Biomedical & Pharmacology Journal Vol. **10**(2), 717-723 (2017)

Related Risk Factors and Outcome of Patients Post Trepanation Epidural Hematoma Evacuation

W NIRYANA[1], H TEDDY[1], N GOLDEN[1] and E WIDYADHARMA[2]

[1]Neurosurgery Department, Faculty of Medicine, Udayana University, Bali, Indonesia.
[2]Neurology Department, Faculty of Medicine, Udayana University, Bali, Indonesia.
*Correspondent author E-mail: eka.widyadharma@unud.ac.id

http://dx.doi.org/10.13005/bpj/1161

(Received: May 01, 2017; accepted: May 05, 2017)

ABSTRACT

Epidural hematoma is 2.7 to 4 percent of all intracranial bleeding with the outcomes tend to be favorable and the mortality rate is expected to approach zero. Efforts to detect risk factors as early as possible is important to do so that quick action resulted in a better outcome. This research is an observational study with cohort research methods involving 80 patients with post-trepanation EDH hematoma evacuation in June 2015 to June 2016. The risk factors identified, age, GCS, pupillary abnormalities, lucid interval, volume and location of the EDH, midline shift and other focal lesions. Were followed up for 3 months after surgery to determine the risk factors that affect pure outcome. Hubungan between risk factors were analyzed using bivariate and multivariate analysis with 95% CI. In bivariate analysis found five significant risk factors: lucid interval, GCS, pupillary abnormalities, midline shift and the duration of the pre-surgery. After multivariate analysis obtained two risk factors were statistically significant to the outcome of patients EDH post trepanation evacuation of hematoma, namely: GCS (RR 4.553 95% CI 3.846 to 2.340) and duration of pre-surgery (RR 4.655 95% CI 4.470 to 2.473). Patients with GCS less than or equal to 8, and the duration of the pre-operation more than 12 hours was associated with unfavorable outcome of patients after trepanation EDH evacuation of hematoma.

Keywords: Epidural hematoma, Epidural hematoma patient outcomes, Risk factors epidural hematoma.

INTRODUCTION

Epidural hematoma is 2.7- 4 percent of all intracranial bleeding with outcome tend to be favorable and the mortality rate is expected approach to be zero.[1,2,3] Efforts to detect risk factors as early as possible is important to do, so that quick action resulting a better outcome. Outcome from evacuation of hematoma after trepanation is affected by several risk factors, such as age, initial GCS, pupil, history of lucid interval, CT-Scan findings and duration of the incident until operation had been done.[4,5,6,7,8,9]

MATERIALS AND METHODS

This research was conducted in the Department of Surgery Sanglah Hospital Denpasar by studying secondary data from medical records and patient had been interviewed in outpatients clinics. Design of this study is an observational cohort study to reveal about risk factors associated with outcome EDH patient after trepanation hematoma evacuation. Sample of this study is EDH patients who get surgery trepanation hematoma evacuation corresponding with protocol of Neurosurgery and

recorded in the medical record Sanglah hospital from June 2015 until June 2016 that fit into inclusion and exclusion criteria. Total amount of statistical sample is 60 patients. Statistic analyzes of this study consisted of univariate, bivariate and multivariate. Data was processed become tables and graphics. Univariate analysis use to get an idea about frequency distribution of studied variables. Bivariate analysis use to analyze the relationship between independent and dependent variables. And multivariate analysis use to analyze the relationship between several independent and dependent variables. Analysis using the Chi-squre formula with 95% level of confidence.

RESULTS

Characteristics of Study Sample

The samples were divided into age group less than 40 years amounted to 44 people (73%) and group more than or equal to 40 years amounted to 16 people (26.7%). Patients with a history of lucid interval amounted to 13 people (21.7%) and patient with GCS level less than or equal to 8 after resuscitation amounted to 19 people (31.7%). And patients with abnormal pupillary amounted to 24 people (40%). The time of the incident until the time of surgery more or equal to 12 hours as many as 21 people (35%). From head CT scan 34 patients (56.7%) had volume of EDH over 30 ml. Most cases had EDH in frontal and temporoparietal region that is 30% (18 people). Midline shift greater than or equal to 5 cm as many as 26 people (43.3%). Focal lesions that accompany most of EDH without surgery indication is contusio hemorrhage and Intracerebral Hemorrhage each is 10 percent. Outcome of patients EDH after trepanation hematoma evacuation with good recovery is 65 percent, and the patient who died amounted to 3 people (5%). (Table 1).

Bivariate Analysis Test

Bivariate analysis showed five significant risk factors to the outcome, that is: lucid interval (RR: 4.317, 95% CI: 1.182 to 15.76), GCS (RR: 35.46, 95% CI: 7.48 to 168.27), pupillary abnormalities (RR: 9.455, 95% CI: 2.54 to 35.16), midline shift (RR: 7.50, 95% CI: 2.05 to 27.40) and the duration of pre-surgery (RR: 46.25, 95% CI: 8.37 to 255.47).

Multivariate Analysis Test

From those five variables above after multivariate analysis had been done with logistic regression test, data was obtained that the GCS and the duration of the pre-operation becomes a major risk factor outcomes for EDH patient after surgery trepanation hematoma evacuation with a value of RR 4.553 95% CI 3.846 to 2.340; p-value 0.005 and RR 4.655 95% CI 4.470 to 2.473; p-value 0.004.

DISCUSSION

Few variables had been identified as a risk factor for the outcome, that is lucid interval, GCS, pupillary abnormalities, midline shift and the duration of the pre-surgery. From these five variables after multivariate analysis had been done, we found that GCS and the duration of the pre-operation become major risk factors that affect patient outcome after trepanation EDH hematoma evacuation.

In this study, GCS less than 8 is a pure risk factor unfavorable outcome in patients with post-trepanation EDH hematoma evacuation. Most patients with unfavorable outcome in this study came with low GCS (82.4%), suggesting that unfavorable outcomes in patients EDH show more likely to be influenced by severe primary brain injury, it is reflected by the low GCS. These conclusions were consistent with studies McKissock, which states that the GCS is the most important determinant factor in assessing prognosis of patients with EDH. Low GCS associated with unfavorable outcomes also found in many studies.[5,6,7,8,9,10,11,12,13,14,15]

The duration of the pre-operation more or equal to 12 hours also become pure risk factor of an unfavorable outcome. This is happens because the longer brain tissue get in pressed by EDH (more than 12 hours post-trauma) will aggravate the irreversible damage to the brain tissue. Resulting an inadequate supply of oxygen and metabolic requirements due to vascular and microvascular disturbances in patients with EDH.[3,12,16] Effort to relieve pressure on the brain tissue only can be done by trepanation hematoma evacuation as soon as possible is important to improve the outcome of patients with EDH.[3,7,17, 18,19,20] This study agree with previous studies which stated that the identification and hematoma evacuation

will rapidly improve the outcome of patients with EDH.[15,19,21]

Tabel 1: Characteristics of patients with post-trepanation EDH hematoma evacuation

Characteristics	Total	Percentage
Age		
< 40 y.o	44	73.30%
e" 40 y.o	16	26.70%
Lucid Interval		
Negative	47	78.30%
Positive	13	21.70%
GCS		
> 8	41	68.30%
d" 8	19	31.70%
Pupil		
Normal	36	60%
Abnormal	24	40%
Pre-op Duration		
< 12 Hours	39	65%
e" 12 Hours	21	35%
Volume of EDH		
15 – 30 ml	26	43.30%
>30 ml	34	56.70%
Site of EDH		
Frontal	18	30%
Temporal	10	16.70%
Parietal	1	1.70%
Frontotemporal	8	13.30%
Frontoparietal	2	3.30%
Temporoparietal	18	30%
Occipital	3	5%
Midline Shift		
< 0,5 cm	34	56.70%
e" 0,5 cm	26	43.30%
Others lession		
None	39	65%
Contusio Hemorrhage	6	10%
Subarachnoid Hemorrhage	4	6.70%
Intracerebral Hematoma	6	10%
Subdural Hematoma	5	8.30%
Outcome Favorable		
•Maximal Recovery	39	65%
•Moderate disability	4	6.67%
Outcome Unfavorable		
•Vegetative persistent	14	23.30%
•Died	3	5%

Generally pupils unisochore is a sign of herniation, whereas bilateral pupillary dilation showed irreversible damage to the brain stem. On multivariate analysis no significant association between abnormal pupil with unfavorable outcome. This difference can be explained because in our study the majority of patients EDH with abnormal pupil dominant with pupil unisochore and had GCS more than 8. Patients with pupils unisochore tend to have lighter level damage than who had bilateral pupillary dilation. Besides at Sanglah Hospital standard operating procedure of spacious EDH with abnormal pupil must be performed trepanation hematoma evacuation as quick as possible so that it can obtain a better outcome. This is same with study by Cohen, which said that patients EDH with unisochore pupil not associated with unfavorable outcomes because it is reversible after getting rapid treatment (less than 70 minutes) after the pupil dilated.[16]

Midline shift indicates there has been a pressing state by mass lesions on one side. Multivariate analysis found no significant relationship between the midline shift with unfavorable outcome. This difference can be explained because from secondary data of this study most of the patients with or without midline shift less than 0.5 cm come up with a better GCS. In addition, the role of midline shift in assessing prognosis should be associated with other CT scan findings, because level of midline shift also influenced by site of the EDH and other lesions. The level of midline shift in patients EDH can change significantly and rapidly after quick trepanation evacuation of hematoma post trauma.[14,22]

Older patients with EDH tend to have worse outcomes. This is happens because older patient have many comorbid together along with aged, capability recovery of the brain reduced, blood vessel elasticity decreased, and the occurrence of brain atrophy resulting blood vessels dural are more susceptible damage after trauma.[23] In this study there is no significant association between age over 40 years with unfavorable outcome. This happens because EDH mostly found in reproductive age and is rare in older patients.[7,24,25] Similar characteristics found in this study sample. The presence of comorbidities and other factors found in patient over

Table 2:The bivariate analysis of risk factors associated with outcome EDH patient after trepanation evacuation of hematoma

Risk factor	Outcome		RR	95% CI	P
	Favorable	Unfavorable			
Age			2.644		0.11
< 40 y.o	34(56.7%)	10(16.7%)		0.786 – 8.900	
e" 40 y.o	9(15%)	7(11.7%)			
Lucid Interval			4.317		0,021*
•Negative	37(61.7%)	10(16.7%)		1.182 – 15.760	
•Positive	6(10%)	7(11.7%)			
GCS			35.46		< 0,001*
• >8	38(63.3%)	3 (5%)		7.475 – 168.27	
• d" 8	5 (8.3%)	14 (23.3%)			
Pupil			9.455		< 0,001*
• Normal	32(53.3%)	4 (6.7%)		2.542 – 35.16	
• Abnormal	11(18.3%)	13(21.7%)			
Durasi pre-operasi			46.25		< 0,001*
• < 12 Hours	37(61.7%)	2 (3.3%)		8.373 – 255.47	
• e" 12 Hours	6 (10%)	15 (25%)			
Volume EDH			3.405		0,052
• 15 – 30 ml	22(36.7%)	4(6.7%)		0.956-12.125	
• >30 ml	21(35%)	13(21.7%)			
Midline Shift			7.5		0,001*
• < 0,5 cm	30 (50%)	4 (6.7%)		2.052 – 27.408	
• e" 0,5 cm	13(21.7%)	13(21.7%)			
Site of EDH					
Frontal					
• Yes	16(26.7%)	2 (3.3%)	4.444	0.898 – 22.008	0.053
•No	27(45%)	15(25%)			
Temporal				0.205 – 4.013	
• Yes	7 (11.7%)	3 (5%)	0.907		0.898
• No	36 (60%)	14(23.3%)		1.194 – 1.652	
Parietal					
• Yes	1 (1.7%)	0	1.405	0.129 – 2.913	0.526
• No	42 (70%)	17 (28.3%)			
Frontotemporal				0.022 – 6.462	
• Yes	5 (8.3%)	3 (5%)	0.614		0.537
• No	38(63.3%)	14 (23.3%)		0.150 – 1.605	
Frontoparietal					
• Yes	1(1.7%)	1(1.7%)	0.381	0.066 – 9.218	0.489
• No	42(70%)	16(26.7%)			
Temporoparietal					
• Yes	11(18.3%)	7(11.7%)	0.491		0.235
• No	32(53.3%)	10(16.7%)			
Occipital					
• Yes	2(3.3%)	1(1.7%)	0.78		0.844
• No	41(68.3%)	16(26.7%)			
Others lession					

None					
• Yes	30(50%)	9 (15%)	2.051	0.647 – 6.501	0.218
• No	13(21.7%)	8 (13.3%)			
Contusio Hemorrhage				0.063 – 1.939	
• Yes	3 (5%)	3 (5%)	0.35		0.214
• No	40(66.7%)	14(28.3%)		1.208 – 1.707	
Subarachnoid Hemorrhage					
• Yes	4 (6.7%)	0	1.436	0.063 – 1.939	0.193
• No	39 (65%)	17(28.3%)			
Intracerebral Hematoma				0.085 – 3.705	
• Yes	3 (5%)	3 (5%)	0.35		0.214
• No	40(66.7%)	14(23.3%)			
Subdural Hematoma	3 (5%)	2 (3.3%)	0.562		0.545
• Yes	40(66.7%)	15(25%)			
• No					

*statistically significant

Table 3: Multivariate analysis of outcome risk factors for patient with EDH after trepanation evacuation of hematoma

Risk Factor	RR	95%CI	p-value
Lucid interval	1,961	0,163 - 310,30	0,309
GCS	4,553	3,846 - 2,340	0,005*
Pupil	1,530	0,004 - 5,697	0,674
Midline shift	1,410	0,003 - 5,049	0,698
Pre-op Duration	4,655	4,470 - 2,473	0,004*

*statistically significant

60 years, while this study have no patients aged over 60 years.

Multivariate analysis of Lucid interval did not show significant association. It could be, because in this study patients with lucid interval comes with a lower GCS so that unfavorable outcomes in these patients tend to result from a low GCS not because lucid interval. Same with some previous studies in which GCS more dominant compared lucid interval to cause unfavorable outcome.[1,3,26] In this study volume and site of the EDH does not have a meaningful relationship with unfavorable outcome in EDH patients post-trepanation hematoma evacuation. This can be explained because most of the patients in this study, the EDH with large volumes found in temporoparietal region causing midline shift and minimal brainstem compression. Besides, EDH with large volume tends to be done trepanation to performed hematoma evacuation as soon as possible (less than 12 hours). The findings were similar to some previous research that there is no meaningful relationship between the volume and site of EDH with outcome.[8,27] Focal lesions accompanying EDH in this study was not a significant association with unfavorable outcome. This is because in our study majority subjects is with pure EDH and the remaining is accompanied by focal lesions. Other lesions that accompany EDH mostly small and did not have surgery indication , this is indicates lighter level of brain damage. The presence of SAH patients tend to have unfavorable outcome.[22,28] We have different result, there is no significant association between SAH accompanying

EDH with unfavorable outcome. This is because most of the study subjects had mild SAH (grade 1 and 2 according to Fisher Grading Scale for Admission SAH on CT Scan) .[29]

CONCLUSSION

Patients with EDH who had initial GCS less than 8 and accompanied by or time between incident and operation trepanation hematoma evacuation more than 12 hours have great affection with unfavorable outcome. Therefore, immediate identification of EDH and immediate decompression will affect patient outcome.

ACKNOWLEDGMENTS

Authors of the current article take this opportunity to thank all of the patients who warmly co-operated in this research program.

REFFERENCES

1. Bricolo A.P., Pasut L.M. Extradural hematoma: toward zero mortality. *Neurosurgery.***14**: 8-12 (1984).
2. Schutzman S, Barnes P, Mantello M, Scott R. Epidural hematomas in children. *Ann Emerg Med* **22**: 535-541 (1993).
3. Lee EJ. Factors influencing the functional outcome of patients with acute epidural haematomas: Analysis of 200 patients undergoing surgery. *J Trauma,* **45** : 946-952 (1998).
4. Bullock MR. Surgical management of Acute Epidural Hematomas. *NEUROSURGERY,* **58**(3): (2006).
5. McKissock W, Taylor JC, Bloom WH. Extradural Hematoma.Observations on 125 cases. *Lancet*; **2**: I67-172 (1960).
6. Gennarelli T, Spielman G, Langfitt T, Gildenberg P, Harrington T, Jane J, Marshall L, Miller J, Pitts L. Influence of the type of intracranial lesion on outcome from severe head injury. *J Neurosurg* **56**:26-32 (1982).
7. Kuday C, Uzan M, Hanci M. Statistical analysis of the factors affecting the outcome of extradural haematomas: 115 cases. *Acta Neurochir* (Wien) **131**: 203-206 (1994).
8. Van den Brink WA, Zwienenberg M, Zandee SM, van der Meer L, Maas AI, Avezzat CJ. The prognostic importance of the volume of traumatic epidural and subdural haematomas revisited. *Acta Neurochir (Wien)* **141**: 509-514 (1999).
9. Oertel M., Kelly D.F., McArthur D., Boscardin W.J., Glen T.C., Lee J.H., Gravori T., Obukhov D., McBride D.Q., Martin N.A. Progressive hemorrhage after head trauma: predictors and consequences of the evolving injury. *J Neurosurg.* **96**(1):109-16 (2002).
10. Hsiang J.N. High-risk mild head injury. *J Long Term Eff Med Implants*. **15**(2):153-9 (2005).
11. Sastrodiningrat, A.G, Memahami Faktor-Faktor yang Mempengaruhi PrognosaCidera Kepala Berat.Divisi Ilmu Bedah Saraf Departemen Ilmu BedahFakultas Kedokteran Universitas Sumatera Utara, Medan. Majalah Kedokteran Nusantara 308 Volume **39**(3): (2006).
12. Werner C., Engelhard K. Pathophysiology of Traumatic Brain Injury. *British Journal of Anaesthesia.* **99** (1) : 4-9 (2007).
13. Mizraji R., Perez-Protto S., Etchegaray A., Castro A., Lander M., Buccino E., Severo L., Alvarez I. Brain death epidemiology in Uruguay and utilization of the Glasgow coma score in acute brain injured patients as a predictor of brain death. *Transplant proc*; **41**(8):3489-91 (2009).
14. Saini N.S., Rampal V., Dewan Y., Grewal S.S. Factors predicting outcome in patients with severe head injury: multivariate analysis. *The Indian Journal of Neurotrauma;* **9**:45-48 (2012).
15. Golden N., Niryana W., Mahadewa TGB., Maliawan S., Chandra Ade. Two different approaches in obtaining head computerized tomography scan in minor head injuries. *J Neurol Res.* **3**(3-4) : 114-121 (2013).
16. Cohen J, Montero A, Israel Z. Prognosis and clinical relevance of anisocoria craniotomy latency for epidural hematoma in comatose patients. *J Trauma* **41**: 120-122 (1996).
17. Faleiro R.M., Pimenta N.J., Faleiro L.C.,

Cordeiro A.F., Maciel C.J., Gusmao S.N. Decompressive craniectomy for the early treatment of traumatic intracranial hypertension. Epub; **25**: (2005)

18. Leach, P., Omar, N., Hiren, C., Julian, E., Raphael, S., Richard, P., and Andrew, T. "Outcome after severe head injury: focal surgical lesions do not imply a better Glasgow Outcome Score than diffuse injuries at 3 months". *Journal of Trauma Management & Outcomes.,* **3**: p.5-9 (2009)
19. Kim Y.J. The Impact of Time from ED arrival to surgery on mortality and hospital length of stay in patients with traumatic brain injury. J Jen;04 (2010)
20. Matsushima K., Inaba K., Siboni S., Skiada D., Strumwasser A.M., Magee G.A., Sung G.Y., Benjaminm E.R., Lam L., Demetriades D. Emergent operation for isolated severe traumatic brain injury: Does time matter?. *J Trauma Acute Care Surg* ; **79**(5):838-42 (2015)
21. Zauner A., Muizelaar J P. Brain metabolism and cerebral blood flow. Head injury 3 rd ed. *Hall Medical.* 90-99 (2004).
22. Maas AI., Hukkelhoven CW., Marshall LF., Steyerberg EW. Prediction of outcome in traumatic brain injury with computed tomographic characteristics: a comparison between the computed tomographic classification and combinations of computed tomographic predictors. *Neurosurgery* **57** : 1173–1182 (2005).
23. Hukkelhoven C.W., Steyerberg E.W., Rampen A.J., Farace E., Habbema J.D., Marshall L.F., Murray G.D., Maas A.I. Patient Age and Outcome Following Severe Traumatic Brain Injury: an Analysis of 5000 patients. *J Neurosurg;* **4**:666-73 (2003).
24. Jones N, Molloy C, Kloeden C, North J, Simpson D. Extradural haematoma: Trends in outcome over 35 years. *Br J Neurosurg* **7**: 465-471 (1993)
25. Lahat E, Sheinman G, Feldman Z, Barzilai A, Harel R, Barzilay Z, Paret G. Metabolic and clinical markers of prognosis in the era of CT imaging in children with acute epidural haematomas. *Pediatr Neurosurg* **33**:70-75 (2000).
26. Cordobes F, Lobato R, Rivas J, Munoz M, Chillon D, Portillo J, Lamas E. Observations on 82 patiens with extradural hematoma. Comparison of result before and after the advent of computerized tomography. *J Neurosurg* **54**: 179-186 (1981).
27. Seelig J; Marshall L, Toutant S, Toole B, Klauber M, Bowers S, Varnell J. Traumatic acute epidural hematoma: Unrecognized high lethality in comatose patients. *Neurosurgery* **15**:617-620 (1984).
28. Murray G.D., Teasdale G.M., Braakman R. The European Brain Injury Consortium Survey of head injuries in neuro-units. *Acta Neurochir;* **14**: 223-236 (1999)
29. Rosen D.S., Macdonald R.L. Subarachnoid Hemorrhage Grading Scales A Systematic Review. *Neurocritical Care.* **2** : 110-118 (2005).