Original Research Article

Conversion of regional to general anaesthesia for caesarean section - A one-year prospective observational study

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Abstract

Background: General anaesthesia for caesarean delivery is associated with substantially greater maternal risk than regional anaesthesia. Most of the deaths occurring during general anaesthesia are related to airway management or aspiration. Spinal and epidural anaesthesia have therefore become more common in obstetric surgical practice. **Objectives:** A one year prospective observational study of caesarean sections (CS) carried out under regional anaesthesia was analysed to know the 1. Incidence and characteristics of failed regional anaesthesia leading to conversion of regional to general anaesthesia (Total/Partial "Failure" of block) in CS. 2. Identification of risk factors for "block failure "3. To identify the options used for managing an inadequate block. **Methods:** The present study was conducted in Anaesthesia Department of Panna Dhai Women Hospital attached to R.N.T. Medical College from 1st Feb. 2011 to 31st Jan.2012. Regional anaesthesia technique for CS included spinal (most common), epidural and combined spinal epidural (CSE) technique. **Results:** Incidence of failed spinal anaesthesia was 77/4038 (1.906%) [52/ 4038; 1.287% -partial spinal failure and 25/4038; 0.62%- complete spinal failure]. There was no case of failure observed in epidural or CSE. Failure rate was 13/1674 (0.77) for elective CS and 64/2403 (2.66%) for emergency CS. Conclusion; Spinal anaesthesia using hyperbaric bupivacaine produced reliable anaesthesia for caesarean section with failure rate of 0.77% in elective surgery and 2.66% in emergency surgery.

Key Word: Regional anaesthesia, CS, SAB, CSE, General anaesthesia

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INTRODUCTION

Success of the spinal block requires the deposit of the correct dose of the proper drug in the CSF contiguous to the medullary cone, cauda equina and nerve roots. In other words "the right dose of the right agent in the right place." Purva *et al*[1] described common reasons for failure which included lack of a dedicated obstetric anaesthetist, staff inexperience poor/slow communication between staff, obstetric preference for GA because of time constraints or obstetric pathology, high number of 'maternal requests' for GA, especially in ethnic minority women, misunderstanding/misclassifying urgency, poor selection of RA type in complex cases, inappropriate assessment/recording of block, high rate of pain or GA

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conversion in epidural top up anaesthesia, management of epidural top up – time and place of commencement, drugs used. Praxedes *et al*[2] identified the various technical reasons of failure which included technical factors like adequate anatomical assessment, judicious choice of the needle and puncture site, care when storing the drugs, dose adequacy and baricity besides proper patients positioning during and after the puncture, and they all should be adequate for the surgical objective. Sng *et al* [3]described that the postpartum sterilization involving exteriorization of uterus with additional surgical manipulation as an independent factor for the failure of spinal anaesthesia. Kinsella *et al* described that type of anaesthesia, operative urgency, BMI, no previous caesarean, and indication for caesarean of acute fetal distress or maternal medical condition were related with preoperative failure, whereas inadequacy of preoperative anaesthetic block and duration of surgery beyond 90 min were important risk factors for intra operative failure. Steiner *et al* described the inadequate CSF concentration of local anaesthetics as a common reason for failure and mal-distribution of bupivacaine could be responsible for failed spinal anaesthesia in such cases. In emergency cases, greater conversion rate with CSE than spinal might be related to less available time in emergencies, or a higher risk of failure when performing the more complicated CSE technique in an urgent and stressful situation Rafi *et al* described the reasons for conversion of regional to general anaesthesia included: inadequate catheter length in epidural space, known poorly functioning labour epidural which was not re-sited, inadequate local anaesthetics top-up dose, inadequate time for onset, inadequate block testing, and not using an opioid with the local anaesthetics. Shivanna *et al* observed that failure occurred due to inadequate pain relief, maternal and fetal causes (category-1 and category-2 CS) and maternal request. In Munhall *et al* study, all failures were due to anaesthetic factors, both technical (25%)and pharmacological(75%), like identification of subarachnoid space, training, ability to utilize different approaches, documentation of free flow of CSF pre and post injection and proper placement of catheter for continuous spinal technique and dosage, use of epinephrine, and / or positioning of patient. Levy *et al*[1] found that failure was significantly associated with error in judgment, either in not properly anticipating the duration of surgery or injecting local anaesthetic solution in the absence of free flow of CSF and use of tetracaine without epinephrine

MATERIAL AND METHODS

It was a one year prospective observational study conducted from 1st Feb. 2011 to 31st Jan. 2012 in department of anaesthesia Panna Dhai Women Hospital attached to R.N.T. Medical College, Udaipur, Rajasthan after getting clearance from institutional ethics committee. Study population included all the patients undergoing caesarean section under regional anaesthesia (RA) during this period. The patients who had partial or complete failure of regional anaesthesia, were 96 enrolled to make sample size of the study. Factors leading to failure were investigated in failed cases. After pre-anaesthetic examination and taking consent for the caesarean section, a specialist anaesthetist or consultant or closely supervised resident anaesthetist performed all the regional blocks. After all aseptic precautions all the blocks were performed in lateral or sitting position via midline/ para-median approach at either the L3-L4 or L4-L5 interspace, as per decision of attending anaesthesiologist. Anaesthesia technique: Subarachnoid block was given with a 25gauge/ 27 gauge spinal needle. A free flowing clear CSF was confirmed before the 10 mg dose of 0.5% hyperbaric bupivacaine was injected into the intrathecal space. Aspiration of cerebrospinal fluid was confirmed before and at the end of the injection. For epidural anaesthesia 15- 20 ml of 2% lidocaine was given in epidural space either as single shot epidural using 18gauge Tuohy needle, or as an epidural extension in already existing epidural catheter placed for labour analgesia. Single shot combined spinal epidural was given by 27gauge whitacre spinal needle inserted via 18gauge Tuohy epidural needle and 1.5 ml (7.5 mg) bupivacaine 0.5% with 25 µgm fentanyl was given in subarachnoid space followed by epidural extension with 5 ml of normal saline. Level of sensory blockade was tested by loss of sensation to pin prick and motor block was assessed by using the Bromage score (0-3). Surgery was allowed when there was loss of pin prick sensation upto the level of T5. “Partial failure” was defined as ‘when a small dose of intravenous induction agents or analgesics like, ketamine, propofol or opioid was used to supplement regional anaesthesia, whenever the patient complained of pain.’ “Complete failure” was defined as ‘when regional anaesthesia was converted to complete general anaesthesia with intubation, or repeat spinal block was given'.

RESULTS

During one year study period, out of 4077 cases of CS, 4045 (99.22%) cases were carried out under regional anaesthesia [4038 (99.83%) under spinal, 5(0.12%) under CSE and 2(0.05%) under labour epidural extended for LSCS]. Incidence of failed regional anaesthesia was 1.903% (77/4045) as partial failure 1.285% (52/4045) and complete failure 0.618% (25/4045) and incidence of conversion of regional to general anaesthesia was

72/4045 (1.77%) [52/4045; 1.285% - partial failure needed general anaesthetic supplementation, 20/4045; 0.494% -complete failure needed general anaesthesia with intubation and 5/4045; 0.1236% - complete failure in whom repeat spinal anaesthesia was given]. Hence these 5 cases were initially counted in failed spinal (n=77) but were not counted in conversion to general anaesthesia (n=72).

Table 1: Distribution of Patients According to Proposed Reasons of Failure

Proposed reason of failure	Total	Partial	Complete
Early start of surgery	26 (33.77%)	22 (84.60%)	4 (15.40%)
Inadequate dose	8 (10.39%)	5 (62.5%)	3 (37.5%)
Ineffective batch of drug	7 (9.09%)	4 (57.14%)	3 (42.86%)
Lack of free flow of CSF	18 (23.38%)	9 (50.00%)	9 (50.00%)
Difficulty in positioning	13 (16.89%)	10 (76.92%)	3 (23.08%)
Surgical reasons	1 (1.29%)	1 (100.00%)	0 (0.00%)
Unknown	4 (5.19%)	1 (25.00%	3 (75.00%)
Grand Total	77	52	25
Chi Value		10.72	
P value		0.09 (NS)	

Table 2: Distribution of Patients According to Dose of Hyperbaric Bupivacaine in Failed Spinal Cases

Bupivacaine Dose	Total	Partial failure	Complete failure
8 mg (1.6 ml)	4 (5.19%)	2 (50.00%)	2 (50.00%)
9 mg (1.8 ml)	15 (19.48%)	10 (66.67%)	5 (33.33%)
10 mg (2 ml)	58 (75.32%)	40 (68.97%)	18 (31.03%)
Grand Total	77	52	25
Range		1.6 – 2.0	
Mean ± SD	1.94 ± 0.11	1.94 ± 0.10	1.91 ± 0.14
P Value			P=0.275 (NS)

Table 3: I.V. Supplemental Drug Combination used in Partial SAB Failure

I.V. Supplemental drug combination	Number
Ketamine + Propofol	10 (19.23%)
Ketamine + Thiopentone sodium	21 (40.38%)
Ketamine + Pentazocine	15 (28.85%)
Ketamine + Thiopentone sodium + Pentazocine	4 (7.69%)
Ketamine + Propofol + Pentazocine	2 (3.85%)
Grand Total	52

Table 4: Management of Complete Failure

Management	Number
General anaesthesia with intubation	20 (80%)
Repeat Spinal	5 (20%)
Grand Total	25

DISCUSSION

The increased use of neuraxial anaesthesia in obstetrics has avoided the risks associated with general anaesthesia which may be associated with greater mortality[3]. There are obvious advantages of regional anaesthesia, including avoiding the problem of a difficult airway, avoidance of multiple drugs required for general anaesthesia as well as allowing the parturient to be awake to witness the delivery of her baby thus enabling her to participate and enjoy the birthing experience. Single shot spinals, are considered the most ideal form of regional anaesthesia for LSCS. However, failures can result in need for conversion to general anaesthesia or analgesic supplementation with consequent risks and medicolegal implications. This prospective cohort study investigated the incidence and characteristics of failed regional anaesthesia and need for supplemental analgesia or anaesthesia. The main type of regional technique used for caesarean delivery are single shot spinal anaesthesia, epidural anaesthesia and CSE anaesthesia.Table-1 depicts proposed reasons of SAB failure. In majority of cases, SAB failure occurred due to anaesthetic factors [like early start of surgery before establishment of adequate block (26/77; 33.77%), inadequate dose of local anaesthetic

(8/77; 10.39%), ineffective batch of drug (7/77; 9.09%)], technical factors [like lack of free flow of CSF (18/77; 23.38%), difficulty in positioning (13/77; 16.89%)] and surgical factors like adhesions (1/77; 1.29%). In 4/77; (5.19%) cases, no reasons of failure were found. None of the factor was found to have significant association with occurrence of failure (p=0.09) In present audit out of 4077 caesarean section, almost all cases [4045 (99.22%)] were carried out under regional anaesthesia [4038 (99.83%) under spinal, 5(0.12%) under CSE and 2(0.05%) under labour epidural extended for LSCS]. In present study overall failure rate of regional anaesthesia for CS was 77/4045 (1.903%). All failure cases occurred as failed spinal anaesthesia 77/4038 (1.906%) [complete failure was 25/4038(0.62%) and partial failure was 52/4038 (1.287%)] and there was no case of failure observed in epidural or CSE. Failure rate was 13/1674 (0.77%) for elective CS and 64/2403 (2.66%) for emergency CS with an overall failure rate of 1.906% which is consistent with the RcoA standards. In the present study, mean age was 25 ± 3.91 years, mean weight 59.54 ± 7.11 kg, mean height 155.42 ± 2.51 cms, mean gestational age 39.06 ± 1.18 weeks. 44 cases (57.14%) were primipara and 58 cases (75.33%) had no previous LSCS. Sng *et al*[3] reported no significant difference in age, weight, height, BMI, previous CS and gestational age, were found between parturients who had successful spinal anaesthesia and those who had failed spinal anaesthesia (partial failure); P >0.05. Steiner *et al* observed that weight, height, and vertical length of vertebral column of patients correlate with the distribution of local anaesthetics after subarachnoid injection of plain bupivacaine. However, the predictive value of these variables was low. Fuzier *et al*[13] found that patients in spinal failure group were younger as compared with patients in the success group. In present study, indications of CS had no association with failure of spinal anaesthesia. Kinsella *et al*[1]found the indication for CS of acute fetal distress or maternal medical condition as the reasons for preoperative failure. When incidence of conversion of regional anaesthesia to general anaesthesia in the study was determined, 72/4045 (1.77%) cases of regional anaesthesia needed general anaesthetic drugs. 52/4045 (1.285%) received partial supplementation (Ketamine/Thiopentone sodium/ Propofol/ Pentazocine, Table-3) and 20/4045 (0.494%) required complete conversion to general anaesthesia with intubation. 5/4045 (0.1236%) cases received repeat spinal anaesthesia with successful outcome(Table-4). Hence these 5 cases were initially counted in failed spinal (n=77) but were not counted in conversion to general anaesthesia (n=72). Reide *et al* found average conversion rates from regional to general anaesthesia were 3.8% for emergency and 0.8% for elective CS (Epidural > CSE > Spinal). They suggested a greater conversion rate with CSE than spinal for emergency cases but not for elective CS. This might be related to less available time in emergencies, or a high risk of failure when performing the more complicated CSE technique in an urgent and stressful situation. Sng *et al*[3] suggested that single shot spinal anaesthesia does not afford the flexibility of extending neuraxial block in the event of inadequate anaesthesia, hence other techniques such as CSE or epidural which allow block extension should be explored to overcome the problem of block failure. In present study all failure cases were of failed spinal anaesthesia hence results of the study are being discussed as "failed spinal anaesthesia". In present study, SAB was performed in right lateral decubitus position in 76 (98.7%) cases and in 1 (1.3%) case, SAB was performed in sitting position. Kinsella *et al* [1]observed that the sitting position was associated with higher intraoperative failure rate using univariate analysis (5.1% versus right lateral 2.9%). In Sng *et al*[3] study, 643 spinals (80.4%) were performed in lateral position and 157 (9.6%) in sitting position and the median block height of T4 was not significantly different between the lateral and sitting position. Shah *et al*[1] observed that the failure rate was 3.6% but no significant difference was found in their failure rates between sitting or lateral position. Munhall *et al* suggested that there was no significant difference in failure rates between spinal anaesthesia administered inthe lateral position (3.5%) and those administered in sitting position (5.9%). Out of 77 cases, as per Table-2, the dose of hyperbaric bupivacaine was 8 mg (5.19%), 9 mg (19.48%), and 10 mg (75.32%). In 8 (10.39%) cases inadequate dose of local anaesthetics was attributed for failed spinal anaesthesia. Fettes *et al*[1] described intrathecal dose of local anaesthetics as an important determinant of quality and duration of block. Overall, the actual dose chosen depend on specific local anaesthetic used baricity of that solution, the patient's subsequent posture, the type of block intended and anticipated duration of surgery. Sng *et al*[3] used 10 mg of hyperbaric bupivacaine with 100 mcg morphine for CS and failure rate was 0.5%. When fentanyl 10 mcg or morphine 200 mcg are incorporated in the intrathecal injection for CS, quality of spinal anaesthetic is found to be improved and to be safer for mother and baby. In present study 10mcg fentanyl was used as an adjuvant to 7.5 mg bupivacaine in CSE (n=5) and no failure was observed. Fuzier *et al*[1] mentioned that the absence of the use of an adjuvant medication with the local anaesthetic injected was associated with high failure rate (3.2%). Anaesthetists experience: In our institution anaesthesiologist early in their training programme performed nearly 3/4 of all subarachnoid block (supervised by seniors) and this did

not affect failure rates. Shah *et al* and mullah *et al* also observed that there is no significant difference to the level of training and block failure'[1]. As far as number of lumbar puncture attempts are concerned, among 77 cases of failed spinal anaesthesia, subarachnoid block was performed in single attempt in 32 (41.56%) cases, in two attempts in 30 (38.96%) cases and in three attempts in 14 (18.18%) cases and in one (1.3%) case subarachnoid block was performed in 4 attempts. It was not significantly associated with failure of spinal anaesthesia. In study by Munhall *et al*, the overall failure rate was 4% but number of attempts at lumbar puncture did not significantly influence their failure rate. Fuzier *et al*[1] reported that the number of puncture attempts at 3 or more was associated with increase of failure. Present study showed that in all cases of complete failure [n=25/77 (32.47%)] sensory level of block was either T10 (n=4/25; 16%) or below T10 (n=21/25; 84%) and patients complained of pain before start of surgery which was managed by general anaesthesia with intubation (n=20; 80%) or repeat spinal (n=5; 20%). In the same way, partial failure was observed in n=52/77 (67.53%) cases in whom sensory level of block was either T6 (n=6/52; 11.54%), T8 (n=31/52; 59.62%), or T10 (n=15/52; 28.84%) and patients complained of pain at the time of incision or intraoperatively which was managed by inj. Ketamine in cases (100%), Thiopentone sodium in 25 cases (48.07%), Pentazocine in 21 cases (40.38%), and Propofol in 12 cases (23.08%), either used alone or in combination. Russell IF[1] study recorded levels of analgesia (loss of sharp pin prick sensation) and anaesthesia (loss of touch sensation) in 220 women during caesarean section under regional anaesthesia (70 epidurals, 150 spinals). They suggested that in the absence of spinal or epidural narcotics a level of anaesthesia up to and including T5 is required to prevent pain during caesarean section, as observed in present study in which none of the patient who achieve T5 level or above had failure. Duration of surgery and experience of surgeon was not significantly associated with the failure rates in the present study which correlates well with the study of Sng *et al*[3]. In present study, there was n=1/77 (1.29%) case who had adhesions due to previous CS and needed supplementation (partial failure) after delivery of baby. Sng *et al*[3] found that post partum sterilization was an independent factor associated with need for IV fentanyl and entonox supplementation.

CONCLUSION

Spinal anaesthesia is usually a simple and effective technique, but failure can occur at any time and in the hands of any clinician, no matter how experienced. Failure can be minimized by proper evaluation of the anatomy of patient related to procedure, a careful storage of anaesthetic agents, proper selection of dose and baricity, along with correct positioning of patient during puncture and shortly after the administration of local anaesthetic and until it is fixed to the tissue. The clear implications of the present study is that careful attention to detail is vital, and it has been shown that a failure rate of <1% for elective and <3% for emergency CS (recently relaxed to <5%) 46 is attainable in every day practice because most of the failure were judged to be "avoidable". Minimizing the incidence of failure is obviously a prerequisite for gaining the benefits of spinal anaesthesia and prevention must start with full recognition of the potential pitfalls so that clinical practice can be tailored to their avoidance.

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