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CLINICAL EXPERIENCE OF CORRECTION OF THE MOTOR-EVACUATION FUNCTION OF DUODENUM IN ACUTE DESTRUCTIVE PANCREATITIS IN THE FIRST PHASE OF THE DISEASE

The purpose of the study was to clinically evaluate the effectiveness of the treatment tactics we developed using the Dextran-40 colloidal solution in patients with duodenal MEF disorders with ADP in the first phase of the disease. The use of a technique using a colloidal solution of Dextran-40 showed greater effectiveness in terms of the rate of reduction in intraduodenal pressure compared to the standard method of prolonged nasogastrojejunal decompression of the upper gastrointestinal tract used for this purpose. Among other things, this made it possible to improve the immediate results of treatment.

Keywords. Acute pancreatitis, motor-evacuation function, duodenostasis.

Introduction. Currently, the problem of acute destructive pancreatitis (ADP) and its complications is one of the most difficult in modern emergency surgery of the abdominal organs. Despite the successes achieved in improving various diagnostic methods, intensive care tactics, surgical treatment using minimally invasive technologies, mortality in destructive pancreatitis over the last decade remains at a fairly high level and amounts to 15–40% [9], with infected forms and the development of pancreatogenic sepsis can reach 65% [3].

In the pathogenesis of many diseases of the pancreatobiliary system, including acute pancreatitis, a special place is occupied by the problem of impaired motor-evacuation function (MEF) of the duodenum [8]. In the medical literature, this pathology can be described under different names: duodenal stasis, megaduodenum, chronic duodenal obstruction,

duodenal dyskinesia, etc. However, with ADP, unlike many other situations, duodenal stasis (DS) is acute [4]. In addition, DS is an integral part of a more significant process that develops against the background of ADP, which includes intestinal failure syndrome (IFS). In turn, IFS, as some researchers believe [1,2,4,10], is the cause of the development of a wide range of infectious complications in ADP. A non-trivial task is that correction of duodenal MEF in ADP can be carried out over a fairly long period of time, taking into account the phase nature of the disease, the presence or absence of certain forms of complications of the disease, the need for surgical interventions, which can also affect the effectiveness of the corrective measures. All this creates the prerequisites for a more in-depth study of this problem by modern emergency pancreatology, and the search for ways to quickly resolve this issue.

Despite the fact that in our time, significant progress has been made in understanding the general principles of treatment of ADP and some of its complications, the issues of correcting disorders of the MEF of the duodenum remain

unresolved, as we indicated above. At different periods of time, different authors proposed certain methods for correcting disturbances in the MEF of the duodenum in ADP [4,6,8,11,12]. In particular, it was pointed out that the most severe MEF disorders are diagnosed in the initial stages of the disease (I A-B phase). However, to this day, despite regular revisions of clinical recommendations for the treatment of acute pancreatitis and its complications, there are no protocols devoted to the correction of duodenal MEF disorders in ADP. It is for this reason that we tried to evaluate the clinical effectiveness of the treatment tactics used in the clinic in relation to patients who were diagnosed with symptoms of duodenal MEF disorders in the first phase of the disease. It is during this period that a pronounced pathomorphological transformation of pancreatic necrosis occurs, ranging from enzymatic peritonitis and parapancreatitis to peripancreatic infiltrate and the formation of delimited fluid accumulations.

The **aim** of the study – to evaluate the clinical effectiveness of the developed treatment tactics in patients with disorders of the duodenal MEF during ADP in the first phase of the disease.

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Material and methods. The study was conducted in a multidisciplinary surgical clinic in the Yakutsk – Republican Hospital № 2 – Center for Emergency Medical Care (RH №2-CEMP) in the period from 2022 to 2024. A non-randomized, single-center, retrospective-prospective study included 61 patients with ADP and who had disorders of the duodenal MEF. The average age of the patients was $38,1 \pm 5,4$ years, there were 35 (57,4%) men, 26 (42,6%) women. The diagnosis of ADP was established on the basis of a standard examination. During the presented period, we were guided by the classification of acute pancreatitis adopted on October 30, 2014 in St. Petersburg at a meeting of the Russian Society of Surgeons and the Association of Hepatopancreatobiliary Surgeons of the CIS countries [5]. Inclusion criteria for the study were: moderate to severe acute pancreatitis; the age of the studied patients was from 18 to 74 years; patients who have not undergone surgical treatment in other health care facilities, in case of their evacuation to a multidisciplinary surgical hospital; absence of surgical or pancreatogenic violations of the integrity of the duodenum at the time of admission to the clinic, absence of death in the first 72 hours from the start of surgical care. Taking into account the fact that today there is no standardized scheme for correcting disturbances in duodenal MEF in ADP, all patients were divided into two groups depending on the treatment tactics used. The first group, the control group, included 34 (55,7%) patients who, in order to relieve gastrosstasis and intestinal paresis, underwent prolonged nasogastric and, if possible, nasogastrintestinal decompression with the installation of a probe 30 cm distal to the Treitz ligament, as recommended in current clinical practice recommendations for the treatment of acute pancreatitis [7]. The second, the main one, included 27 (44,3%) patients who used a scheme developed by us in the clinic and proposed for correcting disturbances in the MEF of the duodenum in ADP. The MEF correction scheme was carried out as follows. During infusion-detoxification therapy, regardless of the need for surgical intervention, 200 ml of a 10% colloidal solution of Dextran-40 with a molecular weight of 35-45 kDa is injected into the duodenum via a two-channel probe 4 times a day for 3-5 days. The procedure for administering the solution is continued until normal values of intraduodenal pressure are achieved (100-130 mm water column). If necessary, the procedure is repeated during the treatment

process. An indispensable condition before introducing the solution was to flush the intestinal lumen to «clean waters» through a previously installed two-channel duodenal tube, preheated in a water bath to 37°C with physiological solution. To determine the form (severity) of duodenostasis and the level of intraduodenal pressure using the open catheter method, we used the method proposed by Kurish R.V. [6]. So, at a level of intraduodenal pressure of 180-190 mm water column, and a fluid flow rate of 20-25 ml, DS was considered compensated, with a level of intraduodenal pressure of 220-230 mm water column, and fluid flow is 30-35 ml, subcompensated and the level of intraduodenal pressure is 260-270 mm water column, and a fluid flow rate of more than 40 ml, decompensated, which is consistent with other authors who studied DS using this method [4,8]. The choice of solution for the purpose of correcting disturbances in duodenal MEF was due to the fact that the colloidal solution Dextran-40, in comparison with other solutions known and used for this purpose, is a drug that has passed state registration and accreditation with known characteristics, is widely used in practical medicine, does not require the creation of laboratories, personnel training, and has a minimum of recorded side effects.

Statistical processing of the received material was carried out using the modern computer program «Stat Plus 2021» for Microsoft office. To determine the

hypothesis and determine the type of distribution of the values of the studied characteristics, the Shapiro-Wilk quantitative test was used. In the groups to be compared, the arithmetic mean – (M) and standard deviation – (σ) were determined. Parametric data are presented as $M \pm \sigma$. The reliability coefficient of differences – p groups with a normal distribution was determined by the t -test. The critical value was taken to be $p \leq 0,05$.

Results and discussion. It is well known that difficulties in diagnosing disturbances in the MEF of the duodenum in ADP and a number of other pathological conditions arise due to the prevalence of symptoms of destructive pancreatitis itself. In addition, there are serious limitations on the possibility of using informative research methods (x-ray, multichannel floor-by-floor manometry, determination of the bioelectrical activity of various parts of the intestine, angiography of the superior mesenteric artery, etc.), which have proven themselves in determining the severity of disorders in chronic processes. This is primarily due to the severity of the condition of patients with ADP, as well as the presence of pain, the presence of encephalopathy, which does not allow the patient to maintain contact with the researcher and follow his recommendations, restrictions on the use of contrast agents in the presence of organ dysfunction, etc. In connection with the existing diagnostic features, we supported the symptoms associated with disruption of the MEF of the duodenum

Table 1

Comparative dynamics of duodenomanometry and duodenodebitometry indices during correction of duodenal MEF in ADP in groups 1 and 2

Indicators	Group	Time period from the start of therapy			
		1 day (M±σ)	3 day (M±σ)	5 day (M±σ)	7 day (M±σ)
IA-phase of the disease					
Basal intraduodenal pressure	1-st 2-nd	228.1±3.2* 200.3±3.3	200.7±3.0* 160.4±4.1	180.1±3.0* 151.1±2.4	164.1±3.3* 129.7±1.8
Residual intraduodenal pressure	1-st 2-nd	231.1±4.4* 225.1±3.1	215.1±3.3* 183.1±5.6	192.3±3.5* 158.4±3.3	174.1±1.5* 141.1±2.0
Duodenal content flow	1-st 2-nd	40.3±1.1 38.6±2.2	31.3±1.2* 24.1±1.7	26.3±2.1* 20.1±2.2	20.3±1.3* 15.0±4.1
IB phase of the disease					
	Group	8-е сут (M±σ)	10-и сут (M±σ)	12-е сут (M±σ)	14-е сут (M±σ)
Basal intraduodenal pressure	1-st 2-nd	312.2±2.3* 291.3±1.1	286.4±3.1* 272.1±2.3	262.1±3.0* 232.0±1.3	178.1±1.2* 146.3±2.1
Residual intraduodenal pressure	1-st 2-nd	325.2±1.3* 310.2±1.2	287.4±2.3* 247.1±1.6	257.0±1.2* 239.0±2.2	236.4±1.6* 219.0±1.1
Duodenal content flow	1-st 2-nd	49.1±2.2 43.5±1.1	43.0±1.3* 34.1±2.5	37.1±2.1* 24.0±1.3	26.0±1.3 20.2±3.3

Note. In table 1-2: *Statistically significant differences between groups ($p \leq 0.05$).

in acute destructive pancreatitis with data obtained during duodenomanometry and duodenodebitometry. The above research methods are simple, informative and accessible for disorders of the MEF of the gastrointestinal tract and are ideal for patients with ADP.

According to our observations, upon admission to the clinic, all 61 (100%) patients with ADP were found to have disturbances of the duodenal MEF of varying severity. The most pronounced changes were observed in the first 3 days in patients in phase IA of the disease and throughout the entire period in phase IB of the pathological process (table 1).

It should be noted that within 1 day from the start of treatment for ADP, there were no significant differences in the groups in terms of the results of correction of DS using either the regimen recommended by the Russian Society of Surgeons or the one proposed by us. At the same time, starting from the 2-nd day of therapy in patients in phase IA of the disease and starting from 2-3 days in patients in phase IB, a clear trend towards a more rapid decrease in intraduodenal pressure in patients of the second group could be observed, and in whom the treatment regimen we developed was used for this purpose.

In our opinion, in many respects, the positive clinical effect of the administration of 10% Dextran-40, in contrast to prolonged nasogastrintestinal decompression, or the administration of saline hypertonic solutions, is ensured by the very nature of high-molecular compounds. In particular, a small volume injection of a solution containing dextran is required – 100-200 ml. Dextran solutions provide the viscosity of solutions, increase the prolonging effect of other substances (if they are used together) included in the solution, are able to reduce the toxic level of the active substance by eliminating sharp fluctuations in concentration, have a pronounced decongestant effect, provide a detoxification effect due to the ability to adsorb on their surfaces various endo- and exotoxins. In addition, during the hydrolysis of dextran, α -oligosaccharides are formed, which are well absorbed into the blood and improve tissue microcirculation by reducing the aggregation of formed elements, thereby preventing thrombus formation. In our case, the positive effect of introducing a colloidal solution of Dextran-40 into the lumen of the duodenum was due to the ability of high-molecular compounds to increase oncotic pressure – colloid-osmotic pressure. In this regard, excess water molecules were removed from the

Table 2
Comparative dynamics of relief of dyspeptic disorders in the correction of duodenal MEF with ADP in the 1-st and 2-nd groups

Clinical sign	Group	Time period from the start of therapy			
		1 day (M±σ)	3 day (M±σ)	5 day (M±σ)	7 day (M±σ)
IA-phase of the disease					
Feeling of bitterness in the mouth, %	1-st	70.1±4.4	63.4±1.1*	44.1±3.2*	25.5±3.3*
	2-nd	65.1±2.2	55.3±3.3	35.1±2.2	15.2±2.4
Heartburn, %	1-st	81.4±3.1*	69.3±4.2	56.1±3.0*	30.1±2.2*
	2-nd	71.3±3.5	65.4±3.3	35.0±3.3	17.0±4.2
Nausea, %	1-st	91.2±4.8*	82.3±4.2*	60.0±1.5*	40.2±4.1*
	2-nd	78.5±3.1	35.2±2.4	28.7±3.1	12.1±1.1
Vomit, %	1-st	79.3±1.5*	60.1±1.3*	30.1±2.3*	16.2±3.2
	2-nd	70.2±2.2	50.3±4.2	18.7±3.2	12.0±1.3
IB phase of the disease					
	Group	8-е сут (M±σ)	10-и сут (M±σ)	12-е сут (M±σ)	14-е сут (M±σ)
Feeling of bitterness in the mouth, %	1-st	85.3±1.5*	72.2±1.3	63.2±1.4*	49.3±1.5*
	2-nd	77.2±1.2	66.1±3.3	52.4±1.2	39.2±1.3
Heartburn, %	1-st	89.2±2.2*	78.3±1.2*	72.1±1.0	70.0±1.0*
	2-nd	83.3±1.2	68.6±2.2	69.3±1.4	46.2±1.2
Nausea, %	1-st	99.3±3.1	92.0±1.5*	74.2±1.2*	56.5±3.3*
	2-nd	95.2±2.2	77.1±3.3	55.0±1.4	23.2±2.2
Vomit, %	1-st	95.0±2.2*	72.3±3.3*	56.0±2.2*	36.4±3.3*
	2-nd	83.0±3.2	56.0±5.2	42.3±1.5	26.0±1.3

Table 3

Comparative characteristics of surgical interventions for ADP in the first phase of the disease in patients of the 1-st and 2-nd observation groups

Type of surgery	Number of patients			
	1-st group (n=34)		2-nd group (n=27)	
	abs.	% \pm σ	abs.	% \pm σ
IA-phase of the disease				
Therapeutic and diagnostic laparoscopy	3	8.8 \pm 4.9	1	3.7 \pm 3.6
Percutaneous drainage of the abdominal cavity under ultrasound guidance	3	8.8 \pm 4.9	2	7.4 \pm 5.0
Projection interventions using a mini-assistant (minilaparotomy)	1	2.9 \pm 2.9	1	3.7 \pm 3.6
IB phase of the disease				
Therapeutic and diagnostic laparoscopy	2	5.9 \pm 4.0	1	3.7 \pm 3.6
Percutaneous drainage of the abdominal cavity under ultrasound guidance	5	14.7 \pm 6.1	2	7.4 \pm 5.0
Projection interventions using a mini-assistant (minilaparotomy)	5	14.7 \pm 6.1	1	3.7 \pm 3.6

interstitial space of the intestinal wall and lumen, thereby ensuring a fairly rapid and effective reduction in intraduodenal pressure and restoration of motor-evacuation function.

In parallel with the decrease in intraduodenal pressure and restoration of duodenal function, the symptoms of the disease also changed. At the same time, more pronounced changes that appeared

in the early stages occurred in patients of the 2-nd observation group. Thus, a weakening of the main symptoms of duodenal MEF disorders (nausea and vomiting) in the 2-nd group of the study was observed already by 2-3 days from the start of therapy – in 78.5% of patients, while in the 1st group, these symptoms persisted for a longer period of time, and a feeling of bitterness in the mouth and

heartburn could be observed at later periods of control (table 2).

An integral part of the treatment process for ADP is surgical correction for emerging complications of the disease. In turn, timely surgical correction according to indications (they must be strictly verified) will be the key to successful relief, including violations of the motor-evacuation function of the gastrointestinal tract. As a rule, in the first phase of ADP (periods 1-2), there are no indications for traditional «open» interventions. This is caused by the severity of the patients condition, the presence of pancreatogenic shock, transient or persistent organ failure, and the low likelihood of developing an infectious process during this period of time. During this period, as a rule, surgical correction is carried out using minimally invasive technologies (laparoscopy, percutaneous drainage of the abdominal cavity under ultrasound guidance, projection interventions using mini-assistants (minilaparotomy), etc.). To confirm our words, we provide a comparative table of the types of surgical interventions (all of them are minimally invasive) that were used in patients in the 1st and 2-nd observation groups in the first phase of the disease (table 3).

It is necessary to comment that, as a rule, in phase IA of the disease, when it comes to the presence of enzymatic fluid in the abdominal cavity (enzymatic peritonitis), preference was given to percutaneous drainage of the abdominal cavity in sloping areas under ultrasound guidance: in group 1 – 8,8% of patients, in group 2 – 7,4% of patients. Therapeutic and diagnostic laparoscopy was performed somewhat less frequently. In most cases, it was of a diagnostic nature (suspicion of a combined nature of the disease or the development of an intra-abdominal complication). In group 1 – 8,8% of patients, in group 2 – 3,7% of patients. In phase IB, the proportion of percutaneous drainage interventions and projection minilaparotomy increased significantly. Thus, in the 1-st group it amounted to 29,4% of patients, in the 2-nd group – 11,1% of patients. This circumstance can be explained by the lack of clinical,

laboratory and instrumentally confirmed dynamics of relief of the inflammatory process, expressed in the preservation and/or increase of free fluid (mainly in the projection of the omental bursa) and the onset of sequestration. In severe forms of ADP, during this period infection of acute necrotic and peripancreatic fluid accumulations and areas of necrotic destruction may begin, which prompts the surgeon to act. At the same time, at the end of phase I of the disease (end of the 2-nd beginning of the 3-rd week from the onset of the disease) during puncture-drainage and minilaparotomy interventions in 5 (14,7%) cases in the 1-st group and in 1 (3,7%) case in the 2-nd observation group, when conducting a microbiological study of the exudate in the postoperative period, microflora was detected. This fact once again confirms that, if possible, earlier relief of MEF disorders in the proximal gastrointestinal tract prevents the development of pancreatogenic infectious complications. At the same time, which, apparently, is also due to earlier leveling of the source of endotoxemia, a decrease in the mortality rate was noted in the group of patients who underwent correction of duodenal MEF disorders using the method we proposed. Mortality in the 1-st group of observations was 15,5%, in the 2-nd group – 9,8%.

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