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OPTIMIZATION OF SURGICAL TACTICS FOR PERFORATED DUODENAL ULCER

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Purpose: To improve the results of surgical treatment of patients with perforated duodenal ulcer by optimising the choice of the operation volume based on predicting the severity of peritonitis course.

Material and methods: 234 admitted patients with duodenal ulcer complicated by perforation, treated in Samarkand branch of RSCEMC in the period from 2017 to 2022, were included in the study. The inclusion criteria for the study were: the presence of duodenal ulcer disease complicated by perforation and widespread peritonitis in the patient; the duration from the moment of perforation was more than 6 hours.

Results: Thus, there was a statistically significant increase in the number of pathogenetically justified primary surgical procedures in the patients of the main group by 18.2% compared to the patients of the control group. Pearson's X was 26.84 ($p < 0.001$). The increase in absolute benefit (ABP) was 18.2%. The increase in relative benefit (ROB) was 30.8%.

Conclusions: A pattern of changes in the nature of the microflora of the abdominal cavity with its pH values was established. With a pH value of the exudate of the abdominal cavity of 6.4 or less, bacillary microflora was detected in 100% of patients, while depending on the timing of perforation up to 24 hours in 19.4%, over 24 hours - 54.2.

Key words: Peptic ulcer of the duodenum, ulcer perforation, nature of the microflora, pH value, surgical tactics.

Relevance. Every year at least 4 million people in the world fall ill with peptic ulcer disease, and ulcer perforation occurs in 5% of them [1,2]. Perforation of chronic ulcer occurs in 15% of patients with peptic ulcer disease [3,4]. Despite the emergence of modern antiulcer drugs in the last decade, both an overall increase in the incidence of duodenal ulcer disease and an increase in the number of complicated forms of peptic ulcer disease have been noted [5,6]. Mortality in ulcer perforation ranges from 1.3 to 29.4%. Among patients with recurrent peptic ulcer disease after suturing of a perforated ulcer, resistance to antisecretory drugs is noted in 7.7 - 42% of patients [7,8].

One of the main unresolved problems in the treatment of patients with perforated ulcers is the issue of choosing the scope of the primary operation. Some authors suggest performing simple suturing of the perforation [9,10]. Others suggest excising the ulcer with pyloroplasty, and still other authors suggest resecting the stomach. This is due to the fact that the severity of peritonitis affects the choice of the method of primary surgery for perforated ulcer of the duodenum, and the progression of peritonitis in each patient occurs differently. To date, there are no objective signs of the aggressiveness of the course of peritonitis, and therefore there is no consensus on the possible timing of pathogenetically substantiated surgical intervention in these patients.

Thus, despite many years of experience in treating patients with perforated duodenal ulcers, the issues of choosing the volume of surgery for each individual patient still await their solution.

Objective of the study. To improve the results of surgical treatment of patients with perforated duodenal ulcers by optimizing the choice of the volume of surgery based on predicting the severity of peritonitis.

Material and methods of the study. The study included 234 admitted patients with duodenal ulcer complicated by perforation, treated at the Samarkand branch of the RSCEMC in the period from 2017 to 2022. The inclusion criteria for the study were: the patient had duodenal ulcer complicated by perforation and widespread peritonitis; the duration from the moment of perforation was more than 6 hours.

All patients were divided into two groups. The control group consisted of 130 patients, whose treatment results were assessed retrospectively. The main group consisted of 104 patients, whose treatment was carried out on the basis of the developed principles. This part of the study was conducted prospectively.

Of these patients, 190 patients sought medical care within 6 to 24 hours from the onset of the disease (81.2%), and the remaining 44 patients (18.8%) sought medical care later than 24 hours from the onset of the disease. Men predominated - 76.1%, women - 23.9%.

In 91 patients (38.9%) there was no ulcer history and perforation was the first manifestation of peptic ulcer disease.

In all patients, peritonitis was widespread. The distribution of patients by the nature of the effusion in the abdominal cavity is presented (in table **1Error! Reference source not found.**).

Distribution of patients according to the nature of abdominal effusion table 1

Character of the effusion	Number of patients
Serous	107 (45.7%)
Serous-fibrinous	82 (35.1%)
Purulent-fibrinous	37 (15.8%)
Purulent	6 (2.5%)
Total	234 (100%)

The severity of peritonitis was assessed by Mannheim index of peritonitis (1987). The distribution of patients depending on the severity of peritonitis is presented (in table **2**).

Distribution of patients depending on the severity of peritonitis according to the Mannheim index table 2

Severity of peritonitis	Number of patients
I degree	193 (82.5%)
II degree	37 (15.8%)
III degree	4 (1.7%)
Total	234 (100%)

All patients without exception were performed review abdominal fluoroscopy and urgent fibrogastroduodenoscopic examination. Ultrasound examination was performed in 143 patients, in which special attention was paid to the presence or absence of free fluid in the abdominal cavity, its amount and location.

The nature of the performed operations in patients of the main and control groups is presented (in table **3**).

The nature of the operations performed in patients of the main and control groups table 3

Type of operation	Number of operations	
	Control group	Main group
Suturing the perforation	27 (20.7%)	-
Ulcer excision with Judd pyloroplasty	24 (18.4%)	22 (21.1%)
Excision of the ulcer with Judd pyloroplasty and truncal vagotomy	51 (39.2%)	50 (48.1%)
Resection of 2/3 of the stomach, antrum resection	28 (21.5%)	32 (30.8%)
Total	130 (100%)	104 (100%)

In 79.1% of the control group patients and in 100% of the main group patients the morphological substrate of the disease was removed during surgery - the ulcer was excised. At the same time the operations directed also on pathogenetically grounded treatment of duodenal ulcer reached the index of 60,7% in the control group and 78,9% in the main group of patients.

The results of surgical interventions depending on the method of operation are presented (in table **4**).

Results of surgical interventions depending on the method of operation table 4

Subgroup of patients	Number of interventions		Number of deaths		Mortality	
	Control group	Main group	Control group	Main group	Control group	Main group
Suturing the perforation	27	0	6	0	22.2%	0
Pyloroplasty according to Jaddu	24	22	2	2	8.3%	9.1%
Pyloroplasty according to Judd with truncal vagotomy	51	50	1	0	1.9%	0
Resection 2/3 stomach, antrum resection	28	32	3	2	10.7%	8.3%
Total	130	104	12	4	9.3%	3.8%

When analysing this table it should be noted that the mortality rate at simple suturing of perforation in the control group is 11.5% higher than at the operation of gastric resection of 2/3 of the stomach and this difference in mortality rates is statistically significant. Pearson's X2 was 0,112 (p = 0,738). At the same time at simple suturing of perforation in the control group the mortality rate was 13.9% higher than at the operation of ulcer excision with pyloroplasty without trunk vagotomy. Both these methods of operation are usually performed in patients with expressed peritonitis. This difference in lethality was statistically significant. Pearson's X2 with Iates correction was 4,79 (p = 0,029). In the main group the mortality rate at ulcer excision with pyloroplasty according to Judd was 9,1%, which is 0,8% higher than in the control group. It is connected with the refusal to perform the operation of simple suturing of the perforation hole in the patients of the main group. When comparing mortality rates at palliative surgical interventions it turned out that they were 15.6% in the control group and 9.1% in the main group. Pearson's X2 with Iates correction was 0.002 (p = 0.961).

The difference in the indicators is statistically insignificant. The difference in mortality rates during gastric resection between the patients of the main and control groups was also statistically insignificant. Fisher's criterion B = 1,00 (p > 0,05).

There was noted an increase in mortality rates as the terms of seeking medical help increased. Thus, among 190 patients who sought medical help in the first day, 5 patients died. The lethality was 2.7%. And of 44 patients who sought medical help later than 24 hours from the onset of the disease, 11 people died. The lethality was 25%.

After gastric resection, 3 patients developed anastomosis failure and 1 patient had duodenal stump failure. The patient with duodenal stump failure was treated conservatively with recovery. All patients with anastomosis failure after resection of 2/3 of the stomach according to the Bilroth-1 method were operated again. They underwent gastric resection according to the Bilroth-11 method. 2 patients died and 1 patient recovered.

Gastrointestinal bleeding in the postoperative period developed in 3 patients in the control group. A patient after antrum resection with bleeding from acute ulcer and erosions of the stomach stump died. 2 patients after simple perforation closure with bleeding from the remaining duodenal ulcer received conservative treatment and recovered.

Suture failure after simple suturing of the perforation developed in 6 patients of the control group. All of them were reoperated. Gastric resections were performed in 4 patients, 2 patients died and 2 recovered. The other 2 patients underwent repeated suturing of the zone of insufficiency. Both of these patients died.

2 patients developed eventure, which was sutured. In 4 patients wound suppuration developed, which was stopped by conservative measures.

Thus, 8 out of 27 patients after the operation of simple closure of the perforation hole developed complications in the nearest postoperative period - 6 patients developed incompetence and 2 patients developed haemorrhage.

Consequently, surgical site-related complications developed in 29.6% of patients after simple perforation closure surgery. These complications could have been prevented if the ulcer and fibrotic tissue around the ulcer had been removed during surgery by ulcer excision surgery with pyloroplasty.

The results of culture of abdominal exudate for flora in 102 patients in the control group were studied. The results of abdominal exudate culture depending on the time of perforation development are presented (in table **5**).

Results of culture of abdominal exudate depending on the time of development of perforation table 5

Character of microflora	Number of patients		Credibility
	up to 24 hours	over 24 hours	
Microflora not sown	27 (40.3%)	3 (8.6%)	F = 0.00062 (p < 0.05)
Fungal microflora	6 (8.9%)	3 (8.6%)	F = 1.00000 (p > 0.05)
Coccus microflora	18 (26.9%)	5 (14.3%)	Yates's X _1.43 (p = 0.233)
Bacillary microflora	13 (19.4%)	19 (54.2%)	F = 0.00060 (p < 0.05)
Mixed pathogens	3 (4.5%)	5 (14.3%)	F = 0.11919 (p > 0.05)
Total	67 (100%)	35 (100%)	-

In the first 24 hours from the moment of perforation the exudate in the abdominal cavity remained sterile in 40.3% of cases, in 35.8% of patients Candida fungi or coccus microflora were isolated. Only in 19.4% of patients bacillary microflora was isolated. In 4.5% of patients mixta of pathogens were isolated, which were presented as a combination of fungal and coccus microflora - fungi of the genus Candida were isolated together with bacteria of the genus Streptococcus or Staphylococcus. At duration of disease more than 24 hours in 54,2 % of patients bacillary microflora was sown in 54,2 % of patients, in 14,3 % of patients mixes were sown.

In patients with a history of perforation longer than 24 hours, there was a statistically significant increase in the number of bacillary microflora by 34.8% (F = 0.00060 (p < 0.05)) and a statistically significant decrease in the number of negative culture results by 31.7% (F = 0.00062 (p < 0.05)).

The obtained data indicate that after 24 hours from the moment of perforation there is a qualitative change in the composition of microflora in the exudate of the abdominal cavity.

Among 102 patients of the control group, who were measured the pH of the abdominal cavity exudate, 90 patients recovered and 12 died.

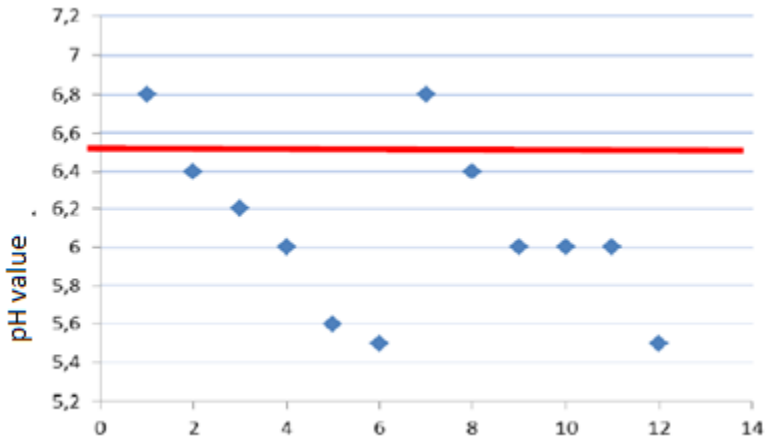

Figure 1 pH data of abdominal exudate of deceased patients in the control group

When calculating the average pH value of the abdominal exudate of deceased patients, 6.09 ± 0.44 was obtained. In 83% of deceased patients, the exudate pH value was 6.4 or less. When the pH value of the abdominal exudate was 6.4 or less, anaerobic pathogens were cultured in the exudate of all patients (in Figure 1).

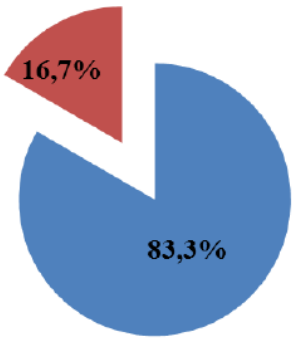

Figure 2

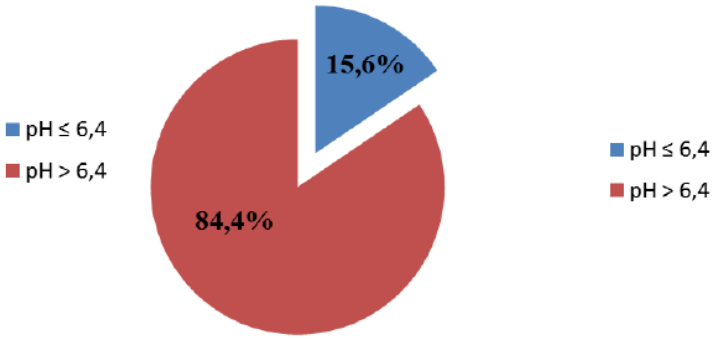

Figure 3

pH values of abdominal exudate from deceased patients in the control group (n = 12)	**pH values of the peritoneal exudate of surviving patients in the control group (n = 90)**

The specificity and sensitivity of this sign 'pH of abdominal exudate 6.4 and less' for the development of unfavourable treatment outcome were calculated. The sensitivity of the sign was Be = 83,3% (in Figure ***2***). The specificity of the sign was Br = 84,4% (in **Error! Reference source not found.**). Predictivity of a positive result was RUR = 41,7%. The predictive value of a negative result was PVW = 97.4%.

The mean pH value of the exudate of the abdominal cavity of the deceased patients was compared with the mean pH value of the exudate of patients with different duration of the disease (in table **6**).

Average pH values of abdominal exudate in deceased patients and patients with different duration of disease from the moment of perforation table 6

Duration from the moment of perforation up to 24 hours (n = 67)	Deceased patients (n = 12)	Duration from the moment of perforation over 24 hours (n = 35)
6.73 ± 0.39	6.09 ± 0.44	6.13 ± 0.56
T criterion = 4.19 (p < 0.01)		T criterion 0.79 (p > 0.05)

The mean value of pH of the abdominal cavity exudate of deceased patients statistically significantly differed from the mean value of pH of the abdominal cavity exudate of patients with duration from the moment of perforation up to 24 hours (the critical value of Student's T criterion at p = 0,05 is 1,992) and statistically significantly did not differ from the mean value of pH of the abdominal cavity exudate of patients with duration from the moment of perforation over 24 hours (the critical value of Student's T criterion at p = 0,05 is 2,015).

Thus, the pH value of abdominal cavity exudate allows to determine the possibility of performing pathogenetically justified primary surgical intervention in each specific patient.

Results and their discussion. Out of 234 patients included in this study, 16 patients (6.8%) died. On analysing the mortality, it was observed that among the 16 patients who died, 8 patients were below 65

years of age and 8 patients were above 65 years of age. At the same time 3 patients were above 70 years of age.

Among the deceased there were 5 patients with duration of illness less than 24 hours and 11 patients were with duration more than 24 hours.

Among those who died, there were 6 patients with serous-fibrinous peritonitis, 16 patients with purulent-fibrinous peritonitis and 1 patient with purulent peritonitis.

The causes of death in patients of the main and control groups are presented (in table **7**).

Causes of death in patients of the main and control groups table 7

Cause of death	Control group	Main group
Multiple organ failure	3	2
Progression of peritonitis due to failure of formed anastomoses	2	1
Progression of peritonitis due to failure of sutured perforation	4	0
Myocardial infarction	2	1
Gastrointestinal bleeding	1	0
Total	12	4

When analysing the causes of mortality, it was noted that there were 6 incompatibilities in the control group. Of these, 4 failures were related to the operation of simple suturing of the perforation hole, which constituted the main part of all failures. And when performing the operation of gastric resection in the control group only 2 inconsistencies developed (27 operations of simple closure of the perforation hole and 28 operations of gastric resection were performed in the control group).

Rejection of the operation of simple closure of the perforation hole and performance of pathogenetically justified operations on the basis of prediction of aggressiveness of peritonitis course in the main group of the study led to a decrease in the number of failures.

Among the patients who died, ulcer perforation was combined with ulcer penetration (pancreas, hepatoduodenal ligament, gallbladder) in 7 patients, with duodenal ulcer bleeding in 3 patients, with pyloroduodenal stenosis in 2 patients.

6 patients died after the operation of perforation closure, 5 patients died after the resection methods of operation, 5 patients died after the operation of ulcer excision with pyloroplasty according to Judd.

Thus, 4 of 6 patients died after the operation of simple suturing of perforation hole developed failure of the sutures applied to the intestine that required repeated operation in conditions of progressing peritonitis. In addition, failure of the sutures placed on the intestine after the operation of simple closure of the perforation hole developed in 2 more patients who recovered after repeated operations. Consequently, of the 27 patients who underwent simple suturing of the perforation hole, suture failure developed in 6 (22%). After resection of 2/3 of the stomach, anastomosis failure developed in 3 patients who died. One patient developed suture failure at the duodenal stump after the operation of gastric resection by the Bilroth-11 method. This patient recovered. Thus, the failure of the sutures after the primary operation in the volume of 2/3 stomach resection developed in 4 out of 60 operated patients (6,6%). After the operation of ulcer

excision with pyloroplasty according to Judd, no suture failure was observed. Absolute risk reduction (ARR) was 5.5%. Relative risk reduction (RRR) was 49.5%.

The results of simple perforation closure and ulcer excision with Judd pyloroplasty were retrospectively analysed. This part of the study included 102 patients of the control group. These patients were divided by us into two categories. Category I consisted of 27 patients who underwent perforation suturing. The difference was that excision of the ulcer edges was not performed. Category II consisted of 75 patients who underwent excision of perforated ulcer with Judd pyloroplasty.

The results of the performed surgical interventions in the compared categories of patients are presented (in table **8**).

Results of surgical interventions in compared categories of patients table 8

Patient group	Number of interventions	Number of deaths	Mortality
Category I	27 (26.5%)	6	22.2%
Category II	75 (73.5%)	3	4%
Total	102 (100%)	9	8.8%

There was an increase in mortality rates with increasing time from the moment of perforation. However, in category I patients this increase was statistically significant, but in category II patients it was statistically insignificant. At the same time 6 patients of category I developed suture failure (22%), which required relaparotomy. Among them 4 patients died and 2 recovered. No suture failure was observed in category II patients. Thus, the operation of perforating ulcer excision with pyloroplasty is a minimal surgical intervention, which allows to eliminate more reliably the developed complication of peptic ulcer disease.

In 71 patients out of 130 patients in the control group, other complications of peptic ulcer disease (severe stenosis, bleeding, penetration into the surrounding organs) were diagnosed during the primary operation, or the patient had been previously operated on for peptic ulcer disease. In such situations we considered the primary operation in the volume of 2/3 gastric resection to be indicated.

Out of 71 patients with a combination of various complications of peptic ulcer disease 28 patients underwent primary surgery in the volume of 2/3 gastric resection. These patients made up the I subgroup of patients. The II subgroup of patients included the remaining 43 patients who underwent various other surgical aids. These surgical aids were ulcer excision with pyloroplasty with or without trunk vagotomy.

Most often duodenal ulcer perforation was combined in isolation with ulcer penetration (50.7%), as well as with ulcer penetration in combination with pyloroduodenal stenosis (29.6%). In 12,7% of patients ulcer perforation was combined with pyloroduodenal stenosis in isolation. Penetration of perforated ulcer isolated or in combination with other complications was noted in 84,5% of patients. Combination of duodenal ulcer perforation with bleeding from the ulcer was noted in 7% of patients. All complications of duodenal ulcer simultaneously were noted in 1% of patients.

The results of the performed operations in the subgroups of patients are presented (in table **9**).

Treatment results for patients in the main and control groups table 9

Group of patients	Control group	Main group
Number of patients	130	102
Number of deaths	12	4
Mortality	9.3%	3.8%

Pearson's χ with Yates correction was 0.008 (p = 0.930). The difference is not statistically significant.

The absolute risk reduction (ARR) was 5.5%. The relative risk reduction (RRR) was 16.3%. The odds ratio (OR) was 5.29.

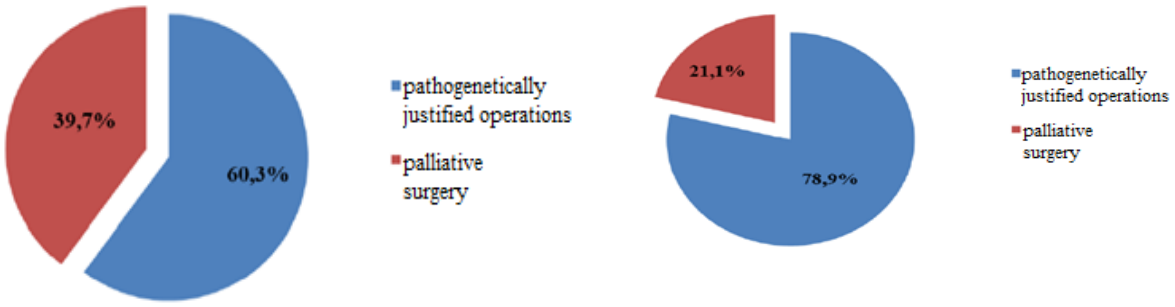

Figure 4 Figur 3

Pathogenetically based and palliative operations in patients in the control group

Pathogenetically based and palliative operations in patients of the main group

There was a statistically significant increase in the number of pathogenetically justified primary surgical procedures in the patients of the main group by 18.6% compared to the patients of the control group (in **Error! Reference source not found.**). Pearson's X was 26.84 (p < 0.001). The increase in absolute benefit (ABP) was 18.2%. The increase in relative benefit (ROB) was 30.8% (in Figur 3).

Increase in the number of pathogenetically justified surgeries leads to decrease in the number of ulcer recurrences, reduces the number of complications of peptic ulcer disease in the distant period. And, consequently, reduces the economic costs of treatment of these patients in the future.

The morphological substrate of the disease - ulcer - was removed in all 100% of patients in the main group. In patients of the control group this indicator was 79.1%. Thus, the difference in this indicator was 20.9%.

Thus, the application of the proposed tactics based on the choice of the operation volume depending on the aggressiveness of peritonitis course allowed to statistically significantly increase the number of pathogenetically justified surgical procedures with a significant decrease in postoperative lethality.

Conclusions.

1. The regularity of changes in the character of abdominal cavity microflora with its pH values has been established. At pH value of abdominal cavity exudate 6.4 and less, bacillary microflora was detected in 100% of patients, at that, depending on perforation terms up to 24 hours in 19.4%, over 24 hours - 54.2%.

2. pH of the abdominal cavity exudate allows to determine the possibility of performing pathogenetically justified primary surgical intervention. At pH more than 6.4 it is possible to perform pathogenetically justified surgical intervention, pH less than 6.4 should be limited to ulcer excision with pyloroplasty or suturing.
3. In patients with predicted severe course of peritonitis, the optimal operation is excision of the ulcer with pyloroplasty, in which mortality is 17.8% less than in its suturing with levelling of cases of suture failure (suture failure after suturing - 22.2%). The choice of pathogenetically grounded primary operation volume according to the proposed criteria allows to increase their volume by 18,7%, reduces the number of patients with pyloroduodenostenosis and ulcer bleedings, reduces the number of recurrences.
4. Application of the tactics of primary operation volume selection in patients with duodenal ulcer perforation based on prediction of aggressiveness of peritonitis course resulted in statistically significant decrease of lethality rate from 9.3% to 3.8% and postoperative complications from 12.3% to 2.9%.

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