Effects of General Versus Spinal Anesthesia Over Apgar Score of Newborns Delivered by Cesarean Sections and Factors Associated with Apgar Score at Gandhi Memorial Hospital, Addis Ababa

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Abstract

Introduction: Apgar score is a practical method of systemically assessing newborn baby immediately after birth to identify those requiring resuscitation and to predict survival in neonatal period. It is best parameter to assess the immediate condition of the baby.

Objective: To assess the effects of general versus spinal anesthesia over Apgar score of newborns delivered by cesarean sections and factors associated with Apgar score from January to March 2016 at Gandhi Memorial Hospital, Addis Ababa.

Method: Institutional based comparative cross sectional study design was conducted. Systematic random sampling technique was used to select study participants. Regular supervision and follow up was made. Data was entered into Epi info version 7 by investigators and was transported to SPSS version 20 for analysis. Bivariate and multivariate analysis was used to identify factors associated with Apgar score.

Result: A total of 86 study subjects were included in the study of which majority of new born baby had low Apgar score at one minute. Out of 43 mothers, who received spinal anesthesia, 15 patients (34.88%) gave birth to neonates having Apgar score ≥ 7 at one minute. On the other hand, out of 43 mothers who received general anesthesia, 7(16.3%) mothers gave birth to neonate having Apgar score ≥ 7at one minute. It had been found that neonates who were born under general anesthesia were three folds more likely to have low Apgar score than the other (AOR 2.768 (95% CI ((.876-8.745).

Conclusion and recommendation: There was relatively a low Apgar score among newborn babies delivered under general anesthesia. Hence, practice of spinal anesthesia was recommended.

Introduction

Newborns delivered by CS can be assessed clinically using the Apgar score which was devised in 1952 by Dr. Virginia Apgar to evaluate the health of newborn and assess the effects of obstetric anesthesia on newborns [1-4]. The test is simple and repeatable method to quickly and summarily assess the health of newborn physical condition immediately after delivery and to determine any immediate need for extra medical or emergency care [5]. The Apgar test is usually done to the baby twice: once at one minute after birth, and again at 5 minutes after birth. Rarely, if there are concerns about the baby condition and the first two scores are low, less than 7, the scoring is also performed at 10, 15 and 20 minutes after delivery [6].

The 1 min. Apgar score may signal the need for immediate resuscitation, and the 5, 10, 15 and 20min.score may indicate the probability of successfully resuscitating an infant. A low score may be due to a number of factors, including drugs given to the mother during labor, caesarean section under general anesthesia and immaturity [7].

Even though, delivery of baby by cesarean section has become increasingly common, the choice of anesthetic technique remains controversial. No technique is ideal for cesarean sections, and both general and spinal anesthesia have certain advantages and disadvantages.[8,9] However the aim of anesthetist is to choose the method which is safest and most comfortable for the mother, least depressant to the newborn and which provides optimal working conditions for obstetrician. [10]. Thus, this study is aimed to assess the effects of general versus spinal anesthesia over Apgar score of newborns delivered by cesarean sections and factors associated with Apgar score

Methods

Study setting. The study employed a comparative cross-sectional study design at Gandhi Memorial Hospital which is located in capital city of Ethiopia, Addis Ababa. The Hospital was established in 1958 G.C when it was called the only maternity hospital in Ethiopia and named as Gandhi Memorial Hospital for the memory of Mohatema Gandhi. The study was conducted from January to March 2016.

Source population. All newborn babies of mothers who gave birth by caesarian section at Gandhi Memorial Hospital, Addis Ababa.

Study population. Selected newborn baby of mothers who gave birth by caesarian section from January to

March 2016 at Gandhi Memorial Hospital, Addis Ababa.

Exclusion criteria: Acute fetal distress, intrauterine fetal death, pregnancies with bleeding and mother who refused to take part in the study

Sample size determination and sampling technique

Pregnant mothers who gave birth by caesarian section at Gandhi Memorial Hospital with exposure to either spinal or general anesthesia were compared to see the effects on Apgar score of newborn baby in both groups. Considering Group A, those subjects who underwent spinal anesthesia as a control and Group B, those subjects who under General Anesthesia as case, equal number of population each 43 was used.

Data collection tools and procedure

Data was collected using pretested structured questionnaires by two degree holder anesthetist and supervised by one MSc holder anesthetist. Apgar score was done as per the protocol prescribed by the neonatal Advanced Life Support advocated by the American Pediatric Association. At delivery, for evaluation of neonate, Apgar scores was assigned at one and five minutes. It was based on the appearance (color), pulse rate, grimace (reflexes), muscle tone (activity) and respiratory effort of neonate each carrying a score from 0 to 2. Total scores indicated were 7-10 = satisfactory Apgar score. Below 7= unsatisfactory Apgar score.

Data Quality Assurance

The structured questionnaire was prepared in English first and translated to the local language, Amharic and again back to translation to English was made to ensure that the consistency of the question. Pretest was done on 5% of the sample size at Zewiditu Memorial Hospital. Data collectors and supervisors were trained on each items included in the study tools, objective, relevant of study, right of respondents. During data collection, regular supervision and follow up was made. Investigator cross checked for completeness and consistency of data on daily basis. Double entry check was made on 10% of sample size.

Data Analyzing and processing

The data was entered into epi info version 7 and was exported to SPSS version 20 computer program for analysis. Descriptive statistics was used to summarize data, tables and figures for display results.

Bivariate and multivariate analysis was used to see the effect of independent variable over Apgar score. Variables which were significant on bivariate analysis at p-value less than 0.2 was taken to multivariate analysis. In multivariate analysis P- value of less than 0.05 was used as a cut of point for presence of association. Strength of association was measured by 95% confidence interval and/ Odd ratio.

Ethical Consideration

Ethical clearance and approval was obtained from ethical review committee, Anesthesia department, Addis Ababa University. Permission to conduct was obtained from Gandhi memorial Hospital. Informed Verbal consent was secured from every study participants. The obtained data was only used for study purpose. Confidentiality and anonymity were ensured**.**

Result

Socio demographic and personal characteristics

From the total 86 pregnant mothers gave birth to 91 new-borns at Gandhi memorial Hospital, 52 were multigravida, 32 were primigravida and the two were unknown. 86 0f all new-born were included in the study whereas the remaining five (5.5%) were excluded from the study due to data incompleteness during analysis. Pertaining to age of pregnant mother, the highest number of age group was found between 25 to 29 years and followed by the age group between 20-24 years of age. The mean age of respondents was $26.98 \pm$ SD (4.267), (minimum 20 and maximum 36). None of them had history of exposure to alcohol drinking and smoking. All of them were from urban areas. (See table 1)

Variables	Category	Frequency	Percentage
Age (in years)	20-24	30	34.9
	25-29	31	36.0
	30-34	12	14.0
	35- 39	13	15.1
Pregnancy state	Gravida I	32	37.18
	Gravida II	42	48.8
	Gravida III	10	11.6
	Missing	2	2.32

	Abortion 0	55	63.98
	Abortion I	29	33.7
	Missing	2	2.32
	Para I	61	70.9
	Para II	25	29.1
BMI	below 18.5	10	11.6
	18-24.99	66	76.7
	25-29.99	10	11.6

Table 1. Sociodemographic and personal charateristics of pregnant mothers of newborns delivered by cesarean sections under general and spinal anesthesia from January to March 2016 at Gandhi Memorial Hospita.

Periperative blood pressure, maternal Medical and Obstetr condition
It was observed from the data that among all pregnant mothers who gave births at Gandhi Memorial Hospital, 88.4 %(n=76) were Normotensive, 11.6 %(n=10) were Hypertensive; but none of them were hypotensive prior to administration of anesthetic agents. About 27 of 86 mothers had developed hypotension after administration of anesthetic agents. This mean that most of them had normal blood pressure both before and after anesthetic agents was administered. Regarding gestational type of pregnant mothers, only five of them had multiple gestations. Only 10 of all pregnant mothers had hypertension induced by pregnancy while the other had no obstretric related medical problem and most of them gave birth on an emmergency basis. About 75.6% of all pregnant mothers were delivered by emmergency ceserian section.

Fetal condition
Among eighty six of new borns delivered by pregnant mothers, fifty (58.14%) were male. Majority of newborns had a normal birth weight and were delivered at term. (see table 2)

Variables	Category	Frequency	Percentage
Sex of the New born baby	Male	50	58.14
	Female	36	41.86
	Total	86	100.0
Birth weight	1.5 to 2.5kg	23	26.7
	2.5 to 4kg	63	73.3
	Total	86	100.0
Gestational age in terms	Term for GA	77	89.5
	Post term for GA	7	10.5
	Total	86	100

Table 2. The fetal condition delivered by cesarean sections under general and spinal anesthesia from January to March 2016 at Gandhi Memorial Hospital

Skin incision to delivery time and apgar score differences
Only 6 and 3 of 56 new born delivered when the skin incision to delivery time was less than five minute had a low Apgar score at one minute and five minute respectively, however,majority (16 of 30) of those who delivered when the skin incision to delivery time was above five minute had a low Apgar score at one minute. This showed that newborn who delivered when skin incision to delivery time was less than five minute had a better Apgar score as compared to the others.

Type of Anesthesia administered and Apgar score differences
The effect of type of anesthesia administered over Apgar score of newborn baby revealed that most of the new born baby had low Apgar score at one minute; but had high Apgar score at five minute. Only 10(11.63%) of all newborn baby has a low Apgar score after resuscitation at five minute. Comparison of satisfactory Apgar score at one minute was was high in spinal group 15(17.44%) as compared to general anesthesia group 7(8.2%%). There was comparable Apgar score at five minute between spinal and general anaesthesia with a slight predominance of better score under spinal anaesthesia. (Table 3)

Variable	Category	Apgar score at one minute			Apgar score at five-minute			
		Less than seven	Seven to ten	Total	Less than seven	Seven to ten	Total	
Anesthesia type	Spinal	28	15	43	4	39	43	

General	36	7	43	6	37	43
Total	64	22	86	10	76	86

Table 3.Comparasion of Apgar score differences among newborns delivered by cesarean sections under general and spinal anesthesia from January to March at Gandhi Memorial Hospital.

Determinants of Apgar score at one minute

Among all determinants of Apgar score at one minute age group, gestational age in terms, maternal heart rate, and type of caesarian section, maintenance agents, body mass index and gestational type were not associated on bivariate analysis at p-value less than 0.2, therefore excluded from multivariate analysis.

It was observed from a data of multivariate analysis that skin incisions to delivery time, type of anesthesia and birth weight were strongly associated with a low Apgar score at p-value less than 0.05. The odd of developing the low Apgar score under general anesthesia about three times as high as the odd of developing low Apgar score under spinal anesthesia at one minute (AOR 2.768 (95% CI ((.876-8.745).

Variable	Category		Sig.	COR	AOR
	Good score	Poor score		95% C.I.	95% C.I.
Type of anesthesia					
General	36	7	.043	.052(2.755-.989)	2.768(.876-8.745)
Spinal	28	15	*	*	*
Skin incision to delivery time					
< 3 minute	50	6	*	*	*
>3 minute	14	16	.044	0.105(.035-.319)	3.805(1.156-47.471)
Birth weight					
1.5- 2.5kg	11	12	.012	5.782(2.001-16.707)	28.697(2.106-391.099)
2.5- 4kg	53	10	*	*	*
BP					
Normotension	59	17	*	*	*
Hypertension	5	5	.793	.250(.034-1.819)	1.589(.092-27.377)
Supplementation of oxygen					
Induction to delivery					
< 6 minute	52	16	*	*	*
>6 minute	12	6	0.399	0.615(1.99-1.903)	.300(.500-.135)
Yes	7	3	*		*
No	57	19	.098	0.344	6.718(.456-106.564)
Induction agents			*	*	*
Thiopentone	17	5	.152	.205 (.830-11.506)	3.091 (.023-1.796)
Ketamine	11	10	*	*	*

Table 4.Factors affecting Apgar score at one minute among newborns delivered by cesarean sections under general and spinal anesthesia from January to March 2016 at Gandhi Memorial Hospital

Determinants of Apgar score at five minute

At five minute, induction agents, anesthesia type, oxygen supplementation, body mass index, type of C/S and age group were not associated on bivariate analysis at p-value less than 0.2, so that it was excluded from multivariate analysis. It was observed from a data of multivariate analysis that skin incision to delivery time and blood pressure were strongly associated with a low Apgar score at p-value less than 0.05. Being multiple gestations was about three times more likely to develop low Apgar score when compared to single gestation at five minute (AOR 3.477 (95% CI ((.033-16.94). (See table 5)

Variable	Category		Sig.	COR	AOR
	Low score	High score		95% C.I.	95% C.I.
Gestational age					
Term	70	7	*	*	*
Post term	5	2	*	.237 (.560-21.573)	3.477 (.033-16.94)
uterine incision to delivery time					
< 3 minute	53	3	*	*	*
>3 minute	24	6	.030	.226(.052-.982)	2.81(.054-1.453)
Birth weight					

1.5- 2.5kg	12	4	.117	2.442(.594-10.035)	2.346 (.546-10.080)
2.5- 4kg	55	5	*	*	*
Blood pressure					
Normotension	70	6	*	*	*
Hypertension	7	3	.036	.097(.007-1.370)	10.289(.167-63.35)
Gestational type					
Single	73	8	*	*	*
Multiple	4	1	.379	0.23(.015-2.45)	.510(.114-2.287)
Maternal heart rate					
Normal	21	5	*	*	*
Tachycardia	58	4	.110	.333(.816-13.615)	.298 (.028-1.313)

Table 5. Factors affecting Apgar score at five minute among newsborns delivered by cesarean sections under general and spinal anesthesia from January to March 2016 at Gandhi Memorial Hospital.

Discussion

In this study, it was attempted to determine the effect of spinal versus general anesthesia over Apgar score of the new born baby both at one and five minute. The analysis of Umbilical cord PH & base excess was not included in order to further elucidate the entity of low Apgar score as there is no ABG analyzer in the hospital. According International classification of disease (ICD), related health problem, 10th revision (ICD-10) Apgar score still defines the degree of birth asphyxia despite of other available method such as Umbilical cord acid base measurement. [11]

In this review, the magnitude of Low Apgar score was 25.58% and 10.46% at one minute and five minute respectively which is almost closest to review conducted in Uganda teaching hospital 28% [12]. In contrast to this study, the magnitude of Low APGAR score in Gondar University Hospital was high 37.5%. The higher magnitude of low APGAR score in Gondar University Hospital could be attributed to pre anesthetic condition as 92% of the cases were emergency C/S, fetal distress being the leading indication.[13]

It was observed from the result of the present study that general anaesthesia was about three times more likely to develop low Apgar score as compared to spinal anaesthesia at one minute. Similar findings were also reported by the similar study conducted in Gondar University Hospital. [13]. The present study also nearly consistent with the study conducted at Abbasi Shaheed hospital on the effect spinal and general anesthesia over apgar score; as there was a low Apgar scores of the neonates whose mothers received general anesthesia. [14]

The low Apgar score at one minute may be due to the result of laryngeal spasm induced by aspiration of liquor or blood during intrauterine manipulation and pregnant mothers who received general anaesthesia have relatively high level of circulating catecholamine causing a reduction in uteroplacental blood flow. [15-17]

A review of different literatures showed that there are different opinions about the ideal time at which the foetus should be delivered after induction of anaesthesia. It was recommended by many workers that delivery is best completed 6-8 minutes after induction of general anaesthesia as inhalational agents could induce neonatal depression by diffusion through the placenta. [19, 20]. A review of the other study have reported that in absence of hypotension there is no change in Apgar scores or acid base status with prolonged induction to delivery interval in spinal anaesthesia [18].The low Apgar score when skin incision to delivery time is prolonged may be due to decrease in blood pressure that causes decreases in uteroplacental circulation and acid base imbalance, hence fetal well-being. [15]

In this study, 6 minutes after induction of anaesthesia to delivery was used as a cut off point for long and short duration and the result of the study showed that only 4 of 43 babies born under general anaesthesia when duration of induction to delivery was short had low Apgar score. This showed new-borns delivered when induction of anaesthesia to delivery time is shorter has higher Apgar score as compared to the other. Similarly, another study reported that long skin incision to delivery time more than 8 minutes and uterine-incision-to delivery time more than 180 seconds have been associated with foetal hypoxia and acidosis regardless of the type of anaesthesia. [20]

Conclusions and Recommendation

Conclusion

The result of the study indicated that there was a significant difference between the effects of general and spinal anesthesia on Apgar score of neonate at one minute, but there is no significant difference between the effect of general and spinal anesthesia on Apgar score five minutes after a birth.

New born baby who delivered under general anesthesia has relatively low Apgar score when compared to those who delivered under spinal anesthesia.

Low birth weight, prolonged uterine incision to delivery time and general anesthesia were found to be associated with low Apgar score at one minute while prolonged uterine incision to delivery time was also

associated with low Apgar score at five minute.

Recommendation

Based on the finding of the study the following recommendations were drawn.

- Obstetrician should limit the duration of uterine incision to delivery time to 180 seconds.
- Anesthetist should limit the use of general anesthesia for caesarean section and reserved only for those who are contraindicated to spinal anesthesia and they should use less depressant drugs while administering anesthetic agents and limit the duration of induction to delivery to 6 minutes.
- Researcher should conduct further research's using a better indicator of neonatal asphyxia, like Arterial Blood Gas analysis.

Abbreviations

FP: Family planning; SNNPRG: Southern Nation Nationality and People of Regional Government; SSA: Sub-Saharan Africa

Competing interests

We s declare that we have no competing interests.

Authors' contributions

MS contributed to the conception, design of the study, data entry, analyzing and interpretation of the data, and drafted and revised the manuscript. MW and TA contributed to the conception and assisted in the initial design of the study, analyzed and interpreted the data and critically revised the manuscript. All authors read and approved the final manuscript

REFERENCES

1. Eslami Z and Fallah R (2008). Evaluation of the Apgar score and its related factors in neonates born in hospitals of Yazd city. Journal of University of Medical Science of Shahid Sadoughi Yazdi 16(5) 40-45 (in persian).
2. Martin Te, Bell P and Ogunbiyi O (2007). Comparison of general anesthesia and spinal anesthesia for caesarean section in Antigua and Barbuda. West Indian Medical Journal 56(4) 330-333.
3. American Society of Anesthesiologists Task Force on Obstetric Anesthesia. Practice guidelines for obstetric anesthesia: an updated report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia. Anesthesiology 2007; 106:843-63.
4. Dutta S, Ostheimer GW, Weiss JB. Neonatal effect of prolonged induction for cesarean secion. Obstet Gynecol 1981; 58:331-35.
5. Apgar V. Proposal for new method of evaluation of newborn infant. Anesth Analg 1953;32:260-67
6. Brian A. Hall , Robert C. Chantigian. Anesthesia, comprehensive review: 4th edition: 223.
7. Klieyman Behrman, Jenson Stanton .Nelson Text book of pediatrics: 18 edtion, 2007; 94:679.
8. Brown DL. Spinal, epidural, and caudal anesthesia. In: Miller RD, editor. Anesthesia. 4th ed. NewYork: Churchill Livingstone; 1995. pp. 1505-33.
9. Wu CL. Analysis on doula parturition method in clinical practice field. Henan J Prev Med 2006-05.
10. Harrad JA, Howell PA. General anesthesia for cesarean section. J Current and Critical care.2000; 11: 66-72.
11. International statitical classification of disease related health problems 10th Revision,http;//www.who.int/classifications/icd/en/.
12. Arif Yeuun, Zeki ertug, Murat Milmaj, Meliha Erman(2003)effects of epidural anesthesia and general anesthesia on newborns at cesarian section:turk j med sci33:311-314.
13. Abdissa Z, Awoke T, Belayneh T, Tefera Y (2013) Birth Outcome after Caesarean Section among Mothers who Delivered by Caesarean Section under General and Spinal Anaesthesia at Gondar University Teaching Hospital North-West Ethiopia. J Anesthe Clinic Res 4: 335. doi:10.4172/2155-6148.1000335
14. Sultana AG, Masood ZU and Hassan SH (2004). Effects of type of anesthesia on neonatal outcome. Annals of Abbasi Shaheed Hospital & Karachi Medical & Dental College 9(2) 552-557.
15. Sultana AG, Masood ZU and Hassan SH (2004). Effects of type of anesthesia on neonatal outcome. Annals of Abbasi Shaheed Hospital & Karachi Medical & Dental College 9(2) 552-557.
16. Marx GE. Anesthesia for caesarian section: newer concepts.Ind J Anesthesia2005:252-259.

17. Crawford Js,Davies P,status of neonate delivery by elective ceserian section.Brit J Anesthesia,2008;54:1015-10

18. Dyer RA, Els I, Farbas J, Torr GJ, Schoeman LK, James MF. Prospective, randomized trial comparing general with spinal anesthesia for cesarean delivery in preeclamptic patients with a non- reassuring fetal heart trace. Anesthesiology. 2003; 99:561-569.

19. Loghis C, Salamalekis E, PanayotopoulosN, Vitoratos N, Zourlas Pa (1997)effect of early second stage bradycardia on newborn status.Eur J ObstetGynecolReprodBiol72:149-152.

20. American Academy of Pediatrics, American Heart Association. Textbook of neonatal resuscitation.4th. ed. Elk Grove Village, American Academy of Pediatrics, 2000