.0 ml 3 times a day, intravenously).*

On day 5 after diagnostic laparoscopy (day 14 of hospitalization), the patient's condition was severe with negative dynamics. Increased abdominal pain was noted. Fully conscious, oriented in space, time and person, Glasgow coma scale: 15 points. Indicators of the system of integral assessment of the severity of the condition: APACHE II 20 points, on the SOFA 8 points. The skin is earthy. No peripheral edema. Body temperature 36.1 °C. Spontaneous breathing: FIO_2: 21%; SPO_2: 98%. Respiratory rate 18/min. Auscultatory respiration was vesicular, no wheezing. Heart sounds were clear, rhythmic. Heart rate 93/min. Blood pressure 104/68 mmHg. The abdomen was distended, soft on palpation, painful in the postoperative wound area. Peristalsis was sluggish, stool was single. Anuria. Postoperative wound dressings were dry and clean. The skin in the area where the main vein catheter was installed was without signs of inflammation. Laboratory examination showed that blood leukocytosis with a shift in the leukocyte formula was reserved and there were high levels of acute-phase proteins; a further increase in bilirubinemia and an increase in alkaline phosphatase activity were noted (Table 3). Increased abdominal pain, increasing intensity of bilirubinemia and systemic inflammatory response syndrome were indications for performing sanitation re-laparoscopy and abdominal revision [10].

Operation protocol. *At abdominal revision, plaques of stearin necrosis and fibrin threads were noted in all sections, 4000 mL of clear effusion was removed (no growth was detected at microbiological examination), sanitation and drainage of focal fluid accumulations in the parapancreatic region were performed, the abdominal cavity was sanitized with saline solution, silicone drains were installed in the left subphrenic and subhepatic spaces, in the lesser pelvis.*

In the postoperative period, the patient's condition remained very severe. A day after the second operation, blood pressure reduced, and vasotropic support with noradrenaline 0.2 mcg/kg/min was initiated. ECG showed signs of ischemia in the subendocardial layers of the myocardium of the anterolateral wall of the left ventricle. Echocardiography revealed impaired local contractility – hypokinesis of the apical anterior and septal segments of the left ventricle. Laboratory examination revealed an increase in cardiac-specific enzymes: total creatine phosphokinase 1896 U/L (norm 26–192), MB fraction of creatine phosphokinase 37 U/L (norm 0.0–24.0), lactate dehydrogenase 830 U/L (norm 81–234), troponin I 21999.9 pg/mL (norm 8.4–18.3). Given the results of laboratory and instrumental examination, the patient was diagnosed with type 2 myocardial infarction. With increasing symptoms of multiple organ failure, the patient died on day 18 of inpatient treatment.

At pathological autopsy, there were many gray-yellow curd-like foci of steatonecrosis on the peritoneum and in the omental tissue; the pancreas was yellow-gray in color, flabby consistency with obliterated lobular pattern and many dirty-yellow curd-like foci of steatonecrosis (histological examination shows extensive foci of steatonecrosis with focal leuko-lymphocytic infiltration); tissue around the gland is dirty gray in color, structureless, with many foci of steatonecrosis. The myocardium was red-brown in color with uneven blood filling with a pronounced clayey tinge (histological examination revealed diffuse and perivascular layers of connective tissue, uneven hypertrophy and contracture damage in cardiomyocytes, lipofuscin deposition in cardiomyocytes, vascular congestion, focal large-droplet fatty dystrophy).

DISCUSSION

The presented case report demonstrates the difficulties of clinical diagnosis of AP in a CKD patient on PD replacement therapy. According to the revised Atlanta-92 classification and national clinical guidelines for AP, the diagnosis of the disease requires two of the following three features [10, 14]:

1. Characteristic abdominal pain syndrome (intense persistent pain localized in the epigastrium, often radiating to the back);
2. Increased blood amylase and/or lipase activity exceeding the upper limit of the norm by three or more times;
3. Characteristic signs on CT/magnetic resonance imaging or transabdominal DUI.

At admission and during the first few days of hospitalization, none of the listed diagnostic criteria of AP was determined in our patient. The disease started with abdominal pain, but the pain did not have a clear localization and irradiation, there was no vomiting, at palpation the pain and slight muscle tension were localized mainly in the hypogastrium. Blood amylase activity was normal, although, as mentioned above, this situation is acceptable because the patient used a dialysis solution containing glucose polymer. Abdominal DUI revealed only diffuse changes in the pancreas and no characteristic symptoms. However, as is known, the diagnostic information value of DUI in AP is limited due to the special topography of the pancreas, as well as in the early stage of the disease. In our patient, the study was performed without removal of the dialysis solution from the abdominal cavity, which could also affect the results obtained. Thus, at the

time of admission and during the first week of hospitalization, clinical and laboratory symptoms – abdominal pain, cloudiness and inflammatory nature (high cytosis) of dialysis solution and signs of systemic inflammatory response (peripheral leukocytosis, serum elevation of C-reactive protein and procalcitonin) – corresponded to PD-associated peritonitis; there was no evidence for other etiology of peritonitis besides PD-associated peritonitis. A common complication of PD – PD-associated peritonitis – has similar manifestations to AP, so the diagnosis of the latter may be delayed. This was the case in our patient. Other authors also report about initial diagnosis of PD-associated peritonitis and delayed diagnosis of AP in PD patients [3, 10]. It is possible that contrast-enhanced CT, the gold standard for the diagnosis of AP, as well as determination of amylase and/or lipase in dialysis solution, could have helped in earlier detection of the disease, but there were no indications for these studies on admission [10].

The question remains open whether PD-associated peritonitis was the cause of AP or it was an early complication of AP – pancreatogenic (enzymatic) peritonitis. It seems that the second assumption is more realistic. This is confirmed by the persistent absence of microflora growth in the dialysis solution during repeated studies (although this could be a consequence of intensive antibacterial therapy) and the development of severe acute destructive peritonitis on the seventh-eighth day of hospitalization, confirmed by a twofold increase in blood amylase level, characteristic signs on CT and laparoscopy.

The cause of AP in our patient remained unknown. She had no classic causes of AP in the general population: alimentary factor, hepatobiliary diseases and pancreatic trauma. She also did not have metabolic disorders (hypercalcemia, secondary hyperparathyroidism, hypertriglyceridemia), which are common in CKD and predispose to the development of AP [3, 10, 12]. Probable risk factors were those associated with the PD method, including PD-associated peritonitis if it was primary. Another potential cause for the development of AP is drug therapy. Due to the duration and severity of the underlying disease, the patient was taking various medications, and she received intensive drug therapy for PD-associated peritonitis, while no high-risk drugs that were capable of initiating AP were prescribed [11]. The absence of a clearly identified single and specific etiologic factor for AP in our patient is a characteristic feature of the dialysis population. Some reports note that it is rare to identify risk factors for AP in dialysis patients; the proportion of such patients is small, from one third to one half of all cases [3, 12]. In the remaining patients, idiopathic AP is diagnosed; it occurs twice as often in PD patients as in the general population. The idiopathic nature of AP in dialysis patients implies the cumulative effect of individual pathogenic factors: risk factors found in the general population, risk factors associated with renal failure and its complications, and another risk factor – dialysis, especially PD, although its association with AP is still debated and not generally accepted [6–8].

In dialysis patients, conventional therapeutic tactics for AP with early administration of antibiotics are used to prevent acute necrotizing pancreatitis, and reduce mortality and infection rate [15]. Conservative treatment is often sufficient, but in this case, its full implementation proved ineffective. Surgical intervention is performed according to certain indications; in the observed patient, these were diagnostic difficulties (DUI signs of multichamber pelvic mass) and the need to interrupt the PD program in the first case and increased abdominal pain syndrome, increasing intensity of obstructive jaundice and systemic inflammatory response syndrome in the second case [10]. It should be noted that there are no clear guidelines regarding the modality of dialysis in PD patients with respect to AP – to continue this method or to transfer to HD. One of the indications for interruption of a PD program is insufficient (negative) ultrafiltration, which occurred in our patient. However, HD in AP is associated with a high incidence of hemorrhagic complications [6, 9].

Our patient had severe AP with the development of necrotizing pancreatitis and serious complications. The CT severity index developed by Balthazar was 8 points (6 zones of peripancreatic fluid accumulation, necrotizing pancreatitis), multi-organ dysfunction according to SOFA scale – 5–8 points [10]. At present, this situation is typical for both the general and the dialysis patient population; among the latter the mortality is several times higher and varies from 8% to 58% [7, 8, 12]. AP in PD patients is more severe than in HD patients, they require hospitalization more often and develop necrotizing pancreatitis more frequently [9]. In our patient, all known factors of poor prognosis of AP were present, which include: >50 years of age, presence of severe underlying disease, leukocytosis and increased activity of hepatic blood transaminases, APACHE II integral score >9 points. The most frequent cause of death in these patients is cardiovascular pathology, which was observed in this case.

CONCLUSION

Patients with CKD on PD are at high risk of developing AP, often due to the cumulative effect of various factors. The diagnosis of the disease may be delayed because of the similarity to PD-associated peritonitis and the lack of diagnostically significant elevation of blood amylase activity in some cases. A proactive approach to early diagnosis of AP in PD patients with abdominal pain syndrome and protracted PD-associated peritonitis, which includes investigation of serum lipase activity, amylase activity in dialysis solution and performance of abdominal CT scan is advisable. Treatment of severe

AP in PD patients presents certain difficulties. Early diagnosis of the disease and proper treatment promote a favorable outcome.

The authors declare no conflict of interest.

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The article was submitted to the journal on 18.07.2023