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Criteria for Selecting Surgical Approaches for Perforated Gastroduodenal Ulcers Based on Laparoscopic and Video-Assisted Combined Techniques

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Abstract This study is based on the surgical outcomes of 116 patients treated for perforated gastroduodenal ulcers. Closure of the ulcer using minimally invasive techniques, in combination with modern postoperative anti-ulcer therapy, resulted in favorable clinical outcomes and a relapse-free course of peptic ulcer disease in 91.6% of cases. Among patients who underwent laparoscopic or video-assisted combined closure, the Visick score revealed predominantly excellent (88.6% and 85%) and good (4.5% and 7.5%) outcomes, respectively. These findings underscore the effectiveness of mini-access ulcer closure in cases where laparoscopic repair is not feasible.

Keywords Perforated gastroduodenal ulcer, Ulcer closure, Minimally invasive techniques

1. Introduction

Perforated peptic ulcer remains one of the leading causes of mortality in patients with peptic ulcer disease, with fatality rates consistently ranging from 5% to 17% over the past decades. Surgical approaches to the management of perforated gastroduodenal ulcers vary significantly depending on the clinical context. The indications for surgery, as well as the choice of operative technique and method, are still a matter of ongoing debate.

In Uzbekistan, there is a broad spectrum of surgical strategies employed in treating perforated gastroduodenal ulcers. The most frequently performed procedure is simple suture closure of the perforation, favored for its technical simplicity and reliability in preserving patient survival. More radical interventions, such as truncal vagotomy combined with pyloroplasty or distal gastrectomy, are reserved for selected cases and are often constrained by the time elapsed since perforation, the extent of peritonitis, and the overall condition of the patient. These advanced procedures are associated with higher rates of postoperative complications and mortality.

Challenges arise when the perforation exceeds 2 cm in diameter or when the surrounding tissues are friable and inflamed, making primary closure technically difficult and potentially unsafe. In such cases, if the initial attempt at closure fails, a second attempt may also be ineffective. Under these circumstances, proceeding with gastric resection may offer a safer and more definitive solution.

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The introduction of innovative surgical technologies has expanded the treatment arsenal for perforated ulcers. One such advancement is the hybrid approach, which integrates endovideoscopic techniques for abdominal exploration and lavage with a mini-laparotomy to perform definitive closure of the perforation. These video-assisted procedures can achieve therapeutic outcomes comparable to traditional surgeries, while retaining the benefits of minimally invasive techniques. Nonetheless, clinical guidelines for patient selection and procedural indications remain to be clearly established.

Objective of the Study. To enhance the clinical outcomes of surgical treatment in patients with perforated gastroduodenal ulcers by prioritizing the application of minimally invasive surgical technologies.

2. Materials and Methods

The present study is based on the surgical treatment outcomes of 116 patients with perforated gastroduodenal ulcers who underwent emergency procedures at the Navoi branch of the Republican Scientific Center for Emergency Medical Care between 2019 and 2023. The age of the patients ranged from 18 to 67 years, with a mean age of 35.7 ± 15.4 years. The majority of patients (90%) were of working age. Males predominated in the cohort, comprising 83.4% of cases, while females accounted for 16.5%. All patients were admitted on an emergency basis.

The comparison group included 61 patients (52.6%) who underwent laparoscopic suturing of the perforated ulcer. In the main group, which consisted of 55 patients, the ulcer closure was performed via a mini-access approach. Several intraoperative challenges limited the feasibility of proceeding

with laparoscopic treatment in these patients.

In 15 patients (27.2%), the ulcer was located in an anatomically unfavorable position for laparoscopic access, particularly in close proximity to the lesser curvature of the stomach. In 14 cases (25.4%), the diameter of the perforation exceeded 10 mm. In 8 patients (16.3%), dense inflammatory infiltration was observed in the perforated area, with a defect measuring more than 1.0 cm, necessitating wide sutures that partially incorporated the inflammatory mass, a task not achievable via laparoscopy.

3. Results and Discussion

The duration of laparoscopic closure for perforated gastroduodenal ulcers ranged from 40 to 150 minutes, with an average operative time of 62.8 ± 3.9 minutes. Within the first 24 hours after surgery, the severity of postoperative pain assessed using the Wong-Baker scale varied between 2 and 7 points, averaging 4.3 ± 0.5 points.

The length of hospital stay in the control group ranged from 3 to 12 days, with a mean of 7.5 ± 0.3 days. At the early stage of adopting the mini-access video-assisted technique, the operation duration ranged between 70 and 110 minutes. However, with increased surgical experience, this time was reduced to 40–60 minutes. On average, the duration of ulcer closure performed via mini-access was 45.4 ± 3.2 minutes.

In patients who underwent mini-access repair of the perforation, postoperative pain scores on the Wong-Baker scale ranged from 3 to 8, with a mean of 6.3 ± 0.7 points. In the early postoperative period, complications developed in 12 out of 116 patients (10.3%) who underwent minimally invasive ulcer repair.

Intra-abdominal abscesses were identified in two patients (1.7%), all of whom were successfully treated via ultrasound -guided aspiration and drainage. Dehiscence of the sutured ulcer site occurred in five cases (4.3%): three patients (2.6%) from the mini-access group and two patients (1.7%) from the laparoscopic group. Patients from the main group underwent relaparotomy followed by gastric resection using the Billroth II method. In the control group, reoperation involved ulcer excision with Jaboulay pyloroplasty.

Surgical site infections were observed in three patients (2.6%) in the main group and in one patient (0.8%) in the control group. Omental eventration through the trocar site occurred in two patients (1.7%) and was managed with intravenous sedation and surgical repair. All patients were discharged in stable condition with clinical improvement (see Table 1).

A comparative analysis was conducted to evaluate the long-term results of patients who underwent surgical closure of perforated gastroduodenal ulcers, with follow-up periods ranging from one to five years. Long-term outcomes were assessed in 84 patients, representing 72.4% of the study cohort. Among them, 40 patients (72.7%) had received video-assisted combined closure via mini-access, and 44 patients (72.1%) underwent laparoscopic ulcer closure.

Table 1. Postoperative Complications According to the Type of Closure of Perforated Gastroduodenal Ulcers

Complications	Laparoscopic closure of PDU	Closure of PDU via mini-access
Abdominal cavity abscess	-	2 (1.7%)
Suture failure	2 (1.7%)	3 (2.6%)
Wound infection	-	1 (0.8%)
Eventration	-	2 (1.7%)
Early adhesive intestinal obstruction	-	2 (1.7%)
Total	2 (1.7%)	10 (8.6%)

Eradication therapy for Helicobacter pylori and peptic ulcer disease was administered to 59 patients (50.8%). Of these, 23 patients had previously undergone video-assisted mini-access ulcer repair, and 26 had received laparoscopic repair. Thirty patients received a triple-drug eradication regimen, while the remaining 29 were treated with a dual-drug protocol.

To assess quality of life in the postoperative period, the study utilized the MOS SF-36 questionnaire and the Visick grading system. The results demonstrated comparable outcomes between the mini-access and laparoscopic groups. The physical health score in both groups was 81.2%, while psychological well-being was rated at 78.4% in the mini-access group and 78.8% in the laparoscopic group.

According to the Visick scale, patients who underwent video-assisted mini-access closure achieved excellent outcomes in 85% of cases, with 7.5% rated as good, two patients experiencing satisfactory results, and one reporting an unsatisfactory outcome. In the laparoscopic group, excellent results were observed in 88.6% of patients, with 4.5% reporting good outcomes, one satisfactory case, and a 4.5% incidence of poor outcomes. Unsatisfactory outcomes were attributed to either the need for repeat surgical intervention due to recurrent peptic ulcer complications or conservative management of late-onset ulcer-related issues.

The study confirms that eradication therapy following combined mini-access closure contributes to sustained clinical remission and enhances quality of life in this patient population.

Despite the advantages of laparoscopic techniques, anatomical and technical limitations occasionally render laparoscopic closure of perforated ulcers unfeasible. In such cases, the mini-access approach, utilizing a "Mini-Assistant" surgical instrument set, offers a viable alternative while preserving the benefits of minimally invasive surgery. For patients presenting with generalized peritonitis due to ulcer perforation, open laparotomy with thorough peritoneal lavage and ulcer suturing remains the justified treatment of choice.

Based on the findings, both treatment groups were deemed representative and comparable in operative time. Patients reported lower levels of postoperative pain, as evidenced by reduced reliance on narcotic analgesics. Bed rest duration and length of hospital stay were nearly identical in both groups.

Implementation of mini-access repair significantly reduced the need for conversion during laparoscopic procedures, subsequently lowering operative time, shortening hospital stays, and improving long-term treatment outcomes in this cohort of patients.

4. Conclusions

1. The choice of surgical technique for managing perforated gastroduodenal ulcers should be guided by the severity of the patient's clinical condition, the size of the perforation, and the extent of local inflammatory changes. Implementation of this diagnostic and therapeutic algorithm has enabled the avoidance of conversion from laparoscopic to open surgery.
2. Laparoscopic closure was performed in 52.6% of patients and was deemed appropriate for ulcer perforations less than 1 cm in diameter and with surrounding inflammatory infiltration not exceeding 0.5 cm. Video-assisted combined procedures were used in 47.4% of patients as a minimally invasive alternative to wide laparotomy, particularly in cases with larger perforations (over 10 mm), significant inflammatory changes around the defect (with risk of suture tearing), difficult anatomical access (e.g., posterior gastric wall, low duodenal ulcers), or combined complications (such as simultaneous perforation with bleeding or stenosis).
3. Minimally invasive repair of perforated gastroduodenal ulcers, when combined with modern postoperative anti-ulcer therapy, resulted in favorable clinical outcomes and a relapse-free course of peptic ulcer disease in 91.6% of cases. According to the Visick grading system, excellent and good long-term results were observed in the majority of patients who underwent laparoscopic or video-assisted mini-access closure (88.6% and 85% excellent outcomes; 4.5% and 7.5% good outcomes, respectively). These findings support the clinical value of mini-access ulcer closure in situations where laparoscopic intervention is not feasible.

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