

# Changing patterns in the surgical treatment of perforated duodenal ulcer – single centre experience

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## Abstract

**Introduction:** Although the surgical treatment of patients with perforated duodenal ulcer is the method of choice, the introduction of effective pharmacotherapy has changed the surgical strategy. Nowadays less extensive procedures are chosen more frequently. The introduction of laparoscopic procedures had a significant impact on treatment results.

**Aim:** To present our experience in the treatment of perforated duodenal ulcer in two periods, by comparing open radical anti-ulcer procedures with laparoscopic ulcer repair.

**Material and methods:** The analysis covered patients operated on for perforated duodenal ulcer. Two groups of patients were compared. Group 1 included 245 patients operated on in the period 1980–1994 with a traditional method (pyloroplasty + vagotomy) before introduction of proton pump inhibitors (PPI). Group 2 included 106 patients treated in the period 2000–2014 with the laparoscopic technique supplemented with PPI therapy. Groups were compared in terms of patients' demographic structure, operative time, complication rate and mortality.

**Results:** The mean operative time in group 1 was shorter than in group 2 ( $p < 0.0001$ ). Complications were noted in 57 (23.3%) patients in group 1 and 14 (13.5%) patients in group 2 ( $p = 0.0312$ ). Reoperation was necessary in 13 (5.3%) cases in group 1 and in 5 cases in group 2 ( $p = 0.8179$ ). The mortality rate in group 1 was significantly higher than in group 2 (10.2% vs. 2.8%,  $p = 0.0192$ ). In group 1, median length of hospital stay was 9 days and differed significantly from group 2 (6 days,  $p < 0.0001$ ).

**Conclusions:** Within the last 30 years, significant changes in treatment of perforated peptic ulcer (PPU) have occurred, mainly related to abandoning routine radical anti-ulcer procedures and replacing the open technique with minimally invasive surgery. Thus it was possible to improve treatment results by reducing complication and mortality rates, and shortening the length of hospital stay. Although the laparoscopic operation is longer, it improves outcomes. In the authors' opinion, in each patient with suspected peptic ulcer perforation, laparoscopy should be the method of choice.

**Key words:** perforated peptic ulcer, laparoscopy, duodenal ulcer, laparoscopic ulcer repair.

## Introduction

Although in the last two decades the global prevalence of uncomplicated ulcer disease has declined, its acute complications in the form of ulcer perfora-

tion (perforated peptic ulcer – PPU), being the first disease symptom in some patients, are still the main reason for emergency operations [1, 2]. Potentially, all patients with ulcer disease are at risk of this complication, and it is related to a high mortality rate

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that can reach even 5.8–40% [3–5]. Although the surgical treatment in these patients demonstrating symptoms of diffuse peritonitis is the method of choice, introduction of effective pharmacotherapy (proton pump inhibitors, *Helicobacter pylori* eradication) has changed the surgical strategy [6, 7]. While previously the gold standard usually included repair of the perforation and a simultaneous radical anti-ulcer procedure (vagotomy or distal gastric resection), nowadays less extensive procedures are chosen more frequently, due to effective supplementary postoperative pharmacotherapy. This coincided with introduction of minimally invasive techniques. In 1990, Nathanson *et al.* were the first to describe the use of laparoscopy for PPU [8]. The initial results, as well as further randomised clinical trials, showed a number of benefits of minimally invasive surgery, although in most cases no radical anti-ulcer procedures were performed simultaneously [9–12]. In our department, the first laparoscopic procedures (cholecystectomy, hernia repair, perforated ulcer repair) were performed in 1992. The rule of starting with laparoscopy in cases of PPU was introduced in 1999.

## Aim

This paper aims to present our experience in the treatment of perforated duodenal ulcer in two periods, by comparing open radical anti-ulcer procedures with laparoscopy supplemented with pharmacotherapy.

## Material and methods

The analysis covered patients operated on for perforated duodenal ulcer. In the period before common use of proton pump inhibitors (PPI), at our institution the method of choice was Heineke-Mikulicz pyloroplasty combined with truncal vagotomy.

In 1999, a rule to start the procedure with laparoscopy was adopted for suspected PPU. The ulcer was closed with single stitches and an omentoplasty, as in the Graham patch technique. This coincided with introduction of PPI into general practice with additional *H. pylori* eradication in cases of infection confirmed with the urease test on intraoperatively collected biopsies. Therefore, a decision was made to abandon vagotomy as a routine procedure.

Two groups of patients were compared: group 1 – patients treated with a traditional method (pyloroplasty + vagotomy) before introduction of PPI,

group 2 – patients operated on with the laparoscopic technique supplemented with PPI therapy.

All patients were included in the analysed groups, regardless of their clinical status directly before the surgery. For obvious reasons, patients in whom peptic ulcer perforation was not suspected in pre-surgery examinations and those originally submitted to an emergency laparotomy were excluded from the analysis in the second period.

Group 1 included patients operated on in the period 1980–1994. Group 2 included patients treated in the period 2000–2014. Furthermore, patients treated during the 5 years (1995–1999) between the analysed periods were excluded, due to inconsistency in surgical techniques and the laparoscopy learning curve.

Groups were compared in terms of patients' demographic structure, operative time, complication rate, mortality, necessity and reasons for using a procedure other than the standard one (need for gastric resection or other procedure in group 1, or conversion to open surgery in group 2).

Two hundred forty-five patients (194 men, 51 women) in total were enrolled in group 1. The number of operations performed in successive years is shown in Figure 1.

Group 2 included 106 patients in total: 68 men and 38 women. The number of operations performed in successive years is shown in Figure 2. Demographic characteristics of both groups are presented in Table I.

## Statistical analysis

A statistical analysis was performed with the StatSoft Statistica v.10 package. Qualitative variables were analysed with the  $\chi^2$  independence test. For quantitative variables with the normal distribution, the Student *t*-test was used; and when other than the normal distribution was found in the groups, the statistical significance of factors was assessed with the Mann-Whitney test. Results with  $p < 0.05$  were considered statistically significant.

## Results

It was observed that in group 2 the percentage of women was significantly higher than in group 1 ( $p = 0.0029$ ). No significant differences were observed for age ( $p = 0.5412$ ). In both periods, women were older than men by 10 years on average ( $p = 0.0102$ ,  $p = 0.0117$ ).

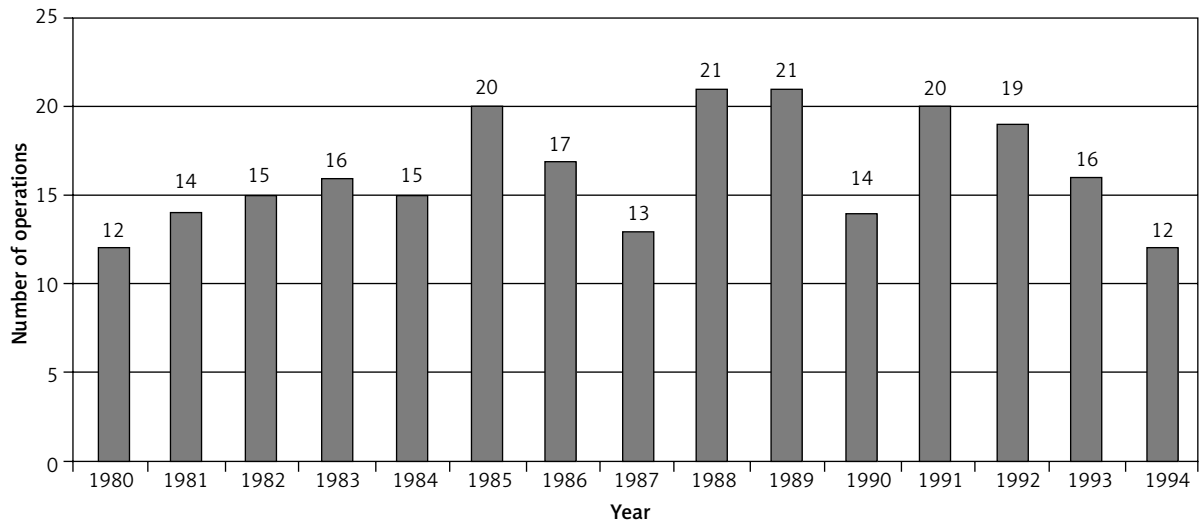


Figure 1. Number of operations performed in successive years in group 1

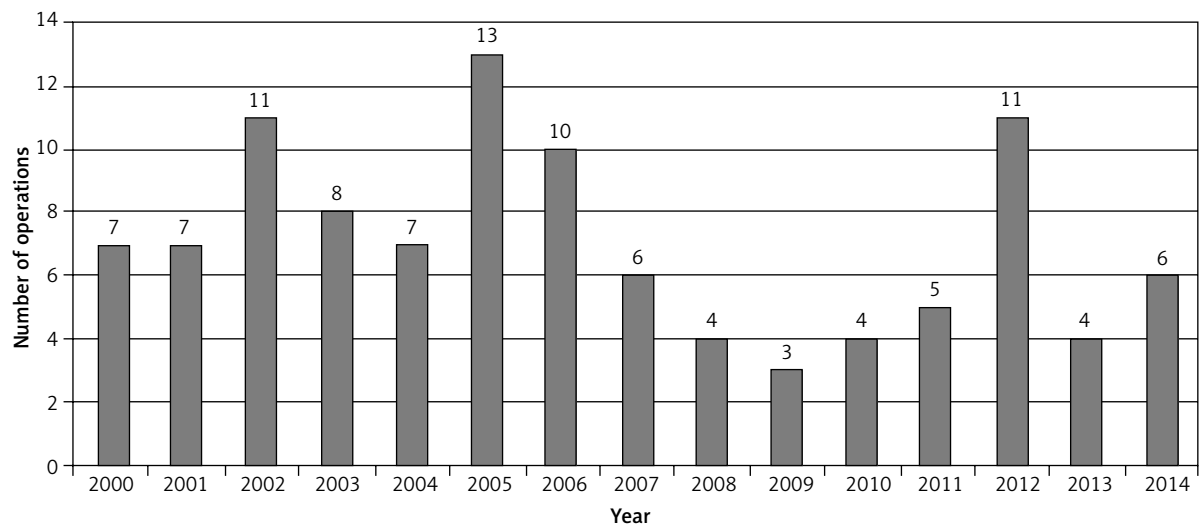


Figure 2. Number of operations performed in successive years in group 2

Table I. Demographic characteristics of study groups

Parameter	Group 1	Group 2	Value of <i>p</i>
Number of patients	245	106	
Mean age of patients [years]	48.6 ±18.1	46.9 ±18.7	0.5412
Number of men	194 (79.2%)	68 (64.2%)	
Mean age of men [years]	46.7 ±19.3	46.9 ±17.8	0.9403
Number of women	51 (20.8%)	38 (35.8%)	
Mean age of women [years]	54.1 ±12.9	55.8 ±15.8	0.5780

In group 1, pyloroplasty with truncal vagotomy, the method of choice in that period, was performed in 171 (69.8%) patients. In the remaining 72 (30.2%)

patients another procedure was performed: simple ulcer closure in 39 (15.9%) patients; pyloroplasty without vagotomy in 17 (6.9%) patients; distal gas-

tric resection with vagotomy in 15 (6.2%) patients; and resection without vagotomy in 3 (1.2%) patients.

In group 2, laparoscopic PPU closure was performed in 98 (92.4%) patients. Conversion was necessary in 8 (7.6%) patients. In 4 patients conversion was needed due to advanced peritonitis with intraperitoneal abscesses; in 3 cases the perforation diameter did not allow for safe laparoscopic repair, and in 1 patient the perforation site was not localized during the laparoscopic stage.

The mean operative time in group 1 was 62 min (40–140 min) and in group 2 – 83 min (40–130 min). This difference is statistically significant ( $p < 0.0001$ ).

Complications were noted in 57 (23.3%) patients in group 1 and 14 (13.5%) patients in group 2 ( $p = 0.0312$ ). Detailed information on complications is presented in Table II.

In group 1, reoperation was necessary in 13 (5.3%) cases (intraperitoneal abscesses in 6 patients, leakage in 5 patients, and abdominal wound dehiscence in 2 patients). In group 2, 5 (4.7%) patients required reoperation (leakage in 3 patients, intraperitoneal abscesses in 2 patients). No significant differences were found between the two groups for the number of reoperations ( $p = 0.8179$ ).

In group 1, 25 (10.2%) patients died within the first 30 days after surgery. Three (2.8%) patients died in group 2. These differences are statistically significant ( $p < 0.0192$ ).

In group 1, median hospital stay was 9 days (5–28 days) and differed significantly from group 2 (6 days, 4–26 days) ( $p < 0.0001$ ).

## Discussion

This study summarizes the changes in the strategy of treatment of PPU that occurred at our unit over the last 35 years. During that time, radical anti-ulcer operations were practically abandoned, and open procedures were nearly completely replaced with laparoscopy. However, we observed that this was a gradual process (therefore patients treated during 5 years of the learning curve were excluded from the analysis). Introduction of minimally invasive surgery into general practice can pose some problems. The study of Sommer published in 2010 can be an example here. He reported that in Denmark only 6% of PPU patients were treated laparoscopically [13]. This resulted from insufficient training of personnel, so laparoscopy was unavailable in many hospitals during emergency duty. Laparoscopic operations are considered to be technically more difficult than open procedures. In our institute, it took several years to train all specialists in this surgical technique. It should be noted that currently the prevalence of peptic ulcer perforation in developed countries is relatively low, being ca. 5 cases per 100 000 inhabitants per annum; thus learning of this new surgical tech-

**Table II.** Complications in analysed groups (figures do not sum up because there was more than one complication in some patients)

Parameter	Group 1	Group 2	Value of <i>p</i>
Total number of patients	245	106	
Pneumonia	16 (6.5%)	6 (5.6%)	
Cardiorespiratory failure	10 (4.1)	4 (3.7%)	
Intraperitoneal abscess	8 (3.3%)	2 (1.8%)	
Prolonged postoperative ileus	5 (2%)	1 (1%)	
Surgical site infection	21 (8.5%)	4 (3.7%)	
Leakage	5 (2%)	3 (2.8%)	
Urinary tract infection	6 (2.4%)	3 (2.8%)	
Abdominal wound dehiscence	3 (1.2%)	0 (0%)	
Total number of patients with complications	57 (23.3%)	14 (13.5%)	0.0312
Death	25 (10.2%)	3 (2.8%)	0.0192
Reoperation	13 (5.3%)	5 (4.7%)	0.8179

nique is significantly slowed down [3]. Additionally, we introduced laparoscopy in PPU repair when only basic minimally invasive operations (cholecystectomy, appendectomy, or inguinal hernia repair) were performed at our institution. Certainly, nowadays independence in operations of this type would be easier to achieve (a full range of laparoscopic procedures in the abdominal cavity is performed, including bariatric surgery and extensive oncologic procedures in the upper part of the abdominal cavity, such as laparoscopic gastrectomy, hemihepatectomy, and pancreaticoduodenectomy).

According to some authors, a serious condition of a patient on admittance and symptoms of shock are contraindications to the laparoscopic surgery due to a longer duration of the procedure, the adverse influence of pneumoperitoneum on the renal function, and increased bacterial translocation in patients with peritonitis [2, 14–17]. However, it should be asked whether this view is actually clinically justified, as during the surgery death occurs relatively rarely, even in patients in shock or after its stabilisation. In prospective randomized trials it was found that laparoscopic surgery is only 18 min longer, on average, than traditional surgery [4]. In our material this difference was 21 min and was statistically significant; however, smaller injury compensated for that difference. In patients with diffuse peritonitis this aspect seems to be crucial. In our unit a rule for starting with laparoscopy regardless of the patient's condition and duration of symptoms was adopted. It is also known that disease duration exceeding 24 h (diffuse fibrinopurulent peritonitis) is not a contraindication to laparoscopy and satisfactory results can be achieved [15, 18, 19].

It is worth emphasising that the surgery for PPU may require intraoperative change of the procedure that was initially planned. In group 1, the procedure was changed from the routine one (pyloroplasty with vagotomy) in over 30% of cases. This decision resulted from a need for gastric resection due to a large perforation size, a suspected malignancy, or the ulcer location. In the remaining cases, vagotomy was not performed because of the serious condition of the patient or technical problems with access to the abdominal part of the oesophagus.

In group 2, laparoscopy was performed in 98 (92.4%) patients. In 8 (7.6%) patients conversion was necessary due to advanced peritonitis with intraperitoneal abscesses, or a perforation size re-

quiring pyloroplasty. It was performed in 6 of them. Furthermore, distal gastric resection was considered necessary in 2 patients. The conversion rate at the level of 7.4% is slightly below the one reported by other authors (even up to 28.5%), and possibly results from the fact that the analysis covered patients from the period when the personnel already had significant experience in laparoscopic PPU repair [2]. In the analysis by Thorsen, this was a reason for a significant drop in the number of conversions observed within several years [20].

Definitely, the best tool for comparing the two surgery methods is the analysis of complications and mortality rates in the perioperative period, and the length of the hospital stay. In the present material, the early complication rate is significantly lower after laparoscopy. In the review by Bertleff, covering data from 56 studies, the observed complication rate in the group of patients operated on with minimally invasive technique was nearly two times lower (14.3% vs. 26.9%) [21]. Some reports indicate a higher risk of leakage after laparoscopy and in consequence a need for reoperation [5, 8, 9]. However, a more detailed analysis of those results shows that leakage occurred more often in patients treated with the sutureless technique, and without omentoplasty. A correct assessment of the perforation size is also important. In our opinion, for perforations involving over 1/4 of the duodenal bulb circumference, conversion and repair by pyloroplasty appears to be a safer approach.

The mortality rate analysis also shows the advantage of laparoscopy. In our material, the mortality rate was 10.2% in group 1 and 2.8% in group 2. Data on the mortality rate vary, depending on the studied group; it ranges between 5 and 20% [21]. In all analyses, a reduction in the mortality rate was observed in the group of patients operated on laparoscopically [2, 9, 20–22]. In our material, a relatively large difference in the mortality rates between groups may result from other factors that changed during the 35 years covered by the analysis. The perioperative care, including intensive care, improved. More sensitive imaging techniques (computed tomography) are commonly used, definitely improving preoperative diagnostics.

Use of minimally invasive techniques, regardless of the surgery type, facilitates full recovery by reducing pain, and thus allowing earlier mobilisation and better tolerance of an oral diet. Therefore, it is not surprising that in all analyses, including ours, a re-

duction in the length of hospital stay was noted after laparoscopic PPU repair [3–5, 10].

Another aspect in the discussion on effective treatment for ulcer disease complications is a decision to perform vagotomy (selective or truncal). Due to widespread use of PPI in the last 20 years, a decision was made at our institution to abandon this procedure as a routine method. In our opinion, the only indication justifying this approach is the group of patients of low social status (homeless, alcoholics), as there is a risk they will not follow recommendations for postoperative anti-ulcer treatment. In our, and in other authors' opinion, vagotomy can also be safely performed with the use of laparoscopy [18, 23, 24].

## Conclusions

Within the last 30 years, significant changes in treatment of PPU have occurred, mainly related to abandoning routine radical anti-ulcer procedures and replacing the open technique with minimally invasive surgery. Thus it was possible to improve treatment results, by reducing complication and mortality rates, and shortening the length of hospital stay. Although the laparoscopic operation is longer, it improves outcomes. In our opinion, in each patient with suspected peptic ulcer perforation, laparoscopy should be the method of choice, and a decision about conversion can be made when any intraoperative difficulties occur. Training provided to the entire team and gaining experience in minimally invasive operations are also important, because access to laparoscopy should be ensured 24/7 due to the need for emergency surgery in this disease.

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## Conflict of interest

The authors declare no conflict of interest.

## References

1. Žáček M, Váňa J, Babiš B. Laparoscopic closure of perforated gastro-duodenal ulcer: 15 years' experience in our centre. *Videosurgery Miniinv* 2014; 9: 578-85.
2. Druart ML, Van Hee R, Etienne J, et al. Laparoscopic repair of perforated duodenal ulcer. A prospective multicenter clinical trial. *Surg Endosc* 1997; 11: 1017-20.
3. Bertleff MJOE, Lange JF. Perforated peptic ulcer disease: a review of history and treatment. *Dig Surg* 2010; 27: 161-9.
4. Møller MH, Adamsen S, Wørdemann M, Møller AM. Perforated peptic ulcer: how to improve outcome? *Scand J Gastroenterol* 2009; 44: 15-22.
5. Svanes C. Trends in perforated peptic ulcer: incidence, etiology, treatment, and prognosis. *World J Surg* 2000; 24: 277-83.
6. Strzałka M, Bobrzyński A. Laparoscopy in the treatment of acute abdominal diseases. *Videosurgery Miniinv* 2008; 3: 1-9.
7. Czubek W, Januszkiewicz M, Wasilczuk M. Laparoscopic repair of perforated peptic ulcer – our own experience. *Videosurgery Miniinv* 2007; 2: 103-7.
8. Nathanson LK, Easter DW, Cuschieri A. Laparoscopic repair/peritoneal toilet of perforated duodenal ulcer. *Surg Endosc* 1990; 4: 232-3.
9. Lau WY, Leung KL, Kwong KH, et al. A randomized study comparing laparoscopic versus open repair of perforated peptic ulcer using suture or sutureless technique. *Ann Surg* 1996; 224: 131-8.
10. Lau H. Laparoscopic repair of perforated peptic ulcer: a meta-analysis. *Surg Endosc* 2004; 18: 1013-21.
11. Sanabria A, Villegas MI, Morales Uribe CH. Laparoscopic repair for perforated peptic ulcer disease. *Cochrane Database Syst Rev* 2013; 2: CD004778.
12. Lunevicius R, Morkevicius M. Systematic review comparing laparoscopic and open repair for perforated peptic ulcer. *Br J Surg* 2005; 92: 1195-207.
13. Sommer T, Elbroend H, Friis-Andersen H. Laparoscopic repair of perforated ulcer in Western Denmark – a retrospective study. *Scand J Surg* 2010; 99: 119-21.
14. Motewar A, Tilak M, Patil D, et al. Laparoscopic versus open management of duodenal perforation: a comparative study at a District General Hospital. *Prz Gastroenterol* 2013; 8: 315-9.
15. Robertson GS, Wemyss-Holden SA, Maddern GJ. Laparoscopic repair of perforated peptic ulcers. The role of laparoscopy in generalised peritonitis. *Ann R Coll Surg Engl* 2000; 82: 6-10.
16. Bloechle C, Emmermann A, Treu H, et al. Effect of a pneumoperitoneum on the extent and severity of peritonitis induced by gastric ulcer perforation in the rat. *Surg Endosc* 1995; 9: 898-901.
17. Evasovich MR, Clark TC, Horattas MC, et al. Does pneumoperitoneum during laparoscopy increase bacterial translocation? *Surg Endosc* 1996; 10: 1176-9.
18. Lagoo S, McMahon RL, Kakihara M, et al. The sixth decision regarding perforated duodenal ulcer. *JSL* 2002; 6: 359-68.
19. Vaidya BB, Garg CP, Shah JB. Laparoscopic repair of perforated peptic ulcer with delayed presentation. *J Laparoendosc Adv Surg Tech A* 2009; 19: 153-6.
20. Thorsen K, Glomsaker TB, von Meer A, et al. Trends in diagnosis and surgical management of patients with perforated peptic ulcer. *J Gastrointest Surg* 2011; 15: 1329-35.
21. Bertleff MJOE, Lange JF. Laparoscopic correction of perforated peptic ulcer: first choice? A review of literature. *Surg Endosc* 2010; 24: 1231-9.

22. Siu WT, Leong HT, Law BKB, et al. Laparoscopic repair for perforated peptic ulcer: a randomized controlled trial. *Ann Surg* 2002; 235: 313-9.
23. Palanivelu C, Jani K, Senthilnathan P. Laparoscopic management of duodenal ulcer perforation: is it advantageous? *Indian J Gastroenterol* 2007; 26: 64-6.
24. Dubois F. New surgical strategy for gastroduodenal ulcer: laparoscopic approach. *World J Surg* 2000; 24: 270-6.

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