

Head injury in children below two years in Nigeria: Epidemiology, management and outcomes in a tertiary hospital

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Abstract

Background: Head injury in children younger than two years presents unique diagnostic and therapeutic challenges because of their distinct anatomical and developmental characteristics. Understanding the epidemiology, severity patterns, and outcomes in this vulnerable age group is critical for guiding interventions and informing policy development.

Methods: This prospective descriptive study was conducted at Ekiti State University Teaching Hospital from November 2024 to October 2025. All children below two years who presented with head injury were enrolled. Data collected included demographic characteristics, aetiology of injury, and severity assessed using the Glasgow Coma Scale (GCS). Management approaches and outcomes, evaluated using the Glasgow Outcome Score (GOS), were also documented. Data were analyzed using SPSS version 27, with statistical significance set at $p < 0.05$.

Results: A total of 46 children met the inclusion criteria. Males accounted for 56.5% of cases, with a male-to-female ratio of 1.3:1. Toddlers aged 1–2 years constituted the majority (87.0%). Falls were the predominant mechanism of injury, accounting for 89.1% of cases, followed by injuries from falling objects (10.9%). Most injuries were mild (76.1%), while moderate and severe injuries accounted for 17.4% and 6.5%, respectively. Conservative management was employed in 93.5% of cases. Favourable outcomes were recorded in 93.5% of patients, whereas three deaths (6.5%) occurred, all among children with severe injuries. Injury severity was significantly associated with outcome ($p < 0.001$), while aetiology ($p = 0.41$) and treatment modality ($p = 0.187$) were not.

Conclusion: Head injury in children below two years is predominantly caused by preventable domestic falls. Although most injuries are mild and associated with excellent outcomes, severe injuries carry significant mortality. Strengthening prevention strategies and improving paediatric trauma care systems are essential.

Keywords: Paediatric head injury; Infants; Toddlers; Outcome; Nigeria

1. Introduction

Head injury remains one of the leading causes of morbidity and mortality among children worldwide, accounting for a substantial proportion of paediatric emergency visits and hospital admissions. Children younger than two years represent a uniquely vulnerable population due to their anatomical, physiological, and developmental characteristics, which predispose them to both injury and challenges in clinical assessment. Their relatively large head-to-body ratio, weak cervical musculature, thin and pliable cranial bones, and immature motor coordination increase their

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susceptibility to falls and blunt head trauma.¹⁻³ Furthermore, preverbal children are unable to communicate symptoms such as headache, dizziness, or visual disturbances, making early diagnosis more difficult and often dependent on caregiver interpretation.

In low- and middle-income countries, including Nigeria, the burden of paediatric head injury is compounded by environmental hazards, inadequate childproofing of homes, overcrowded living conditions, and lapses in supervision. Several studies have demonstrated that domestic falls, particularly those involving furniture, stairs, caregivers' arms, and elevated surfaces, are the predominant cause of head injury in this age group.⁴⁻⁶ Although road traffic injuries are a major contributor to trauma in older children, they are far less common among infants and toddlers.

Despite the high frequency of head injuries in young children, there is limited literature in Nigeria focusing specifically on children below two years of age. Most available studies combine all paediatric age groups, making it difficult to draw age-specific conclusions. Children under two years require special attention due to the unique biomechanical properties of their skull, their dependence on caregivers, the higher likelihood of non-accidental injury, and the different clinical thresholds used for imaging and intervention. This study therefore aimed to examine the epidemiology, mechanisms of injury, injury severity, management patterns, and outcomes of head injuries in children younger than two years presenting to a tertiary hospital in Southwestern Nigeria. By focusing exclusively on this age group, the study provides insights necessary for targeted prevention, improved clinical decision-making, and the development of child-specific injury prevention policies.

2. Methods

2.1. Study Design

This was a prospective descriptive study conducted to evaluate the epidemiology, clinical characteristics, management patterns, and outcomes of head injuries in children below two years of age. The prospective design allowed for systematic and real-time data collection, thereby minimizing recall bias and enhancing data completeness.

2.2. Study Setting

The study was carried out at Ekiti State University Teaching Hospital, a tertiary referral centre serving both urban and rural populations within Ekiti State and its neighbouring regions. The hospital is equipped with paediatric emergency services, inpatient facilities, and neurosurgical care, making it suitable for the management of paediatric head injuries.

2.3. Study Population

The study population comprised all children aged 0 to 23 months who presented with head injury, either as an isolated condition or as part of polytrauma, between November 2024 and October 2025.

2.4. Eligibility Criteria

Children were included if they were younger than two years, had a clinical diagnosis of head injury made by the attending physician, and had complete clinical documentation. Exclusion criteria included age ≥ 2 years, incomplete records, patients brought in dead, and those referred out before adequate evaluation.

2.5. Sampling Technique

A consecutive sampling approach was employed. All eligible patients presenting during the study period were recruited, ensuring that the sample reflected the full spectrum of cases encountered in this setting.

2.6. Data Collection

Data were collected prospectively from the children's emergency department, intensive care unit, paediatric wards, and neurosurgical outpatient clinic using a structured data collection proforma to ensure consistency and completeness.

Demographic variables included age, sex, and classification into infants (less than one year) and toddlers (one to two years). Clinical variables included mechanism of injury, presenting features, and associated injuries. Mechanisms of injury were categorized into falls at home, falls from caregivers, falls on stairs, falling objects, road traffic accidents, and assault, including suspected non-accidental injuries where applicable.

2.7. Clinical Assessment and Definitions

All patients underwent prompt assessment and stabilization following standard trauma care principles. Injury severity was assessed using the Glasgow Coma Scale adapted for paediatric patients.⁷ Injuries were classified as mild (GCS 13–15), moderate (GCS 9–12), and severe (GCS ≤8).

Clinical outcomes were assessed using the Glasgow Outcome Score at discharge and at three-month follow-up.⁸ For analytical purposes, outcomes were dichotomized into favourable (GOS scores 4–5) and unfavourable (GOS scores 1–3), with death corresponding to a score of 1.

2.8. Investigations

Radiological investigations, including cranial computed tomography scans, were performed based on clinical indications such as altered consciousness, focal neurological deficits, suspected skull fractures, or clinical deterioration during observation. Imaging findings were recorded where available but were not mandatory for study inclusion.

2.9. Management

Management strategies were categorized as conservative or operative. Conservative management included observation, medical therapy, wound care, and supportive measures. Operative management involved neurosurgical interventions such as craniotomy, evacuation of intracranial hematomas, and elevation of depressed skull fractures. Treatment decisions were guided by clinical findings, imaging results where available, and institutional protocols.

2.10. Data Analysis

Data were entered and analyzed using IBM SPSS version 27. Descriptive statistics were used to summarize variables and were presented as frequencies and percentages. Associations between categorical variables—particularly aetiology, injury severity, treatment modality, and clinical outcome—were analyzed using Fisher's exact test due to the relatively small sample size. Statistical significance was set at $p < 0.05$.

2.11. Data Quality Assurance

Data accuracy and completeness were ensured through regular cross-checking of entries against source clinical records. Any discrepancies or missing information were verified and corrected before final analysis.

2.12. Ethical Considerations

Ethical approval was obtained from the Research and Ethics Committee of Ekiti State University Teaching Hospital. The study was conducted in accordance with the principles of the Declaration of Helsinki. Informed consent was obtained from the parents or guardians of all participants prior to enrolment, and all data were anonymized to ensure confidentiality.

3. Results

A total of 46 children below the age of two years presented with head injuries during the study period.

3.1. Demographic Characteristics

As shown in Table 1, there was a slight male predominance, with 26 males (56.5%) and 20 females (43.5%), giving a male-to-female ratio of 1.3:1. The study population was overwhelmingly composed of toddlers aged 1–2 years, who accounted for 40 cases (87.0%), while infants constituted only 6 cases (13.0%). This distribution highlights the markedly increased vulnerability to head injury as children transition into the more mobile toddler phase.

3.2. Aetiology of Injury

The mechanisms of injury are detailed in Table 2. Falls were responsible for all recorded cases, underscoring their dominant role in this age group. Falls occurring within the home environment were the most frequent, accounting for 20 cases (43.5%). This was followed by falls on stairs in 12 children (26.1%) and falls from caregivers in 9 cases (19.6%). Injuries resulting from falling objects were less common, occurring in 5 patients (10.9%). Notably, there were no cases attributed to road traffic accidents or assault. Overall, these findings emphasize the home as the principal setting for injury occurrence in children under two years.

3.3. Severity of Injury

The distribution of injury severity is presented in Table 3. The majority of patients sustained mild head injuries, with 35 children (76.1%) presenting with Glasgow Coma Scale (GCS) scores of 13–15. Moderate injuries (GCS 9–12) were observed in 8 patients (17.4%), while severe injuries (GCS \leq 8) were relatively uncommon, occurring in 3 cases (6.5%). Despite their low frequency, severe injuries represent a clinically significant subgroup.

3.4. Management

Management strategies are also summarized in Table 3. Most patients were treated conservatively, with 43 children (93.5%) receiving non-operative care, including observation, medical therapy, and wound management. Only 3 patients (6.5%) required operative intervention. This distribution reflects the predominance of mild injuries and suggests that conservative management was sufficient in the majority of cases.

3.5. Clinical Outcomes

Clinical outcomes at discharge and follow-up are presented in Table 3. A favourable outcome (Glasgow Outcome Score \geq 4) was achieved in 43 patients (93.5%). There were 3 deaths (6.5%), all of which occurred in children who sustained severe head injuries. No deaths were recorded among patients with mild or moderate injuries.

3.6. Relationship between Aetiology and Outcome

The association between mechanism of injury and clinical outcome is shown in Table 4. Among children who sustained falls at home, 19 had favourable outcomes while 1 died. All 9 patients who sustained falls from caregivers had favourable outcomes. For falls on stairs, 11 patients recovered while 1 death was recorded. Among injuries caused by falling objects, 4 patients had favourable outcomes and 1 died. Overall, there was no statistically significant association between aetiology and outcome (Fisher's exact $p = 0.41$), indicating that the mechanism of injury did not independently predict clinical outcome.

3.7. Relationship between Severity, Treatment Modality, and Outcome

The relationship between injury severity, treatment modality, and outcome is summarized in Table 5. Injury severity showed a strong and statistically significant association with outcome ($p < 0.001$). All patients with mild and moderate injuries achieved favourable outcomes, whereas all patients with severe injuries died.

3.8. Relationship between Mode of treatment and Clinical outcome

The mode of treatment was not significantly associated with outcome ($p = 0.187$) as shown in table 6. Among patients managed conservatively, 41 had favourable outcomes while 2 died. Of those who underwent operative intervention, 2 had favourable outcomes and 1 died. These findings suggest that injury severity, rather than treatment modality, was the primary determinant of outcome in this cohort.

Overall, the results demonstrate that head injuries in children below two years are predominantly mild, largely attributable to domestic falls, and associated with excellent outcomes. However, severe injuries, though infrequent, carry a disproportionately high risk of mortality.

Table 1 Age and sex distribution of children below 2 years with head injury (n = 46)

Age group	Male (%)	Female (%)	Total (%)
Infants	3 (50.0)	3 (50.0)	6 (13.0)
Toddlers	23 (57.5)	17 (42.5)	40 (87.0)
Total	26 (56.5)	20 (43.5)	46 (100.0)

Footnote: percentages for male and female are calculated within each age group; total percentages are based on overall sample size

Table 2 Aetiology of Head injury among Children below 2 years (n = 46)

Mechanism of injury	Frequency	Percentage (%)
Fall at home	20	43.5
Fall from caregiver	9	19.5
Fall from stairs	12	26.1
Falling object	5	10.9
Road traffic accident	0	0.0
Assault	0	0.0
Total	46	100.0

Table 3 Severity, Management, and Outcome of head injuries (n = 46)

Variable	Category	Frequency	Percentage (%)
Severity	Mild (GCS 13-15)	35	76.1
	Moderate (GCS 9-12)	8	17.4
	Severe (3-8)	3	6.5
Mode of treatment	Conservative	43	93.5
	Operative	3	6.5
Outcome	Favourable (GOS \geq 4)	43	93.5
	Death (GOS =1)	3	6.5

Table 4 Relationship between Aetiology of Head injury and Clinical outcome (n = 46)

Aetiology	Favourable outcome (GOS \geq 4)	Death (GOS = 1)	Total
Fall at home	19	1	20
Fall from caregiver	9	0	9
Fall from stairs	11	1	12
Falling object	4	1	5
Total	43	3	46

Fisher's exact $p= 0.41$

Table 5 Relationship between Severity of Injury and Clinical Outcome (n = 46)

Severity	Death (GOS = 1)	Favourable (GOS \geq 4)	Total
Mild	0	35	35
Moderate	0	8	8
Severe	3	0	3
Total	3	43	46

Fisher's exact $p < 0.001$

Table 6 Relationship between Mode of treatment and Clinical outcome (n = 46)

Severity	Death (GOS = 1)	Favourable (GOS ≥4)	Total
Mild	0	35	35
Moderate	0	8	8
Severe	3	0	3
Total	3	43	46

Fisher's exact p = 0.187

4. Discussion

This study provides a detailed insight into the epidemiology, mechanisms, severity patterns, management strategies, and outcomes of head injuries in children below two years of age in a Nigerian tertiary hospital setting. By focusing specifically on this highly vulnerable age group, the findings offer important context-specific evidence that aligns with, and in some respects extends, existing literature.

The demographic distribution observed in this study, as shown in Table 1, demonstrates a slight male predominance, with males accounting for 56.5% of cases and a male-to-female ratio of 1.3:1. This pattern is consistent with several previous studies that have reported higher injury rates among male children, likely reflecting early behavioral tendencies toward increased activity and environmental interaction.⁹⁻¹² More striking, however, is the overwhelming predominance of toddlers (87.0%) compared to infants (13.0%). This finding underscores the role of developmental milestones in injury risk. As children transition from infancy to toddlerhood, increasing mobility-crawling, standing, and walking-combined with poor hazard awareness significantly heightens their exposure to environmental dangers. The data in Table 1 therefore reinforces the critical period of vulnerability during the second year of life.

The aetiological pattern of injury, presented in Table 2, reveals that head injuries in this age group are overwhelmingly domestic in origin. Falls accounted for nearly all cases, with falls at home (43.5%), falls on stairs (26.1%), and falls from caregivers (19.6%) collectively representing the vast majority of injuries. Injuries from falling objects constituted a smaller proportion (10.9%), while notably, there were no cases attributable to road traffic accidents or assault. This distribution highlights the home as the primary environment of risk for children under two years. The prominence of falls from caregivers is particularly noteworthy, as it reflects not only environmental hazards but also issues related to handling practices and caregiver fatigue. These findings are consistent with earlier reports emphasizing domestic falls as the leading mechanism of injury in this age group.^{4-6,13} Importantly, the absence of road traffic injuries contrasts with patterns seen in older paediatric populations, further validating the age-specific focus of this study.

The severity profile of injuries, detailed in Table 3, shows that the majority of cases were mild (76.1%), with moderate and severe injuries accounting for 17.4% and 6.5%, respectively. This distribution aligns with global trends in paediatric head injury, where mild traumatic brain injury predominates. However, despite the relatively small proportion of severe cases, their clinical significance is profound, as they accounted for all recorded mortality. This highlights an important clinical reality: while most head injuries in this age group are benign, a small subset carries a disproportionately high risk of death.

Management patterns, also outlined in Table 3, indicate a strong preference for conservative treatment, which was employed in 93.5% of cases. Only 6.5% of patients required operative intervention. This approach reflects both the predominance of mild injuries and the effectiveness of non-operative management in appropriately selected cases. It also suggests judicious use of surgical intervention in this setting, likely guided by clinical assessment and available imaging. The high rate of conservative management is comparable to findings in similar low- and middle-income settings, where resource considerations often necessitate careful patient selection for surgery.

Clinical outcomes, as presented in Table 3, were overwhelmingly favourable, with 93.5% of patients achieving good recovery (GOS ≥4). The mortality rate of 6.5%, though relatively low, is clinically significant given that all deaths occurred among patients with severe head injuries. This reinforces the critical importance of early identification and aggressive management of severe cases.

The relationship between mechanism of injury and outcome, explored in Table 4, showed no statistically significant association (p = 0.41). Although falls at home accounted for the largest number of injuries and included one death, similar outcomes were observed across other mechanisms. This finding suggests that the nature of the incident itself is

less predictive of outcome than the physiological impact of the injury. In other words, regardless of how the injury occurs, it is the resulting severity that ultimately determines prognosis.

This observation is further strengthened by the findings in Table 5, which demonstrate a highly significant association between injury severity and outcome ($p < 0.001$). All patients with mild and moderate injuries survived with favourable outcomes, while all patients with severe injuries died. This stark contrast underscores the central role of injury severity, as measured by the Glasgow Coma Scale, in predicting clinical outcomes. The prognostic reliability of the GCS has been well established in both adult and paediatric populations (7,8,12,14), and the present study reaffirms its utility in children under two years.

In contrast, the mode of treatment did not show a statistically significant relationship with outcome ($p = 0.187$), as shown in Table 6. Although mortality occurred in both conservatively and operatively managed patients, the numbers were small, limiting definitive conclusions. Nevertheless, this finding suggests that treatment modality alone does not determine outcome; rather, it is the underlying severity of brain injury that dictates prognosis. Surgical intervention, while life-saving in selected cases, may not overcome the adverse effects of severe primary brain injury.

Taken together, the findings of this study emphasize several key points. First, head injuries in children below two years are largely preventable, with the home environment serving as the principal setting of risk. Second, while most injuries are mild and associated with excellent outcomes, severe injuries, though less frequent, carry a very high mortality rate. Third, injury severity remains the most important determinant of outcome, outweighing both mechanism of injury and treatment modality.

These insights have important implications for both clinical practice and public health. Preventive strategies must focus on improving home safety and caregiver awareness, particularly during the toddler stage. Clinically, there is a need for rapid assessment and prioritization of severe cases, with emphasis on early intervention and intensive care support.

Overall, this study contributes valuable age-specific data to the limited body of literature on head injury in children under two years in Nigeria and similar settings, and it provides a strong foundation for targeted prevention and improved management strategies.

5. Conclusion

Head injury in children below two years in this setting is overwhelmingly a consequence of preventable domestic falls, with no contribution from road traffic accidents or assault. The majority of injuries are mild and associated with excellent outcomes; however, severe injuries, though infrequent, are uniformly fatal in this cohort. Injury severity remains the single most important determinant of outcome, outweighing both mechanism of injury and treatment modality. These findings underscore the critical importance of targeted home safety interventions, caregiver education, and early recognition of severe injury. Strengthening paediatric trauma systems, particularly with regard to rapid assessment and intensive care support, is essential to improving survival in this vulnerable population.

Recommendations

In light of the findings of this study, a coordinated approach to prevention, early recognition, and system strengthening is essential to reduce the burden of head injury in children below two years.

First, there is a pressing need for targeted caregiver education. Community-based and hospital-linked programmes should focus on raising awareness about the mechanisms and risks of head injury in infants and toddlers, with particular emphasis on safe handling practices, supervision, and early recognition of warning signs following trauma. Given that most injuries occur within the home, such interventions must be practical, culturally appropriate, and easily implementable.

Second, home safety interventions should be actively promoted. Simple but effective measures-including the use of stair gates, window guards, protective barriers, non-slip flooring, and safe play environments-can significantly reduce the risk of falls. Public health campaigns and primary healthcare platforms provide valuable opportunities to integrate these safety messages into routine maternal and child health services.

Third, improving early recognition and emergency response is critical. Frontline healthcare providers should be trained in standardized paediatric trauma assessment, including the appropriate use of neurological scoring systems, to

facilitate timely identification of severe injuries. Strengthening pre-hospital care systems and referral pathways will further enhance early intervention and improve outcomes.

In addition, hospital-based trauma care systems require ongoing strengthening. This includes improving access to diagnostic imaging, ensuring the availability of essential equipment, and enhancing paediatric intensive care capacity. Timely neurosurgical evaluation and intervention, where indicated, remain crucial for managing severe cases.

At a policy level, child injury prevention should be integrated into national and regional health strategies. Establishing robust injury surveillance systems will enable continuous monitoring, guide resource allocation, and support evidence-based policymaking.

Finally, further research is warranted. Multicentre studies and long-term follow-up investigations are needed to better understand regional patterns, refine management protocols, and evaluate functional and neurodevelopmental outcomes over time.

Collectively, these measures offer a practical and scalable framework for reducing preventable head injuries and improving outcomes among children in this vulnerable age group.

Compliance with ethical standards

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Disclosure of conflict of interest

The author declares no conflict of interest.

Statement of ethical approval

Ethical approval for this study was obtained from the Research and Ethics Committee of Ekiti State University Teaching Hospital, Ado-Ekiti, Ekiti State, Nigeria.

Statement of informed consent

The study was conducted in accordance with the principles of the Declaration of Helsinki. Consent was obtained from the parents or guardians of all participating children prior to enrolment. Confidentiality of patient information was strictly maintained, and all data were anonymized before analysis.

Author Contributions

The author was solely responsible for the conception and design of the study and drafting of the manuscript. The author conducted data collection, patient evaluation and clinical follow-up.

Availability of Data Material

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Consent for Publication

Not applicable. This manuscript does not contain any individual person's data in any form (including images, videos, or voice recordings). All data are presented in aggregated and anonymized form, and individual participants cannot be identified.

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