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Original Article

EXTRADURAL HAEMATOMA IN CHILDREN: SURGICAL EXPERIENCES AND PROSPECTIVE ANALYSIS OF 138 CASES

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Abstract:

Objective: The authors present their experiences in the management of extradural haematoma in children which involved an aggressive diagnostic approach, prompt surgical evacuation of the haematoma results in an excellent outcome.

Subjects and method: 138 consecutive patients with cranial extradural haematoma who underwent surgery in department of Neurosurgery from 1st January 2006 to 31st July 2009 were included in this prospective study. Each of the patients were evaluated in term of age, sex, mode of injury, localization of haematoma, clinical presentation, CT findings, operative measures and outcome.

Results: Out of 138 cases 72.47 % were boys and 13.78 % were girls. The boys and girls ratio was 2.64: 1. Age ranges from 1.8 to 15 years with a mean age of 9.49 years. Most of the victims are in first half of second decade of life and closely followed by the 5-10 years age group. The most common mode of injury was fall 40.58 %, (n = 56) followed by Road traffic Accident (RTA) 31.89 %, (n = 44) .The Most common clinical presentation was altered sensorium 59.43 %, (n = 82), followed by Headache / Vomiting 56.53 %, (n = 78)

Conclusion: Extradural haematoma in children is a recognized and one of the most rewarding neurosurgical emergencies. It must be recognized and evacuate early to prevent potential mortality and morbidity. Many factors affect the outcome of extradural haematoma surgery. In addition to influence of presence cranial fractures, associated brain lesions and pre-operative neurological condition of patient, duration of time interval between onset of coma and surgical intervention, morbidity and mortality have also been shown to be affected by age – with better prognosis in patients under 10 years of age.

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Introduction:

EDH is a unique form of neurotrauma, being potentially lethal, yet easily remedied if diagnosed early and promptly treated. For this reason, the outcome of treatment of EDH has remained a yardstick to measure the efficacy of neurotrauma service [1].The incidence of EDH among traumatic brain injury (TBI) patients has been reported to be in the range of 2.7 to 4% [2] . It has been estimated that EDH represents 2–3% of all head injuries in the pediatric population .[3] The mean age of pediatric patients harboring EDH is between 6 and 10 years and EDH is even rarer among infants under the age of 12 months [2 - 5.]

It is recognized that EDH in children differ from EDH in adults in that the haematoma may follow a trivial injury, the symptoms are different, the course is more insidious, associated skull fracture is infrequent [6] and this make it difficult to diagnose and often challenging to manage. Furthermore, the criteria for utilizing surgical evacuation vs conservative management have remained ill-defined. Thus, the lack of any guidelines regarding the appropriate management of EDH in pediatric patients and particularly in infants makes the management of this specific group of patients all the more complicated [3].The reported mortality rates of EDH in children are quite different varying between 0% and 50%. [7] These considerable variations in the outcome and lack of data that provide a clear cut picture of EDH in children prompted us to carry out this study. We present our experience with 138 cases of acute epidural hematoma in children less than 18 years of age. Here, we discuss the age-related findings and the differences with adults.

Clinical Materials and Methods:

Between January 2006 and July 2009, 138 patients were surgically managed at the Department of Neurosurgery, Dhaka Medical College Hospital. This prospective study includes these consecutive patients. The patients were categorized according to age and were divided into four groups, for analysis and comparison of their presentation and management. Group A: aged 0 to 2 years - 6 cases (4.35%), Group B: aged 3 to5 years -21 cases **(15.22%);** Group C aged 6 to 10 years- 50 cases (36.23), Group D aged 11 to 18 years- 61 cases (44.20%). A meticulous physical examination, with an emphasis on neurological function, was performed on admission. The diagnosis of haematoma was confirmed by CT scanning. In addition, standard epidemiological data including age, sex and mode of injury, presence of skull fracture, presenting clinical features from injury to surgery, preoperative Glasgow Coma Score (GCS) and pupillary reaction to light, presence of other injury, CT findings, localization of haematoma, the effect of injury and timing from injury to surgery were recorded. Surgical decision was determined by the following clinical and radiologic parameters: 1) Unconscious or deterioration of neurological status in patients with a Extradural hematoma larger than 20 ml, 2) Volume of the hematoma 30 mL even if the patient is awake and free from neurological deficit, 3) Volume of the hematoma ?20 mL when located in critical sites, such as posterior cranial fossa or temporal base, 4) midline Shift > 0.5 cm with deterioration of level of consciousness,5) Increase in the hematoma size.

We calculated the volume of the hematoma by measuring the diameters (length, width, and height) and considering hematoma shape as an ellipsoid. In particular, we used the following method: a x b x c 0.52, where “a,” “b,” and “c” represent the diameters of the hematomas.[8]

Patients with spontaneous EDH or patients with EDH of unknown etiology and patients treated conservatively were excluded from current study. Asymptomatic patients, patients presenting only minor symptoms with small haematoma (thickness less than 20mm), patients admitted 24 or more hour after trauma with neurological stable condition were selected for conservative management. These patients were very closely observed clinically by monitoring level of consciousness, focal neurological signs, and vital signs and follow up CT scan was done to asses clot size. We had to operate on 7 such cases when patient’s level of consciousness and GCS score were deteriorated and repeat CT scan showed increase in size of haematoma. All the cases were operated on emergency basis. Surgical management consisted of craniotomy under general endotracheal anesthesia and removal of the underlying hematoma .Outcome was assessed on an outpatient basis. The Glasgow Outcome Scale (GOS) was utilized for evaluating the outcomes.

Results:

Clinical Parameters:

Ages of the patients were ranged from 1.8 years (One year eight months) to 18 years with a mean age of 9.49 years. Age distribution demonstrates that most of the victims were in first half of second decade of life. There were 72·47 % male and 27·54 % female patients; the ratio between them was 2·64:1. The most common mode of injury was fall (40.58 %) followed by Road traffic Accidents (RTA) 31.89 .Most of our road traffic accidents involved passengers of **“Three Wheel Vehicles”** like Baby taxi and Rickshaw. In our series, commonest clinical presentation was altered sensorium 59.43 %, followed by Headache / Vomiting 56.53 %,. 18.85% patients had neurological deficit (hemiparesis). Early seizures were recorded in 10.15 % children presenting with EDH. The classically described “lucid interval” i, e. a patient who was initially unconscious, then wake up and secondarily deteriorates, was observed in 27.54 % cases (Table-II) .According to CT findings, temporo-parietal region was involved in 42.03 % followed by frontal region in 30.44 %.The posterior fossa involvement was very few, 1.45 % cases .Table-III).62.32 % patients showed skull fractures demonstrated either by x-ray, or CT scan or discovered at the time of operation. Associated injuries were present in 27.53 % cases (Table-IV). All the cases were operated on emergency basis and two third of cases (66.76 %) were operated on within the first 24 hours (Table V).

Twelve patients (8.69 %) were expired. Among these unfortunate 12 patients, 5 had associated brain injuries, 8 cases were deeply unconscious and 9 of these had fixed pupil / pupils at the time of admission.

Table-I
Mode of Injury

Cause of injury	No. of population	Percentage
Fall from height	56	40.58
RTA	44	31.89
Assaults	31	22.47
Fall of heavy weight on head	7	5.07

Table-II
Clinical Presentations

Signs / Symptoms	No. of population	Percentages
Altered sensorium	82	59.43
Headache / Vomiting	78	56.53
Lucid interval	38	27.54
Neurodeficit (hemiparesis)	26	18.85
Seizure	14	10.15

Table-III
Population distributions as per site of Haematoma

Site of Haematoma	No. of population	Percentages
Temporoparietal	58	42.03
Frontal	42	30.44
Parietal	19	13.77
Temporal	15	10.87
Occipital	2	1.45
Posterior fossa	2	1.45

Table-IV
Associated injuries

Associated injuries	No. of population	Percentages
Fracture	86	62.32
Contusion / ICH Acute	34	24.64
Subdural Haematoma	4	2.89

Table-V
Time interval between trauma and operation

Hours	No. of population	Percentages
0 -12	14	10.15
13 - 24	78	56.63
25 -48	46	33.34

Discussion:

Traumatic extradural haematoma (EDH) in children have some unique features when compared with those in the adult population. Our institution is not a pediatric neurotrauma center but a neurosurgery department that admits patients of all ages with an average number of 15,000 neurotrauma admissions per year. Therefore, there is every reason to assume that the data we present are a true reflection of the comparison with those of the adult population. Traumatic extradural haematoma (EDH) in children accounted for 15.86% of the 870 patients with an epidural hematoma operated in our institution in the same period. This lower incidence of acute epidural hematoma in the children compared with adults is also reported in other series and is attributable to the tight adherence of the dura mater to the inner table of the skull.[8]

Our analysis has identified that EDH is more frequent in 11 years of age or above among children (44.21%)). Only 4.35% victims were infants. This data is correlated with other reported series of EDH in children [7, 9, 10-13] This is due to the high-velocity trauma mechanism in the older age group [8]. In these series majority of patients were boys (74.47%).It is similar to other reported series of EDH in children [10, 11,12,14]. and this trends was observed even in infants (66.67%). It was reflecting the natural tendency of boys to indulge in risky play activities.

In our series, falls were the predominant modes of injury (40.58%) followed by RTA (31.89 %,). Out of 56 victims of fall, (29/56) were in domestic (22 /56), in sports and recreation; and (7/56) were in work. Similar results have been reported by other authors [7, 8, 10, 14] but Dhellemmes found that 64% patients with EDH had been involved RTA and other causes had occurred less frequently [11]. RTA is the commonest mode of injury in adult also. [13] The cause of accident in this subcontinent include a poor design and maintenance of roads, poorly maintained vehicle with no safety facilities, apathy by authorities, poorly trained drivers and most importantly public and children awareness of prevention of accidents etc. These factors play important role in road traffic accidents and head injuries including EDH [15]

Historically, bleeding from middle meningeal artery has been considered as the main source for EDH. But in a recent report on EDH in 102 pediatrics patients and 387 adults, arterial bleeding identified as the source of EDH in 36 % of adults and in 18 % of children.

[2,16] In 31% of pediatrics patients a bleeding source could not be identified and venous bleeding accounted for approximately 32% of EDH in this age group [2].

In these series most patients (59.43 %,) had altered sensorium and we strongly believe that this is the most significant sign of EDH in Children. It is supported in other reported series also [9-11]. 56.53% Children had headache associated with persistent vomiting. It is nonspecific but important clinical sign. In our series we evaluated other clinical signs such as hemiparesis (18.84%) and pupil dilatation (22%). The classically described "lucid interval" was observed in 27.54% cases in our series. It is almost similar to Ersahin et al [17] who had found lucid interval in 37% cases but was contradictory to Hanci et al [10] who discovered it was only in 11.125 cases. In our series, early seizure was noted in 10.15% cases. Our data is in agreement with Lahat et al ,[4] who reported early seizure in 8% of pediatrics patients.

Simpson et al [18] pointed out that diagnosis of EDH in a child may not be made until early clinical feature of raised ICP is present. In our series, we evaluated clinical signs as expected. Accordingly early detection of the lesion is critical. The sign / symptoms were nonspecific in majority of cases. Based on clinical findings early diagnosed was established only in small percentage of cases. We believe that CT scan of head should be done routinely in suspected case as early diagnosis of EDH is mandatory for good recovery as radiological changes always occur earlier than clinical changes and should be monitor to predict the clinical progression [18-20].

In this series, the temproparietal region (42.03%) was the commonest site followed by frontal region. It is similar to Hanci et al [10] who had opinion that EDH originating in the fronto temporal region does not spread to the frontal region. A possible explanation is the adherence of dura at the suture line [21]. As regard location, frontal haematomas have shown a better prognosis and a slower course than convexity haematomas. It is contrary to Mohanty et al [16] who found that the site of haematoma had no correlation with the final outcome; whereas the GCS score and the associated parenchymal injuries had a strong correlation with the outcome both in adult and children. It is in agreement with our experiences.

In our series, cranial fractures were present in 62.32 % patients' with significantly lower mortality rate. In many reported series, cranial fractures were in between 70-95% [2, 14, 22-26]. The impact of fracture on outcome is controversial. Kuday et al. [25] observed a significant relationship between cranial fractures and adverse outcome in 115 patients undergoing surgery for EDH. Lee et al. [27] did not see this relationship in a series of 200 patients managed similarly .But Rivas et al. [28] reported a significantly lower mortality rate in patients with cranial fractures which is in strong agreement with our findings.

In our series, associated brain injuries discovered in 27.53% cases. These are predominantly contusions, intra-cerebral haemorrhage; sub dural haematomas and diffuse brain swellings. The incidence of associated lesion in reported series is less in pediatrics age group [2,14,16,22,] SDH and / or parenchymal injuries in association with EDH lower the chance of good outcome [2].

Despite a steady decline in mortality, in this series, twelve patients (8.69 %) were expired. Among these unfortunate patients, 41.67% had associated brain injuries, 66.67% cases were deeply unconscious and 75% victims of these had fixed pupil / pupils at the time of admission. Mazza et al. [9] discovered associated brain lesions in 40% of his cases, over all mortality rate was 17%, with 14% operative mortality. Ersahin et al.[17] found 10% overall mortality, with mortality rate in the CT and plain x-ray groups were 6% and 16% respectively. Though the mortality rate in children was less than adult's series [13] but 0 % mortality as proposed by Ammiriti [29] and Bricolo [30] should be the goal of EDH surgery.

Conclusion:

Extradural haematoma in children is one of the most rewarding neurosurgical emergencies. It must be recognized and evacuate early to prevent potential mortality and morbidity. Our experiences of 138 surgically managed cases involved an aggressive diagnostic approach, prompt surgical evacuation of the haematoma results in an excellent outcome. Many factors affect the outcome of extradural haematoma surgery. In addition to influence of presence cranial fractures, associated brain lesions and pre-operative neurological condition of patient, duration of time interval between onset of coma and surgical intervention, morbidity and mortality have also been shown to be affected by age – with better prognosis in patients under 10 years of age.

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