Median and paramedian approach for spinal anaesthesia for caesarean delivery: A comparative analysis of safety and effectiveness

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Abstract

Introduction: Spinal anaesthesia can be achieved either through the median or paramedian approach. The median approach may be technically difficult due to the exaggerated lumbar lordosis in pregnant patients. The paramedian approach is a useful technique in difficult or challenging situations like elderly and pregnant patients. The paramedian approach does not require the patient to fully reduce lumbar lordosis. A study was conducted on pregnant patients to evaluate the safety and efficacy of the paramedian approach.

Materials and Method: 100 parturients of ASA I-II who underwent caesarean delivery under spinal anaesthesia were divided into two groups:

a. Group M (n=50) received spinal block through median approach while Group PM (n=50) received through paramedian approach.
b. Number of attempts, success of the block, presence of paraesthesia, and the incidence of headache and lower backache were recorded in postoperative period.
c. The data was analysed by using chi-square and T-test where P <0.05 was considered as statistically significant.

Results: In Group M, ten (20%) patients developed PDPH vs. five (10%) in group PM. Even though more patients developed post-dural puncture headache (PDPH) in median group, it was not statistically significant (P=0.161). There was no significant difference in the incidence of paraesthesia in both groups. The mean duration of onset of PDPH was similar in both groups (2.8 ± 0.8 vs. 2.7 ± 1.2 days).

Conclusion: Our study shows that paramedian approach is equally effective and may be helpful in reducing the incidence of PDPH and paraesthesia, and can be easily performed on pregnant patients.

Keywords: Caesarean delivery, Spinal anaesthesia, Median approach, Paramedian approach, PDPH.

Introduction

Regional anaesthesia, especially spinal anaesthesia, is most commonly used for caesarean delivery (CD). Spinal anesthesia can be achieved either through the median or paramedian approach. Headache or PDPH is one of the widespread complications following spinal anaesthesia. Reducing the number of attempts to get the spinal puncture is very important as multiple attempts increase the incidence of complications such as spinal hematoma, injury to the neuronal structures, PDPH etc.[(1)]

The midline approach is most commonly used for administration of spinal anaesthesia.[(2)] The midline approach for spinal needle insertion requires accurate identification of a lumbar interspinous process. In the midline approach, the needle is inserted into the substance of the interspinous ligament and it passes through the ligamentum flavum and epidural space and then pierces the dura arachnoid before entering into subarachnoid space. For most patients, the midline approach is faster, easy to administer and less painful.

The paramedian approach is a useful technique that allows for successful identification of the subarachnoid or epidural space, especially in difficult cases, in obese patients, in pregnant patients and in geriatric patients.[(3)] Even though it is not regularly or frequently used, the paramedian approach is a very easy method and can be used routinely. The paramedian approach directly punctures ligamentum flavum. The advantage of paramedian approach is that it does not require the parturient to fully reduce the lumbar lordosis.

Post dural puncture Headache (PDPH) or post spinal headache is more common in younger age groups, in female patients and in pregnant females[(4,5,6,7,8)] and also in patients with the previous history of headache (migraine, tension or cluster headache). The incidence of PDPH is reported to be high in parturients.[(9)] PDPH usually occurs 72 hours after the spinal anaesthesia, but most often it occurs within the first 48 hours, and it can last up to seven days.

Vilming and Kloster reported a median duration of six days.[(10)] The influence of median or paramedian approach towards the incidence of PDPH remains unclear. Haider et al[(11)] had shown that the incidence of PDPH was less in paramedian than median approach (4% vs. 28%), which was statistically significant. However, other studies show that incidence were similar in both approaches.[(11,12,13)]

We conducted a prospective observational study of patients who underwent caesarean delivery using spinal anaesthesia by both midline as well as paramedian

approach to evaluate the safety and efficacy of paramedian approach.

Materials and Method

After obtaining the approval from the ethics committee, 100 consecutive pregnant patients were enrolled on prospective observational study, underwent caesarean delivery under spinal anaesthesia. Informed consent was obtained from them.

Inclusion criteria: All pregnant females between the age 20 – 45 and with ASA Grade I & II. Patients who were not willing to receive spinal anaesthesia, with history of allergy to local anaesthetic agent, pre-existing neurological disease, coagulopathies and infection at the site of puncture were excluded from the study. Patients with any anatomical deformity involving vertebrae, spinal pathologies, previous history of head ache and morbidly obese patients were also excluded from the study. Patients were divided into two groups: Group M (n=50) received spinal anaesthesia with median approach and Group PM (n=50) received through paramedian approach.

Standard monitors were attached to the patients. The spinal anaesthesia was given in sitting position, using 25 G Quinke needle at the L3 – L4 space. After achieving a complete sterile condition, the spinal anaesthesia was given in the following technique:

a. **Median approach:** The patient is placed in the sitting position. A stool was provided as a footrest and a pillow placed on the lap. The patient is maintained in a vertical plane while the patient's neck was flexed and the patient's lower back pushed out. The needle was inserted below the lower edge of the spinous process of the selected upper vertebrae. 10 mg of Inj. Bupivacaine heavy 0.5% with Inj. Fentanyl 25 microgram was used to achieve spinal anaesthesia. (Fig. 1)
b. **Paramedian approach:** A skin wheal is raised 1 cm lateral and 1 cm caudal to the L4 spinous process. A longer needle is used to infiltrate deeper tissues in a cephalomedial plane. The spinal needle inserted 10 to 15 degrees off the sagittal plane in a cephalomedial plane. Once the cerebrospinal fluid (CSF) was obtained after ligamentum flavum punctured, 10 mg of Inj. Bupivacaine heavy 0.5% with Inj. Fentanyl 25 microgram was injected to achieve spinal anaesthesia. The level of analgesia and time to achieve were noted. After the block was administered, supine position was given and a wedge was placed to tilt the patient towards left side. In both the approaches, maximum of three attempts at L3-L4 space done. If not successful, the L4-L5 space was selected.

After the surgical procedure (caesarean delivery) was over, the patient was shifted to post-anaesthesia care unit (PACU). The following variables were observed and recorded:

Number of attempts, success of the block, presence of paraesthesia, the level of sensory level, and the incidence of head ache and lower back ache. The patients were observed for a period of 7 days postoperatively. The Visual Analogue Scale (VAS) was used to assess the severity of the pain. Post dural puncture head was defined as headache developed within 7 days of spinal anaesthesia, relieved or reduced in intensity by lying down.

Patients were asked to give a score from 1 to 10; higher the score, more severe the pain. Inj. Tramadol 50mg i.v or Inj. Paracetamol 1g i.v was used to treat the PDPH wherever deemed necessary.

Statistical analysis: The data was analysed using Chi-square and T-test where P <0.05 was considered as statistically significant.

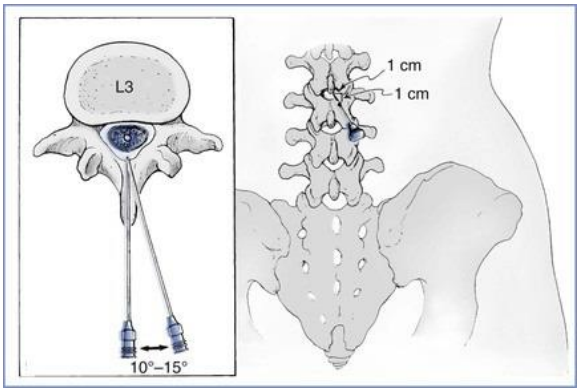

Fig. 1

Results

100 parturients were included in the study, received the spinal anaesthesia with a median (n=50) or paramedian (n=50) approach. The demographic data of (Table 1) the patients were comparable in both groups. The mean age of patients in Group M was 26 ± 4.3 vs. 26 ± 3.9 in Group PM. In Group M, five (10%) patients required more than one attempt, while in Group PM two (5%) patients required (Table 2). The success rate was 100% in both the groups. The incidence of PDPH, paraesthesia and analgesic requirement for the headache are shown in Table 3. In Group M, ten (20%) patients developed PDPH vs. Five (10%) in Group PM, which was not statistically significant (P= 0.161). There was no significant difference in the incidence of paraesthesia in both groups. PDPH was treated with conventional analgesics in all patients. The mean duration of onset of PDPH was similar in both groups (2.8 ± 0.8 vs. 2.7 ± 1.2 days).

Table 1: Demographic variables

Sl. No.	Variables	Median	Paramedian	P value
1.	Age	26 ± 4.3	26 ± 3.9	0.48
2.	Weight	65 ± 8.3	68 ± 6.9	0.87
3.	BSA	1.8 ± 0.5	1.7 ± 1.0	0.52

Table 2: Success rate & attempts

Sl. No.	Variables	Median	Paramedian	P value
1.	Mean additional attempts	2.6 ± 0.8	2 ± 0	0.41
2.	No. of patients required additional attempts	5 (10%)	2 (4%)	0.23
3.	Success rate	50 (100%)	50 (100%)	NS

Table 3: Adverse effects / complications

Sl. No.	Variables	Median	Paramedian	P value
1.	Headache (no. of pts)	10 (20%)	5 (10%)	0.161
2.	Headache pod	2.8 ± 0.8	2.7 ± 1.2	0.87
3.	Paraesthesia	8 (16%)	5 (10%)	0.37
4.	Medications required (no. of patients) to treat PDPH (Tramadol / Paracetamol)	9 (18%)	4 (8%)	0.13

Discussion

Pain during the first stage of labour results primarily from changes in the lower uterine segment and cervix. Pain is transmitted by visceral afferent nerve fibres that accompany the sympathetic nerves and enter the spinal cord at the T10 to L1 segments. During the late first stage and second stage of labour, pain results from distension of the pelvic floor, vagina, and perineum. Pelvic pain is transmitted by somatic nerve fibres, which enter the spinal cord at the S2 – S4 segments (Fig. 1). Hormonal changes, anatomic changes, decrease in CSF specific gravity are likely responsible for the lower local anaesthetic dose requirements during spinal anaesthesia in pregnant women.[14,15]

Pregnant women have an exaggerated lumbar lordosis, and it is more difficult for them to flex the lumbar spine. However, most pregnant women are young, and in younger patients there is sufficient flexibility to facilitate the insertion of needle into the epidural or subarachnoid space. Most obstetric patients may assume the lateral decubitus position comfortably.

Headache or PDPH is the most common complication following spinal anaesthesia or analgesia and presents hours to days after the dural puncture. The loss of CSF from the intrathecal space is the main causative factor. The CSF leakage results in fall in intracranial CSF volume & CSF pressure.[16] It causes gravitational traction on the pain sensitive structures causing head ache.[17] The loss of CSF may result in compensatory intracranial vasodilatation. Relative CSF hypovolemia[18] results in painful possibly adenosine receptors mediated [19] cerebral vasodilatation. It is characterised by dull or throbbing headache and the severity is increased in an upright posture and lesser in supine position. The incidence of headache following CD was ranging from 0 – 4%.[20] The technique, type of needle and number of puncture may influence the incidence of complications like PDPH.[21,22] The incidence varies with size of needle. Greater the size of the needle, higher the incidence of PDPH. Turnbull DK et al reported a decrease in the incidence of PDPH from 40% with a 20GA needle to less than 2% with a 29GA needle.[23] The other causes for PDPH should be evaluated or excluded before confirming the diagnosis of PDPH: migraine, tension or cluster headache, neuralgia, subdural hematoma, lactation headache, postpartum cerebral angiopathy, preeclampsia and caffeine withdrawal.[21,24-29]

Spinal anaesthesia is performed using either median or paramedian approach. The median approach is the most commonly used one. Technically it may be difficult to perform the midline approach in elderly patients (calcified interspinous ligaments), in obese individuals, and in parturients (difficulty in positioning). In these kinds of situations, the paramedian approach may be useful.

The overall incidence of PDPH was 15% in our analysis. The incidence was higher in the median group than the paramedian group but it was not statistically significant. Few studies show that incidence were similar in both approaches.[11,12]

The target area is large in paramedian approach. Because the needle is introduced laterally, any limitation of the spinous process is avoided. It does not require the parturient to reduce the lumbar lordosis fully. The paramedian approach may result in decreased incidence of PDPH. Studies show that there is less CSF leak in the paramedian approach than the median approach. It may be because of a valvular mechanism produced which prevents the excess amount of leakage of CSF.[10,30-31] The valvular mechanism is created because the dura matter and arachnoid are perforated at different angles. Our study also found that the incidence of PDPH was lower in paramedian approach. The success rate was equal on both approaches. We were able to perform the spinal puncture easily in both approaches, even though we felt that paramedian approach was easier to perform and was well accepted by the patients.

There were no differences in the incidence of backache between the two groups. Up to 46.5% of pregnant patients can have backache following spinal anaesthesia.[22] We could not find any difference in the incidence of backache. We found that there was a high incidence of paraesthesia in the median group but it was

not statistically significant. This was in contrast with other studies which showed higher incidence of paraesthesia in paramedian group. May be a bigger sample size would have shown better association between the incidence of paraesthesia and technique of spinal blockade (median vs. paramedian). Blomberg et al showed a statistically significant difference between the median and paramedian approaches with regard to number of attempts and paraesthesia.[26]

We have a few limitations in our study. Firstly, it is a non-randomised study. The number of patients may be small to draw any firm conclusion about the safety and effectiveness of the paramedian approach for spinal anaesthesia in parturient.

Conclusion

Our study shows that paramedian approach is equally effective and may be helpful in reducing the incidence of PDPH and paraesthesia, and it can be easily performed in pregnant patients.

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