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Перфорированная пептическая язва: прогностические факторы послеоперационных осложнений и смертности

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Резюме

Цель. Выявить прогностические факторы послеоперационных осложнений и смертности при перфорированной пептической язве.

Материал и методы. Ретроспективное исследование включало пациентов, прооперированных по поводу перфорированной пептической язвы двенадцатиперстной кишки в период с 1 января 2012 г. по 30 июня 2021 г.

Результаты. Всего было 129 пациентов. В исследуемую группу вошли 114 (88,4%) мужчин и 15 (11,6%) женщин с соотношением полов М/Ж 7,6 и средним возрастом 44,8 (диапазон 17—89) года. Всем пациентам было проведено экстренное хирургическое лечение. Лапароскопический доступ был выполнен в 90,7% случаев, срединная лапаротомия — в 9,3%. Интраоперационное обследование выявило перитонит в 123 случаях. Перфорация располагалась в передней части луковицы двенадцатиперстной кишки у 95,3% пациентов и на верхнем крае луковицы двенадцатиперстной кишки у 4,7% больных. У всех пациентов были выполнены ушивание перфорации, перитонеальный лаваж и дренирование брюшной полости. Средняя продолжительность процедуры составила 93 мин. Конверсия в лапаротомию составила 6,2%. Время до конвериии варьировало от 50 до 120 мин. Общая частота осложнений составила 7,8%, общая смертность — 7,8%. В многофакторном анализе факторами риска заболеваемости и смертности были: возраст >45 лет, женский пол, курение, сопутствующие заболевания, шок при поступлении, задержка операции >6 ч, креатинин крови >106 мкмоль/л, степень перитонеальной контаминации и размер перфорации.

Вывод. Анализ прогностических факторов заболеваемости и смертности при перфорации пептической язвы имеет решающее значение для улучшения результатов лечения пациентов и принятия клинических решений.

Ключевые слова: *перфорация пептической язвы, заболеваемость, смертность, перитонит.*

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Perforated peptic ulcer: predictive factors of postoperative morbidity and mortality

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Abstract

Objective. To identify predictive factors of morbidity and mortality following perforated peptic ulcer (PPU).

Material and methods. A retrospective study included patients with PPU who underwent surgery between 1 January 2012 and 30 June 2021.

Results. A total of 129 patients were included. There were 114 men (88.4%) and 15 women (11.6%) with M/F ratio 7.6 and mean age 44.8 years (range 17—89). All patients underwent urgent surgical treatment. Laparoscopic approach was carried out in 90.7% of cases, median laparotomy — in 9.3% of cases. Intraoperative exploration revealed peritonitis in 123 cases. Perforation was located in anterior aspect of the duodenal bulb in 95.3% of patients and on the upper edge of the duodenal bulb in 4.7% of cases. Perforation suturing, peritoneal lavage and abdominal drainage were performed in all patients. Mean surgery time was 93 min. Conversion to laparotomy was performed in 6.2% of patients. Time to conversion ranged from 50 to 120 min. The overall morbidity rate was 7.8%, overall mortality rate — 7.8%. In multivariate analysis, morbidity and mortality risk factors were age >45 years, female gender, smoking, comorbidities, shock on admission, delay of surgery >6 hours, creatinine >106 μmol/L, degree of peritoneal contamination and perforation size.

Conclusion. Analysis of predictive factors of morbidity and mortality in PPU is crucial to improve patient outcomes and guide clinical decision-making.

Keywords: *Peptic Ulcer Perforations, Morbidity, Mortality, peritonitis.*

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Introduction

Peptic ulcers disease are focal defects in the gastric or duodenal mucosa that extend into the submucosa or deeper. They may be acute or chronic and, ultimately, are caused by an imbalance between mucosal defences and acid/peptic injury. This pathology is a common global health problem with an estimated annual incidence of 0.03 to 0.19% [2, 3] and affects a young active population. Perforation is the second most common complication of peptic ulcer. PPU is characterized by a full-thickness breach in the gastric or duodenal wall, leading to a leakage of gastrointestinal contents into the peritoneal cavity. This results in chemical peritonitis, which can progress to bacterial peritonitis, sepsis, and multi-organ failure if not promptly treated. PPU is a life-threatening surgical emergency that requires immediate intervention. Despite advances in medical and surgical management, PPU remains associated with significant morbidity and mortality. PPU mortality ranges from 0 to 13% and morbidity from 10 to 20% [4].

The therapeutic management of acute peritonitis by perforation of duodenal ulcer consists of prompt rescisutation, naso-gastric tube, broad-spectrum antibiotic therapy and correction of ionic disorders [5, 6]. After rescissutation, urgent surgery is intended to treat acute peritonitis and duodenal perforation. Postoperatively ulcerative disease is medically treated. Proton pump inhibitor and antibiotherapy allow to eradicate Helicobacter Pylori. Given its advantages, the minimally invasive approach is widely used as the first approach. It allows peritoneal lavage and perforation repair [7].

Few articles were interested in the study of risk factors affecting mobidity and mortality related to surgical treatment. Identifying predictive factors of poor outcomes is essential for risk stratification, optimizing preoperative preparation, and guiding postoperative care. This article explores the key factors that influence postoperative morbidity and mortality in patients with PPU and discusses strategies to improve outcomes.

Patients and Methods

This is a retrospective descriptive and analytical study involving patients operated for perforated peptic ulcer in the General Surgery Department at Habib Bougatfa University Hospital in Bizerte (Tunisia) between January 2012 and June 2021.

It was included patients underwent urgent surgery for PPU. Were not included patients treated with Taylor's method, patients with post-traumatic duodenal perforations and those with perforation of gastric ulcer.

After adequate resuscitation, patients were operated, laparoscopic approach was the reference, open approach was indicated in case of laparoscopic contraindication. Perforation site was identified, parameters were recorded, peritoneal fluid was collected for bacteriological examintion and culture. A simple repair of the ulcer perforation without omental patch was performed in all cases. Meticulous postoperative care and follow-up were performed in all cases. Individuals getting complications and sepsis were managed accordingly. The criteria for judgement were operative mortality and postoperative morbidity defined as the death or occurrence of a complication within 30 days after the intervention or during the same hospitalisation regardless of the duration of the intervention. Data were analysed with standard software (SPSS 20.0 for Windows). Statistical treatment of data has two components, descriptive and analytical. We calculated absolute and relative frequencies (percentages) for the qualitative variables. Averages, medians and standard deviations were calculated and extreme values for quantitative variables were determined. For the analytical study, Student tests are used to compare two means for two independent samples. We used the analysis of variance (ANOVA) developed by Fisher. All analyses were performed using SPSS 20.0.

Results

Among the 129 patients collected, 114 were male (88.4%) and 15 female (11.6%) with an average age of 44.8 years (extremes 17—89 years). Smoking was observed in 75 patients (59.1%) and alcohol use in 24 patients. Twenty-nine patients (22.5%) took gastrotoxic medication at the time of diagnosis. A past medical history of chronic disease was noted in 15 patients **(Table 1)**.

Surgical history was noted in 3 patients operated for perforated duodenal ulcer. The median consultation delay was 20.6 hours (extremes 2—120 hours). The hemodynamic status was stable in 117 patients, cardiovascular collapse was present in 10 patients (7.8%), and 2 patients presented with septic shock. Urea was elevated (>0.43 g/L) in 35 patients (28.5%). Creatinine was elevated (>106μmol/L) in 14 patients (13.2%).

Chest X-ray was performed in all patients and revealed the presence of free air under the diaphragm in 83 patients (64.3%). The CT scan was performed in 47 patients (36.4%), it showed pneumoperitoneum in 42 patients, intra-abdominal fluid in 25 patients and intraperitoneal collection in 2 other patients.

The average traitment delay was 20.6 hours. Fourty-eight patients (37.2%) presented to emergency room within 6 hours of the onset of symptoms and 81 patients (62.8%) presented after 6 hours. The morbidity rate in the two groups was respectively 5.4% and 12% and mortality rates were 7.1% and 26.5%. Thus, a traitment delay more than 6 hours was a predictive factor of morbidity and mortality.

Shock on admission was observed in 12 patients and was associated with worse outcomes. Morbidity rates increase from 6.7% to 55.6% (p=10–4) and mortality rates increase from 5% to 80% (p=10–4) in the presence of shock on admission.

Laparoscopic approach was performed in 117 patients (90.7%) and laparotomy was performed in 12 patients. The surgical exploration showed the absence of peritonitis in 6 patients (4.7%), mild peritoneal contamination in 52 patients (40.3%), moderate peritoneal contamination in 30 patients (23.3%) and severe peritoneal contamination in 41 patients (31.8%). The first group of patients without peritonitis or with mild contamination had a low morbidity rate 6.8% compared to the second group with moderate and severe peritonitis in which the morbidity was 12.7% (p=0.014). Mortality rates was 3.4% in the first group and reached 11.3% in the second group (p=0.003). Perforation was located in the anterior aspect of the duodenal bulb in 123 patients (95.3%) and at the upper edge of the duodenal bulb in 6 patients (4.7%). The average size of the perforation was 5 mm. The morbidity rate was 4.7% in patients with a small perforation less than 1 cm and 53.8% when the size of the perforation exceeded 1 cm (p=10–4).

After an intensive peritoneal lavage with normal saline, a perforation repair was performed in all patients. Drainage of the peritoneal cavity was also performed in all patients. The average duration of the operation was 92.6±38.3 min (30 min—210 min). Conversion to laparotomy was performed in 8 cases (6.2%). Postoperative care was uneventful in 109 patients. Overall mortality was 7.8% **(Table 2)**.

The overall morbidity rate was 7.8%. Medical complications were noted in 7 patients and surgical complications in 3 patients **(Table 3)**.

In the univariate study, preoperative factors that significantly influenced morbidity and mortality were: age >45 years (p=0.012), female gender (p=0.046), the presence of comorbidities (p=10–4), traitment delay ⩾6 hours (p=0.016), smoking (p=0.030), blood urea >0.43 mmol/l (p=0.013), shock on admission (p=10–4) and blood creatinine >106 mmol/l (p=10–4). Intraoperative factors that significantly influenced morbidity and mortality were: perforation size (p=0.01) and the degree of peritoneal contamination (p=0.001) **(Table 4)**.

In the multivariate study factors independently related to postoperative morbidity and mortality were age >45 years, female gender, smoking, presence of comorbidities, shock on admission, Creatinine >106 mmol/l, degree of peritoneal contamination, size of perforation and traitment delay ⩾ 6 hours **(Table 5)**.

Discussion

Perforated peptic ulcer is a serious medical condition. It can be life-threatning if diagnosis and treatment are not carried out early. Surgical treatment allows to repair the duodenal perforation and to treat peritonitis. A review of the literature showed that perforation peptic ulcer mortality ranges from 0 to 13% and morbidity ranges from 10 to 20% [4]. The present study showed that the overall mortality rate was 7.8% and the overall morbidity rate was 10.1%. Our results in terms of morbidity and mortality approach the literature results. The analysis of the different prognostic factors that affect postoperative morbidity and mortality allows a comprehensive approach to minimise risks and optimize outcomes.

Table 1. **Patient's comorbidities**

Chronic disease	Number
Type 2 diabetes	9
Systemic hypertension	9
Chronic heart disease	5
Chronic renal failure	2
Chronic Obstructive Pulmonary Disease	1

Table 2. **Cause of death summary**

Cause of death	Number
Septic shock refractory to resuscitation	5
Myocardial infraction	1
Heart failure secondary to chronic heart disease	3
Chronic Obstructive Pulmonary Disease decompensation	1

Table 3. **Postoperative complications summary**

Postoperative complications	Number
Pulmonary infection	3
Renal failure	2
Heart failure	2
Biliary fistula	1
Intestinal perforation	1
Intestinal obstruction	1

In this study, predictive factors of morbidity and mortality in multivariate study can be classified into patient-related factors (age, sex, smoking and comorbidities), clinical presentation factors (shock on admission, creatinine level, delay of surgery) and intraoperative fundings factors (degree of peritoneal contamination and size of perforation). While this study provides valuable insights, the small number of cases limits the generalizability of the findings.

In this study, the morbidity and mortality rates were respectively 3% and 0% before the age of 45 years and 12.9% and 10% after this age. The morbidity rate in our patients with a medical history was 87.5% and 12.5% in those without a medical history (p=10—4).

Thus, age >45 years is considered a predictive factor of morbidity and mortality in many studies [2—4]. M.H. Moller et al. in a study including 2668 patients who underwent surgery for perforated duodenal ulcer, found that age over 65 years is a risk factor for mortality and had the highest predictive impact [8]. Advanced age is a strong predictor of poor outcomes due to reduced physiological reserve and higher prevalence of comorbidities. Therefore, the management of PPU in elderly patients should take into consideration the patient's history and optimize comorbidities before surgery.

The number of smokers was 75 (59.1%), with an average consumption of 25.41 packs/year. The morbidity rate was 17.3% in smoking patients and 5.3% in the non-smokers (p=0.03). The mortality rate was 15.4% in smoking patients and 2.7% in non-smokers (p=0.011). Smoking increases significantly morbidity and mortality in this study. In the literature no study has shown that smoking is a predictive factor of morbidity and mortality. For Moller et al, smoking has a low impact as a predictive factor for mortality risk [8] whereas according to Noguiera's study, smoking has no impact on the risk of morbidity or mortality. Indeed, the morbidity rate among non-smokers was 31.7% and 27.4% among smokers (p=0.620). While the mortality rate was 7.9% in non-smokers and 1.2% in smokers (p=0.190) [3].

The impact of treatment delay in PPU is significant and can lead to severe complications, increased morbidity, and higher mortality rates. PPU is a surgical emergency that requires prompt diagnosis and intervention to prevent life-threatening sequelae. Delays in treatment can exacerbate the condition due to the spillage of gastric or duodenal contents into the peritoneal cavity, leading to peritonitis, sepsis, and multiorgan failure.

In this study delay beyond 6 hours is strongly associated with higher mobidity and mortality rates. Studies show that mortality increases from approximately 5—10% with early intervention to 30—50% or higher when surgery is delayed beyond 24 hours. Delayed treatment allows the progression of peritonitis and systemic sepsis, which are the major contributors to death. Additionally, delayed surgery is associated with a higher incidence of postoperative complications, such as intra-abdominal abscesses, wound infections, anastomotic leaks (if repair is performed) and prolonged ileus. These complications often require additional interventions, which prolong recovery and hospital stay. To minimize a treatment delay, an early diagnosis and a prompt surgical repair is recom-

Table 4. **Predictive factors of morbidity and mortality in univariate study**

Predictive factors	P
Age >45	0,012
Female gender	0,046
Smoking	0,030
Comorbidities (diabetes, hypertension and renal failure)	0,000
Heart disease	0,074
Lung disease	0,089
Fever	0,356
Shock on admission	0,000
Urea > 0.43	0,013
Creat>106 µmol/L	0,000
Degree of peritoneal contamination	0,001
Size of perforation > 1cm	0,010
Traitment delay ⩾ 6 hours	0,016
Operating time > 75 min	0,580

Table 5. **Predictive factors of morbidity and mortality in multivariate study**

Predictive factors	P	Odds ratio	Confidence Interval
Age ⩾ 45	0,011	0,544	[1,3787—1,5568[
Female gender	0,023	0,426	[1,0559—1,1681[
Smoking	0,029	1,705	[0,4926—0,6687[
Comorbidities (diabetes, hypertension, renal failure)	0,000	0,089	[0,0433—0,1472[
Shock on admission	0,000	0,000	[0,0449—0,1812[
Creatinine > 106 µmol/L	0,000	0,104	[0,7811—1,0376[
Traitment delay ⩾ 6H	0,004	0,417	[0,2277—0,3914[
Degree of peritoneal contamination	0,001	0,388	[0,2425—0,4083[
Size of perforation >1 cm	0,002	0,231	[1,0665—1,2072[

mended. In fact, the physician should maintain a high index of suspicion for PPU in patients with sudden-onset severe abdominal pain, especially those with a history of peptic ulcer disease or non-steroidal anti-inflammatory drugs use. If the diagnosis is confirmed, surgery should ideally be performed within 6 hours of diagnosis.

The presence of shock on admission in patients with PPU is a critical prognostic factor and is associated with significantly worse outcomes. In this context, shock typically indicates septic or hypovolemic origin due to systemic inflammation, peritonitis, and fluid loss from the perforation. It reflects the severity of the condition and often delays definitive treatment, further exacerbating the risks. Shock on admission is one of the strongest predictors of mortality in PPU. In this study mortality rates in patients presenting with shock is 80%, compared to 5% in hemodynamically stable patients. The presence of shock indicates advanced disease, often with established sepsis or multiorgan dysfunction [9]. Immediate resuscitation should be considered in instable patients. Surgery should be performed as soon as the patient becomes stable. Postoperative management in the intensive care unit is often required.

In this study the degree of peritoneal contamination in PPU significantly affects patient outcomes, including morbidity and mortality. Patients with generalized peritonitis and sepsis have significantly higher morbidity and mortality rates compared to those with localized peritonitis. Severe peritoneal contamination increases the risk of bacterial translocation and systemic infection, leading to sepsis, multiorgan dysfunction, and septic shock [10]. Early recognition and management of contamination are critical to prevent these complications.

The size of the perforation in a PPU is a critical factor that influences the severity of the condition, the choice of treatment, and patient outcomes [11]. The size of the perforation can be considered as a predictor factor of morbidity and mortality in this study. Larger perforations are associated with higher morbidity and mortality due to increased spillage of gastric or duodenal contents into the peritoneal cavity, leading to more severe peritonitis, systemic inflammation, and complications. Larger perforations are more likely to cause generalized peritonitis, which is associated with systemic inflammation, sepsis, and multiorgan dysfunction. Smaller perforations may cause localized peritonitis, which is less severe and easier to control with prompt treatment. The size of the perforation influences the choice of surgical approach, the extent of peritoneal lavage, and the need for additional procedures (omentoplasty or resection). Female gender is associated with a poor outcome in this study but further studies with large numbers of patients are needed to confirm this.

Conclusions

Perforated peptic ulcer remains a challenging condition with significant morbidity and mortality, particularly in high-risk populations. Predictive factors such as advanced age, comorbidities, delayed presentation, and severe peritonitis can help identify patients at increased risk. Early diagnosis, prompt surgical intervention, and aggressive perioperative management are key to improving outcomes. A multidisciplinary approach tailored to the patient's individual risk factors is essential for optimizing care and reducing the burden of this life-threatening condition.

Authors contributions:
Mohamed Amine Alioua — wrote the first draft.
Ahmed Itaimi, Ahmed Kotti, Wissem Trikic — ollected and curated clinical data.
Ahmed Itaimico — ntributed to manuscript revisions.
Wissal Jaafarp — erformed statistical analysis.
Sami Bouchoucha, Oussema Baraketr — evised final version of the manuscript.

All authors read and approved the final version of the manuscript.
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