

Minimally Invasive Technologies in the Surgical Treatment of Perforated Gastric and Duodenal Ulcers

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Abstract

Introduction: Perforation is a formidable complication of gastric ulcer and duodenal ulcer. Closure of a perforated ulcer is the most common urgent surgical operation. The choice of a surgical approach in connection with the expansion of minimally invasive operations for perforated gastroduodenal ulcers is an urgent problem.

Purpose of the Study: Evaluation of the effectiveness of various methods of treating patients with perforated gastric and duodenal ulcers.

Materials and Methods: The results of treatment in 82 patients with perforated gastric and duodenal ulcers were studied. Minimally invasive technologies are used in 50 patients, minimally invasive technologies are used in 32 patients.

Results and Discussion: Minimally invasive methods of surgical treatment of perforated gastric ulcer and duodenal ulcer are accompanied by a significant reduction in the total period of disability.

Conclusions: Minimally invasive technologies in the surgical treatment of perforated gastric ulcer and duodenal ulcer in the short term are not worse than the treatment outcomes in comparison with the laparotomic approach and are accompanied by a significant reduction in the duration of general disability. The choice of the method of surgical treatment should be determined taking into account the timing of the disease, the data of fibro-gastro-duodenoscopy, the technical equipment of the surgical hospital and the endosurgical training of the surgeon.

Keywords: Perforated Ulcer; Minimally Invasive Technologies

Introduction

Peptic ulcer (PU) like no other nosology, demonstrates the imperfection of clinical concepts of the essence of the disease and its treatment in a specific period of time. In the historical context, 5 stages can be conventionally distinguished in the treatment tactics for peptic ulcer disease.

Stage 1 - which lasted until the end of the third quarter of the 19th century, was characterized by the predominance of conservative methods in treatment.

Stage 2 - the end of the 19th and beginning of the 20th century, gastroenterostomy becomes the main surgical method in the treatment of peptic ulcer disease.

Stage 3 - 30 - 70 years of the XX century, gastric resection - becomes a priority in the treatment of peptic ulcer disease.

Stage 4 - mid-70s - mid-90s of the XX century - the emergence of inhibitors of gastric secretion, which dealt the first blow to the dominance of the surgical concept of treatment of ulcer and duodenal ulcer, and put an end to the era of vagotomy. In 1993, at a conference at the Yale University School of Medicine, dedicated to the memory of Dragstedt, it was agreed that vagotomy should not be considered the method of choice in the treatment of peptic ulcer disease.

Stage 5 - the beginning of the 90s of the 20th century to the present - the discovery by Warren and Marshall in 1983 of *Helicobacter pylori* and the subsequent in 1996 1 Maastricht Consensus declaring the obligation of eradication therapy, which put an end to the surgical methods of treating uncomplicated forms of peptic ulcer disease [1].

It would seem that peptic ulcer disease has been defeated, and after the development of effective methods of conservative treatment, the era of surgical methods is over. In fact, this is what happened. However, after more than 30 years of the triumph of proton pump inhibitors over the surgical scalpel, new aspects have emerged that require close attention of the clinical community. So in St. Petersburg in the period from 1999 to 2009 there was a decrease in the share of the overall incidence of peptic ulcer disease from 139,000 to 55,000 patients. At the same time, the number of complications in the form of gastroduodenal bleeding and perforation in absolute numbers has hardly changed, if in 1999 2632 patients were hospitalized for gastroduodenal bleeding and perforation, then in 2009 - 2363 patients. At the same time, in percentage terms, against the background of a decrease in the incidence of peptic ulcer disease by 2.5 times, there was an increase in complications of peptic ulcer disease by a factor of 2.5, from 1.9% in 1999 to 4.3% in 2009 [2].

According to the data provided by the chief surgeon of the Russian Federation, A.Sh. Revishvili at a meeting of the profile commission on surgery under the Ministry of Health of the Russian Federation, the number of hospitalized patients with perforated ulcers in our country is about 19-20,000 per year, while over the past three years, there has been an increase in hospital mortality from 9.7 to 11.4%, an increase in postoperative mortality from 9 to 10.7%, an increase in the proportion of late hospitalization from 23 to 30%. And in terms of the specific weight of the applied laparoscopic technologies, perforated ulcers are an absolute outsider, which account for no more than 10% of laparoscopic operations [3]. Thus, despite the advances in pharmacotherapy and the development of endoscopic technologies, in recent years the problem of surgical treatment of perforated ulcers has not lost its relevance [4,5].

Surgical care for patients with perforated gastric ulcers in our country is regulated by national clinical guidelines (NCR) [6]. In world practice, clinicians adhere to the Guidelines of the World Society of Emergency Surgery (WSES), the latest revision from 2020 and the Consensus of the European Association of Endoscopic Surgeons [7,8]. An interesting fact in the latest revision of the European guideline from 2011, the effectiveness of laparoscopic suturing of perforated ulcers is reduced from three pluses to two, and this fact occurs against the background of increasing efficiency in other acute abdominal pathology.

Perforations in the structure of complications of peptic ulcer disease rank second, and it accounts for up to 10% of all complications of peptic ulcer disease. Today, in their treatment, 3 types of surgical interventions are used in the treatment of perforated ulcers: suturing of the perforated hole, excision of the ulcer with possible pyloroplasty, and gastric resection.

Of all the surgical methods for treating perforated ulcers, suturing is the most common operation in surgical hospitals, and laparoscopic technologies are increasingly used to perform it [9-12]. However, the concept of minimally invasive surgery is not limited to laparoscopic technologies. The use of the mini-access set "Mini-Assistant" has proved its right to exist in the surgery of gallstone disease, in connection with which there is interest in extrapolating this method to other abdominal pathology [13]. Thus, the surgical treatment of perforated gastric and duodenal ulcers is an extremely urgent problem that is still far from being resolved.

Purpose of the Study

Evaluation of the effectiveness of various minimally invasive methods of treating patients with perforated gastric and duodenal ulcers.

Materials and Methods

The study included patients with perforated gastric and duodenal ulcers, with a level of anesthetic risk no higher than class III on the ASA scale; the study did not include patients with perforated ulcers in combination with gastroduodenal bleeding, the presence of a terminal phase of acute peritonitis, and a high anesthetic risk IV - V classes on the ASA scale. In total, from 2017 to 2020, the Dmitrov regional hospital treated 114 patients with perforated ulcers. The study material consisted of the results of treatment of 82 patients who met the criteria for inclusion in the study. All patients were divided into two groups. The main group consisted of 20 patients who underwent laparoscopic suturing (LSS) of perforated ulcers, and 12 patients in whose surgical treatment were used minilaparotomic suturing (MAS) or excision followed by pyloroplasty with laparoscopic support or without it, the control group - 50 patients in whose treatment traditional laparotomic access (LS).

At the stage of admission, all patients underwent general clinical analyzes, plain radiography of the abdominal cavity, ultrasound examination (ultrasound) of the abdominal cavity, fibro-gastro-duodenoscopy (FGDS). The sensitivity of plain radiography was 70%; in 30% of cases, EGD and contrast oral computed tomography of the abdominal cavity were performed to verify the diagnosis. EGD was performed in all patients of the main group, the diagnostic value was determined primarily by the possibility of verifying the diagnosis itself, visualizing the size of the ulcer, positioning the ulcer on the anterior abdominal wall, as well as visual assessment of stenosis and deformities that may require duodenoplasty. Ultrasound was used as a tool to visualize free fluid in the abdominal cavity and the extent of peritonitis. The feasibility of performing laparoscopic suturing of a perforated ulcer was determined using the Boey scale presented in table 1.

Feature	Value	Score	Value	Score
SBP	>100	0	<100	1
Duration of the disease	<24	0	>24	1
ASA	<3	0	>3	1

Table 1: Boey scale.

The Boey prognostic scale has become widespread among surgeons due to the high level of forecast reliability (93.8%). It consists of 3 risk factors, each of which is estimated at 1 point: hemodynamic instability on admission (systolic blood pressure less than 100 mm Hg), late hospitalization (over 24 hours), the presence of concomitant diseases (ASA > 3). In the presence of 2 factors, the European Society of Endoscopic Surgeons (EAES) does not recommend using attempts at laparoscopic treatment in these patients, but suggests immediately performing the operation from the open access. To analyze the severity of pain, a numerical rating scale (NRS) was used. The severity of the pain syndrome was recorded 3, 6, 12, 24, 48, 72 hours after the operation.

The analysis of the comparability of groups by age, sex, timing from the moment of perforation, size and location of the ulcer in the study groups is presented in table 2.

Indicator	Group Comparisons (LS) (N = 50)	Study Group LSS (N = 20)	Study Group MAS (N = 12)	Stat. Difference
Age (Me,25%,75%)	46 (22; 70)	41 (24; 58)	47 (27; 67)	*p = 0.6431
Men (absolute numbers)%	41 (82%)	16 (80%)	10 (83,3%)	*p = 0.7635
Women (absolute numbers)%	9 (18%)	4 (20%)	2 (17,7%)	*p = 0.7147
Time from the moment of perforation (hours)	6,4 ± 2,7	7,1 ± 2,9	6,8 ± 4,1	*p = 0,3072
Punch hole dimensions (mm)	5,0 ± 3,4	4,0 ± 2,1	5,0 ± 2,7	*p = 0.2387
Ulcer localization				
Duodenum (absolute numbers)%	39 (72%)	16 (80%)	9 (75%)	*p = 0,7127
Stomach (absolute numbers)%	11 (28%)	4 (20%)	3 (25%)	*p = 0,6162

Table 2: Distribution of patients by age, sex, timing from the moment of perforation, size and location of the ulcer in the study groups.

*: U-Mann-Whitney test.

The analysis by age, sex, timing from the moment of perforation, size and location of the ulcer did not reveal statistically significant differences in the study groups.

In patients of the main group, an overview laparoscopy was performed, according to the results of which the surgical tactics were finally determined; in case of an ulcer defect up to 1 cm in diameter, laparoscopic suturing of the ulcer was performed, we used a polyglycolide resorbable suture of size 2-0, on a 3/8 pricking needle. The ulcer defect was sutured with a traditional two-row suture, in a number of cases suturing according to Opel-Polikarpov was used. Next, the abdominal cavity was sanitized and, depending on the prevalence peritonitis, the abdominal cavity was drained through the right subcostal trocar, and in some cases the pelvic area was drained through an additional puncture.

In the presence of an over-cultivated infiltrate, stenosis, or a perforated hole more than 1,0 cm in diameter, suturing or excision of the ulcer was used, followed by pyloroplasty using a mini-assistant kit manufactured by Liga-7. For this purpose, a 3-cm transrectal minilaparotomy was performed; access was performed using 4 retractors, the size of which was selected intraoperatively. After installing retractors, the duodenum was mobilized according to Kocher, longitudinal excision of the ulcer with transverse pyloroplasty according to Heinecke-Mikulich. In the absence of indications for excision of the ulcer, or duodenoplasty, with a perforation opening of more than 1 cm, the ulcer defect was sutured with a two-row suture. Drainage was performed through an additional puncture in the right hypochondrium. If sanitation was necessary, laparoscopic support was used; according to indications, the pelvis was additionally drained.

In 4 patients, mini-accessible suturing was undertaken without prior laparoscopy due to preoperatively diagnosed stenosis and deformity of the duodenal bulb.

Intra/postoperative complications, duration of inpatient treatment, time of general disability, severity of pain were used as criteria for effectiveness.

Results and Discussion

The results of treatment in the study groups are presented in the upper table 3.

	Study Group LSS (N = 20)	Study Group MAS (N = 12)	Total (N = 32)	Group Comparisons (LS) (N = 50)	Stat. Difference
Intraoperative complications	0	1 (8,3%)	1 (3,1%)	1 (2%)	RR: 1.56 CI: 0.10-24.10
Postoperative complications	0	1 (8,3%)	1 (3,1%)	4 (8%)	RR: 0.78 CI: 0.15-4.02
Operation duration (min.)	47 ± 17,3	51 ± 24,9	49,3 ± 19,5	41,1 ± 6,7	*p = 0,4768
Duration of the inpatient stage of treatment (days)	6 ± 1,9	6 ± 2,3	6 ± 2,1	12,1 ± 4,4	*p = 0,6578
Time of general disability (days)	17 ± 9,3	21 ± 5,7	19 ± 8,1	44 ± 9,9	*p = 0,0417

Table 3: Treatment results in the study groups.

RR is relative risk. CI: Confidence Interval.

*: U-Mann-Whitney test.

Intraoperative complication in the form of suture eruption during ulcer suturing was noted in 2 cases, in one case with MAS suturing, in the second with laparotomic access, in both cases, repeated suturing according to Oppel-Polikarpov was performed.

Postoperative complication - subphrenic abscess was noted in one case in a patient who underwent MAS suturing. In the group of laparotomic suturing, 4 postoperative complications were noted: in 3 cases - suppuration of the postoperative wound, in 1 case - the failure of the sutured perforation hole, which required relaparotomy, tamponation of the defect with an omentum on the pedicle and intensive therapy of the developed peritonitis. No complications were observed with laparoscopic suturing of perforated ulcers.

The duration of inpatient treatment in patients of groups 1 and 2 was 6 days, in patients of group 3 - 12.1 days. When analyzing the data obtained, a statistically significant decrease in the duration of general disability from 44 days to 19 in patients who underwent suturing of perforated ulcers using minimally invasive technologies was noted.

The characteristics of the pain syndrome are presented in the lower table 4.

Points	Study Group LSS (N = 20)				Study Group MAS (N = 12)				Group Comparisons (LS) (N = 50)			
	0	1-3	4-6	7-10	0	1-3	4-6	7-10	0	1-3	4-6	7-10
3	0	5 (25%)	14 (70%)	1 (5%)	0	3 (25%)	8 (66,7%)	1 (8,3%)	0	4 (8%)	39 (78%)	7 (14%)
6	0	10 (25%)	15 (75%)	0	0	3 (25%)	9 (75%)	0	0	4 (8%)	40 (80%)	6 (12%)
12	0	9 (45%)	11 (55%)	0	0	6 (50%)	6 (50%)	0	0	8 (16%)	39 (78%)	3 (6%)
24	0	20 (100%)	0	0	0	12 (100%)	0	0	0	20 (40%)	29 (58%)	1 (2%)
48	6 (30%)	14 (70%)	0	0	4 (25%)	8 (75%)	0	0	0	32 (64%)	18 (36%)	0
72	18 (90%)	2 (10%)	0	0	11 (93,7%)	1 (6,3%)	0	0	8 (16%)	39 (78%)	3 (6%)	0

Table 4: Distribution of patients depending on severe pain syndrome.

In the first 6 hours after the operation, moderately severe pain syndrome prevailed with all methods of surgery. After 24 hours, the pain syndrome in the study groups was mild, in the control group - in 58% the pain was more pronounced. After 72 hours, 90% of patients with minimally invasive access noted the absence of pain syndrome, in contrast to patients who underwent laparotomy, in whom pain was absent only in 16% of cases. Thus, the pain syndrome with minimally invasive access is less pronounced and longer in time than with laparotomy.

Conclusion

1. Minimally invasive technologies in the surgical treatment of perforated gastric ulcers and duodenal ulcers in the short term do not worsen treatment outcomes in comparison with laparotomic access and are accompanied by a significant reduction in the duration of general disability.
2. The choice of the method of surgical treatment should be determined, taking into account the timing of the disease, the data of EGD, ultrasound, the technical equipment of the surgical hospital and endosurgical training of the surgeon.

Participation of Authors

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