Original Article

Nepal Journal of Neurosciences 15:8-13, 2018

Clinical Predictors of outcome in Isolated Traumatic Acute Subdural Hematoma

Maya Bhattachan, MS, MCh
Department of Surgery
Tribhuvan University Teaching Hospital
Kathmandu, Nepal

Ali Niyaf , MS, MCh
Department of Surgery
Tribhuvan University Teaching Hospital,
Kathmandu, Nepal

Ram K.Shrestha, MS, MCh
Department of Surgery
Tribhuvan University Teaching Hospital
Kathmandu, Nepal

Amit Pradhananga, MS, MCh
Department of Surgery
Tribhuvan University Teaching Hospital
Kathmandu, Nepal

Gopal Sedain, MS, MCh
Department of Surgery
Tribhuvan University Teaching Hospital
Kathmandu, Nepal

Mohan R. Sharma, MS
Department of Surgery
Tribhuvan University Teaching Hospital
Kathmandu, Nepal

Sushil K. Shilpakar, MS
Department of Surgery
Tribhuvan University Teaching Hospital
Kathmandu, Nepal

Address for correspondence:
Maya Bhattachan
E-mail: mayab@mail.ru

Date submitted: 5/8/2018
Date accepted: 20/12/2018

To access Nepal Journal of Neuroscience, Archives scan QR code:

Head injury is the major cause of death in young adult population worldwide with associated high morbidity. The objective of this study is to find out the outcome and factors affecting the outcome in isolated traumatic acute subdural hematoma.

All patients with isolated acute subdural hematoma presenting within 24 hours of trauma and admitted over a period of 1 year were included in this study. Patient was classified according to Glasgow Coma Scale(GCS) after resuscitation in the emergency department. The outcome of the patient was recorded according to the Glasgow Outcome Scale at the time of discharge and at 3 months after the trauma in follow-up. Statistical analysis was performed to find the correlation between GCS, pupillary changes and radiological finding in the form of midline shift and hematoma volume to dichotomized outcome.

Out of 38 patients enrolled in the study, 33 patients had favorable outcome. Surgery was performed in 12 patients out of whom 4 patients had unfavorable outcome. GCS score, papillary changes, midline shift and hematoma volume were found to have significant association with the outcome in isolated traumatic acute subdural hematoma.

Clinical parameters and radiological parameters can gauge the outcome in isolated traumatic brain injury.

Keywords: Acute subdural hematoma, Glasgow outcome scale, Glasgow coma score, midline shift, hematoma.

Traumatic brain injury is the major cause of death and disability in young population globally. The incidence of injuries like road traffic accidents, violence, self inflicted injuries accounted for 17% of the global disease burden in adults aged 15–59 years in 2001.[16,17]

Traumatic brain injury (TBI) patients constitute about 34-35% of all trauma patients.[5,14]Fall is the major cause of TBI in Nepal followed by road traffic accidents (RTA).[6,19] Similarly in the USA majority of the TBI is due to fall which is seen increasingly in older population while in Nepal younger population (pediatrics population) are more

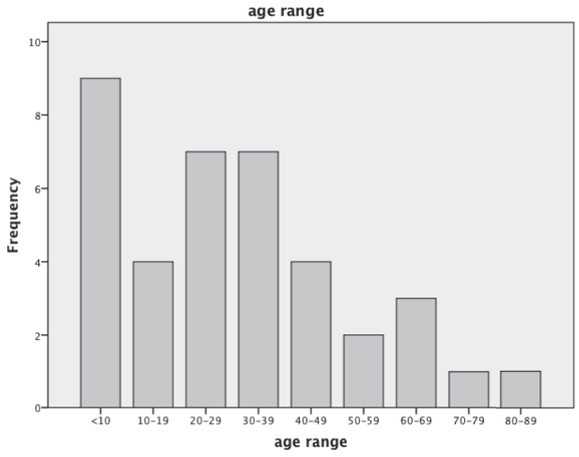

Figure 1 Age Range

affected by fall injury.[2,3,19] In India the RTA is the major cause of TBI which constituted 60% of TBI followed by fall 20-25%.[7]

Acute subdural hematoma(ASDH) occurs in about 5-29% of all TBI.[1,4,20] The development of guidelines, pre-hospital management of TBI patients has improved survival in severe TBI patients but the mortality rate of ASDH remains as high as 55-66%.[9,10,18,28] Ryan et al in 2012, reported in their article of 16% mortality in patients with traumatic ASDH.[21]

The aim of this study was to find out the correlation between different clinical and radiological parameter to outcome in isolated traumatic ASDH in Nepal

Materials and Methods

This is a prospective observational study conducted in TribhuvanUniversity Teaching Hospital from September 2011till August 2012. All the patients who presented to our emergency department with traumatic head injury within 24 hours of injurywas resuscitated, subjected to a battery of thorough neurological examination and CT scan of head based on clinical decision. Out of all TBI patients, the subgroup of patients with isolated traumatic acute subdural hematomaand those who were admitted to our hospital were included in this study. Patients with open or penetrating wounds, concomitant epidural hematoma, contusions, intracerebral hematoma or severe subarachnoid hemorrhage and serious extra-cranial injuries were excluded from the study.

The patients were managed according to institutional protocol in the management of head injury. The patient'smanagement was decided with emphasis on Glasgow Coma Scale, thorough neurological examination and CT image findings. CT scan head is used at our center

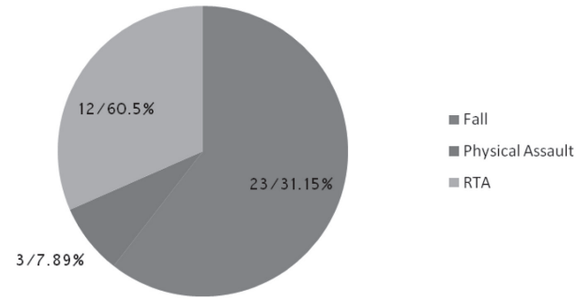

Figure 2 Mechanism of Injury

as the primary and decision making tool in traumatic head injury. Hence, the diagnosis of ASDH was made through the CT scan.

Glasgow outcome score was used as the standard measure of outcome. GOS was recorded at discharge; three months follow up and in the unfortunate event of demise of the patient at the time of death.

Dichotomized Glasgow Outcome Score (GOS), 3 or less than 3 is categorized as unfavorable and 4 and 5 as favorableoutcome,was analyzed for correlation with, GCS at admission, pupillary changes, mode of injury,and radiological parameters.

All the patients were resuscitated and accordingly treated conservatively with serial CT scan or emergency surgical treatment was performed following the "Brain Trauma Foundation Guidelines". The decision making parameters were ASDH volume, midline shift in CT Scan and deteriorating neurological conditions.

The ASDH was evacuated via a large standard decompressivecraniectomy or craniotomy with or withoutduroplasty using patient's own pericranium, fascia or dural substitute as needed depending on

Variables of the study

Clinical variables included age, sex, pupillary status, preoperative GCS scores post resuscitation and the mechanism of injury. Pupillary changes were recorded as present or absent.

CT scan were obtained at the time of presentation to the emergency department or before surgery within 24 hours of injury. The location, hematoma volume and midline shift was estimated from radiological findings. The hematoma volume was calculated on CT scan using the formula (0.5height × width × length) and <30ml, 30-50ml and >50 ml.[18] The midline shift was analyzed on CT scan at septum pellucidum and grouped as <5 mm, 5–15 mm, >15 mm according to classification byLobato et al.[15]

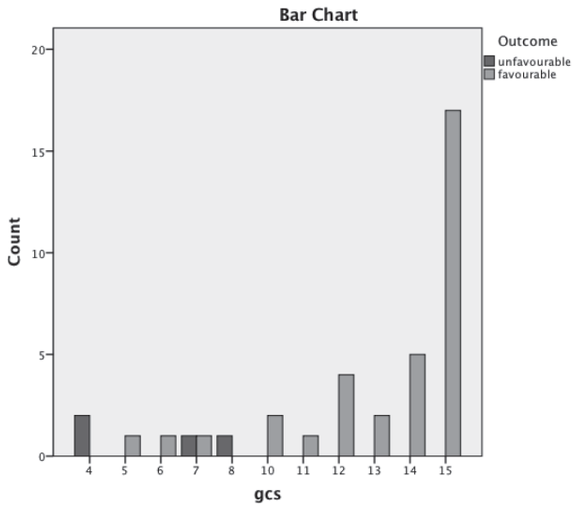

Figure 3 GCS and outcome

The time intervals from trauma to the decompression surgery was taken as within 12 hours and 12-24 hour and the type of procedure asdecompressivecraniectomy or craniotomy.

These variables were then used to compare with the outcome.

Assessment of neurological outcome by Glasgow Outcome Score is used to evaluate the final outcome in patient at discharge/death and at 3 months follow up. The outcome was divided into favorable outcome (GOS 5, 4) and unfavorable outcome (GOS 3, 2, 1). And mortality was defined as postoperative death within 30 days post-surgery.

Statistical analysis

Theunivariate analysis of correlation between different variables and outcome was assessed using Chi –square test or Fisher's test exact test.

Results

A total of 38 patients were included in this study. There were 25 males and 13 female patients. Average age was 29.32 years (SD 22.13).

The patients included in this study ranged from 1 year to 88 years old, while comparing the outcome in different age group there was no significant correlation (p value 0.612).

Similarly, there was no difference in male or female patients regarding outcome (p value 0.681).

12 patient sustained TBI due to RTA, 23 patients due to fall and remaining 3 patients sustained injury due to physical assault.

There were 24(64%) mild head injury patients, 7(18%) moderate and 7(18%) severe head injury patients.

There wasa overall mortality (unfavorable outcome) of 10.52%(4 patients); 89% (33 patients) had favorable outcome with GOS of 4or 5and one patient had unfavorable outcome with GOS of 3.

Glasgow Coma Score (GSC) at admission was found to have strong correlation with the outcome (p value >0.0001), with all the unfavorable outcomes seen in patients with GCS<8. Out of 7 patients with GCS < 8, death occurred in 4 patients.

Similarly, pupillary changes at presentation were found to be associated with poorer outcome (p value 0.001).

Pupil	Outcome		Total
	Unfavorable	Favorable	
Normal RRTL	0	30	30
Abnormal Change	5	3	8
Total	5	33	38
		p value	0.001

Table 1 Pupillary change and Outcome

Midline shift was categorized into three group as < 5mm, 5 - 10mm and as>10mm as measured in the CT scan of the head. The association between the poor outcome and amount of midline shift was found with greater the shift poorer the outcome.

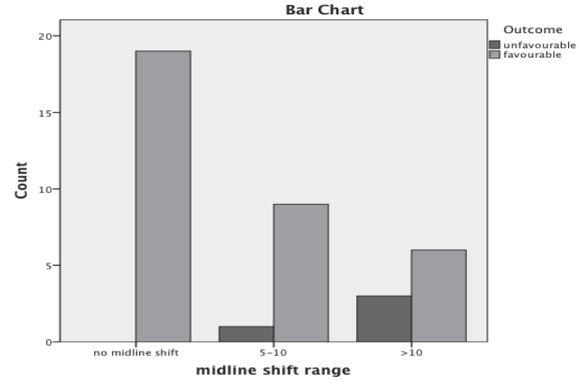

Figure 4 Midline Shift and Outcome

The hematoma volume was <30ml in 28 patients (73.68%). Seven patients (18.4%) had hematoma volume > 50ml, and half of these patients (4) had unfavorable outcome.

The relationship between the haematoma volume and unfavorable outcome was significant with p value 0.001.

Clinical variable	No. of patients	Unfavorable outcome (%)	p value
Total	38	5(13.15%)	
Sex			
Male	25 (65.77%)	4 (10.52%)	
Female	13 (34.2%)	1 (2.63%)	0.643
Age years			
<15	12(31.57%)	1 (2.63%)	
15-30	8 (21%)	3 (7.89%)	
30-45	9 (23.67%)		
45-60	5 (13.15%)		
>60	4 (10.52%)	1(2.63%)	0.284
Mechanism of Injury			
Fall	23 (60.5%)	4 (10.52%)	
RTA	12 (31.5%)		
Physical assault	3 (7.89%)	1(2.63%)	0.197
Preoperative GCS			
GCS < 8	7 (18%)	4 (10.52%)	
GCS 9-12	7 (18%)		
GCS 13-15	24 (64%)	1 (2.63%)	0.001
Pupil			
Sym. RRRTL	30 (78.9%)		
Abnormal	8 (21%)	5 (13.15%)	0.002
Radiological variable			
Hematoma Volume			
<30 ml	28 (73.6%)	1 (2.63%)	
30-50ml	3 (7.89%)		
>50ml	7 (18%)	4 (10.52%)	0.001
Midline Shift			
<5mm	16 (42%)	1 (2.63%)	
5-10mm	12 (31.5%)		
>10mm	10 (26.3%)	4 (10.52%)	0.006

Table 2 Clinical and Radiological Variable related to Outcome

A total of 12 patients underwent surgical treatment while 26 patients were treated conservatively. Decompressivecraniectomywas performed in 2 patients both of whom had unfavorable outcome. Of 10 decompressive craniotomy cases, 2 patients had unfavorable outcome. There was no difference in outcome in patients treated surgically within 12 hours of injury or a within a day.

Surgical variable	No of patients	Mortality no (%)	p value
Type of surgery	Total 12		
Craniotomy	10	2 (16.6%)	
Craniectomy	2	2 (16.6%)	0.000
Time to surgery			
<12 hrs post injury	7	3 (24.9%)	
>12 hrs post injury	5	1 (8.3%)	0.5

Table 3 Surgical Variable Related to outcome

Discussion

Traumatic ASDH is a common neurosurgical entity, often requiring emergency surgical evacuation. Despite newer diagnostic tool available to diagnose ASDH and aggressive treatment modality the mortality rate is till high around 39.8% -60%.[11,12] ASDH is found in 20-30% of severe head injury.[23]It is usually associated with parenchymal contusion, subarachnoid haemorrhages, diffuse axonal injury and epidural hematoma.[22,24,26]These associated injury worsens the prognosis of ASDH.[24]This study was conducted only in isolated traumatic ASDH patients. In the literature the mortality rate of isolated ASDH is 21.75%-39.8%.[11,27]In our series the mortality of isolated traumatic ASDH was 10.52%. High mortality rate is associated with increase in age, older patients above 70 years of age has mortality rate of 50%, 25.6% between 40 and 70 years and 26% below 40 years.[8]In another study by Tian et al patients younger than 30 years had a mortality rate of 14.08%, whereas patients above 50 years had mortality rate of 36.17%.[27]Our study did not find significance of age affecting the mortality.

Pupillary abnormalities are associated with a significantly worse outcome. Similarly, normal pupillary reactivity suggests favorable outcome, as shown by

Kim et al, 67.8% of patients who had bilateral reactive pupils achieved a functional recovery which was similar to our findings the where the patients with abnormal pupillary reactivity had unfavorable outcome while patients with normal pupillary reactivity had favorable outcome.[24,27]

The patients having isolated traumatic ASDH with bilateral fixed dilated pupils have higher postoperative mortality rates of 64.0% to 88.1%.[24,27] Monitoring the pupillary changes in the trauma will aid in urgent evacuation of the hematoma via decompressive craniec to my in case the patient deteriorates or if the patients has bilateral unresponsive pupils.

The most important predictor of outcome was preoperative or admission GCS score. We observed higher rate of unfavorable outcome in patients with severe head injury (GCS <8), of 7 patients with GCS score<8 , unfavorable outcome was seen in 4 patients. The lower the GCS score the lower the functional recovery with higher mortality rate.[23,27]

We observed in our series that CT variables like midline shift, hematoma volume and thickness correlates with outcome. The greater the midline shift and hematoma volume the greater the brain compression with raised intracranial pressure leading to decreased functional recovery after trauma.

We, in our study, found patients under going decompressive craniec to my had unfavourbale outcome, that maybe due to the fact that these patients had brain swelling even after the surgery requiring the removal of bone flap. Our series had 2 decompressivecraniectomy both with unfavorable outcome. Shigemori etal. in their study showed a significant reduction of ICP after decompressivecraniectomy and compared different surgicaltreatment in traumatic ASDH patientsand concluded that craniotomy to yield better recovery of function than craniectomy.[26]

Time to surgical interval was not significant in our study because of small sample size but there are many studies which suggest surgical decompression to start as soon as possible to avoid herniation.[22,24,25]

Conclusion

In isolated traumatic ASDH, preoperative GCS score, pupillary abnormality, midline shift and hematoma volume which all were independently significant predictors of outcome in isolated traumatic ASDH.

References

1. Bullock MR, Chesnut R, Ghajar J, Gordon D, Hartl R, Newell DW, et al. Surgical management of acute subdural hematomas. **Neurosurgery 58 (3 Suppl):**S16-24; discussion Si-iv, 2006
2. Coronado VG, McGuire LC, Sarmiento K, Bell J, Lionbarger MR, Jones CD, et al. Trends in Traumatic Brain Injury in the U.S. and the public health response: 1995-2009. **J Safety Res 43 (4):**299–307, 2012
3. Coronado VG, Xu L, Basavaraju SV, McGuire LC, Wald MM, Faul MD, et al. Surveillance for traumatic brain injury-related deaths--United States, 1997-2007. **MMWR Surveill Summ 60 (5)**:1–32, 2011
4. Feliciano CE, De Jesús O. Conservative management outcomes of traumatic acute subdural hematomas. **P R Health Sci J 27 (3)**:220–3, 2008
5. Gennarelli TA, Champion HR, Copes WS, Sacco WJ. Comparison of mortality, morbidity, and severity of 59,713 head injured patients with 114,447 patients with extracranial injuries. **J Trauma 37 (6):**962–8, 1994
6. Ghimire P, Yogi N, Acharya G. Management of Head Injury by General Surgeons in a General Hospital**. Nepal Journal of Medical Science 1 (1):**19-22, 2012
7. Gururaj G. Epidemiology of traumatic brain injuries: Indian scenario. **Neurol Res 24 (1):**24–8,2002
8. Hanif S, Abodunde O, Ali Z, Pidgeon C. Age related outcome in acute subdural haematoma following

traumatic head injury. **Ir Med J 102 (8):**255–7,2009
9. Hatashita S, Koga N, Hosaka Y, Takagi S. Acute subdural hematoma: severity of injury, surgical intervention, and mortality. **Neurol Med Chir (Tokyo) 33 (1):**13–8,1993
10. Karasu A, Civelek E, Aras Y, Sabanci PA, Cansever T, Yanar H, et al. Analyses of clinical prognostic factors in operated traumatic acute subdural hematomas. **Ulus Travma Acil Cerrahi Derg 16 (3**):233–6,2010
11. Kim K-H. Predictors for functional recovery and mortality of surgically treated traumatic acute subdural hematomas in 256 patients. **J Korean Neurosurg Soc 45 (3):**143–50,2009
12. Koç RK, Akdemir H, Oktem IS, Meral M, Menkü A. Acute subdural hematoma: outcome and outcome prediction. **Neurosurg Rev 20 (4):**239–44.1997
13. Kothari RU, Brott T, Broderick JP, Barsan WG, Sauerbeck LR, Zuccarello M, et al. The ABCs of measuring intracerebral hemorrhage volumes. **Stroke 27 (8):**1304–5,1996
14. Langley JD, McLoughlin E. Injury mortality and morbidity in New Zealand. **Accid Anal Prev 21 (3):**243–54, 1989
15. Lobato RD, Cordobes F, Rivas JJ, de la Fuente M, Montero A, Barcena A, et al. Outcome from severe head injury related to the type of intracranial lesion. A computerized tomography study. **J Neurosurg 59 (5):**762–74,1983
16. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. **Lancet 367(9524):**1747–57,2006
17. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. **Lancet 380 (9859):**2095–128,2012
18. Massaro F, Lanotte M, Faccani G, Triolo C. One hundred and twenty-seven cases of acute subdural haematoma operated on. Correlation between CT scan findings and outcome. **Acta Neurochir (Wien) 138 (2):**185–91,1996
19. McClennan S, Carolyn S. Head Injuries In Kathmandu, Nepal. **Mc Master University Medical Journal 1 (1):**10–4,2003
20. Nolan S. Traumatic brain injury: a review. **Crit Care Nurs Q 28 (2):**188–94,2005
21. Ryan CG, Thompson RE, Temkin NR, Crane PK, Ellenbogen RG, Elmore JG. Acute traumatic subdural hematoma: current mortality and functional outcomes in adult patients at a Level I trauma center. **J Trauma Acute Care Surg 73 (5):**1348–54,2012
22. Seelig JM, Becker DP, Miller JD, Greenberg RP, Ward JD, Choi SC. Traumatic acute subdural hematoma: major mortality reduction in comatose patients treated within four hours. **N Engl J Med 304 (25):**1511–8, 1981
23. Servadei F. Prognostic factors in severely head injured adult patients with acute subdural haematoma's. **Acta Neurochir (Wien) 139 (4):**279–85,1997
24. Servadei F, Nasi MT, Giuliani G, Cremonini AM, Cenni P, Zappi D, et al. CT prognostic factors in acute subdural haematomas: the value of the "worst" CT scan. **Br J Neurosurg 14 (2):**110–6,2000
25. Servadei F, Compagnone C, Sahuquillo J. The role of surgery in traumatic brain injury. **Curr Opin Crit Care 13 (2**):163–8,2007
26. Shigemori M, Tokutomi T, Kuramoto S, Moriyama T, Kikuchi N, Sasaguri Y. Diffuse axonal injury and early intracranial sequelae in severe head injury. **Neurol Med Chir (Tokyo) 31 (7):**390–5,1991
27. Tian H, Chen S, Xu T, Hu J, Rong B, Wang G, et al. Risk factors related to hospital mortality in patients with isolated traumatic acute subdural haematoma: analysis of 308 patients undergone surgery. **Chin Med J 121 (12):**1080–4,2008
28. Wilberger JE, Harris M, Diamond DL. Acute subdural hematoma: morbidity, mortality, and operative timing. **J Neurosurg 74 (2):**212–8,1991