

## ORIGINAL ARTICLE

## SPINAL ANESTHESIA FOR CESAREAN DELIVERY AT TWO TEACHING HOSPITALS IN ADDIS ABABA, ETHIOPIA

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## ABSTRACT

**Introduction:** Either regional or general anesthesia is an acceptable approach to providing anesthesia for cesarean delivery. However, regional anesthesia is the widely preferred option considering its multiple benefits. The aim of this study was to assess the prevalence of spinal anesthesia use, attitude of mothers towards spinal anesthesia, and magnitude of its complications.

**Methods:** This is a hospital-based cross-sectional study conducted from April-June 2014 at Tikur Anbessa Specialized Hospital and Gandhi Memorial Hospital, Addis Ababa, Ethiopia. Data was collected using a pre-tested questionnaire and analyzed using SPSS version 21 statistical software.

**Result:** During the study period, there were 1,713 deliveries, with overall cesarean section delivery prevalence of 32.5%. The overall proportion of cesarean delivery with spinal anesthesia was 68.2%. Only two mothers were given spinal anesthesia in left lateral position. The experience of the anesthetist was the only factor significantly associated with the occurrence of hypotension in a multivariable analysis. Postdural puncture headache after cesarean section with spinal anesthesia was reported in 34.2% of the cases. After the operation, 90.3% of the mothers were happy with the type of anesthesia administration.

**Conclusion:** The rate of spinal anesthesia for cesarean delivery in this study is significantly lower than reports from the developed as well as sub-saharan countries implying a need to increase use of this procedure to achieve the recommended 90-95% target and avail epidural anesthesia as an option for those in need. The current practice in administering spinal anesthesia needs to be revised to minimize such side effects.

**Keywords:** Regional anesthesia, Cesarean delivery, Lidocaine, Bupivacaine.

## INTRODUCTION

Caesarean section (C/S) refers to the procedure where a baby is delivered through an incision on the abdominal wall (laparotomy) and uterine wall (hysterotomy) of the mother. There has been an increasing trend in the C/S delivery rate in the last few decades not just in developed countries but also in developing countries. Nowadays cesarean section accounts for 32% of deliveries in the USA and 25.2% in Singapore (1,2). According to WHO's 2009 survey, the rate of caesarean section in Africa was 8.8%, which ranged from 1.1% in Angola to 18% in the Democratic Republic of Congo (3). Local studies done at Tikur Anbessa Specialized Hospital (TASH) in Addis Ababa (Abebaw YA, 2013 unpublished) and Gondar Hospital in Gondar reported C/S delivery rates of 30.5% and 27%, respectively (4).

Either regional (epidural or spinal) or general anesthesia (GA) is an acceptable approach to providing anesthesia for cesarean delivery (5). Both regional anesthesia (RA)

and GA for C/S have advantages and disadvantages (6). GA is a more quickly administered procedure and is often preferred in cases where speed is important (7). The risks, however, include the aspiration of stomach contents, failed intubations, and respiratory problems for both mother and baby (7). A recent review examining anesthesia-related maternal deaths from 1991 to 2002 noted maternal mortality rates of 16.8 per million in 1991-96 for general anesthesia, which then decreased to 6.5 per million in 1997-2002. Regional anesthesia mortality rates remained lower (i.e. 2.5 per million in 1991-96 and 3.8 per million in 1997-2002) (8).

Owing to the established advantages of RA, there has been a move towards more C/S being performed using this technique (9,10). The use of GA has fallen dramatically and it now accounts only for about five percent of cesarean deliveries in the United States and United Kingdom (9,11,12). The Royal College of Anaesthetists in the United Kingdom has proposed that more than 95% of elective caesarean deliveries and more than 85% of emergency caesarean deliveries should be performed using RA techniques (13). The types of regional anesthesia in C/S, spinal (subarachnoid) and epidural (extradural) anesthesia,

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involve the infiltration of a local anesthetic agent (usually bupivacaine) into the surroundings of the spinal cord.

Compared to epidural anesthesia, placement of a spinal anesthetic is technically easier. It is more rapid in onset and more reliable in providing surgical anesthesia with a failure rate of 1% (14). Potential adverse effects common to both include maternal hypotension, post-dural puncture headache (PDPH), vomiting, itching and transient backache over the injection site. The American College of Obstetrics & Gynecology (ACOG) and U.S Academic Center reported hypotension in 25-67% and 24% of patients, respectively (15,16). A study from the University of Gondar showed 8.3% (8/97) of patients operated under spinal anesthesia (SA) developed hypotension (4).

According to the ACOG report, post dural puncture headache (PDPH) occurred in 1.5-3% while in another study from UK it was seen in 1% of patients (15,17). A large-scale study has shown regional block failure of 1.7% requiring GA and shifts to GA for specific single shot SA in 1.2-1.4% (18).

SA has been used since 1898 and is becoming more common. Currently, in the sub-Saharan Africa, 80-90% of the C/S are currently performed under SA (1). Data on regional anesthesia use for C/S in Ethiopia is very limited and the use of SA for C/S appears to be low compared to the practice in many other countries as well as the international recommendations. The reported use of SA technique for C/S by local study done at Gondar Hospital reported was only 34% (4). In addition, there is no adequate information on the quality of RA use in our setting. The purpose of this study was to assess the hospital prevalence of SA use, attitude of mothers towards spinal anesthesia, and associated complications.

## MATERIALS AND METHODS

This is a hospital based cross-sectional study conducted from April-June 2014 at TASH and Gandhi Memorial Hospital (GMH), Addis Ababa, Ethiopia. These hospitals are affiliated with the Department of Gynecology and Obstetrics, School of Medicine, Addis Ababa University (AAU). About 8,000 mothers deliver every year in the two hospitals with about a quarter of them delivering by C/S.

The sample size (n=380) was calculated with a single population proportion formula using a local study prevalence (p=34%) for SA during cesarean delivery. All women who delivered by C/S with SA in the two study hospitals during the study period were included in the current study. Data was collected by trained health professionals using a pretested questionnaire and supervised by the principal investigator. It was done through face to face interview and follow-up telephone interview of the study participants. In addition, medical records and Hospital registers were reviewed for further information.

The data was coded, cleaned and analyzed using Statistical Package for Social Sciences (SPSS) version 21. Bivariate regression analysis was employed to test for association between the independent variables (age, marital status, occupation, ethnicity, religion, parity, Gestational Age (GA), indication for C/S, type of C/S, type of SA, if preloaded with IV fluid, time interval between anesthesia and skin incision, operator status and experience of the anesthetist) and complications during the procedure (vomiting during C/S, development of hypotension, PDPH, chronic backache and need for GA. Variables having p-value  $\leq 0.2$  in the bivariate analyses were used for multivariable logistic regression to control the confounding effect. Odds ratio with their 95% confidence intervals were computed to identify the strength of association, and statistical significance was declared if  $p < 0.05$ .

Ethical clearance was obtained from the Research & Publication Committee (RPC) of the Department of Gynecology and Obstetrics, and IRB of the College of Health Sciences, AAU. Permission was also obtained from the study Hospitals to conduct the research. In addition, informed consent was obtained from each study participant.

## RESULTS

During the study period, there were 1,713 deliveries, of which 557 (32.5%) were delivered by C/S. A total of 380 mothers who delivered by C/S with spinal anesthesia were included in the current study. Fifty four of the mothers, however, were non respondent to telephone communication for follow up interview done six weeks after the operation. Among the 557 women who gave birth by C/S, 380 (68.2%) delivered by SA. The mean (SD) age of the 380 study participants was 28 ( $\pm 4.8$ ) years. The majority, 244 (64.2%), of them were in the age group 25-34. The majority, 363 (95%) were married, 353 (93%) were Orthodox Christian, 205 (54%) were from the Amhara ethnic group, and 246 (64.8%) had completed primary school or higher levels of education. Nearly half, 182 (48%), of the participant mothers were primiparous, while only 5 (1.4%) were para-V or more (Table 1).

Table 1: Socio-demographic characteristics of mothers who delivered by cesarean section with spinal anesthesia at two hospitals, Addis Ababa, Ethiopia, April- June 2014

Characteristics	Number (N=380)	Percent
Age in years		
15-19	21	5.5
20-24	67	17.6
25-29	155	40.8
30-34	89	23.4
>34	48	12.6
Marital status		
Married	363	95.5
Single	17	4.5
Religion		
Orthodox	284	74.7
Muslim	59	15.5
Protestant	36	9.5
Others	1	0.3
Ethnicity		
Amhara	205	53.9
Oromo	72	18.9
Guragae and Silti	77	20.3
Others	26	6.9
Education		
Primary Education or above	330	86.8
Not educated	50	13.2
Parity		
1	182	47.9
2-5	193	50.8
>5	5	1.3

As shown in Table 2 below; majority of the C/S deliveries, 254 (66.8%), were at term. Non-reassuring fetal heart rate pattern (NRFHRP) and previous C/S scar with X-factor were the most common indications for the C/S deliveries each accounting for 29%. The majority of the C/S deliveries, 313 (82.4%), were done on an emergency basis. Lidocaine (5%) was used as the anesthetic agent in 296 (78%) of SA cases, while Bupivacaine-5% was used in the remaining (22%). None of the cases were given prophylactic epinephrine or opioids intra-operatively. About two-third, 241(63.4%) of the mothers, were pre-loaded with crystalloids. Only two of the mothers were given SA in left lateral position.

The time interval between anesthesia and skin incision was  $\geq 5$  minutes in 273 (71.8%) of the cases. The majority of the cesarean deliveries, 237(62%), were done by Year 2 residents while only 9 (2.4%) of the C/S were done by senior Obstetricians. SA was done by anesthetists with work experience of four years and less in 253 (66.5%) of the cases.

Table 2: Obstetric characteristics of mothers who delivered by caesarean section with spinal anesthesia at two hospitals, Addis Ababa, Ethiopia, April- June 2014.

Characteristics	Number (N=380)	Percent
Gestational Age (GA)		
Pre-term	26	6.8
Term	254	66.8
Post-term	47	12.4
Unknown LMP	53	13.9
Indication for C/S		
NRFHB	112	29.5
Previous C/S	111	29.2
Cephalo-Pelvic Disproportion (CPD)	42	11.1
NRBPP with unfavorable Bishop score	29	7.6
Malpresentation	32	8.4
Multiple pregnancy	30	7.9
Others	24	6.3
Type of C/S		
Emergency	313	82.4
Elective	67	17.6
Spinal anesthesia type		
Bupivacaine (5%)	84	22.1
Lidocaine (5%)	296	77.9
Preloaded with IV Fluid		
Yes	241	63.4
No	139	36.6
Time interval between anesthesia and skin incision		
≤ 2 minutes	28	7.4
3 minutes	34	8.9
4 minutes	45	11.8
≥5 minutes	273	71.8
Operator status		
Year-II resident	237	62.4
Year-III resident	113	29.7
Year-IV resident	21	5.5
Consultant/senior	9	2.4
Anesthetist experience		
1 Year	59	15.5
2 Years	75	19.7
3 Years	60	15.8
4 Years	59	15.5
5 Years	39	10.3
>5 Years	88	23.2

Hypotension during the procedure occurred in 139 (36.6%) of the cases. PDPH after C/S with SA was reported in 130 (34.2%) of the cases. Vomiting was experienced by 109 (28.7%) of the mothers during and immediately after the surgery. General anesthesia was initiated 30 minutes after the SA in 13(3.4%) mothers, while 7 (1.8%) required intubation. The large majority, 361(95%), of the newborns had APGAR score of 7 and above at delivery and 72 (18.9%) of them were admitted to neonatal ICU.

Only 24(6.3%) of the mothers were counseled on the choice of anesthesia while the remaining were just given information about what was going to be done. After the operation, 343(90.3%) of the mothers were happy with the mode of anesthesia administration and expressed SA to be their preference in the future. Six weeks after the operation 326 mothers were communicated by telephone (the rest 54 mothers were not reachable), of which 40 (12.3%) complained of persistent or recurrent back pain that was not there prior the SA injection.

The odds of having vomiting during C/S with lidocaine injection was about two times that of vomiting with bupivacaine (OR 1.9 (95% CI: 1.1-3.5)). There was no statistically significant difference in the odds ratios of the two drugs used for SA and the other complications like PDPH, chronic backache and the need for GA.

Fluid preload didn't show any statistically significant effect on the occurrence of hypotension (Table 3). The type of SA had significant association with the development of hypotension in bivariate analysis, but the association was lost in multivariable analysis. Experience of the anesthetist was the only factor which had significant association with the development of hypotension ( $P < 0.001$ ). The occurrence of hypotension during surgery decreased as the experience of anesthetist increases ( $P < 0.001$ ). The odds of developing hypotension during the procedure was more than three times higher when the SA was given by the anesthetist with experience of only one year compared to those with more than five years of experience (AOR 3.27 (95% CI: 1.54-6.97)).

Table 3: Factors associated with occurrence of hypotension among women delivered by caesarean section with spinal anesthesia at two hospitals, Addis Ababa, Ethiopia, April- June 2014

Characteristics	No of women		Prevalence of hypotension (%)	P-value	OR for presence of hypotension	
	With hypotension	Without hypotension			COR (95% CI)	AOR (95% CI)
<b>Type of SA</b>				<b>0.001*</b>		
Bupivacaine (5%)	44	40	52.4		0.430 (0.26-0.70)	0.64 (0.32-1.30)
Lidocaine(5%)	95	201	32.1		1	1
<b>Anesthetist experience</b>				<b>&lt;0.001*</b>		
1 Year	15	44	25.4		3.86 (1.88-7.95)	3.274 (1.54-6.97)
2 Years	19	56	25.3		3.88 (1.99-7.58)	3.308 (1.64-6.66)
3 Years	18	42	30.0		3.07 (1.532-6.15)	2.707 (1.32-5.54)
4 Years	18	41	30.5		3.007 (1.49-6.01)	2.591 (1.24-5.43)
5 Years	19	20	48.7		1.39 (0.65-2.95)	1.860 (0.76-4.57)
>5 Years	50	38	56.8		1	1
<b>Time interval between anesthesia and skin incision</b>						
≤ 2 minutes	11	17	39.3	<b>0.162</b>	0.85 (0.38-1.89)	1.01 (0.44-2.35)
3 minutes	18	16	52.9		0.49 (0.24-1.00)	0.779 (0.36-1.68)
4 minutes	13	32	28.9		1.35 (0.68-2.71)	1.433 (0.70-2.95)
≥5 minutes	97	176	35.5		1	1

\*P-value <0.05,

## DISCUSSION

The proportion of delivery by C/S has increased dramatically in developed and developing countries alike in the past few decades. Considering the multiple benefits, RA is the widely preferred option (9,11,12). In our study, C/S accounts for 32% of all deliveries. This finding is comparable to reports of a previous local study from Gondar (28%) as well as developed countries like the U.S (32%) (4,19). The use of SA for C/S identified in our study (68.2%) is significantly lower than reports from the developed countries and what has been reported by WHO for sub-Saharan countries, which is in the order 80-90%(3). It was, however, much higher than the proportion (34.1%) reported from Gondar Hospital (4).

Maternal hypotension is a recognized complication of spinal anesthesia, which may compromise the welfare of both the mother and the fetus (20). Techniques to prevent maternal hypotension include intravascular volume expansion using IV fluid ("preload") immediately before spinal injection, use of left lateral tilt or manual uterine displacement, or both (21,22). In the current study, however, only two mothers were given SA in a left lateral position, not in line with the recommendations. This could be due to lack of awareness and experience by the managing team and needs to be addressed.

Methods commonly used to prevent hypotension, in addition to fluid preloading and positioning to relieve aortic caval compression, include the use of hyperbaric bupivacaine and vasopressor therapy (23). In our study, however, vasopressors were not used and fluid preloading was provided only to about two-third of the mothers. In addition, hypotension was reported in 61% of the cases and there was no significant association between fluid preloading and incidence of hypotension. This incidence of hypotension is much higher than prior reports from Gondar (8.3%), ACOG (45%) and US Academic Center (24%) (1,2,24). This possibly is due to the difference in the definition of hypotension, amount and type of IV fluid used, and drugs used. Although contrary to the expectation and most prior reports, the loss of association between fluid preloading and hypotension is in agreement with few prior studies (25).

Dural puncture can lead to cerebrospinal fluid (CSF) loss with resultant intracranial hypotension, compensatory vasodilatation and headache (PDPH). The larger the size of the needle puncturing the dura, the greater the CSF loss, and incidence of a headache. The incidence of PDPH (34.2%) is significantly higher than the report by ACOG and a UK study which were 1.5-3% and 1%, respectively (15,17). This may be related to the experience of the anesthetists in administering spinal anesthesia where multiple attempts are made.

Failure of spinal anesthesia requiring supplemental analgesia or outright conversion to general anesthesia sometimes occurs. The incidence of failed spinal anesthesia for C/S necessitating conversion to general anesthesia in this study was 1.8%. This is much lower compared to the conversion rate of 6% from a Nigerian study (26). It is, however, comparable to the 1.7% conversion rate reported from developed settings and the Maternal Fetal Medicine Unit Network, which showed SA failure rate of 1.7% (14).

Nausea and vomiting during regional anesthesia for C/S are very common. They cause significant discomfort to the patient and also interfere with the surgical procedure. They have multiple etiologies, which include hypotension, vagal hyperactivity, visceral pain, IV opioid supplementation, uterotonic agents, and motion. In this study, vomiting was experienced in 28.7% of the cases. This is comparable to many prior reports, which ranged from 7% to 42% (27).

Measuring patient satisfaction is not easy as it is subjective and complex involving physical, emotional, mental, social, and cultural factors (28). Asking patients what they think about the care and treatment they have received is one of the ways and an important step towards improving the quality of care. Most (90.3%) of the mothers who delivered by C/S with spinal anesthesia in this study expressed their overall happiness with the mode of anesthesia. This is comparable to some prior reports (29).

**Limitations of the study:** The study was conducted in patients sampled from two hospitals in Addis Ababa, though these are referral facilities. Thus, the results of the study may not be generalizable to the national setting.

**Conclusion:** The rate of C/S delivery with spinal anesthesia in this study is significantly lower than what has been reported from the sub-Saharan countries as well as those from the developed settings. There is a need to increase the use of C/S to achieve the recommended 90-95% target and also avail epidural anesthesia as an option for those in need. PDPH and hypotension were high in our study compared to reports from previous studies. The experience of the anesthetist was the only factor statistically significantly associated with the occurrence of hypotension. Therefore, there is a need to look into the current practice and make adjustments in administering spinal anesthesia to minimize such side effects. Studies based on representative sample are recommended to assess the practice at the national level and identify factors associated with side effects identified in this study.

## ACKNOWLEDGMENT

The Authors are thankful to the patients and staffs of the Department of Obstetrics and Gynecology at Addis Ababa University.

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