Sriwijaya Journal of Surgery
Journal Homepage: https://sriwijayasurgery.com/index.php/sjs

Accuracy of Bleeding Volume as a Predictor of Mortality in Epidural Hemorrhage Patients Undergoing Surgery at Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia

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ARTICLE INFO

Keywords:
Bleeding volume
Epidural hemorrhage
Mortality
Predictor

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All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/sjs.v6i2.93

A B S T R A C T

Introduction: EDH is a collection of blood clots between the dura layer and the cranium. This is usually caused by rupture of the middle meningeal artery but can also be caused by rupture of the dural venous sinus, diploic vein, meningeal vein, or bleeding from the fracture line. CT scan is the investigation of choice to detect intracranial injury after trauma. CT scans can also identify additional features that influence the results, namely, midline shifting, blood clot thickness and hematoma volume, cerebral edema, and cranium fractures. This study aimed to determine the accuracy of bleeding volume as a predictor of mortality in epidural hemorrhage patients undergoing surgery at Dr. Mohammad Hoesin General Hospital, Palembang Indonesia. **Methods:** This study is a retrospective study of prognostic tests to determine the accuracy of bleeding volume as a predictor of mortality in patients with EDH who underwent surgery at Dr. Mohammad Hoesin General Hospital. This study uses secondary data obtained from medical record data at the medical records installation of Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia. A total of 106 research subjects participated in this study. **Results:** The sensitivity value of bleeding volume was 77.7%, and specificity was 78.3%, and also obtained a positive predictive value of 7.21% and a negative predictive value of 97.4%, it can be concluded that bleeding volume is not accurate as a predictor of mortality. **Conclusion:** Bleeding volume is not an accurate predictor of mortality in epidural hemorrhage patients undergoing surgery at Dr. Mohammad Hoesin General Hospital, Palembang Indonesia.

1. Introduction

Head injuries are a major health and socioeconomic problem worldwide. This incident can occur in countries with high or low income and occurs at all ages. Head injuries are associated with 50,000 deaths in the United States each year. Motorcycle accidents are the main cause of death in adults aged < 40 years. Head injuries are called a silent epidemic, reflecting their frequency of underestimation incidents from actual cases. As many as 2% of all head injury patients and 15% of patients with severe head injury are estimated to experience epidural hemorrhage (EDH). Approximately 17% of previously conscious patients who deteriorate into coma after trauma experience EDH. EDH is a collection of blood clots between the dura layer and the cranium. This is usually caused by rupture of the middle meningeal artery, but can also be caused by rupture of the dural venous sinus,

diploic vein, meningeal vein, or bleeding from the fracture line. CT scan is the investigation of choice to detect intracranial injury after trauma. CT scans can also identify additional features that influence the results, namely, midline shifting, blood clot thickness and hematoma volume, cerebral edema, and cranium fractures.[1-5]

Concomitant brain damage other than EDH is responsible for poor neurological function after injury. The outcome of EDH is highly dependent on the preoperative Glasgow coma scale (GCS) and neurological status. Massive EDH is an extradural collection of blood that is large enough to cause immediate bleeding midline shifting, herniation, and brain stem compression, which causes mortality and morbidity in patients. This is a neurosurgical emergency requiring rapid evacuation of the EDH and stabilization of the patient. The success of treatment in EDH patients is greatly influenced by various factors, including the patient's age, the time between injury and treatment, coma or lucid interval, the presence of pupillary abnormalities in the GCS score upon arrival, CT scan findings, namely the volume of bleeding, the degree of midline shift, signs of active bleeding, and associated intradural lesions.[6-10] This study aimed to determine the accuracy of bleeding volume as a predictor of mortality in epidural hemorrhage patients undergoing surgery at Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia.

2. Methods

This study is a retrospective study of prognostic tests to determine the accuracy of bleeding volume as a predictor of mortality in patients with EDH who underwent surgery at Dr. Mohammad Hoesin General Hospital. This study uses secondary data obtained from medical record data at the medical records installation of Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia. A total of 106 research subjects participated in this study, where the research subjects met the inclusion criteria. The inclusion criteria for this study were EDH patients who were treated at Dr. Mohammad Hoesin General Hospital and had indications for surgery, namely: bleeding volume > 30 cc, midline shifting > 5 cm, GCS < 8. This study has received approval from the medical and health research ethics committee of Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia.

This study observed the EDH volume, where the EDH volume was assessed via head CT scans. The observation of the study outcome is the mortality of the research subjects. The research results were analyzed univariately, bivariate, and multivariate using SPSS software. Univariate analysis was carried out to obtain an overview of the frequency distribution of each variable studied. Bivariate analysis was carried out to test the accuracy of predictor variables against standard variables by determining sensitivity and specificity values using ROC (receiver operating characteristic) and value cut-off point. Multivariate analysis was carried out to determine which independent variables had the strongest relationship to mortality using logistic regression.

3. Results

Table 1 presents the characteristics of the research subjects. The majority of research subjects were male, and the majority were aged between 12-45 years. In this study, the largest volume was found to be 54.87 cc, and the smallest volume was 21.87 cc, with a mean of 36.70 ± 7.34 cc. There were 27 patients who experienced midline shifting, with a maximum value of 2.1 cm. with a mean of 0.29 ± 0.5 cm. In this study, it was found that the time from the incident to the fastest operation was 6 hours, and the time from the incident to the longest operation was 49 hours, with a mean of 27.48 ± 12.24 hours. The highest hemoglobin level was 15.8 g/dl, and the lowest was 7.4 g/dl, with a mean value of 12.3 ± 1.9 g/dl. The maximum value of MAP was 123 mmHg, and the minimum value was 61 mmHg, with a mean of 91.8 ± 10.7 mmHg.

Table 1. Characteristics of research subjects.

Characteristics	Frequency	Percentage (%)
Gender		
Male	82	77,4
Female	24	22,6
Age		
< 11 years	11	10,4
12-25 years	56	52,8
26-45 years	29	27,4
46-65 years	10	9,4
Age		
Mean ± SD	24,9±13,8	
Median (min-max)	21 (4-61)	
Bleeding volume		
Mean ± SD	36,70 ± 7,34	
Median (min-max)	36,81 (21,87-54,88)	
Midline shifting		
Mean ± SD	0,29 ± 0,5	
Median (min-max)	0,0 (0,0-2,1)	
Time from incident to operation		
Mean ± SD	27,48 ± 12,24	
Median (min-max)	27 (6-49)	
Hemoglobin level		
Mean ± SD	12,3 ± 1,9	
Median (min-max)	11,7 (7,4 – 15,8)	
Mean arterial pressure		
Mean ± SD	91,8 ± 10,7	
Median (min-max)	91,8 (61-123)	

In this research, values were obtained, and the cut-off point for bleeding volume is 41.80 cc. With statistical analysis, the results showed that there was a significant relationship between bleeding volume and mortality (p= 0.001). Because p < 0.25, bleeding volume was included in the multivariate analysis. The sensitivity value of bleeding volume was 77.7%, the specificity was 78.3%, and also the positive predictive value was 7.21%, and the negative predictive value was 97.4%. It can be concluded that bleeding volume is not an accurate predictor of mortality.

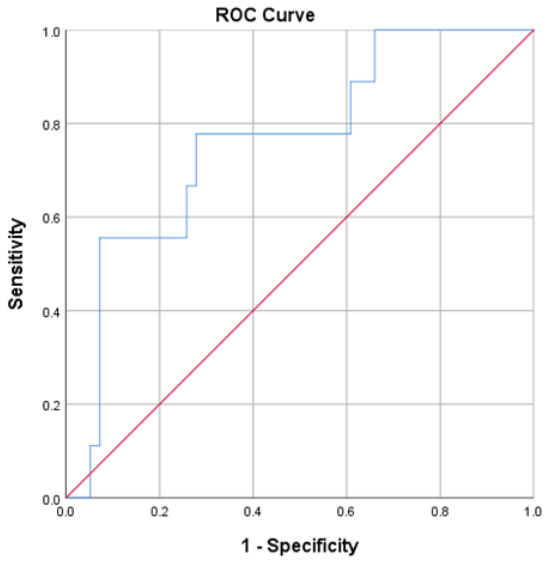

Figure 1. ROC bleeding volume and mortality.

Table 2. Accuracy of bleeding volume with mortality.

Characteristics	Mortality		OR	CI95%	P-value
	Yes	No			
Bleeding volume					
≥41,8	7	21	12,667	2,447-65,565	0,001
<41,8	2	76			
Sensitivity	77,7%				
Specificity	78,3%				
Positive predictive value	25 %				
Negative predictive value	97,4%				

Fisher exact test, * p<0,05.

4. Discussion

In this study, the mean bleeding volume was 36.70 ± 7.34 cc., and the value cut-off point for bleeding volume was 41.80 cc. In other studies, volumes were found to be 15-30 cc (43.30%) and >30 cc (56.70%). Meanwhile, in other studies there were 77.6% of patients with a volume <30 cc and the remainder ≥30 cc. However, these two studies did not assess EDH patients who underwent surgery alone but as a whole.[11,12] With statistical analysis, in this study, the results showed that there was a significant relationship between bleeding volume and mortality (p= 0.001). The sensitivity value of bleeding volume was 77.7%, and specificity was 78.3%, and also obtained a positive predictive value of 7.21% and a negative predictive value of 97.4%. It can be concluded that bleeding volume is not accurate as a predictor of mortality.

Bleeding volume is not always accurate as a direct predictor of mortality. Although the volume of bleeding is an important factor in assessing the condition of patients experiencing bleeding, many other factors also influence the mortality rate. The location of the bleeding in the body can have a different impact on the patient's prognosis. Bleeding in some vital organs, such as the brain, heart, or lungs, can be more dangerous than bleeding in other parts. The cause of bleeding is also important. For example, bleeding due to physical injury can have a different mortality rate compared to bleeding due to blood vessel disorders or certain diseases. The patient's previous medical condition can also influence the prognosis.[13-16] Patients with a history of chronic illnesses or diseases that weaken their immune system may be at higher risk of serious complications. How quickly and effectively the bleeding can be stopped, and the patient receives appropriate medical care are also key factors in determining the prognosis. Patient age can also play a role in mortality rates. Typically, older people tend to have a higher risk of serious complications due to bleeding. Bleeding can cause various complications, such as shock, infection, or organ failure. The possibility of these complications also affects mortality prediction.[17-20]

5. Conclusion

Bleeding volume is not an accurate predictor of mortality in epidural hemorrhage patients undergoing surgery at Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia.

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