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Original Research Article

An Analysis of Treatment Outcome in Traumatic Intracranial Bleed with Midline Shift of More Than 5mm: A Tertiary Level Health Care Center Based Study

Ankit Agarwal[1], Shashank Sah[2]

[1]Senior Resident, Department of General Surgery, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh, India

[2]Assistant Professor Neurosurgery, Department of Neurosurgery, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh, India

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Corresponding author: Dr. Shashank Sah

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Abstract:

Background: Traumatic intracranial bleed is an acute event with a pathophysiology that is dynamic. It has the potential of inducing progressive neurological deterioration either because of its continued expansion over initial few hours or subsequently by the combined effect of hematoma and edema. The hematoma and edema induced mass effect leads to midline shift (MLS) that may cause secondary damage to the delicately balanced architecture of brain between the two hemispheres, thus aggravating the neurological deficits or may even threaten the life. Influenced by a multitude of factors, the treatment and its outcome varies across centers. This signifies the need to identify factors that might possibly be modified to deliver a favorable outcome or prognosticate the patient in concern.

Among the factors having bearing on the decision of medical or surgical treatment, midline shift and Glasgow Coma scale score (GCS) are the most important ones and inversely related among themselves. We conducted a prospective study to assess their impact in need of surgery and outcome of treatment on a short-term basis.

Objectives: In patients of head injury having acute intracranial bleed and producing mass effect and midline shift of more than 5mm – to determine 1. The percentage of patients requiring surgery 2. To determine the incidence of mortality 3. To evaluate the functional recovery at 6 months post trauma

Methods: 61 patients with traumatic intracranial bleed and MLS of 5mm or more were enrolled over a period of 3 years. Medical or surgical treatment as justified by clinico radiological parameters and standard guidelines were given. Analysis was carried out with the objectives of identifying -the need of surgery in study subjects, mortality and functional outcome at 6 months post injury.

Results: 60% patient were less than 40 years of age. 50.8% patients were admitted with severe head injury (GCS<8). 73.8% patients (45/61) had a MLS between 5-10mm. 41 out of 61(66.7%) patients were treated by surgery. Overall, mortality was 37.7% (23/61). Of those who survived, 56.5% were functionally independent for activities of daily living at 6 months follow-up.

Conclusions: Traumatic intracranial bleed associated mass effect and midline shift is associated with high mortality. Treatment benefit rapidly declines with increasing mass effect. Only half of the survivors achieve functional independence for activities of daily living at 6 months post trauma.

Keywords: Midline shift, Traumatic, Intra cranial bleed, Glasgow coma scale, Functional outcome.

Introduction

Head injury is common across all age groups. Common reasons are road traffic accidents, fall from height, assault etc. Minor head injury can be symptomatic for long period of time and severe injuries may have good outcome suggesting thereby influence of various factors in subsequent recovery or complications.

At times, impact of secondary brain damage is more disastrous than primary injury itself. Alteration of consciousness is directly related to Mid line shift (MLS).In patients with acute hemispherical mass lesion – greater the MLS, worse is the neurological state. Evolution of edema further aggravates hematoma-associated mass effect and emergency surgical intervention might have to be resorted to, in order to prevent permanent neuronal damage or death. 15 days following an acute stroke, Pullicino et al. discovered that both MLS and coma were independent predictors of mortality.

Method

Study design: Prospective, Observational

Clearance from ethical committee of the institution and consent from participating patients were obtained.

Patients coming to hospital emergency with history of head injury and requiring admission were screened with inclusion and exclusion criteria. 61 patients with intracranial injuries and having MLS of more than 5 mm were enrolled over a period of 3 years, (August 2019 to July 2022). Inclusion Criteria – Traumatic intracranial bleed with MLS of more than 5 mm getting admitted within 12 hours of injury. Exclusion criteria - Patients less than 15 years age, acute or chronic renal disease, bleeding disorders etc. were excluded from study. Treatment was analyzed with regards to–the need for surgery, duration of hospital stay, mortality and functional outcome at 6 months follow up.

Results

Table 1: Patient distribution as per age group

Age	Number of patients
<20	5
21 to 40 yr	31
41 to 60 yr	20
>60 yr	5

Table 2: Patient distribution according to GCS

GCS Score	No. of patients
3 to 8	31 (50.8%)
9 to 12	22 (36.1%)
13 to 15	8 (13.1%)
	61

Table 3: Midline shift and patient distribution

Midline Shift	No of patients
5.1 to 10 mm	45 (73.8%)
10.1 to 15mm	11 (18%)
> 15 mm	5 (8.2%)

Table 4: Treatment modality

GCS Score	Medical Management	Surgical Treatment
3 to 8	9	22
9 to 12	5	17
13 to 15	6	2
	20	41

Table 5: Mortality in treatment groups

Treatment outcome	Medical Management	Surgical Mx
Survival	11	29
Death	9 (45%)	12 (29.3%)

Table 6: Mortality in relation to Midline Shift

Midline shift	No of Patients	Mortality
5.1mm to 10mm	45	11 (24.4%)
10.1 to 15mm	11	5 (45.5%)
>15mm	5	5 (100%)

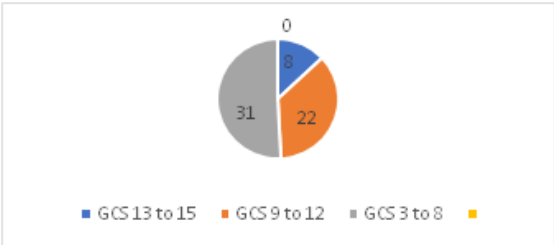

Figure 1: Patient distribution according to severity of head Injury

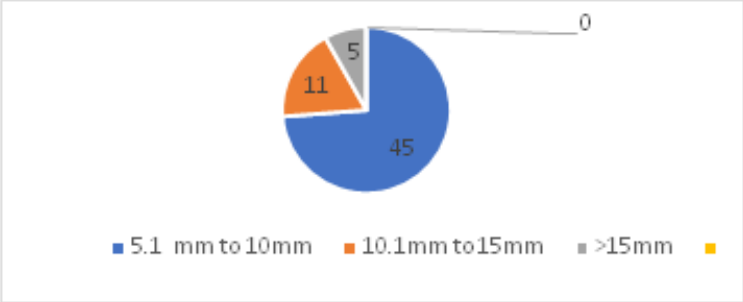

Figure 2: Midline shift and patient distribution

Of the enrolled patients, more than 60% were young males -less than 40 years of age (Table 1). Road traffic accident was the commonest mode (82%) of injury. Admission time GCS score was 8 or less in 50.8% patients whereas 13.1% pts had GCS between 13-15 (Table 2 and Fig 1). Radiological findings -most common hematoma type was mix of acute SDH and contusion followed by contusional hematoma and EDH. Pure Subdural hematomas were uncommon and were mostly associated with contusional injuries or SAH. 73.8% of enrolled patients had MLS between 5-10mm, 18% had shift of 11 to 15mm and 8.2% had MLS of more than 15mm (Table 3 and Fig 2). Cisternal obliteration i.e. effacement of basal cisterns was seen in 20.5% patients at admission time.

33.3% (20/61) patients were managed medically as against 66.7% (41/61) (Table 4) managed by surgery which includes 4 patients with cross over from medical to surgical group due to deterioration. Of The 20 patients managed medically, 5 had GCS score between 3 and 4. Here, in view of the clinical findings - dilated and non-reactive pupils/ signs of global ischemia on CT, aspiration pneumonia, respiratory failure, cisternal obliteration – we considered medical management was best.

All patients having GCS 12 or less were managed initially in ICU and 67.5% required ventilatory support. Tracheostomy was needed in 20 patients and added procedure (re exploration) in 2 patient. Among the survivors, hospital stay was more than 15 days in nearly 1/3rd patients.

Mortality – Altogether, 21 out of 61 (34.4%) enrolled patients died during the hospital stay (Table 5). Mortality rate was 45.5% when MLS was between 10 to 15 mm while no survivors were seen for MLS beyond 15mm (Table 6). Mortality was 45% in medical group and 29.3% in operated patient. None of those discharged had mortality in 6 months follow up.

Follow-up –As assessed by Glasgow outcome scale extended, 57.5% of the survivors (22/40) were functionally independent for activities of daily living at a follow up of 6 months.

Discussion

Head injury is a frequently seen entity in emergency dept with more than 80% of injuries falling under category of mild head injury GCS 13-15 [1]. Even under the category of mild injury- there are subset of patients with acute positive radiological findings- the high-risk mild head injury patients 2 who are at risk of neurological deterioration and need admission.

Traumatic intracranial hematomas represent a rapidly evolving pathology. A unilateral hematoma produces mass effect and MLS that puts the neurovascular structures at edge of temporary or permanent damage. It is a perfect example of territorial aggression that may initially go through silent phase owing to compensatory mechanisms or subsequently to phases of conflict, destruction and devastation. The tolerance to anatomical distortion observed with unilateral mass lesions like tumor or hematoma depends upon the pace of evolution of pathological masses – faster the appearance, worse is the clinical picture. Shifts as high as 15mm or more have been observed with minimal symptoms where mass lesions have appeared slowly like chronic SDH or occasionally a brain tumor owing to compensatory mechanisms which is not the case in traumatic hematomas. Presence of intracranial hemorrhage, midline shift and cerebral swelling has been shown to correlate with poor neurological outcome [3].

Studies have shown the validity of midline shift as a predictor of deterioration and poor neurological outcome. Quattrocchi et al [4] in a retrospective study analyzed that the risk of poor neurological outcome was 61% in intracranial hemorrhage with midline shift as compared to 34% in those without it. In same study it was observed that midline shift disproportionate to hematoma size was useful predictor of poor neurological outcome in 88% head injury patients.

We undertook the current study to specifically evaluate the treatment outcome in patients having traumatic intracranial bleed with midline shift of more than 5mm.The included patients had all types of traumatic hematomas.

Findings of this study revealed 86.9% patients had GCS score of 12 or less – 50.8% between GCS 3-8

and 36.1% between 9-12. It is a reflection that intracranial bleed with mass effect is a dangerous situation where in the patients are already serious on arrival to hospital. Yang et al [5] in his study reported that on admission majority of patients had a GCS score of 3-8 followed by 8.5% patients with a GCS score of 9-12. Ropper6 in his study observed that midline shift caused by unilateral acute mass lesions correlated with deterioration of consciousness. The study on 24 patients concluded that severity of shift is indicator of severity of brain damage. Our understanding is that though the multiple injuries observed on CT scan is responsible for the neurological status at presentation, and higher the mass effect - poorer is the neurological status.

A midline shift in conjunction with clinical status is an important determinant of treatment modality – surgical vs medical management (Nelson et al., 2010) [7]. Bullock [8] in his study on subdural hematoma patients suggested that all acute SDH with mass effect and MLS of more than 5mm or hematoma thickness greater than 10mm should be operated regardless of their GCS.MLS, Deteriorating/ low GCS, large hematoma volume with midline shift, clinical signs of uncal herniation, obliteration of basal cisterns were the main indications of surgical intervention. In our study 67.2% patients required surgery and 32.8% underwent medical management. Medical management was considered for those patients who had either GCS of 3-4 with dilated non-reactive pupils in conjunction with CT findings suggestive of extensive parenchymal injury not compatible with meaningful survival. Also patients with good GCS score(GCS between 13 to 15- 6 patients) were treated medically. Neurological deterioration after initial period of positive response is possible specially after 4-5days after trauma- the time when cerebral oedema starts worsening and may necessitate surgery.4of our patients on medical treatment subsequently needed surgery. Mortality remains high in head injury patients due to multiple factors. In a large series of 2068 patients treated at level 1 trauma centre, in-hospital mortality in severe head injury group was 36% [9]. Kagan et al [10]. observed mortality rates between 26.7% and 41.4% for head injured patients at Level 1 trauma centres. These studies included all types of head injured patients. While evaluating the specific subset of patients having intracranial bleed with MLS of 5mm or more, we observed a very high mortality rate -37.8%, combined in medical and surgical group. Mortality was higher in medical group as there were more patients where surgical option was not considered suitable. Cerebral herniation/ ischemia are responsible for deaths in early / immediate deaths post injury whereas septic shock, multiorgan failure were responsible for most deaths in those surviving initial few days.

TBI survivors carry functional disability long after initial survival. We followed the patients post discharge for 6 months to evaluate the functional independence as assessed on Glasgow outcome scale extended. Only 56.5% patients were able to perform activities of daily living by this time period post discharge. Studies report increasing level of functional independence on a long term follow-up. Nelson et al7. in a prospective study evaluating functional recovery, symptoms and quality of life in head injury patients, reported progressively increasing functional independence over 5 years but also observed higher mortality during this period. Juan Lu [11] et al evaluated the trajectory of functional independence measurements during the first 5 years after moderate and severe traumatic brain injuries. Largest improvement in functional ability was found around 3rd month to 1 year post injury and thereafter at a much slower pace till 5 years.

Conclusion

Traumatic intracranial bleed associated mass effect and midline shift is associated with high mortality. Treatment benefit rapidly declines with increasing mass effect. Only half of the survivors achieve functional independence for activities of daily living at 6 months post trauma.

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