

Analysis of Factors Influencing Outcome of Depressed Skull Fracture in Pediatric Group

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ABSTRACT

Objective: To look for outcome and analyze the factors influencing outcome of depressed skull fracture in pediatric group managed at tertiary care neuro-surgery unit

Study Design: Comparative Cross-sectional Study

Place and Duration of Study: Neurosurgery department Ayub Teaching Hospital Abbottabad Pakistan, from Jun 2021 to Apr 2022

Methodology: A prospective study was conducted on the pediatric patients managed for depressed skull fractures with any surgical intervention in our neurosurgery unit. Outcome was assessed at 72 hours by consultant neurosurgeon and classed as good outcome if discharged at 72 hours with GCS 15/15. Various sociodemographic and clinical variables were associated with presence of poor outcome among children included in the study

Results: A total of 100 children were included in the final analysis. Out of them 69(69%) were male while 31(31%) were females. Mean age of the study participants was 8.88 ± 4.731 years. Eighty-six (86%) children with depressed skull fracture had good outcome after surgery while 14(14%) had poor outcome. Statistical analysis revealed that presence of compound fracture, dural tear and brain contusion was statistically significant association with poor outcome (p -value <0.05) in our study participants.

Conclusion: Outcome was good in most of the pediatric patients managed for depressed skull fractures in our study. Patients who had compound fractures, Dural tear or brain contusions at time of presentation were more at risk of having poor outcome in our study participants.

Keywords: children, depressed skull fracture, outcome, socio-demographic factors analysis

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INTRODUCTION

Trauma surgery is not a separate specialty in our part of the world and neurosurgeons bear almost all the burden of head trauma in all age groups in Pakistan.¹ Things become more complex when children present with various types of head and brain injuries to emergency departments and surgical units.² Multiple patients related, injury related and service related factors influence the outcome of pediatric head trauma managed in neurosurgical departments of tertiary care teaching hospitals.³

Children make a considerable chunk of head injuries a skull fractures across the globe due to various reasons.⁴ Head injury in pediatric age group may lead to multiple consequences ranging from superficial scalp lacerations to depressed skull fractures leading to brain damage of underlying area.⁵ Treating teams managing pediatric head trauma should be equipped with certain surgical and post-

surgical equipment and skills in order to provide best care to this fragile group of population presenting with head trauma.⁶

Studies have been done on adult and pediatric population regarding outcome of depressed skull fractures after surgical management. Hussein et al. in 2021 assessed the outcome and identified predictors of the outcome in surgically treated adult patients. They came up with the conclusion that overall results of surgery were not too bad but presence of motor deficit, post-resuscitation Glasgow Coma Scale ≤ 13 , pneumocephalus, reoperation, and hospital stays for more than 3 days emerged as predictors of poor outcome.⁷ Lee et al. in 2019 identified factors predicting outcomes in pediatric traumatic brain injury patients who underwent surgery. It was revealed that raised intracranial pressure and hypotension were predictors of poor outcome though in most of the patients' outcome was favorable.⁸ Impact of pupillary status and Glasgow Coma Scale (GCS) score on outcome of pediatric and adult patients with severe traumatic brain injury. They came up with the findings that children admitted with a missing

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motor response or fixed and bilaterally dilated pupils had poor outcome.⁹

Trauma injuries need specialized management and situation become trickier when children with head trauma are encountered in clinical practice. A recent local study published in Pakistan Journal of Neurological surgery concluded that overall mortality pediatric skull fractures was around 10.5% and linear fractures had better outcome as compared to other types. Limited local data is available regarding outcome of depressed skull fractures in children. We therefore planned this study with the rationale to look for outcome of depressed skull fractures in children and analyze the factors influencing outcome in patients of pediatric age group managed at tertiary care neuro-surgery unit of Abbottabad.

METHODOLOGY

This comparative cross-sectional study was conducted at the neurosurgery department of Ayub Teaching Hospital Abbottabad Pakistan from June 2021 to April 2022. Sample size was calculated by WHO Sample Size Calculator by using population prevalence proportion of good outcome in patients of depressed skull fractures as 94%.¹¹ Non probability Consecutive sampling technique was used to gather the sample.

Inclusion Criteria: All pediatric patients between the age of 1 and 14 years presenting with depressed skull fracture diagnosed by consultant neurosurgeon with GCS score <15 were included in the study.

Exclusion Criteria: The children with severe congenital malformations or those with other metabolic, immunological or skeletal problems were excluded. Children who presented with GCS score 15/15 were not included in the study. Patients who had poly-trauma and fractures of other bones of the body were excluded as well.

After ethical approval from the ethical review board committee via IREB letter and written informed consent from the parents or guardians of the potential participants or their care-givers, patients with depressed skull fractures managed at our neurosurgery unit were included in the study. Depressed skull fracture was diagnosed by consultant neurosurgeon on the basis of clinical examination and relevant radiological findings.¹² Good outcome was defined as uneventful recovery after surgery and discharge within 72 hours with GCS score 15/15. Poor outcome was shift to HDU, CCU or any complications

occurring in ward not enabling the team to discharge the patient within 72 hours or death of the patient.¹³ Presence of compound skull fracture was also ascertained at the time of presentation by treating team on the basis of clinical and radiological assessment.¹⁴

Characteristics of neonates participating in the study and the outcome variables were described with the help of descriptive statistics. Pearson chi-square analysis was done to evaluate the association of various factors with outcome of management in study participants. Statistics Package for Social Sciences version 24.0 (SPSS-24.0) was used for all the above-mentioned analysis. The *p*-values less than or equal to 0.05 were considered significant for ascertaining the association between variables.

RESULTS

A total of 100 children were included in the final analysis. Out of them 69(69%) were male while 31(31%) were females. Table-I summarized the general characteristics of study participants. Mean age of the study participants was 8.88 ± 4.731 years. Eighty-six (86%) children with depressed skull fracture had good outcome after surgery while 14(14%) had poor outcome. 58(58%) had fall, 12(12%) had alleged physical assault while 22(22%) had fall as cause of skull fracture. 19(19%) had compound fracture, 23(23%) had open wound, 20(20%) had dural tear while 14(14%) had brain injury or contusion.

Table-I: Characteristics of neonates included in the study

Study parameters	n(%)
Age (years)	
Mean + SD	8.88±4.731
Range (min-max)	1-14
Gender	
Male	69(69%)
Female	31(31%)
Cause of fractures	
Fall	58(58%)
Alleged physical assault	12(12%)
Road traffic accident	22(22%)
Others	08(8%)
Outcome at 72 hours	
Good	86(86%)
Bad	14(14%)
Complications at time of presentation	
Compound fracture	19(19%)
Open wound	23(23%)
Dural tear	20(20%)
Brain contusion or injury	14(14%)
Others	03(3%)

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Table-II summarized the results of statistical analysis. It was revealed that presence of compound fracture (p -value-0.004), dural tear (p -value-0.001) and brain contusion (p -value<0.001) was statistically significant association with poor outcome in patients who presented with and surgically managed for depressed skull fractures while presence of open wound had no such relationship (p -value-0.601) with presence of poor outcome in our study participants.

Table-II: Association of Various Factors With Outcome of Depressed Skull Fracture In Study Participants

Parameters	Good outcome	Poor outcome	<i>p</i> -value
Compound fracture			
No	74(86.1%)	07(50%)	0.004
Yes	12(13.9%)	07(50%)	
Dural tear			
No	74(86.1%)	06(42.8%)	0.001
Yes	12(13.9%)	08(57.2%)	
Open wound			
No	67(77.9%)	10(71.4%)	0.601
Yes	19(22.1%)	04(28.6%)	
Brain contusion			
No	81(94.2%)	05(35.7%)	<0.001
Yes	05(5.8%)	09(64.3%)	

DISCUSSION

Pediatric neurosurgery or trauma surgery are still non-existent specialties in Pakistan. Treating teams may be managing these patients on basis of special interest or local guidelines. Skull fractures are not an uncommon presentation in children and routinely managed in neurosurgical departments of various hospitals. Outcome in these fractures may range from smooth discharge after management in couple of days to even death of the patient. Treating team need to have knowledge regarding high risk cases right from the start of management in order to manage each case on specific grounds. We conducted this study with an aim to look for outcome and analyze the factors influencing outcome of depressed skull fracture in pediatric group managed at tertiary care neurosurgery unit.

Spazzapan *et al.*¹⁵ in 2019 published a meta-analysis regarding risk factors for bad outcome in pediatric epidural hematomas. They came up with the findings that low GCS at presentation was predictor of poor outcome and neurological damage otherwise short term outcome and long term prognosis of such injuries was goof if managed in time and by expert hands. Our results were similar as around 86% patients in our study had good outcome and patients were not followed up for long otherwise a good

chance that out of remaining 14%, a good number have good long term outcome as well.

Octay *et al.*, in 2019 evaluated pediatric patients who were operated with the diagnosis of depressed skull fracture.¹⁶ They revealed that 81% of their study participants had good outcome, 10% had moderate disability, and 6.5% had severe disability. Single or compound fracture did not impact outcome in their study. Our results were slightly different and patients who had compound fractures, Dural tear or brain contusions at time of presentation were more at risk of having poor outcome in our study participants.

Indian study published by Prakash *et al.* showed data of 453 patients managed for depressed skull fracture at a neurosurgery unit.¹⁷ The results of the study showed that most common mode of injury was noted to be alleged assault, overall outcome was good and not related to presence of dural tear. Overall outcome was good in our patients as well but most common mode of injury was fall and dural tear at the time of presentation was significantly associated with poor short term outcome in our study participants. Large studies with patients from multiple neurosurgery units may clear the facts in a better way.

Tariq *et al.* in 2021 published data from Peshawar regarding outcome of patients operated for depressed skull fracture with a dural tear.¹⁸ They revealed that around 8% of patients died due to extensive brain injury. Another observation was that brain injury was associated with poor outcome as well in patients who survived after the surgery. Our study was slightly different as we included all patients of depressed skull fractures with and without dural tear and found out that outcome was good in most of the patients managed for depressed skull fractures. Patients who had compound fractures, Dural tear or brain contusions at time of presentation were more at risk of having poor outcome as compared to others.

LIMITATION OF STUDY

Data set was small and heterogeneous. Though inclusion and exclusion criteria was strict but still number of confounding factors and effect modifiers can affect the outcome in pediatric patients managed for depressed skull fractures. Short term outcome was observed only, long term follow up of study participants may have yielded different results.

CONCLUSION

Outcome was good in most of the pediatric patients managed for depressed skull fractures in our study. Patients who had compound fractures, Dural tear or brain contusions

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at time of presentation were more at risk of having poor outcome in our study participants.

Most of the patients with pediatric head trauma had good outcome in our data set. They were discharged at third day without any major event occurring in the pathway of recovery. Treating teams should pay special attention to children who at the time of presentation had compound fractures, Dural tear or brain contusions because they were found more at risk of having poor outcome in our study participants. Most of the children without compound fractures, dural tears or brain contusions recovered uneventfully.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MH & AAK: Data acquisition, data analysis, critical review, approval of the final version to be published.

ZM & NB: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

MW & AN: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Salman S, Saleem SG, Shaikh Q, Yaffee AQ. Epidemiology and outcomes of trauma patients at The Indus Hospital, Karachi, Pakistan, 2017 - 2018. *Pak J Med Sci.* 2020; 36(1): S9-S13. <https://doi:10.12669/pjms.36.ICON-Suppl.1717>
2. Hegde S, Bawa M, Kanojia RP, Mahajan JK, Menon P, Samujh R, et al. Pediatric Trauma: Management and Lessons Learned. *J Indian Assoc Pediatr Surg.* 2020; 25(3): 142-146. <https://doi:10.4103/jiaps.JIAPS.35.19>
3. Garg K, Sharma R, Gupta D, Sinha S, Satyarthee GD, Agarwal D, et al. Outcome Predictors in Pediatric Head Trauma: A Study of Clinicoradiological Factors. *J Pediatr Neurosci.* 2017; 12(2): 149-153. <https://doi:10.4103/jpn.IPN.179.16>
4. Ortiz JB, Sukhina A, Balkan B, Harootunian G, Adelson PD, Lewis KS, et al. Epidemiology of Pediatric Traumatic Brain Injury and Hypothalamic-Pituitary Disorders in Arizona. *Front Neurol.* 2020; 10: 1410. <https://doi:10.3389/fneur.2019.01410>
5. Bedry, Tuji, and Henok Tadele. "Pattern and Outcome of Pediatric Traumatic Brain Injury at Hawassa University Comprehensive Specialized Hospital, Southern Ethiopia: Observational Cross-Sectional Study." *Emergency medicine international* vol. 2020 1965231. 29 Jan. 2020. doi:10.1155/2020/1965231
6. Yue JK, Upadhyayula PS, Avalos LN, Cage TA. Pediatric Traumatic Brain Injury in the United States: Rural-Urban Disparities and Considerations. *Brain Sci.* 2020; 10(3): 135. Published 2020. <https://doi:10.3390/brainsci10030135>
7. Hussein AA, Laeke T, Yohannes D. Clinical Outcomes and Prognostic Determinants of Surgically Treated Depressed Skull Fracture in Addis Ababa University Neurosurgical Teaching Hospitals: A Prospective Multicenter Observational Study. *World Neurosurg.* 2021; S1878-8750(21)01586-2. <https://doi:10.1016/j.wneu.2021.10.089>
8. Lee SWY, Ming Y, Jain S, Chee SY, Teo K, Chou N, et al. Factors Predicting Outcomes in Surgically Treated Pediatric Traumatic Brain Injury. *Asian J Neurosurg.* 2019; 14(3): 737-743. <https://doi:10.4103/ajns.AJNS.2.19>
9. Emami P, Czorlich P, Fritzsche FS, Westphal M, Rueger JM, Lefering R, et al. Impact of Glasgow Coma Scale score and pupil parameters on mortality rate and outcome in pediatric and adult severe traumatic brain injury: a retrospective, multicenter cohort study. *J Neurosurg.* 2017; 126(3): 760-767. <https://doi:10.3171/2016.1.JNS152385>
10. Muhammad G, Javeed F, Rehman L, Abbas A, Afzal A. Pattern of Skull Fractures and Its Outcome in Pediatric Head Injury Patients. *Pak J Neurol Surg.* 2020; 24(4): 350-356.
11. Manne S, Musali SR, Gollapudi PR, Nandigama PK, Mohammed I, Butkuri N. Surgical Outcomes in Depressed Skull Fractures: An Institutional Experience. *Asian J Neurosurg.* 2019; 14(3): 815-820. <https://doi:10.4103/ajns.AJNS.111.19>
12. Arneitz C, Sinzig M, Fasching G. Diagnostic and Clinical Management of Skull Fractures in Children. *J Clin Imaging Sci.* 2016 Nov 16; 6: 47. <https://doi:10.4103/2156-7514.194261>
13. Satardey RS, Balasubramaniam S, Pandya JS, Mahey RC. Analysis of Factors Influencing Outcome of Depressed Fracture of Skull. *Asian J Neurosurg.* 2018; 13(2): 341-347. doi:10.4103/ajns.AJNS.117.16
14. Shao X, Wang Q, Shen J, Liu J, Chen S, Jiang X. Treatment of Traumatic Depressed Compound Skull Fractures. *J Craniofac Surg.* 2019; 30(7): 2239-2244. <https://doi:10.1097/SCS.00000000000005982>
15. Spazzapan P, Krašovec K, Velnar T. Risk factors for bad outcome in pediatric epidural hematomas: a systemic review. *Chin Neurosurg J.* 2019; 5: 19. <https://doi:10.1186/s41016-019-0167-6>
16. Oktay K, Guzel E, Unal E, Yilmaz T, Okten AI, Guzel A. Outcome of Primary Bone Fragment Replacement in Pediatric Patients with Depressed Skull Fracture. *Pediatr Neurosurg.* 2019; 54(1): 28-35. <https://doi:10.1159/000495807>
17. Prakash A, Harsh V, Gupta U, Kumar J, Kumar A. Depressed Fractures of Skull: An Institutional Series of 453 Patients and Brief Review of Literature. *Asian J Neurosurg.* 2018; 13(2): 222-226. <https://doi:10.4103/ajns.AJNS.168.16>
18. Tariq M, Mian AM, Filza F, Ayub S, Khan SD, Jalal K. Outcome of patients operated for depressed skull fracture with dural tear. *Pak J Neurol Surg.* 2021; 5 (2): 126-133.