



**ACCURACY OF BOEY SCORE AND PEPTIC ULCER PERFORATION (PULP) SCORE AS A MORTALITY PREDICTIVE FACTOR IN PERFORATED PEPTIC ULCER PATIENTS IN H. ADAM MALIK MEDAN GENERAL HOSPITAL**

<b>Hanny Fadhila</b>	Surgery Resident, Faculty of Medicine, Universitas Sumatera Utara, - H. Adam Malik Medan General Hospital
<b>Asrul*</b>	Digestive Surgery Division, Department of Surgery, Faculty of Medicine, Universitas Sumatera Utara - H. Adam Malik Medan General Hospital *Corresponding Author
<b>Adi Muradi</b>	Digestive Surgery Division, Department of Surgery, Faculty of Medicine, Universitas Sumatera Utara - H. Adam Malik Medan General Hospital

**ABSTRACT**

**BACKGROUND:** Every year, peptic ulcer affects 4 million people worldwide. Ten to twenty percent (10-20%) of patients with peptic ulcer have complications and 2-14% of them have perforated peptic ulcer. Perforated peptic ulcer's mortality varies from 10-40%. Several scoring systems have been reported to predict outcomes in patients with peptic ulcer perforation, namely the American Society Anesthesiology (ASA) score, Acute Physiology and Chronic Health Evaluation II (APACHE II) score, Peptic Ulcer Perforation (PULP) score and Boey score. The purpose of this study was to determine the accuracy of the Boey score and PULP score as a predictive factor for mortality in perforated peptic ulcer patients at H. Adam Malik Medan General Hospital.

**METHODS:** This study is an analytical study with a retrospective design. The sample obtained was 31 patients. Data was collected from medical records at H. Adam Malik Medan General Hospital during the period of January 2013 to December 2016. Then the analysis was carried out using diagnostic tests with 2x2 tables and displaying Receiver Operating Characteristic (ROC) statistical curves.

**RESULTS:** From 31 patients with perforated peptic ulcer, it was found that the average age of patients was 60.1 years old with a mortality rate of 10 cases (32.3%). The accuracy of the Boey score to predict mortality was 91.7% and the PULP score was 88.6%.

**CONCLUSION:** Boey score and PULP score have good accuracy to predict mortality in perforated peptic ulcer patients

**KEYWORDS :** perforated peptic ulcer, score, Boey, PULP, mortality

**BACKGROUND**

Peptic ulcer is a focal defect in the gastric or duodenal mucosa that extends to the submucosa or deeper. Peptic ulcer can be acute or chronic, that caused by an imbalance between mucosal defense and aggression factors.<sup>1,2,3</sup>

Every year, peptic ulcer affects 4 million people worldwide.<sup>4</sup> In peptic ulcers, bleeding, perforation, and obstruction can occur as complications. Perforation is the second most complication after bleeding.<sup>2</sup> Ten to twenty percent (10-20%) of patients with peptic ulcer have complications and 2-14% of them have perforated peptic ulcer. Perforated peptic ulcer's mortality varies from 10-40%. More than half of the cases affected women and they are usually older and have comorbidities than men.<sup>5</sup>

Many scoring systems have been reported to predict outcomes in patients with perforated peptic ulcer. Now, the American Society Anesthesiology (ASA) score, Acute Physiology and Chronic Health Evaluation II (APACHE II) score, Peptic Ulcer Perforation (PULP) score and Boey score are the most prognostic scoring systems used in patients with perforated peptic ulcer.<sup>2,6</sup> Peptic Ulcer Perforation (PULP) Score is a new score to predict the prognosis of perforated peptic ulcer clinically.<sup>7</sup>

The accuracy of each scoring system gives different results in each study. In the Møller MH, et al. (2011) study, the results of the accuracy of the PULP score was 0.83, the Boey Score was 0.70, and ASA score was 0.78 in predicting mortality and in cases of peptic ulcer perforation. In Nichakankitti's study (2016) the accuracy of the Boey score was 0.728, the ASA score was 0.776, Manheim Peritonitis Index (MPI) was 0.771 and the PULP score was 0.784.<sup>8</sup>

In H. Adam Malik Medan General Hospital, we never applied this score in cases of perforated peptic ulcer. Therefore, the authors interested to know the accuracy of the Boey Score and PULP score in determined predictive factors for mortality in perforated peptic ulcer patients at H. Adam Malik Medan General Hospital.

**METHODS**

This study is an analytical study with a retrospective design. The study was carried out in the Digestive Surgery Division, Department of Surgery, H. Adam Malik Medan General Hospital during the period of January 2013 to December 2016 by taking data from medical records of patients diagnosed with perforated peptic ulcer that performed exploratory laparotomy. Patients with age <18 years old were excluded from this study. The data collected was then processed with the SPSS program version 21 and cross tabulation. The statistical curve shown was in the form of Receiver Operating Characteristic (ROC) and determined the Area Under Curve (AUC) for each score, and also calculates Positive Prediction Value (PPV), Negative Prediction Value (NPV), sensitivity and specificity. The research ethics was obtained from the Research Ethics Commission at the Faculty of Medicine, Universitas Sumatera Utara, Medan.

**RESULT**

**SAMPLE CHARACTERISTICS**

In this study, we found 31 patients of perforated peptic ulcer that performed exploratory laparotomy through medical records for 4 years from January 2013 to December 2016. Of the total respondents, the characteristics of respondents observed were age, sex, length of stay, mortality, location of perforation, surgery techniques, Boey score, and PULP score.

**Table 1. Description Of Sample's Characteristics**

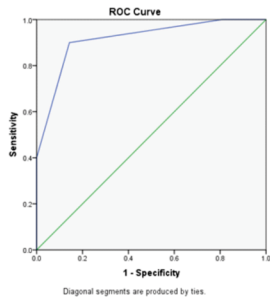
Characteristics	Frequency (n)	Percentage (%)
<b>Mean Age (± SD)</b>	60,1 ± 11,5	
<b>Sex</b>	8	25,8
- Female	23	74,2
- Male		
<b>Mean Length of Stay (± SD)</b>	7 ± 4,1	
<b>Location of Perforation</b>	29	93,5
- Antrum	2	6,5
- Duodenum part 1		
<b>Surgery Techniques</b>	31	100
- Omental Patch	0	0
- Omental Plague		

<b>Boey Score</b>		4	12,9
- 0		15	48,4
- 1		8	25,8
- 2		4	12,9
- 3			
<b>PULP Score</b>		17	54,8
- 0-7		14	42,2
- 8-18			
<b>Mortality</b>		21	67,7
- No		10	32,3
- Yes			

**Accuracy of Boey Score and Peptic Ulcer Perforation (PULP) Score**

**Accuracy of Boey Score**

The analysis using the ROC test showed that Boey score had an area under ROC (AUROC) of 91.7%, with a 95% confidence interval, between 0,806 to 1,0.



**Figure 1. ROC Curve of Boey Score in Patients with Perforated Peptic Ulcer at H. Adam Malik Medan General Hospital**

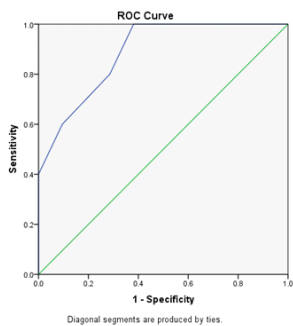
From the calculation using the SPSS program, it was found that the sensitivity of Boey score in H. Adam Malik Medan General Hospital was 90.0%, the specificity was 85.7%, the Positive Predictive Value (PPV) was 75.0%, and the Negative Predictive Value (NPV) was 94.7%.

**Table 2. Cross Tabulation Of Boey Score And Mortality**

		Mortality		Total
		Yes	No	
Boey Score	2-3	9	3	12
	0-1	1	18	19
Total		10	21	31

**Accuracy of Peptic Ulcer Perforation (PULP) Score**

The analysis using the ROC test showed that the PULP score had an area under ROC (AUROC) of 0.886, with a 95% confidence interval, between 0,77 to 1,0.



**Figure 2. ROC Curve PULP Score in Patients with perforated Peptic Ulcer at H. Adam Malik Medan General Hospital**

From the calculation using the SPSS program, it was found that the sensitivity of the PULP score in H. Adam Malik Medan General Hospital was 80%, with a specificity of 71.4%, Positive Predictive Value (PPV) of 57.1%, and Negative Predictive Value (NPV) of 88.2%.

**Table 3. Cross Tabulation Of Pulp Score And Mortality**

		Mortality		Total
		Yes	No	
PULP Score	8-18	8	6	14
	0-7	2	15	17
Total		10	21	31

**DISCUSSION**

Every year, peptic ulcer affects 4 million people worldwide. In peptic ulcers, bleeding, perforation, and obstruction can occur as complications. Perforation is the second most complication after bleeding.<sup>2</sup> Ten to twenty percent (10-20%) of patients with peptic ulcer have complications and 2-14% of them have perforated peptic ulcer. Perforated peptic ulcer's mortality varies from 10-40%. More than half of the cases affected women and they are usually older and have comorbidities than men.<sup>5</sup>

In this study, we collected 31 samples from data of medical records from January 2013 to December 2016. Based on the characteristics of the study sample, the average age of perforated peptic ulcer patients was 60,1 years old with the youngest age was 21 years old and the oldest age was 75 years old. The average age according to data from various studies varies greatly. The study by Møller et al showed that the average age of patients with perforated peptic ulcer was 70,9 years old, with an age range 16,2-104,2 years.<sup>7</sup> Other studies showed that the average age of perforated peptic ulcer patients was 40,5 years 54,7 years (range 17- 109 years).<sup>8,9</sup> Latest evidence shows an increased incidence of perforated peptic ulcer in old age, this may be due to aspirin and nonsteroidal anti-inflammatory drugs (NSAIDs) consumption in this population.<sup>3,10,11,12</sup>

According to sex, this study showed the number of female patients with perforated peptic ulcer as many as 8 (25.8%) and male as many as 23 (74.2%). This is in line with several previous studies which stated that there are more male than female patients with perforated peptic ulcer. Study by Nichakankitti et al. showed that 82.1% of the sample were male.<sup>8,9</sup> Another study by Ahmad et al. also showed that 68.46% of the sample were male.<sup>10</sup> Possible explanations for this finding were related to smoking and drinking habits which were more common in male.<sup>10,13,14,15</sup>

Based on the length of stay, the average length of stay of patients with perforated peptic ulcer was 7 days, with the shortest length of stay was 1 day and the longest length of stay was 14 days. The shortest length of stay was experienced by patients who died. According to data from Lohsiriwat et al., the average length of stay in the hospital was 11 days (range of length of stay was 3-76 days).<sup>9</sup> The study by Li described several factors that influence the length of stay of patients with perforated peptic ulcer. Patients aged ≥ 65 years old, patient with liver cirrhosis, diabetes mellitus, peptic ulcer, preoperative shock, delay of surgery > 12 hours, creatinine level > 1,5 mg/dL, and have postoperative infections and complications such as positive culture in ascites, infection of surgical wounds, bacteremia, pneumonia, catheter infections, urinary tract infections and complications of abdominal non infection are factors that make the length of stay long. However, the majority of deaths occur early after surgery, so severe cases will make the length of stay shorten.<sup>12,13,16</sup>

In this study, there were 21 patients (67.7%) survived after laparotomy exploratory, and 10 patients (32.2%) died. This is higher than previous studies by Nichakankitti et al. who got a 30-day mortality rate of 3.57%.<sup>5</sup> Other previous studies showed a 30-day mortality rate were 9%, 27% and 25.38%.<sup>7,10,11</sup> The lower mortality rate is one of the effects of intensive care development in the present. In the center where Lohsiriwat (2009) conducted his study, high-risk patients were treated and resuscitated in the intensive care unit before undergone surgery. The mortality rate of perforated peptic ulcer patients can be reduced by improving the quality of

patient care, such as grouping patients based on high risk and low risk groups, then managing them according to the risk group.<sup>16,17,18</sup>

The majority of this study samples had a Boey score 1 as many as 15 people (48,4%), and the minority had a Boey score 0 and 3, each of them was 4 people (12,9%). In contrast to the study by Lohsirawat, the number of patients with a Boey score 0 was 59,8%, Boey score 1 as many as 23,6%, Boey score 2 as much as 7,8%, and Boey score 3 as much as 8.5%.<sup>9</sup> In addition, the average PULP score of patients with peptic ulcer perforation in this study was 7,39. The highest score was 13 as many as 1 patient (3,2%) and the lowest score was 3 as many as 3 patient (9,7%).

The author used the Receiver Operating Characteristics (ROC) curve in this study to assess the accuracy of each scoring system. Area Under the Curve (AUC) was used to measure the size of a curve that represents the predictive ability of the score and was displayed in a graph between "sensitivity" and "1-specificity". AUC has a range of values from 0,5 to 1,0 and a result of 1,0 indicates perfect discriminatory ability. The value of AUC > 0,8 is interpreted well, 0,60-0,80 is interpreted moderate, and < 0,60 is interpreted poor.<sup>8</sup>

Analysis with the ROC test showed Boey scores in this study had an area under ROC (AUROC) of 0,917 with a 95% confidence interval between 0,806 to 1,0, that means that Boey scores showed good results to predict mortality in patients with perforated peptic ulcer. Analysis with the ROC test showed that the PULP score had an area under ROC (AUROC) of 0,886 with a 95% confidence interval between 0,77 to 1,0, that means that the PULP score also showed good results to predict mortality in patients with perforated peptic ulcer.

Study by Møller et al. in 2011 showed an increase in mortality rates within 30 days as the PULP score increased. At score 1 there was a 1% mortality rate and at score 16 the mortality rate reached 100%. There were no patients with a score of 17 and 18 in that study.<sup>7</sup>

In this study, the sensitivity of the PULP score in H. Adam Malik Medan General Hospital was 80%, with specificity of 71,4%, Positive Predictive Value (PPV) of 57,1%, and Negative Predictive Value (NPV) of 88,2%. This sensitivity shows 80 out of 100 patients who have an 8-18 PULP score (mortality > 25%) died after laparotomy exploration. While the specificity shows that 71 out of 100 patients who have a PULP Score of 0-7 (mortality ≤ 25%) did recover after laparotomy exploration. The PPV of PULP score was 51,7%, that means that 51 out of 100 patients who died did have a score between 8-18, and the NPV of PULP score was 88,2%, that means that 88 out of 100 patients who recovered did have a score of 0-7.

Research by Møller et al. in 2011 showed an increase in specificity in line with increased of PULP scores, which reached 100% in score 14. This is inversely proportional to decrease in sensitivity with increasing PULP score.<sup>16,17</sup>

Previous research comparing the AUC of Boey score and PULP score stated that PULP Score (AUC 0,83) had a more accurate advantage in predicting mortality within 30 days compared to Boey Score (AUC 0,70).<sup>18</sup> However, both PULP score and Boey score can accurately identify high-risk perforated peptic ulcer patients so it helps in grouping and triage patients.<sup>18,19,20</sup>

## CONCLUSION

Boey score have a good accuracy to predict mortality in perforated peptic ulcer patients at H. Adam Malik Medan General Hospital with PPV 75,0% and NPV 94,7%. Accuracy of PULP score to predict mortality in perforated peptic ulcer patients at H. Adam Malik Medan General Hospital namely PPV 57,1% and NPV 88,2%.

## REFERENCES

1. Brunicaardi, F.C., Andersen, D.K., Billiar, T.R., Dunn, D.L., Hunter, J.G., & Matthews, J.B. (2010). *Stomach, dalam Schwartz's Principle of Surgery 10th Ed.* Houston. Mc Graw-Hill. p. 1053-1073.
2. Thorsen, K., Søreide, J.A., & Søreide, K. (2013). Scoring Systems for Outcome

- Prediction in Patients With Perforated Peptic Ulcer. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine.* 21:25.
3. Bertleff, M.J.O.E., & Lange, J.F. (2010). Perforated Peptic Ulcer Disease: A Review History and Treatment. *Digestive Surgery.* KARGER. 27: 161-169. DOI: 10.1159/000264653.
4. Chung, K.T., & Shelat, V.G. (2017). Perforated Peptic Ulcer – An Update. *World J Gastrointest Surg.* 9(1):1-12. DOI: 10.4240/wjgs.v9.i1.1.
5. Di Saverio, S., Bassi, M., Smerieri, N., Masetti, M., Ferrara, F., Fabbri, C., & Ansaloni L. (2014). Diagnosis and Treatment of Perforated or Bleeding Peptic Ulcers: 2013 WSES Position Paper. *World Journal of Emergency Surgery.* 9:45.
6. Søreide, J.A., Søreide, K., & Thorsen, K. (2014). What is the best predictor of mortality in perforated peptic ulcer disease? a population based, multivariable regression analysis including three clinical scoring systems. *J Gastrointest Surg.* 2014;1-7.
7. Møller, M.H., Engebjerg, M.C., Adamsen, S., Bendix, J., & Thomsen, R.W. (2011). The Peptic Ulcer Perforation (PULP) Score: A Predictor of Mortality Following Peptic Ulcer Perforation. A Cohort Study. *Acta Anaesthesiologica Scandinavica.* DOI: 10.1111/j.1399-6576.2011.02609
8. Nichakankitti, N., & Athigakunagorn, J. (2016). The Accuracy of Prognostic Systems For Post-Operative Morbidity and Mortality in Patients With Perforated Peptic Ulcer. *International Surgery Journal.* 3(1):286-290. DOI: 10.18203/2349-2902.isj20160244.
9. Anbalakan, K., Chua, D., Pandya, G.J., & Shelat, V.G. (2015). Five Year Experience in Management Of Perforated Peptic Ulcer and Validation of Common Mortality Risk Prediction Models – Are Existing Models Sufficient? A Retrospective Cohort Study. *International Journal of Surgery.* 14:38-44. <http://dx.doi.org/10.1016/j.jisu.2014.12.022>.
10. Lohsirawat, V., Prapasrivorakul, S., & Lohsirawat, D. (2009) Perforated Peptic Ulcer: Clinical Presentation, Surgical Outcomes, and the Accuracy of the Boey Scoring System in Predicting Postoperative Morbidity and Mortality. *World J Surg.*; 33:80. <https://doi.org/10.1007/s00268-008-9796-1>
11. Ahmad, M., Nawaz, H., Khan, M., Mehmood, A., & Uzai, M. (2013). Frequency of High Boey Score And Its One Month Mortality After Surgery For Perforated Peptic Ulcer Disease. *KJMSJ.*; Vol.6, No.2.
12. Li, C.H., Bair, M.J., Chang, W.H., & Shih, S.C. (2009). Predictive Model For Length of Hospital Stay of Patients Surviving Surgery for Perforated Peptic Ulcer. *J Formos Med Assoc.* Vol 108 No.8.
13. Singh, R., Kumar, N., Bhattacharya, A., & Vajifdar, H. (2011). Preoperative Predictors of Mortality in Adult Patients with Perforation Peritonitis. *Indian Journal of Critical Care Medicine.* 5(3): 157-163. DOI: 10.4103/0972-5229.84897
14. Thorsen, K., Søreide, J.A., & Søreide, K. (2013). Scoring Systems for Outcome Prediction in Patients with Perforated Peptic Ulcer. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine.* 21:25.
15. Unver, M., Firat, ., & Ünalp, .V. (2015). Prognostic Factor in Peptic Ulcer Perforations: A Retrospective 14-Year Study. *Int Surg.*; 100(5):942-948.
16. Prabh, V., & Shivani, A. (2014). An Overview of History, Pathogenesis and Treatment of Perforated Peptic Ulcer Disease with Evaluation of Prognostic Scoring in Adults. *Annals of Medical and Health Sciences Research.* <http://dx.doi.org/10.4103/2141-9248.126604>
17. Nwashilli, N.J., & Nwajie, C.O. (2014). Boey Score in Predicting Mortality in Patients with Perforated Peptic Ulcer. *Annals of Biomedical Sciences.*; 13(2). <https://www.ajol.info/index.php/abs/article/view/105623>
18. Menekse, E., Kocer, B., Topcu, R., Olmez, A., Tez, M., & Kayaalp, C. (2015). A Practical Scoring System to Predict Mortality in Patients with Perforated Peptic Ulcer. *World Journal of Emergency Surgery.* <https://doi.org/10.1186/s13017-015-0008-7>
19. Dhiyanesh, S.R., Swaminathan, A.G., Subramanian, C.S., Krishnan, A. (2017). A Study of Clinical Presentation and Accuracy of the Scoring System (Based on Boey) in Predicting Postoperative Morbidity and Mortality of Perforated Peptic Ulcers. *Journal of Medical Science And Clinical Research.*; Vol 5.30380-30384.
20. Agarwal, A., Jain, S., Meena, L.N., Jain, S.A., & Agarwal, L. (2015). Validation of Boey's Score in Predicting Morbidity and Mortality in Peptic Perforation Peritonitis in Northwestern India. *Tropical Gastroenterology.*; 36(4): 256-260.