ORIGINAL ARTICLE

Minimal Invasive Burr – Hole Management of Traumatic EDH

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ABSTRACT

Introduction: *Epidural hematoma (EDH) is a neurosurgical emergency. Delay in urgent treatment may lead to severe morbidity and even mortality. Conventionally, EDH was treated by formal craniotomy. Rarely, minimally invasive burr – hole drainage is employed especially in critically sick patients. We believe every case of pediatric EDH can be successfully drained by minimally invasive burr – hole drainage.*

Materials and Methods: *This study was conducted at the Department of Pediatric Neurosurgery, The Children's Hospital and the Institute of Child Health Lahore, between 19-01-2014 and 24-03-2016. The medical record of patients with EDH managed by minimally invasive burr – hole technique was reviewed in prospective way for history, clinical examination, investigations, management given, complications, and outcome.*

Results: *There were a total of 50 patients. Thirty four were male and 16 were female patients (M:F 2.1:1). Age was ranged between 45 days and 12 years (6.48yr ± 3.30yr). In 27 patients etiology of EDH was fall from roof and in 5 patients it was fall from bed/sofa, in 3 children fall from lap, in 8 fall from stairs, in 6 children it was road traffic accident, and brick fall over head in 1 child. Preoperative GCS was 3 – 8 in 11 patients, between 9 - 12 in 18, and between 13 – 15 in 21 patents. CT scan/MRI was performed in all patients for diagnosis, as per availability. All patients were operated by minimally invasive burr – hole drainage technique. Postoperatively, 1 patient required re-drainage by the same technique. There was one expiry in our series. All the 49 patients are discharged at GCS 15/15.*

Conclusion: *A survival rate of 98% is evident of safety and effectiveness of minimally invasive burr – hole drainage of EDH in children with added benefits of less operative time, operative morbidity, and hospital stay.*

Keywords: *EDH; Extra-dural hematoma; Burr hole drainage; Outcome; Formal craniotomy.*

Abbreviations: *EDH: Extra-dural hematoma. GCS: Glasgow Coma Scale.*

INTRODUCTION

EDH is a sinister complication of head trauma. Fall from height, road side accidents, head collision during street fight, and child abuse are important etiological factors of EDH in children.[1] It accounts for 1-3% of pediatric closed head injury admissions in emergency departments. It has male predilection (M:F 2-3:1).[2]

EDH is a neurosurgical emergency and various factors including Glasgow Coma Scale (GCS) at admission, timings of admission and intervention, and associated brain injury act as prognostic factors for ultimate outcome.[2-4] In the past, the mortality of EDH was quite high which now has declined to less than 5% in good centers;[5] however, the mortality data from developing countries is still in the range of 10 – 20%.[1,4]

The recommended treatment for EDH is surgical drainage by formal craniotomy. Minimal invasive burr – hole drainage is reserved for very sick children or those associated with clotting abnormalities and where health facilities are not up to the mark. We believe that in children, this minimal invasive burr – hole drainage is sufficient to deal EDH. This study was planned to evaluate outcome of patients with traumatic EDH managed with minimal invasive burr – hole evacuation technique in children.

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MATERIALS AND METHODS

This study is conducted in the Department of Pediatric Neurosurgery, The Children's Hospital and the Institute of Child Health Lahore, between 19-01-2014 and 24-03-2016. It is a descriptive study done prospectively after getting approval from IRB (Appended). All patients with traumatic EDH (0-14 years) necessitating intervention are included in the study. The medical record of patients with EDH managed by minimally invasive burr – hole technique is reviewed for history, clinical examination, investigations, management given, complications, and outcome.

Statistical Analysis

The information retrieved is stored in preformed proforma. The data is then entered in SPSP version 16 and analyzed. **The quantitative variables** like age, weight, hospital stay, volume of hematoma, time of surgery, time lag between presentation and operation, are presented as mean and standard deviations (SD).

Qualitative variables including gender, clinical presentation, etiology of hematoma, GCS categories, and site of hematoma, complications, and mortality are presented as frequencies and proportions.

Indications of Surgery

Clinical condition of the patients like continuous headache, repeated vomiting, irritability, and continuous drowsiness are the main indications for surgery. However, hematoma volume more than 30 ml on CT scan/ MRI (calculated by Peterson and Espersen equation),[6] thickness of hematoma >15mm on biggest slide, and midline shift of >5mm are the indications of surgery in our study.[7,8] The patients with asymptomatic EDH are treated conservatively.

TECHNIQUE

A small vertical skin incision (1 inch) was given over the proposed site of hematoma as dictated by CT scan/ MRI; tissue was dissected till the bone is exposed. Burr – hole is performed and then by nibbling, a window of about 1.5 × 1.5 cm is created in the cranium. Hematoma itself starts pouring out of the burr – hole. With the help of nerve dissector and gentle suction, all the hematoma is evacuated. The identification of complete hematoma drainage is re-apposition of dura with the cranium. Bone wax is applied on the bone margins for hemostasis. No drain is placed at the end of procedure.

The patient is then shifted to SICU and GCS is monitored after 6 hours for improvement. In case GCS was 15/15 and there are no other complaints, the patient was discharged after establishing oral feed on oral antibiotics and analgesics for one week. In case GCS not improved, a re-scan was performed to look for residual hematoma. The patients were followed on OPD basis for any sequelae.

RESULTS

There were a total of 50 patients. Thirty four were male and 16 were female patients (M:F 2.1:1). Ages ranged between 45 days and 12 years (Mean = 6.48yr, SD ± 3.30yr). Mean weight was 19.3 kg (SD ± 7.9).

In 27 (54%) patients etiology of EDH was fall from roof, in 8 (16%) patients fall from stairs, in 6 (12%) children it was road traffic accident; Table 1 describes frequency of etiology of head injury leading to EDH formation in our series.

All patients presented in surgical emergency. Headache, vomiting, drowsiness, and unconsciousness

Table 1: *Etiology of Fall Leading to EDH.*

Etiology	Frequency	Proportion
Fall from roof	27	54%
Fall from stairs	8	16%
Road Traffic Accident	6	12%
Fall from bed	5	10%
Fall from Lap	3	6%
Brick fall on head	1	2%
Total	50	100%

Table 2: *Frequency of Presentations.*

Presentation	Frequency	Proportion
Vomiting	41	82%
Headache	24	48%
Pallor	23	46%
Drowsiness	14	28%
Unconsciousness	12	24%
Irritability	5	10%
Fits	5	10%
Anisochoria	2	4%
Others*	7	14%

*Nasal bleed, severe pallor, intracerebral bleed, Dural rent, Loss of weight bearing

Table 3: *Frequency of Site of Hematoma.*

Site	Frequency	Proportion
Parietal Right	17	34%
Parietal Left	13	26%
Frontal Left	3	6%
Occipital Right	1	2%
Fronto-Parieto-Temporal Right	1	2%
Fronto Parietal Left	2	4%
Parieto-Temporal Left	1	2%
Temporal Right	1	2%
Parieto-Occipital Right	3	6%
Parieto-Occipital Left	1	2%
Parieto-Temporal Right	3	6%
Posterior Fossa	1	2%
Fronto Parietal Right	2	4%
Occipital left	1	2%
Total	50	100%

were the main presenting complaints in our series. Table 2 describes frequency of clinical presentations in our series. Forty seven (94%) patients had associated fracture of skull at the corresponding site of hematoma. Preoperative GCS was 3 – 8 in 11 (22%) patients, 9 – 12 in 18 (36%), and 13 – 15 in 21 (42%) patients.

Mean hemoglobin was 9.5 g/dl (SD ± 2.2) and ranged between 3.9 and 15.5. Twenty three (46%) patients required transfusions before surgery on account of anemia. PT/APTT was performed in only 10 patients and was normal. CT scan was performed in 46 patients for diagnosis whereas MRI was performed in 4 patients as per availability of the modality. Mean volume of hematoma was 50.1ml (SD ± 27.4 ml).Forty patient had > 30 ml of hematoma on CT scan/MRI. The common site of EDH formation was parietal region. Table 3 describes relative proportions of various sites of EDH formation in our series.

The mean time period between presentation and operation was 22.8 hours (SD ± 40.3). All patients were operated by minimally invasive burr – hole drainage technique as described earlier. The mean operative time was 28 minutes (SD ± 6.5). All patients were given per-operative transfusion. Postoperative recovery was uneventful in all except in two patients. One patient required re-drainage by the same technique as there was little improvement in GCS (from 6 to 9) after drainage; CT scan was repeated which showed residual hematoma (from initial 113.4 ml to 48.96 ml). In rest of the patients drainage was adequate. One patient presented at GCS 3/15, was put on ventilator and despite burr – hole drainage (119.7 ml hematoma), the patient could not be saved; this is the only expiry in our series. All the 49 patients were discharged at GCS 15/15.

Follow-up ranged from 2 weeks to 2.5 years. During follow-up, one child again developed EDH after a trivial trauma and was operated in another institute by formal craniotomy. This patient was later on proven to have factor V deficiency. Another patient was discharged at GCS 15/15 but he presented to a private hospital with recurrent headache after 10 days of discharge. CT scan showed residual hematoma which was drained through the same burr – hole in the private hospital. Two other patients had occasional complaints of headache which were amenable to analgesics. Two more patients have learning problems (difficulty in remembering) in the school. One patient complained of mood swings. One patient who had femur fracture developed leg – length discrepancy and gait problem. All these children are under treatment of respective departments. Rest of the patients revealed excellent recovery.

DISCUSSION

EDH is extra-axial, intracranial collection of blood in the extradural space and is a most feared complication of head injury although timely identification and management carries excellent prognosis. The common reasons of post trauma EDH include tearing of middle meningeal vessels and sinus, bleeding from edges of the fractured cranium, bleeding from small veins, and unidentified bleed or generalized ooze.[7] There exist various contrasting features about etiology, site of EDH, presentation, and outcome between adults and children. In children, bleeding from the fractured cranium margins is considered most common source of EDH as compared to adults where tearing of middle meningeal vessels forms the most common source.[8] In our series, 94% patients had fracture of the cranium which also supports this source of hematoma in children. Various studies documented less – incidence of associated cranial fractures in infants owing to more pliable nature of the skull and open fontanelle.[8-10] We have three infants in our series and all had associated skull fractures.

The common site of EDH in adults is temporal region. In infants and children parietal EDH is com-

monly reported.[8,11] The reason behind this site predilection is more prominence of parietal eminence in children especially in infants.[8] In our series parietal site EDH was in 60% of the patients and all the three infants in our series also had parietal EDH. The common presenting features in adults was headache and vomiting followed by loss of consciousness and neurological deficits.[4,12,13] In our series, we had vomiting (82%) as most common presenting feature followed by headache (48%), pallor (46%), drowsiness (28%), unconsciousness (24%), and irritability (10%). Children have less reserves of blood especially in small infants.[8] In our series all the patient having Hb less than 7g/dl were less than 3 years of age. In adults the common mode of head injury was road traffic accidents[12,14] whereas in children it was fall from height. In our series except in 6 patient of road traffic accident and one patient of brick fall on head, all patients had fall from height including fall from roof (54%), stairs (16%), bed (10%), and lap (6%).

The diagnosis was based upon clinical suspicion and confirmation on CT scan or MRI. Vomiting headache, drowsiness, focal neurological deficit, rapid deterioration of GCS, anisochoria, etc. were the features directed towards CT/MRI. We performed CT scan or MRI in our patients depending upon the availability of the modality. The average time between admission and operation in our series was 22.8 hours. This time period includes initial observation of the patient with head injury and on persistence of the symptoms CT/MRI was requested which helped in the diagnosis. The time between diagnosis and operation was not more than 1 hour in our series. We work in the only centre in the province catering majority pediatric neurosurgery, both elective and emergency, in the country. On average more than 10 patients of head injury were seen in the department on daily basis. The burden of EDH was not more than 1 – 2% of all cases of head injury presenting to our centre.

In 40 patients of this series the volume of hematoma was more than 30 ml, whereas in 10 cases where the volume was less than 30 ml, the decision to intervene was taken on the basis of deteriorating GCS, nonsettling headache and vomiting, and development of fits. The conventional surgery in case of EDH is by formal craniotomy which involves raising of osteoplastic flap and drainage of hematoma. This technique is practices worldwide both in adults and in pediatric patients.[11,13,15] The surgery is very invasive and takes more than 1 hour. Burr – hole drainage is usually reserved for critically sick patients not fit for anesthesia and usually performed under local anesthesia. Very few studies are done on burr – hole technique as a primary modality to deal EDH.[16,17] One study was done during earthquake in 2005, Pakistan, which concludes the usefulness and effectiveness of this technique.[16] No proper pediatric study has been published in literature, to the best of our knowledge. This study clearly describes effectiveness and usefulness of the technique. There is only one inadequate drainage in our study which is more due to an early learning curve of the draining surgeon as 5 neurosurgeons have been involved in draining EDH by burr – hole technique. In another patient, the immediate postoperative course was uneventful but later on he presented in a private hospital where on CT scan a significant collection was found which too drained through the previously made burr – hole. This again reflects its effectiveness in dealing failed drainage, residual, or recollected hematomas.

We are using this technique in our department for more than 15 years. We believe, this technique is as effective as formal craniotomy but has additional benefits like being minimal invasive as compared to formal craniotomy, and takes much less operative time (28 min). We observed early recovery in our patients within hours of the surgery and early return to usual activities. There is less pain and wound related problems although we have not evaluated these parameters in our study. The other limitation of our study is its model. It is a case series, it would have been better if we could plan a randomized controlled trial comparing it with formal craniotomy. But no other centre in our province is dealing with pediatric neurosurgery patients and we are not practicing formal craniotomy for more than one and half decade therefore we designed a prospective case series. The mortality in best neurosurgery units is less than 5%.[15] In our series only one patient expired out of 50 patients and that too was related to its very poor GCS at presentation. That patient is not truly reflecting mortality related to the procedure as patient was critical since presentation and was on ventilator however surgery could not help her.

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CONCLUSION

Negligible morbidity and mortality along with ease of procedure with added benefits of minimal invasive surgery, less operative time, and equal effectiveness to the formal craniotomy reflects usability of this procedure. We suggest this procedure can be used with confidence for draining EDH in pediatric patients with EDH. Further research in the form of randomized controlled trials can be done to further validate our results. This study further enhances our confidence in this procedure.

REFERENCES

1. Mezue WC, Ndubuisi CA, Chikani MC, Achebe DS, Ohaegbulam SC. Traumatic Extradural Hematoma in Enugu, Nigeria. Niger J Surg. 2012; 18: 80–4.
2. Erşahin Y, Mutluer S, Güzelbag E. Extradural hematoma: analysis of 146 cases. Childs Nerv Syst. 1993; 9: 96.
3. Servadei F. Prognostic factors in severely head injured adult patients with epidural haematomas. Acta Neurochir. 1997; 139: 273–8.
4. Rehman L, Khattak A, Naseer A, Mushtaq Outcome of acute traumatic extradural hematoma. J Coll Physicians Surg Pak. 2008; 18: 759–62.
5. Roka YB, Shah A. Post Traumatic Epidural Hematoma: Outcome Analysis in 68 Consecutive Unselected Cases. Nepal J Neurosc. 2010; 1: 6-9.
6. Petersen OF, Espersen JO. Extradural hematomas: measurement of size by volume summation on CT scanning. Neuroradiol. 1984; 26: 363-7.
7. Bullock MR, Chesnut R, Ghajar J, Gordon D, Hartl R, Newell DW, Et al. Surgical management of acute epidural hematomas. Neurosurg. 2006; 58: S2-7.
8. Mishra SS, Nanda N, Deo RC. Extradural hematoma in an infant of 8 months. J Pediatr Neurosci. 2011; 6: 158.
9. Khan IU, Nadeem M. There is high Incidence of skull fracture associated with extradural hematoma in patients with head injury. Rawal Med J. 2008; 33: 228-30.
10. Rehman RU, Mushtaq MI, Azam F, Khattak A. Skull fracture on x-ray skull as an indicator of extradural hematoma in patients with head injury. Pak J Surg. 2012; 28: 106-9.
11. Islam MJ, Saha SK, Elahy MF, Islam KM, Ahamed SU. Factors influencing the outcome of patients with acute extradural haematomas undergoing surgery. Bangladesh J Med Sci. 2011; 10: 112.
12. Umerani MS, Abbas A, Sharif S. Traumatic brain injuries: experience from a tertiary care centre in Pakistan. Turkish Neurosurg. 2013; 24: 19-24.
13. Ayub S, Rehman RU, Shah M, Khattak R, Ahmad M, Nabi A. Management outcome of extradural hematoma. Pak J Neurol Surg. 2014; 18: 17-20.
14. Haroon A, Khan ZM, Rehman AU, Majid, Vohra AH. Analysis of head injury patients and review of 100 cases of motor bike accidents. Pak. J Neurol Surg. 2014; 18: 8-12.
15. Figaji A. Intracranial and extracranial hematomas. In: Albright AL, Pollack IF, Adelson PD, editors. Principles and practice of pediatric neurosurgery. 3rd ed. New York: Thieme, 2015: 718-28.
16. Aurangzeb A, Ahmed E, Maqbool S, Ihsan A, Ali A, Bhatti SN, et al. Burr hole evacuation of extradural hematoma in mass trauma. A life – saving and time saving procedure: our experience in the earthquake of 2005. Turk Neurosurg. 2016; 26: 205-8.
17. Liu JT, Tyan YS, Lee YK, Wank JT. Emergency management of epidural haematoma through burr hole evacuation and drainage. A preliminary report. Acta Neurochir. 2006; 148: 313-7.

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