

BIRTH INJURY AND ASSOCIATED FACTORS IN JIMMA UNIVERSITY SPECIALIZED
HOSPITAL, SOUTH WEST ETHIOPIA

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Abstract

Background

Birth injury including perinatal asphyxia is the most preventable cause of neonatal mortality and morbidity in developing countries. Little can be done for a baby affected by birth injury especially in severe perinatal asphyxia. Hence, full attention to reduce them to an absolute minimum should nowadays be the golden standard.

Objectives: To assess magnitude of birth injury and its associated factors in Jimma University Specialized Hospital.

Design: Cross sectional study was conducted at JUSH labour wards from April to May 2014. Data were collected using structured data collection format at postnatal ward.

The data analyzed using SPSS version 20 and frequency tables were constructed and association of birth injury with different variables was checked with multivariate logistic regression analysis

Results: Among the study population 61% of the newborns were males. Birth injury was diagnosed in 42(15.4%) of the newborns that can be sub-grouped to perinatal asphyxia 22(8.1%) and mechanical birth trauma 22(8.1%). Two newborns sustained both types of injury. Scalp injury was diagnosed in 63.6% of the newborns with birth trauma. Birth injury was associated with place of residence, parity, fetal presentation, fetal position, fetal distress, route of delivery (vaginal) and need of resuscitation.

Conclusion: The magnitude of birth injury is nearly comparable to the results found in most other developing countries but significantly higher than those in developed countries. Place of residence, parity, fetal presentation, fetal position, fetal distress; route of delivery and need of resuscitation were found to be associated with birth injury.

Key words; Birth injury, perinatal asphyxia, Birth Trauma

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Abbreviations

AAP- American academy of Pediatrics

Adm. -Administration

ANC -Antenatal care

ACOG-American College of Obstetrics and Gynecology

CNS -central nervous system

CPD-cephalopelvic disproportion

C/S-caesarean section

E.C - Ethiopian Calendar

HIV -Human immunodeficiency virus

Hrs -hours

ICD-10- International statistical Classification of Diseases & Related Health problems, 10th rev.

JUSH- Jimma University Specialized Hospital

LNMP-Last Normal Menstrual Period

LBW- Low birth weight

MSF- Médecins Sans Frontières

NBW- Normal birth weight

NICU- Neonatal Intensive care Unit

OR-odds ratio

PNA –perinatal asphyxia

WHO- World Health Organization

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Chapter One: Introduction

1.1. Background

Birth injury including perinatal asphyxia is the most important preventable cause of neonatal mortality and morbidity in developing countries. (1) According to the 2001 World Health Organization (WHO) estimates birth injury accounts about 29% of the Neonatal deaths only surpassed by neonatal infections.(2) Birth injury encompasses any systemic damages incurred during labour and delivery processes. Birth injury can occur before labour, during labour or postnatally during resuscitation. Birth injuries can be divided into those due to lack of oxygen (asphyxia) or due to physical trauma during the birth process (birth trauma). Thus these types of injuries (perinatal asphyxia and birth trauma) can occur separately or in combination.(3-5)

Birth asphyxia is an important cause of neonatal morbidity and mortality especially in less developed nations. About 3% of 130 million newborns delivered globally each year are asphyxiated and from these around 1.2 million die and the same number develop severe consequences, such as epilepsy, cerebral palsy, and developmental delay.(6) Newborns with low Apgar scores can have problems with their pulmonary, cardiovascular, central nervous system, gastrointestinal and renal system.(7, 8)

The Criteria for the assessment of asphyxia in many studies have been non-specific. The World Health Organization has defined perinatal asphyxia as a “failure to initiate and sustain breathing at birth”.(9) But according to American academy of Pediatrics(AAP) and American college of Obstetrics and Gynecology(ACOG), all the following must be present for designation of perinatal asphyxia. The criteria are profound metabolic or mixed acidemia ($\text{pH} < 7.00$) in cord, Persistence of Apgar scores 0-3 for longer than 5 minutes, neonatal neurologic sequelae (eg, seizures, coma, hypotonia), and multiple organ involvement (eg, of the kidney, lungs, liver, heart, intestine).(10) when resources are lacking like in developing countries, perinatal asphyxia can be crudely assessed by use of the Apgar score that is measured at 5 minutes. Apgar scores at 10 minutes provide useful prognostic data before other evaluations are available.(11)

Birth trauma also affects different parts of newborn during delivery. The spectrum of the common types of birth injuries (trauma) ranges from CNS trauma to skin and other soft tissue injuries. Superficial injury to the skin is the most common birth related trauma. Bruising, petechiae, and abrasions can occur on the scalp or on any other presenting part during passage through the bony pelvis or from instruments used in delivering the newborn.

Extracranial injuries like caput succedaneum and Cephalohematomas are the most common type of birth related head trauma. Nerve injuries can occur with different degree of severity that varies from edematous compression to laceration. Injuries to the upper extremity including clavicular and humeral fractures may occur. Clavicular fractures are the most common fractures in newborns and usually associated with injury to brachial plexus. Humeral fracture is the most common long bone fracture. (4, 12,13)

The incidence of birth injury has great variation among developing and developed countries and is related to many factors that can be broken into three groups: maternal, delivery and baby related factors. Among the maternal factors are small maternal stature and the presence of maternal pelvic anomalies where as the newborn factors are macrosomia, post- maturity and malpresentation. The delivery factors which may have adverse effect on labor outcome include induction of labor, shoulder dystocia and operative vaginal delivery. Even though, birth injuries are suggested to be mostly due to difficult vaginal delivery especially shoulder dystocia and use of instruments, some of the injuries can occur in the absence of any predisposing factors. It has been suggested that despite optimal care, birth-related injury can occur with normal, uncomplicated hospital births. (4, 12,13)

A newborn who has sustained birth injury is a great concern for the parents, obstetrician, pediatrician and as well as for the public health experts. Little can be done for a baby affected by birth injury especially severe perinatal asphyxia. Identification of high risk deliveries prior to labour, the use of less harmful obstetrical instruments and techniques as well as Cesarean sections delivery can decrease the incidence of birth injury.(1, 14)

1.2. Statement of the problem

Birth injury including perinatal asphyxia is a global problem causing significant mortality or morbidity with serious sequelae. Birth injury is among leading causes of neonatal mortality and reflects social, educational and economical standards of a community. Now a day's neonatal mortality is decreasing significantly globally. Even though currently decreasing, in Ethiopia birth injury resulted in loss of 30% births in 2012. There are very few epidemiological data on birth injury in Ethiopia and most focus on mortality results alone.

Chapter Two: Significance of the study

Birth injury contributes significantly to neonatal deaths in developing countries .The incidence of birth injury differs among developed and developing countries. There are few studies related to birth injury in our country and mainly focus on mortality alone.

The study is designed to assess the magnitude and types of birth injuries in Jimma University Specialized hospital and may generate important data that will be utilized by the University and hospital administrators. The study result may be used as the initial input for further organized studies that can be conducted over long period with adequate sample that can potentially represent the catchment area

Chapter Three: Literature Review

Perinatal mortality rate gives a good indication of the extent and quality of health care available to mother and the newborn. Perinatal deaths result mostly from complication of preterm, asphyxia or other problems including birth trauma. Birth injuries occur due to avoidable and unavoidable mechanical and anoxic trauma sustained by the neonate at labor and delivery. The causes are multifactorial and may follow normal, abnormal and operative abdominal and vaginal deliveries.(15) Birth injuries can be divided into those due to physical trauma during the birth process (traumatic birth injury) and those due to lack of oxygen (hypoxic-ischemic injury). These types of injuries can occur separately or in combination. (5) Asphyxial injury occurs when oxygen delivery to fetal organs is impaired or interrupted. Perinatal asphyxia and birth traumas together contribute to almost 29% of the neonatal deaths that occurs in developing countries. Perinatal asphyxia may occur in utero, at birth or in the postnatal period. Even though the definition perinatal asphyxia varies among WHO and ACOG, definitions based on Apgar scores may be useful as it can be used for formulating guidelines for post-asphyxial treatment of neonates. Because the Apgar score is an expression of the infants' physiologic condition and also useful for predicting long term outcome in infants with perinatal asphyxia, it is used to define perinatal asphyxia by the WHO especially in developing countries.(16) The WHO definition of perinatal asphyxia is failure to initiate or sustain breathing at birth.(9) But use of Apgar score only to diagnose perinatal asphyxia is not without limitations. It has limited time frame and includes subjective components and also affected by a number of factors including drugs, trauma, congenital malformations, and preterm birth.(10)

Birth trauma occurs in 2-7% of all deliveries worldwide and usually linked with neonatal morbidity and mortality. The rate of birth trauma in the US has been reported to reach to 37 birth traumas per 1000 births in the population but it was approximately 29 per 1000 in-hospital births.(12) Birth trauma alone is responsible for about 2%-11% of all neonatal deaths .

But identification of high risk deliveries prior or during labor, use of less harmful instruments or techniques and cesarean section delivery can decrease the mortality and morbidity related to birth trauma significantly.(14, 17) Study done in Nigeria on newborns presented with mechanical birth trauma, the incidence of birth trauma was 9 in 1000(3)

Neonatal birth trauma usually results from trauma sustained during a difficult delivery or secondary to obstetric manipulation of the fetus to allow for delivery. The three most frequently diagnosed birth traumas were injuries to the scalp, injuries to the skeleton and fracture of the clavicle. Significant predictors for birth trauma in the study were male gender, high birth weight, instrument delivery, malpresentation and labour and delivery related complications. In studies conducted primarily at single hospitals in USA, from the infants diagnosed with birth trauma 6.8% were also diagnosed with a complication of labor and delivery like malpresentation, malposition and forceps delivery.(12) According to the study done at postnatal ward and neonatal intensive care unit in Bombay Hospital, most common birth injury identified was bleeds (51.16%). Highest incidence being noticed in vaginal deliveries (83.9 %) as compared to caesarean deliveries (16.1%).The predisposing factors were difficult labor (41.9%), difficult breech extraction, macrosomia, shoulder dystocia, maternal pelvic anomalies. There was no risk factor found in 32.3% of the cases of birth trauma.(12)

Even though, cesarean section deliveries are absolutely necessary, cesarean deliveries performed on emergency basis are major risk factors for newborn injury. While some cesarean deliveries are planned or elective, roughly one in four are unplanned and may have to be performed immediately because of certain complications that are preventing a baby from being delivered vaginally. A recent study examining a large sample of 37,110 cesarean deliveries concluded that although cesarean deliveries posed a risk of injury to 1.1% of newborns, the risk was far greater for cesarean deliveries that were conducted on emergency basis, particularly when done after failed instrumental delivery. In one study the rate of birth trauma was 6 per 1000 live births. The risk of neonatal injuries was 18.1%for singletons. The risk of neonatal injury was higher in teaching hospitals than nonteaching hospitals. A study done in Canada to estimate the impact of cesarean delivery on the incidence of birth trauma and other selected neonatal outcomes; of the total deliveries 19% were by cesarean section from which 61% were conducted in labor.

From the study caesarean delivery appears protective against neonatal birth trauma, especially when performed without labor. (18) In retrospective study done at referral teaching hospital to assess the prevalence birth related fractures, all the newborns who sustained fracture were vaginal deliveries. Majority (71.4%) of the affected newborns were male. The average birth weight of the newborns with birth fractures was 3850 grams.(19) In study done in Saudi Arabia, Cesarean section delivery was 5.2% and the least injuries were sustained during this mode of delivery.(4)

Birth related trauma was suggested to be mostly associated with breech presentation, shoulder dystocia and delivery by forceps.(4) According to Study done in Nigeria on newborns presented with mechanical birth trauma, 66% of the victims were males and Cephalohaematoma (34%) was the commonest injury identified injury. Risk of birth trauma was significantly higher with breech, vacuum, cesarean delivery than spontaneous vertex delivery.(3) Advanced maternal age has been regarded as a risk factor for complications in pregnancy. There was a study done on pregnancy outcome of older multiparous women and multiparous in 20-29years in Istanbul, Turkey. The study showed rate of fetal complications, low 5th minute Apgar score were significantly higher among the older mothers .The rate of cesarean section delivery and fetal macrosomia were also higher in the study group than control group. Older nulliparous had increased incidence of malpresentation. (20) Dystocia is common in nulliparous women and indicated by the number requiring augmentation, operative vaginal delivery or cesarean section. Dystocia is associated fetal malposition and cephalopelvic disproportion that predispose to birth trauma.(21) According to study done in Cameroon over 15years to assess the birth outcome of term breech deliveries, breech fetus faces increased risk of asphyxia from cord compression and of traumatic injuries during labor and delivery of shoulder and head. In the study out of the total breech deliveries,45.4% were by cesarean section .The proportion of elective cesarean section is higher in primiparous and success in labor trial was also low in primiparous than multiparous. The incidence of traumatic neonatal morbidity is not significantly different from the elective.(22)

Infants with high birth weight are candidates for birth trauma. According to study done in Zaria, Nigeria at University hospital, high birth weight was associated with increased maternal age and birth order.(23)

A study was done in Georgetown University Hospital on full term newborn that have birth associated trauma on head and neck to identify risk factors. The risk factors identified were Primiparity, high birth weight, vaginal delivery and male gender.(24)

In retrospective study conducted in Nepal medical College Teaching Hospital over 3years, the prevalence of post term pregnancy was 4.6%.(25) Birth related trauma not only affects the newborn but also pause significant impact on the mother if it occurs. Birth related complication with obstetric birth trauma can cost life of a mother .Everyday; approximately1000 women die in child birth or from pregnancy related complications. Without appropriate medical interventions a woman may spend a number of days in labor and eventually die of complications. About 45% of postpartum death occurs within the first 24hours and 66% occur during the first week. Majority of the maternal deaths are preventable if access to emergency obstetric care is ensured. (26, 27)

The incidence of neonatal birth injury has reportedly decreased over time because of improvements in obstetric care and prenatal diagnosis. Simple birth traumas like bruises or malpuncture marks do happen in daily clinical practice and may not be completely avoidable. However, full attention to reduce birth injuries to an absolute minimum should nowadays be the golden standard. Thus, in order to avoid and prevent these complex birth and neonatal care injuries, highest personal attention and alert should be put up by every neonatal carer in charge.(14)

Chapter Four: Objectives

3.1 .General objective

To assess magnitude and types of birth injuries as well as factors associated with birth injuries in JUSH

3.2. Specific objectives

3.2.1. To assess the magnitude of birth injuries in JUSH

3.2.2. To assess the types of birth injuries in JUSH

3.2.3. To identify factors associated with birth injuries in JUSH

Chapter Five: Methods

Study design- Cross sectional study was conducted in Jimma University Specialized Hospital. The hospital serves as referral teaching hospital and located at about 352KM southwest of Addis Ababa. Annually on average about 4000 deliveries are conducted in the hospital with cesarean section rate of 39.8%.

The study was conducted starting from beginning of April to beginning of May; 2014. All live born newborns that were born during the study period at JUSH and have no major malformations were included in the study. After checking for completeness, data was entered to the computer and verified. Data was analyzed using SPSS version 20. Frequency tables were constructed. Associations between birth injury and independent variables were computed using logistic regression analysis.

The data collectors were trained before embarking in data collection process to have common understanding about the variables of interest. Structured data collection format was used and completeness has been checked after every session of the data collection.

Setting- The study was conducted in Jimma University Specialized Hospital labor ward.
Participant: Permission and ethical clearance was granted from the university institutional ethics review board as well as hospital administration. The data was collected after verbal or written consent was taken from the mother or other responsible care giver. All live born neonates that were born during the study period at Jimma University Specialized Hospital and have no major malformations were included in the study.

Variables

Dependant variable: birth injury (perinatal asphyxia and birth trauma)

Independent variables:

- Sociodemographic variables: place of residence, age of the mother, maternal educational status, maternal HIV serostatus and source of referral.
- Pregnancy and labour related factors: Parity, antenatal care, onset of labor, duration of labor, fetal presentation, fetal position, and fetal distress, mode of delivery and need of resuscitation.
- The newborn related variables: sex of newborn, gestational age, birth weight and Apgar score.
- Other independent variables: duration stay in JUSH before delivery and maternal condition after delivery

Operational definitions

Birth injury: any newborn who has diagnosis of perinatal asphyxia, birth trauma or both.

Perinatal asphyxia: diagnosed as usual hospital routine practice based on the Persistence of Apgar scores 0-3 for longer than 5 minutes, and /or neonatal neurologic sequelae (eg, seizures, coma, and hypotonia).

Mild perinatal asphyxia: if baby suspected of PNA and may be jittery or hyper alert, with increased muscle tone and poor feeding.

Moderate perinatal asphyxia: diagnosed if baby suspected with PNA and may be lethargic and have feeding difficulty with occasional episodes of apnea and/or convulsions.

Severe perinatal asphyxia: if baby suspected of PNA and may be floppy or unconscious with convulsions and frequent apnea and does not feed. (30) If the newborn with perinatal asphyxia was diagnosed as stage I, II and III, data were recorded as mild, moderate and severe perinatal asphyxia respectively.

Birth trauma: any physical injury to parts of the newborn during birth process that can be identified by clinical evaluation.

Fetal malpresentation: refers to any non-vertex fetal presentation (face, brow or breech)

Fetal malposition: refers to any fetal position in labour that is not right occipitoanterior, occipitoanterior and left occipitoanterior

Fetal distress: if non-reassuring fetal heart rate pattern diagnosed in laboring mother

Major congenital malformations: are anatomic abnormalities which are severe enough to reduce life expectancy or compromise normal function such as neural tube defects.

Antenatal care: if the mother had at least one health institutional visit for the pregnancy.

Data sources/measurement- the data were collected from maternal chart that was documented at admission to the labour room or delivery summary after the mother has gave birth. But data related to educational status, place of residence other Sociodemographic variables that were not documented during intrapartal evaluation were collected verbally.

Bias- There is no apparent source of bias as the newborns are included according to the predefined criteria.

Study size and technique- All liveborns delivered at Jimma University specialized Hospital during the study period, who have no major malformations were the candidates for the study.

The sample size was determined using the formula:

$n = z^2 pq / w^2$ Where **n** is the number sample required

Z is the value for 95% confidence interval

P is the estimated proportion of birth injury, based on Zambia study (29)

q is 1-p

Then $n = (1.96)^2 \times 0.23 \times 0.77 / (0.05)^2, n = 272$, hence data was collected from 272 live newborns

Statistical methods- All live born newborns without major malformation were candidates for the study. Out of the total deliveries conducted in the hospital during the study period 272 newborns were included in the study after exclusion of newborns with major malformation and still births.

Chapter Six: Results

Among the study population 61% of the newborns were males. The minimum birth weight recorded was 1200grams where as the maximum birth weight was 4900grams with mean birth weight of 3190grams. From the total newborns 13.2% were low birth weight (LBW) and 4.8% were macrosomic. The proportion of postterm babies were only 2.2% where as preterm constitute 11.4% of the study population. Among study population 13.2% of the newborns had low 5th minute Apgar score (score of 0-7) but only 5 newborns (1.8%) had 5th minute Apgar score in 0-3 range. The 10th minute Apgar score was recorded for 30 newborns of which 13(43.4%) had a score of 0-7 at 10th minutes.

From the total newborns, birth injury was diagnosed in 42(15.4%) of the newborns. Two of the newborns had both perinatal asphyxia and birth trauma. About 11.4% of the newborns had 5th minute Apgar score of 4-7 and the remaining 86.8% had the 5th minute Apgar score of 8-10. The diagnosis of different degree of perinatal asphyxia was made in 8.1% of the newborns from which 72.7% of the newborns were diagnosed with moderate PNA.

From the total newborns 8.1% of the newborns had clinical identifiable birth trauma with different degree of injuries contributing about 52.4% of the total birth injury. From those newborns with birth trauma, Scalp injury was diagnosed in 63.6% and skeletal and other birth traumas make up the remaining injuries. Among 14 newborns diagnosed with scalp injuries, 33.3% had bruising, 20.0% Subgaleal hemorrhage and the remaining 46.7% had other forms of scalp injuries.

Among the lists of risk factors of perinatal asphyxia, hypertensive disorder of pregnancy and cephalopelvic disproportion were the only identified risk factor in 1.1% and 2.7% of the mothers respectively. Majority of the mothers 156 (57.4%) who gave birth at JUSH during the study period lives outside of Jimma town and 23.9% of the mothers have no education and 76.1% had completed primary school or more. Most of the mothers (90.8%) were aged from 19-35years but 5.5% were aged eighteen or below. Seven percent of the mothers delivered at JUSH during the study period were reactive for HIV antibody and 51.1% were not screened for HIV. About 74.6% of the mothers came after referred from health institutions and 258(94.9%) of the mothers had at least one antenatal care visit during their pregnancy.

More than half of the mothers (60.7%) were multiparous. The average duration of labour was 11.7 hours and 7.4% of mothers delivered by elective Caesarean section before labor begins for the different anticipated complications. Forty five (16.5%) and sixty (22.1%) of laboring mothers had diagnosis of fetal malpresentation (non-vertex) and fetal malposition during intrapartal evaluation respectively. Among 43 fetuses with diagnosis of meconium staining, 11.8% had grade II or III meconium stained liquor. Intrapartal fetal distress was diagnosed in 18.8% of the newborns. From the total newborns, 44.8% were born by caesarean section from which 16 (13.1%) were elective C/S.

Table 1: Pregnancy and labour related factors JUSH July, 2014

Variables		frequency	percent
Source of referral	Health institution	203	74.6%
	Self referral	69	25.4%
ANC	yes	258	94.9%
	No	14	5.1%
Parity	Primiparous	108	39.7%
	Multiparous	164	60.3%
Onset of labour	elective	20	7.4%
	Spontaneous	235	86.4%
	induced	17	6.3%
Fetal position	Normal fetal position	212	77.9%
	Fetal Malposition	60	22.1%
Fetal presentation	Vertex	227	83.5%
	Non-vertex	45	16.5%
Meconium stained	No	229	84.2%
	yes	43	15.8%
Diagnosis of fetal distress	No	221	81.3%
	yes	51	18.8%
Mode of delivery	Vaginal	150	55.1%
	C/S	122	44.9%

According to the result of bivariate analysis of birth injury with maternal, pregnancy and labour related factors as well as neonatal factors, it was found to associated with some of the variables different degree of associations. It was associated with Place of residence ($P < 0.05$), source of referral ($P < 0.05$) and parity ($P < 0.05$).It was also associated with fetal position ($p < 0.001$), fetal presentation ($P < 0.001$) and need of resuscitation ($P < 0.001$)

Table 2: Birth injury with maternal, pregnancy and labour related factors JUSH July, 2014

Variables	Birth injury		COR (95% CI)	
	Yes	No		
Place of residence	Outside Jimma town	30(19.2%)	126(80.8%)	0.49(0.24-0.99)
	Within Jimma town	12(10.3%)	104(89.7%)	
Source of referral	Health institution	37(18.2%)	166(81.8%)	0.35(0.13-0.93)
	Self	5(7.2%)	64(92.8%)	
Parity	Primiparous	23(21.3%)	85(78.7%)	0.48(0.25-0.94)
	Multiparous	19(11.6%)	145(88.4%)	
Fetal position	Normal fetal position	24(11.3%)	188(88.7%)	3.36(1.67-6.74)
	Fetal malposition	18(30.0%)	42(70.0%)	
Fetal presentation	Vertex	24(10.6%)	203(89.4%)	5.64(2.71-11.72)
	Non-vertex	18(40.0%)	27(60.0%)	
Intrapartal fetal distress	No	31(14.0%)	190(86.0%)	1.69(0.78-3.63)
	Yes	11(21.6%)	40(78.4%)	
Route of delivery	Vaginal	24(16.0%)	126(84.0%)	0.91(0.47-1.77)
	Caesarean section	18(14.8%)	104(85.2%)	
Need of resuscitation	No need of resuscitation	25(11.4%)	195(88.6%)	3.79(1.86-7.73)
	Needed resuscitation	17(32.7%)	35(67.3%)	

When the different variables were checked for one class of birth injury, perinatal asphyxia, it was found that place of residence ($p < 0.05$), fetal position ($p < 0.001$), fetal presentation ($p < 0.001$),

degree of meconium staining ($p < 0.05$), vaginal delivery ($p < 0.05$) and need of resuscitation ($p < 0.001$) were associated. When the other class of birth injury: birth trauma was checked with different variables; fetal presentation and route of delivery were found to be associated ($p < 0.01$).

Antenatal care visit, maternal educational status, birth weight and sex of the newborn were not found to be associated with birth injury in general or with each category of birth injury i.e. perinatal asphyxia and birth trauma

Birth injury was found to be associated with place of residence with ($p < 0.05$), fetal presentation ($p < 0.001$) and route of delivery ($p < 0.01$) as evidenced by multivariate analysis

Table 3: Multivariate analysis of birth injury with maternal, pregnancy and labour related factors JUSH July, 2014

	Variables	Birth injury		COR(95% CI)	AOR(95% CI)	P - value
		yes	No			
Residence	Outside Jimma	30	126	0.49(1.86,7.73)	3.32(1.00,5.35)	<0.05
	Within Jimma	12	104	reference	1.00	
Parity	Primiparous	23	85	0.48(0.25,0.94)	1.91(0.89,4.05)	<0.09
	Multiparous	19	145	Reference	1.00	
Fetal presentation	Non-vertex	18	42	5.64(2.71,11.72)	8.39(3.38,20.86)	<0.001
	Vertex	24	188	1.00	1.00	
Fetal distress	yes	11	40	1.69(0.78,3.63)	2.39(0.85,6.72)	<0.09
	No	31	190	Reference	1.00	
Need of resuscitation	Needed resuscitation	17	35	3.79(1.86,7.73)	2.72(1.15,6.50)	<0.02
	Not Needed resuscitation	25	195	Reference	1.00	
Route of delivery	Vaginal	24	126	0.91(0.24,0.99)	3.34(1.30,8.59)	<0.01
	C/s	18	104	Reference	1.00	

Perinatal asphyxia found to be associated with fetal presentation with ($P<0.001$) and 95% CI of 6.92(6.92-18.55) in multivariate logistic regression. Newborns with non-vertex presentation had about seven times increased risk of getting asphyxiated. Fetus with intrapartal fetal distress had increased risk of getting asphyxiated by 6.4 as compared to fetuses without diagnosis of intrapartal fetal distress with ($P<0.001$) 95% CI of 6.38(2.14-16.88) .Birth trauma found to be independently associated with fetal presentation and route of delivery in multivariate logistic regression ($p<0.001$).

Table 4: Multivariate analysis of birth trauma with maternal, pregnancy and labour related factors in JUSH July, 2014

Variables		Birth trauma		COR(95% CI	AOR(95% CI)	P -value
		yes	No			
Fetal presentation	Non-vertex	8	37	3.29(1.29,8.29)	8.89(2.75,28.76)	<0.001
	Vertex	14	213	Reference	1.00	
Intrapartal fetal distress	yes	16	205	1.71(0.63,4.61)	6.23(1.73,22.47)	<0.01
	No	6	45	Reference	1.00	
Source of referral	Health institution	20	183	0.27(0.62,1.20)	4.31(0.92,20.17)	<0.06
	Self	2	67	Reference	1.00	
Route of delivery	Vaginal	18	132	0.25(0.08,0.76)	17.63(4.15,74.83)	<0.001
	Caesarean section	4	118	Reference	1.00	

Chapter Seven: Discussions

Birth injury was diagnosed in 15.4% of the newborns. Fetal presentation, need of resuscitation and route of delivery were found to associate with birth injury both in bivariate and multivariate logistic regression. Fetuses with non- vertex presentation had more chance of sustaining birth injury with adjusted Odds ratio (AOR) of 8.39, 95% CI (confidence interval) of (3.38-20.86). The other variables need of resuscitation and route of delivery were associated with birth injury with AOR 2.72 and 3.34 at 95% confidence interval respectively. The finding is nearly comparable to the studies done in developed countries but there were limitations of literatures which studied birth injury with similar definition.

In the study perinatal asphyxia was diagnosed in 8.1% of the newborns using either 5th minute Apgar score or involvement of different organs like CNS.(10)The asphyxia definition used in the study was Persistence of Apgar scores 0-3 for longer than 5 minutes, and /or neonatal neurologic sequelae (eg, seizures, coma, hypotonia).According to study done in Uganda referral hospital perinatal asphyxia was diagnosed in 12.8% of the live births using the Apgar score of 0-4.(30) But according to Zambian study the proportion of perinatal asphyxia was 23%. According to study done in New Delhi, India; perinatal asphyxia was diagnosed in 3.6% of the newborns.(31) In studies done in 8 African countries in central referral hospital of each country to determine prevalence of PNA using Apgar score, it was found to be 22.8%. In our case 19.1% needed resuscitation at birth indicating likely of asphyxia cases. Hence the finding is nearly comparable to most studies in developing countries even though there is variation in the definition of perinatal asphyxia.

Multivariate regression analysis revealed fetal presentation and intrapartal fetal distress were significantly associated with perinatal asphyxia. Other variables like antenatal care ,sex of the newborn were not associated in this study and the result was similar to findings in some studies.(31) In case control study in India to identify risk factors for perinatal asphyxia, factors that were independently associated with perinatal asphyxia were instrumental delivery, inadequate antenatal visits, and meconium stained amniotic fluid(32) According to study done in Uganda referral hospital perinatal asphyxia ,fetal distress and meconium stained liquor were associated significantly with birth asphyxia.(30)

The mechanical birth trauma was diagnosed in 8.1% of the newborns. Majority of newborns with birth trauma (63.6%) had scalp injury. The commonest scalp injury diagnosed was bruising and Subgaleal hemorrhage identified 20.0% of the scalp injury. With multivariate logistic regression birth trauma was significantly associated with fetal presentation, route of delivery ($P < 0.001$) and fetal distress ($p < 0.005$). Newborns with intrapartum fetal distress, non-vertex presentation and born vaginally had increased chance of sustaining birth trauma with AOR of 6.23, 8.89 and 17.63 respectively. In this study the rate of birth trauma is slightly higher than the Saudi Arabian study (5.2%) as well as the average worldwide prevalence of birth trauma which ranges from 2-7%. (4, 12) According to studies done in USA at single hospitals, birth trauma was associated with malpresentation, malposition and cephalopelvic disproportion. (33) According to the study done at postnatal ward and neonatal intensive care unit in Bombay Hospital, the most common birth injury identified was bleeds (51.16%). Birth trauma was diagnosed in 83.9% of vaginal deliveries but only in 16.1% of caesarean deliveries. (13) The associated variables more or less similar to the other studies. For example, according to study done in Nigeria; newborns with fetal distress had increased odds for all birth trauma and infants born by caesarean delivery had decreased odds ratio for all types of birth trauma. Cephalohematoma was the commonest injury identified. (34)

The variation in definition of birth trauma and study population (eg. Inborn and out born newborns) used makes comparison slightly difficult. In this study imaging studies to screen internal organ injury was not used and only birth traumas that were identified clinically included. Most other studies used both in born and out born babies which may be preferable than my sample population which is limited to the inborn babies. In study done in our country in Addis Ababa, Subgaleal hemorrhage was the commonest birth trauma identified and make up 61%. In that study Primiparity was found to be also strongly associated with birth trauma.

Limitations: Diagnosis of perinatal asphyxia needs combination different variables like Cord blood PH and blood gas values with Apgar score. But in this study only AAP definition of perinatal asphyxia that uses fifth minute Apgar score of 0-3 with systemic involvements (eg CNS) was used. Internal organ injuries and other injuries that cannot be identified with clinical examination were not considered in this study. As the study was conducted in the referral teaching hospital where most of deliveries attended were referral cases from catchment area possibly raising prevalence of birth injury than the real community estimates of birth injury in the catchment area.

Interpretation: The finding of the study was nearly comparable to the other studies that were done in developing countries.

Generalisability: The study was conducted in a single referral teaching hospital where most deliveries were referred from catchment areas usually after noticing abnormal labour.

On the other hand the labors in JUSH were attended by highly skilled staffs that include senior residents with involvement senior obstetrician and gynecologists whenever required.

The study was also conducted over a month duration which may be short time and potentially affect the result.

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Chapter Eight: Conclusions and Recommendations

8.1. Conclusion

The magnitude of birth injury in the study was nearly comparable to the similar studies done in developed countries. Place of residence, parity, fetal presentation, fetal position, fetal distress; route of delivery and need of resuscitation were found to be associated with birth injury in this study.

8.2 Recommendation

Even though total prevention of birth injury may not be possible, the number can be reduced by improving obstetric care services and training of health professionals in all levels. Moreover, improving the referral system and strengthening health facilities in the JUSH catchment area could play significant role in the reducing the occurrence of birth injury.

Further study that may include deliveries that occur in the non referral health institutions in the area as well as use of investigative modalities when needed is recommended.

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Annex I: Consent form

This is a consent form for study on patterns of birth injury in Jimma University Specialized Hospital as partial fulfillment of the requirement for specialty certificate in pediatrics and child health.

Data will be obtained from mother's hospital records and by evaluating the baby for birth trauma that can be identified by evaluating the baby clinically. This will not harm your baby. Your name and other personal information will not be included in the data collection format.

I have been told and understood the reason and process of data collection. I am also informed as the data collection procedure will not harm my baby, hence I agreed to cooperate.

Name _____ signature _____

Annex II: Data collection format

Data collection format on patterns of birth injuries for the partial fulfillment of the specialty certificate on pediatrics and child health

Mother's hospital no _____ and /or Newborn hospital no _____

Part I. Maternal ,pregnancy and labour related factors			
S.no	variable	Response	Skip to
101	Place of residence	Within Jimma town adm._____ Outside of Jimma town adm.____	
102	Source of referral?	1.health institution____ 2.self referral____	
103	Educational status of the mother	1.No education ____ 2.Primary ____ 3.secondary ____ 4.More than secondary	
104	Age of the mother in years	_____	
105	Antenatal care follow up visit	Yes____ No____	
106	Parity	1.Primiparous____ 2.multiparous ____	
107	Maternal HIV serostatus	1.Reactive__ 2.nonreactive_ 3.unknown	
108	Onset of labor	Spontaneous____ induced____	
109	Duration of labour in hours	_____hrs.	
110	Fetal position	1.Normal fetal position_____ 2.Malposition(specify)_____	
111	Fetal presentation	1. Vertex__ 2. Non-vertex (specify)_____	
112	Is the liquor meconium stained?	1. yes____ 2. No____	
113	If yes to 113, what is the degree of staining?	1. grade I 2. grade II 3. grade III	
114	Is fetal distress diagnosed during laboring?	1. yes____ 2.No____	
115	Mode of delivery	3.Cesarean section ____ 4.vaginal ____	
116	For cesarean section(c/s), type of C/S	1.Elective____ 2.Emergency____	
117	For vaginal delivery, is it operative delivery?	1.Yes____ 2.No____	
118	For operative vaginal delivery(specify)	1.Forceps____ 2.vacuum extraction____	
119	Duration of stay in JUSH before delivery?	_____	
120	Maternal condition after delivery	1. Alive w/t delivery complication__ 2. Alive with delivery complication__ 3.dead	

Part II. Neonatal related variables			
s.no	variable	response	skip to
201	Sex	1.Male____ 2.Female____	
202	Gestational age in completed weeks	_____wks	
203	APgar scores	1 min.___ 5 min.___ 10 min.___	
204	Is the newborn resuscitated?	1.yes ___ 2.no___	
205	If yes to question 204,what was done	1.bag and mask ventilation only___ 2.Intubation____ 3.others _____	
206	Birth weight in grams	_____grams	
207	Is there a diagnosis of perinatal asphyxia?	Yes____ No____	
208	If yes to question 207, did the newborn develop seizure that can be potentially attributable to perinatal asphyxia?	1.yes ___ 2.no____	
209	If perinatal asphyxia already diagnosed what is the degree?	1.mild ___ 2.moderate___ 3.severe___	
210	If perinatal asphyxia diagnosed what is the perceived cause)	1.Hypertensive disorder of pregnancy___ 2. Severe anemia____ 3.Hypotension____ 4.Hypoxia due to pulmonary or heart disease____ 5.placenta and cord related problems (aging , abruption , prolapse) ____ 6..Cephalopelvic disproportion____ 7. shoulder dystocia____ 8.others(specify)_____	
211	Is the newborn is admitted to NICU?	Yes____ No____	
212	If yes to Q. 211, what is the condition of newborn?	1.alive ___ 2.dead____	
213	Any birth trauma that can be identified clinical ?	Yes____ No____	
214	If yes to question 213, write the type?	Go to part III	

Part III. Type of birth trauma as adapted from ICD_10 Revision version for 2010			
s.no	Variable	Response	Skip to
301	Birth injury to scalp (if yes encircle the specific type)	1.yes___2.No___	
	Cephalohematomas due to birth injury		
	Subgaleal hemorrhage due to birth injury		
	Bruising of scalp due to birth injury		
	Other birth injuries to scalp (specify)_____		
302	Birth injury to skeleton (if yes encircle the specific type)	1.yes___2.No___	
	Fracture of skull due to birth injury		
	Fracture of femur due to birth injury		
	Fracture of clavicle due to birth injury		
	Fracture of other bones due birth injury(specify) _____		
303	Birth injury to peripheral nervous system(if yes encircle the specific type)	1.yes___2.No___	
	Erb paralysis due to birth injury		
	Klumpke paralysis due to birth injury		
	Others(specify) _____		
304	Other birth injuries (if yes encircle the specific type)	1.Yes___2.No___	
	Birth injury to eye(subconjunctival hemorrhage)		
	Birth injury to face (Facial congestion due to birth injury)		
	Birth injury to external genitalia		
	Other physical identifiable birth injuries		

Name of data collector _____signature_____