

**ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
DEPARTEMENT OF ANESTHESIA**



SCHOOL OF GRADUATE STUDY

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.

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Abstract

Introduction: The Apgar score is a practical method of systematically assessing newborn baby immediately after birth to identify those requiring resuscitation and to predict survival in neonatal period. In spite of the growing number of newborns that are delivered via Cesarean section, the decrease in Apgar score of babies delivered under cesarean has become one of the concerning issues.

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. Training was given for data collectors and supervisors. Regular supervision and follow up was made. Data was entered into Epi info version 7 computer software by investigators and was transported to SPSS version 20 computer program for analysis. Bivariate and multivariate analysis was used to identify factors associated with Apgar score.

Result: A total of 86 study subjects were included. Majority of baby had low Apgar score at one minute and high Apgar score at five 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 ≥ 7 at one minute. It had been found that those neonates who were born under general anesthesia were three folds more likely to have low Apgar score than those who born under spinal anesthesia (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. Therefore, the use of spinal anesthesia was recommended.

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List of acronyms and abbreviations

AAU	Addis Ababa University
BMI	Body Mass Index
CS	Cesarean Section
FMOH	Federal Ministry of Health
GMH	Gandhi Memorial Hospital
NVD	Normal Vaginal Delivery
NGO	Non-Governmental Organization
RHB	Regional Health Bureau
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization
ZHB	Zonal Health Bureau
ZMH	Zewiditu Memorial Hospital

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Chapter: 1 introduction

1.1 Background

Child birth is one of the most amazing and beautiful phenomena in the world. Passing the embryonic phase and entering into life in the world outside of the womb is accompanied by serious and quick physiologic changes. That is why the newborn needs to be evaluated right after birth [1]. If childbirth via Normal Vaginal Delivery (NVD) is not safe for mother and the child, Cesarean surgery seems necessary. Cesarean section can be performed under general or regional anesthesia [2].

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 at birth [3, 4]. It is performed one and five minutes after delivery. 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].

Five factors are used to evaluate the baby's condition and each factor is scored on a scale of 0 to 2, with 2 being the best score for each: Activity, muscle tone, Pulse, Grimace response, Appearance and Respiration. Scores obtainable are between 0- 10, with 10 is highest possible score. There are many factors that affect Apgar score including false positive and false negative score [7].

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].

1.2 Statement of problem

The rate of cesarean section has been increasing worldwide. It exceeds 24% in USA, Canada and Greece [6]. According to WHO's 2009 survey, the rate of caesarean section in Africa was 8.8%, which ranges from 1.1% in Angola to 18% in democratic republic of Congo [8][7]. A study conducted in Nigeria from 1990-2005; has shown that caesarean section (C/S) for emergency cases has increased from 11.3%- 20.9% and for elective cases the rate increased from 1.2 to 6.2% [9].

In the last 30 years, the rate of Cesarean section has considerably grown in both developed and developing countries and become one of the most common surgeries which takes place all over the world. So, regarding the growing number of newborns that are delivered via Cesarean section, one of the concerning issues is the decrease in Apgar score of babies delivered under cesarean which is directly related to increasing rate of death in these children[10.11].

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.[13,14] 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. [20].

According to the study conducted in Persia, one of most common the influential factors on low Apgar score of the child is the type of anesthesia administered.[12] The choice of anesthesia for caesarean section depends upon indication for operation, its urgency, patient and obstetricians preferences and skill of anesthetist [15].

In India, the comparison between two groups of patients, one received general anesthesia and other spinal anesthesia found that no significant difference was seen in the mean 1 ± minute Apgar scores in the two groups; however, more neonates of the general anesthesia group

appeared depressed soon after birth, needing free flow of oxygen and bag and mask ventilation. [16]

In a study conducted in Gondar University Hospital, there was a significant difference in the mean 1 ± minute Apgar scores in the two groups while there was no a significant difference in Apgar scores at five minute.[55] Low birth weight (birth weight <2.5 kg) and type of anesthesia administered were positive predictor of low Apgar score. [17]

Although general anesthesia is considered much safer and is still the method of choice in certain situations like urgency of surgery, drugs required for general anesthesia are multiple, most of the drugs affect the baby in two ways: by direct effect from placental drug transfer and by indirect effect resulting from maternal physiological and biochemical changes, which appear to be much more important. They may produce systemic effects in the baby like low Apgar score and sedation [21-23].

On other hand, 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 anesthesia administered. In absence of hypotension there is no change in Apgar scores or acid base status with prolonged induction to delivery interval with spinal anesthesia.[18,19] However, in general anesthesia, many workers have recommended that delivery is best completed 6-8minutes after induction of general anesthesia as it could cause neonatal depression by transferring through the placenta [36, 37].

Spinal anesthesia is not free from side effects and has its own complications like maternal hypotension, fetal cardiac decelerations and post-operative headache [24]. But, it is relatively easy to perform, gives excellent anesthesia with a low potential of toxicity and allows mother to be awake and interact with baby immediately after the birth. [25]

Thus, this study is aimed to assess neonatal asphyxia as evidenced by low Apgar score among babies delivered by cesarean section under spinal and general anesthesia by evaluating Apgar score of neonate after birth at the first and fifth minute.

1.3 Justification of the study

Birth asphyxia as evidenced by low Apgar score is common among babies born by caesarean section due to added to stress of anesthesia and associated complications. The question posed regarding the effect of general versus regional anesthesia on neonatal Apgar scores has been studied in developed countries by many investigators over the years, most commonly retrospectively and in the setting of elective cases. [16] Some have shown no difference in Apgar scores between the two groups. Some have reported lower Apgar scores and worse outcomes with the use of general anesthesia. [17] As the world is dynamic, there has been change in change type of administered for caesarian over a time. Therefore, it is very important to identify current practice of type of administered and its effects on Apgar score so that the health care provider choose the safest type of anesthesia for caesarian sections

Although Millennium Development Goal MDG aimed at reducing child mortality by two third between 1990 and 2015, it was failed to address child mortality as compared to decline in maternal mortality so that this study can provide feedback to target lied down by Millennium Development Goal.

In our countries, there have been very limited studies conducted on maternal and neonatal outcome. Even those limited studies failed to address factors associated with poor neonatal outcome. There has no published evidence on the same topic in the same area so that it can be used as a source of information for further researchers and a sole input to the literature.

This study is also helpful for program planners and policy makers so as to devise different strategies which help to improve neonatal outcome.

Chapter 2. Literature review

Different studies suggested that obstetric anesthesia requires special skills because two lives are involved. Although most patients undergoing caesarean section are young and healthy, they represent a high risk group of patients. Neither general anesthesia nor spinal anesthesia is ideal for caesarean section because each has advantage and risk to both mother and fetus [26- 29].

A study conducted on effects of spinal and general anesthesia on neonatal and maternal outcome showed that regional anesthesia has become the preferred technique because general anesthesia associated with higher maternal mortality and fetal depression [30]. However, no technique is ideal for caesarean sections as both general and spinal anesthesia have certain advantages and disadvantages, therefore opinion remain divided whether regional block offers any real advantage over general anesthesia to both mother and baby during elective section delivery [31].

A large population studies in Great Britain and in the United States have shown that regional anesthesia for caesarean section is associated with less maternal morbidity and mortality than general anesthesia, whereas death associated with regional anesthesia are generally related to excessively high neural blockade or local anesthetic toxicity.

Death associated with general anesthesia is generally related to airway problem, such as inability to intubate, inability to ventilate or aspiration pneumonitis [30]. But, in another Study done on effect spinal versus general anesthesia over Apgar score showed that there was no significant difference between the effects of general anesthesia and spinal anesthesia on Apgar score of neonates at 5 minutes interval, born after full term elective caesarean section of healthy patients. Present anesthetic techniques; however limit the dose of intravenous agents such that fetal depression is usually not clinically significant with general anesthesia and recommended that spinal anesthesia is safe for caesarean section of healthy patients [32].

A comparative study done on two groups of patients; one received general anesthesia and other spinal anesthesia and found that no significant difference was seen in the mean 1 minute Apgar scores in the two groups; however more neonates of the general anesthesia group appeared depressed soon after birth, needing free flow of oxygen and bag and mask ventilation. There are different opinions about the ideal time at which the fetus should be delivered after induction of anesthesia [35].

On the other hand a similar study conducted in California indicated that the Neonates delivered with general anesthesia had scored significantly lower on some of the test items than neonates delivered by spinal anesthesia at one minute after delivery [32].

According to the findings of study done on the effects of general versus spinal anesthesia over Apgar score, long skin incision to delivery time more than 8 minutes and uterine-incision-to-delivery time more than 180 seconds have been associated with fetal hypoxia and acidosis regardless of the type of anesthesia[38].

The study conducted at Abbasi Shaved hospital Karachi found that Apgar score of neonate at 01 and 05 minutes was significantly high in those women who received spinal anesthesia in the present study as compared to those who received general anesthesia. [39] But, another study found that no differences between different anesthetic regimens. Comparison of satisfactory Apgar score at one minute was also observed high in spinal group 78(97.5%) as compared to general anesthesia group 60(75%) neonates. Unsatisfactory Apgar score was observed in 20(25%) neonates in general anesthesia group as compared to 2(2.5%) of the neonates who received spinal anesthesia [40].

Similar findings were also reported by the study conducted on short term neonatal outcome that the first minute Apgar score of neonates in the spinal Anesthesia group was better than general anesthesia group, but there was no statistical Significant difference in 5th Apgar score and umbilical artery biochemical values between two groups, although fetal acidosis was a little higher in the spinal anesthesia group, it was not statistically significant ($\text{pH} = 7.27 \pm 0.13$ vs. 7.21 ± 0.13). Besides, in those infants whose mothers had cesarean section under spinal anesthesia, first and fifth minute Apgar scores were higher than those who underwent general anesthesia and the difference was significant [41].

A study conducted to compare maternal and neonatal outcome between spinal and general anesthesia groups on Apgar score showed that newborns of mothers who underwent spinal anesthesia had significantly better Apgar scores and lower NICU admission than babies from general anesthesia [42].

Another study showed that the 1st and 5th Apgar scores of neonates delivered from general anesthesia were lower than neonates delivered from mothers underwent elective cesarean section with regional anesthesia including epidural and they concluded that general anesthesia, rather than asphyxia or aortocaval compression, is responsible for most of the depressed neonates delivered by cesarean section [43].

Some studies showed that regional anesthesia decreased uterine blood flow in placenta and thus impaired fetal acidic-base condition even in an existence of a normal placental store [44- 46]. The review conducted in Uganda teaching hospital from 1998- 2000 showed that the prevalence of Low Apgar score was 20 % [47].

Another study conducted in Nigeria Lagos in 2010 also reported a low Apgar score 5 of 40% [48]. The higher incidence 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.[55]

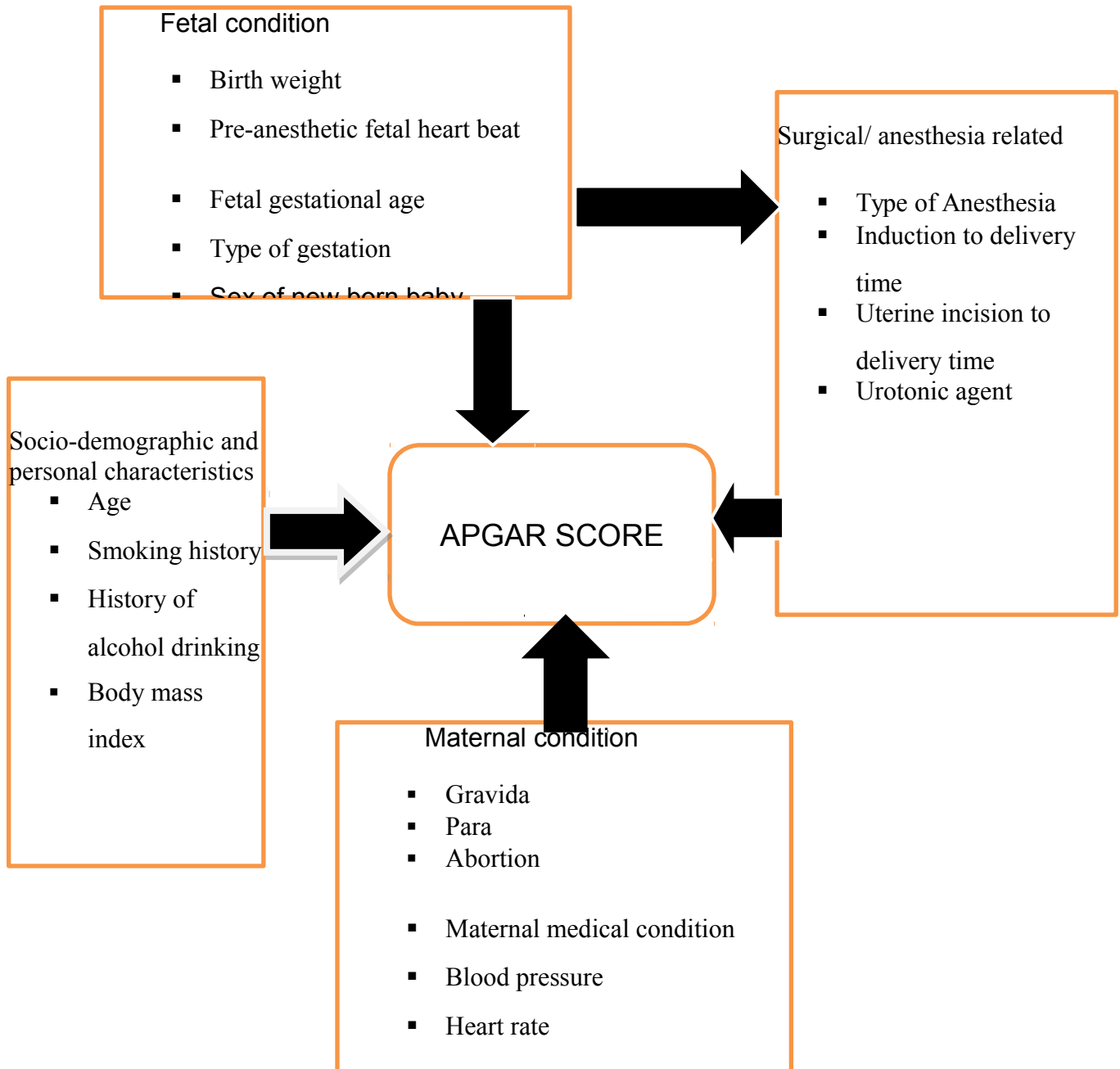
Low Apgar score 5 was associated with type of anesthesia, accordingly neonates born under general anesthesia showed significant lowering of Apgar 5, as compared with neonates born under spinal anesthesia. This finding is consistent with a randomized controlled study conducted in Turkey among mothers that delivered under general anesthesia and spinal anesthesia [50].

Low birth weight (birth weight <2.5 kg) was found to be associated with low Apgar score. This is in-line with a retrospective study among 601 neonates in Denmark, where neonates with low birth weight had low Apgar score 5, as compared with those with birth weight \geq 2.5 kg [51].

Another factor showed that association with Apgar score 5 was pre anesthetic fetal heart rate. Babies with pre anesthetic fetal heart rate of greater than 160 beat per minute have better Apgar score 5 as compared to babies with pre anesthetic fetal heart rate of 120-160 beat per minute and

less than 120 beat per minute. This is in contrast with the finding of a study conducted in Greece that concluded as there is no association between pre-anesthetic fetal heart rate and Apgar score [52].

Conceptual Framework



Chapter 3. Objective

3.1 General 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.

3.2 Specific Objective

1. To compare the effects of general and spinal anesthesia over Apgar score of newborns delivered by cesarean sections
2. To determine factors associated with Apgar score among newborns delivered by cesarean sections

Chapter 4. Method and Materials

4.1 Study area and period. The study was conducted at Gandhi Memorial Hospital which is located in capital city of Ethiopia, Addis Ababa. It was established in 1958 G.C when it was called the only maternity hospital in Ethiopia. The hospital was named as Gandhi Memorial Hospital for the memory of Mohatema Gandhi. It is one of the thirteen governmental hospitals found Addis Ababa and one of the hospitals which was administered by Addis Ababa Health Bureau. The Hospital primarily gives services for women and children. The Hospital provides Gynecologic, Obstetric and reproductive health services including Mother and Child Health (MCH), infertility and sexual violence services. Currently, it is providing inpatient, outpatient services and emergency cases. In October 2016, the hospital established a neonatal unit and currently serves as inpatient unit for at least 120 neonates per month. The hospital has 110 beds and delivers 25 neonates each day. The hospital has four operation theatre and average number of caesarian deliveries done at the hospital is eight to ten per day. Study was conducted from January to March 2016.

4.2 Study design. Comparative cross sectional study design was employed

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

4.4 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

4.5 Sample size determination and sampling technique

4.5.1 Sample size determination

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, sample size was calculated using double population proportion formula.

Sample size=
$$Z_{\alpha} \sqrt{\left(1 + \frac{1}{w}\right) p^{\hat{c}} (1 - p^{\hat{c}})} + Z_{\beta} \sqrt{\frac{p_1(1-p_1)}{w} + p_2(1-p_2)} \hat{c}^2$$

- **Z α** =Standard normal variate for level of significance
- **W**=Number of spinal per General anesthesia
- **Z β** =Standard normal variate for power or type 2 error as explained
- **P1**=probability of events who take Spinal Anesthesia 20 %[47]
- **P2**=probability of events who take General Anesthesia 40 %[48]

$$p^{\hat{c}} = \frac{p_2 + \phi p_1}{w + 1}$$

According to previous studies magnitude of low Apgar score in general anesthesia case 40% and in spinal Anesthesia cases is 20% hence sample size calculation for 5% of significant level and 80% power with equal number of General and spinal Anesthesia was

$$\frac{\left[1.96 \sqrt{\left(1 + \frac{1}{1}\right) 0.3(1-0.3)} + 0.84 \sqrt{\frac{0.4(1-0.4)}{1} + 0.2(1-0.2)} \right]^2}{(0.4 - 0.2)^2} = 43$$

So, the result was 43 samples in each group.

3. 5. 2 sampling technique

Study participants was selected using systematic random sampling technique. Depending upon average number of the caesarian deliveries in the last two month (N=480) and sample size (n=86), the value for sampling interval K_{th} was calculated as. $K_{th}=N/n=480/86=5$. A random number 2 was chosen and then every 5th new study subject was included.

4.6 Study variables

Dependent variable: Apgar score

Independent variables:

- **Personal and Socio demographic characteristics:** Age, Marital status, Educational level, Occupation, Income etc.
- **Type of Anesthesia administered:** General and Spinal Anesthesia
- **Obstetric related:** Gestational age, fetal heart rate, birth weight, gestational age, gravidity, parity
- **Maternal medical condition:** Liver, heart or kidney failure associated with pregnancy and metabolic disorder like diabetes Mellitus, hypertension, thyrotoxicosis,
- **Surgical/ anesthesia related:** Type of Anesthesia, induction to incision time, type of agent/s administer, duration of incision to delivery time.
- **Maternal resuscitation utilities:** Uterotonic drugs, fluid, oxygen and vasopressors

4.7 Data collection tools and procedure

- Data was collected using pretested structured questionnaires 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. Apgar score was done as per the protocol of neonatal advanced life support advocated by the American pediatric association (APA).

APGAR Score	0	1	2
Heart rate	Absent	>100	>100
Respiratory effort	Absent	Irregular	Good
Reflex irritability	No response	Reflex irritability	Cough/ sneeze
Appearance (color)	Blue or pale	Body pink with blue extremities	Completely pink
Muscle tone	Flaccid	Good tone	Spontaneous flexion

Apgar score scaling based on neonatal advanced life support advocated by the American pediatric association (APA). [10]

4.8 Data Quality Assurance

Data were collected using structured questionnaire, address the objective of the study, and was adopted from the literature of study conducted at Gondar University Hospital and Abbasi Hospital and Karachi Medical College. Then, it was modified and used in the present study. The 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 was made on 10% of sample size.

4.9 Data Analyzing and processing

The data was entered on 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.

4.10 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.

4.11 Operational Definition

Age: Age of pregnant mother who gave birth to newborn baby

Educational level: Educational level of pregnant mother who gave birth to newborn baby

Body mass index: body mass index of pregnant mother who gave birth to newborn baby

Gravida: Number pregnancy experienced

Abortion: Number abortion done for pregnant mother

Para: Number of all live birth in all pregnancy experience

Blood pressure: Blood pressure of pregnant mother

Heart rate: Heart rate of pregnant mother before anesthetic agent administered

Type of Anesthesia: type of anesthesia administered for cesarean delivery

Birth weight: Birth weight of the fetus

Preanesthetic fetal heart rate: the rate of feeling pulsations at the base of the umbilical cord or by listening to the precordium of the new born baby with a stethoscope.

Fetal gestational age: gestational age of the fetus at the time of delivery

Gestational type: gestational type of the fetus during current pregnancy.

Induction to delivery time: Time taken from administration of anesthetic agent to delivery of fetus.

Uterine incision to delivery time: Time taken from uterine incision to delivery of fetus.

Urotonic agent: the drug used after delivery of baby for uterine contraction

Caesarian section: An intentional incision made on an intact uterus to delivery fetus.

New born: It refers specifically to the infant in the first minutes to hours after birth.

Neonate: It refers generally defined as an infant during the first 28 days of life. Infancy includes the neonatal period and extends through 12 months of age.

Respiration: After initial respiratory efforts, the newly born infant should be able to establish regular respirations sufficient to improve color and maintain a heart rate >100 bpm.

Color: An uncompromised newly born infant will be able to maintain a pink color of the mucous membranes without supplemental oxygen.

Satisfactory or high Apgar score: Apgar Scores of 7 or above

Unsatisfactory Apgar score or low Apgar score: Apgar Scores below 7

Chapter 5: 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 Of 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 characteristics of pregnant mothers of newborns delivered by cesarean sections under general and spinal anesthesia from January to March 2016 at Gandhi Memorial Hospital.

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. Most of them had normal blood pressure both before and after anesthetic agents was administered. About 27 of 86 mothers had developed hypotension after administration of anesthetic agents. (See graph.1)

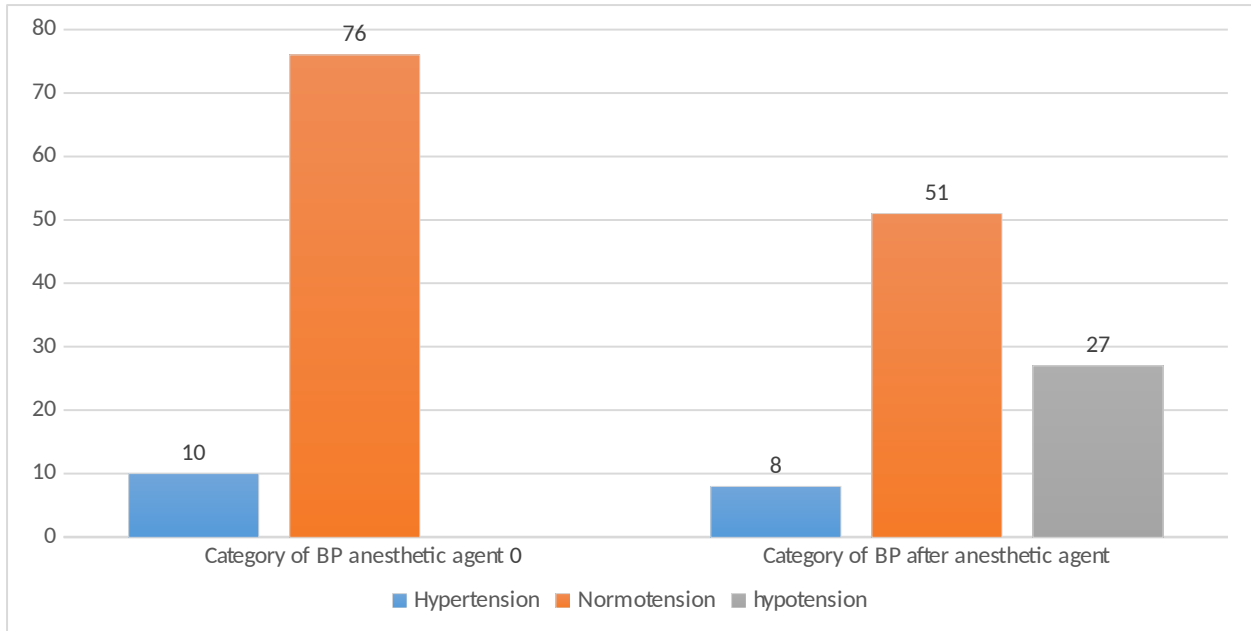


Figure 1. Blood pressure status of pregnant mothers of newborns delivered by cesarean sections under general and spinal anesthesia from January to March 2016 at Gandhi Memorial Hospital.

Almost all of pregnant mothers had single gestation and only five of them had multiple gestations. 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. Only 10 of all

pregnant mothers had hypertension induced by pregnancy while the other had no obstetric related medical problem and most of them gave birth on an emergency basis.(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	8.12
	Missing	2	2.38
	Total	86	100
Types of gestation	Single	81	94.2
	Multiple gestation	5	5.8
	Total	86	100
Maternal medical condition	Hypertension	10	11.62
	Normal	76	88.38
	Total	86	100
Type of C/S	Emergency	65	75.6
	Elective	21	24.4

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

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. Generally, comparing Apgar of new born baby at one minute to five minute, Apgar score of more than seven was increased from 64 to 77 while there was a decrease in number of Apgar score less than seven from 22 to 9 see (figure2)

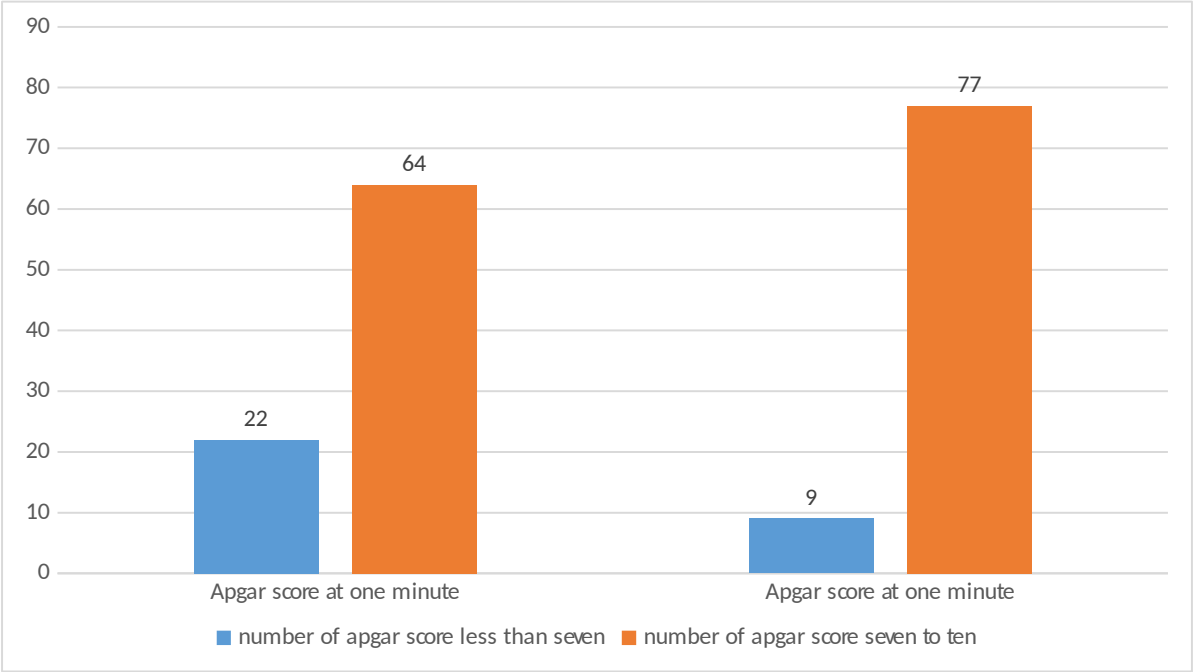


Figure 2. Apgar score difference at one and five minute among newborns delivered by cesarean sections under general and spinal anesthesia from January to March 2016 at Gandhi Memorial Hospital.

Of all pregnant mothers 64(74 %) took oxytocin alone for uterine contraction while 16 (19 %) took ergometrine alone and six (7%) took both ergometrine and oxytocin. But, none of them had received any urotonic agents during the preoperative phase. (See Fig.2)

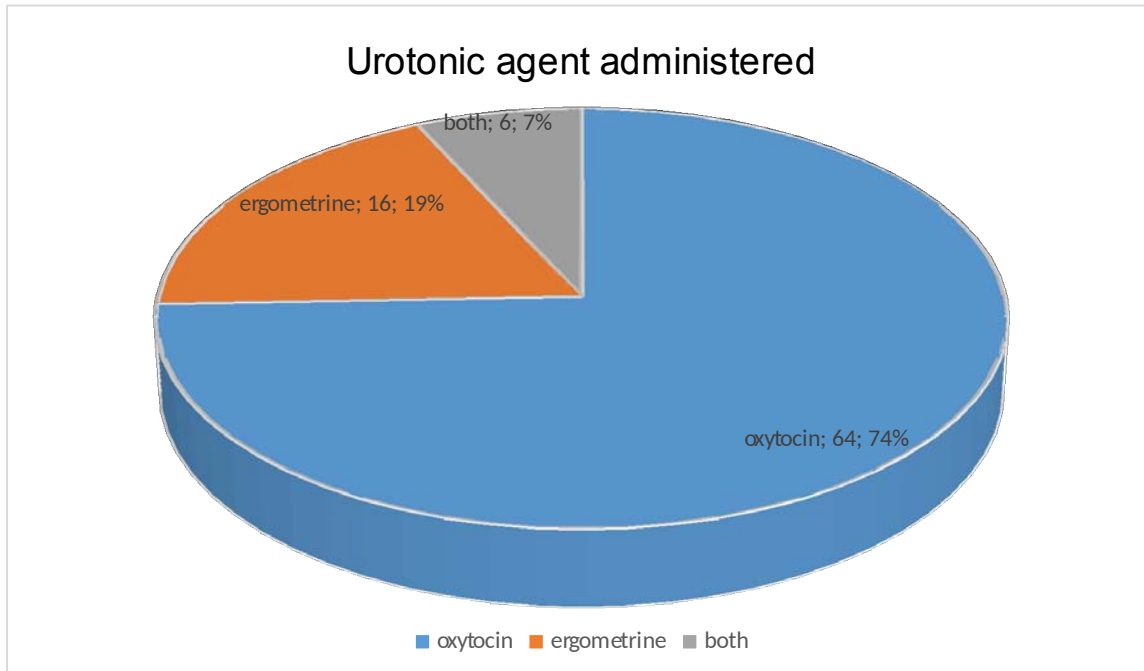


Table 3. Urotonic agents used for resuscitation of pregnant mothers of newborns delivered by cesarean sections under general and spinal anesthesia from January to March 2016 at Gandhi Memorial Hospital

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 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. Overall, of the two group of population, the one who was delivered under spinal anesthesia had a better Apgar score than those who was delivered under general Anesthesia both at one and five minute post-delivery.(table 3)

Variable	Category	Apgar score at one minute			Apgar score at five-minute		
		Seven than ten	Less than seven	Total	Less than seven	Seven to ten	Total
Anesthesia type	Spinal	36	7	43	4	39	43
	General	28	15	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.

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 incision 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
	High score	Low score			
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

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 gestation 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
	High score	Low score			
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)	3.477 (9.033 16.94).
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 newborns delivered by cesarean sections under general and spinal anesthesia from January to March 2016 at Gandhi Memorial Hospital

Chapter 6: 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. []

Majority of the pregnant mothers gave birth by caesarean section were found between age group 25 to 29 of whom the mean age was $26.98 \pm SD (4.267)$, (minimum 20 and maximum 36). 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% [47]. 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.[55]

The review of this study also revealed that majority of new born babies had better Apgar score both at one and five minute regardless of type of anaesthesia administered. Comparisons of the Apgar score of new-born delivered by caesarean section under general and spinal anaesthesia at one minute have demonstrated that new born who delivered under spinal anaesthesia had a better Apgar score which is consistent with other similar studies. [49,48]. This is in contrast with the finding of another study reported as no statistically significant difference in Apgar scores between the two groups at 1 minute, however more neonates of the general anaesthesia group appeared depressed soon after birth, needing free flow of oxygen and bag and mask ventilation[40].

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. It is also found that there was almost equivalent Apgar score after resuscitation at five minute between the two groups with a slight higher proportion of better score under spinal anaesthesia. Similar findings were also reported by the similar study conducted in Gondar University Hospital. [55]. 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. [64] 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. [65, 66]

Similar to the current study, a large retrospective review on the effects of general and regional anesthesia in infants delivered by elective and non-elective cesarean section showed that when controlled for confounding factors, general anesthesia was associated with lower Apgar scores at 1 and 5 minutes and with greater requirements for intubation and artificial ventilation. [57, 58]

In line with other study [61] low birth weight (birth weight <2.5 kg) was found to be associated with low Apgar score at one minute and uterine incision to delivery time [59,60] had association with Apgar score both at one and five minute post-delivery. A data from multivariate analysis also showed that babies born when uterine incision to delivery time was above three minute was four and three times more likely to have low Apgar score at one and five minute respectively. This study also found that, only 3.5 % of all babies born when uterine incision to delivery time was below three minute has a low Apgar score which is almost consistent with other similar finding [59] of which only 4% of neonates born within 3 minutes of uterine incision had low Apgar score.

A review of different literatures indicated that there are different opinions about the ideal time at which the foetus should be delivered after induction of anaesthesia. Many workers have recommended that delivery is best completed 6-8 minutes after induction of general anaesthesia as inhalational agents could cause neonatal depression by diffusion through the placenta. [62, 63]. It was also 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 [61]. 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 foetal well-being. [66]

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.[63] 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 when compared to 9 of them had high Apgar score.

Chapter 7: Conclusion and Recommendation

7.1 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.

7.2 Recommendation

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

- Obstetrician should limit the duration of uterine incision to delivery time below 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 below 6 minutes.
- Researcher should conduct further research's using a better indicator of neonatal asphyxia, like Arterial Blood Gas analysis.

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Annexe –III Assurance of principal investigator

I the undersigned agrees to accept responsibility for the scientific ethical and technical Conduct of the research project and for provision of required progress reports as Per terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this application.

Name of the principal investigator:

Date. December 2 17 ,2016 Signature _____

Name of the advisor:

Date. December 2 17 ,2016 Signature _____

Annexe-IV Information sheet

Hello.

My name is _____ . I

am a researcher and I have been attending postgraduate program in the field of Anesthesia at Addisababa university. I am going to conduct research on **the effects of general versus spinal anesthesia over Apgar score of newborns delivered by elective cesarean sections and factors associated with Apgar score from January to March s2016 at Gandhi Memorial Hospital,**

The information going to be obtained will help the government and other responsible bodies to improve neonatal out come. Your participation is very valuable for the success of this project.

Also be mindful that whatever we will get here is for research purposes only and the information will not be used by any other person apart from this research and therefore,confidentiality cannot be guaranteed. However, your names will not be mentioned or be attached to anything that you say.

Do you want to continue yes----- No------(Thank you in advance for your help!)

Name and contact address of investigators

Mohammed Suleiman Email msuleiman43@yahoo.com Cell phone +251-924-33-31-99

Identification card no. -----

Part I: Personal and socio demographic characteristics

			Skip pattern	Remark
101	Age	-----		
102	Pregnancy state	Gravida----- Abortion----- Para-----		
103	Ethnicity	Amhara-----1 Oromo-----2 Gurage -----3 Tigray-----4 Others-----5		
104	Occupation	-----		
105	Address	Urban-----1 Rural-----2		
106	Education level	University-----1 College-----2 High school-----3 Intermediate school-----4 Primary school-----5 No (illiterate)-----6 Other(please specify)-----7		
107	Smoking	Smoker-----1 Non-smoker-----2		
108	Alcohol drinking	Alcohol drinker-----1 Non- Alcohol drinker-----2		

Part II. Factors affecting apgar score of new born baby

Maternal and fetal condition			Skip pattern	Remark
701	Gestational age(in weeks)	-----		
702	Types of gestation	Single-----1 Multiple gestation-----2		
703	Maternal medical condition	Hypertension-----1 Rénale disease-----2 Diabetes mellitus-----3 Previous history of PIH-----4 Other (specify)-----5		
704	Maternal Vital sign before anesthetic administered	BP-----1 SPO2-----2 HR-----3 BMI-----4		
705	Maternal Vital sign after anesthetic administered	BP-----1 SPO2-----2 HR-----3 BMI-----4		
706	Pre-anesthetic fetal heart beat	-----		
707	Apgar score	At 1 minute-----1 After resuscitation at 5min-----2		
708	Sex of the New born baby	Male-----1 Female-----2		
709	Birth weight	Less than 1.5kg-----1		

		1.5 to 2.5kg-----2 2.5 to 4kg-----3 More than 4kg-----4		
710	Type of anesthesia	Spinal-----1 General-----2		
711	Skin incision to delivery time			
712	Uterine incision to delivery time			
712	Uterotonic drugs administered,	Oxytocin-----1 Ergometrine-----2 Other (please specify)-----3		
713	Route of drug administration	-----		
714	Type of fluid administered for preloading	-----		
715	Amount of preloading			
716	Prophylactic vasopressor	Yes-----1 No-----2		
717	If yes identify	-----		

Name of data collector-----signature-----date-----

Name of supervisor-----signature-----date-----