



A STUDY OF INCIDENCE, MANAGEMENT, AND OUTCOME OF PAEDIATRIC EDH (EXTRADURAL HEMATOMA IN CHILDREN)

Vidhya Narasimhan

Mch Neurosurgery, Associate Professor, Centre for Advances Brain and Spine Surgery, Tamil Nadu Government Multi Super Specialty Hospital, Omandurar Government Estate, Chennai – 600 002.

Bruno-Mascarenhas, Mariano Anto J*

Mch Neurosurgery, Senior Assistant Professor of Neurosurgery, Department of Neurosurgery, Centre for Advances Brain and Spine Surgery, Tamil Nadu Government Multi Super Specialty Hospital, Omandurar Government Estate, Chennai – 600002
*Corresponding Author

ABSTRACT

Background: Children are not little adults, and the management of outcome of head injuries in general and extradural hematoma, in particular, are not the same as in Adults.

Aim: To study the Incidence, Management and Outcome of Paediatric EDH (Extradural Hematoma in Children)

Settings and Design: This study is based on Analysis of Case Records

Materials and Methods: Patients aged 12 years and below, admitted with Extra Dural Haematoma at the Institute of Neurology, Madras Medical College between January 2013 and July 2014 were studied. Follow up period ranges from 3months to 18 months

Statistical analysis used: Epi-Info, MS-Excel, SPSS

Results and Conclusions: Paediatric EDH is relatively common

Fall is the most common Cause of EDH in Children

Age 5 to 12 is most commonly affected among all age groups

Road Traffic Accidents Caused Extra Dural Hematomas more commonly in older age groups

The fracture was more common in Children Less than two years of age

Children, less than five years had a better outcome

Fracture did not affect the outcome of the injury

Low GCS at admission did not always accurately predict the outcome

Cases with less than 25 ml did not require surgery, cases with volume 25-30 required surgery based on serial assessment and cases more than 30 ml required surgery Patients with Posterior Fossa EDH more than 15 ml required surgery

Indications of Surgery were signs of herniation, mass effect, and volume of clot

97% of patients had a good outcome, and 3% died

The mortality rate is lower in children than in adults

KEYWORDS : Extra Dural Hematoma, Children, head injury

INTRODUCTION

It is a common knowledge that, Children are not just little adults and that they have different incidence, clinical manifestation of different conditions and also require a different approach to treatment. To start with, the pliability of immature newborn skull makes the brain more vulnerable to injury and also the immature brain appears to tolerate anoxia and hypoxia better than adults. The pediatric brain forms fewer edema fluids and can clear any edema more rapidly than the adult brain. Diffuse swelling of the brain may develop more readily in children because of the lack of CSF available for displacement. Children have unique biophysical properties of the skull and brain. Also, Pupillary response is not a good indicator of outcome The importance of Serial CT imaging in Paediatric patients with head trauma is also well documented. It is known that that Low GCS did not always accurately predict outcome in the absence of hypoxia and ischemia

Various authors have studied the Extra Dural Hematomas in children. This study is done to study the Incidence, Management and Outcome of Paediatric EDH (Extradural Hematoma in Children)

Aims of the Study

This study is done to study the Incidence, Management and Outcome of Paediatric EDH (Extradural Hematoma in Children)

Objectives of the Study

To Study the following parameters concerning Paediatric EDH

- (I) Incidence
- (II) Etiology
- (III) Age Distribution
- (IV) Fracture
- (V) Outcome and Age Correlation
- (VI) Age and Site of EDH

- (VII) Presenting Features
- (VIII) Supratentorial vs. Posterior Fossa EDH
- (IX) Associated Fractures
- (X) Other Associated Injuries
- (XI) Presenting Features
- (XII) Correlation between Outcome and Presenting Complaints
- (XIII) Analysis of Volume of Supratentorial EDH
- (XIV) Analysis of Volume of Posterior Fossa EDH
- (XV) Management
- (XVI) Indications of Surgery
- (XVII) Outcome
- (XVIII) The outcome in Children vs. Outcome in Adults

MATERIALS AND METHODS

The study was done by analysis of cases sheets of Patients aged 12 years and below, admitted with Extra Dural Haematoma at the Institute of Neurosurgery, Madras Medical College between January 2013 and July 2014. Follow up period ranges from 3months to 18 months.

Type of Study

- Retrospective and Prospective Analytical Epidemiology

Number of Patients

- 35

Inclusion Criteria

- Patients of age 12 years and below with Extra Dural Haematoma were included
- Extra Dural Haematoma with or without skull fracture
- Extra Dural Haematoma with or without other associated brain injuries

Exclusion Criteria

- Clinically insignificant thin fracture hematomas

- Haematomas due to non-traumatic causes

RESULTS

(I) Incidence

- Among Paediatric Patients with Head Injuries who required Inpatient Management, 10 % had EDH

(II) Etiology

- Fall is the most common Cause of EDH in Children attributing for 74% of the patients

(III) Age Distribution

- Age 5 to 12 is most commonly affected among all age groups, attributing to 60 % of the patients
- Road Traffic Accidents Caused Extra Dural Hematomas more commonly in older age groups

(IV) Fracture

- A fracture was more common in Children Less than two years of age

(V) Outcome and Age Correlation

- Children, less than five years had a better outcome
- Fracture did not affect the outcome of the injury

(VI) Age and Site of EDH

- Posterior Fossa EDH was found in 50% of children younger than two years and 20% overall

(VII) Presenting Features

- Vomiting (in 37 %) and Scalp Injuries (in 25 %) were a common presenting factor and Lucid interval of 90 minutes was present in 3 % of the patients

(VIII) Supratentorial vs. Posterior Fossa EDH

- 77 % had supratentorial Extra Dural Haematoma, 20 % had posterior fossa Extra Dural Haematoma, and 3 % had posterior fossa Extra Dural Haematoma with supratentorial extension.

(IX) Associated Fractures

- 50 % Had no Skull Fracture while 3 % had skull fracture in the opposite side while rest had same side fracture skull

(X) Other Associated Injuries

- Associated Injuries included midline shift or mass effect, Contrecoup Extra Dural Haematoma, double Extra Dural Haematoma in the same side, thin SDH, brain contusions, diffuse cerebral edema.

(XI) Presenting Features

- Most of the drowsy/unconscious children were brought to the hospital between 1-12 hours
- Children who were brought late to the hospital were Conscious

(XII) Correlation between Outcome and Presenting Complaints

- Low GCS at admission did not always accurately predict the outcome

(XIII) Analysis of Volume of Supratentorial EDH

- Cases with less than 25 ml did not require surgery, cases with volume 25-30 required surgery based on serial assessment and cases more than 30 ml required surgery

(XIV) Analysis of Volume of Posterior Fossa EDH

- Patients with Posterior Fossa EDH more than 15 ml required surgery

(XV) Management

- Of the 35 Patients, 40 % (14 Patients) underwent surgery while 60 % (21 patients) were managed conservatively.

(XVI) Indications of Surgery

- Indications of Surgery were signs of herniation, mass effect, and volume of clot

(XVII) Outcome

- 97% of patients had a good outcome, and 3 % died

(XVIII) The outcome in Children vs. Outcome in Adults

- The mortality rate is lower in children than in adults

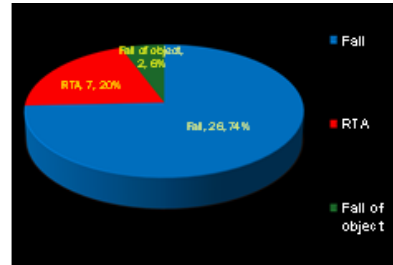
DISCUSSION

(I) Incidence

- During the study period of 19months (January '13- July '14), 345 pediatric head injuries were treated out of which 35 patients had Extra Dural Haematoma (10.14% of inpatient admissions in pediatric age group).

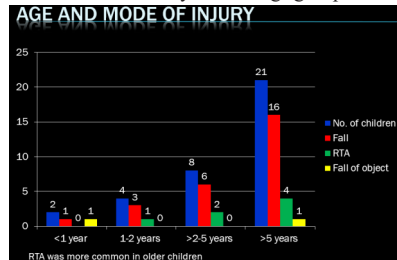
(II) Etiology

- Fall is the most common Cause of EDH in Children
- Of the 35 Patients admitted in the study period, 26 injuries were caused due to the child falling, seven due to Road Traffic Accidents and two due to Fall of Objects on the head of the child Of the 26 Injuries due to Fall, 22 fell from a height less than 3 feet, and 3 fell from a height more than 3 feet, and one child had fallen during skating



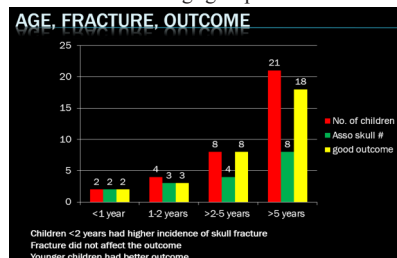
(III) Age Distribution

- Age 5 to 12 is most commonly affected among all age groups with 21 out of 35 patients being in this age group
- It is also seen that Road Traffic Accidents Caused Extra Dural Hematomas more commonly in older age groups



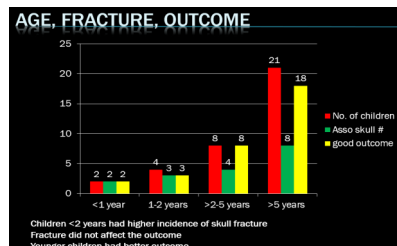
(IV) Fracture

- A fracture was more common in Children Less than two years of age with more patients in this age group presenting with fracture as compared to children from age group 2 to 12



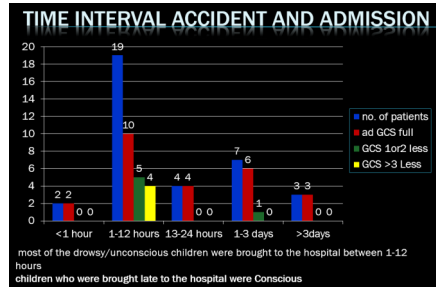
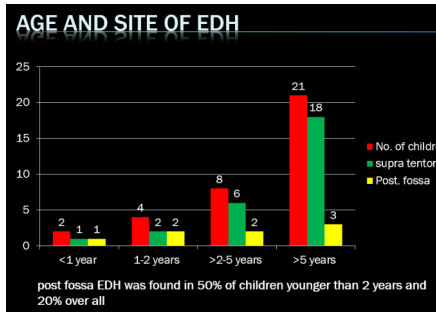
(IV) Outcome and Age Correlation

- Children, less than five years had a better outcome as compared to children in the age group 5 to 12 as seen from the graph below
- It is also seen that Fracture did not affect the outcome of the injury



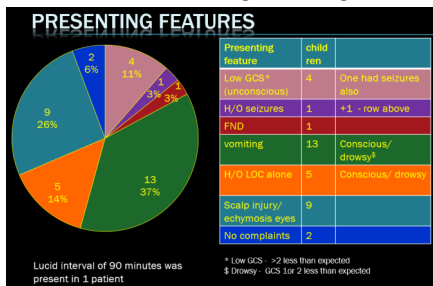
(V) Age and Site of EDH

- It can be seen that Posterior Fossa EDH was found in 50% of children younger than two years and 20% overall



(VII) Presenting Features

- Among the presenting features
- 13 presented with Vomiting
- 9 with scalp injuries and Eye Ecchymosis
- 5 had only Loss of Consciousness
- 4 with Low GCS of whom 1 had seizures
- Two did not have any specific complaints
- 1 had only seizures
- 1 had Focal Neurological Deficit
- A lucid interval of 90 minutes was present in 1 patient



(VIII) Supratentorial vs Posterior Fossa EDH

- Out of the 35 children,
- 27 had supratentorial Extra Dural Haematoma,
- 7 had posterior fossa Extra Dural Haematoma
- 1 had posterior fossa Extra Dural Haematoma with supratentorial extension. [posterior fossa – 22.8%]

(IX) Associated Fractures

- Of the 35 patients,
- Sixteen patients had associated skull fracture corresponding to the site of Extra Dural Haematoma.
- One patient had a fracture on the opposite side.
- 18 had no skull fracture
- Extra Dural Haematoma can occur without fracture, more commonly in children
- In our study also, 51.4% had no fractured skull
- However, 5 out of 6 children <2years of age were found to have a skull fracture

(X) Other Associated Injuries

- Associated Injuries were present in the following manner
- Six patients had a midline shift or mass effect
- Contrecoup Extra Dural Haematoma with minimally depressed coup fracture and contusion in one case
- Two children had double Extra Dural Haematoma in the same side
- Two patients had underlying thin SDH,
- Two patients had brain contusions,
- Two patients had diffuse cerebral edema.
- One patient with brain contusion had residual hemiparesis.

(XI) Presenting Features

- Most of the drowsy/unconscious children were brought to the hospital between 1-12 hours
- Children who were brought late to the hospital were Conscious
- Two children who had GCS 4 and 5 with poor respiratory attempts were brought between 1-12 hours after injury, and both survived with a minimal deficit.
- One episode of Impact seizures occurred in 2 patients, one with temporoparietal EDH and Other with posterior fossa EDH. Both the patients did not have further seizures, and both of them had a good outcome.

(XII) Correlation between Outcome and Presenting Complaints

- Low GCS at admission did not always accurately predict the outcome (Paediatric GCS adjusted for age used) as can be seen from the following table

GCS	No. of cases	supratentorial	Post. fossa	No. of cases with Shift/mass effect	No. of cases operated	Outcome
Appropriate for age	24	20	4	2	8	One expired, others good
One less for age	4	4	0	0	0	One hemiparesis (contusion brain), others good
Two less for age	3	1	2	1	2	All good
8/11	1	0	1	0	1	Good -11/11
10/14	1	1	0	1	1	Good -14/14
E1V1M3 pupils 4mm NRL DEM imp, Resp shallow	1	1	0	1	1	14/14, L hemiparesis
E1V1M2 R pupil dilated NRL, DEM imp, resp shallow	1	1	0	1	1	14/14, R 3rd nerve palsy

(XIII) Analysis of Volume of Supratentorial EDH

- The volume of Supratentorial EDH was as below

volume	No of cases	Low GCS	Shift	Cases operated	outcome
< 25cc	17	0	0	0	Good *
25-30cc	3	0	0	3	good
>30cc	7	3	5	6	Four good, \$

- 6 cases with volume >30 were operated
- 3 cases with volume 25-30cc were operated because of symptoms of ICT
- *One had hemiparesis due to contusion brain
- \$ 1 expired, one had hemiparesis, one had third nerve palsy

(XIV) Analysis of Volume of Posterior Fossa EDH

- The volume of Posterior Fossa EDH was as below

volume	No. of cases	Low GCS	Other features	Cases operated	outcome
<10 cc	3	0	0	0	Good
20cc	3	0	1 had a mass effect	3	Good
30cc	2	1	One sup tent extension	2	good

- 5 cases of posterior fossa EDH volume >15cc were operated, and all had a good outcome

(XV) Management

- Of the 35 Patients, 14 Patients underwent surgery while 21 were managed conservatively.
- Among those who were operated, 9 had supratentorial EDH, and 5 Had Posterior Fossa EDH
- Supratentorial EDH
- 6 cases with volume >30 were operated
- 3 cases with volume 25-30cc were operated because of symptoms of ICT
- Posterior fossa EDH
- 5 cases of posterior fossa EDH volume >15cc were operated, and all had a good outcome
- 21 patients were managed conservatively with close observation because of the fully conscious child/ small size of the EDH/ no shift or mass effect,
- Only one patient had residual hemiparesis grade 4 power attributable to the contusion brain. All others had a good outcome

(XVI) Indications of Surgery

- Indications of Surgery are as below

Indications	No. of cases	
Signs of herniation	2	
Shift/mass effect	4	One post fossa
The thickness of clot >15mm or vol >30cc -supra tent	1	without shift
vol <30 cc ICT features	3	Vomiting +
Post fossa vol>15cc	4	

(XVII) Outcome

- Of the 35 patients in the study period, 34 had Good outcome
- 31 patients recovered fully without neurological deficit,
- Three patients had a residual neurological deficit not affecting the activities of daily living – two had hemiparesis, one had third nerve palsy
- Only one out of 35 patient died (Mortality Rate 3%)

(XVIII) The outcome in Children vs. Outcome in Adults

- During the study period, the Mortality rate is lower in children than in adults as seen below

During the study period	children	adult
Total head injury	345	4256
EDH	35 (10.14%)	351 (8.2% of head injury)
Operated	14 (40%)	156 (44% of EDH)
Expired	1 (2.8%)	24 (6.8% of EDH)

CONCLUSION

- Paediatric EDH is fairly common

name	age	sex	IP No	MIN No	unit	mode of injury	fall from	from height in feet	time of injury	time of admission
RAKESH	5	M	1854	693	1	fall	stairs	4		8.1.13
KEERTHANA	3	F	4475	2136	1	FALL	gate	4	21.1.13,9am	22.1.13,10am
PRIYA	3	F	6066	2755	3	RTA			28.1.13,10pm	28.1.13,12MN
SAM	6	M	6908	2864	3	fall	building	12	31.1.13,9pm	1.2.13,5am
HARISH	9	M	9761	4268	1	RTA			12.2.13, 1.30PM	12.2.13,6pm
AJITH KUMAR	10	M	11517	5042	1	fall	stairs	4		19.2.13
KAVITHA	12	F	27512	12549	1	Fall	first floor	12	27.4.13, 10 am	27.4.13, 10pm
YUVASANKAR	3	M	31035	13508	5	fall	at ground level at play	0	10.5.13,5pm	12.5.14,11am
GUNAL	7	M	32794	14478	5	fall	tree	6	17.5.13,12.45pm	19.5.13,9am
SACHIN	9 MONTHS	M	36592	16035	4	fall of object-2 wheeler			3.6.13,10am	3.6.13,4pm
VAISHNAVI	5	F	36536		5	fall	stairs	4		3.6.13
IMTHIYAS	6	M	38441	17130	4	fall	chair	2	.	9.6.13,2.30pm
PRAVEEN	2	M	41626	18116	5	fall	two heeler	4	23.6.13,9am	23.6.13,11.45am
KAVIDOSS	2	M	45113	19653	1	RTA			5.7.13,6.30am	6.7.13,6.20pm

- Fall is the most common Cause of EDH in Children
- Age 5 to 12 is most commonly affected among all age groups
- Road Traffic Accidents Caused Extra Dural Hematomas more commonly in older age groups
- The fracture was more common in Children Less than two years of age
- Children, less than five years had a better outcome
- Fracture did not affect the outcome of the injury
- Low GCS at admission did not always accurately predict the outcome
- Cases with less than 25 ml did not require surgery, cases with volume 25-30 required surgery based on serial assessment and cases more than 30 ml required surgery
- Patients with Posterior Fossa EDH more than 15 ml required surgery
- Indications of Surgery were signs of herniation, mass effect, and volume of clot
- 97 % of patients had a good outcome, and 3 % died
- The mortality rate is lower in children than in adults

ACKNOWLEDGMENTS

1) We owe our thanks to THE DEAN, Madras Medical College, Chennai, for permitting us to utilize the facilities and conducting this study and the members of the Ethical Committee for their role.

2) We wish to thank the Director, Professors, Assistant Professors, Post Graduates, Interns, Paramedics, Office Staff, Technicians and Workers of the Institute of Neurosurgery for their cooperation which enormously helped us in this study.

3) No Financial Support or Grant was received or used for this study

KANNAN	8	M	51561	21363	2	fall	at ground level at play	0	29.7.14,6pm	1.8.13,12.30am
DHARINI	8 Months	F	53353	21936	2	fall	mothers lap	2	30.7.13, 6pm	7.8.13
VISHAL NATH	9	M	56012	22486	5	fall	while skating	0	17.8.13,6pm	17.8.13,10pm
SALMAN RAJ	8	M	69757	28929	4	RTA			5.10.13	11.10.13
AJAY	6	M	69838	28937	4	fall	at ground level at play	0	11.10.13,10.30am	11.10.13,10.45am
VIGNESH	1	M	74056	31065	1	fall	cot	3	29.10.13, 9 AM	29.10.13, 12NOON
ASHIRA BANU	7	F	76762	31981	4	RTA			10.11.13,5PM	10.11.13,11.30pm
ADHIKESAVAN	11	M	85613	35168	4	Fall	from auto	3	15.2.14,10am	16.12.13,9am
GUNA NITHI	7	M	9472	4122	3	Fall	1st floor	12	3.2.14,2.45pm	6.2.14,1pm

REFERENCES

1. Suresh HS, Praharaj SS, Indira Devi B, Shukla D, Sastry Kolluri V R. Prognosis in children with head injury: An analysis of 340 patients. *Neurol India* 2003;51:16-8
2. Kumar S. Prognosis in children with head injury: Inaccuracies in the analysis. *Neurol India* 2003;51:427-8
3. Chen JW, Gombart ZJ, Rogers S, Gardiner SK, Cecil S, Bullock RM. Pupillary reactivity as an early indicator of increased intracranial pressure: The introduction of the Neurological Pupil index. *Surg Neurol Int.* 2011;2:82.
4. Durham, S. R., Liu, K. C., & Selden, N. R. (2006). The utility of serial computed tomography imaging in pediatric patients with head trauma, *Journal of Neurosurgery: Pediatrics PED*, 105(5), 365-369. Retrieved Feb 26, 2019, from <https://thejns.org/view/journals/j-neurosurg-pediatr/105/5/article-p365.xml>
5. Ong, Lai & M. Selladurai, Benedict & K. Dhillon, Malkeet & Atan, Maimunah & Lye, Munnsann. (1996). The Prognostic Value of the Glasgow Coma Scale, Hypoxia and Computerised Tomography in Outcome Prediction of Pediatric Head Injury. *Pediatric neurosurgery*. 24. 285-91. 10.1159/000121057.