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RESEARCH ARTICLE

IMMEDIATE PROGNOSTIC OUTCOME IN TRAUMATIC EPIDURAL HEMATOMA AT A TERTIARY CARE CENTRE

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ABSTRACT

Background: Traumatic brain injury (TBI) is one of the leading causes of death and disability. It is a critical issue in dealing with public health and socioeconomic crisis throughout the world. Extradural hematomas (EDH) accounts for 10.6% of all head injury patients admitted to the hospital and occur in 5-15% of fatal head injuries. This was a single center, retrospective, multivariate analysis of 1150 patients with EDH treated at a tertiary care hospital in India. **Objective(S):** To assess the immediate and long-term outcome of patients in terms of the Glasgow outcome score (GOS), and to analyze the factors predicting outcome in patients managed for traumatic EDH. **Methods:** Retrospective single center study. Details of patients who were admitted with traumatic EDH from August 2013 to July 2016 were collected from medical records and discharge summaries, namely, patient's age, sex, mode of injury, Glasgow coma scale (GCS), nature of pupils at admission, head CT at the time of admission including volume of EDH, associated lesions, midline shift and degree of effacement of basal cistern, management and duration of hospital stay. **Results:** 1015 patients were males (88.1%) and 137 patients were females (11.9%). Median age at presentation was 30 years (22-43 years). The most common mode of injury was road traffic accident which accounted for 87.8%. The most common presenting complaint was head ache (61.8%) followed by loss of consciousness (31.4%). There exists a significant negative correlation (spearman correlation coefficient - -0.171; p - 0.000) between age and GCS at admission. significant relationship exists between GCS at admission and age, sex of the patient, volume of EDH, pupils at admission, cisternal effacement and midline shift (p - <0.05). 387 had associated intracranial lesions. 64.5% had associated fractures, of which temporal bone fractures were the most common (33.2%) followed by frontal bone fractures (19.5%). Among those patients who survived (966 patients (83.85%)), mean duration of stay was 8 days (6-12 days). Surgery was indicated for 402 patients (34.9%) **Conclusions**: Factors for good functional outcome of treatment of EDH as noted in this study are abnormal pupils on admission, GCS at admission, presence of associated intracranial lesions and time between neurological deterioration and surgery. Other prognostic factors identified from our study includes age of the patient, sex, volume of EDH >30ml, cisternal effacement and midline shift >5mm.

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INTRODUCTION

Traumatic brain injury (TBI) is one of the leading causes of death and disability in the world. It has become a critical issue in dealing with public health and socioeconomic crisis throughout the world. Though the incidence is higher in developed nations, trauma related deaths have come down reasonably in these countries. However in developing countries, trauma is still one of the major causes of mortality and morbidity (Hofman *et al*., 2005). In spite of better understanding of the various molecular pathophysiologic mechanisms underlying traumatic brain injury, we are still not successful in defining a treatment paradigm (David *et al*., 2017). Neurosurgeons have emphasized on immediate and aggressive management of raised intracranial pressure (ICP), reduced cerebral perfusion pressure (CPP) and intracranial mass lesion (Part, 2001). Studies have proven that protocol driven therapy has resulted in tremendous improvement in patients' outcome which led to the establishment of TBI guidelines for management of head injury (Fakhry *et al*., 2004). Extradural hematomas (EDH) accounts for 10.6% of all head injury patients admitted to the hospital and occur in 5-15% of fatal head injuries (Sarkar *et al*., 2014; Lindenberg, 1971; Maloney, 1969). In 1886 Jacobson proposed the classical presentation of extradural hematomas which was however seen only in 14-21% of these patients (Jacobson, 1886; van den Brink, 1999).

Prognostic outcome is the best in pure EDH compared to those with associated intradural lesions (Haselsberger, 1988). Any diagnostic or treatment delay due to atypical presentation of EDH has resulted in increased mortality and morbidity. This single center, retrospective, multivariate analysis of 1,152 patients treated at a tertiary care hospital in India, was conducted to assess the immediate and long-term outcome of patients in terms of the Glasgow outcome score (GOS), and to analyze the factors predicting outcome in patients managed for traumatic EDH.

MATERIALS AND METHODS

This is a retrospective single centre study of traumatic epidural hematoma patients who were admitted from August 2013 to July 2016 at the Institute of Neurosurgery, Rajiv Gandhi Government General hospital. Institutional ethical clearance was obtained before commencing the study. The details of patients who were admitted with traumatic extradural hematoma from August 2013 to July 2016 were collected retrospectively from the medical records and discharge summaries namely patient's age, sex, mode of injury, Glasgow coma scale (GCS), nature of pupils at admission, head CT at the time of admission including volume of EDH, associated lesions, midline shift and degree of effacement of basal cistern, management and duration of hospital stay were assessed. Revised Brain Trauma Foundation guidelines (BTF 2007) were used to determine the management of these patients. IBM SPSS version 20 was used for statistical analysis. Binary logistic regression was used to determine the effects of age, sex, preoperative clinical and radiological findings on the immediate outcome of patients. Spearman correlation coefficient and Chi-squared test was used to assess the strength of association between age, sex and mode of injury with admission GCS. The Chi-squared test and Fischer's exact test was applied to categorical variables. A 'p' value less than 0.5 was considered significant. Continuous variables are reported as mean and standard deviation, and categorical variables as absolute and relative frequencies.

RESULTS

1152 patients who were diagnosed with traumatic EDH were included in the study. Out of the 1152 patients 1015 patients were males (88.1%) and 137 patients were females (11.9%). The median (inter quartile range) age at presentation was 30 years (22-43 years). The most common mode of injury was road traffic accident which accounted for 87.8% of the lot. The most common presenting complaint was head ache (61.8%) followed by loss of consciousness (31.4%). The incidence of mild, moderate and severe head injury was 62.1%, 11.7% and 26.2% respectively. There exists a significant negative correlation (spearman correlation coefficient - -0.171; p - 0.000) between age and GCS at admission. However there exists no correlation between mode of injury and GCS at admission. A significant relationship exists between GCS at admission and age, sex of the patient, volume of EDH, pupils at admission, cisternal effacement and midline shift (p - <0.05). 387 patients with EDH (33.6%) had associated intracranial lesions. 64.5% of patients had EDH associated with fractures, of which temporal bone fractures were the most common (33.2%) followed by frontal bone fractures (19.5%). Among those patients who survived (966 patients (83.85%)), mean duration of stay in the hospital was 8 days (6-12 days).

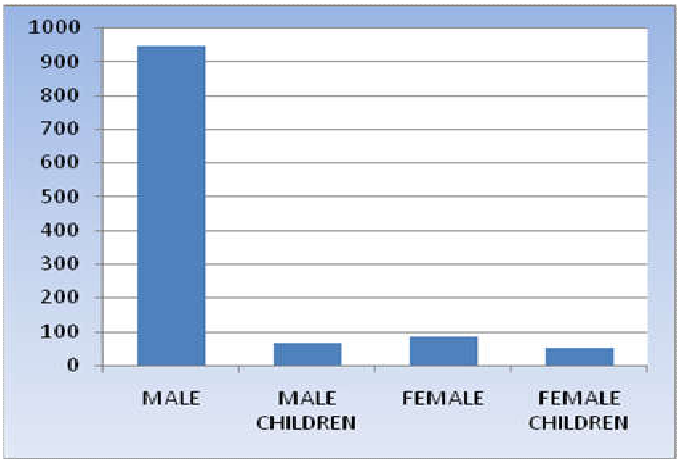

Figure 1. Sex distribution

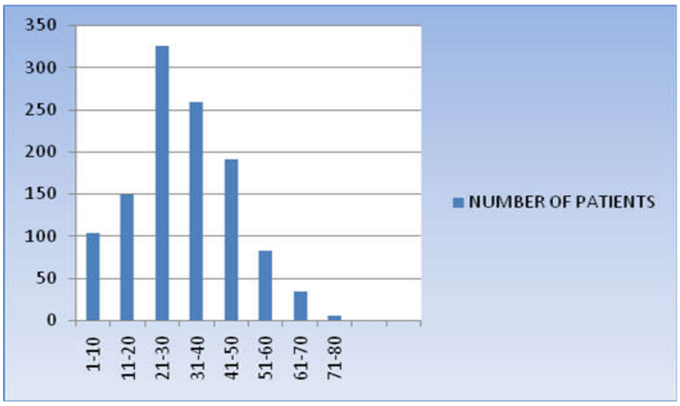

Figure 2. Age distribution

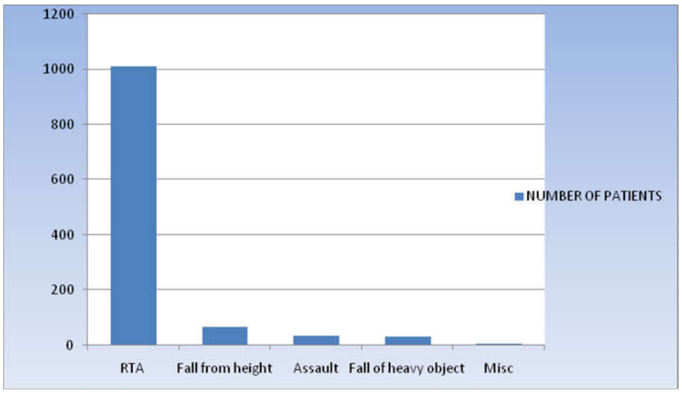

Figure 3. Mode of injury

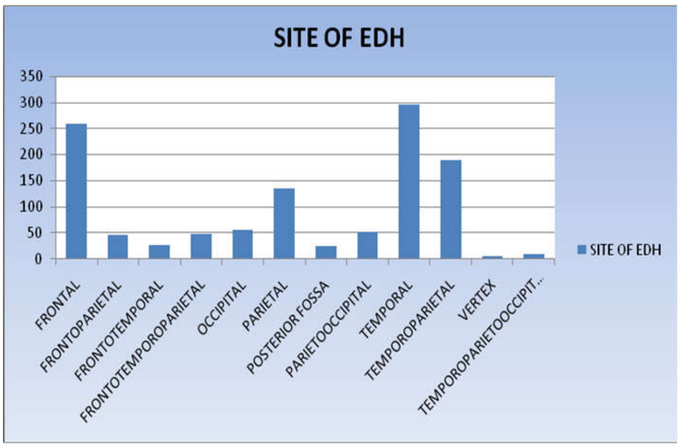

Figure 4. Site of edh

Table 1. Association of demographic, clinical and ct profile with admission gcs

Variables	p Value
Age	0.000
Sex	0.000
Mode of injury	0.977
Volume of edh	0.000
Cistern effacement	0.000
Volume of edh	0.000

Table 2. Factors predicting immediate outcome

Variables	Correlation	'p' Value
Male sex	-0.083	0.002
Age	-0.188	0.000
Admission gcs	0.641	0.000
Anisocoria	-0.269	0.000
Volume ofedh > 30ml	-0.290	0.000
Midline shift >5mm	-0.290	0.000
Cisternal effacement	-0.290	0.000
Surgical management	-0.290	0.000
Presence of associated intracranial leson	-0.400	0.000

Surgery was indicated for 402 patients (34.9%) who underwent either craniotomy and EDH evacuation alone or a decompressive craniectomy for an underlying contusion or SDH.

Outcome predictors

The outcome of the patient was influenced by various factors such as age, sex, preoperative clinical and radiological findings. Bivariate correlation analysis suggested that there was a negative correlation between male sex and survival (spearman correlation coefficient - -0.083; p - 0.002). A similar negative correlation is seen with increasing age and survival of the patient (spearman correlation coefficient - -0.188; p - 0.000). Furthermore there was a negative correlation between anisocoria (spearman correlation coefficient - -0.269; p - 0.000), volume of EDH >30 ml (spearman correlation coefficient - -0.290; p - 0.000), shift >5mm (spearman correlation coefficient - -0.290; p - 0.000), cistern effacement (spearman correlation coefficient - -0.290; p - 0.000), surgical management (spearman correlation coefficient - -0.290; p - 0.000), presence of associated intracranial lesions (spearman correlation coefficient - -0.400; p - 0.000) and survival of the patient. It was evident that a positive correlation exists between admission GCS (spearman correlation coefficient - 0.641; p - 0.000) and patients' survival.

DISCUSSION

In our institute we observed that incidence of EDH was greater among males. Age at presentation of EDH was between 22-43 years which is in concordance with literature data (11-14). 75% of male patients were either under alcohol influence while driving or were travelling at high speeds without safety precautions like seat belt or helmets. Though EDH is more common in focal impact injuries such as assault or fall of heavy objects, in our study EDH was more common following RTA. Admission GCS of our patients was between 13 and 15 in 62% of the patients suggesting that EDH occurs following low impact trauma with negligible effects on brain parenchyma. 26.2% of the patients had to be intubated owing to poor GCS at admission. Those patients who were intubated and went on to be managed surgically continued to require ventilator support at the post operative period making them susceptible to ventilator associated complications. Periera *et al* demonstrated in his study that 22-56% of the patient were in coma on admission or immediately prior to surgery (Pereira *et al*., 2005). A higher incidence of intracranial complications is seen in patients with severe head injury. The recovery is usually complete in patients with minor head injury (Dacey *et al*., 1986). The morbidity and mortality rates are lower in pediatric series than the adult series, which is similar to our study results (Cordobrs *et al*., 1981; Hawkes , 1962; Heiskanen , 1975; Iwakuma *et al*., 1973; Matson , 1969). Fractures of the skull were seen in 64.5% of the patients with temporal, frontal and temporo-parietal regions being the most common site for EDH which is consistent with other series (Pereira *et al*., 2005; Luna *et al*., 1997; Bricolo , 1984; Paiva *et al*., 2010; Bullock *et al*., 2006; Yilmazlar *et al*., 2005). The site of EDH in our series confirms the intrinsic relationship of middle meningeal artery with the underlying bones especially the temporal and parietal bones. However sinus bleed from superior sagittal sinus may be responsible for frontal EDH.

A temporal clot produces early medial displacement of the uncus which exerts pressure on the midbrain and oculomotor nerve, and so is considered more lethal. In contrast, hematomas located over the fronto-parietal convexity tend to extend up to the falx or even spread along the whole hemisphere, and have less ability to shift the medial temporal lobe. Similarly, lesions in the occipital region shift the cerebral hemispheres rostrally, and so spare the brainstem and oculomotor nerve (Lindenberg, 1977). A focal clot over a small area of dura produces more brain shift than a same-sized clot that is spread over a large surface area of dura (Carcassone *et al*., 1977; Hirsh, 1980; McKissock, 1960). The gross shift of brain tissues and suppression of the cerebral blood supply and venous drainage following herniation, leading to development of brain edema and post-traumatic massive cerebral infarction requiring intensive medical care or a decompressive craniectomy (Mangla *et al*., 2014).

In infants and young children, EH tend to spread thinly over large areas of the convexity and are less likely to cause focal brain shift (Hawkes, 1962; Heiskanen, 1975; Carcassone *et al*., 1977; Hirsh, 1980; McKissock, 1960). The reduction in mortality from acute EDH has been greatly contributed by the introduction of computed tomography (CT) and the advancement of neuromonitoring and intensive care (30). Clinicopathological correlates prior to and following hematoma can be adequately delineated by CT. The initial diagnosis and postoperative management of patients with acute epidural hematomas has drastically improved through the introduction of CT scanning (Bricolo, 1984; Bruce *et al*., 1978; Clifton *et al*., 1980; Cordobrs *et al*., 1981; Fankhauser , 1983; Kvarnes , 1978; Lipper , 1979; Lobato , 1983; Mendelow , 1979; Nelson , 1982; Oatey , 1983; Petersen , 1984; Petersen , 1984; Piepmeier , 1982; Seelig , 1984; Tamas *et al*., 1985; Taneda, 1979; Vilalta *et al*., 1986; Zimmerman, 1982; Zimmerman *et al*., 1982). The CT scan helps in identifying the unsuspected coexisting lesions associated with extradural hematomas (Cordobrs *et al*., 1981; Jamieson *et al*., 1968; McKissock *et al*., 1960; McLaurin, 1964; Munro *et al*., 1941; Phonprasert, 1980). 33.6% of the patients in our study series had an associated intracranial lesion which is consistent with other study series, of which 12.5% of these patients did not survive. The mortality rate increases by three- to fivefold in the presence of associated lesions with epidural hematoma. The incidence of associated pathology is higher in patients with poorer preoperative neurological status (Cordobrs *et al*., 1984; Kvarnes, 1978; Lobato *et al*., 1983; Gallagher, 1968; Heiskanen, 1975; Hooper, 1959; Jamieson, 1968; McLaurin, 1964; Ericson, 1981; Miller , 1981). The coexistence of diffuse axonal injury with epidural hematoma is a critical issue, as it escapes CT recognition but interferes with clinical course and surgical prognosis (Vilalta *et al*., 1986; Adams, 1982; Cordobrs, 1986; Gennarelli, 1982; Strich, 1986). After the initial brain damage, secondary brain tissue insult is due to hypoxia and hypotension (Hammell, 2009). The essential principles in the emergency management of patients with TBI are securing early airway and circulation control. The brain trauma foundation (BTF) surgical guidelines are widely accepted as they provide objective criteria for deciding on surgical or conservative management in EDH patients (Bullock *et al*., 2006). A hematoma volume <30 cm3 and 15 mm thickness, and with <5 mm midline shift on CT examination for patients with GCS score >8 without neurologic deficits, can be managed conservatively with repeated CT follow-up (Bullock *et al*., 2006). In patients managed non-operatively, EDH progression (EDHP) may alter the course of conservative management. Incidence of EDHP needing surgical intervention ranges between 6.25-32% in patients treated with conservative management initially (Bezircioğlu *et al*., 1996; Mayr *et al*., 2012; Salama , 2010; Sullivan *et al*., 1999). The most cost effective of all surgical procedures to treat EDH in terms of quality of life and years preserved is surgical evacuation (Pickard, 1993). Among the surgical cases, the most used method with complete evacuation and bleeding control was craniotomy (Bullock *et al*., 2006). The extradural hematomas in the posterior fossa are highly lethal and should be operated without delay (Burres , 1979; Cordobds , 1980; Hooper , 1954; Zuccarello, 1981). In patients with traumatic acute EDH, the recovery is good if the hematoma can be evacuated on a timely basis (Araujo *et al*., 2012). However zero mortality with epidural hematoma seems unattainable.

Conclusion

The most important factors for good functional outcome of treatment of EDH as noted in this study are abnormal pupils on admission, GCS at admission, presence of associated intracranial lesions and time between neurological deterioration and surgery. Other prognostic factors identified from our study includes age of the patient, sex, volume of EDH >30ml, cisternal effacement and midline shift >5mm. Delayed transportation to the hospital and delayed diagnosis are a few avoidable factors that are implicated in preoperative deterioration of patients with extradural hematomas. Hence it is prudent that knowledge of the epidemiology of traumatic EDH can assist in developing public health measures aimed at prevention and early identification of this disease in the population.

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