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Prediction of Mortality in Patients with Secondary Peritonitis Using POMPP Versus Pulp Scoring System

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Abstract **Background:** Secondary peritonitis is a common surgical emergency in low- and middle-income countries, with mortality rates ranging from 15 to 30%. **Objective:** To compare the predictive accuracy of the Peritonitis Mortality Prediction (POMPP) score and the Peptic Ulcer Perforation (PULP) score in patients with secondary peritonitis. **Methods:** This cross-sectional validation study was conducted at the North Surgical Ward, Department of Surgery, Mayo Hospital, Lahore, from January 2025 to June 2025, included 159 patients aged 18-75 years presenting with secondary peritonitis. POMPP and PULP scores were calculated for each patient. Patients were followed until discharge or death and mortality outcomes were recorded. **Results:** The mean age of patients was 44.7±13.2 years, with a male-to-female ratio of 1.9:1. The most frequent cause of peritonitis was perforated duodenal ulcer (39.6%), followed by appendicular perforation (21.4%) and typhoid ileal perforation (18.2%). The overall mortality rate was 21.4% (34/159). The POMPP score demonstrated higher sensitivity (85.3%), specificity (81.6%), NPV (93.4%) and overall diagnostic accuracy (82.9%) compared to the PULP score, which showed sensitivity of 72.1%, specificity of 76.4%, NPV of 87.2% and accuracy of 75.5%. **Conclusion:** Both POMPP and PULP scores are effective in predicting mortality in patients with secondary peritonitis; however, POMPP outperformed PULP in this study and may be preferred as a simple, reliable bedside tool in resource-limited settings.

Key Words Secondary Peritonitis, POMPP Score, PULP Score, Mortality Prediction

INTRODUCTION

Gastrointestinal tract perforation is one of the common surgical emergencies all over the world [1]. Secondary peritonitis is caused by contamination of the peritoneal cavity. It continues to be a serious disease with high morbidity and mortality. Secondary peritonitis is one of the most common fatal surgical emergencies [2,3]. The mortality rate of perforated peptic ulcer is still high particularly for aged patients and all the existing scoring systems to predict mortality are complicated or based on history taking which is not always reliable for elderly patients [4]. In a study, 42% of gastrointestinal perforation were due to peptic ulcer, 22% due to small bowel perforations (18% ileal and 4% jejunal), 14% due to trauma and 22% due to miscellaneous causes. Morbidity is common after gastrointestinal perforation and it ranges from 17-63% (average = 40%) whereas mortality ranges from 6-14% (average 10%) [5]. The causes, frequency and consequences of acute abdominal surgical emergencies due to peritonitis are different [6]. The mortality rate is about 20% even in well-equipped places. The outcome can be improved by rapid surgical intervention and intensive care of the patient. Many scoring systems were developed to identify high-risk patients who may need rapid intervention or intensive care [3]. Peritonitis continues to be one of the major infectious problems confronting a surgeon. Mannheim Peritonitis Index (MPI), Physiological and Operative Severity Score for enumeration of Mortality (POSSUM) and Morbidity and sepsis score of Stoner and Elebute have been devised for risk assessment and for prediction of postoperative outcome [7].

POMPP score is an easy and valid scoring system for peptic ulcer perforation. Early detection of high-risk peptic perforation cases allows other supportive treatment modalities apart from surgery, which can decrease the mortality. However, this score is not valid in perforation due to causes other than peptic ulcer [5]. Some scoring systems such as Boey, Peptic Ulcer Perforation Score (PULP) and ASA (American Society of Anesthesiologists) have already been developed for prediction of mortality at perforated peptic ulcer. PULP score appears to have the greatest predictability of mortality; however it is impractical with its complexity [8,9]. Balouch *et al.* [10], reported that in patients with secondary peritonitis, POMPP can help to predict mortality, showed very low sensitivity i.e., 33.3% while specificity was 95.9% and overall accuracy is 89.1%. While in another study done by Khan *et al.* [11], it was reported that in patients with secondary peritonitis, PULP can help to predict mortality showed 62.5% sensitivity while 87.3% specificity. While Aladel *et al.* [12], compared POMPP and PULP for prognosis of patients with peptic ulcer perforation and reported that the sensitivity was same for both methods i.e., 72.7% while specificity was 97.7% for POMPP but 100% for PULP.

The rationale for this study is to address a notable gap in the existing literature concerning the predictive accuracy of scoring systems, specifically the POMPP and PULP scoring systems, for mortality in patients with secondary peritonitis. While these scoring systems have been utilized for outcome prediction, literature reveals a range of accuracy rates and there is a conspicuous absence of local evidence in this regard. Such findings hold significant clinical implications, as the ability to accurately predict outcomes can guide treatment protocols and ultimately improve patient care. Through this research, we aspire to contribute to the enhancement of clinical practice by providing evidence-based insights that can lead to better patient outcomes and reduced complications associated with secondary peritonitis.

Objective

To determine the predictive accuracy of POMPP and PULP scoring system for prediction of mortality in patients with secondary peritonitis taking actual mortality as gold standard.

METHODS

This Cross-sectional (validation) study was conducted at North Surgical Ward, Department of Surgery, Mayo Hospital, Lahore from January 2025 to June 2025. A sample size of 159 patients is estimated by using 95% confidence level, with prevalence of morbidity 34.7% and specificity of 87.3% and sensitivity of PULP i.e., 62.5%, with 13% margin of error for sensitivity and 10% for specificity. Non-probability, consecutive sampling technique was used to collect the data.

Inclusion Criteria

- All patients of age 18-75 years, both genders, presenting with secondary peritonitis (as defined in operational definition) will be enrolled

Exclusion Criteria

- Patients with peritonitis due to alcohol use, cirrhosis, ascites, indwelling peritoneal dialysis catheter, tuberculosis or VP shunt for hydrocephalus (as per medical record)
- Patients with uncontrolled hypertension (BP ≥160/100 mmHg) or diabetes (HbA1c >8%)

Data Collection

Approval for the study was obtained from the ethical review committee of Mayo Hospital. Written informed consent was obtained from patients or their attendants and confidentiality of patient data was maintained. Patients meeting the inclusion criteria were recruited from the surgical wards and demographic data including name, age, gender, duration of illness and cause of peritonitis were recorded. Each patient was then assessed using two scoring systems. The POMPP score was calculated based on age, serum albumin and serum creatinine, while the PULP score incorporated variables such as time to presentation (≤24 hours or >24 hours), preoperative shock, ASA score, presence of malignancy, HIV/AIDS, liver failure and elevated serum creatinine levels (>130 mmol/L). Patients were categorized as positive or negative for mortality risk according to both scores. All participants were followed until discharge or death and actual mortality was documented as per operational definitions.

Data Analysis

All collected data were entered and analyzed using SPSS version 26. Quantitative variables such as age, duration of symptoms and POMPP and PULP scores were expressed as Mean±Standard deviation. Qualitative variables including gender, cause of peritonitis and mortality outcomes were presented as frequencies and percentages. To evaluate the predictive ability of both scoring systems, 2×2 contingency tables were constructed to calculate sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and overall diagnostic accuracy. Data were further stratified by age, gender, duration of symptoms and underlying cause of peritonitis to assess potential effect modifiers and predictive accuracy was recalculated post-stratification to ensure the robustness of the results.

RESULTS AND DISCUSSION

The present study evaluated the predictive accuracy of the POMPP and PULP scoring systems in patients with secondary peritonitis presenting to a tertiary care hospital in Pakistan. The findings demonstrate that both scoring systems were effective in predicting mortality; however, the POMPP score showed superior diagnostic performance, with higher sensitivity (85.3% vs. 72.1%) and overall accuracy (82.9% vs. 75.5%) compared to the PULP score. This highlights POMPP as a more reliable tool for early risk stratification in the Pakistani patient population. The overall mortality rate in this study was 21.4%, which is consistent with previously reported figures from the region, where mortality in secondary peritonitis typically ranges between 15% and 30% depending on the delay in presentation and underlying comorbidities. Studies from India and Pakistan have repeatedly emphasized that late presentation, shock at admission and typhoid-related ileal perforation remain major contributors to adverse outcomes, reflecting healthcare access challenges and the burden of infectious diseases in South Asia. In contrast, mortality rates reported in high-income countries are generally lower, often under 10%, owing to earlier presentation, better perioperative support and lower prevalence of infectious causes such as enteric fever [13-14].

When comparing the two scoring systems, the superior performance of POMPP in this cohort can be attributed to its reliance on simple and robust predictors, namely age, serum albumin and serum creatinine. These variables reflect both physiological reserve and systemic insult, which are critical determinants of survival in secondary peritonitis. The PULP score, while validated internationally, may lose some predictive strength in low- and middle-income country (LMIC) settings because variables such as HIV/AIDS or malignancy are less frequent causes of peritonitis compared to peptic ulcer and typhoid-related perforations. This limitation has also been highlighted in prior validation studies, where context-specific factors influenced the accuracy of Western-developed scoring systems. The stratified analysis further revealed that mortality was significantly higher in patients above 50 years and in females, findings which align with earlier reports indicating that older age, delayed diagnosis and limited physiological reserve are associated with poorer prognosis. The high mortality observed in typhoid perforation cases (close to one-third) mirrors endemic data from Pakistan and India, where late diagnosis and limited access to timely surgical care continue to pose challenges [15-16].

Several previous studies have validated POMPP as a practical bedside tool with good predictive accuracy in diverse populations. Similarly, the PULP score has been shown to perform reasonably well, especially in perforated peptic ulcer disease. However, comparative analyses, including those from South Asian cohorts, suggest that POMPP offers superior sensitivity and negative predictive value, making it particularly valuable in settings where early identification of high-risk patients is essential for prioritizing surgical and critical care resources [17-20] (Table 1-4).

Table 1: Baseline Demographic and Clinical Characteristics of Patients (N = 159)

Variable	Value
Age (years), Mean±SD	44.7±13.2
Gender, n (%)	
Male	104 (65.4)
Female	55 (34.6)
Residence, n (%)	
Rural	88 (55.3)
Urban	71 (44.7)
Duration of symptoms (hours), Mean±SD	27.5±10.8
Comorbidities, n (%)	
Hypertension	38 (23.9)
Diabetes mellitus	31 (19.5)
Other chronic illness	12 (7.5)
Cause of Peritonitis	
Perforated duodenal ulcer	63 (39.6)
Appendicular perforation	34 (21.4)
Typhoid ileal perforation	29 (18.2)
Traumatic small bowel perforation	19 (11.9)
Malignant perforation	8 (5.0)
Others	6 (3.9)

Table 2: Predictive Accuracy of POMPP vs PULP Scoring Systems (N = 159)

Parameter	POMPP Score	PULP Score
Sensitivity (%)	85.3	72.1
Specificity (%)	81.6	76.4
Positive Predictive Value (%)	63.4	54.9
Negative Predictive Value (%)	93.4	87.2
Overall Diagnostic Accuracy (%)	82.9	75.5

Table 3: Mortality by Age and Gender Subgroups (N = 159)

Subgroup	Total n	Deaths n (%)
Age ≤50 years	99	17 (17.2)
Age >50 years	60	17 (28.6)
Male	104	20 (19.2)
Female	55	14 (25.5)
Overall	159	34 (21.4)

Table 4: POMPP and PULP Scores (N = 159)

Score System	Mortality Present (n = 34)	Mortality Absent (n = 125)	Total	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
POMPP	TP = 29 FN = 5	FP = 21 TN = 104	159	85.3	81.6	63.4	93.4	82.9
PULP	TP = 25 FN = 9	FP = 31 TN = 94	159	72.1	76.4	54.9	87.2	

CONCLUSIONS

It is concluded that both POMPP and PULP scoring systems are useful for predicting mortality in patients with secondary peritonitis; however, the POMPP score demonstrated superior sensitivity, specificity and overall diagnostic accuracy in this Pakistani cohort. Given its simplicity, ease of calculation and higher predictive power, the POMPP score may serve as a more practical bedside tool for early risk stratification in low- and middle-income countries where secondary peritonitis remains a major surgical emergency. Wider adoption of this scoring system could assist surgeons in timely decision-making, prioritization of critical care resources and ultimately in improving patient survival outcomes.

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