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Adverse neonatal outcomes and associated factors among mothers who gave birth through cesarean section at Arba Minch General Hospital, Southern Ethiopia

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Cesarean section (CS) refers to the delivery of fetus, placenta, and membrane through an abdominal and uterine incision after 28 completed weeks of gestation. This mode of delivery minimizes both maternal and perinatal morbidity and mortality; however, it is associated with lower but severe neonatal outcomes as compared to vaginal delivery. Thus, the current study was aimed to assess the current status of adverse neonatal outcomes and its contributing factors. A retrospective cross-sectional study was employed from July 2016 to August 2017. The data were collected from records of mothers who gave birth through CS in Arba Minch General Hospital using a structured record review checklist. Simple random sampling technique was used to select records for extracting data. Variables with p-value <0.25 in the bivariate model were entered into multivariable model to declare statistical significance at p-value <0.05. Results revealed that nearly one-third of newborns delivered through cesarean section developed adverse outcome. Rural residency (AOR: 2.96; 95% CI: 1.47, 5.96), fetus with cephalopelvic disproportion (AOR: 2.58; 95% CI: 1.23, 5.42), CS with general anesthesia (AOR 3.28, 95% CI: 1.21, 8.93) and maternal complication due to CS (AOR: 2.38; 95% CI: 1.21, 4.70) were determinants of adverse neonatal outcome. Newborns delivered at term, have lower risk of adverse outcome as compared to pre-term (AOR: 0.11; 95% CI: 0.01, 0.93). Mothers with prolonged rupture of membrane before CS was 3.33 times more likely to deliver a baby with adverse outcome than their counterparts (AOR: 3.33; 95% CI: 1.13, 9.84). It can therefore be concluded that nearly one-third of newborns delivered through cesarean section developed an adverse outcome. Each caesarian delivery with cephalopelvic disproportion, pre-term caesarian delivery, and under general anesthesia should get prompt and appropriate management.

Key words: Adverse, neonatal outcome, cesarean delivery, Ethiopia.

INTRODUCTION

Cesarean section delivery signifies the expulsion of a fetus, placenta, and membrane through abdominal and uterine incision after 28 completed weeks of gestation (Alan et al., 2007). This mode of delivery has played significant role in curtailing maternal and perinatal morbidity and mortality in the past century. Initially, the procedure was performed to save the life of mothers with dystocia, and over years indications have extended to include delivery for a variety of more mild dangers to the mother or fetus. Evidence suggests that, frequent use of cesarean delivery is mainly due to increased safety of cesarean section that is mostly the result of improved surgical technique, better use of anesthesia, effective antibiotics, and accessibility of blood for transfusion (Cunningham et al., 2005; Menacker and Hamilton, 2010).

In the United States, cesarean-section delivery increased by 53% from 1996 to 2007, getting 32%, which is reported the highest rate ever (Menacker and Hamilton, 2010). In the year 2006 in America, nearly one-third (31.1%) of all births were cesarean deliveries. The increase in cesarean delivery includes both primary and repeat cesarean. In addition, some studies noted that, the risk of neonatal and maternal mortality increases for medically elective cesareans when compared with vaginal birth (Signore et al., 2006; Wax, 2006; MacDorman et al., 2008).

Evidences suggest that, cesarean section delivery may be mandatory when vaginal delivery impose a risk either to the mother or the baby due to prolonged labor, fetal distress, or abnormal presentation (Hannah et al., 2000). In fact, emergency cesarean delivery was accompanied with more fresh stillbirths, neonatal deaths and severe neonatal morbidity probably related to prolonged labor, asphyxia, and sepsis (Shah et al., 2009).

The World Health Organization (WHO) statement published currently declares that, when cesarean section rates rise towards 10% across a population, the amount of maternal and newborn deaths decreases. However, there is no evidence that suggests improvement in the mortality rate with an increasing cesarean rate beyond 10%. Furthermore, across a population, the effects of cesarean section rates on maternal and newborn outcomes such as stillbirths or morbidities like birth asphyxia still remain unknown (Organization, 2015).

Three-quarters of all women from hospitals of sub-Saharan Africa gave birth through CS mainly for maternal reasons which include: prolonged labor, abruptio placenta, earlier cesarean section, eclampsia, placenta previa, and mal-presentation (Dumont et al., 2001).

According to 2008 Ethiopian Ministry of Health Report,

overall, even with the fertility decline, the population is still growing at an annual rate of 2.6% (Health, 2010). Increase in the rate of cesarean delivery was associated with an increase in fetal mortality rates and admission to neonatal intensive care unit for seven or more days. An increase in the rate of cesarean delivery between 10-20%, raises the rate of both preterm delivery and neonatal mortality (José Villar et al, 2006). Compared with a plan for vaginal delivery, cesarean delivery on maternal request may be associated with a lower rate but severe neonatal outcomes (Ecker, 2013).

Arba Minch General Hospital is a center of Comprehensive Emergency Obstetric Care (CEmOC). Hence, there is a higher prevalence of cesarean section delivery which was 24.65% with emergency cesarean delivery accounting for 87% of all cesarean deliveries. Fetal distress, Cephalopelvic Disproportion (CPD) and an obstructed labor accounted for half of all indications for cesarean section (Wae et al., 2017). There were plenty of studies that compare the outcomes of delivery by mode of delivery yet, there is dearth of evidence on adverse neonatal outcomes among mothers who gave birth through cesarean section. Thus, the current study was aimed to assess, adverse neonatal outcomes and associated factors among mothers who gave birth through a cesarean section in Arba Minch General Hospital.

MATERIALS AND METHODS

Study setting

The study was conducted at Arba-Minch General Hospital (AGH) in Arba Minch Town. Arba Minch town is located in Gamo Gofa Zone of the southern nations, nationalities and peoples region about 505 km south of Addis Ababa. Arba-Minch General Hospital is one of the governmental hospitals in Gamo Zone of Southern Ethiopia.

Study design and period

A retrospective cross-sectional study design was employed. The data was collected in December 2017 from selected records of mothers who gave birth through CS from July 2016 to August 2017.

Sample size and sampling procedure

A single population proportion formula was used to calculate the sample size by considering the following assumption: 95% level of certainty, 5% margin of error, 22% proportion of neonates with the adverse outcome from the previous study in Ethiopia (Yenit et al., 2016) and 10% for incomplete record. Thus, the total sample size was 290 records. The list of mothers who gave birth through cesarean-section from July 2016 to August 2017 in the hospital was

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identified by referring to the delivery room, operation room, and postnatal ward log books. Identification number of mothers who gave birth through CS from July 2016 to August 2017 was obtained from the record. Using Stata version 14, table of random numbers were generated to identify the Identification number of mothers selected for review.

Eligibility criteria

All recorded women who gave birth by cesarean section at Arba Minch General Hospital from July 2016 to August 2017 were included in the study. Records of mothers with ectopic pregnancy and incomplete records were excluded.

Data collection

A structured and pre-tested record review checklist was used to collect data from delivery records. The English version of the record review checklist was adapted and developed from similar studies conducted previously (Moges et al., 2015; Yenit et al., 2016; Wae et al., 2017). Selected records were collected from the respective units to extract the necessary variables using their identification number.

Variables and definition

The dependent variable was an adverse neonatal outcome following cesarean birth. The independent variables include maternal socio-demographic characteristics, pregnancy-related characteristics, delivery-related factors, and maternal health service utilization related characteristics.

Adverse neonatal outcome: These were considered when the neonate has one of the following: low APGAR scores, hypoglycemia, low birth weight, pre-term birth, neonatal asphyxia, sepsis, meconium aspiration syndrome or neonatal seizures.

Maternal CS delivery complication: Intra-operative surgical complications that include damage to adjacent organs during surgery, incision extension, hemorrhage, atony or blood transfusion during operation.

Obstetric complications: These refer to the presence of one of the following condition; Antepartum hemorrhage (APH), PROM/chorioamnionitis, preeclampsia or eclampsia, obstructed labor, malpresentation, suspected uterine rupture, previous cesarean delivery or gynecology operations.

Quality control

To ensure the quality of data, a pre-test was done on 5% of the sample. A two days training was given for data collectors and supervisor on data collection. In addition, the collected data were checked for completeness, accuracy, and consistency on a daily basis.

Data processing and analysis

The collected data were coded, cleaned and entered using Epidata version 3.1 and analyzed using Stata version 14. Descriptive statistics were carried out to explain the socio-demographic

characteristics and magnitude of neonatal outcomes following cesarean section. Bivariate and multivariable logistic regression was done and odds ratio with 95% confidence interval was used to identify the presence and strength of association between variables. Independent variables which showed association with the dependent variable in the bivariate analysis at $P < 0.25$ were included in the final model for multivariable analysis. Multicollinearity was checked using variance inflation factor and standard error. Variables with p-value less than 0.05 was considered significant in all cases. Model fitness was plaid using Hosmer- Lemeshow goodness of fit test.

Ethical clearance

Letter of ethical clearance was obtained from Arba Minch University Research and ethical review board. Official letter from the university was submitted to Arba Minch General Hospital to obtain their cooperation. Since we extracted secondary data, consent for participation was not applicable.

RESULTS

From the total selected records of mothers, 286 (98.6%) were reviewed. Four (1.6%) were excluded due to incomplete recording. The mean age of mothers who gave birth by CS was 26.19 (\pm SD5.29) years and the majority (65.4%) were less than 30 years old. Nearly 55% of all mothers were referred from other health facilities. About, half of the mothers had four and above ANC visits whereas, 9.4% had no visit at all (Table 1).

Nearly one-third, 90 (31.8%) of neonates developed adverse outcome following cesarean delivery. From the total record reviewed, 2 (0.7%) neonates die immediately after birth. From alive newborn, 33 (11.6%) were admitted to the neonatal intensive care unit (NICU), the leading causes of admission were: perinatal asphyxia (57.6%), low birth weight (15.2%), sepsis (12.1%) and preterm birth (12.1%) and cause of admission for one newborn was unrecorded. Out of the total admitted neonates, 7 (21.2%) died and 26 (78.8%) had good progress at discharge (Table 2).

From the total reviewed records, 29 (10.1%) of all mothers had a medical illness during pregnancy; hypertension and diabetes mellitus accounts for the biggest proportion. Only 44 (15%) of the mothers underwent CS before the onset of labor. Cephalopelvic disproportion was the leading cause of neonatal complication in 27.3% of all mothers who delivered through CS (Table 3).

Age of the mother, residency, referral from other health facilitates, ANC visit, type of CS, type of anesthesia, maternal CS complication and obstetric complication, fetal distress, membrane status and duration of rapture, labor status and stage, cephalopelvic disproportion, obstructed labor, and gestational age were associated with adverse neonatal outcome on bivariate logistic regression.

The result of multivariable logistic regression analysis showed that residency, membrane status and duration,

Table 1. Socio-demographic and cesarean delivery related characteristics of mothers (n=286) who gave birth through CS categorized by neonatal complication Southern Ethiopia, 2017.

Variable	Category	No Complication	Complication	Total
		[n (%)]		
Age of the mother	<30	154(36.2)	59(13.8)	213(74.5)
	≥30	41(28.1)	32(21.9)	73(25.5)
Residency	Urban	107(39.9)	27(10.1)	134(46.9)
	Rural	88(28.9)	64(21.1)	152(53.1)
Referred	Yes	94(29.9)	63(20.1)	157(54.9)
	No	101(39.1)	28(10.9)	129(45.1)
Number of ANC visit	0	13(24.1)	14(25.9)	27(9.4)
	1-3	79(32.6)	42(17.4)	121(42.3)
	≥4	103(37.3)	35(12.7)	138(48.3)
Maternal medical illness	Yes	19(32.8)	10(17.2)	29(10.10)
	No	176(34.2)	81(15.8)	257(89.9)
Type of CS	Emergency	172(33)	89(17.0)	261(91.3)
	Elective	23(46)	2(4.0)	25(8.70)
Type of anesthesia	Spinal	184(35.5)	75(14.5)	259(90.6)
	General	11(20.4)	16(29.6)	27(9.4)
Duration of operation	<60 min	172(34.1)	80(15.9)	252(88.1)
	60-90 min	23(33.8)	11(16.2)	34(11.9)
Maternal CS delivery complication	No	151(38.1)	47(11.9)	198(69.2)
	Yes	44(25.0)	44(25.0)	88(30.8)
Obstetric complication	Yes	118(34.1)	55(15.9)	173(60.5)
	No	77(34.1)	36(15.9)	113(39.5)

Table 2. Neonatal outcomes (n=284) after cesarean section delivery in Arba Minch General Hospital, Southern, Ethiopia, 2017.

Variable	Category	Frequency (n)	%
APGAR Score at 1 st minute	≤3	2	0.70
	4-6	97	34.15
	≥7	185	65.14
APGAR Score at the 5 th minute	4-6	29	10.21
	≥7	255	89.79
Birth Weight (n=286)	Low	14	4.90
	Normal	233	81.47
	Large	39	13.64
Neonatal resuscitation	Yes	82	28.87
	No	202	71.13
Prenatal asphyxia	Yes	19	6.69
	No	265	93.31
Neonatal sepsis	Yes	4	1.41
	No	280	98.59
	No	251	88.38

the presence of cephalopelvic disproportion, type of anesthesia, maternal CS delivery complication and gestational age had a significant association with adverse

neonatal outcome. Hence, those mothers who came from rural areas were 2.96 times more likely to have adverse neonatal outcome compared with urban (AOR: 2.96; 95%

Table 3. Delivery related characteristics categorized by neonatal outcome after CS at Arba Minch General Hospital, Ethiopia, 2017.

Variable	Category	No-complication	Complication	Total
		[n (%)]		
Fetal distress	Yes	63(30.6)	40(19.4)	103(36.0)
	No	132(36.1)	51(13.9)	183(64.0)
Membrane status and duration	Not ruptured	74(39.4)	20(10.6)	94(32.9)
	≤12 h	101(33.9)	48(16.1)	149(52.1)
	>12 h	20(23.3)	23(26.7)	43(15.0)
Duration of labor	≤24 h	152(33.9)	72(16.1)	224(78.3)
	>24 h	7(19.4)	11(30.6)	18(6.3)
Labor status and stage	No labor	36(40.9)	8(9.1)	44(15.4)
	Latent first stage	65(36.1)	25(13.9)	90(31.5)
	Active first stage	73(31.7)	42(18.3)	115(40.2)
	Second stage	21(28.4)	16(21.6)	37(12.9)
Cervical status	Closed	36(40.9)	8(9.1)	44(15.4)
	<4 cm	65(36.1)	25(13.9)	90(31.5)
	4-9 cm	73(31.7)	42(18.3)	115(40.2)
	10 cm	21(28.4)	16(21.6)	37(12.9)
Cephalopelvic disproportion	No	62(3for 9.7)	16(10.3)	78(27.3)
	Yes	133(32)	75(18.0)	208(72.7)
Mal presentation	Yes	20(40.0)	5(10.0)	25(8.7)
	No	175(33.5)	86(16.5)	261(91.3)
Obstructed labor	Yes	5(16.7)	10(33.3)	15(5.2)
	No	190(35.1)	81(14.9)	271(94.8)
Gestational age	<37	2(11.1)	7(38.9)	9(3.1)
	37-42	184(35.1)	78(14.9)	262(91.6)
	>42	9(30.0)	6(20.0)	15(5.2)
Number of pregnancy outcome	Singleton	179(33.6)	87(16.4)	266(93.0)
	Twin	16(40.0)	4(10.0)	20(7.0)

CI: 1.47, 5.96). The proportion of neonatal complication was lower for term born infant compared with pre-term (AOR: 0.11; 95% CI: 0.01, 0.93). A fetus with cephalopelvic disproportion was 2.58 times more likely to have an adverse neonatal complication (AOR: 2.58; 95% CI: 1.23, 5.42).

Mothers with rupture of the membrane that lasted for more than 12-h before CS was 3.33 times more likely to give birth to a neonate with complication than those with a membrane not ruptured. (AOR: 3.33;95% CI: 1.13, 9.84). Mothers who underwent CS with general anesthesia had greater odds of having neonates with the adverse outcome as compared with spinal anesthesia (AOR: 3.28, 95% CI: 1.21, 8.93). Maternal complication due to CS delivery had significantly increased the proportion of neonatal complication by more than two times (AOR: 2.38; 95% CI: 1.21, 4.70) (Table 4).

DISCUSSION

The current study showed that, 31.8% of newborns

delivered through cesarean section developed a adverse outcome. Perinatal asphyxia was the leading adverse neonatal outcome which lead to admission. A consistent finding was reported on two studies conducted in Ethiopia, at Finote Selam Hospital, Northwest and Attat Hospital, Central Ethiopia, which showed perinatal or birth asphyxia was the leading cause of admission to (NICU) (Moges et al., 2015; Yenit et al., 2016).

Our finding revealed that 11.6% of the live-born infants require immediate admission to NICU. which is slightly higher than the finding of a study at the University of Colorado Denver, USA which showed that 9.3% were admitted to NICU. However, this USA study was conducted to examine the outcome of neonates born by elective repeated cesarean delivery as compared with vaginal birth after cesarean delivery (Kamath et al., 2009).

In this study, infants born with increased gestational age were less likely to develop an adverse neonatal outcome. A study conducted to explore adverse neonatal outcome among elective caesarian delivery in America indicated similar finding and reported that infants

Table 4. Factors associated with adverse neonatal outcome among mothers who gave birth through the cesarean section from July 2016 to August 2017 in Arba Minch General Hospital, Arba Minch, Ethiopia, 2017.

Variable	Category	COR	AOR 95%(CI)
Residency	Urban	Ref	Ref
	Rural	2.88**	2.96(1.47, 5.96) **
Age of the mother (years)	<30	Ref	Ref
	≥30	2.04*	1.69(0.82, 3.49)
Referred	Yes	Ref	Ref
	No	0.41**	0.67(0.33, 1.36)
Member status and duration	Not ruptured	Ref	Ref
	≤12 h	1.76	1.08(0.43, 2.75)
	>12 h	4.25**	3.33(1.13, 9.84)*
Labor status and stage	No labor	Ref	Ref
	Latent first stage	1.73	2.97(0.75, 11.71)
	Active first stage	2.59*	3.44(0.81, 14.54)
	Second stage	3.43*	5.27(1.03, 26.99)*
Cephalopelvic disproportion	No	Ref	Ref
	Yes	2.19*	2.58(1.23, 5.42)*
Mal-presentation	Yes	Ref	Ref
	No	1.97	1.37(0.37, 5.10)
Obstructed labor	Yes	Ref	Ref
	No	0.21**	0.67(0.17, 2.59)
Type of anesthesia	Spinal	Ref	Ref
	General	3.57**	3.28(1.21, 8.93)*
ANC follow up	none	Ref	Ref
	1–3	0.49	0.68(0.24, 1.90)
	≥4	0.32**	0.99(0.35, 2.86)
Maternal CS delivery complication	No	Ref	Ref
	Yes	3.21**	2.38(1.21, 4.70)*
Type of CS	Emergency	Ref	Ref
	Elective	0.17*	0.52(0.08, 3.48)
Gestational age	<37 weeks	Ref	Ref
	37- 42 weeks	0.12**	0.11(0.01, 0.93)*
	≥42 weeks	0.19	0.58(0.05, 6.38)
Number of pregnancy outcome	Singleton	Ref	Ref
	Twin	0.51	0.54(0.14, 2.01)

* P-Value<0.05, ** P-Value<0.01.

delivered at 37-39 weeks encounter more serious outcome than those delivered above 39 weeks of gestation (Clark et al., 2009). Similarly, another observational study in Saudi Arabia also showed that lower gestational age was associated with adverse neonatal outcome (Alzahrani, 2017).

A study conducted by Sengupta et al. (2013) reported that early-term neonates were at higher risks for the development of hypoglycemia, NICU admission, need for respiratory support, and need for mechanical ventilation than term neonates (Sengupta et al., 2013). A similar finding was also reported by Bastek et al. (2008) which showed, late preterm infants, have increased the risk of

adverse neonatal outcomes as compared with term infants. It indicated that with controlling for confounders, there was a 23% decrease in adverse outcomes with each week of advancing gestational age (Bastek et al., 2008).

The current study showed that babies born to mothers who took spinal anesthesia were less likely to have adverse neonatal outcomes including better Apgar score. A similar finding was reported in a study by Jawad Zahir et al. (2011), which showed that babies born to mothers who underwent spinal anesthesia had a significantly better one minute Apgar score. The study also reported that NICU admission was significantly higher in babies

born with general anesthesia (28%) as compared to babies born under spinal anesthesia (0.6%) (Zahir et al., 2011).

The main strength of this study was the application of the proper model for analysis and sampling approach. However this study had also limitation like: the finding depends on the secondary source, which is subject to incomplete recording, missed values, and inconsistencies. Cross-sectional nature of the study was another limitation that made it difficult to establish a causal relationship.

CONCLUSION AND RECOMMENDATION

Health outcomes of cesarean delivery for both the mother and fetus have been bothersome. Nearly one-third of a newborn delivered through cesarean section develop adverse neonatal outcome which may result in admission to NICU or death. Mothers with preterm labor, cephalopelvic disproportion, CS complication, living in rural area, who encounter early rupture of the membrane prior to the cesarean section and under general anesthesia had an increased risk of having a baby with adverse outcome. The leading adverse neonatal outcome that contributes to the largest rate of admission to NICU was perinatal asphyxia. It is recommended that each cesarean delivery with cephalopelvic disproportion, pre-term cesarean delivery, and use of general anesthesia should get due attention to take timely and appropriate measure, which can save the lives of the mother as well the fetus.

ABBREVIATIONS

ANC, Antenatal care; **PNC**, postnatal care; **EDHS**, Ethiopian Demographic and Health Survey; **WHO**, World Health Organization; **AOR**, adjusted odds ratio; **CI**, confidence interval; **NICU**, neonatal intensive care unit, **CS**, cesarean section.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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