

Predictive Accuracy of Pulp Versus Boey in Laparotomy Patients with Perforated Peptic Ulcerations. Cohort Study

Novath Ngowi^{1*}, Larry Akoko¹, and Ibrahim Mkoma²

¹Department of Surgery, Muhimbili University of Health and Allied Sciences (MUHAS), Dar es Salaam, Tanzania

²Department of Surgery, Muhimbili National Hospital (MNH), Dar es Salaam, Tanzania

*Corresponding author:

Novath Ngowi, Department of Surgery, Muhimbili University of Health and Allied Sciences (MUHAS), Dar es Salaam, Tanzania.

ABSTRACT

Background: Perforated peptic ulcers are common in emergency surgical patients worldwide, causing significant post-operative morbidity and mortality. Studying patient outcomes and scoring ease is crucial for intervention planning in limited resources and intensive care services for high-risk patients.

Objective: Study aimed at comparing the predictive accuracy of PULP versus Boey in laparotomy patients with perforated peptic ulcerations.

Methodology: Combine retrospective and prospective cohort study analyzed patients with perforated peptic ulcers treated by explorative laparotomy at Muhimbili National Hospital in Tanzania. Demographics, risk scoring parameters, and adverse outcomes were collected and presented as frequency and percentages. Predictors of mortality were analyzed using a bivariate regression model. Predictive accuracy was identified and compared using receiver operating characteristic curves.

Results: The study recruited 100 patients aged 18 years and older, with a 6:1 male-to-female ratio. The median hospital admission time from onset of first symptom was 72 hours. During 30-days of follow-up after surgery, 49 (49%) patients developed complications, among them 13 (13%) died. Significant predictors of 30-day mortality found to be sex, pre-operative shock, comorbidities, serum creatinine, and ASA score. The PULP predictive score had good predictive ability, with an AUROC of 0.7505, sensitivity of 57.14% and specificity of 78.43%, compared to Boey's score of 0.6629.

Conclusion: Peptic ulcer perforation is a common clinical problem with poor post-operative prognosis. The PULP score is more accurate than BOEY in predicting mortality in perforated peptic ulcers, aiding in allocating resources for individual patient care.

Keywords: Perforated Peptic Ulcer Disease, Complications, Mortality Predictive Score.

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Introduction

Background

Peptic ulcer Disease (PUD) affects over 4 million people each year around the world, with a lifetime risk of about 5-10% and an annual incidence of around 0.1 percent to 0.3 percent [1,2]. There are significant mortality and morbidity after a perforated peptic ulcer (PPU), and fatality rates of 25–30% have been observed in published research [3].

Perforated PUD has been reported to vary across high income countries (HICs) and low- and middle-income countries (LMICs), such as Tanzania, based on socio-demographic and environmental factors. Helicobacter pylori infection is three- to four-fold higher among patients with PUD [4]. While 50% are infected with H. pylori globally, 80% of infected individuals are in Low- and Middle-income countries (LMICs) due to poor

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hygienic conditions [5]. *Helicobacter pylori* colonization of the antral mucosa has been shown to be the major cause of gastric and duodenal ulcers, accounting for 70% to 90% of gastric and 90% of duodenal ulcers [6]. The epidemiology of the disease is further modified by an increase in the use of NSAIDs, and the high prevalence of alcohol and smoking misuse [7,8].

Patients with PUD can develop various complications including bleeding from the ulcer, gastric outflow obstruction, hour glass appearance of the stomach and a perforation (PPU) [9]. Perforated peptic ulcer (PPU) are the most common ulcer surgical emergencies with bleeding now controlled by either endoscopists or interventional radiologists. When the serosa lining gastric or duodenal wall is eroded, a perforation occurs causing acute pain from peritonitis that can become generalized, and sepsis develop which can lead to multiple organ failure and death [10].

Peptic ulcer perforation patients usually experience acute and intense epigastric pain. PPU describe by the typical triad of rapid onset abdominal pain second tachycardia, then abdominal rigidity [11]. Except when the patient is unstable for surgery, a perforated peptic ulcer is almost always a reason for surgery on emergence or urgent basis. Due to nonspecific signs and symptoms, as well as delays in diagnosis and investigations upon admission to the health facility, have the potential to aggravate symptoms and deteriorate the clinical condition, with a negative outcome. Around 30% of patients experience post-operative complications include surgical site infection, leakage presented as entero-cutaneous fistula and intra-abdominal collection, gaped wound, and peritonitis [12].

There are number of scoring systems to predict post-operative outcome among patient with PPU. Among them, the American Society of Anesthesiologists (ASA) score, with an accuracy range of 73% to 91%, is the most widely used surgical prognostic prediction rule worldwide. Many have not demonstrated their utility on a broad scale, either because they are limited in their applicability or because the number of parameters they evaluate makes scoring them too difficult [13]. However, only the Boey score with the accuracy range from 63% to 85% and PULP scores with accuracy range 72% to 83% are specifically designed for the prediction of mortality in PPU patients [14]. The Boey's and PULP score incorporates straightforward characteristics that are easily scored at the time of admission to our setting, and has superior clinical utility compared to the rest of score for perforated PUD.

The majority of patients who visit to our center treated by simple closure of the perforation followed by *Helicobacter pylori* eradication. Although, significant postoperative complications have been reported, to streamline management of PPU patients and improve results, classification of patients into distinct categories depending on the likelihood of morbidity and mortality is critical. To address the risk of morbidity and death, proper risk assessment and therapeutic option selection become critical.

Methods and Material

Study Design

The study was am bidirectional cohort study among patients treated with PPU at Muhimbili National Hospital from January 2021 to December 2022

Study Population

All patients who presented with acute abdomen and were operated by laparotomy during the period under review.

Study Sample

All patients with a postoperative diagnosis of a perforated viscus were included.

Sample Size

The sample size calculation is given by the formula:

$$n = \frac{Z\alpha^2 \times Sn (100-Sn)}{L^2 \times \text{Prevalence}} \quad [15]$$

Where

$Z\alpha$ = Standard table value for 95% CI = 1.96

Sn = Sensitivity

L = 5% of Life time Prevalence of perforation for PUD

Based on a previous study by [32] 72 % is the sensitivity for mortality in PULP score (≥ 8) and lifetime prevalence of perforation in peptic ulcer patients is [12] 5%, 91 patients.

Therefore, $n = 1.96^2 \times 72 \times (100-72)/4.132 \times 5 = 90$

A sample size of 100 people was able to be recruited

Study Variables

Dependent Variables

Primary Outcome: 30-day mortality

Secondary Outcome: Surgical Site Infection, Leak with intra-abdominal collection or entero-cutaneous fistula, burst abdomen. Grade of complication as measured by Clevian-Dindo.

Independent Variables of the Patients

These include clinical and demographic data (age, sex, presenting symptoms, pulse rate, blood pressure) Boey indicators (pre-operative shock, presence of comorbidity and duration of perforation >24hours) and PULP score indicators (Age >65 Co-morbid (AIDS or cancer, liver disease,) Steroids use, Shock on admission, Time from admission to surgery >24 hours, Serum creatinine >1.4mg/dl (mg/dl) and ASA score) as described in the review.

Measurement

The time start from the onset of abdominal pain to presentation to the emergency room was measured in hours to determine the duration of perforation. Prior to surgery, vital signs (temperature in degrees Celsius, pulse rate in beats per minute, and blood pressure in mmHg) were recorded in their measured SI units on patient treatment charts. Shock was regarded as pretreatment systolic blood pressure of less than 90mmHg. All these variables are routinely collected in the emergency admission chart. Age in years, sex as either male or female, Presence of co-morbidities (chronic obstructive pulmonary disease, heart failure, and active cancer), and any liver disease, use of steroids, serum creatinine and HIV infection were checked from medical records. ASA score was obtained from the patient's anesthetic chart.

Recruitments

All patients at Muhimbili National Hospital who underwent surgery for perforated peptic ulcers during the study period were enrolled as subjects to participate in a study. Trained research assistants were fully committed to get consent from patients before collecting data during admission as well as through cellphone for the patients who were already discharged from hospital, and participants were educated about their rights to participate.

Data Collection

An administered structured checklist was used to gather important study variables. For those patients who failed to provide consent due to their medical conditions, relatives/next of kin was asked so. For the patients who were already discharged from hospital (retrospective group) were communicated by phone and informed on the study, able to give consent and provide the information. A study checklist was used to collect laboratory results from Jeeva system, intraoperative findings and possible post-operative complication diagnosed to patients from files and treatment chart. Patient was classified as per PULP and Boey score classification before the operation and followed for 30 days for post-operative desirable outcome.

Data Management and Analysis

For each patient, three clinical scores were computed: Boey, calculated by presence of shock, delay from admission to surgery > 24 h, and ASA, based on patients' pre-existing co-morbidity, considers the present clinical condition at admission and is graded 1–5 increasingly indicating a healthy person, mild systemic disease, severe systemic disease, severe systemic disease that is a constant threat to life and a moribund person not expected to survive without operation. PULP is a seven-variable score (range = 0–18), based on age > 65 years, liver failure, AIDS/active cancer, concomitant use of steroids, shock on admission, time from admission to surgery > 24 h, serum creatinine > 1.4mg/dl (130μmol/l) and ASA score.

Statistical analyses were done using statistical software package STATA version 17. Descriptive statistics summarized participants' demographic and clinical characteristics along with postsurgical complications, they were presented as frequency and proportions; mean (standard deviation [SD], and median (interquartile range, [IQR]). Associations between two or more categorical variables were assessed using Chi-square and Fisher exact tests. A two-sided P value < 0.05 was considered statistically significant. Continuous variables were compared using the independent sample t test and Mann-Whitney U-test. Objectives were analyzed as follows.

Objective 1

The clinical demography of patients with perforated peptic ulcer disease described by frequency distribution in percentage presented with pie chart and bar chart. Age categorized as per predictive score

Objective 2

The classification of post-operative complications according to modified Clavien-Dindo grading system presented in frequency table and percentage distribution by bar chart.

Objective 3

The predictors of mortality among patients with perforated PUD from Boey and PULP score variables expressed as frequency and percentage and analyzed based on bivariate liner regression model.

Objective 4 and 5

The accuracy of Boey and PULP for predicting post-operative complication was analyzed by ROC curves summarized in a visually comprehensive way. Hence, the sensitivity and specificity values of these scores were computed.

Objective 6

Computed sensitivity and specificity values of the Boey and PULP score calculated from a receiver operating characteristic (ROC) curve were compared.

Results

Participant Selection

In total, 684 patients had undergone an emergency laparotomy from which 547 did not have viscous perforation and hence excluded. Of the remaining 137 with viscous perforation, another 30 were excluded due to perforation of non-duodenal small or large bowel not related to peptic ulceration. Another 7 had traumatic or malignant perforation of the stomach hence excluded. This left 100 patients who met the inclusion criteria and are hence further analyzed as per study objectives [Figure 1].

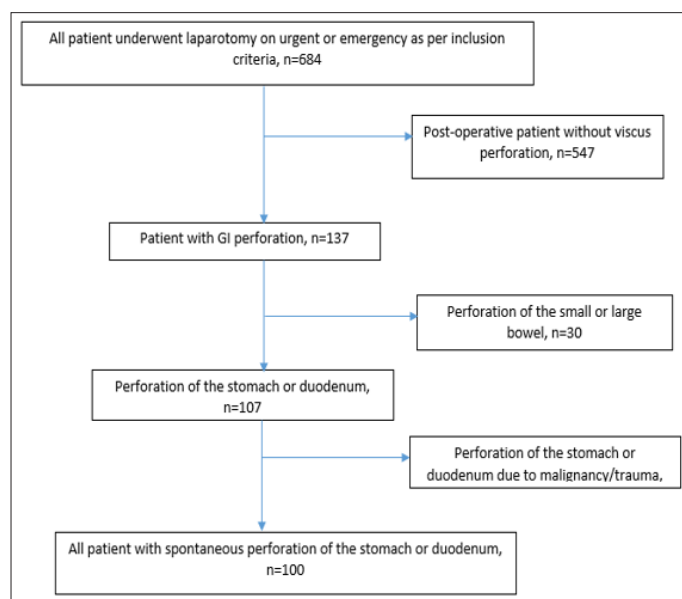


Figure 1: Flow chart describing the recruitment process

Demographic Characteristics

Table 1 comprise with clinico-demographic characteristic of the patients participated in the study where majority of patients who underwent emergency or emergent surgery for perforated peptic ulcers (gastric and duodenal) were male 85 (85%) giving a male to female ration of 6:1, most of participants, 91 (91%) were under the age of 65 years and had a median age of 38 years (24, 52). The median time (IQR) for hospital admission from the time when patients experienced first symptom due perforated peptic

ulcer disease were 72 hours (25, 119) where majority of patient 88 (88%) arrival to the hospital more than 24 hours. Twenty-three patient (23%) were having comorbidities out which cardiovascular diseases were the leading 10 (10%), followed by 5 (5%) presented with malignancy. Regarding clinical findings of the patients on arrival to the hospital 14 (14%) had shock presented with Systolic blood pressure of <100 mmHg and heart rate of below 90beats/min and 36 (36%) presented with serum creatinine above 1.4 mg/dl.

Table 1: Clinical-demographic characteristics among patient with perforated peptic ulcer disease treated by repair at Muhimbili National Hospital 2021 to 2022

Variables	Frequency (%)
Age (Median + IQR)	38 (24, 52)
>65 years	9 (9%)
≤65 years	91 (91%)
Sex	
Male	85 (85%)
Female	15 (15%)
Clinical presentation	
Fever	35 (35%)
Decrease urine output	14 (14%)
Time from perforation to admission	
≤ 24 hours	12 (12%)
>24 hours	88 (88%)
Pre-op Systolic BP	
< 90 mmHg	14 (14%)
≥90 mmHg	86 (86%)
Comorbidities	
Yes	23 (23%)
No	77 (77%)
Type of comorbidity	
CVD	10 (10%)
DM	2 (2%)
HIV	2 (2%)
Malignancy	5 (5%)
COPD	4 (4%)
Serum creatinine	
<1.4 mg/dl	64 (64%)
≥ 1.4 mg/dl	36 (36%)
ASA Score	
I	12 (23.5%)
II	29 (56.9%)
III	9 (17.7%)
IV	1 (2.0%)

Post-operative Complications among Patients with Perforated Peptic Ulcers

Patient were followed up to 30 days post-operative and the patient who discharged home before end of follow-up days were

followed at the surgical clinic and others were contacted through mobile phone to document their progress information. For those who had serious complication were diagnosed as shown in Figure 2, and treated accordingly. Out of 100 patients 49 (49%) were having complications where majority 16 (33%) and 15 (31%) had surgical site infection and peritonitis respectively and 13 (31%) patients died.

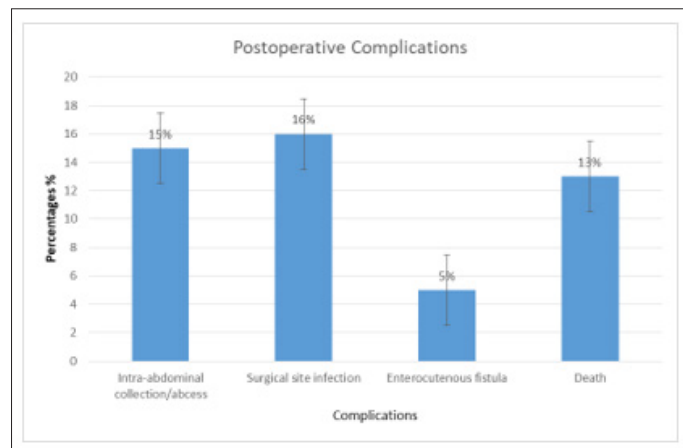


Figure 2: Complications occurring among emergence laparotomy for patients with perforated peptic ulcer diseases

The severity of complications was graded based on modified Clavien Dindo into low grade (I-II) and High Grade (III-V). Severe complications were categorized to a high grade with preponderance score grade III-V as shown in figure 1. The leading category of complication experienced by patient was noted high grade with Clavien Dindo grade IIIB 21 (21%).

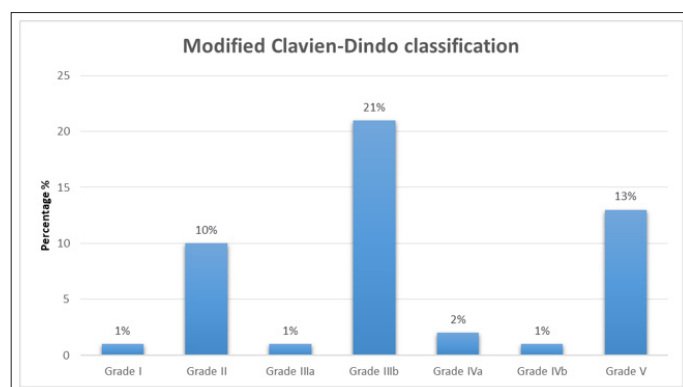


Figure 3: Modified Clavien-Dindo Classification of complications among patients with perforated peptic ulcers at MNH 2021-2022

Predictors of Mortality among Patients with Perforated PUD at MNH

Table 2, below depicts the characteristics of PDU patients by 30-day mortality for categorical and continuous variables. The data reveals that sex, pre-operative systolic blood pressure, comorbidities, serum creatinine and ASA score, were significantly associated with 30-day mortality.

Table 2: Predictors of mortality among patients with perforated PUD

Variables	Alive n (%)	Dead n (%)	p-value
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Age (Median + IQR)			
≤65 years	81 (89%)	10 (11%)	0.057
>65 years	6 (67%)	3 (33%)	
Sex			
Male	77 (91%)	8 (9%)	0.011
Female	10 (67%)	5 (33)	
Clinical presentation			
Fever Yes	30 (86%)	5 (14%)	0.779
No	57 (88%)	8 (12%)	
Decrease urine output Yes	12 (86%)	2 (14%)	0.877
No	75 (87%)	11 (13%)	
Time from perforation to admission			
≤ 24 hours	11 (92%)	1 (8%)	0.608
>24 hours	76 (86%)	12 (14%)	
Pre-op Systolic BP			
< 90 mmHg	9 (64%)	5 (36%)	0.006
≥90 mmHg	78 (90%)	8 (10%)	
Comorbidities			
Yes	20 (74%)	7 (26%)	0.019
No	67 (92%)	6 (8%)	
Serum creatinine			
<1.4 mg/dl	61 (95%)	3 (5%)	0.001
≥ 1.4 mg/dl	26 (72%)	10 (28%)	
ASA Score			
I	17 (100%)	0 (0%)	0.001
II	44 (96%)	2 (4%)	
III	21 (75%)	7 (25%)	
IV	5 (56%)	4 (44%)	

Predictive Accuracy of the BOEY, PULP and ASA Score on Postoperative Mortality in Patients with Perforated Peptic Ulcer at MNH.

Table 3 shows the prevalence of the patient with complication as predicted by Boey with respective their risk score, Mortality was attributed to higher scores with mortality of 3 (50%) as high-risk patient who scored 3 as shown in the table.

Table 3: Predictive Boey's scores and Outcome (number of patients/%)

Boey's score	Risk of mortality	Alive, n (%)	Died, n (%)	p-value
0	0%	2 (100%)	0 (0%)	0.011
1	10%	58 (93.5%)	4 (6.5%)	
2	45.5%	24 (80%)	6 (20%)	
3	100%	3 (50%)	3 (50%)	

Table 5 shows the prevalence of the patient with complication as predicted by PULP with respective their risk score, Mortality

was attributed to higher scores with mortality of 4 (44%) as high-risk patients who scored 8-18 as shown in the table below.

Table 4: Predictive PULP scores and Outcome (number of patients/%)

PULP score	Risk of mortality	Alive, n (%)	Died, n (%)	p-value
Low risk (0-7)	≤25%	82 (90%)	9 (10%)	0.003
High risk (8-18)	>25	5 (56%)	4 (44%)	

Mortality: PULP Score 0-7: low risk ≤25%, score 8-18: high risk >25

During follow-up of patients 30 days post-operative, participant who developed complications were recorded. In order to assess the predictive accuracy of Boey score of post PDU repair 30-day mortality, ROC analysis was carried out and showed that AUC was 0.6629 (0.572-0.753, 95% CI, p <0.003) at cutoff value of ≥2 (Figure 4), with sensitivity and specificity of 51.02% and 78.43%, respectively.

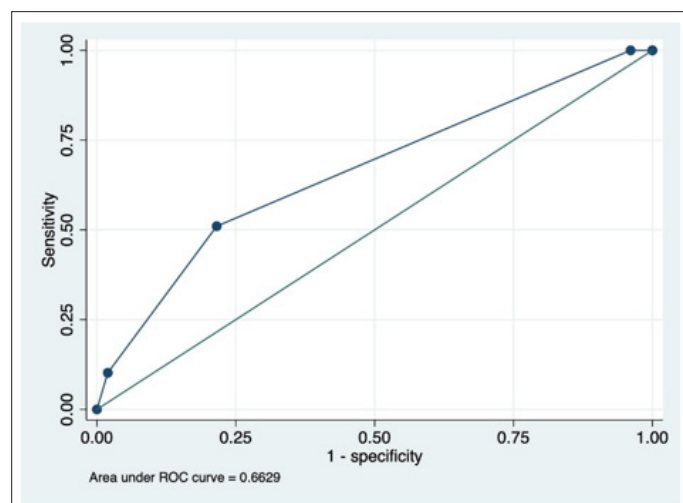


Figure 4: Receiver operating characteristics curve (ROC) of Boey Score

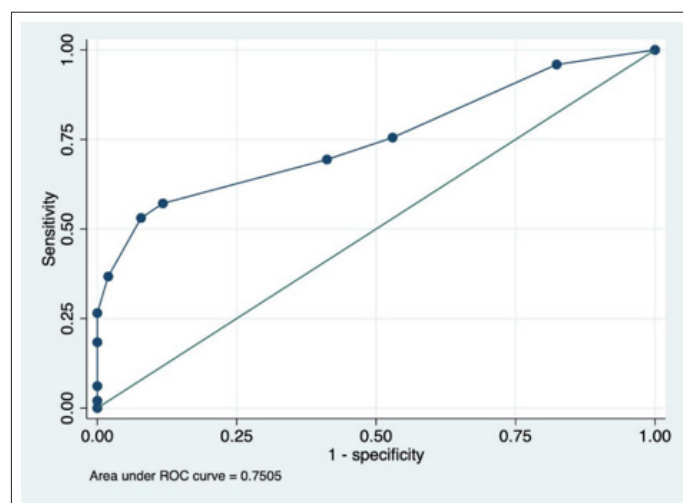


Figure 5: Receiver operating characteristics curve (ROC) of PULP Score

Predictive accuracy of PULP score was assessed and ROC analysis was carried out as shown in Figure 5 and show that AUROC 0.7505 (0.65486-0.84614, 95% CI, p <0.000) has sensitivity of 57.14% and specificity of 78.43%.

Compare the Predictive Accuracy of the PULP and BOEY Scores on Postoperative Mortality and Morbidity in Patients with Perforated Peptic Ulcers at MNH.

PULP's accuracy indices were compared with Boey (Table 5) using ROC analysis. Table 5 depicts that PULP had largest

AUROC 0.750 (0.654-0.846), while Boey exhibited slightly less AUROC 0.662 (0.572-0.753). The table also shows that PULP has highest sensitivity of 57.14% (42.21% to 71.18%) at cutoff value ≥ 4 and specificity 88.24% (76.13% to 95.56%) with Positive predictive value and Negative predictive value 82.35% and 68.18% respectively. Boey's score has lower sensitivity and specificity compared to PULP of 51.02% (36.3% to 65.5%) at cutoff value ≥ 2 and specificity 78.43% (64.6% to 88.7%) with Positive predictive value and Negative predictive value 69.44% and 62.5% respectively.

Table 5: Accuracy of the PULP versus BOEY scores on postoperative mortality

Predictive score	Accuracy		Sensitivity (95% CI)	Specificity (95% CI)	PPV	NPV	p-value
	AUROC (95% CI)	Cutoff					
PULP Score	0.750 (0.654-0.846)	≥ 4	57.14% (42.2 -71.1)	88.24% (76.1-95.5)	82.35%	68.18%	0.000
Boey Score	0.662 (0.572-0.753)	≥ 2	51.02% (36.3-65.5)	78.43% (64.6 - 88.7)	69.44%	62.50%	0.003

AUC Area under the receiver operating characteristic curve, PPV Positive predictive value, NPV Negative predictive value

Discussion

A severe consequence of peptic ulcers is gastric or duodenal perforation. There is a substantial risk of death and morbidity in patients with stomach perforation, which is frequently accompanied by acute abdominal symptoms. Due to the development of proton pump inhibitors and the treatment for H. pylori, the role of surgery in the treatment of peptic ulcer disease has also shown a declining trend, though the proportion of patients who need emergency surgery for complex diseases remains constant. To plan and manage the level of perioperative monitoring and treatment, early and precise identification of patients with a higher risk of a negative result is required. Therefore, in a resource-constrained situation like ours, a clinical scoring system that can accurately anticipate the unfavorable outcome is of utmost relevance.

This study recruited 100 patients diagnosed with gastric or duodenal perforation from January 2021 to December 2020 where majority were male 85 (85%) aged more than 45 years (36%) with the median age was 38 years (24, 52). This result is similar with findings of the study done in Addis Ababa Ethiopia (June 1, 2018 to May 31, 2019) in four teaching hospitals involved 97 patients operated, with a male to female ratio of 6:5:1. [16]. Also, the findings are similar to study was conducted on patients presenting to the hospitals attached to Bangalore Medical College and Research Institute, Bengaluru found that peptic ulcer perforation was more common in the third and fourth decade and the mean age was found to be 43.5 which is also comparable to other studies [15,17,18].

The typical triad of peptic ulcer perforation includes sudden-onset abdominal discomfort, tachycardia, and muscular tenderness. This study revealed 98% and 71%, respectively, abdominal pain and vomiting were the most frequent symptoms experienced by patients with perforated peptic ulcer disease enrolled. The average mean time of stay after the onset of the first symptom of perforated peptic ulcer illness was 72 hours (25, 119), with the

majority of patients—88 (88%)—arriving at the hospital after more than 24 hours. However, this pattern is different compared to the PULP retrospective cohort study of PPU patients operated at national university in Singapore from Jan 2008 to Dec 2012 where 61.7 percent of patients arrive at the hospital within 24 hours of the commencement of their acute abdominal pain. The study reported that, their healthcare system is unusual in that a patient can get to the hospital in 20 to 30 minutes depending on necessity [19].

This study revealed that 30 (30%) of participants had comorbidities out which cardiovascular diseases were the leading 10 (10%), and 7 (7%) presented with other comorbidities include epilepsy, elephantiasis and obstructive urological symptoms. Regarding clinical findings and laboratory workup of the patients on arrival to the hospital, pre-operatively 14 (14%) had shock presented with Systolic blood pressure of <100 mmHg and heart rate of below 90beats/min and 36 (36%) presented with serum creatinine above 1.4 mg/dl. These findings are nearly similar to the study conducted at Nepal from October2014 to January 2016 for 16 months' duration where 26% of patients had comorbidities out of which diabetes mellitus (DM) were most common followed by cardiac diseases [20].

During the study period, patient was followed up to 30 days post-operative for clinical assessment, those who had complication were diagnosed and 49 (49%) had complications, majority 16 (33%) and 15 (31%) had surgical site infection and peritonitis respectively and mortality of 13 (31%) patients. These findings are not similar with findings in a prospective cohort study conducted in Ethiopia from 2018 to 2019 where major problems post PPU repair reported are wound infection, post-operative collection, pneumonia, patch failure were found in 16 (16.5 percent) of the patient's Ninety-six percent (96.6%) were discharged, while three percent (3.1%) died. Also, these findings are differed with retrospective chart review in Qatar (January 2014–December 2017) included 157 patients with

PPU and Post PDU repair 30-day morbidity and mortality were 10.5% (16 morbidities) and 0.7% (1 mortality) respectively. Most patients (92%) had laparoscopic repair of PDU, 6% had laparoscopic converted to open repair and 2% had open repair [8]. This discrepancy in post-operative complications findings was attributed to patients frequently presenting late with severe generalized peritonitis in developing nations, such as Africa, and more recently, laparoscopic repair of perforated peptic ulcer has also been reported, which is thought to contribute to a reduction in postoperative morbidity and mortality [21-23].

30-day morbidity was substantially correlated with sex, shock at admission, preoperative comorbidities, ASA score and elevated serum creatinine level. Patients were grouped according to several grading methods, Boey, and PULP strongly predicted 30-day post-repair morbidity. These findings are closely similar to the nationwide cohort study was approved by the Danish Data Protection Agency (no 2009-41-3905) between 1 February 2003 and 31 August 2009 revealed the associations of each candidate variable with 30-day mortality within the developed adjusted logistic regression model are ASA score ≥ 3 , age older than 65 years, co-morbid liver cirrhosis, and elevated serum creatinine had the highest prognostic impact [11].

The predictive accuracy of PULP and Boey score was assessed and ROC analysis was carried out that AUROC of PULP 0.7505 (0.65486-0.84614, 95% CI, $p < 0.000$) has sensitivity of 57.14% (42.21% to 71.18%) at cutoff value ≥ 4 and specificity 88.24% and Boey score was 0.6629 (0.572-0.753, 95% CI, $p < 0.003$) at cutoff value of ≥ 2 with sensitivity and specificity of 51.02% and 78.43%, respectively. PULP's accuracy indices were compared with Boey and found that PULP had largest AUC (75%, $P = 0.000$), while Boey exhibited slightly less AUCs (66%, $P = 0.003$). These findings are similar with observational study conducted at BIR hospital, NAMS, Nepal for a period of 16 months from October 2014 - January 2016, the study revealed that Boey score, ASA, MPI, and PULP scoring all were capable of predicting poor surgical outcomes, especially Boey score, MPI scoring and PULP score was better than ASA in predicting postoperative mortality. Boey score with scores ≥ 2 had sensitivity of 78% and specificity of 78% while PULP score of ≥ 7 had sensitivity of 82 % and specificity of 86 %.

Limitations of the Study

1. Single-Center Study: The study was conducted at Muhimbili National Hospital, this may limit the generalizability of the findings to other settings or populations. The results may not be representative of the broader patient population with perforated peptic ulceration from other centers.
2. Confounding Factors: The study inadequately accounts for potential confounding factors that can influence postoperative outcomes, such nutritional status, or surgeon experience as they are not indicators of neither PULP nor BOEY mortality predictive score. Failure to control for these factors could impact outcome hence the predictive accuracy of the scoring systems
3. Lack of Long-Term Follow-Up: The study may have a limited follow-up period, focusing only on short-term outcomes occurred within 30 days of follow-up. This could

restrict the assessment of the predictive accuracy of the scoring systems for long-term outcomes, such as recurrence rates or mortality beyond the immediate postoperative period.

Conclusion and Recommendation

Conclusion

When predicting mortality in patients with gastric perforation, the PULP scoring system performs better with sensitivity 57.14% and specificity 88.24% than the BOEY scoring system with sensitivity 51.02% and specificity 78.43%. The use of mortality predictive score can be recommended as the initial reference, this can have a number of effects in a setting with limited resources like ours, and including helping us identify high-risk patients before surgery and enabling us to make better use of our facilities. It can also be used to explain the risk of unfavorable outcomes to patients and care givers, improve preoperative care in the ICU, and provide extensive postoperative care for better outcomes overall.

Recommendations

1. The PULP score can be advised as the main reference for the aim of predicting death in patients with peptic ulcer perforation. The score can be used to forecast both mortality and morbidity.
2. To confirm and reinforce the findings of this study, additional research with a prospective cohort of peptic ulcer perforation patients, primary data, and a bigger sample size is required.

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