



Role of Peptic Ulcer Perforation (PULP) score to Predict the Outcome in Patients with Perforated Peptic Ulcer

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Received: 08 April 2022

Revised: 14 April 2022

Accepted: 22 April 2022

Published: 23 June 2022

Abstract

Background: Peptic ulcer disease is a global burden of disease associated with potentially life-threatening complications, including bleeding, perforation and obstruction. Perforated peptic ulcer (PPU) is a frequent emergency condition worldwide with associated morbidity and mortality. Variations in the clinical presentation, as well as delay in diagnosis and work-up at admission to the hospital, may potentially cause a worsening of symptoms and a deterioration of the clinical condition, with a detrimental outcome. Therefore, accurate and early identification of high-risk surgical patients with perforated peptic ulcers (PPUs) is important for triage and risk stratification. Currently, the ASA score and the Boey score are the most frequently used prognostic scoring systems in patients with PPU. Yet, the ASA score is a general surgical risk score not intended for PPU patients in particular. Moreover, the external validation of the Boey score is uncertain. PULP score appears to have the greatest predictability of the outcome of perforated PUD. Aim of the study: The objective of the study was to evaluate the role of the PULP score in the prediction of outcomes in patients with a perforated ulcer. **Material & Methods:** It is an observational cross-sectional study, carried out in the Department of Surgery, Dhaka Medical College Hospital, Dhaka. Ethical approval was obtained from the Dhaka Medical College ethical review board. Patients aged 18 to 60 years admitted to the emergency department with a clinical diagnosis of perforated peptic ulcer disease, confirmed by different investigation modalities, e.g, imaging, sonography, laboratory test, etc were enrolled in the study. The data regarding sociodemographic, clinical, biochemical, radiological and surgical profiles were recorded. The operation was done by upper midline incision under general anesthesia. A modified Graham's patch technique was used to repair the duodenal ulcer. Postoperative follow up was conducted meticulously. Patient outcome was assessed during their hospital stay and then OPD follow-up or by telephone interviews up to 30 days after the intervention. All the information is recorded in the data collection sheet. All collected questionnaires were checked very carefully to identify the error in the data. Data processing work consisted of registration schedules, editing computerization, preparation of dummy tables, and analyzing and matching data. Data was processed and analysed with the help of the computer program SPSS and Microsoft excel. Quantitative data are expressed as mean and standard deviation and qualitative data as frequency and percentage. The comparison was done by tabulation and graphical presentation in the form of tables, pie charts, graphs, bar diagrams, histograms & charts etc. **Results:** Present study

demonstrates that the maximum number of patients (43.0%) was between 51-60 years of age group, mean age of the patient was 49.35 ± 11.7 years. The male and female ratio was 3.54:1. Maximum (57%) patients came from urban, (36%) rural and (7%) urban non-slum areas. In this study, the most common signs were tachycardia (100%), abdominal tenderness (100%), abdominal rigidity (100%), absence of vowel sound (86.2%), and obliteration of liver dullness (78.7%), dehydration (67.5%). The time lapse between the onset of symptoms and admission to the hospital varied from 4 hours to 4 days. Most of the patients (76.0%) were admitted after 24 hours. In this study, PULP score was assessed according to the operational definition of optimal cut-off point 7, below this considered as low-risk patients. In this study 85% were 0-7 PULP scores and 15% were PULP scores 8-18. Patients' condition after proper treatment, symptoms, degree of abnormalities or dependence on the daily physiological activity and the clinical outcome had evaluated and measured by follow up and close monitoring. The study shows that 69.0% of the patients recovered completely, but 24.0% of patients had developed complications. The mortality rate in this study was 7.0%. Finally, a correlation of the PULP score with mortality of perforated PUD was carried out. Among the 7 expired cases the, PULP score was correlated with 6 cases like high risk. In 93 cases of recovered, the PULP score was predicted in 84 cases as low risk. So the effectiveness of PULP has proven significant in the prediction of mortality in perforated PUD patients. The Sensitivity and Specificity of the Peptic Ulcer Perforation (PULP) score was 85.7% and 90.3% respectively. Similarly, the positive predictive value and accuracy rate for the same was 40.0% and 90.0% respectively. **Conclusion:** Patients with perforated peptic ulcer (PPU) often present with acute, severe illness that carries a high risk for morbidity and mortality. Several prognostic scoring systems have been suggested to identify high-risk surgical patients with perforated peptic ulcers accurately and early. The present study demonstrates that the PULP score can be used to predict 30-day mortality accurately in patients operated for PPU. The prognostic predictors included in the PULP score can be readily identified prior to surgery. The PULP score can assist in the accurate and early identification of high-risk patients with PPU.

Keywords:- Peptic Ulcer, Perforation & Perforated Peptic Ulcer.

INTRODUCTION

Peptic ulcer disease (PUD) affects 4 million people worldwide annually. The incidence of PUD has been estimated at around 1.5% to 3%. Perforated peptic ulcer (PPU) is a serious complication of PUD and patients with PPU often present with an acute abdomen that carries a high risk for morbidity and mortality.^[1] Defining the exact etiological

factor in any given patient may often be difficult, as more than one risk factor may be present and they tend to interact. While previous reports have shown age, ASA score, and having a comorbid disease were found to affect both mortality and morbidity.^[2] Currently, the American Society of Anesthesiologists (ASA) score, the Boey score and the PULP score are the most frequent used



prognostic scoring systems in patients with PPU. Although a perforated peptic ulcer (PPU) is worsened consequence of peptic ulcer disease (PUD), several clinical features and prognoses are dramatically different. One of the reasons is that symptoms of PPU vary over time and are classified into three phases. The first phase appears within 2 h of onset, and symptoms such as acute abdominal pain, tachycardia and peripheral coldness are typical of this stage. Then, a perforation releases the gastroduodenal contents into the peritoneal cavity, causing chemical peritonitis. Severe pain stimulates sympathetic nerves, and tachycardia and peripheral coldness result.^[3] Within 2 to 12 h of onset, the inflammation extends to the broader area of the peritoneum, and localized pain becomes generalized. After more than 12 h of onset, patients become hemodynamically unstable, and death may be a consequence.^[4] As a result, several clinical features, such as diffuse abdominal pain, muscular defence and a change in symptoms are unique to PPU. Early detection and rapid intervention are crucial for treating PPU and affecting the prognosis of patients. The lifetime prevalence of perforation in patients with PUD is about 5%.^[1] PPU carries mortality ranging from 1.3% to 20%.^[1] The perforation site usually involves the anterior wall of the duodenum (84.2%), gastric (15.3%) and prepyloric area.⁵ Patients may present with severe, sudden-onset epigastric pain, which can become generalized, abdominal distension, and vomiting.^[5] The peritonitis resulting from acid exposure may present as abdominal 'board-like rigidity'. The clinical picture may be less clear in the obese, the immunocompromised, patients on steroids, patients with a reduced level of consciousness,

the elderly, and children. In these situations, the clinical history and examination may be non-specific prompting additional imaging and laboratory studies to rule out differential diagnoses. Only two-thirds of patients present with frank peritonitis, which may in part explain the diagnostic delay in some patients.^[6] Clinical prediction rules are used, but accuracy varies with the study population. Early surgery, either by laparoscopic or open repair and proper sepsis management is essential for a good outcome.^[7] No single factor can readily identify patients at high risk for a poor outcome, but older age, presence of comorbidity, and delay in surgery have consistently been associated with a higher risk of death. The identification of modifiable risk factors with the potential to improve outcomes is of greatest interest. In a systematic review by Møller et al (2010) covering over 50 studies with 37 preoperative prognostic factors comprising a total of 29,782 patients, risk factors consistently associated with mortality were found.^[8] Only two-thirds of the studies provided confounder-adjusted estimates. Further, definitions and cut-offs (e.g. age-discriminator for 'old'; level of creatinine for defining 'acute renal failure, blood pressure to define 'shock' etc) were not consistent among studies. Thus, combining risk factors to predict disease outcomes has been attempted.^[7] The ideal clinical prediction rules should be easy to use, reliable, have high generalizability, and be adequately validated both internally and externally. The PPU prediction rules evaluated to date are yet to be categorized as ideal. The difficulty in defining a uniform set of prognosticators is likely attributed to the overall complexity of the disease and the number of factors involved.^[9] Some considered

factors are fixed (e.g. age and gender) and others are amenable to intervention (e.g. time to treatment; resuscitative goals etc).^[2] Also, as geographical differences exist in age, gender and presentation patterns, a universal, reproducible and valid scoring system may be hard to develop. Several scoring systems including the Boey scoring system and the Mannheim Peritonitis Index (MPI) have been used to stratify the risk of the patients and predict the outcomes of patients with perforated peptic ulcers.^[10] The Boey score is the most commonly and easily implemented among these scoring systems, and accurately predicts perioperative morbidity and mortality.^[10] Menekse E et al. derived the Peptic Ulcer Perforation score (PULP score), a clinical prediction rule for 30-day mortality. The score assesses and compares its prognostic performance with the American Society of Anaesthesiologists (ASA) and Boey scores.^[11] Compared with ASA and Boey, the PULP score had the largest area under the curve and was the only score to significantly predict post perforated duodenal ulcer repair 30-day morbidity.^[12] Scores commonly employed to risk stratify perforated peptic ulcer patients include ASA (American Society of Anesthesiologists), Boey and peptic ulcer perforation score (PULP). However, few studies assessed and compared the accuracy indices of these three scores in predicting post PPU repair 30-day morbidity.^[12] American society of anesthesiologists (ASA) classification is the most commonly used for assessing perioperative risk worldwide. It is graded in six categories; depending on the patient's pre-operative health status. The previous study found that ASA classification was capable of predicting poor surgical outcomes due to the

correlation of the overall condition of the patient.^[13] The Mannheim peritonitis index (MPI) is a scoring system for the prognostic evaluation of patients with peritonitis. It has eight risk factors and needs operative findings to complete the score. As the name implies, the score was designed for surgical patients presenting with peritonitis but not specific to PPU patients.^[16] The peptic ulcer perforation (PULP) score is a new clinical prediction rule for PPU. Moller MH et al (2011) derived the PULP score and compared it with the boey score and ASA classification.^[15] This study found that the PULP score can predict mortality in PPU patients better than the Boey score and the ASA classification. The PULP score may be the better prognostic scoring system for postoperative morbidity and mortality of PPU patients than the Boey score, ASA and MPI.^[14] Another study reported that the PULP score accurately predicts 30-day mortality in patients operated for PPU and can assist in risk stratification and triage.^[15] Therefore, this study aimed to evaluate the role of the PULP score in predicting outcomes in patients with a perforated ulcer in DMCH.

MATERIAL AND METHODS

This is an observational cross-sectional study. The study was conducted in the Department of Surgery, Dhaka Medical College Hospital, Dhaka. The study was conducted from August 2018 to August 2019. The study subjects were patients aged 18 to 60 years admitted to the surgery department of surgery with a clinical diagnosis, and investigation proved as perforated peptic ulcer disease. Purposive sampling was applied for sampling.

Inclusion criteria:

- Patients aged 18 to 60 years admitted to the surgery department with a clinical diagnosis of perforated peptic ulcer disease.
- Patients planned for surgical management.

Exclusion criteria:

- The patients who have severe preexisting co-morbidity like CRF, and uncontrolled DM.
- The patients who have antiplatelet drugs, steroids, and chemotherapeutic agents for other illnesses from before.
- Patients denied being included in the study.
- Presence of serious systemic illness.

All data were presented in a suitable table or graph according to their affinity. A description of each table and graph was given to understand them clearly. All statistical analysis was performed using the statistical package for social science (SPSS) program, and Windows. Continuous parameters were expressed as mean \pm SD and categorical parameters as frequency and percentage. Comparisons between groups (continuous parameters) were done by Student's t-test. Categorical parameters compared by Chi-Square test. The significance of the results as determined by a 95.0% confidence interval and a value of $P < 0.05$ was considered to be statistically significant.

RESULTS

This observational cross-sectional study was carried out to investigate the role of the PULP score in the prediction of outcomes in patients

with perforated peptic ulcers. This study included a total of 100 patients admitted to the hospital and surgery was done as per hospital protocol. All patients completed treatment and follow up. The result and observations given below, Table showed the age distribution of patients. According to the questionnaire, the history of all the 100 selected cases was taken, and the clinical examination was carried out meticulously. During the hospitalized period all appropriate investigations were done. The study demonstrates that a maximum number of patients (43.0%) were between 51-60 years of age group, next (24.0%) were between the age group of 41-50 years. The mean age of the patient was 49.35 ± 11.7 years. The table shows the gender distribution of the patients. Out of 100 cases, 78% were male and 22% were female. The male and female ratio was 3.54:1. The table shows the marital status of the patients. Married were (69), unmarried (37%). The table shows the occupation status of the patients. A large number of respondents were labourers/rur (34%) followed by businessmen (23%). A considerable portion of the respondents (17%) were service holders. Figure 1 shows the residency of study subjects. The figure shows that (36%) of patients came from rural, (57%) from urban slums and (7%) from urban non-slum areas. Table-2 shows different risk factors associated with PUD. The study revealed that several predisposing factors contribute to the development of a worse condition of peptic ulcer disease, which leads to perforation. We found that (78%) of patients were smokers, sixty-four patients (64.0%) were current ulcerogenic drug users; out of them, (49.0%) patients were using NSAIDs and 15 patients were steroid users. Drinking alcohol was reported in 6%, and all of them were



males. The table also shows that 6.0% had the malignant disease and 2.0% had co-morbid liver cirrhosis. The p-value is 0.000138. The result is significant at $p < 0.05$. Figure-2 shows the time between the onset of symptoms and hospital admission. The time lapse between the onset of symptoms and admission to the hospital varied from 4 hours to 4 days. Most of the patients (76.0%) were admitted after 24 hours. Table-3 shows major signs at the admission of perforated PUD patients. The table shows most common signs were tachycardia (100%), abdominal tenderness (100%), abdominal rigidity (100%), absence of bowel sound (86.2%), and obliteration of liver dullness (78.7%), dehydration (67.5%). Other signs were anaemia (36.2%) and raised temperature (17.5%). Table-4 shows the American Society of Anaesthesiologists (ASA) Score. In this study 78.0% were an ASA score of 3 and 22.0% were an ASA score of 4. Table-5 shows the PULP score in perforated PUD patients. The PULP score was assessed according to the operational definition of optimal cut-off point 7, below this are considered low-risk patients. Table-6 shows that 85% were 0-7 PULP scores and 15% were

PULP scores 8-18. The table shows the outcome of cases after surgical management. Patients' condition after proper treatment, symptoms, degree of abnormalities or dependence on the daily physiological activity and the clinical outcome had evaluated and measured by follow up and close monitoring. The study shows that 69.0% of the patients recovered completely, but 24.0% of patients had developed complications. The mortality rate in this study was 7.0%. The Peptic Ulcer Perforation (PULP) score - is comprised of eight variables and the score ranges from 0 to 18 points. The 30-day mortality increases progressively with increasing score points. Those with a score of 0 to 7 are categorized as low-risk patients ($n=85$ in this study), and with a score of 8 to 18 are high-risk patients ($n=15$ in this study). The table shows the correlation of the PULP score with mortality of perforated PUD. Among the 7 expired cases, the PULP score was correlated with 6 cases like high risk. In 93 cases of recovered, the PULP score was predicted in 84 cases as low risk. So the effectiveness of PULP has proven significant in the prediction of mortality in perforated PUD patients.

Table 1: Demographical characteristics of the study population (N=100).

Variables	Number of patients	Percentage (%)
Age (years)		
≤40	4	4
41-50	24	24
51-60	43	43
61-70	18	18
>70	11	11
Sex		
Male	78	78
Female	22	22
Total	100	100

Marital status		
Unmarried	28	28
Married	69	69
Separated/Divorced	3	3
Widowed	0	0
Occupation		
Service holder	17	17
Businessman	23	23
Day Laborer	38	38
Retired	6	6
Housewife	11	11
Unemployed, others	5	5

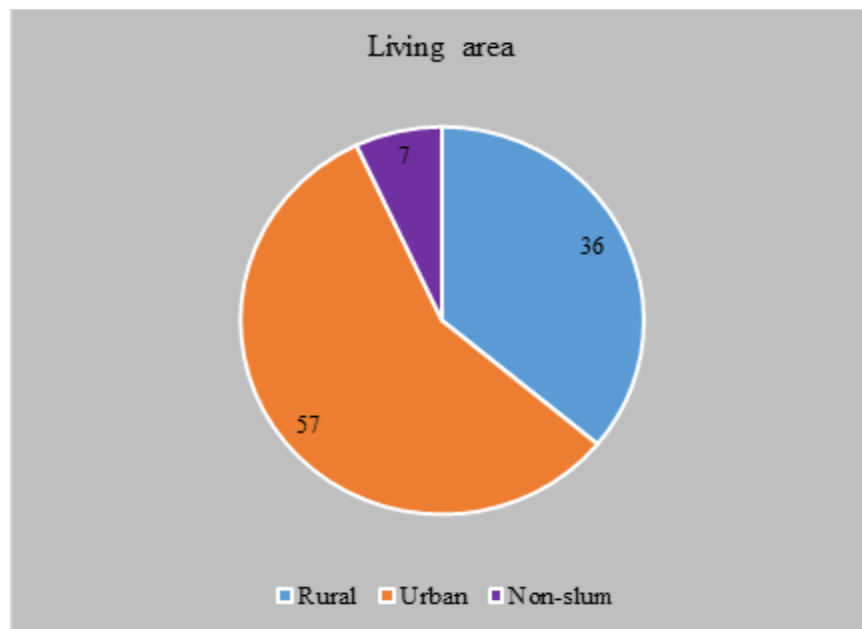


Figure 1: Distribution of living area of the study population.

Table 2: Different risk factors and comorbidity associated with perforated PUD (n=100)

Risk factors and comorbidity	Frequency		p-value
	M (n= 78)	F (n= 22)	
NSAIDs	31(39.7%)	18(81.8%)	0.0001
Smoking	73(93.5%)	5(22.7%)	
Betel nut chewing	9(11.5%)	8(36.3%)	
Alcohol consumption	6(7.6%)	0	
Use of Steroids	10(12.8%)	5(22.7%)	
Malignant disease or AIDS	6(7.6%)	0	
Co-morbid liver cirrhosis	2	0	

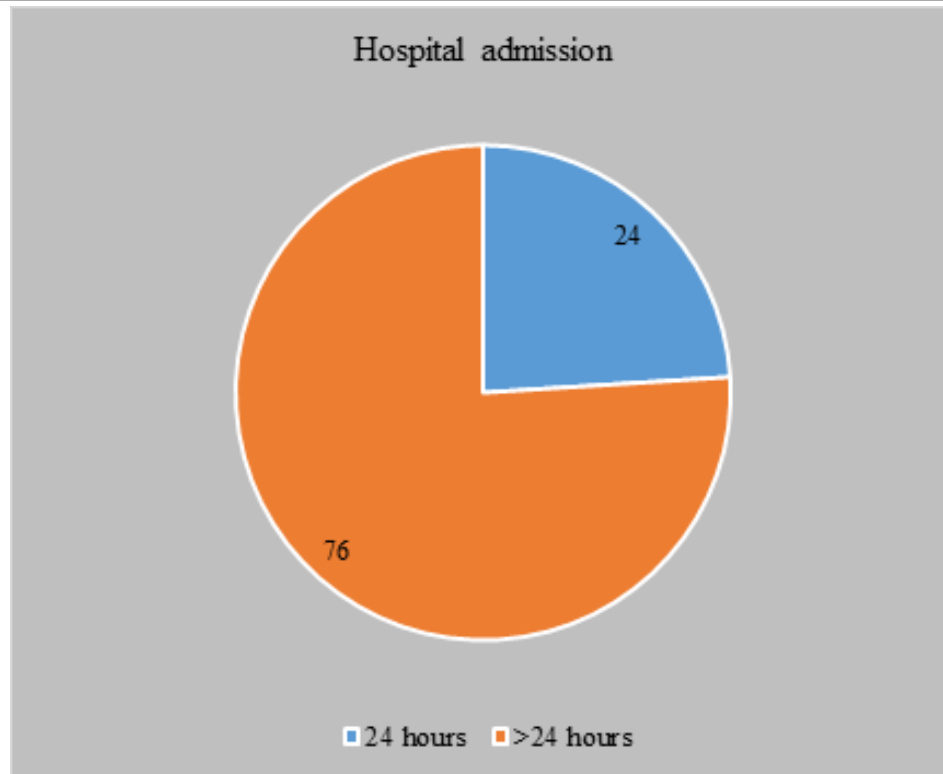


Figure 2: Time between onset of symptoms and hospital admission (n=100)

Table 3: Major signs at admission (n=100)

Signs	No. of patients	Percentage (%)
Tachycardia	100	100
Dehydration	100	100
Abdominal distention	60	60
Abdominal tenderness	100	100
Abdominal rigidity	100	100
Obliteration of liver dullness	45	45
Absence of bowel sound	86	86
Anaemia	36	36
Raised body temperature	17	17

Table 4: American society of anaesthesiologist (ASA) Score (n=100)

Score	No. of patients	Percentage (%)
2	0	0
3	78	78
4	22	22
5	0	0

Table 5: Assessment of PULP score in perforated PUD patients (n=100)

PULP Score	No. of patients	Percentage (%)
0-7	85	85
18-Aug	15	15

Table 6: Outcome of cases after surgical management (n=100)

Outcome & fate	Number of patients	Percentage (%)
Complete recovery	69	69
Not recovered/ Complications	24	24
Expired	7	7

Table 7: Correlation of PULP score with mortality of perforated PUD (n=100)

PULP score prediction of outcome	30 days mortality of the patients	
	Expired (n=7)	Not expired (n=93)
High risk (n=15)	6	9
Low risk (n=85)	1	84

DISCUSSION

According to the questionnaire, the history of all the 100 selected cases was taken, and the clinical examination was carried out meticulously. During the hospitalized period all appropriate investigations were done. The study demonstrates that the maximum number of patients (43.0%) was between 51-60 years of age group, and the mean age of the patient was 49.35 ± 11.7 years. Out of 100 cases, 78% were male and 22% were female. The male and female ratio was 3.54:1. Maximum (57%) patients came from urban, (36%) rural and (7%) urban non-slum areas. This was close to a study from Turkey, the male: female ratio was 6:1 to 7:1.^[16] Bharti et al (1996) 1996, in their study of peptic ulcer bleeding & perforation, reported that the maximum incidence of 48% of peptic ulcer perforation was found in the age group of 31-40 years.^[17] Hannan et al, in 2005, in their study of peptic bleeding & perforation, reported that the mean age was 41 years, and the highest incidence of 34% was in

the age group of 30-40 years. Maximum patients had duodenal perforation and the cause behind this was attributed to peptic ulcer disease. All these findings are consistent with our study result. A possible explanation for these findings may be that some behaviors, such as smoking and drinking alcohol, are more frequent among men, thus increasing the risk of PUD and perforation, especially in middle adult males. In another study forty-eight (57.1%) were males and females were 36 (42.9%) with a female ratio of 1.3:1. The patient's age ranged from 12 to 72 years with a median of 32.4 years. The peak incidence was in the 4th decade (31-40 years).^[5] The present study revealed that several predisposing factors contribute to the development of a worse condition of peptic ulcer disease, which leads to perforation. We found that (78%) of patients were smokers, sixty-four patients (64.0%) were current ulcerogenic drug users; (49.0%) patients were using NSAIDs and 15 patients were steroid users. A similar study



reported that the following seven factors were statistically significant in two to three models: diffuse pain, daily NSAID use, antiplatelet use, back pain, vomiting, platelet count, and haemoglobin concentration.^[3] In a study median duration of illness was 5.8 days. The majority of patients (69.0%) had no previous history of treatment for peptic ulcer disease. The use of non-steroidal anti-inflammatory drugs, alcohol and smoking was reported in 10.7%, 85.7% and 64.3% respectively. Eight (9.5%) patients were HIV positive.^[3] An increasing proportion of patients presenting with UGIB are older and a significant number of patients with UGIB consume NSAIDs and/or antiplatelet therapy to treat other medical comorbidities. Given these factors, UGIB continues to have a considerable impact concerning patient morbidity and mortality, as well as a health care resource utilization.^[10] There is a limitation of different scoring systems is that the use of NSAIDs and *H. pylori* etiology is not included in the prediction of outcomes. It may be due to changes in sociodemographic characteristics, lifestyle improvement and rationale use of PPI. The perforation frequency follows in part the geographic distribution patterns of *H. pylori*, with duodenal perforations being more common in regions with a predominant *H. pylori* etiology. The virulence of *H. pylori* may also contribute; as different strains appear to have variable pathogenic influences.^[2] Further, it is important to remember that PPU also may occur in children, where it is usually associated with *H. pylori*. In parallel to the drop in the prevalence of *H. pylori* in many western countries, a change from predominantly duodenal ulcers to gastric ulcers seen in the elderly is attributed to increased NSAID use in

this population. While an overall imbalance between the protective and the ulcerogenic factors is obvious in ulcer formation, it is unclear why some patients perforate and others do not. The ulcerogenic involves infection (*H. pylori*), mucosal barrier injury (e.g. use of drugs) and increased acid production.^[2] However, the exact risk estimates and contribution of each factor are still poorly understood. Only about a third of patients with PPU have a previous history of or current is known peptic ulcer at the time of diagnosis. Further, some patients develop very small (<5 mm) perforations without large mucosal defects, which suggests ulcer size to be unrelated to perforation risk, while other patients may develop large mucosal defects with perforation of several centimetres.^[2] In this study, the most common signs were tachycardia (100%), abdominal tenderness (100%), abdominal rigidity (100%), absence of vowel sound (86.2%), and obliteration of liver dullness (78.7%), dehydration (67.5%). The time lapse between the onset of symptoms and admission to the hospital varied from 4 hours to 4 days. Most of the patients (76.0%) were admitted after 24 hours. The findings are consistent with the results of other studies. The classic triad of sudden onset of abdominal pain, tachycardia and abdominal rigidity is the hallmark of perforated peptic ulcer. Early diagnosis, prompt resuscitation and urgent surgical intervention are essential to improve outcomes.^[4] Tachycardia and abdominal tenderness with rigidity are common clinical signs. Severe pain, the systemic inflammatory response from chemical peritonitis and fluid deficit either due to poor intake or vomiting or pyrexia leads to compensatory tachycardia. In patients who delay seeking medical attention,



hypotension ensues due to total body water deficit. If uninterrupted; this progresses to mental obtundation and acute kidney injury. This leads to a state where the patient becomes physiologically unfit for operative intervention which is necessary. Hence it is important to establish a prompt confirmatory diagnosis.^[1] Patients with PPU have a typical history of sudden onset of acute, sharp pain usually located in the epigastric area and sometimes with shoulder pain, indicating free air under the diaphragm. The typical patient with PPU is male with an average age of 48 years. He may have a history of peptic ulcer disease (PUD) (29%), or nonsteroidal anti-inflammatory drugs (NSAIDs) usage (20%). Vomiting and nausea are present in 50% of the cases.^[19] From a physical examination, common presenting symptoms were severe epigastric pain, vomiting and abdominal distension in 36 (100%), 22 (66.7%) and 10 (27.8%) patients respectively. Presenting features include signs of peritonitis were demonstrable in 30 (83.3%) patients with 8 (22.2%) of them presenting in shock (systolic blood pressure < 90mmHg).^[20] So all other study found correlates with the findings of this study. In this study, the PULP score was assessed according to the operational definition of optimal cut-off point 7, below this are considered low-risk patients. The table shows that 85% were 0-7 PULP scores and 15% were PULP scores of 8-18. Patients' condition after proper treatment, symptoms, degree of abnormalities or dependence on the daily physiological activity and the clinical outcome had evaluated and measured by follow up and close monitoring. The study shows that 69.0% of the patients recovered completely, but 24.0% of patients had developed complications. The mortality rate in this study was 7.0%. A

perforated peptic ulcer is associated with short-term mortality of up to 30% and is considered one of the most lethal surgical emergencies globally. Clinical prediction rules can identify patients at high risk of death, but with variable accuracy. Elderly patients with sepsis, presenting with delay to surgery have the highest mortality.^[7] Another study shows that the mortality rate is 11.1%. Surgical site infection is the most-commonest postoperative complication; frequency is 19.4%; while 4 patients died giving a mortality rate of 11.1%.^[20] Postoperative complications (morbidity) affected 55 (23.0%) of 239 patients. Some patients experienced more than one complication. The most common morbidities were respiratory infection (33.3%), sepsis (18.0%), and wound infection (12.5%). The average age of the morbidity group was significantly higher than the group without morbidity ($P < 0.001$); that is, as the age of the patients increased, the morbidity risk increased. The factors significantly related to complications were premonitory illness, HIV status, CD 4 count < 200 cells/ μl , treatment delay and acute perforation ($P < 0.001$). The mortality rate was high in patients who had aged ≥ 40 years, delayed presentation (>24 hrs), shock at admission (systolic BP < 90 mmHg), HIV positivity, low CD4 count (<200 cells/ μl), gastric ulcers, concomitant diseases and presence of complications.^[5] At present, clinical prediction rules are not routinely used in PPU patients in everyday clinical practice. Identification of PPU patients with a high risk of adverse outcomes following surgery is important for clinical decision-making. Accurate and early identification of high-risk surgical patients with perforated peptic ulcer (PPU) is important for triage and risk

stratification, e.g. timing and extent of pre-operative respiratory and circulatory stabilization, post-operative admission to a high dependency unit (HDU), the level and extent of monitoring, and inclusion in specific perioperative care protocols.^[15] The Peptic Ulcer Perforation (PULP) score – is comprised of eight variables and the score ranges from 0 to 18 points. In this study correlation of PULP score with mortality of perforated PUD was carried out. Among the 7 expired cases, the PULP score was correlated with 6 cases like high risk. In 93 cases of recovered, the PULP score was predicted in 84 cases as low risk. So the effectiveness of PULP has proven significant in the prediction of mortality in perforated PUD patients. The Sensitivity and Specificity of the Peptic Ulcer Perforation (PULP) score was 85.7% and 90.3% respectively. Similarly, the positive predictive value and accuracy rate for the same was 40.0% and 90.0% respectively. About 11 different scoring systems used to predict outcomes in PPU can be identified through the literature: the Boey score, the American Society of Anesthesiologists (ASA) score, the Sepsis score, the Charlson Comorbidity Index, the Mannheim Peritonitis Index (MPI), the Acute Physiology and Chronic Health Evaluation II (APACHE II), the Simplified Acute Physiology Score II (SAPS II), The Physiology and Operative Severity Score for the Enumeration of Mortality and Morbidity Physical Sub-score (POSSUM-phys score, the Mortality Probability Models II (MPM II), Peptic Ulcer Perforation (PULP) score, the Hacettepe score and the Jabalpur score.^[1] Among the most frequently used are the ASA classification, the Boey score, MPI and the more recently introduced PULP score. However, only the

Boey and PULP scores are specifically designed for the prediction of mortality in PPU patients.^[14] In a cohort, sensitivity, specificity, and the PPV of the individual values of the PULP score were 73%, 79%, and 52%. The 30-day mortality increased progressively with increasing score points, from 1% (1 point) to 100% (16 points).^[15] Morbidity is common after perforation. Pulmonary and wound infections are the most common postoperative infections. More recently a study comparing three scoring systems (American Society of Anesthesiologists (ASA), Boey and peptic ulcer perforation (PULP)) regarding the ability to predict mortality in PPU, found that the PULP score had an odds ratio (OR) of 18.6 and the ASA score had an OR of 11.6, both with an area under the curve (AUC) of 0.79. The Boey score had an OR of 5.0 and an AUC of 0.75.^[10] The PULP score may perform better than the ASA score because it includes predictors related to disease severity, including markers of the sepsis syndrome. Because the ASA score is based on the surgeon's subjective evaluation of the patient's disease severity and functional status, inter-observer variation may be an inherent problem. This may in turn affect the overall predictive performance of the ASA score in our study and may also affect its performance in different settings. To assess PULP's predictions of post PDU repair 30-day morbidity, ROC analysis shows that AUC was 72% at a cutoff value of ≥ 3 , with sensitivity and specificity of 64.71% and 74.63%, respectively.^[12]

Limitations of the study:

This study was not without limitations. The limitations of the studies were as follows; It was a single centre study. Only patients



admitted to Dhaka Medical College Hospital, Dhaka was taken for the study. So this will not reflect the overall picture of the country. A large scale study needs to be conducted to reach a definitive conclusion. Pre-existing use of NSAIDs cannot be correlated in this scoring system. Samples were taken by the purposive method in which questions of personal biases might arise. Surgery and preoperative assessment were done by various surgeons. The study was conducted in a tertiary care hospital which may not represent a primary or secondary centre.

CONCLUSIONS

Perforated peptic ulcer (PPU) is a surgical emergency and is associated with short-term mortality and morbidity. The diagnosis of perforated PUD poses a diagnostic challenge in most cases. The spillage of duodenal or gastric contents into the peritoneal cavity causing abdominal pain, shock, peritonitis, marked tenderness and decreased liver dullness offers little difficulty in the diagnosis of perforations. Delay in diagnosis and initiation of surgical treatment of perforated PUD has been reported to be associated with high morbidity and

mortality after surgery. Worldwide variation in demography, socioeconomic status, *Helicobacter pylori* prevalence and prescription drugs make an investigation into risk factors for PPU difficult. PPU presents as an acute abdominal condition, with localized or generalized peritonitis and a high risk of developing sepsis and death. Early diagnosis is essential but clinical signs can be obscured in the elderly, or the immunocompromised and thus delay diagnosis. Appropriate risk assessment and selection of therapeutic alternatives become important to address the risk for morbidity and mortality. In conclusion, our study demonstrates that the PULP score can be used to accurately predict 30-day mortality and morbidity in patients operated for PPU and that it performs better than another score. The prognostic predictors included in the PULP score can be readily identified prior to surgery. The PULP score can assist in the accurate and early identification of high-risk patients with PPU, and thus assist in risk stratification and triage. Considering easy availability and use in practice, the PULP score can be used with other diagnostic methods in the management of perforated PUD.

REFERENCES

1. Chung KT, Shelat VG. Perforated peptic ulcer - an update. *World J Gastrointest Surg.* 2017;9(1):1-12. doi:10.4240/wjgs.v9.i1.1
2. Kuo WT, Banerjee A, Kim PS, DeMarco Jr FJ, Levy JR, Facchini FR, et al. Pulmonary embolism response to fragmentation, embolectomy, and catheter thrombolysis (PERFECT): initial results from a prospective multicenter registry. *Chest.* 2015;148(3):667-73.
3. Burton AR, Fazalbhoy A, Macefield VG. Sympathetic Responses to Noxious Stimulation of Muscle and Skin. *Front Neurol.* 2016;7:109. doi:10.3389/fneur.2016.00109
4. Chan KS, Wang YL, Chan XW, Shelat VG. Outcomes of omental patch repair in large or giant perforated peptic ulcer are comparable to gastrectomy. *Eur J Trauma Emerg Surg.* 2021;47(6):1745-1752. doi: 10.1007/s00068-019-01237-8.
5. Mawalla B, Mshana SE, Chalya PL, Imirzalioglu C, Mahalu W. Predictors of surgical site infections among patients undergoing major surgery at Bugando Medical Centre in Northwestern



- Tanzania. *BMC Surg.* 2011;11:21. doi: 10.1186/1471-2482-11-21.
6. Zhong L, Hidalgo GE, Stromberg AJ, Khattar NH, Jett JR, Hirschowitz EA. Using protein microarray as a diagnostic assay for non-small cell lung cancer. *Am J Respir Crit Care Med.* 2005;172(10):1308-1314. doi:10.1164/rccm.200505-830OC
 7. Bhangu A, Søreide K, Di Saverio S, Assarsson JH, Drake FT. Acute appendicitis: modern understanding of pathogenesis, diagnosis, and management. *Lancet.* 2015;386(10000):1278-1287. doi: 10.1016/S0140-6736(15)00275-5.
 8. Møller P, Jacobsen NR, Folkmann JK, Danielsen PH, Mikkelsen L, Hemmingsen JG, et al. Role of oxidative damage in toxicity of particulates. *Free Radic Res.* 2010;44(1):1-46. doi: 10.3109/10715760903300691.
 9. Søreide K, Thorsen K, Søreide JA. Strategies to improve the outcome of emergency surgery for perforated peptic ulcer. *Br J Surg.* 2014;101(1):e51-64. doi: 10.1002/bjs.9368.
 10. Di Saverio S, Sibilio A, Giorgini E, Biscardi A, Villani S, Coccolini F, et al. The NOTA Study (Non Operative Treatment for Acute Appendicitis): prospective study on the efficacy and safety of antibiotics (amoxicillin and clavulanic acid) for treating patients with right lower quadrant abdominal pain and long-term follow-up of conservatively treated suspected appendicitis. *Ann Surg.* 2014;260(1):109-17. doi: 10.1097/SLA.0000000000000560.
 11. Menekse M. Computer science teacher professional development in the United States: a review of studies published between 2004 and 2014. *Computer Science Education.* 2015;25(4):325-50.
 12. Abdelkader K, Gerstmans H, Saafan A, Dishisha T, Briers Y. The Preclinical and Clinical Progress of Bacteriophages and Their Lytic Enzymes: The Parts are Easier than the Whole. *Viruses.* 2019;11(2):96. doi: 10.3390/v11020096.
 13. Mittal M, Kumar K, Behal S. Deep learning approaches for detecting DDoS attacks: a systematic review. *Soft comput.* 2022;1-37. doi:10.1007/s00500-021-06608-1
 14. Nichakankitti N, Athigakunagorn J. The accuracy of prognostic scoring systems for postoperative morbidity and mortality in patients with perforated peptic ulcers. *Int Surg J.* 2016;3(1):286-90.
 15. Møller MH, Adamsen S, Thomsen RW, Møller AM; Peptic Ulcer Perforation (PULP) trial group. Multicentre trial of a perioperative protocol to reduce mortality in patients with peptic ulcer perforation. *Br J Surg.* 2011;98(6):802-10. doi: 10.1002/bjs.7429.
 16. Bas DC, Rogers DM, Jensen JH. Very fast prediction and rationalization of pKa values for protein-ligand complexes. *Proteins.* 2008;73(3):765-83. doi: 10.1002/prot.22102.
 17. Bharti AK, Olson MO, Kufe DW, Rubin EH. Identification of a nucleolin binding site in human topoisomerase I. *J Biol Chem.* 1996;271(4):1993-7. doi: 10.1074/jbc.271.4.1993.
 18. Hsu G, Hannan MT. Identities, genres, and organizational forms. *Organization science.* 2005;16(5):474-90.
 19. Bertleff MJ, Lange JF. Laparoscopic correction of perforated peptic ulcer: first choice? A review of the literature. *Surgical endoscopy.* 2010;24(6):1231-9.
 20. Dodiya-Manuel A, Jebbin NJ, Igwe PO. Abdominal injuries in the university of a Port Harcourt teaching hospital. *Nigerian Journal of surgery.* 2015;21(1):18-20.
 21. Kuo WT, Banerjee A, Kim PS, DeMarco FJ Jr, Levy JR, Facchini FR, et al. Pulmonary Embolism Response to Fragmentation, Embolectomy, and Catheter Thrombolysis (PERFECT): Initial Results From a Prospective Multicenter Registry. *Chest.* 2015;148(3):667-673. doi: 10.1378/chest.15-0119.
- Source of Support: Nil, Conflict of Interest: None declared