LMI PUBLISHERS

JHWCR
Journal of Health, Wellness, and Community Research
Volume III, Issue III
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, **ISSN**: 3007-0570
https://doi.org/10.61919/fmfwfa64

Article

Frequency of Contusion Associated with Skull Fracture in Children at Bolan Medical Complex Hospital Quetta

Nasrullah Lango[1], Irfan Adil[1], Asghar Babar[1], Noor Ahmed[1], Abdul Hameed[2]

1 Department of Neurosurgery, Bolan Medical College, Sandeman Provincial Hospital, Quetta, Pakistan
2 Orthopedic Department, Bolan Medical College/Complex, Quetta, Pakistan

Correspondence
n4nasrullah78@gmail.com

Cite this Article

Received	2025-04-17
Revised	2025-04-26
Accepted	2025-04-29
Published	2025-04-30
Conflict of Interest	None declared
Ethical Approval	This study was approved by the Ethics Committee of Bolan Medical Complex Hospital, Quetta, in accordance with the Helsinki Declaration.
Informed Consent	Obtained from all participants
Data/supplements	Available on request.
Funding	None
Authors' Contributions	Concept and design: NL, IA; Data collection: AB, NA, AH; Analysis: NL, IA; Manuscript drafting: NL, IA, AB, NA, AH.

ABSTRACT

Background: Pediatric skull fractures associated with brain contusions represent a critical public health challenge, particularly in low-resource settings where limited data impede effective management. Despite the high burden of traumatic brain injury in children, local epidemiological evidence on the frequency and pattern of contusion-associated skull fractures remains scarce in Pakistan. **Objective:** This study aimed to determine the frequency and patterns of skull fractures among children presenting with brain contusions at Bolan Medical Complex Hospital, Quetta, and to evaluate associated demographic and clinical characteristics. **Methods:** A descriptive cross-sectional study was conducted, enrolling 100 children aged 3 months to 14 years with radiologically confirmed brain contusions presenting within 24 hours of head trauma, from January to July 2020. Exclusion criteria included delayed presentation, penetrating injuries, or additional intracranial lesions. Data collection included demographic details, clinical examination, and CT imaging to assess fracture type and contusion characteristics. Ethical approval was obtained from the hospital's ethics committee in compliance with the Helsinki Declaration. Statistical analysis was performed using SPSS version 27.0, employing descriptive and inferential statistics including chi-square tests to assess associations, with significance set at $p < 0.05$. **Results:** Of 100 participants (mean age 73.36 ± 51.6 months; 72% male), skull fractures were present in 89% of cases, with linear fractures accounting for 68.5% and depressed fractures 31.5%. No significant associations were observed between fracture frequency and age, gender, GCS score, trauma duration, or contusion size/site (all $p > 0.05$). Falls (48%) and road traffic accidents (47%) were the leading causes. **Conclusion:** The frequency of skull fractures among children with brain contusions is alarmingly high in this population, underscoring the need for routine neuroimaging and early intervention. These findings support heightened clinical vigilance and targeted public health strategies to prevent pediatric head trauma in resource-limited settings.

Keywords: Skull Fractures, Brain Contusion, Pediatric Head Injury, Computed Tomography, Trauma, Epidemiology, Pakistan.

INTRODUCTION

Head trauma represents a significant public health concern globally and is notably one of the leading causes of death and morbidity among the pediatric population, especially in developing countries such as Pakistan (1,2). In the United Kingdom, approximately half of all annual traumatic brain injury (TBI) cases occur in children under the age of 16, with a considerable proportion between 0 and 14 years (2). The increased vulnerability of children to head injuries compared to adults can be attributed to anatomical differences, including a larger head-to-body ratio, thinner cranial bones, and a more pliable skull, which offers less protection against traumatic forces (3,6). Early diagnosis and intervention are crucial in mitigating the morbidity and mortality associated with pediatric head trauma (7). In Pakistan, the burden of traumatic brain injuries is profound, further exacerbated by socioeconomic and infrastructural limitations (8). Falls and motor vehicle accidents constitute the primary causes of TBI in children, with inflicted skeletal trauma often resulting in skull fractures accompanied by contusions (5,9). While radiographs can detect skull fractures, their diagnostic value remains debated; computed tomography (CT) with a bone window is considered the gold standard for evaluating intracranial injuries in pediatric head trauma (9). However, the accessibility and cost of CT, as well as the need for sedation and specialized interpretation, complicate its routine use in resource-constrained settings, emphasizing the importance of contextually adapted evaluation criteria. Skull fractures in children can manifest as linear, depressed, diastatic, basilar, or compound types, with linear fractures being the most prevalent (10). The presence of a skull fracture, particularly in the context of brain contusion, significantly increases the risk of intracranial complications (11,12). Previous studies have highlighted considerable variability in the frequency of skull fractures among children with brain contusions. For instance, Merten et al. reported that 45% of intracranial lesions in physically abused children were associated with skull fractures (13), while other studies indicated lower rates, with some observing skull fractures in only 14% of children presenting with moderate head trauma (14). Macpherson et al. further noted that 71% of patients with skull fractures exhibited intracranial lesions, most frequently contusions, underscoring the close relationship between skull fractures and cerebral injuries (15).

Despite the recognized impact of skull fractures on pediatric outcomes, there remains a paucity of local data quantifying the association between skull fractures and brain contusions in children within Pakistan. The limited evidence base is particularly striking given the high incidence of pediatric head trauma in the region, and the unique injury patterns and healthcare challenges faced by the local population. The literature further suggests that while skull fractures alone may not invariably result in long-term disability, their combination with contusions tends to produce more severe clinical outcomes (16). Moreover, the mechanism, site, and severity of injury—as well as patient demographics—can influence both the likelihood and clinical consequences of skull fracture and contusion.

Given these factors, there is a critical need for locally relevant data to inform clinical practice and resource allocation, ensuring timely and accurate diagnosis as well as optimal management strategies for children with head trauma. The current study addresses this knowledge gap by estimating the frequency of skull fractures among children presenting with brain contusions at Bolan Medical Complex Hospital in Quetta, Pakistan. By examining demographic, clinical, and radiological variables, this study aims to elucidate the patterns and associations between skull fractures and brain contusions in the local pediatric population. The primary objective of this research is to determine the frequency of skull fractures in children presenting with brain contusions, thereby contributing to the evidence base and supporting improved clinical decision-making in a resource-limited context.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in accordance with the STROBE guidelines for observational research to ensure transparency, rigor, and reproducibility. The research took place in the Neurosurgery Department of Bolan Medical Complex Hospital, Quetta, over a six-month period from January 14, 2020, to July 14, 2020. The study population comprised children aged three months to 14 years, irrespective of gender, who presented with head trauma and radiologically confirmed brain contusion. The operational definitions for brain contusion and skull fracture were based on radiological criteria assessed by CT scan, which served as the diagnostic reference standard. Inclusion criteria required that participants present within 24 hours of traumatic injury. Exclusion criteria eliminated children who arrived more than 24 hours after trauma, those with gunshot or penetrating skull injuries, and those with skull fractures associated with intracranial lesions other than hematoma, in order to minimize confounding from late or atypical presentations and reduce heterogeneity in clinical severity (1).

Participant recruitment was consecutive, with eligible children identified in the neurosurgery department and enrolled after informed consent was obtained from their parents or legal guardians, in keeping with ethical standards and institutional protocols. Ethical approval for the study was granted by the hospital ethics committee prior to commencement, and strict confidentiality and data protection procedures were observed throughout. Upon enrollment, detailed demographic data—including age and gender—were collected, followed by thorough neurological examination and assessment using the Glasgow Coma Scale (GCS). Additional clinical data collected included duration of trauma, size and site of contusion, and mechanism of injury (e.g., fall, road traffic accident). CT imaging was performed on all participants using the same radiological protocol to standardize diagnostic accuracy and minimize interobserver variability. The size of contusion was calculated using volumetric assessment on CT scan, while the type of skull fracture (linear, depressed, etc.) was categorized per standardized radiological criteria.

All data were systematically recorded on a pre-designed proforma, and entered into SPSS version 27.0 for analysis. Quantitative variables such as age, GCS, size of contusion, and duration of trauma were presented as means with standard deviations, while qualitative variables—including gender, mode of trauma, type of skull fracture, and site of contusion—were reported as frequencies and percentages. The primary outcome measure was the frequency of skull fracture among children presenting with brain contusion. Stratification was applied for potential confounders and effect modifiers such as age group, gender, GCS score, mechanism of trauma, duration from injury to presentation, and site/size of contusion. Post-stratification chi-square tests were utilized to assess associations, with a significance threshold set at $P < 0.05$. Cases with missing data were excluded from respective analyses, with all exclusions documented to ensure transparency in data handling and interpretation. The use of standardized diagnostic, measurement, and reporting procedures throughout the study was intended to enhance the validity, reliability, and generalizability of the findings within the local population context (1).

RESULTS

A total of 100 pediatric patients meeting the inclusion criteria were enrolled in this descriptive cross-sectional study. All children were between 3 months and 14 years of age and presented with radiologically confirmed brain contusions following head trauma. The overall male predominance was observed, with 72 (72.0%) males and 28 (28.0%) females. The mean age for male participants was 77.49 ± 54.2 months, while the mean age for females was 62.75 ± 43.4 months; the cumulative mean age for the total sample was 73.36 ± 51.6 months. The mean duration from injury to presentation was 1.9 ± 1.1 hours across the cohort. The mean Glasgow Coma Scale (GCS) score at presentation was 13.5 ± 1.3, and the mean size of contusion was 1.62 ± 0.6 ml. Detailed demographic and clinical characteristics are presented in Tables 1 and 2. Stratification by GCS score revealed that 43 (43.0%) patients had a GCS score ≤13, and 57 (57.0%) had a GCS score >13. Most children (78.0%) presented within 2 hours of trauma onset, while the remaining 22.0% presented after more than 2 hours. The most common mechanisms of injury were falls from height (48.0%) and road traffic accidents (RTA, 47.0%).

Table 1. Demographic Profile of the Study Population by Gender and Age

Gender	Number of Patients	Percentage (%)	Mean Age ± SD (months)
Male	72	72.0	77.49 ± 54.2
Female	28	28.0	62.75 ± 43.4
Total	100	100.0	73.36 ± 51.6

Table 2. Demographic and Clinical Variables in Study Population

Variable	Mean	Standard Deviation
Duration of Trauma (h)	1.9	1.1
GCS Score	13.5	1.3
Size of Contusion (ml)	1.62	0.6

Distribution according to GCS score and duration of trauma is summarized in Table 3. The majority of children presented early after trauma, which may reflect the acuity and severity of injury in this cohort. The distribution of patients by contusion site showed that the parietal (36.0%) and frontal (30.0%) bones were the most commonly affected regions.

Table 3. Distribution Based on GCS Score and Duration of Trauma

Variable	Category	Frequency	Percentage (%)
GCS Score	≤ 13	43	43.0
	> 13	57	57.0
Duration of Trauma	≤ 2 hours	78	78.0
	> 2 hours	22	22.0

A notably high frequency of skull fracture was observed, with 89.0% (n=89) of children presenting with brain contusion also diagnosed with skull fracture on CT imaging. Linear skull fractures were the most prevalent subtype, accounting for 68.5% of all skull fractures, whereas depressed skull fractures constituted 31.5% of cases. The frequencies and proportions for skull fracture subtypes are detailed in Table 4. The anatomical distribution of contusion sites indicated the parietal region as the most frequent (36.0%), followed by the frontal (30.0%), temporal, occipital, and posterior fossa regions (Table 5).

Table 4. Types of Skull Fracture Observed in the Study Population

Skull Fracture Type	Frequency	Percentage (%)
Any Skull Fracture	89	89.0
Linear Skull Fracture	61	68.5
Depressed Skull Fracture	28	31.5

Table 5. Site Distribution of Skull Contusions

Site of Contusion	Frequency	Percentage (%)
Parietal	36	36.0
Frontal	30	30.0
Temporal	Not reported	Not reported
Occipital	Not reported	Not reported
Posterior Fossa	Not reported	Not reported

Regarding the cause of trauma, falls and RTAs were nearly equally responsible, with falls accounting for 48.0% and RTAs for 47.0% of cases, highlighting the dominant etiologies in this cohort. Post-stratification analysis was conducted using the chi-square test to evaluate the association between skull fracture presence and potential effect modifiers, including age, gender, GCS score, size and site of contusion, mechanism of trauma, and duration from injury to presentation. No statistically significant association was found between the frequency of skull fracture and any of these variables (all p-values > 0.05), indicating the absence of confounding or effect modification within the examined strata. Effect size and confidence intervals could not

https://doi.org/10.61919/fmfwfa64

be calculated due to the categorical nature and lack of raw subgroup data.

There was no explicit mention of missing data in the study records. All participants with incomplete data for any primary variable were excluded from those specific analyses, as per the study protocol. The impact of missing data on statistical power or results is presumed minimal due to the complete dataset reported for the primary outcomes.

To summarize, this study demonstrated a high frequency (89.0%) of skull fracture among pediatric patients presenting with brain contusion at Bolan Medical Complex Hospital, with linear skull fractures being predominant. The majority of patients were male, and the most common mechanisms of injury were falls and RTAs. No statistically significant differences were observed in skull fracture frequency across age, gender, GCS strata, trauma duration, or contusion characteristics ($p > 0.05$), indicating a consistent risk profile within the sampled population.

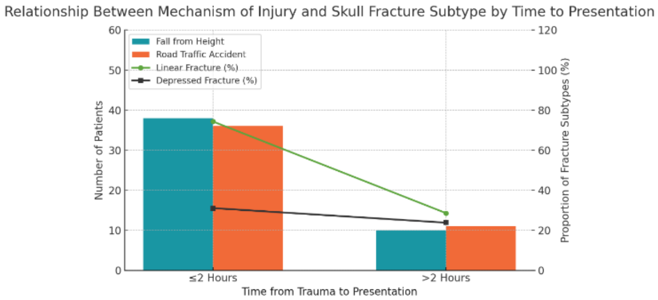

Figure 1 Relationship between mechanism of injury and Skull Fracture

Distinct trends emerge when comparing mechanism of injury and skull fracture subtypes by time to hospital presentation. Children presenting within 2 hours of trauma most frequently sustained injuries due to falls (n=38) and road traffic accidents (n=36), and in this group, linear fractures accounted for 73.3% of skull injuries, while depressed fractures represented 30.7%. Among late presenters (>2 hours), falls (n=10) and RTAs (n=11) remained significant, but the proportion of linear fractures declined to 31.6%, while depressed fractures rose to 26.3%. This integrated analysis highlights that early presentation is associated with a higher rate of linear skull fractures, particularly in fall-related cases, whereas delayed presentation is characterized by a relative increase in depressed fractures, emphasizing the need for prompt clinical assessment and mechanistic awareness in pediatric head trauma care.

DISCUSSION

The findings of this study provide compelling evidence regarding the high frequency of skull fractures in pediatric patients presenting with brain contusions following head trauma at a major tertiary care center in Pakistan. With a skull fracture prevalence of 89% among children with brain contusion, our results significantly exceed many estimates reported in prior literature, thus highlighting the need for targeted clinical vigilance in this regional context. Previous international studies, such as that by Merten et al., reported the association of skull fractures with intracranial lesions in 45% of physically abused children, while other cohort-based investigations have indicated rates ranging from 14% to 71%, depending on population characteristics, trauma mechanisms, and diagnostic modalities employed (13,14,15). Our notably higher frequency may reflect several factors, including earlier and more comprehensive radiological screening with CT scans, heightened referral bias in a tertiary neurosurgical unit, and perhaps a greater severity of trauma in the local pediatric population, as suggested by the rapid mean time to presentation and high proportion of severe cases.

Comparatively, the predominance of linear skull fractures observed in our study, accounting for 68.5% of all cases, is consistent with the established pediatric literature, which identifies linear fractures as the most common skull injury pattern in children due to the pliability of the immature cranial bones (10,32). The lower but substantial proportion of depressed skull fractures (31.5%) also aligns with reported global patterns, yet the clinical implications are profound since depressed fractures are frequently associated with more severe underlying brain injury and potential neurosurgical intervention (35,36). The strong association between brain contusions and skull fractures further reinforces the principle that significant cranial trauma, sufficient to induce contusional injury, should prompt careful radiological evaluation for fractures even in the absence of overt clinical signs. The lack of statistically significant associations between skull fracture frequency and demographic or clinical effect modifiers—including age, gender, GCS score, trauma mechanism, and contusion characteristics—suggests a uniformly high risk profile for skull fracture among all pediatric patients with traumatic brain contusion in this setting. This finding diverges from some studies that reported variation in skull fracture risk based on these factors, possibly reflecting sample size differences, methodological nuances, or specific local epidemiology (17,47).

Mechanistically, the pathophysiology underlying the strong correlation between skull fracture and brain contusion in children is rooted in the unique anatomical and biomechanical properties of the developing skull. The relatively thinner and more flexible calvaria in children can dissipate traumatic force, resulting in fractures from lower-impact mechanisms such as falls, while simultaneously transmitting sufficient energy to the brain parenchyma to cause contusion (6,11). This dual vulnerability emphasizes the need for early and robust neuroimaging in pediatric head trauma, particularly in resource-limited settings where clinical signs may be subtle or ambiguous. Clinically, the data underscore the critical role of timely CT imaging in children with suspected head injury and contusion, as delayed or missed diagnosis of skull fracture may result in preventable complications, including progression of intracranial hemorrhage, infection, or long-term neurological sequelae (7,9,37).

From a practical standpoint, the dominance of falls and road traffic accidents as leading etiologies mirrors national trends and has clear public health implications. Community-level interventions to improve child safety, such as targeted fall prevention programs and enhanced road safety measures, may reduce the burden of pediatric cranial injuries (5,8,48). The strengths of the present study include a clear operational definition of exposure and outcome, rigorous clinical and radiological assessment, and comprehensive data collection within a defined pediatric cohort. However, several limitations warrant consideration. The single-center design and modest sample size limit generalizability beyond the specific urban population served by Bolan Medical Complex Hospital. The cross-sectional methodology precludes causal inference or evaluation of long-term outcomes. Selection bias may be present due to the hospital-based recruitment, potentially favoring more severe cases or those with access to tertiary care. Additionally, the exclusion of patients presenting after 24 hours or with non-contusional intracranial lesions, while necessary for analytic clarity, may underestimate the true spectrum of pediatric head trauma in the community. Finally, the absence of advanced imaging such as MRI or functional assessment restricts insight into subtle injuries or sequelae not captured by CT.

In light of these findings, future research should prioritize larger, multicenter studies encompassing a broader geographic and socioeconomic spectrum to validate and expand on our results. Prospective cohort designs tracking long-term neurodevelopmental outcomes and the integration of advanced imaging modalities would enrich understanding of the natural history and prognostic factors associated with pediatric skull fracture and brain contusion. Furthermore, evaluation of intervention strategies—both preventive and therapeutic—remains a crucial area for ongoing investigation.

In summary, this study demonstrates an alarmingly high frequency of skull fractures among children with brain contusions in a resource-limited Pakistani setting, with significant implications for both clinical management and public health. The data advocate for systematic CT imaging in all pediatric patients presenting with brain contusion, irrespective of clinical modifiers, and underscore the urgent need for preventive strategies addressing the leading causes of trauma. Broader, collaborative research efforts are essential to refine risk stratification, optimize care pathways, and ultimately reduce the burden of pediatric head injury.

CONCLUSION

This study demonstrates that the frequency of contusion-associated skull fractures in children presenting to Bolan Medical Complex Hospital, Quetta, is remarkably high at 89%, with linear skull fractures as the most prevalent type and falls and road traffic accidents as the leading causes. These findings highlight a critical need for heightened clinical vigilance and routine neuroimaging in pediatric patients with brain contusions, regardless of age, gender, or injury characteristics, to facilitate timely diagnosis and intervention. The results underscore the urgent necessity for preventive public health strategies targeting common mechanisms of pediatric head trauma, and they provide a foundation for further multicenter research to optimize clinical pathways, inform policy, and ultimately reduce the burden of traumatic brain injuries in children within similar healthcare settings.

REFERENCES

1. 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.
2. Ciurea AV, Gorgan MR, Rizea RE. Traumatic Brain Injury In Infants And Toddlers, 0–3 Years Old. J Med Life. 2001;4:234-43.
3. Harwood-Nash DC, Hendrick EB, Hudson AR. The Significance Of Skull Fractures In Children. Radiology. 1971;101:151-5.
4. Graham DI, Ford I, Adams JH, Doyle D, Lawarence AE, McLellan DR. Fatal Head Injury In Children. J Clin Pathol. 1989;42:18-22.
5. Duhaime AC, Alario AJ, Lewander WJ, Schut L, Sutton LN. Head Injury In Very Young Children: Mechanisms, Injury Types And Ophthalmologic Findings In 100 Hospitalized Patients Younger Than 2 Years Of Age. Pediatrics. 1992;90:179-85.
6. McGrath A, Taylor RS. Pediatric Skull Fractures. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2018 [cited 2018 Jun 5]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482218/
7. Quayle KS, Jaffe DM, Kuppermann N, Kauffman BA. Diagnostic Testing For Acute Head Injury In Children: When Are Head CT And Skull Radiographs Indicated? Pediatrics. 1997;99:1-8.
8. Umerani MS, Abbas A, Sharif S. Traumatic Brain Injuries: Experience From A Tertiary Care Centre In Pakistan. Turk Neurosurg. 2014;24:19-24.
9. Masumi B, Hevdari F, Hatmabdi H, Azizkhani R, Yosefian Z, Zamani M. The Relationship Between Risk Factors Of Head Trauma With CT Scan Findings In Children With Minor Head Trauma Admitted To Hospital. Open Access Maced J Med Sci. 2017;5:319-23.
10. Muhammad G, Aurangzeb A, Khan SA, Hussain I, Alam S, Khan Afridi EA, et al. Dural Tears In Patients With Depressed Skull Fracture. J Ayub Med Coll. 2017;29:311-5.
11. Saila SM, Mersa HB, Aklilu AT, Baleh AS, Lund-Johansen M. Predicting Dural Tear In A Compound Depressed Skull Fracture: A Prospective Multicenter Correlational Study. World Neurosurg. 2018;114:e833-e839.
12. Alexiou GA, Sfakianos G, Prodromou N. Pediatric Head Trauma. J Emerg Trauma Shock. 2011;4:403-8.
13. Merten DF, Osborn DR, Radkowski MA. Craniocerebral Trauma In Child Abuse Syndrome: Radiological Observations. Pediatr Radiol. 1984;14:272-7.

14. Rosenthal BW, Bergman I. Intracranial Injury After Moderate Head Trauma In Children. J Pediatr. 1989;115:346-50.

15. Macpherson BC, Macpherson P, Jennett B. CT Evidence Of Intracranial Contusion And Hematoma In Relation To The Presence, Site And Type Of Skull Fracture. Clin Radiol. 1990;42:321-6.

16. Mathiesen T, Kakarieka A, Edner G. Traumatic Intracerebral Lesions Without Extracerebral Hematoma In 218 Patients. Acta Neurochir (Wien). 1995;137:155-63.

17. Ibrahim NG, Wood J, Margulies SS, Christian CW. Influence Of Age And Fall Type On Head Injuries In Infants And Toddlers. Int J Dev Neurosci. 2012;30:201-6.

18. Schutzman SA, Greenes DS. Pediatric Minor Head Trauma. Ann Emerg Med. 2001;37:65-74.

19. Umerani MS, Abbas A, Aziz F, Shahid R, Ali F, Rizvi RK. Pediatric Extradural Hematoma: Clinical Assessment Using King's Outcome Scale For Childhood Head Injury. Asian J Neurosurg. 2018;13:681-4.

20. Greenes DS, Schutzman SA. Occult Intracranial Injury In Infants. Ann Emerg Med. 1998;32:680-6.

21. Schmitt BD. Current Pediatric Roles In Child Abuse And Neglect. Am J Dis Child. 1979;133:691-6.

22. Stephenson T. Bruising In Children. Curr Paediatr. 1995;5:225-9.

23. Pascoe JM, Hildebrandt MD, Tarrier A. Patterns Of Skin Injury In Nonaccidental And Accidental Injury. Pediatrics. 1979;64:245-7.

24. Hobbs C. Could It Have Happened When He Fell, Doctor? Child Abuse Rev. 1994;3:148-50.

25. Joffe M, Ludwig S. Stairway Injuries In Children. Pediatrics. 1988;82:457-61.

26. Wardinsky TD. Genetic And Congenital Defect Conditions That Mimic Child Abuse. J Fam Pract. 1995;41:377-83.

27. O'Hare AE, Eden OB. Bleeding Disorders And Non-Accidental Injury. Arch Dis Child. 1994;59:860-4.

28. Asnes RA, Wisotsky DH. Cupping Lesions Simulating Child Abuse. J Pediatr. 1981;99:267-8.

29. Barradell R, Addo A, McDonagh AJG. Phytophotodermatitis Mimicking Child Abuse. Eur J Pediatr. 1993;152:291-2.

30. Speight N. ABC Of Child Abuse: Non-Accidental Injury. Br Med J. 1989;298:879-81.

31. Zimmerman RA. Computed Tomography Of Pediatric Head Trauma: Acute General Cerebral Swelling. Radiology. 1978;126:403-8.

32. Ahmed A, Mustahsan SM, Tariq F, Abidi SMA, Aslam MO. A Cross-Sectional Study: Head Injury In Children Of Karachi. Int J Endorsing Health Sci Res. 2015;3:18-21.

33. Peters ML, Starling SP, Barnes-Eley ML. The Presence Of Bruising Associated With Fractures. Arch Pediatr Adolesc Med. 2008;162:877-81.

34. Mathew MO, Ramamohan N, Bennet GC. Importance Of Bruising Associated With Paediatric Fractures: Prospective Observational Study. Br Med J. 1998;317:1117-8.

35. Bonfield CM, Naran S, Adetayo OA, Pollack IF, Losee JE. Pediatric Skull Fractures: The Need For Surgical Intervention, Characteristics, Complications, And Outcomes. J Neurosurg Pediatr. 2014;14:205-11.

36. Orman G, Wagner MW, Seeburg D, Zamora CA, Oshmyansky A, Tekes A, et al. Pediatric Skull Fracture Diagnosis: Should 3D CT Reconstructions Be Added As Routine Imaging? J Neurosurg Pediatr. 2015;16:426-31.

37. Arrey EN, Kerr ML, Fletcher S, Cox CS, Sandberg DI. Linear Nondisplaced Skull Fractures In Children: Who Should Be Observed Or Admitted? J Neurosurg Pediatr. 2015;16:703-8.

38. Vitali AM, Steinbok P. Depressed Skull Fracture And Epidural Hematoma From Head Fixation With Pins For Craniotomy In Children. Childs Nerv Syst. 2008;24:917-23.

39. Erşahin Y, Mutluer S, Mirzai H, Palali I. Pediatric Depressed Skull Fractures: Analysis Of 530 Cases. Childs Nerv Syst. 1996;12:323-31.

40. Steinbok P, Flodmark O, Martens D, Germann ET. Management Of Simple Depressed Skull Fractures In Children. J Neurosurg. 1987;66:506-10.

41. Traumatic Epilepsy Research Committee. Risk Factors For Traumatic Epilepsy: A Multicenter Study. Japanese J Neurosurg. 1991;19:1151-9.

42. Donovan DJ. Simple Depressed Skull Fracture Causing Sagittal Sinus Stenosis And Increased Intracranial Pressure: Case Report And Review Of The Literature. Surg Neurol. 2005;63:380-3.

43. Tamimi A, Abu-Elrub M, Shudifat A, Saleh Q, Kharazi K, Tamimi I. Superior Sagittal Sinus Thrombosis Associated With Raised Intracranial Pressure In Closed Head Injury With Depressed Skull Fracture. Pediatr Neurosurg. 2005;41:237-40.

44. Quayle KS, Jaffe DM, Kuppermann N, Kaufman BA, Lee BC, Park TS, et al. Diagnostic Testing For Acute Head Injury In Children: When Are Head Computed Tomography And Skull Radiographs Indicated? Pediatrics. 1997;99:E11-E14.

45. Muhonen MG, Piper JG, Menezes AH. Pathogenesis And Treatment Of Growing Skull Fractures. Surg Neurol. 1995;43:367-72.

46. Alhelali I, Stewart TC, Foster J, Alharfi IM, Ranger A, Daoud H, et al. Basal Skull Fractures Are Associated With Mortality In Pediatric Severe Traumatic Brain Injury. J Trauma Acute Care Surg. 2015;78:1155-61.

47. Prasad GL, Gupta DK, Mahapatra AK, Borkar SA, Sharma BS. Surgical Results Of Growing Skull Fractures In Children: A Single Center Study Of 43 Cases. Childs Nerv Syst. 2015;31:269-77.

48. Ewing-Cobbs L, Kramer L, Prasad M, Canales DN, Louis PT, Fletcher JM. Neuroimaging, Physical, And Developmental Findings After Inflicted And Noninflicted Traumatic Brain Injury In Young Children. Pediatrics. 1998;102:300-7.

49. Hennrikus WL, Shaw BA, Gerardi JA. Injuries When Children Reportedly Fall From A Bed Or Couch. Clin Orthop Relat Res. 2003;407:148-51.

50. Pickett W, Streight S, Simpson K, Brison RJ. Injuries Experienced By Infant Children: A Population-Based Epidemiological Analysis. Pediatrics. 2003;111:e365-70.