

Proportion and factors associated with low fifth minute Apgar score among singleton newborn babies in Gondar University referral hospital; North West Ethiopia.

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Abstract

Back ground: New born babies with low Apgar scores are at an increased risk of perinatal morbidity and mortality.

Objective: To assess proportion and factors associated with low 5th minute Apgar score among singleton newborn babies in Gondar University referral hospital; North West Ethiopia.

Methods: A cross-sectional study was conducted on singleton 261 live births from March - May, 2013. Data was collected from mother/newborn index using a structured and pre-tested questionnaire. It was then cleaned, coded and entered using EPI INFO version 3.4.3, then analyzed with IBM SPSS statistics versions 20.0. Logistic regression was used to identify significant variables with low 5th minute Apgar score.

Result: The proportion of low 5th minute Apgar score in this study was 13.8%. Factors that were significantly associated with low 5th minute Apgar score were: non-vertex fetal presentation, prolonged labor, presence of meconium stained liquor, induced/augmented labor and low birth weight.

Conclusion: Mainly obstetric factors contribute to low Apgar score. Improving labor management through implementing regular use of partograph, 1:1 midwife-client ratio and advanced electronic fetal monitoring technology is recommended.

Keywords: Apgar score, Gondar University referral hospital.

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Introduction

Childbirth is the period of increased risk of mortality for a mother and her baby¹. An estimated 42% of the world's 535, 900 annual maternal deaths are intrapartum-related; these deaths are closely linked to the deaths of 1.02 million babies during labor and 904,000 intrapartum related ("birth asphyxia") neonatal deaths¹⁻³.

The Apgar score, first introduced by Virginia Apgar⁴ in 1952, initially was a practical method of systematically assessing newborn infants immediately after birth to help identify those requiring resuscitation⁵. Later, the Apgar scores determined at five minutes after delivery became

widely used for the prediction of asphyxia as well as hypoxic-ischemic encephalopathy and cerebral palsy⁶⁻⁹.

It is established that there is association between low Apgar scores and increased perinatal morbidity and mortality¹⁰. A recent study showed that Apgar scores of less than 7 at five minutes after birth were associated with low cognitive function, neurologic disability and even subtle cognitive impairment as measured by academic performance at 16 years of age^{11,12}. However, the value of the Apgar score < 7 is still considered controversial by different studies and many neonatologists across the world^{13,14}. Perinatal morbidity and mortality can be reduced if high risk infants can be identified and managed appropriately. The present study therefore aimed to assess the proportion and associated factors with low 5th minute Apgar score among newborns in Gondar University referral hospital.

Methods

An institution based cross-sectional study was conducted at the University of Gondar referral hospital, maternity ward from March-May, 2013.

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The hospital is located in North Gondar zone at about 727 kilometers NorthWest of Addis Ababa, the capital city of Ethiopia. The hospital provides delivery services 24 hours a day, 7 days a week and is staffed with midwives, intern doctors, general practitioners and obstetricians.

All mother/neonate index singleton live births after 28 weeks of gestation during the study period were included in the study. Deliveries of unknown gestational age(unknown last normal menstrual Period and no ultrasound estimation) were not included.

A sample size of 261 was calculated using single population proportion formula assuming a 35.7% proportion of 5th minute low Apgar score from previous study in Ethiopia¹⁵ at a 95% confidence limit, 5% margin of error and correction formula.

Systematic random sampling technique was used to reach at each participant. By taking a monthly average of 350 deliveries from preceding year report and considering a skip interval of 4, the calculated sample size was achieved in the three months of data collection period.

Data was collected by five graduating first class degree midwifery students in the delivery and operation rooms. Data collectors were assigned at day and night rotations to address the design. Training on the standard procedures of Apgar score estimation with emphasis on a three scale easily identifiable selection criteria for each Apgar score variables and an interview procedure was provided to data collectors. Each newborn recruited was assessed for Apgar in the 1st, 5th and 10th minutes after birth and weighed only once soon after delivery. Maternal and obstetric information was collected at admission, during first stage of labor and after delivery.

The interview questionnaire consisted of maternal socio-demographic and obstetric variables. In addition, variables related to the newborn were included. Completeness of the data and relative accuracy of Apgar score estimation was evaluated by a senior midwife who was the maternity ward head on daily basis.

Apgar score was estimated using five variables [Strength and regularity of heart rate; (100 beats/minute or more (2 points), Less than 100 (1 point), none (0 points)), Lung maturity / breathing effort; (Regular breathing (2 points), Irregular and < 30 breath/minute (1 point), None (0 points)), Muscle tone and movement; (Active (2 points), Moderate (1 point), Limp (0 points)), Skin color / oxygenation; (Pink (2 points), bluish extremities (1 point), totally blue (0 points) and reflex response to irritable stimuli; (Crying (2 points), whimpering (1 point), silence (0 points)). Then the score of each finding was summed up by investigator and a score below value seven was considered as low^{4,6}.

All collected questionnaires were checked for completeness and consistency of responses manually. Then data was coded, entered in to EPI INFO version 3.4.3 and analyzed using IBM SPSS statistics versions 20.0. Bivariate crude odds ratio and multivariate adjusted odds ratio was done by Logistic regression model. The presence and strength of association of variables was assessed using odds ratio with 95% confidence interval.

Ethical clearance was obtained from department of Midwifery which is a delegate of the institutional review board of Gondar University. Permission to conduct the study was also obtained from Gondar University referral hospital. Participants were informed about the purpose and objective of the study. They were also informed that, they had the right to discontinue or refuse to participate in the study. Verbal consent was obtained from each study participants. Confidentiality of information and privacy was observed.

Result

A total of 261 neonate/mother pairs were involved in this study. About 82% of the mothers were aged 20 – 34 years, with a range between 18 - 42 years and a median age of 25 years. Nearly three quarters were urban dwellers. Majority (95.0%) were married and 55.9% house wives (Table 1).

Table 1: Socio-demographic characteristics of mothers who gave birth in Gondar University Referral Hospital, Gondar Town, Ethiopia; March - May, 2013

n=261		
Variable (characteristics)	Frequency(No)	Percent (%)
Age (maternal)		
<20	18	6.9
20-34	215	82.4
35+	28	10.7
Marital status		
Married	248	95.0
Other *	13	5.0
Occupation		
House wife	146	55.9
Government employee	46	17.6
Private employee	17	6.5
Merchant	24	9.2
Others**	28	10.8
Educational status		
No formal education	95	36.4
Primary education(1-8)	53	20.3
Secondary education(9-12)	76	29.1
College and above	37	14.2
Residence		
Urban	192	73.6
Rural	69	26.4
Household Income per month (per quartile)		
< 1000 birr (< Q1)	64	24.5
1000-2800 birr (Q1-Q3)	131	50.2
> 2800 birr (> Q3)	66	25.3

* Single, cohabited

**daily laborer, student, farmer

One hundred and thirteen mothers (43.3%) were primiparous. About 88% participants had history of at least one ANC follow up during the current pregnancy. In about 90% of the mothers labor was spontaneous and

in about 90% these mothers labor duration was less than 24 hours. Nearly three quarter (74.7%) of mothers had spontaneous vertex deliveries (SVD). The proportion of low 5th minute Apgar score in newborn babies was 13.8% (Table 2).

Table 2: Obstetric and Neonatal characteristics of study participants in Gondar University Referral Hospital, Gondar Town, Ethiopia; March - May, 2013

n=261		
Variable	Frequency	Percent (%)
ANC follow up		
Yes	230	88.1
No	31	11.9
Parity *		
1	113	43.3
2-4	135	51.7
≥5	13	5.0
Condition of labor		
Spontaneous	234	89.7
Induced/Augmented	27	10.3
Duration of labor		
3-24hrs (normal)	234	89.7
>24 hrs (prolonged)	27	10.3
Mode of delivery		
SVD	195	74.7
Instrumental	15	5.7
C/S	51	19.6
Gestational Age at Birth		
Preterm (< 37 wks)	20	7.7
Term (37-42 wks)	232	88.9
Post term (>42 wks)	9	3.4
Birth weight		
Low (1500 -2500 gm)	31	11.9
Normal (2500-4000 gm)	230	88.1
5th Minute APGAR Score		
Low (< 7)	36	13.8
Normal (≥ 7)	225	86.2
Sex		
Male	145	55.6
Female	116	44.4

*mothers in their first delivery were included as Para = 1

The results of multivariate analysis (Table 3) indicated a significant association between fetal presentation and low 5th minute Apgar score. Fetuses who adapted non-vertex presentation were 4.46 times (AOR (CI) = 4.46 (1.41, 14.08)) more likely to have a low Apgar score than those who adapted vertex presentation.

Other factors that remained significantly associated on multivariate analysis include; induced/augmented labor, labor duration > 24 hours, the presence of meconium and low birth weight (Table 3).

Table 3: Bivariate and multivariate analysis of factors associated with low 5th minute Apgar score; Gondar Town, Ethiopia; March - May, 2013

Variables	5 th Minute APGAR Score		COR (95% CI)	AOR (95% CI)
	Low No. (%)	Normal No. (%)		
n=261				
History of Neonatal death				
Yes	8 (34.8)	15 (65.2)	4.00 (1.56,10.28)*	***
No	28 (11.8)	210 (88.2)	1	
Gravidity				
Primigravida	9 (9)	91 (91)	0.58 (0.26,1.33)	0.39 (0.15,1.05)
Gravid ≥ 5	6 (37.5)	10 (62.5)	3.54 (1.16,10.78)	1.84 (0.48,7.02)
Gravid 2-4	21 (14.5)	124 (85.5)	1	1
Gestational age				
Pre-term	6 (30)	14 (70)	3.39 (1.20,9.60)*	***
Post-term	4 (44.4)	5 (55.6)	6.34 (1.60,25.11)*	***
Term	26 (11.2)	206 (88.8)	1	
Fetal presentation				
Vertex	25 (10.5)	213 (89.5)	1	1
Non-vertex	11 (47.8)	12 (52.2)	7.81 (3.12,19.54)**	4.46 (1.41,14.08)*
Condition of Labor				
Spontaneous	25 (10.7)	209 (89.3)	1	1
Induced/Augmented	11 (40.7)	16 (59.3)	5.75 (2.40,13.75)**	4.85 (1.71,13.72)*
Duration of labor				
≤ 24 hours	27 (11.5)	207 (85.5)	1	1
> 24 hours	9 (33.3)	18 (66.7)	3.83 (1.57,9.38)*	4.09 (1.39,12.02)*
Meconium stained liquor				
Yes	20 (32.3)	42 (67.7)	5.45 (2.60,11.39)**	2.72 (1.13,6.54)*
No	16 (8.0)	183 (92.0)	1	
Mode of delivery				
SVD	20 (10.3)	175 (89.7)	1	
Instrumental	2 (13.3)	13 (86.7)	1.35 (0.28,6.39)	***
Caesarean	14 (27.5)	37 (72.5)	3.31 (1.53,7.15)*	***
Birth weight				
Low (1500-2499 gm)	11 (35.5)	20 (64.5)	4.51 (1.94,10.49)**	4.47 (1.55,12.83)*
Normal (≥ 2500 gm)	25 (10.9)	205 (89.1)	1	1

* p-value <0.05

** p-value <0.001

*** Variables not associated by back ward step wise logistic regression analysis

Discussion

The purpose of this study was to assess the proportion and associated factors of low 5th minute Apgar score among newborns in Gondar University referral hospital. The proportion of low 5th minute Apgar score in this study was 13.8%. This result is lower than another institution-based study in South-West Ethiopia (35.7%)¹⁵. This difference might be explained by the time gap between these two studies. In the earlier time, institutional delivery was only utilized by a small (5% with 31-39.5% urban residents) proportion of the population in the country^{25,26}; from this we can extrapolate that the then institutional

deliveries might be self referred obstetric complications with high neonatal morbidity.

In other studies done among West, North and sub-Saharan African emigrants and in Uganda^{16,17}; 3.9%, 1.8% and 8.4% proportion of low 5th minute Apgar score was reported. The disparity in the proportion from current study might be due to better utilization of institutional delivery²⁷ (36.6% with 79.2% urban residents) and probably better obstetric care even in the case of emigrants.

In the analysis of associated factors, non-vertex fetal presentation was significantly associated with low 5th minute

Apgar score. A study done in Uganda¹⁷ showed similar findings. This similarity might be due to the fact that in non-vertex fetal presentation, there will be chance of caesarean¹⁸ or manipulative vaginal deliveries, which could further affect Apgar score.

One of the factors that were associated with 5th minute low Apgar score in this study, prolonged labor, was similar to other studies¹⁹. In addition, induced/augmented labor and the presence of meconium stained liquor in this study were significantly associated with low Apgar score. In the case of prolonged labor, induction/augmentation and meconium stained liquor, there will be a chance of fetal distress, which could affect mode of delivery and subsequently distressed fetuses will have low Apgar scores. Studies also supported that tachy-systole and uterine rupture are among identified side effects of induction/augmentation of labor which can result in fetal distress, then passage of meconium and eventually end up in caesarean delivery or hysterectomy^{20,21}.

The current study also revealed that newborn babies with low birth weight were about 4.5 times more likely to have low 5th minute Apgar score compared to those with normal birth weight. The findings from other studies^{18,22} also showed consistent results with current study. Different from the finding in this study, one study²³ showed low Apgar score associated with extremely low birth weight. This could be explained by the fact that small babies might suffer from difficult birthing and might develop difficulty in cardiopulmonary transition and perinatal asphyxia²⁴.

Limitations

This study did not consider some potential risk factors for low Apgar score such as placental factors, multiple pregnancy, congenital syndromes and intra-uterine infections since the conditions were unavailable at the time of study.

Conclusion and recommendation

In this study 13.8% neonates had low Apgar score at 5th minute of life. Mainly obstetrics factors (non-vertex fetal presentation, prolonged labor, presence of meconium stained liquor, induced/augmented labor and low birth weight) were significantly associated with low 5th minute Apgar score. Improving labor management through implementing regular use of partograph, 1:1 midwife-client

ratio and advanced electronic fetal monitoring technology is recommended. In addition, in order to address other potential variables and to identify immediate and long term outcomes of low apgar score, a large scale study is recommended.

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Competing interests

The author declares no competing interests.

Author's contributions

TW designed the study, participated in the data collection, performed analysis and interpretation of data, drafted the paper developed and revised the manuscript.

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