Magnitude of Birth Trauma and Contributing Factors among Neonates Admitted to Neonatal Intensive Care Unit of Asella Teaching and Referral Hospital

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Abstract

Background: Birth trauma is a significant cause of neonatal morbidity and disability globally, particularly in low- and middle-income countries. It refers to structural or functional impairment resulting from mechanical forces during labor and delivery. This study aims to investigate the magnitude, pattern, and contributing factors of birth trauma among neonates admitted to the Neonatal Intensive Care Unit (NICU) at Asella Teaching and Referral Hospital.

Methods: A hospital-based cross-sectional study was conducted at Asella Teaching and Referral Hospital (ATRH), Ethiopia. Data were collected from the medical records of neonates admitted to the NICU between July 1, 2022, and June 30, 2024. A total of 189 neonates were included in the analysis. Data were analyzed using SPSS version 27.0. Bivariate and multivariate logistic regression analyses were used to identify contributing factors.

Results: Among the 189 neonates included, the overall magnitude of birth trauma was 24.3% (46 cases), corresponding to an incidence of 243 per 1,000 live births. Subgaleal hemorrhage was the most frequent type of injury, accounting for 47.8% of cases, followed by caput succedaneum (21.7%). Multivariate analysis revealed significant associations between birth trauma and cephalopelvic disproportion (CPD) (AOR 12.2, 95% CI: 3.0-49.2, p < 0.0001), instrumental delivery (AOR 16.6, 95% CI: 3.5-79.8, p < 0.0001), maternal age < 26 years (AOR 3.3, 95% CI: 1.2-8.9, p = 0.01), and macrosomia (AOR 4.7, 95% CI: 1.7-33.0, p = 0.049).

Conclusion: The prevalence of birth trauma in this setting is notably high. Instrumental delivery, young maternal age, CPD, and macrosomia were identified as independent predictors of birth trauma. Strategies focusing on strict indications for instrumental delivery and early identification of CPD and macrosomia are essential to reduce the burden of birth injuries.

Keywords: Birth Trauma; Neonate; Asella; Ethiopia; Instrumental Delivery; Subgaleal Hemorrhage

Background

Birth trauma is defined as structural or functional impairment of a newborn's body resulting from mechanical forces during labor and delivery. Globally, the burden of these injuries remains high in low- and middle-income countries (LMICs) [1]. In Ethiopia, recent meta-analyses show that the pooled prevalence of birth trauma ranges from 11% to 15% [2,3].

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Neonatal birth weight is a critical indicator of health and is influenced by maternal nutrition, gestational weight gain, and conditions such as gestational diabetes [4]. Specifically, macrosomia (high birth weight) is identified as a primary predictor of mechanical birth trauma, as it significantly increases the risk of shoulder dystocia and the requirement for instrumental interventions during delivery [5]. This study aims to assess local magnitudes and risk factors at ATRH.

Materials and Methods

Study settings and period: The study was conducted at Asella Teaching and Referral Hospital (ATRH), a tertiary-level teaching hospital in Asella, Ethiopia. The hospital serves a population of over 3.5 million people. The study utilized data from July 1, 2022, to June 30, 2024.

Study design and population: A hospital-based retrospective cross-sectional study design was employed. The study population consisted of neonates admitted to the NICU of ATRH during the study period.

Sample size and sampling procedure: The sample size was calculated using the single population proportion formula based on a previously reported prevalence of neonatal birth trauma of 16.9% from a study conducted in Eastern Ethiopia. Assuming a 95% confidence level, 5% margin of error, and 10% allowance for incomplete records, the final calculated sample size was 236. Due to incomplete charts and exclusions, 189 complete neonatal records were included in the final analysis.

Inclusion criteria: Neonates with neonatal charts that have complete information.

Exclusion criteria: Neonates with incomplete neonatal charts.

Data collection: Data were extracted from patient charts using a structured questionnaire covering sociodemographic characteristics, obstetric history, and neonatal outcomes. Variables included maternal age, parity, mode of delivery, fetal presentation, and specific types of birth trauma.

Statistical analysis: Data were entered and analyzed using SPSS version 27.0. Descriptive statistics were used to summarize the data. Bivariate logistic regression was performed to screen for associations, and variables with a p-value < 0.25 were entered into a multivariate logistic regression model. A p-value < 0.05 was considered statistically significant.

Ethics consideration: Ethical approval was obtained from the Arsi University Ethical Review Committee. Patient confidentiality was maintained by using medical record numbers instead of names during data extraction.

Results

Sociodemographic and obstetric characteristics: A total of 189 neonates were included in the study. The mean maternal age was 26.6 years (SD ± 4.6). More than half of the mothers (51.3%) resided in rural areas. Regarding obstetric history, 98.4% of mothers had antenatal care follow-up. The majority of neonates (90.5%) had a vertex presentation. Spontaneous labor occurred in 87.3% of cases. In terms of delivery mode, 56.6% were normal vaginal deliveries, 35.4% were cesarean sections, and 7.9% were instrumental deliveries.

Magnitude and pattern of birth trauma: The overall prevalence of birth trauma among the admitted neonates was 24.3% (46 cases). Among those with birth trauma, Subgaleal hemorrhage was the most common type, accounting for 22 (47.8%) cases. Caput succedaneum was the second most frequent injury (21.7%), followed by cephalhematoma (10.9%). Other injuries included facial nerve palsy, fractures, and skin abrasions.

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In multivariable logistic regression analysis, instrumental delivery was strongly associated with birth trauma (AOR = 16.6, 95% CI: 5.7-79.8, p < 0.001). Cephalopelvic disproportion (CPD) also showed a significant association (AOR = 12.2, 95% CI: 3.0-49.2, p < 0.001). Neonates with macrosomia had higher odds of birth trauma compared to normal birth weight neonates (AOR = 7.7, 95% CI: 1.7-33.0, p = 0.04). In addition, maternal age ≤26 years was independently associated with birth trauma (AOR = 3.3, 95% CI: 1.2-8.9, p = 0.01). Other variables including neonatal sex, parity, type of pregnancy, fetal presentation, gestational age, birth weight categories other than macrosomia, and cesarean section delivery were not significantly associated after adjustment.

Type of Birth Trauma	Frequency	Percentage (%)
Subgaleal hemorrhage	22	47.8
Caput succedaneum	10	21.7
Cephalhematoma	5	10.9
Facial nerve palsy	2	4.3
Femoral fracture	2	4.3
Others (Erb's palsy, fractures, bruising)	5	10.9
Total	46	100.0

Table 1: Pattern of birth trauma among neonates admitted at ATRH (N = 46).

Factors associated with birth trauma: In multivariate logistic regression analysis, four factors were independently associated with birth trauma:

1. **Cephalopelvic disproportion (CPD):** Mothers with CPD were 12.2 times more likely to have neonates with birth trauma compared to those without (AOR 12.2, 95% CI: 3.0-49.2).

2. **Instrumental delivery:** Neonates delivered via instrumental delivery had significantly higher odds of trauma compared to spontaneous vaginal delivery (AOR 16.6, 95% CI: 3.5-79.8).

3. **Maternal age:** Mothers younger than 26 years had a 3.3-fold increased risk of neonatal birth trauma (AOR 3.3, 95% CI: 1.2-8.9).

4. **Macrosomia:** Birth weight ≥ 4000g was associated with a 4.7-fold increase in the odds of birth trauma (AOR 4.7, 95% CI: 1.7-33.0).

Discussion

This study demonstrated a high magnitude of neonatal birth trauma (24.3%) among neonates admitted to the NICU of ATRH. This prevalence is considerably higher than reports from high-income countries, where birth trauma rates range from 9 to 17 per 1,000 live births, reflecting differences in obstetric care, intrapartum monitoring, and timely access to cesarean delivery.

Compared with national data, our finding is also higher than pooled Ethiopian estimates ranging from 11% to 15%. Similar institutional studies in Eastern Ethiopia and Addis Ababa have reported prevalence between 13% and 20%, suggesting that birth trauma remains a significant but variable problem across regions [2,4]. The higher magnitude observed in our setting may reflect referral bias, as ATRH is a tertiary hospital receiving complicated labor cases.

Subgaleal hemorrhage was the most frequent injury identified. This is consistent with studies from Ethiopia and other LMICs where instrumental delivery and prolonged labor are major contributors. Subgaleal hemorrhage is strongly associated with vacuum extraction and delayed recognition can lead to severe morbidity, emphasizing the need for careful monitoring after assisted delivery [6].

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Instrumental delivery was the strongest predictor of birth trauma in this study. Similar findings have been reported in Ethiopia, Nigeria, and other LMIC settings, where neonates delivered with vacuum or forceps had significantly higher odds of traumatic injury. Although instrumental delivery can be lifesaving, inappropriate indications, poor technique, or delayed decision-making may increase neonatal risk [2,7].

Cephalopelvic disproportion was also independently associated with birth trauma. Obstructed or prolonged labor increases mechanical pressure on the fetal head and shoulders, predisposing to soft tissue injury, nerve palsy, and hemorrhage. Early recognition of CPD and timely cesarean section are critical preventive measures [8].

Macrosomia was another significant predictor, consistent with global evidence linking high birth weight to shoulder dystocia and traumatic delivery. Larger fetuses increase the likelihood of difficult labor and instrumental assistance, thereby increasing injury risk [9].

Younger maternal age was associated with birth trauma in this study. This may be explained by biological immaturity, smaller pelvic dimensions, and delayed healthcare-seeking behavior, which can contribute to prolonged labor and obstetric interventions [11].

The relatively high prevalence observed in this study may be explained by several factors. First, ATRH is a referral and teaching hospital that receives complicated and prolonged labor cases from surrounding health facilities, increasing the likelihood of obstructed labor and instrumental delivery. Second, limited intrapartum monitoring resources and delayed referral may contribute to difficult deliveries. Third, as this study included only NICU admissions, milder cases not requiring admission were excluded, potentially over-representing severe birth injuries.

Limitations of the Study

This study was hospital-based and included only neonates admitted to the NICU of Asella Teaching and Referral Hospital, which may not represent all neonates born in the region. Neonates with mild birth trauma who did not require NICU admission were excluded, potentially leading to an overestimation of prevalence. In addition, NICU admission is based on clinical judgment, which may introduce selection bias. Some neonatal and obstetric data were missing for referred neonates born outside Asella. Therefore, the findings may have limited generalizability to other settings with different population characteristics and obstetric care practices. In summary small sample size, selection bias and lack of control group as limitations of the study.

Conclusion

The magnitude of birth trauma in this setting is alarmingly high. Instrumental delivery, CPD, macrosomia, and young maternal age are significant predictors of injury. We recommend strict adherence to protocols for instrumental delivery, improved intrapartum monitoring to detect CPD early, and enhanced training for healthcare providers on safe delivery techniques.

Ethics Consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) ofArsi University A waiver of informed consent was granted for the use of primary data.

Authors' Contribution

SA conceived the study and performed the analysis. LM and BM reviewed the manuscript and contributed to the write-up. All authors approved the final manuscript.

Conflict of Interest

The authors declare no competing interests.

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Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

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