



Birth Injuries, Risk Factors and Predictors of Outcome in Maiduguri North-eastern Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors SP, YM and MB designed the study, wrote the protocol and along with author BJD performed the statistical analyses and wrote the first draft. Authors SP and MB managed the statistical analysis. Authors SP and HYM managed the literature searches. All the authors read and approved the final manuscript.

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ABSTRACT

Introduction: Birth injuries are impairment of neonatal body function sustained by the baby at birth which can be avoidable and unavoidable. Despite advances in prenatal care, birth injuries occurs especially in prolonged and difficult labour /deliveries.

Objectives: The study aimed to determine the risk factors and predictors of outcome at Special Care Baby Unit of the University of Maiduguri Teaching Hospital Maiduguri, North-Eastern Nigeria.

Patients and Methods: This was a prospective cross-sectional studies conducted over 12 months from 1st January to 31st December 2016. Patients who met the inclusion criteria after obtaining ethical clearance were evaluated after consenting to participate in the study.

Results: Sixty one (5.7%) out of 1078 neonates admitted to Special Care Baby Unit (SCBU) with birth injuries were recruited into the study. The common risk factors identified were primiparity 25/61 (40.7%) p=0.017, mode of delivery spontaneous vaginal delivery 36/61 (58.8%). Deliver at tertiary centre was high 38/61 (62.3%), though not statistically significant. When compared neonates with one- two birth injuries compared to those greater than 2 birth injuries delivery by

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non-obstetrician was associated with higher risk of birth injury $p=0.001$. Facial nerve palsy, Erb's palsy was the common central nervous system injury; perinatal asphyxia was higher 24/61 (39.1%). Soft tissue injury constituted the majority; Facial and skin bruises 37/61 (60.7%), sub-conjunctival haemorrhage 25/61 (40.1%) cephalhaematoma and subgaleal haemorrhage was 10/61 (16.4%) and 8/61 (13.1%) respectively. Clavicular fracture was the commonest 5/61 (8.2%), followed by humerus 4/61 (6.6%). Two patients with liver and splenic rupture died within 2 days of admission.

Conclusion: The risk factors and predictors of birth injuries are intertwined; largely birth injury is avoidable with good antenatal care and prompt management of labour processes by trained personnel.

Keywords: Neonatal; birth injury; risk factors; predictors of outcome.

1. INTRODUCTION

The Predisposing risk factors for birth injuries are multifaceted and can be classified into maternal, Foetal or birth attendants associated risk factors. [1] The common risk factors of birth injuries are usually identified early in pregnancy or at an early stage of labour by trained health personnel at well-equipped health facilities, however either due to lack of experience or poor facility setting, newborn incur a severe form of birth injury. [1] Lack of supervision of pregnancy, maternal medical conditions, difficult labour, shorter or prolong labour, higher birth weight >4000 g, instrumental delivery especially forceps (mid cavity), or vacuum, malpresentation, obstructed labour, and maternal age less than 16 years or greater than 35 years have been identified as common risk factors for birth injuries. [1-6]

Also implicated as risk factors for birth injuries are breech delivery, various obstetric version manoeuvres and abnormal or excessive traction during delivery. [7,8] Maternal pelvic anomalies and presence or absence of skills of obstetrician may also influence the development of birth injuries. Maternal physical profiles such as maternal obesity with BMI greater than 40, maternal height less than 150 CM are predisposing risk factors for the development of birth injuries such as shoulder dystocia resulting in brachial plexus palsy, clavicular fractures. [8-10] Other studies have found pre-existing maternal diabetes and other diseases like hypertension in pregnancy leading to induction of labour predispose to birth injuries. [11]

Foetal risk factors identified in some literatures were larger head circumference, multiple gestation especially first twins at delivery, and male sex. [12] Subgaleal haemorrhage was said

to occur in the presence of the following risk factors, prolonged second stage of labour, delivery during the at risk hours between 2:00 AM-8:00 AM it has been observed that labour ward staff at night are exhausted by this time so less attention is paid to mothers in labour, vacuum assisted delivery, nulliparity, placement of vacuum extraction cup over the sagittal suture at a distance too close to the neonates anterior fontanel, also in addition to delivery per vaginam was at increased risk factor of birth injury in situation of cephalopelvic disproportion as compared to Caesarean section with potential to birth injury. [12-14]

Similar study on birth injury, risk factors and predictors of outcome has not been reported across Nigeria and especially in our region. We, therefore, decided to conduct a study to identify the risk factors and immediate predictors of birth injuries among neonates that suffer birth injury delivered within the hospital or those referred with the birth injury to this centre.

2. PATIENTS AND METHODS

The subjects were recruited prospectively over a one year period between 1st January and 31st December 2016 and managed in the Special Care Baby Unit (SCBU). Our SCBU is manned by two Consultants, one senior registrar supported by two registrar and two house officers with at least five neonatal staff nurses on each shift. Ethical clearance was received from the hospital research and ethical committee. An informed consent was written and verbal was obtained from the parents of each baby before they were enrolled.

The researchers attended to the patients and information was obtained on the demographic variables: such as maternal age, maternal weight, and height, reproductive and labour

variables: prenatal care, parity, gestational age, prolong rupture of amniotic membrane (PROM) >18 hours, duration of PROM, induction of labour, shoulder dystocia, breech presentation, prolong obstructed labour or difficult labour, mode of delivery, and skill of delivery attendants. Information obtained on the neonates includes: age, sex, birth weight, length, head circumference, Apgar score, and types of birth injuries.

After full physical examination by the researchers, any newborn with the diagnosis of neonatal birth injury is supported by relevant laboratory investigations such as X-ray, ultrasound where applicable. Neonatal asphyxia was diagnosed based on clinical evidence (low Apgar score at 1 and 5 minutes, need for resuscitation, hypotonia, seizures, Acidosis) and radiological evidence where suspicion of skeletal injuries were entertained. Treatment was offered according to the presentation and diagnosis made. These include exchange blood transfusion in cephalhaematoma complicated by anaemia/jaundice, phototherapy, antibiotics, also in the presence of surgical/or orthopaedic injuries skin traction and/or plaster of Paris (POP) was applied. Outcome of the patients such as whether patients got well and discharged home, left against medical advice or died were all documented. The study was also conducted in strict compliance with 1945 Helsinki declaration on study involving human subjects.

2.1 Statistical Analysis

Statistical analysis was done using SPSS version 16 (SPSS Inc., Illinois, Chicago USA). Tables and charts were used to present simple descriptive statistics, student t-test to compare mean values between groups and Chi-squared test to test for association between categorical variables. A P-value <0.05 was considered statistically significant.

3. RESULTS

Of the 1078 newborns admitted into a special care baby unit (SCBU) 61 (5.7%) of them had a birth injury, 23 (38%) were out born deliveries and referred to the centre from other facilities. The remaining 38 patients (62.3%) were delivered at the study centre. Most of the women that delivered at the centre 20/38 (52.6%) were referred to the labour ward of the study centre with difficult/obstructed labour. The overall gestational age of those with birth injuries ranged

between 30-40 weeks with mean of 38.1(±2.4) weeks, the weight ranged between 900-5700 g with mean of 3000(±898.2 g). Of all the patients only 5 (8.2%) had weight greater 4000 g while 46 patients (75.4%) had normal birth weight. Maternal characteristic factors and associated birth injuries, amongst which primiparity had significant statistical with birth injury p=0.017 seen in Table 1. Also noted was the mode of delivery in which spontaneous vaginal delivery was associated with high birth injuries though was not statistically significant p=0.283. Table 2. Shows relationship between birth injury and the risk factors involved, skill of birth attendants played a significant role in birth injury. Delivery by Obstetrician (Doctor) were less at risk of birth injury compared to those delivered by non-obstetrician (non-Doctor) and this was statistically significant p=0.001.

Table 1. Maternal demographic/risk factors and associated birth injuries

Variables	Responses	Frequency (%)
Maternal height (cm)	<150	4(6.6)
	150-159	31(50.8)
	160-169	23(37.7)
	≥170	3(4.9)
Maternal age (yrs)	<20	12(19.7)
	20-29	33(54.1)
	30-39	14(23.0)
	≥40	2(3.3)
Maternal weight (kg)	<50	0(0.0)
	50-59	1(1.6)
	60-69	9(14.8)
	70-79	22(36.1)
	≥80	29(47.5)
Maternal parity	<2	25(41.0)
	2-4	24(39.3)
	>4	12(19.7)
Place of delivery	Home	3(4.9)
	PHC	10(16.4)
	Private	1(1.6)
	Secondary	9(14.8)
Mode of delivery	Tertiary	38(62.3)
	SVD	36(59.0)
	CS	17(27.9)
	Vacuum/forceps	8(13.1)
Gestational age (wks)	<37	7(11.5)
	37-42	53(86.9)
	>42	1(1.6)

PHC=primary health care, SVD=spontaneous vertex delivery, CS= caesarean sections

History of big babies was not a contributing factor to birth injury in this study, on the contrary, male

Table 2. Risk factors in those with 1-2 and ≥3 birth injuries

Variables		1-2 birth injuries	≥3 birth injuries	X ²	p-value
ANC place	Tertiary	10(52.6)	17(40.5)	1.110	0.574
	Non-tertiary	14(47.4)	20(59.5)		
History of big babies	No	18(94.7)	38(92.9)	0.075	0.784
	Yes	1(5.3)	4(7.1)		
Place of delivery	Home	1(5.3)	3(7.8)	1.427	0.232
	Hospital	18(94.7)	39(92.2)		
Labour induced	No	14(73.7)	17(40.5)	1.138	0.286
	Yes	5(26.3)	25(59.5)		
Mode of birth	Vaginal birth	16(84.2)	30(71.4)	1.153	0.283
	C/ section	3(15.8)	12(28.6)		
Birth attendants	Obstetrician	4(21.1)	9(21.4)	0.974	0.001*
	Non-obstetrician	15(78.9)	33(78.6)		
Sex of baby	Male	11(57.9)	30(71.4)	1.087	0.297
	Female	8(42.1)	12(28.6)		
Outcome	Death	2(10.5)	2(4.8)	0.709	0.400
	Survived	17(89.5)	40(95.2)		

gender was associated higher number of birth injuries though both were statistically not significant $p>0.05$. Table 3. Indicate the subgrouping of the spectrum of birth injuries into those central nervous systems (CNS) birth injuries and those with non-central nervous system (non-CNS) birth injuries. Of the CNS injuries, hypoxic-ischaemic injury was high 24 (39.3%), facial nerve palsy, Erb's palsy constituted 8 patients each (13.1%) and Klumpke's paralysis was the least with 2 patients (3.3%). Non-CNS birth injuries constituted the majority and out of this subgroup soft tissue injury was the predominant 37(60.7%). Ten (16.4%) of these patients had severe form soft tissue injuries such cephalhaematoma, 8(13.1%) had subgaleal haemorrhage, while 2 (1.6%) had liver and splenic rupture (1.6%), they both died shortly after admission, while the other 2 death were from patients with hypoxic-ischaemic injuries. Skeletal birth injury seen includes clavicular fracture was the commonest accounting for 5 (8.2%), followed by humeral fracture 4 (6.6%) and femoral fracture 3 (4.8%) and there was one patient with depressed skull fracture (1.6%). The pattern of distribution of birth injuries is shown in Fig. 1, and percentage of patients with either 1-2 birth injuries or more birth injuries see Fig. 2.

4. DISCUSSION

In this study, our finding was that parity, either multiparity or primiparity had significant association with birth injury, as primiparity was a high risk factor for birth injury while multiparity

was low risk factor of birth injury. Also knowledge of birth attendants had significant association with birth injury, delivery conducted by highly skilled health personnel were at lesser risk of developing birth injury. Short mother, elderly mother, as well as mode of delivery had no significant association with birth injury. It has been previously documented in literature that risk factors of birth injury is closely associated maternal characteristics such as short stature maternal height less than 150 cm, with probably contracted pelvic outlet, maternal nulliparity and maternal medical conditions such as pregnancy associated hypertension, prolonged second stage of labour have led to the development of birth injuries.

Neonatal conditions like macrosomia, breech position, and multiple gestations contributed to perinatal birth injuries. [14,15] Also delivery methods, assisted vaginal delivery such Vacuum assisted delivery, forceps extraction and failed vacuum extraction was associated with development of birth injury such as subgaleal haemorrhage.[13] However in this study we did not find that association. However, delivery by Caesarean section and instrumental delivery was associated with low risk of birth injury. Also in this study maternal nulliparity was highly associated development of birth injury. Also birth injury was high among newborns delivered per vaginam than those delivered via caesarean section, this finding is similar to the report Moczygomba et al. [16], this contradict that report by Walsh et al. [17]. Those delivered by c/s and vacuum extraction in this study had low chances of

developing birth injury, these was similar to findings from developed countries which show decrease in birth injuries compared to babies delivered vaginally. [18-20]

Table 3. Subtypes of birth injuries

Pattern of birth injuries	n (% of all injuries)
CNS¹ Injuries	
Facial nerve palsy	8(13.1)
Erb's palsy	8(13.1)
Klumpke's paralysis	2(3.3)
Asphyxia	24(39.3)
Non-CNS injuries	
Soft tissue injury	
Facial and skin bruises	37 (60.7)
Subconjunctival haematoma	25 (41)
Bluish/ecchymoses of skin	15 (24.6)
Fat necrosis	10(16.4)
Skin laceration/bruise	7(11.5)
Scrotal/Labial trauma	4(6.6)
Cephalhaematoma	10 (16.4)
Caput succudenum	23 (37.7)
Fractures	
Mandibular fracture	1 (1.6)
Clavicular fracture	5 (8.2)
Humeral fracture	4 (6.6)
Femoral fracture	3 (4.8)
Skull fracture	1 (1.6)
Internal Organ injury	
Liver rupture	1(1.6)
Splenic rupture	1(1.6)
Subgealeal haemorrhage	8(13.1)

¹CNS Central Nervous System

In this study multiparity had significant effect on birth injury as those babies delivered to multiparous mothers were at low risk of developing birth injury compared to those delivered to primi mothers which is supported by similar studies. [13,21-23] Also observed in our study were the findings that those delivered by Obstetrician or at least a Doctor were less likely to develop birth injury compared to those delivered or attended to by non-obstetrician. This is similar to other studies which found that birth injuries were high among babies delivered to primipara and those delivered by non-obstetrician [4,24]. Male sex has also been associated with risk of birth injury [25], although in our study male sex was high 41/61(67.2%), but was not statistically significant.

When we categorized the birth injury into those associated direct central nervous system effect, Facial nerve palsy, followed by Erb's palsy were common nerve injury identified, while hypoxic- ischaemic injury secondary to severe perinatal asphyxia was higher than both injuries, these findings were similar to that by Warke et al. [26] and Ghorashi et al. [27]. In their study, they found that hypoxic-ischaemic injury was higher than those that have no direct effect on central nervous system. However in this study similar to most reports, the common non-central nervous system associated birth injuries were soft tissue

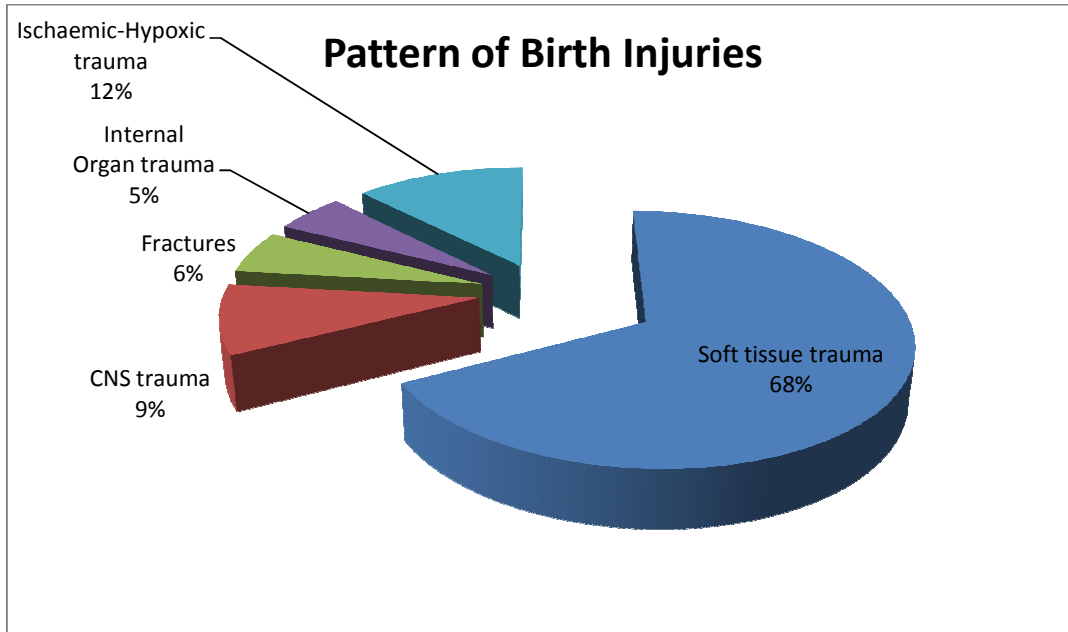


Fig. 1. Pie chart showing various birth injury percentages

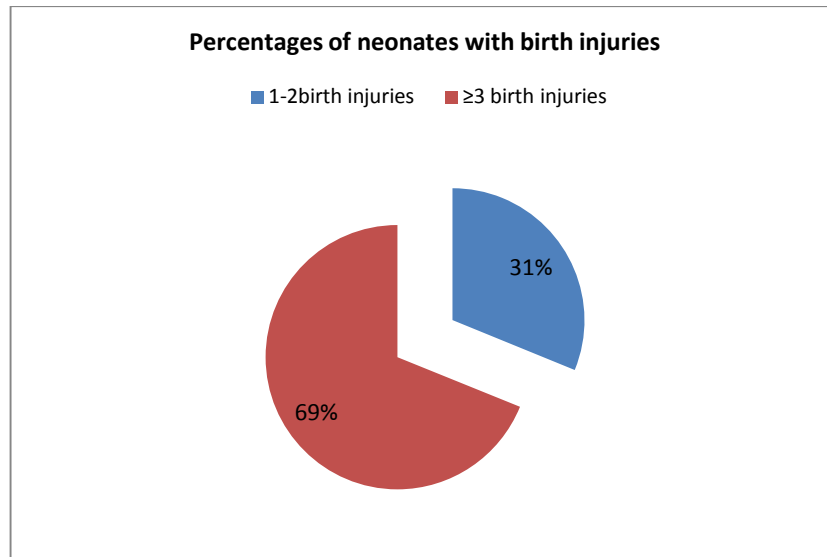


Fig. 2. Shows percentages of neonates with birth injuries

injuries, of these the commonest were facial and skin bruises 37/61(60.7%), followed by sub-conjunctival haemorrhages 25/61(40.9%), caput succedaneum 23/61 (37.7%). Cephalhaematoma was responsible for 10/61(16.4%) and subgaleal haematoma accounted for 8/61 (13.1%). Two patients, one a case of breech deliver had live rupture and the other a case of severe perinatal asphyxia associated with splenic rupture both confirmed on abdominal ultrasound scan expired within 24 hrs of admission. In our study, the common fractures were clavicular fracture, followed by fracture of humerus and femur, this finding was similar to the report by Papp et al. [28].

For those with soft tissue injuries within few days of admission, those patients that required closed monitoring were cases of cephalhaematoma and subgaleal haemorrhage exchange blood transfusion were done but they all survived. Also those with fractures formed callus within two weeks of admission. This report corroborated closely with similar study by Warke et al. [26] and Groenendaal et al. [29]. Overall, only 4 patients expired that means 93.4% of these patients managed for various birth injuries survived with minimal or no complication when they were reviewed at follow up visit in the clinic up to six months of life.

5. CONCLUSION

Birth injury has persisted in our hospitals despite tremendous advances in antenatal

care. The common risk factors which include maternal primiparity, knowledge of birth attendants were more significant in our study. Soft tissue injury is still the commonest birth injury sustained by the babies. Mortality is associated with the severity of the birth injury and majority were discharged home with no residual sequelae. It is a preventable birth complication with meticulous antenatal care and birth processes.

CONSENT

As per international standard or universal standard, patient's written consent has been collected and preserved by the authors

ETHICAL APPROVAL

As per international standard or universal standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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