



Neonatal Birth Injuries: A 10 Year Review of 11410 Life Deliveries in a Nigerian Hospital

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ABSTRACT

Introduction: Birth trauma often interchanged with birth injury is defined as an impairment of the neonate's body function or structure due to an adverse event that occurred at birth. Risk factors identified for neonatal birth traumas can be categorized into maternal factors, fetal factors and the application of instrumentation during delivery.

Materials and Methods: This retrospective cohort study investigated term neonates born between January 1, 2015 and January 1, 2024. Maternal and neonatal medical records were thoroughly reviewed to gather comprehensive demographic, clinical and outcome data. Term neonates with no preexisting conditions who experienced unexpected complications were identified using the Perinatal Care-06 coding.

Results: This study showed that over a period of ten years 11410 life deliveries were taken at the the hospital of which 115 newborns had one form of birth injury or the other, this amounted to 13.2/1000 deliveries. Vaginal delivery had the highest number of cases with 6914 cases (60.6%) while deliveries via caesarean section was 4496 cases (39.4%). In this study there were some birth trauma that were seen with only vaginal deliveries, these included scalp injuries, cerebral haemorrhage and shoulder dystocia. Clavicular fractures were the most prevalent birth injuries with a total of 36 such injuries over the study period.

Discussion: Birth injury rates vary significantly worldwide, generally ranging from 0.2 to over 50 per 1,000 live births. In this study the incidence was 13.2/1000 live birth. The commonest birth injury observed in this study was clavicular injuries accounting for 23.8%, this was followed by brachial plexus injuries (15.2%) the other common injuries in this study were lacerations (14.6%), long bone fractures (12.6%), scalp injuries (11.9%) and cranial nerve injuries (8.6%). These injuries were commonly seen with vaginal deliveries except for lacerations which was more associated with deliveries via C-sections. There were no cases of scalp injuries, cerebral hemorrhages and shoulder dystocia seen with C-sections.

Conclusion: Most of the injuries were seen with vaginal deliveries however lacerations are commonly seen with C-sections. Fractures of the clavicle was the highest injury seed in this study. Most of the deliveries were in women within the age group of 20-30 years while the least number of deliveries were in women >40 years. The proportion of trauma cases increased with decreasing age groups with those below 20 years having the highest proportion of trauma cases (4%).

Keywords:

Birth trauma, Newborns, Paediatric, Neonate, Child Birth.

Introduction

Paediatric surgeons are often challenged with the care and management of newborns with birth trauma usually within the first few hours of their birth following complaints of multi-systemic birth injuries arising from the delivery process [1]. The management of these birth trauma in newborns is usually

multidisciplinary depending on the type of birth trauma. Birth trauma often interchanged with birth injury is defined as an impairment of the neonate's body function or structure due to an adverse event that occurred at birth. Injury may be observed during labor, delivery, or after delivery, especially in neonates who require resuscitation in the delivery room. There is a wide spectrum of birth injuries ranging from minor and self-limited problems to severe injuries that may result in significant neonatal morbidity or mortality. Birth injuries differ from

congenital malformations and can typically be distinguished through focused clinical assessment shortly after delivery. Over recent decades, birth trauma rates have declined due to advances in obstetrical techniques and an increased reliance on cesarean delivery, particularly in cases of labor dystocia where operative vaginal deliveries using vacuum or forceps might previously have been performed [2]. Up to 37 birth traumas per 1,000 births have been reported in a few population-based studies conducted [1]. Parents with newborns with birth may experience psychological requiring some counseling as well as social and mental support. Parents frequently believe that birth traumas can be avoided and when they occur, it can result in feelings of anger, frustration, and, in some cases, legal action [3]. Although physical injuries are more frequently considered when birth trauma is considered, the birthing process is a psychologically and physiologically stressful event that can impact patients' mental health as well.

Advancements in prenatal diagnosis and obstetric care have changed the epidemiology of neonatal birth trauma in developed countries [4], however this cannot be said of low and medium income countries where facilities for prenatal diagnosis and sufficient skilled personnel is inadequate. The epidemiology of risk factors for birth trauma has changed over the last two decades as the number of instrumental deliveries has decreased [5]. Cesarean deliveries, a protective factor for birth trauma [6] have increased owing to increasing incidence of Large for Gestational Age (LGA) neonates secondary to maternal obesity and gestational diabetes [7]. Risk factors identified for neonatal birth injuries can be categorized into maternal factors, fetal factors and the application of instrumentation during delivery [8]. Knowledge of the pattern of birth traumas and the related risk factors can benefit the paediatric surgeons in case management and prognostication. Fetal and pregnancy-related factors include macrosomia, macrocephaly, very low birth weight, extreme prematurity, congenital anomalies, oligohydramnios and malpresentation. Maternal factors include obesity and preexisting medical conditions like diabetes or hypertension. Other factors include medical conditions diagnosed during pregnancy, including diabetes or hypertension, Cephalopelvic disproportion, small maternal stature, nulliparity, labor dystocia and difficult fetal extraction, use of vacuum or forceps and prolonged or rapid labor [9].

This study had not been done in our institution and the authors aim to use the study to determine the incidence of neonatal birth trauma, care and management in our institution.

Materials and Methods

Study design and period

This retrospective cohort study investigated term neonates born at $\geq 37+0/7$ weeks gestational age with unexpected complications at birth between January 1, 2015 and January 1, 2024 at Irrua Specialist Teaching Hospital located in Edo State Nigeria. Maternal and neonatal medical records were thoroughly reviewed to gather comprehensive demographic, clinical and outcome data.

Data management

Data was securely captured in REDCap, developed by Vanderbilt University, it is widely used for its compliance with

security standards like HIPAA, offering audit trails, user rights management and tools for data validation. After retrieving the number of patients, the dataset was downloaded into Excel and subsequently exported to IBM SPSS for data cleaning and analysis. The study included all neonatal births with injuries during the period under review.

Inclusion criteria

Term neonates born at ≥ 37 weeks gestational age at the Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria.

Exclusion criteria

Preterm neonates born ≤ 36 weeks gestational age. Also, those born at home or a health facility outside the hospital or newborns with congenital malformations were excluded.

Ethical approval

Ethical approval was obtained from the Health Research Ethical Committee (HREC) of the hospital.

Source population

Term neonates with no preexisting conditions who experienced unexpected complications were identified using the Perinatal Care-06 coding. Perinatal Care (PC) PC-06 is a quality performance measure developed by The Joint Commission and the California Maternal Quality Care Collaborative (CMQCC), titled "Unexpected Complications in Term Newborns". This measure tracks moderate-to-severe adverse outcomes in full-term infants who were otherwise healthy and had no preexisting conditions, with the aim of reducing preventable harm during childbirth.

Study population

Term neonates with no preexisting conditions who experienced birth trauma.

Outcome variable

The primary outcome of the study was birth trauma, defined as the presence of one or more injuries sustained during delivery. These injuries were categorized as follows:

- Scalp injuries: Included cephalohematoma, caput succedaneum, subgaleal hemorrhage and other scalp lesions.
- Soft tissue injuries: Included erythema, abrasions, petechiae, ecchymoses (bruising), subcutaneous fat necrosis and lacerations.
- Cerebral injuries: Included subdural, subarachnoid, tentorial, intraventricular and intracranial hemorrhages.
- Fractures: Included skull, clavicle and long bone fractures.
- Brachial plexus injuries: It caused by stretching of the cervical nerve roots from traction on the neck during delivery. These include upper arm palsy (Erb-Duchenne), lower arm palsy (Klumpke) and Horner's syndrome.

Data collection

This retrospective study utilized patient medical records to obtain detailed maternal, labor and delivery and neonatal variables. All data collection procedures adhered to Institutional Review Board (IRB) protocols. An Institutional Review Board (IRB) is an international committee involving designated to approve, monitor and review research involving human

subjects. Its primary mandate is to protect the rights, safety and welfare of participants by ensuring ethical standards are met, risks are minimized and informed consent is properly obtained. Data were entered into REDCap, a secure, web-based platform and underwent rigorous cleaning to ensure completeness, accuracy and standardization before statistical analysis.

Results

This study showed that over a period of ten years 11410 life deliveries were taken at the the hospital of which 115 newborns had one form of birth injury or the other, this amounted to 13.2/1000 deliveries. The highest incidence/year of birth trauma was seen in 2015 with 3% while the lowest incidence/year was seen in 2023 with 0.6% as shown in Table 1 and Figure 1.

Table 1: Yearly deliveries and birth injuries.

S/N	Year	No of births	No of birth injuries	%
1	2015	773	23	3
2	2016	960	13	1.3
3	2017	821	18	2.2
4	2018	913	8	0.9
5	2019	980	7	0.7
6	2020	914	15	1.6
7	2021	1511	18	1.2
8	2022	1588	20	1.3
9	2023	1440	8	0.6
10	2024	1510	21	1.4
Total		11410	151	

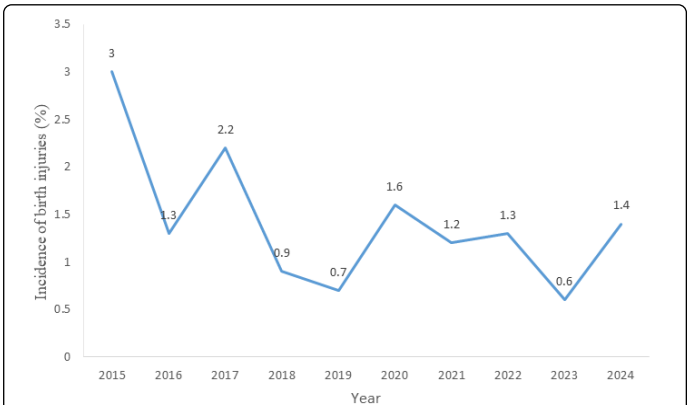


Figure 1: Showing the incidence of birth injuries with year.

Table 2: Incidence of birth injuries by type of delivery.

Mode of deliveries	Number	Number of birth trauma (N)	Incidence per 1000
Vaginal delivery	6914	115	16.6
Caesarean section	4496	38	8
Total	11410	151	13.2

Caesarean sections were performed by both senior residents and consultants in the department. Vaginal deliveries are usually taken by experienced nurses and midwives as well as senior residents. Consultants are rarely involved in taking vaginal deliveries (Figure 2).

The overall cumulative incidence of birth injuries over the 10-year period was 13.2 per 1000 births.

The number of deliveries increased in 2021 up to 2024 with 2022 having the highest number of deliveries of 1588. The lowest number of deliveries was in 2017 with 821 deliveries. Mode of deliveries was via vaginal and caesarean section. Vaginal delivery had the highest number of cases with 6914 cases (60.6%) while deliveries via caesarean section was 4496 cases (39.4%). 115 birth trauma cases was seen with vaginal deliveries amounting to 16.6/1000. In the case of caesarean section 36 birth trauma was seen amounting to 8/1000 (Table 2). The incidence of birth injuries in vaginal deliveries was double the incidence in Caesarean sections.

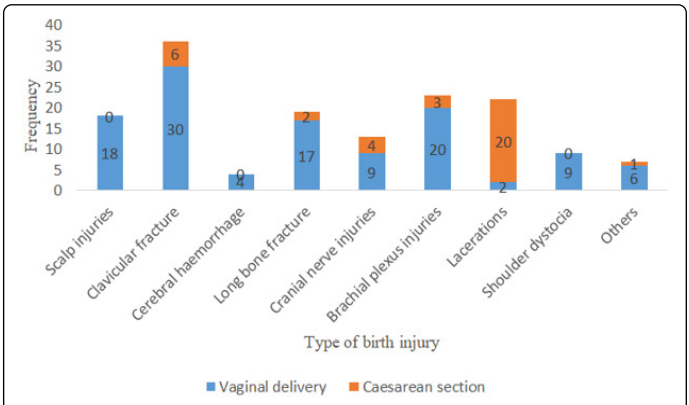


Figure 2: Frequency of types of birth injuries overall and stratified by type of delivery.

Birth injuries were seen in both vaginal deliveries and in deliveries via caesarean section. In this study there were some birth trauma that were seen with only vaginal deliveries, these included scalp injuries, cerebral haemorrhage and shoulder dystocia.

Clavicular fractures were the most prevalent birth injuries with a total of 36 such injuries over the study period. Most of the different types of injuries occurred during vaginal delivery with the exception of lacerations which were more common with caesarean sections.

Most of the deliveries were in women within the age group of 20-30 years while the least number of deliveries were in women in the age group of >40 years. Maternal age from 20 to 40 years

Table 3: Types of injuries.

Injury type	Number	Vaginal delivery	Caeserean section
Scalp injuries	18	18	-
Clavicular fracture	36	30	6
Cerebral haemorrhage	4	4	-
Long bone fracture	19	17	2
Cranial nerve injuries	13	9	4
Brachial plexus injuries	23	20	3
Lacerations	22	2	20
Shoulder dystocia	9	9	-
Others	7	6	1
Total	151	115	36

Table 4: Maternal demographics and the presence of birth trauma.

Variable	Trauma N (%)	No trauma N (%)	χ^2 (df)	P-value
Age				
>40 years	5 (0.6)	818 (99.4)	41.962 (3)	<0.001
31-40 years	43 (1.0)	4129 (99.0)		
20-30 years	77 (1.3)	5691 (98.7)		
<20 years	26 (4.0)	621 (96.0)		
Marital status				
Single	30 (3.3)	877 (96.7)	246.351 (3)	<0.001
Married	101 (1.0)	10080 (99.0)		
Divorced	15 (4.8)	297 (95.2)		
Widowed	5 (50.0)	5 (50.0)		
χ^2 =chi-square; df=degree of freedom Percentages are row percentages				

forms the main reproductive age and accounted for over 80% of deliveries seen in this study.

Discussion

Birth injury rates vary significantly worldwide, generally ranging from 0.2 to over 50 per 1,000 live births, depending on the region, quality of obstetric care and reporting methods. Low- and Middle-Income Countries (LMICs) often experience higher rates, with some areas in Africa reporting up to 53 per 1,000 live births, compared to much lower rates in many high-income nations. A meta-analysis of birth injuries in Africa reveals a high and significant prevalence, estimated at approximately 52.9 per 1,000 live births, which is notably higher than many other regions [10]. In this study the incidence was 13.2/1000 live birth. It was observed that the incidence was higher with vaginal deliveries (16.2/1000) compared to deliveries through caesarean section (8/1000). The overall cumulative incidence of birth injuries over the 10-year period was 13.2 per 1000 births. This incidence in this study is compared to many other ares in LMICs. A 2024 meta-analysis identified the highest rates in Africa with some studies in East Africa finding a prevalence of neonatal birth trauma at 15% (150 per 1,000) in hospital settings, often with high rates of clavicle fractures and nerve injuries [10,11]. While caesarean sections (C-sections) are generally safe, they carry risks of surgical injury to the baby (approx. 1% of cases). Common fetal injuries include skin lacerations (nicks),

cephalhematoma and fractures. A birth injuries rate of 1.1% was reported by James M Alexander et al [12]. This study observed a rate of 0.8% from caesarean sections. C-sections are usually performed by senior resident doctors and consultants. Some factors may naturally be considered to affect the rates of birth injuries, however fetal injury did not vary in frequency with the type of skin incision, preterm delivery, maternal body mass index, or infant birth weight greater than 4,000 g [12].

The commonest birth injury observed in this study was clavicular injuries accounting for 23.8%, this was followed by brachial plexus injuries (15.2%) the other common injuries in this study were lacerations (14.6%), long bone fractures (12.6%), scalp injuries (11.9%) and cranial nerve injuries (8.6%). These injuries were commonly seen with vaginal deliveries except for lacerations which was more associated with deliveries via C-sections. There were no cases of scalp injuries, cerebral hemorrhages and shoulder dystocia seen with C-sections.

Clavicular fractures are the most commonly reported fractures in neonates [13]. These are birth-related fractures that may be avoidably occurring during the process of labor and delivery. The incidence of clavicular fracture in the newborn is between 0.2% and 4.5% [14]. The occurrence of these fractures is related to many factors including maternal, fetal and skills of the obstetrician [15]. Fractures of the clavicle maybe displaced or non-displaced, usually unpredictable and commonly

encountered in spontaneous vaginal delivery. Since clavicular fractures in neonates resolve spontaneously with no long-term complication, parental reassurance and soft handling are required for management.

Brachial plexus injuries were the second commonest injuries in this study (15.2%). Brachial Plexus Birth Injury (BPBI) occurs during birth and damages the nerve fibers compromising the brachial plexus. Incidence across countries varies between 0.5 and 3 for every 1000 live births [16]. Most patients recover within the first 3 months of life. Surgery is necessary for others to regain function, but many of those will sustain some degree of permanent injury [17]. The most common types are Erb's palsy (upper arm), Klumpke's palsy (lower arm) and global palsy (full arm).

Fetal lacerations during cesarean sections are rare but documented injuries, occurring in approximately 0.88% to 3.12% of cases, often when the scalpel or instruments cut the skin during uterine incision. Risk is higher in emergency scenarios. Most injuries are minor (skin-deep) and heal well, though severe injuries can occur. Approximately, 70% of lacerations occurred on the face, head and ear, 20% of lacerations occurred below the waist (buttocks, leg and ankle) and 10% were on the back [17].

Scalp injuries are common birth injuries, often caused by pressure during difficult or assisted vaginal deliveries (vacuum/forceps). The most frequent types are caput succedaneum (superficial swelling) and cephalhematoma (blood pooling under the scalp). Most are harmless, self-limiting injuries that resolve in days to months without treatment, although severe cases can lead to jaundice, anemia, or infection. All cases of scalp injuries (11.9%) were seen with vaginal deliveries.

Birth injuries were observed in all the maternal age groups however there was a statistically significant association between the age group of mothers and the presence of birth trauma ($p < 0.001$). The proportion of trauma cases increased with decreasing age groups with those below 20 years having the highest proportion of trauma cases (4%). Teenage mothers, in particular, may face higher risks of physical trauma due to smaller pelvic sizes. Marital status was also significantly associated with the presence of trauma ($p < 0.001$). Half of those who were widowed had babies with birth trauma while only 1% of those who were married had birth trauma. However, the widowed group had a small size of only 10.

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None.

Conflict of Interests

The authors declare no conflict of interest.

Authors Contributions

Aiwanlehi Eighemhenrio conceptualized the study, participated in data collection, performed the data analysis and drafted the manuscript. Charles Igene contributed to data collection. Enodiana Xavier assisted with data collection and manuscript writing. Hillary Ugwu contributed to data analysis. Anuli Onyenusi assisted with data analysis. Charles Ikhifa contributed

to the analysis of the data. Imadiyi Best obtained the ethical approval for the study. All authors reviewed and approved the final version of the manuscript.

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