Netsanet Workneh. Ethiop. J. Pediatr. Child Health , 2016, Vol. XII, No. 1

ORIGINAL ARTICLE

BIRTH INJURY AND ASSOCIATED FACTORS IN JIMMA UNIVERSITY SPECIALIZED HOSPITAL, SOUTHWEST 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 asphyxial and mechanical birth 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*

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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 academia (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, 12-14)

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. (4,12-14)

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

OBJECTIVE:

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

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.

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.

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, 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. (16) 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 - 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.

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 calculated was 272 live newborns

RESULT

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 and7.4% of mothers delivered by elective Caesarean section before labor begins for the different anticipated complications. Fourty 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 which16 (13.1%) were elective C/S. (Table 1)

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

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

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 ($p < 0.03$), vaginal delivery ($p < 0.02$) 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 ($p < 0.009$).

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 in jury 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 ($p< 0.012$) as evidenced by multivariate analysis

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 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			
Place of residence	OutsideJimma	30	126	0.49(1.86,7.73)	3.32(1.00,5.35)	0.049
	Within Jimma	12	104	reference	1.00	
Parity	Primiparous	23	85	0.48(0.25,0.94)	1.91(0.89,4.05)	0.094
	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	
Intrapartal fetal distress	yes	11	40	1.69(0.78,3.63)	2.39(0.85,6.72)	0.099
	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)	0.024
	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)	0.012
	C/s	18	104	Reference	1.00	

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

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)	<0.064
	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	

DISCUSSION

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.(17) 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.(18) Compared to most studies in developing countries the rate of perinatal asphyxia was lower in this

study. This variation can be due to the lack of consistence in definition of perinatal asphyxia and over estimation of Apgar score.

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.(18) 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(19) According to study done in Uganda referral hospital perinatal asphyxia ,fetal distress and meconium stained liquor were associated significantly with birth asphyxia.(17)

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 intrapartal 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 .(20) 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 cesarean delivery had decreased odds ratio for all types of birth trauma .Cephalohematoma was the commonest injury identified .(21)

The variation in definition of birth trauma and study population (eg. Inborn and outborn 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.

CONCLUSION AND RECOMMENDATION

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.

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.

ACKNOWLEDGEMENT

We would like to extend our heartfelt gratitude to Jimma University, College of Public Health and Medical Sciences, department of Pediatrics and child health for letting us conduct this study by providing financial support. And we would like to thank all individuals involved in the study.

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