Original Research Article

Incidence of failed subarachnoid block in patients undergoing caesarean section

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Abstract

Background: The narrowest, and perhaps most specific, definition of a failed spinal blockade was developed by Praxedes and Filho (2010). Neuraxialanaesthesia is the commonest, safest, and most logical choice of anaesthesia for caesarean section. Prevention of injection of wrong drug is of utmost importance. Apart from failure, wrong drug injection can cause maternal mortality (e.g., tranexamic acid.). Such errors are unpardonable and must be avoided by double checking of drugs before injection, use of prefilled syringes, and use of luer-lock connection. **Objectives:** To determine the incidence of failed subarachnoid block in patients undergoing caesarean section and to identify the contributory factors to the failure. **Methods:** The study was conducted on 1000parturientsundergoing caesarean section under single-shot spinal anaesthesia. Study women underwent either elective or emergency caesarean section with ASA II-III. 25 or 26 G Quincke type short beveled spinal needle was used. After confirmation of free-clear flow cerebrospinal fluid was confirmed the volume 0.5% hyperbaric bupivacaine decided by one attending anesthetist was injected slowly into intrathecal space. **Results:** Majority of patients were below 35 years (86; 86%).32% had previous caesearean section and 68% patients belong either to primigravidae or had no surgical intervention in previous deliveries. Out of 1000 patients, 4% parturients had a history of failed spinal anaesthesia. The incidence of failed spinal was 19%, highest in L3-L4 interspace, followed by 1% in L4-L5 interspace. Among the anaesthetists, the incidence of failed spinal anaesthesia was observed higher when junior resident performed the lumbar puncture as compared to certified anaesthetists. **Conclusion:** Greater prevention efforts by anaesthesia professional to avoid spinal anaesthesia failure will most likely lead to an improvement in failure rates. A decrease in failure rates can greatly improve the safety, care, and outcomes for the parturient and fetus.

Keywords: Neuraxialanaesthesia, spinal anaesthesia, primigravidae, lumbar puncture.

Introduction

When literature discusses or uses the terms "failed spinal anaesthesia," "failed spinal blockade," or "spinal block failure," they can simply imply that the spinal anaesthesia was attempted, but that no block resulted. However, another common definition of these terms occurs when some form of sensory and/or motor block results, but is inadequate for the proposed surgery and requires need for further anaesthesia whether general, regional, or supplemental. A recent review of the literature produced varying definitions of failed spinal anaesthesia. The narrowest, and perhaps most specific, definition of a failed spinal blockade was developed by Praxedes and Filho (2010)[1].

Neuraxialanaesthesia is the commonest, safest, and most logical choice of anaesthesia for caesarean section. The Saving Mothers Report[2], which assessed the deaths of 92 parturients in South Africa, between 2008 and 2010, revealed that 73 (79%) patients died due to complications of spinal anaesthesia. Out of these, 10 deaths were related to the complications of a subsequent general anaesthesia administered when spinal anaesthesia proved inadequate for surgery. As there are very limited options to approach the failure, utmost vigilance is warranted while performing spinal anaesthesia to minimise both failure rate as well as maternal or foetal complications. With careful performance of technique, a failure rate as low as 1% is attainable though various studies have quoted failure rate up to 17%[3,4].

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Prevention of injection of wrong drug is of utmost importance. Apart from failure, wrong drug injection can cause maternal mortality (e.g., tranexamic acid.)[5]. Such errors are unpardonable and must be avoided by double checking of drugs before injection, use of prefilled syringes, and use of luer-lock connection[6].

The efficacy and potency of the drug can get altered by various factors such as prolonged exposure to sunlight, excessive dilution of the drug, chemical incompatibility after mixing with other drugs, or altered pKa due to interaction with the alkaline CSF. In such conditions, even if the entire drug reaches the nerves, the desired action may not be obtained. Mixing of two drugs may cause precipitation or lowering of the pH altering the movement of local anaesthetics across the neuronal membrane. Local anaesthetic resistance due to mutation of sodium channel has been reported as a cause of ineffective drug action in few patients[7].

Formal testing of the block prior to commencement of surgery is the key to success. The level of the block must be checked bilaterally and documented properly on the anaesthesia chart without fail. There is no consensus as to the best practice about checking the block. However, three modalities like, sensation of cold (ice cubes or ethyl chloride spray), light touch (cotton swab), and loss of motor power are used commonly[8]. Use of pinprick method is not recommended. It must be understood that adequate level of the block does NOT guarantee its quality. Although level of block needed for abolishing somatic pain during caesarean section is T10 dermatome, a block as high as T4 is required to abolish visceral pain and discomfort[9,10]. Cold sensation felt at T4 or lower, light touch sensation felt at T8 or lower, and poor motor block in lower extremities after 10 minutes are causes of concern about adequacy of the block.

Objectives

The aims and objectives of this study were to determine:

1. To determine the incidence of failed subarachnoid block in patients undergoing caesarean section.
2. To identify the contributory factors to the failure.

Methodology

After obtaining the ethical clearance from the Institutional Ethical committee, the present study was conducted in the Department of Anaesthesia and Critical Care, LallaDed Hospital, an associated hospital of Government Medical College, Srinagar.Women undergoing caesarean section with ASA II and III were recruited for the study. The study was conducted on 1000parturientsundergoing caesarean section under single-shot spinal anaesthesia at LallaDed Hospital from November 2018 to July 2020. The sample size was calculated by using single population proportion taking 5% margins of error. After ethical clearance was obtained from ethical review committee, a standard questionnaire consisting of the sociodemographic factors, obstetrics related conditions, aesthesia related factors and surgery related factors was used to collect data. Written and verbal informed consent was obtained from each study participant after clear explanation of merits and demerits of the study. All blockages were performed by using bupivacaine without addition of any adjuvants. Women operated under combined spinal and epidural anaesthesia were excluded from the study. Study women underwent either elective or emergency caesarean section with ASA II-III. 25 or 26 G Quincke type short beveled spinal needle was used. After confirmation of free-clear flow cerebrospinal fluid was confirmed the volume 0.5% hyperbaric bupivacaine decided by one attending anesthetist was injected slowly into intrathecal space.

The women were placed in the supine position with wedge under right buttock. The sensory block height was determined by the loss of cold sensation using methylated spirit swab. The main outcome measure was the incidence of failed spinal anaesthesia (defined as partial or incomplete spinal block requiring repetition, supplementary to the block or conversion to general anaesthesia) after waiting 15-20 min. The Secondary outcome measures include factors contributing for failed spinal anaesthesia.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 21.0 (SPSS Inc., Chicago, Illinois, USA). Then binary and multivariate analyses were conducted to control the confounders and the risk factors associated with failed spinal anaesthesia. P-value of <0.05 in the multivariate analysis was considered as statistically significant**.**

Results

The mean age was 29.1 ± 5.65 years with the range from 19 to 39 years. Maximum number of cases were seen between the age group of 25-35 years (65; 65 %), followed by <25 years (21; 21%). Majority of patients were below 35 years (86; 86%).32% had previous caesearean section and 68% patients belong either to primigravidae or had no surgical intervention in previous deliveries. Out of 1000 patients, 4% parturients had a history of failed spinal anaesthesia. Maximum number of failed spinal anaesthesia were seen in age group of 25-35 years. Only 20 patients (14.3%) showed spinal anaesthesia failure in age group above 35 years. The incidence of failed spinal was 19%, highest in L3-L4 interspace, followed by 1% in L4-L5 interspace. The incidence of failed spinal was higher when more than one attempts were practiced after first failed attempt. Among the indications for caesarean section, the maximum incidence of failed spinal was seen in parturients with fetal distress. Among the anaesthetists, the incidence of failed spinal anaesthesia was observed higher when junior resident performed the lumbar puncture as compared to certified anaesthetists. The number of patients with failed spinal with caesarean section done by resident obstetricians was higher than failed spinal anaesthetics in patients operated by senior obstetricians. The causes of failed spinal anaesthesia are multifactorial and more than one cause may be responsible for a failed spinal anaesthesia.None of the patients had complications during the study.

Table 1: Age, BMI, ASA and Parity of Participants

		No. of patients(n)	Percentage (%)
Age (years)	<25	210	21
	25-35	650	65
	>35	140	14
BMI (kg/m^2)	<25	440	44
	25-30	400	40
	>30	160	16
ASA Score	II	860	86
	>II	140	14
Parity	Nulliparous	360	36
	Multiparous	640	64

Table 2: Obstetric history in parturients

Parameter	Category	No. of patients (%)
Previous caesarean section	Yes	320 (32)
	No	680 (68)
Previous spontaneous birth	Yes	320 (32)
	No	680 (68)
History of failed spinal	Yes	40 (4)
	No	960 (96)

Table 3: Determinants of failed spinal anaesthesia during caesarean section

Parameter	Category	Incidence of failed spinal (%)	p-value
Age (years)	<25	60 (6)	0.15
	25-35	120 (12)	
	>35	20 (2)	
BMI (Kg/m^2)	<25	100 (10)	0.70
	25-30	70 (7)	
	>30	30 (3)	

Site of lumbar puncture	L3-L4	190 (19)	0.79
	L4-L5	10 (1)	
Number of spinal attempts	1	80 (8)	0.35
	>1	120(12)	
Previous caesarean-section	Yes	60 (6)	0.79
	No	140 (14)	
Previous failed spinal	Yes	10 (1)	0.98
	No	190 (19)	

Discussion

In our study, the incidence of the failed spinal anaesthesia was 20% with majority of failures in emergency caesarean section (26.2%) and in case of elective caesarean section, the incidence was seen in 10.2% of parturients. This is high compared to the conversion rates of less than 1% for electives and less than 3% for non-elective Caesarean section suggested by the Royal College of Anaesthetists[11] and other reports from developed nations[3,12]. The results of our study fall towards the upperrange (5-17%) of previous studies reported in South Africa, Nigeria, UK and Singapore[3,13,14]. The incidence of failed spinal anaesthesiain our study was similar to that of study by Ashagrie HE et al (2019)[15], wherein the incidence of failed spinal aneasthesia was 19.5%.

The failure rate of spinal anaesthesia was significantly highest in those women with pre term gestational age (14 %) as compared to those with term pregnancy (4%), and the incidence of failed spinal was least seen in post-dated parturients (2%). These results were consistent with the findings in USA (Adesope OA et al[16]) where the failure rate decreases as gestational age increase. The global increase in intra-abdominal pressure with increased gestational age might increase intrathecal drug spread during pregnancy and better effects of centrineuraxial block.

Our study showed that the parturients operated as emergency cases were more likely to have failed spinal anaesthesia (p=0.03), which is in agreement with Fettes PD et al (2009)[17]. In emergency situations, patients are usually in labor and they might move while injecting the drug that results in needle movement and deposition of the local anesthetics in incorrect space. Also, in our hospital set up, surgeons rush to operate early in category-I emergency situations and start skin pinching for checking the level of block before time, thereby adding to the anxiety and sometimes start incision before adequate blockage.

In our study, there was no statistical significance in failure rate among obese and non-obese respondents (p-value = 0.70). Compared to a study done by Hood DD and Dewan DM (2020)[18] that revealed regional anaesthesia being feasible but there was initial high failure rate that required replacement of epidural catheter among the obese patients. Likewise, in a study by Tonidandil A et al (2014)[19] there was no statistical significance in the obese and non-obese patients who underwent conversion.

In our study, the incidence of failed spinal among caesarean section done due to maternal reasons was 6%, compared to 13% among caesarean section done due to fetal reasons. This was statistically significant (p-value = 0.028). This finding was similar to a study done by Harberg C et al. (2001)[20].

The parturients with comorbidities such as hypertension, myoma, diabetes, hypothyroidism and respiratory diseases (14% with comorbidities) had higher incidence of failure. This was consistent with the findings of Fettes PD et al. (2009)[17], that revealed higher incidence of failed spinal for caesarean section in parturients with comorbidities. This finding could be explained due to pre-existed chronic pain or the patient might be anxious and complaining more due to intra-abdominal stimuli that may result in afferent impulses in unblocked parasympathetic and phrenic nerve fibers. The level of competence of anaesthetist was a significant risk factor (p = 0.017) for failure of the spinal anaesthesia in the present study. The number of failed spinals via trainee anaesthesiologists was 16% as compared to 4% via certified anaesthetists. This observational finding was consistent with many other studies, including the study by De Filho G (2002)[21], wherein the predictors of successful neuraxial block identified was the level of competence of the attending anesthetist as an independent determinant of a successful neuraxial block. While observing the relation of needle gauge with incidence of failure, our observation was that the incidence of failure rate was significantly higher (p= 0.005) with spinal needles of higher Gauge i.e. 26 and very less with 25 G needles, and this finding was consistent with study of Imbelloni LE et al (1995)[22], Parikh KS and Seetaramiah S et al (2018)[23] and Alabi et al (2017)[24] where they concluded that the failed spinal rates are higher with needles of gauge > 25.

Uterine exteriorization, surgical complications, finding of myomas on exploration and postpartum sterilization were identified risk factors for supplemental intra-operative analgesic in our study. Similar observations were picked up by Sng BL et al (2009)[4], who noted that postpartum sterilization was a significant risk factor for partial failure necessitating intra-operative supplemental analgesics. They opined that this may be attributable to the additional surgical manipulation including exteriorization of the uterus required for postpartum sterilization which is performed after the baby is delivered and the block is already receding.

Conclusion

Spinal anaesthesia is considered the anesthetic of choice for caesarean section. While it does have an excellent safety profile, it remains essential for anaesthesia professionals to promptly recognize risk factors and manage associated problems related to spinal anaesthesia failure. Awareness of these risk factors provide the anaesthesia professional a better opportunity to develop and implement strategies to minimize these failure risks and problems. Greater prevention efforts by anaesthesia professional to avoid spinal anaesthesia failure will most likely lead to an improvement in failure rates. A decrease in failure rates can greatly improve the safety, care, and outcomes for the parturient and fetus.

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