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Research Article

The accuracy of prognostic scoring systems for post-operative morbidity and mortality in patients with perforated peptic ulcer

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ABSTRACT

Background: To determine the accuracy of Boey score, American society of anesthesiologists (ASA) score, peptic ulcer perforation (PULP) score and the mannheim peritonitis index (MPI) score and compare each predicted scoring systems for prediction the morbidity and mortality of patients with perforated peptic ulcer.
Methods: We retrospectively reviewed the patients with gastric or duodenal ulcer perforation in Bhumibol Adulyadej Hospital, Bangkok, Thailand between 1 January 2008 and 31 December 2012. The morbidity and mortality within 30 days of the PPU patient who underwent the surgical procedure was determined. The predicted scoring systems included Boey score, ASA score, PULP score and MPI score were calculated. We used area under curve of receiver operating characteristics curve to compare the scoring accuracy.
Results: The study included 140 patients, Female 17.9% and male 82.1%. The mean age was 48.5 years. The most common site of PPU was the pre-pyloric region (80%). The most common operative procedure was the simple suture with omental graft. The complication rate was 20.71%. Overall mortality rate was 3.57%. The AUC for morbidity prediction was 0.671 for Boey score, 0.684 for ASA score, 0.698 for MPI score and 0.727 for PULP score. The AUC for mortality prediction was 0.728 for Boey score, 0.776 for ASA score, 0.771 for MPI score and 0.784 for PULP score.
Conclusions: The PULP score may be the better prognostic scoring system for post-operative morbidity and mortality of PPU patient than Boey score, ASA and MPI.

Keywords: Scoring system, Perforated peptic ulcer (PPU), Morbidity, Mortality

INTRODUCTION

In urgent surgical procedures for perforated peptic ulcer (PPU), there is considerable postoperative morbidity and mortality. The overall mortality rate is about 9-27%.[1-3] A large number of prognostic factors for morbidity and mortality in patients with perforated peptic ulcer have been reported.[2-7] Several clinical scoring system have been proposed for prognostic prediction. The most well-known predicted scoring system is Boey score 3, which predicted mortality in PPU patients base on the time from perforation to admission, pre-operative systolic blood pressure and comorbid conditions of patients. Then Boey score was classified in three groups, score 0, 1 and 2 and mortality rate were 0%, 10% and 100% respectively. Lohsiriwat et al was found that a higher Boey score was associated with increasing rates of both morbidity and mortality and could be considered as a simple and appropriate prognostic marker in the management of PPU.[1]

The American society of anesthesiologists (ASA) classification is the most commonly used for assessing perioperative risk worldwide. It is graded in six categories; depend on the patient's pre-operative health status.[5] The previous study found that ASA classification

was capable of predicting poor surgical outcome due to correlate the overall condition of the patient.[1]

The Mannheim peritonitis index (MPI) is a scoring system for prognostic evaluation of patients with peritonitis.[4] It has eight risk factors and need 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.

The peptic ulcer perforation (PULP) score is a new clinical prediction rule for PPU. Moller MH et al[2] was derived PULP score and compared with boey score and ASA classification. This study found that the PULP score can be used to predict mortality in PPU patient better than the Boey score and the ASA classification. The PULP score is more complex and has not been widely validated outside the original cohort.

The aims of the present study were to determine the incidence of morbidity and mortality of patients with PPU in Bhumibol Adulyadej Hospital and to determine the accuracy of each predicted scoring systems for prediction of the morbidity and mortality in patients with PPU included the Boey score, ASA classification, PULP score and MPI.

METHODS

After our Institute Ethics Committee (IEC) approved the study, we carried out a retrospective study including patients who underwent the emergency surgery for peptic ulcer perforation at the Bhumibol Adulyadej Hospital between 1 January 2008 and 31 December 2012. The clinical data of patient was collected based on each predicted scoring systems (Table 1-4). The outcome measures were morbidity and mortality within 30 days of the PPU surgical procedure.

Receiver operating characteristics curve (ROC) is the statistical tool that measures diagnostic accuracy of a test and offers a plot of the true positives versus the false positives. ROC curve analysis was used in this study to estimate the predictive ability of Boey score, ASA score, PULP score and MPI. The area under the ROC curve (AUC) indicated the probability of postoperative morbidity or mortality.

Table 1: The Boey score.

Risk factors	Points
Time from perforation to admission >24 hours.	1
Pre-op SBP <100 mmHg.	1
Any one or more systemic illness : heart disease, liver disease, renal disease, DM	1
Mortality : Score 0 = 0%, 1 = 10%, 2 = 45.5%, 3 = 100%	

Table 2: ASA classification.

Class	Status
1	A normal healthy patient
2	A patient with mild systemic disease
3	A patient with severe systemic disease
4	A patient with severe systemic disease that is a constant threat to life
5	A moribund patient who is not expected to survive without the operation
6	A declared brain-dead patient whose organs are being removed for donor purposes

Table 3: The peptic ulcer perforation (PULP) score.

Variables	Points
Age >65 years	3
Co-morbid active malignant disease or AIDS	1
Co-morbid liver cirrhosis	2
Concomitant use of steroids	1
Shocks on admission	1
Time from perforation to admission >24 hrs.	1
Serum creatinine > 1.47 mg/dl	2
ASA score 2	1
ASA score 3	3
ASA score 4	5
ASA score 5	7
Total PULP score	0-18
Mortality : Score 0-7:low risk ≤ 25%, score 8-18: high risks > 25%	

Table 4: The Mannheim Peritonitis Index (MPI).

Risk factors	Weightage
Age >50 years	5
Female gender	5
Organ failure	7
Malignancy	4
Preoperative duration of peritonitis >24 hrs.	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Exudate	
Clear	0
Cloudy, purulent	6
Fecal	12
Mortality : Score <15 = 0%, 16-25 = 4%, >25 = 82.5%	

RESULTS

A total 140 patients were included. The mean age was 40.5 years (89-18), 82.1% of the patient were male (115/140), and 20.71 % of the patients had used steroid drugs. The average time from ulcer perforation to admission was 16.85 hours. The most common of co-morbidity disease of patient was hypertension, and the second was diabetes (Table 5).

Table 5: Demographic data.

Patient Characteristic	n
Total	140
Gender - Female - male	 25 (17.9%) 115 (82.1%)
Mean age (max., min.)	48.5 (89,18)
Time from ulcer perforation to admission (hr.) (max., min.)	16.85 (168, 0.5)
Steroid usage	29 (20.71%)
Hypertension	33 (23.57)
Diabetes	13 (9.28)
Liver disease	5 (3.57)
Pulmonary disease	7 (5.0)
Cardiac disease	6 (4.29)
Cancer	4 (2.86)
others	12 (8.58)

The most common site of PPU was the prepyloric region (n=112; 80%), followed by the first part of duodenum (n=23; 16.43%), the body of stomach (n=3; 2.14%) and the second part of duodenum (n=2; 1.43%). The average size of perforation was 0.64 cm (4.0-0.15) (Table 6).

Table 6: Perforated site, size.

Ulcer characteristic	n (%)
Perforated site -Pre-pyloric -1st duodenum -2nd duodenum -Body of stomach	 112 (80.0) 23 (16.43) 2 (1.43) 3 (2.14)
Size of perforation (cm.) -average (max, min.)	 0.64 (4.0, 0.15)

All the patients in this study were underwent the operation, primary closure with omental grafting (n=140; 100%). One patient was added truncal vagotomy. Three patients were re-operated due to post-operative leakage (2.14%).The average of operative time were 103.34 minutes (range 40-250 minutes).

Overall 30-day mortality was 3.57% (n=5). Post-operative complications was 20.71% (n=29). The most major complication was pulmonary disease (n=16; 55.17%). The most minor complication was surgical site infection (n=10; 34.48%) (Table 7).

Table 7: Complications and death.

Complication	n (%)
Complication	29 (20.71)
-Pulmonary e.g. Pneumonia, ARDS	16 (55.17)
-Cardiac e.g. CHF, arrhythmia	8 (27.59)
-Surgical site infection	10 (34.48)
-Sepsis	4 (13.79)
-Renal failure	2 (6.89)
-Urinary tract infection	4 (13.79)
-Wound dehiscence	2 (6.89)
-Others	4 (13.79)
Death	5 (3.57)

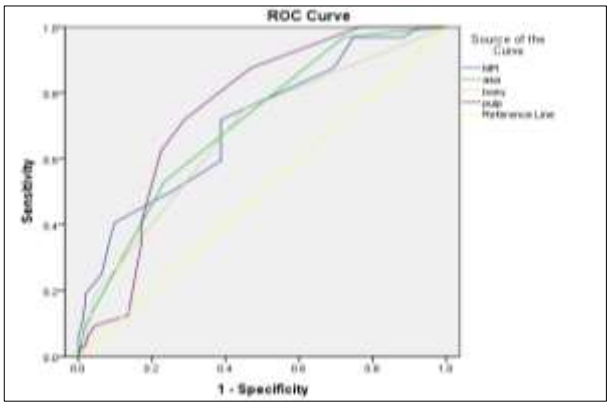

Figure 1: ROC curve analysis of predicted score for morbidity.

Table 8: ROC curve analysis of predicted score for morbidity.

Score	Boey	ASA	MPI	PULP
AUC	0.671	0.684	0.698	0.727

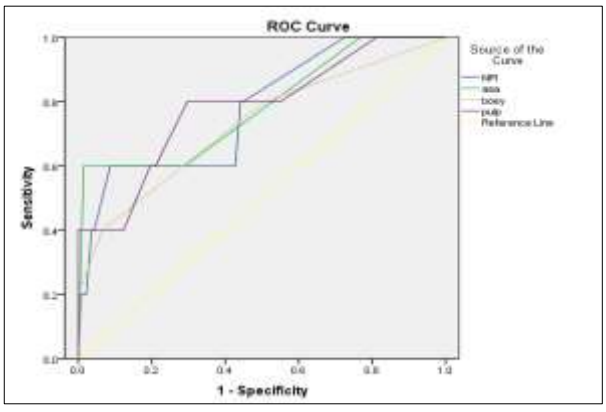

Figure 2: ROC curve analysis of predicted score for mortality.

Table 9: ROC curve analysis of predicted score for mortality.

Score	Boey	ASA	MPI	PULP
AUC	0.728	0.776	0.771	0.784

When comparing AUC values from ROC analyses from different scoring system. The ROC curve analysis for predicting mortality and morbidity (Figure 1 and 2) demonstrated that the PULP score had the highest area under curve (AUC) compare to the Boey score, ASA classification and MPI.

DISCUSSION

Patients with PPU often present in emergency setting with severe illness that need surgery and carries a high risk for post-operative morbidity and mortality. It is important to categorize patients into different severity based on the likelihood of morbidity and mortality. Therefore the high-risk patients can receive more appropriate treatment and greater for intensive care. Several risk scores exist for the prediction of outcomes in patients with perforated peptic ulcer.[8-10] 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. The aim of this study was to evaluate the accuracy of available scoring systems used for outcome prediction in PPU patients.

In our study, we found that the overall mortality rate was 3.57% which lower than report in previous literature. The most likely reason is our patient's age is younger than the patients in previous literature from western country. The most common site of PPU in this study was pre-pyloric region. It could be explained by the prevalence of Helicobacter pylori infection was high in Thai population.[11]

We used receiver operating characteristics curve (ROC) in our study to determine accuracy of each scoring system. Area under the curve (AUC) is used to measure the size of the curve representing predictive performance and composed by the graphic display between the 'sensitivity' and the '1-specificity'. AUC can range from 0.5 to 1.0 and a result of 1.0 indicates a perfect discriminatory ability. An AUC value > 0.8 is considered good, a range between 0.60-0.80 is considered as moderate, and an AUC value < 0.60 is regarded as poor.[12]

We found that all of the scoring system includes ASA physical status classification system, the Boey score, MPI and PULP score provide moderate accuracy for mortality and morbidity prediction. Among of all these scoring system, PULP has the highest AUC for mortality which is 0.727 and 0.784 for morbidity. In the other hand, the well-known Boey score has the lowest AUC compared to other scoring system in both mortality and morbidity prediction as well. Our study reaffirmed the efficacy of the new PULP scoring system in predicting postoperative death and complications.

CONCLUSION

In conclusion, the new PULP score could be consider as a better prognostic scoring system for morbidity and mortality in PUP patients than the Boey score, ASA score and MPI score. It may be assisted in accurate and early identification of high risk patients with PPU.

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Ethical approval: The study was approved by the institutional ethics committee

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