

## A Retrospective Study to Evaluate the Incidence and Factors Influencing Failed Spinal Anaesthesia in Women Undergoing Caesarean Section

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## Abstract

## Original Research Article

Spinal anaesthesia has emerged as the preferred anaesthesia technique for caesarean sections in last few decades due to lesser number of complications and ease of administration compared to general or epidural anaesthesia. However failed spinal anaesthesia causes a huge physiological & psychological impact on the patient. In this study we aimed at finding the incidence of failed spinal anaesthesia along with the factors that may influence the occurrences of failure in patients undergoing caesarean section. A retrospective analysis was done for all the caesarean sections performed under spinal anaesthesia in our institute from January 2019 to June 2020. Patient & anaesthetic procedure related factors influencing the failure rate were analysed statistically. The incidence of failed spinal anaesthesia was 4.5% of which 0.7 % were documented as total failure & 3.7% as inadequate block. Failure rate was higher in emergency caesarean section, in patients with BMI  $\geq 25$  and having active labour pain (p-value  $< 0.05$ ). Spinal injection in lateral position and procedure done by anaesthesia trainee had a statistically significant higher failure rate. A proper positioning of patients in active labour and those with high body mass index along with extra serenity and alertness during emergency procedure is expected to reduce the failure rate. A better understanding and knowledge about the patient and procedure related factors influencing the block height, duration and quality of spinal anaesthesia amongst the trainee would improve the overall success rate.

**Keywords:** Failed spinal anaesthesia, Body mass index, Patient position, Caesarean section, Trainee, Active labour.**Copyright @ 2020:** This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited

## INTRODUCTION

Due to more advanced ways of monitoring foetal and maternal wellbeing along with increased patient preferences, the rate of both elective and emergency caesarean sections have increased globally in recent years [1]. At the same time, the choice of spinal anaesthesia for caesarean section has gained popularity over general anaesthesia (GA) as the complications related to airway arising due to upper airway oedema, enlarged breasts, weight gain during pregnancy is avoided. Also, most of the patients have delayed gastric emptying, gravid uterus causing diaphragmatic push and progesterone effect relaxing the lower gastro-oesophageal junction increasing the chances of aspiration [2]. Compared to epidural anaesthesia spinal anaesthesia can be administered quickly and also the technique is easy to learn. Though the overall incidence of failed and inadequate anaesthesia could be far less than 2% and 1% respectively in experienced hands, different studies in different countries quoted different

incidences and factors contributing to failed spinal anaesthesia [3, 4]. In addition to adverse physiological impact, failed spinal anaesthesia may cause extreme anxiety, pain, emotional stress and discomfort for the patient. Severe pain, anxiety, fear, stress arising out of inadequate block may lead to vasovagal syncope or asystole especially when uterine exteriorization or manipulation is tried [5]. Delay in administration of anaesthesia due to failed procedure during emergency, complications associated with GA may influence both maternal & foetal outcomes. The consequences of inadequate or total failed spinal anaesthesia and reporting of variable failure rate in different studies necessitated this retrospective analysis to find out the incidence and factors affecting failed spinal anaesthesia in our institute to further reduce its occurrences.

## MATERIALS & METHOD

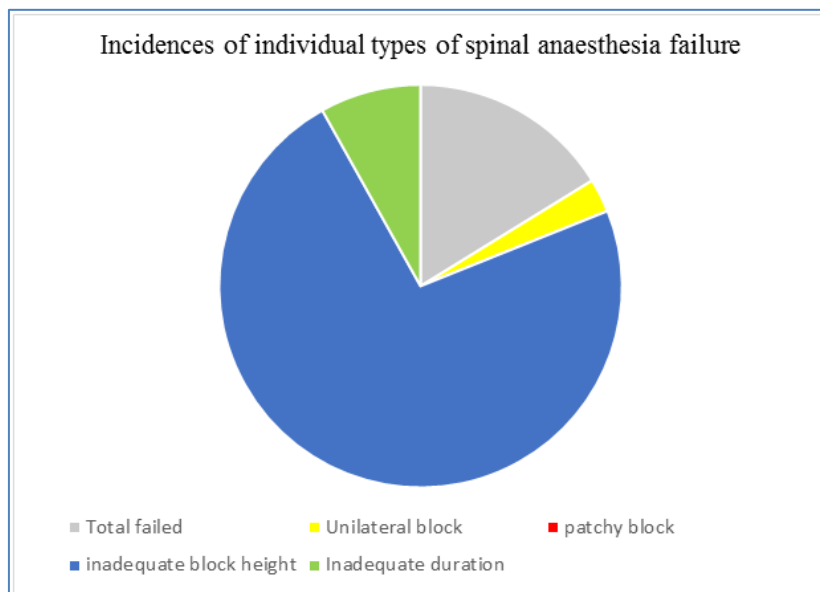
A retrospective analysis of all the caesarean sections performed as either emergency or elective procedure under spinal anaesthesia was done between

January 2019 to June 2020 from the records available in medical records department of our institute. We analysed all the cases which documented a failure of spinal anaesthesia during caesarean section and described as total failure or no block, inadequate block height, inadequate duration of anaesthesia, patchy block, unilateral block. Cases have been documented as total failed spinal or no block if there is no sensory or motor blockade after 20 minutes of drug injection requiring repeat spinal injection or conversion to GA. Inadequate block height, patchy block, unilateral block, inadequate duration of block (lasting less than 60 minutes) requiring repeat spinal, GA, supplement of inhalational nitrous oxide and oxygen, injection ketamine, fentanyl alone or in combination were also considered as failed spinal anaesthesia. Demographic parameters like age, weight, height, body mass index, gestational age, history of previous spinal anaesthesia of all the patients were collected. Incidence of failed spinal anaesthesia was measured and all the procedure related factors likely to influence the spread, duration & quality of block were analysed. SPS software 22 was used for statistical analysis. P-value <0.05 was considered statistically significant.

**RESULTS**

According to the data collected we found some uniformity in practice amongst all anaesthesiologists in

the institute like all the procedures were done using hyperbaric injection of bupivacaine heavy (0.5%) without any adjuvants and Quincke’s spinal needle was used in most cases. Pencil point needle was used only in three cases with one incident of inadequate block height. In none of the cases, failed spinal anaesthesia was found to affect the immediate maternal or foetal outcome. Out of 947 caesarean sections performed during the study period, 814 were done under spinal anaesthesia. The incidence of failed spinal anaesthesia was 4.5% (37 of 814 caesarean sections). Six cases of no block or total failure, 27 cases of inadequate block height, one case of unilateral block and three cases of inadequate duration were documented (figure 1). Twenty-three cases required conversion to GA, ten cases were managed by a repeat spinal anaesthesia while four cases were managed with supplemental analgesia, injection ketamine, fentanyl, nitrous-oxygen inhalation either alone or in combination. Patient factors like BMI ≥25, patient in active labour and emergency caesarean section were associated with higher failure rate of spinal anaesthesia (p-value <0.05). Injecting drug in lateral position, procedure done by anaesthesia trainee were significantly associated with failure of spinal anaesthesia (p-value of 0.003, 0.02 respectively). Influence of drug volume, size of spinal needle, intervertebral level of injection didn’t show any influence on failure of spinal anaesthesia (Table 1).



**Fig-1: Types of spinal anaesthesia failure**

**Table-1: Comparison of various parameters**

Parameters compared	Incidence of failure (%)	P-value	
Age (years)	<35	27 (5.5%)	0.12
	≥35	10 (3.0%)	
BMI	<25	19(3.1%)	0.003
	≥25	18(8.3%)	
Past history of spinal anaesthesia	Yes	15(4.8%)	0.86
	No	22(4.3%)	
Type of Surgery	Elective	6 (2.1%)	0.02
	Emergency	22 (5.7%)	
Active labour	Yes	11 (9.1%)	0.01
	No	25 (3.6%)	
Gestational age	37 to 42 weeks	29 (4.0%)	0.66
	< 37 weeks	6 (7.5%)	
	≥42 weeks	2 (1.2%)	
Comorbidity	Yes	5 (4.7%)	0.80
	No	32(4.5%)	
Anaesthetist designation	Trainee	21(7.2%)	0.02
	Senior Residents	15(3.0%)	
	Consultant	1(2.4%)	
Patient position	Lateral	35(5.7%)	0.003
	Sitting	2 (0.9%)	
Needle size	25 G	36 (4.6%)	1.0
	23 G	1(3.0%)	
Drug volume(ml)	<2.2	15(4.1%)	0.73
	≥ 2.2	22(4.8%)	
Intervertebral space	L <sub>2-3</sub>	2(3.2%)	0.88
	L <sub>3-4</sub>	28(4.6%)	
	L <sub>4-5</sub>	7(4.4%)	

## DISCUSSION

The discussion of failed spinal anaesthesia will not be complete without mentioning Gaston Labat, one of the pioneers of regional anaesthesia who quoted “Two conditions are, absolutely necessary to produce spinal anaesthesia; puncture of the dura mater and subarachnoid injection of an anaesthetic agent.” Failed spinal anaesthesia may be in the form of total or no block, inadequate height of block, unilateral block, and patchy block, short duration of spinal anaesthesia or early regression of block height [6]. The different incidences of failure rate in different studies could be due to the unique institutional practices, patient factors & experience of anaesthetist. In our study the incidence of total failed spinal or no block (0.7%) was much lesser than the incidence of inadequate block (3.8%). Ashagrie *et al.* found a very high incidence of failed subarachnoid block (19.5%) [7]. Sng *et al.* documented 0.5% cases of total spinal failure or no block requiring GA. They found that 4.1% needed injection fentanyl & 0.9% required entonox inhalation intraoperatively for analgesia [3].

We found that in two cases block height had decreased to T9 dermatomal level or below after 15-25 minutes of spinal drug injection and both of them developed asystole during uterine manipulation following complaints of discomfort and pain. However, in both the cases reversal was immediate and complete

with injection atropine and discontinuation of manipulation. Usually such episodes are self-limited and well compensated by sympathetic activity. However under spinal anaesthesia, compensatory sympathetic activity is blocked. Additionally, peritoneal stretch and subsequent infundibulo-pelvic ligament stretch during uterine manipulation causes afferent nerve stimulation ultimately leading to vasovagal attack and cardiovascular collapse [5].

Emergency cases had higher failure rate (5.7%) especially those with indications of foetal distress which may be attributed to the efforts to quicken up the procedure and sometimes surgeons putting an early incision before adequate block is achieved. Overweight patients (BMI ≥25) had increased rate of failure which may be due to technical difficulty in locating the space. A similar finding was described in the study conducted by Manuel *et al.* [8]. High failure rate seen in patients having labour pain is usually because of the difficulty in positioning and movements of patient during drug injection. Lateral position may cause difficulty in identifying intervertebral space leading to higher chances of failure as in our study. Inglis A *et al.* found a longer time to injection in lateral position, but contrary to our findings there was no difference in failure rate [9]. Patient co-operation along with the experience of

assistant holding the patient in lateral position may also influence the successful outcome.

In one case we noted unilateral block up to T12 dermatomal level 15-20 minutes following spinal injection, on repeat injection block extended up to unilateral T6 level necessitating conversion to GA. Such cases of unilateral block may be explained by the presence of ligaments or barriers within theca causing unilateral spread of drug. Failure rate was not affected by the use of different doses of hyperbaric bupivacaine (0.5%). Proper selection of dose based on patient's height and weight along with proper table and patient position helps attain adequate block height. Ashagrie *et al.* emphasised that the fear of spinal induced hypotension amongst obstetric anaesthetists as the reason behind the use of low volume of intrathecal drug leading to higher failure rate in his study [7]. Procedure performed by anaesthesia trainee had slightly higher incidence of failure compared to senior residents and consultants. Experience of the performer plays a major role in predicting the failure of subarachnoid block due to better understanding of the factors affecting spread, duration and quality of spinal anaesthesia along-with prior experience, confidence gained over long period of practice helping them in better handling of emergency situations. Pencil point needle was used only in three cases and one incident of inadequate block height was documented. Slight posterior displacement of pencil point spinal needle during injection or syringe attachment may occur allowing the dura to bridge the opening causing a flap valve effect leading to deposition of some amount of drug outside subarachnoid space making the block ineffective. Other factors that could not be evaluated but may play a role in predicting failure are loose attachment between needle hub and syringe, CSF quality and flow. In rare cases presence of arachnoid cyst may give false impression of CSF flow [10].

## CONCLUSION

Failure of spinal anaesthesia is multifactorial. Proper positioning of the patient for better identification of intervertebral space especially in those who are overweight, in active labour or requiring emergency

caesarean section may significantly reduce the failure rate. A better understanding and knowledge about the patient and procedure related factors influencing the block height, duration and quality of spinal anaesthesia amongst the trainee would improve the overall success rate.

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