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Determinants of Poor Apgar Score and Associated Risk Factors among Neonates after Cesarean Section in Public Health Facilities of Arba Minch Town, Southern Ethiopia

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Abstract

Introduction: Cesarean section has been increased in most countries in recent years, but put the neonates to short and long term risks. The APGAR score is the most commonly used measure of newborn infant well-being. However Level of low APGAR score and associated factors have not been established in many sub-Saharan countries including Ethiopia.

Objective: To determine the level of APGAR score and associated factors among neonates after cesarean section in Arba Minch General Hospital, Southern Ethiopia.

Method: An institutional based cross sectional study by reviewing records was conducted from March 15 to March 30, 2017 among mothers who delivered by cesarean section from January 01, 2016 to December 30, 2016 at Arba Minch General hospital, southern Ethiopia. Data was collected by three BSC nurses. Then it was entered and cleaned by Epi Info version 7.2.1 and exported to SPSS 20 statistical software for analysis. Descriptive statistics were done to display variables. Then bivariate and multivariate analysis was employed to determine independent predictors of APGAR scores. Odds ratio with 95% CI were used to declare a statistically significant association with outcome variables.

Result: The level of poor and good APGAR score was 110 (31.8%) and 236 (67.9%) respectively. Pre-term gestational age (AOR = 3.09, 95%CI = 1.28 - 7.45), indication of non-reassuring fetal status (AOR = 3.01, 95%CI = 1.14 - 7.92), indication of Preeclampsia/Eclampsia (AOR = 5.33, 95%CI = 1.93 - 14.7), indication of Cord prolapsed (AOR = 4.00, 95%CI = 1.41 - 11.3), mothers whom underwent cesarean section in emergency (AOR = 2.74, 95%CI = 1.16 - 6.49), mothers has undergone general anesthesia (AOR = 4.39, 95%CI = 2.45 - 7.88) and mothers whose hemoglobin level is less than 11 gm/dl (AOR = 3.07, 95%CI = 1.51 - 6.22.7) were significantly associated with level of poor APGAR score.

Conclusion: Our finding level of poor APGAR score following cesarean section was 31.8%. The predictors were indication of cesarean section, type of anesthesia, type of surgery, women who were give birth pre-term gestational age, mothers with Preeclampsia and mothers with anemia. Therefore health profession working in delivery wards should take cautious approach to a better outcome of the neonate after cesarean section.

Keywords: *Cesarean Section; APGAR Score; Arba Minch; Southern Ethiopia*

Abbreviations

AOR: Adjusted Odd Ratio; AN C: Ante Natal Care, CI: Confidence Interval; CS: Cesarean Section; DDT: Decision-Delivery Time; EDHS: Ethiopia Demographic and Health Survey, EmNOC: Emergency Obstetric and Neonatal Care; IESO: Integrated Emergency Surgery Officers; WHO: World Health Organization: SNNPR: Southern Nations, Nationalities, and Peoples' Region

Introduction

A caesarean section (CS) is a life-saving surgical procedure when certain complications arise during pregnancy and labor. However, it is a major surgical procedure performed when vaginal delivery will put the mother or child's health or life at risk and is associated with immediate maternal and prenatal risks as well it may have implications for future pregnancies as well as long term effects that are still being investigated [1].

The World Health Organization (WHO) recommended that national rates not exceed 10 to 15 cesarean deliveries per 100 live births [2]. Despite this, cesarean deliveries has been increasing worldwide [3] particularity sub-Saharan [4].

In Ethiopia among 16% of births that were delivered at a health facility the CS delivery rate performed was found to be 18% [5]. However according to different studies many complications can occur to the mother and new born after cesarean section [6-8]. Many pregnant women was develop severe complications in pregnancy and childbirth, and up to 15% of all childbirths will develop a potential fatal complication, even though many of these complications are preventable and treatable [9].

Newborns delivered with caesarean section were at increased risk of low APGAR score and/or prenatal death [10]. The APGAR score is the most commonly used measure of newborn infant well-being and assess the effects of obstetric anesthesia on newborns at birth. It is performed at one and five minutes after delivery. The test is simple and repeatable method to quickly and summarily assess the health of the newborn physical condition immediately after delivery and to determine any immediate need for extra medical or emergency care [11].

In a national review of cesarean delivery in Ethiopia reported that there were 2 maternal deaths and 14% of the newborns were stillbirths or died shortly after birth. The same study also shows an emergency cesarean section have more risk of complication than the elective cesarean section [5].

Therefore, as the rate cesarean delivery was increasing and the need to know for complication associated with cesarean section is necessary manly on a new born. New born with poor APGAR score can have an adverse outcome immediately or a long lasting effect in the long term and identifying the risk factors for poor APGAR score after cesarean section will enable the health provider for rapid response and reverse the status of the neonate before adverse outcome occurs. Thus the aim of this study was to assess the level of APGAR score and associated factors after cesarean section in Arba Minch General Hospital, Gamo Gofa zone Southern Ethiopia.

Materials and Methods

Study design and setting

An institutional based cross sectional study was conducted in Arba Minch General hospital, Gamo Gofa zone, southern Ethiopia in March 2017. Arba Minch General Hospital is the one of among the three public hospitals in the zone which found in Arba Minch Town. Arba Minch Town is located 505 km from the capital city, Addis Ababa and 275km far from Hawassa, regional city of SNNPR. Since Arba Minch General Hospital is the referral hospital for the Gamo Gofa zone and surrounding zone, many complicated cases referred to the hospital, which in turn increased assisted vaginal delivery and cesarean section. It has a total capacity of 200 beds from which obstetrics and gynecology ward accounts for 72 beds. In the maternity ward there are 16 midwife nurses who interchangeably work for the whole 24 hrs of a day, with 6 Gyni/Obs Specialist who usually available for difficult cases by on call and 5 trained of Integrated Emergency Surgery

Officers and 4 trained health officers. Also 30 students who were attending Integrated Emergency Surgery Officers at hospital. During the study period 2216 mothers got delivery service from the hospital. Among them 1381 (62.32%) were by spontaneous vaginal delivery, 590 (26.62%) were by cesarean section and 245 (11.05%) were by vacuum assisted vaginal delivery.

Population

Chartist records of all women who were admitted to Arba Minch General Hospital delivery ward from January 2016 to December 2016 and delivered by cesarean section were Source population and Selected chart records of mothers among those who gave birth by cesarean section and whose record was complete were study population.

Sample size

The sample size for this study was not determine, since we purposely select one year follow up data which means the number of mother who delver by cesarean section from January 2016 up to December 2016.This period was select due to reason at this time in this hospital high number delivery as well as high number of professional and high number ISCO Student.

Sampling technique

All records of mothers who delivered by cesarean section at Arba Minch general hospital during the study period were traced from Operation room log book and patient charts from the card room. The list of all mothers who had cesarean section delivery during the study period was prepared for sampling frame, but we exclude those cards who were not register the APGAR score level at their 1st minute after delivery those were unacceptable files in our sample in order to manage biases.

Operational Definition

- **Poor APGAR score:** A newborn that developed low APGAR score (0 - 7) at one minute following cesarean section delivery [12].
- **Good APGAR score:** a newborn with normal status after cesarean section delivery and APGAR score >7at one minute following cesarean section delivery [12].

Data collection procedures and tools

Data was collected using structured data extraction tools prepared in English which was adapted from different literatures related to the topic. The questionnaire mainly addressed socio demographic variables of mothers (age, residence); obstetrics history (parity, gestational age, indication for Cesarean section etc.); type of surgery (elective, emergency) and type of anesthesia used (spinal anesthesia, general anesthesia). APGAR score was a scoring system based on five criteria (heart rate, respiration, color, muscle tone and response to stimulation) and used as a marker of a newborn baby's need for resuscitation at birth. A score of 0, 1 or 2 is awarded for each criterion, with a total score out of ten. APGAR was categorized as Poor and Good outcome. A newborn who's APGAR score (0 - 7) at 1st one minute following cesarean section delivery was categorized as Poor APGAR score [12]. And a newborn with normal status after cesarean section delivery and APGAR score > 7at one minute following cesarean section delivery was categorized as Good APGAR score [12].

Three Midwives were participated for data extraction after giving two day training and orientation. The principal investigator checked completeness of data every day. Patient information requiring for this study was retrieved from patient chart in card office.

Data quality control

To assure the quality of data, data collectors and supervisors were trained for two days on data extraction tool and procedure. Pre-test was done in Arba Minch general hospital before actual data collection. During data extraction, data retrieving forms were revised by the investigator for being complete and appropriate. The data collectors were instructed to write the cards number on the data extraction tool during the data collection so that any identified errors was traced back using the card number. Close supervision of data collection process was done by supervisors and principal investigators and data was checked for completeness on a daily basis.

Data analysis

After the data collection, the collected data were edited, coded and entered into Epi Info version 7.2.1 and exported to SPSS 20 statistical software for analysis. Double entry was done by principal investigator before analysis. Descriptive statistics such as frequency, percentage and mean were done to display variables. Each variable was entered in bivariate analysis with dependent variables, and those variables with P value of ≤ 0.25 were included in the multivariate analysis. Odds ratio, 95% confidence interval and p-value were used to identify associated factors and to determine the strength of association with the dependent variables. Significance was declared as P value < 0.05.

Ethical consideration

Ethical approval and clearance were obtained from an ethical review committee of Arba Minch University, College of Medicine and Health Sciences. Official letter was written and permission was taken from Arba Minch hospital chief clinical service officer to extract the data. To keep the privacy of mothers, name of the mothers was not included in the study; rather a registration number was used.

Results

Socio demographic characteristics of mothers

A total of 590 caesarean sections were done within the study period. Three hundred forty six questionnaires were used for analysis after the questionnaires were checked for completeness. One hundred eighty one (52.3%) of the mothers were rural dwellers and about 85.5% of the mothers were aged 20 - 34 years, and a mean age of 25.5 years. Nearly half were referred from other health institution (Table 1).

Variables (n = 346)	Category	Frequency	Percent
Age of mother (year)	< 20	27	7.8
	20 - 34	296	85.5
	35+	23	6.6
Residence of mother	Urban	165	47.7
	Rural	181	52.3
Referral Status	Not referred	173	50.0
	Referred	173	50.0

Table 1: *Socio-demographic characteristics of mothers delivered by cesarean section in Arba Minch General Hospital, southern Ethiopia, March 2017.*

Obstetric and Preoperative characteristics of mothers

Concerning obstetric history of mothers, more than half of them, 180 (52%) were primigravida, 242 (69.9%) were at gestational age between 37 - 42 weeks and 218 (63%) of the CS were attended by an Integrated Emergency Surgical Officer (IESO). Regarding indication for CS, obstructed labor was the primary indication for CS 73 (21.1%) followed by previous CS (20.2%). Regarding the type of cesarean delivered women the majority of case mothers 268 (77.5%) were emergency patients that underwent caesarean section and two hundred forty ninety (72%) of the cases were operated under spinal anesthesia and the rest 97 (28%) were done under general anesthesia (Table 2).

Variables (n = 346)	Category	Frequency	Percent
Gravidity of mother	Primigravida	180	52
	Multi-gravida	166	48
Gestational age	Term	242	69.9
	Pre-Term	38	11
	Post-term	66	19.1
Operation done by	Obs/Gyni Specialist	95	27.5
	MSC/IESO	218	63.0
	HO + surgical skill training	33	9.5
Indication for CS	Mal presentation	61	17.6
	Obstructed labor	73	21.1
	Non-reassuring fetal status	53	15.3
	Preeclampsia/Eclampsia	49	14.2
	Previous CS	70	20.2
	Cord prolapsed	40	11.6
Type of surgery	Emergency	262	75.7
	Elective	84	24.3
Type of Anesthesia	Spinal Anesthesia	252	72.8
	General Anesthesia	94	27.2

Table 2: *Obstetric characteristics of mothers delivered by cesarean section in Arba Minch General Hospital, southern Ethiopia, March 2017.*
Note *Obs/Gyni: Obstetrics/Gynecology; IESO: Integrated Emergency Surgical Officers; HO: Health Officers; MSC: Master of Science, CS: Cesarean Section.*

New born outcome

One hundred ten (31.8%) of the babies had poor APGAR score at one minute. The mean (± SD) of the APGAR score at one minute is 6.85 (± 1.34). One hundred seventy seven (51.2%) of newborn were female. The minimum and maximum birth weights of new born were 1500 gram and 4800 gram respectively. Two hundred sixty seven (77.2%) of the babies had a birth weight of greater or equal to 2500 grams. Forty five (13%) of neonate need resuscitation. Of all the new born 5 (1.4%) were stillbirth and 3 (0.9%) early neonatal deaths occurred (Table 3).

Variables (n = 346)	Category	Frequency	Percent
Sex of Neonate	Male	169	48.8
	Female	177	51.2
First minute APGAR Score	Good APGAR score	236	68.2
	Poor APGAR score	110	31.8
Neonatal birth weight	< 2500 gram	79	22.8
	≥ 2500 gram	267	77.2
Need resuscitation	Yes	45	13.0
	No	301	87.0
Neonatal outcome	Normal	331	95.7
	NICU admission	7	2.0
	Still birth	5	1.4
	Early neonatal death	3	0.9

Table 3: *Outcome of Newborn after delivered by cesarean section in Arba Minch General Hospital, southern Ethiopia, March 2017.*
Note: NICU: Neonatal Intensive Care Unit.

Factors associated with Poor APGAR score after cesarean section

The finding from multiple logistic regressions revealed that gestational age, type of surgery, indications of CS, maternal hemoglobin level and types of anesthesia were found to be significantly associated with poor APGAR score 1st minute at 0.05 levels of significance.

Those babies delivered pre-term gestational age (AOR = 3.09, 95%CI = 1.28 - 7.45), indication of non-reassuring fetal status (AOR = 3.01, 95%CI = 1.14 - 7.92), indication of PIH (AOR = 5.33, 95%CI = 1.93 - 14.7), indication of cord prolapsed (AOR = 4.00, 95%CI = 1.41 - 11.3), mothers whom underwent CS in emergency (AOR = 2.74, 95%CI = 1.16 - 6.49), mother has undergone general anesthesia(AOR = 4.39, 95%CI = 2.45-7.88) and mothers whose hemoglobin level is less than 11 gm/dl (AOR = 3.07, 95%CI = 1.51 - 6.22.7) had shown positive association with poor APGAR score (Table 4).

Variables (n = 346)	APGAR score		COR (95% CI)	AOR (95% CI)	P-value
	Poor	Good			
Referral Status					
Not referred	53	120	1.00	1.00	
Referred	58	115	1.14 (0.73,1.79)*	1.20 (0.68,2.11)	0.526
Gravidity of mother					
Primigravida	65	115	1.47 (0.93,2.33)*	0.62 (0.32,1.19)	0.153
Multi-gravida	46	120	1.00	1.00	
Gestational age					
Term	66	176	1.00	1.00	
Pre-term	25	13	5.13 (2.48,10.64)*	3.09 (1.28,7.45)**	0.012**
Post-term	20	46	2.03 (1.82,5.02)*	1.06 (0.34,3.26)	0.918
Type of surgery					
Emergency	100	162	4.09 (2.07,8.09)*	2.74 (1.16,6.49)**	0.02**
Elective	11	73	1.00	1.00	
Indication for CS					
Mal presentation	10	51	1.00	1.00	
Obstructed labor	18	55	1.67 (0.71,3.95)	1.22 (0.32,4.54)	0.765
Non-reassuring fetal status	21	32	3.34 (1.39,8.01)*	3.01 (1.14,7.92)**	0.025**
Preeclampsia/Eclampsia	29	20	7.39 (3.05,17.92)*	5.33 (1.93,14.7)**	0.001**
Previous CS	11	59	0.95 (0.37,2.42)	1.94 (0.66,5.68)	0.222
Cord prolapsed	22	18	6.23 (2.48,15.65)*	4.00 (1.41,11.3)**	0.009**
Type of Anesthesia					
Spinal anesthesia	54	198	1.00	1.00	
General anesthesia	57	37	5.64 (3.38,9.42)*	4.39 (2.45,7.88)**	0.001**
Maternal hemoglobin level					
> 11 gm/dl	75	210	1.00	1.00	
< 11gm/dl	36	25	4.03 (2.27,7.16)*	3.07 (1.51,6.22)**	0.002**

Table 4: *Factors associated with Poor APGAR score after cesarean section in Arba Minch General Hospital, southern Ethiopia.*
**: Candidate for Multivariate analysis < 0.20. **: Significant in multivariate analysis (p-value < 0.05).*

Discussion

This study was conducted to identify level of poor APGAR score after caesarian delivery at Arba Minch general hospital, southern Ethiopia. Our study showed that 110 (31.8%) of the newborns after caesarian delivery had poor APGAR score. The Factors which had an association with poor APGAR score were pre-term gestation, type of surgery, indications for the CS, type of anesthesia and mother hemoglobin level were associated with poor APGAR score.

The level of poor APGAR score after caesarian delivery was 31.8% (95% CI: 27.2% - 37.3%). This finding was comparable with the study conducted in Gondar University Hospital (37.5%) [13], but it was Higher than study conduct in Tikur Anbessa specialized hospital, Ethiopia. Poor APGAR scores (< 7) among live operative deliveries at the 1st minute of life were identified in 363 (10%) of the new born and it also higher than finding of study conduct in Uganda with first minute poor outcome prevalence of 8.4% [14].

Our study showed that those newborns delivered from mothers whose gestational age less than 37 week were more likely to be poor APGAR score than those delivered from mothers whose gestational age 37 - 42 week. This finding was supported by different studies done in different countries [4,15,16]. This might be associated with a result of relative surfactant deficiency in pre-term neonates.

Those newborns delivered from mothers underwent emergency CS were about three times more likely to be poor APGAR score than those delivered from mothers whom underwent elective CS. This finding was in line with WHO global survey on maternal and prenatal health in Africa, which reports high emergency cesarean delivery rates increased low APGAR score risk. Similarly, risk of neonatal death was lower in facilities with high elective cesarean rates [17]. A study in Rabat, Morocco, comparing fetal outcome in emergency versus elective cesarean sections fresh stillbirth and neonatal death encountered in emergency CS than elective CS [15]. This variable was not significant in the study conducted in Gondar, Ethiopia. This could be associated with the majority (92%) of the study participant was mothers who underwent emergency CS and not enough comparison participants are included.

The finding of this study revealed that mothers with indication of non-reassuring fetal status, mothers with PIH and cord prolapsed showed a statistical significant association with poor APGAR score respectively. This Finding was support from study conduct in Tikur-Anbesa referral Hospital, Ethiopia, which also report obstructed labor and PIH were the highest case-fatality rates [6]. In WHO global survey on maternal and prenatal health in Africa, Babies born to women with pre-eclampsia were found at increased risk of severe morbidity [17], this result is also identical with the study Cesarean Section Rates and Indications in Sub-Saharan Africa [18]. This can be explained as the mother haemostatic stability would be affected in preeclampsia/eclamptic mothers. In the study Cesarean Section Rates and Indications in Sub-Saharan Africa, APH also as indications were associated with maternal and early neonatal demise, Cord prolapse were associated with early neonatal death [18].

Poor APGAR score was significantly associated with type of anesthesia, accordingly new born whose mothers undergo general anesthesia showed significantly associated with poor APGAR score, as compared with new born whose mothers undergo spinal anesthesia. This finding is consistent with study conduct in Gondar, Ethiopia which shows that Neonate born under general anesthesia were 3 times more likely to have low APGAR score when compared to those born under spinal anesthesia [13].

This finding is consistent with a retrospective observational study done among mothers that delivered under general anesthesia and spinal anesthesia [19]. Similar results were found in Gondar, Ethiopia, with babies born under general anesthesia were 3 times more likely to have low APGAR score when compared to those born under spinal anesthesia. S Mekonen., *et al.* and Sahana KS 2014 also found lower APGAR scores of the neonates whose mothers received general anesthesia. This could be explained by anesthetic drugs given during the general anesthesia cross the placenta and depress the fetus.

The finding of this study shows that the significant association between pre-operative maternal hemoglobin level and neonate level of APGAR score were also found this study. The Poor APGAR score was 3 times more likely to occur on the new born with maternal hemoglobin less than 11gm/dl. A similar result is found in different studies associating level of hemoglobin level with a poor APGAR score of the neonate [20,21].

Conclusion

The findings of this study have shown that the level of poor APGAR score at one minute was 31.8% among neonates delivered by caesarian delivery in Arba Minch General Hospital in 2016. The predictors were indication of cesarean section, type of anesthesia, type of surgery, women who were give birth pre-term gestational age, mother with Preeclampsia and mothers with anemia.

Recommendation

Based on the findings of the study the following recommendations are forwarded:

For Health professionals

- Appropriate preparation should be done for Mothers with pre-term gestation.
- Cesarean sections under emergency condition and with anesthetic technique of general anesthesia are prone to poor Apgar score. So providing the mother with spinal anesthesia when appropriate lead to good Apgar score.
- Cautious approach to indications which are associated with the poor APGAR score.

For Researchers

- Further prospective study needs to be performed by including additional variables which are not addressed in this study with large sample size.

Authors' Contributions

TS has made substantial intellectual contributions to conception, design, and acquisition of data, analysis and interpretation of data to this study. NB has been involved in drafting the manuscript and revising it critically for important intellectual contents. AY and MG have made substantial contributions to conception, design, analysis and interpretation of data and participated in the critical review and editing of all the manuscript drafts for scientific merit and depth. All authors read and approved the final manuscript and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Arba Minch University supports this research financially. The university has no role in the design of the study, collection, analysis, and interpretation of the data and in writing the manuscript.

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