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Postdural Puncture Headache: A Comparison between Median and Paramedian Approach under Spinal Anesthesia in Cesarean Section

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Abstract

Aims and Objectives: To compare the incidence of Postdural Puncture Headache (PDPH) with spinal anesthesia using median and paramedian approach in pregnant women undergoing elective cesarean section. *Materials and Methods:* One Hundred patients with American Society of Anesthesiologists Physical Status I and II scheduled for elective cesarean section under spinal anesthesia were randomly allocated into two groups with fifty patients each. Group M: Received the subarachnoid block with median approach using 25G Quinke spinal needle and 10 *mg* Inj Bupivacaine heavy 0.5% at L3–L4 intervertebral space. Group P: Received the subarachnoid block with paramedian approach using 25G Quinke spinal needle and 10 *mg* Inj Bupivacaine heavy 0.5% at L3–L4 intervertebral space. Patients were assessed for hemodynamic changes, sensory and motor block and adverse effects in the intraoperative period. Postoperatively patients were monitored for PDPH, low backache, nausea, vomiting, first attempt success rate and the need for rescue analgesia. *Results:* The incidence of Postdural Puncture Headache (PDPH) was 18% in Group M as compared to 4% in Group P with *p* - value of 0.025 which is statistically significant. While the incidence of low backache was 14% in Group M as compared to 0% in Group P with *p* - value of 0.006 which is also statistically significant. *Conclusion:* The paramedian approach of subarachnoid block has lesser tendency to cause post dural puncture headache and low backache as compared to median approach in patients undergoing elective caesarean section.

Keywords: Post dural puncture headache; Median spinal approach; Paramedian spinal approach; Elective cesarean section.

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Introduction

Subarachnoid Block (SAB), a form of regional anesthesia is most commonly practiced for cesarean delivery. It is considered simple, safe, cost-effective with lesser complications as compared to general anesthesia.[1]

Postdural Puncture Headache (PDPH) is a common iatrogenic complication assosciated with subarachnoid block. According to International Headache Society, PDPH is defined as "bilateral frontal/occipital headache that develops within *7 days* after a lumbar puncture and disappears within *14 days*. The headache worsens within *15 min* of resuming the upright position, disappears or improves within *30 min* of resuming the recumbent position".[2] PDPH usually occurs *48–72 hours* after dural puncture and last for several days.[2] Associated symptoms include stiff neck, hearing loss, tinnitus, nausea, vomiting and photophobia.[3]

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Risk factors for developing PDPH include young adults (*18–30 years*), female sex, pregnancy, large size spinal needle, cutting needle tip design and multiple attempts of lumbar puncture.[4–6] The exact mechanism involved in the development of postdural puncture headache is unclear. There are two hypothesis put forward for its development.

First, the CSF leakage resulting in fall of CSF volume and pressure causes gravitational traction on the pain sensitive structures in upright position causing headache. Second, the loss of CSF may result in compensatory intracranial venodilatation *via* the Monro–Kellie doctrine.[7,8]

Subarachnoid block can be achieved by either median or paramedian approach. The median approach is most commonly used for administration of spinal anesthesia. The paramedian approach is a useful technique that allows for successful identification of epidural or subarachnoid space, especially in difficult cases, obese, pregnant and geriatric patients.[9,10]

Behery *et al*. had done a similar study for incidence of PDPH on cesarean section patients under spinal anesthesia. The study concluded that the incidence of PDPH was less in paramedian (5.2%) than median approach (19.6%), which was statistically significant.[11]

However, completely contrarary results were found in a study conducted by Sadeghi A *et al*. done on cesarean section patients where the PDPH incidence was more in paramedian than median approach (9.8% *vs* 9.4%) though the results were statistically insignificant (p - value > 0.05).[12]

Based on the above studies, we hypothesized to conduct this study to evaluate the safety and efficacy of both approaches of subaracnoid block. The rationale of this study was to compare the frequency of PDPH with median and paramedian approach in elective cesarean section using 25G Quincke needle for subarachnoid block. The study was conducted with a hope to bring change in clinical practice of using better approach (median or paramedian) to reduce PDPH associated morbidity.

Materials and Methods

Randomized, prospective, double blind study was conducted on 100 patients scheduled to undergo elective cesarean section at Major operation theatre MIMS, Mandya, Karnataka, India after obtaining approval from Institutional Ethical Committee and informed consent from patients.

Inclusion Criteria

1. ASA I and II patients undergoing elective cesarean section
2. Age 20–40 *years*
3. Weight 50–100 *kgs*
4. BMI < 30

Exclusion Criteria

1. Spinal deformities
2. Coagulation abnormalities
3. Medical comorbidities
4. Any chronic preoperative headache
5. Neurological or psychiatric disorders
6. Patients who had PDPH in previous surgery
7. Infection at lumbar puncture site
8. Allergic to local anesthetics
9. Lumbar Puncture attempt failure more than two.

Preoperative assessment of patient including routine blood investigations and electrocardiogram (ECG) was done a day prior to surgery. Patient was briefed about details of the study and informed consent was taken.

On the day of surgery, patient was shifted to operation theatre and connected to multiparameter monitor to record pulse rate, non-invasive blood pressure, ECG, and oxygen saturation.

An 18G intravenous cannula was inserted in the non-dominant hand and premedicated with *50 mg* Inj Ranitidine and *4 mg* Inj Ondensetron. Ringer lactate was infused at *15 ml/kg* as preload fluid over *30 min*.

Selected patients were randomly divided into two groups Group M and Group P, comprising 50 patients each using computer randomization programs.

Group M received subaracnoid block with median approach while Group P received subarachnoid block with paramedian approach.Under strict aseptic precautions, subarachnoid block was given in sitting position, using 25G Quinke needle at L3–L4 intervertebral space.

In Group M (median approach), subarachnoid block was given with spinal needle introduced at L3–L4 intervertebral space below the spinous process of L3, whereas in Group P (paramedian approach), the spinal needle was introduced *10 to 15*° in a cephalo medial plane at *1 cm* lateral and caudal to the spinous process of L3. In both the groups, *10 mg* of Inj Bupivacaine heavy 0.5% was

used to achieve subarachnoid block. Immediately after spinal anesthesia, the patient was positioned in supine position and a >*15*° wedge was placed under the right hip to avoid supine hypotension. The level of anesthesia and time to achieve were noted. Hypotension was treated with rapid administration of intravenous fluids and Inj Phenylephrine *0.5 mcg/kg*. In case of failure or insufficient block, general anesthesia was given and patient was excluded from the study.

An independent observer not involved in the study followed the patients for *7 days* for PDPH, low backache, nausea, vomiting, first attempt success rate and the need for rescue analgesia. Numeric Visual Analogue Scale (VAS) was used to assess the severity of PDPH, shown as in Figure 1.

Score 0 was considered as No pain due to PDPH while Score 1–3 as Mild, 4–6 as Moderate, 7–9 as severe and 10 Very severe. Mild pain was treated with bed rest and intravenous fluids while moderate to severe form with intravenous Inj Paracetamol *1g* as rescue analgesia.

Statistical Analysis

All the collected data were entered into SPSS version 16. Quantitative variables such as age, weight and BMI were presented by mean ± SD using student *t* - test. Qualitative variables such as PDPH, low backache, nausea and vomiting and use of rescue analgesia were presented as frequency and percentage using Chi-square test. A *p* - value of ≤ 0.05 was considered statistically significant.

Results

The demographic data variables of the patients were comparable in both the groups as shown in Table 1. The mean age of patients in Group M was 25.22 ± 2.562 *vs* 24.80 ± 2.755 in Group P with *p* - value of 0.439 which is statistically insignificant. The mean weight in Group M was 68.56 ± 6.899 while in Group P it was *69.04 ± 6.305 kg* with *p* - value of 0.717 which is statistically insignificant. The mean BMI in Group M was 23.374 ± 1.778 *vs* 22.906 ±1.460 with *p* - value of 0.154 which is statistically insignificant.

In Group M, the failure rate of first spinal attempt was more (14%) when compared to Group P (4%) though the *p* - value is statistically insignificant 0.081, (Table 2, Graph 1).

Nausea and vomiting was more with Group M (16%) when compared to Group P (4%) with

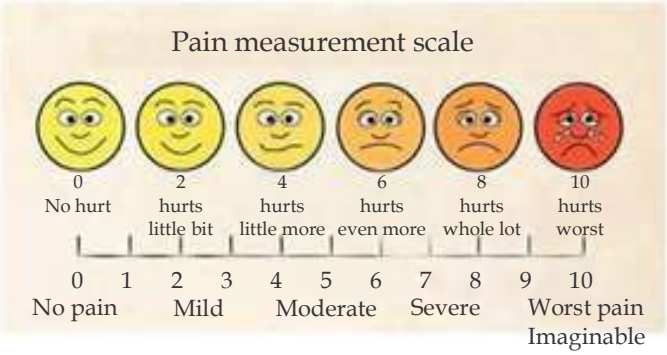


Fig. 1: Pain measurement scale

Table 1: Demographic variables

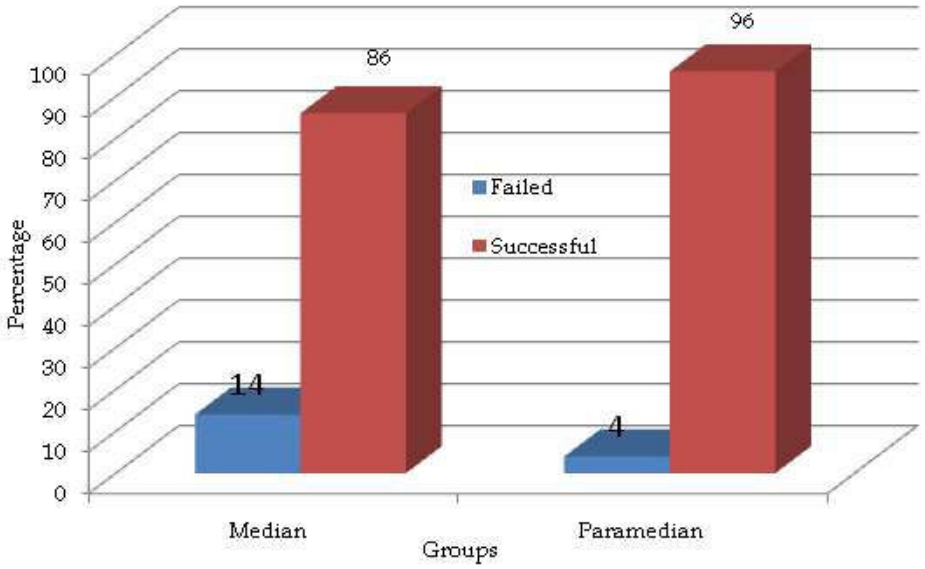
	Group M	Group P	*t*-test value	*p* - value
Age	25.22 + 2.562	24.80 + 2.755	0.777	0.439
Weight	68.56 + 6.899	69.04 + 6.305	0.363	0.717
Gestational Age	38.694 + 0.450	38.454 + 0.404	2.804	0.006
BMI	23.374 + 1.778	22.906 + 1.460	1.438	0.154

Table 2: Distribution according to failure of first spinal attempt in the study group subjects

First Spinal attempt	Group M	Group P	Chi-square value, df and *p* - Value
Failed	07 (14.0)	02(04.0)	
Successful	43 (86.0)	48 (96.0)	3.053; 1; 0.081
Total	50	50	

p - value of 0.046 which is statistically significant, (Table 3, Graph 2).

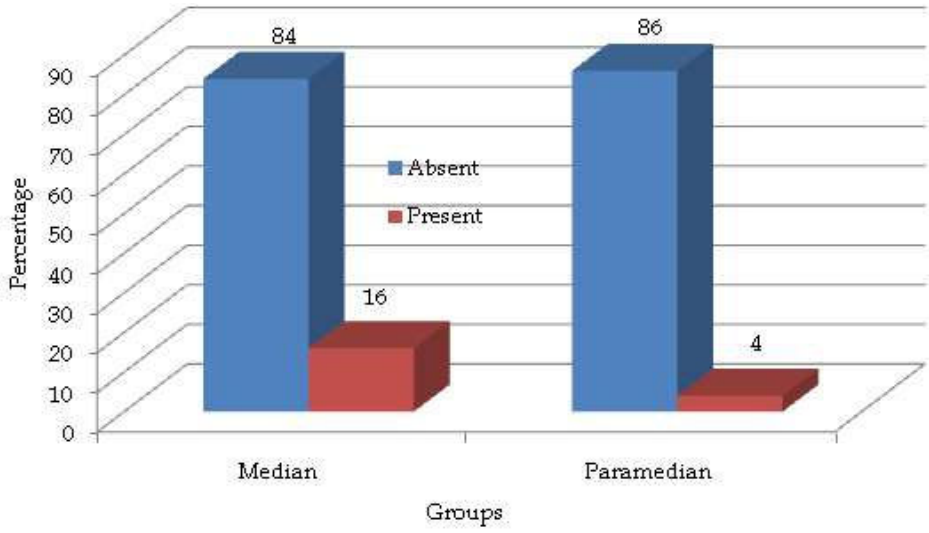
Postdural Puncture Headache (PDPH) was more with Group M (18%) when compared to Group P (4%) with *p* - value of 0.025 which is statistically significant, (Table 4, Graph 3). In Group M total 9 patients developed PDPH, out of which 4 patients had mild form (VAS Score 1–3) and other 5 patients had moderate form (VAS Score 4–6). In Group P total 2 patients developed PDPH, out of which one patient had mild form and the other had moderate form.



Graph 1: Multiple Bar diagram showing failure of First Spinal attempt among Group M and Group P.

Table 3: Distribution according to Nausea and vomiting in the study group subjects

Nausea and Vomiting	Group M	Group P	Chi-square value, df and *p* - Value
Absent	42 (84.0)	48(96.0)	4.00; 1; 0.046
Present	08 (16.0)	02 (04.0)	
Total	50	50	

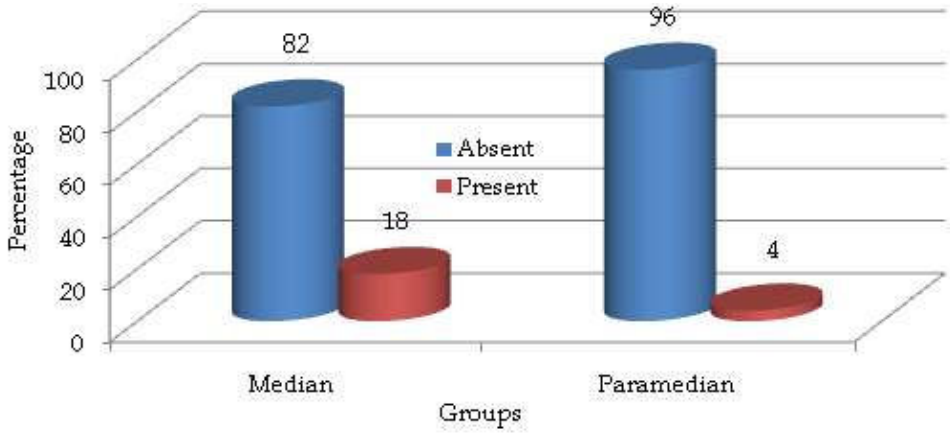


Graph 2: Multiple Bar diagram showing nausea and vomiting among Group M and Group P

Low backache was more in Group M (14%) when compared to Group P (0%) with p - value of 0.006 which is statistically significant, (Table 5, Graph 4).

Table 4: Distribution according to PDPH among the study group subjects

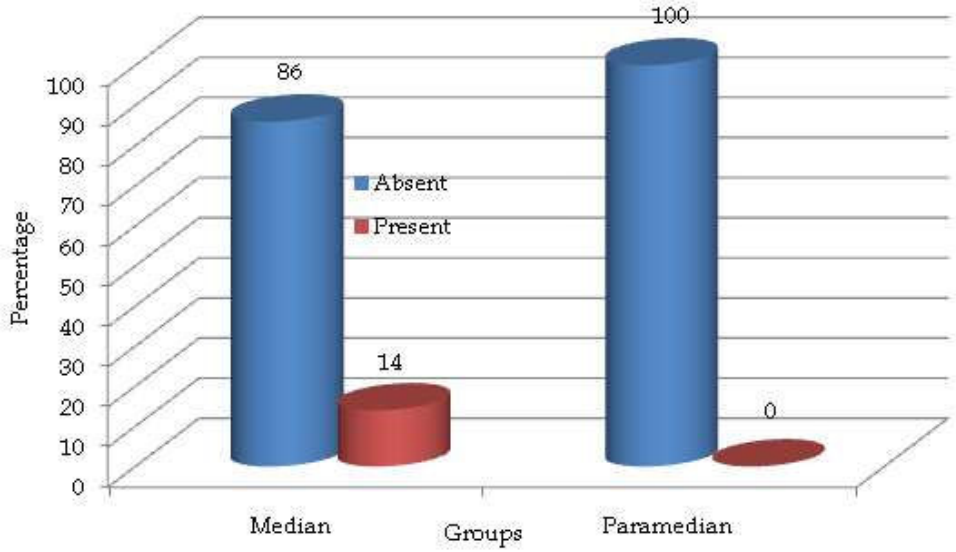
Postdural Puncture Headache	Group M	Group P	Chi-square value, df and p - Value
Absent	41 (82.0)	48(96.0)	5.005; 1; 0.025
Present	09 (18.0)	02 (04.0)	
Total	50	50	



Graph 3: Multiple Bar diagram showing postdural puncture headache among Group M and Group P.

Table 5: Distribution according to low backache among the study group subjects

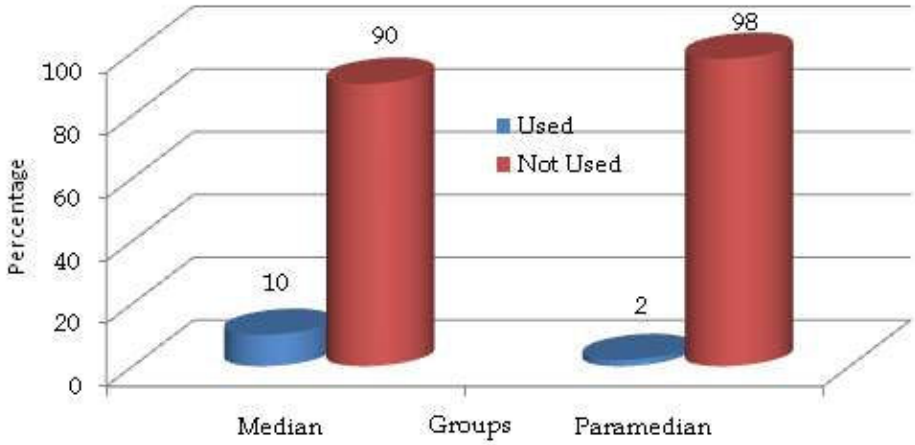
Backache	Group M	Group P	Chi-square value, df and p - Value
Absent	43 (86.0)	50 (100.0)	7.527; 1; 0.006
Present	07 (14.0)	0	
Total	50	50	



Graph 4: Multiple Bar diagram showing Backache among Group M and Group P

Table 6: Distribution according to use rescue analgesia among the study group subjects

Rescue Analgesia	Group M	Group P	Chi-square value, df and p- Value
Used	05 (10.0)	01 (02.0)	
Not Used	45 (90.0)	49 (98.0)	2.837; 1; 0.092
Total	50	50	



Graph 5: Multiple Bar diagram showing use of rescue analgesia among Group M and Group P study groups subjects.

In Group M, use of rescue analgesia was more (10%) when compared to Group P (2%) though the difference between two groups is statistically insignificant, (*p* – value= 0.092), (Table 6, Graph 5).

Discussion

Postdural Puncture Headache (PDPH) is the most common complication following spinal anesthesia and presents within *48–72 hours* after dural puncture and last for several days.[2]

The loss of CSF from the intrathecal space is the main causative factor. The CSF leakage results in fall in intracranial CSF volume and CSF pressure causing gravitational traction on the pain sensitive structures causing headache.[7,8]

The loss of CSF may result in compensatory adenosine receptor mediated intracranial vasodilatation leading to PDPH.[13,14]

Spinal anesthesia is performed using either median or paramedian approach. The median approach is the most commonly used.[15] Midline approach involves passage of the needle through supraspinous, interspinous and ligamentum flavum. Technically it may be difficult to perform the midline approach especially in elderly patients (calcified ligaments), obese individuals and in parturients (difficulty in positioning).[16]

Alternatively, paramedian approach which is technically easier can be used which avoids the midline ligamentous structures and hits the ligamentum flavum directly after passing through the paraspinal muscles. The paramedian approach does not require flexed position as in midline approach.[16,17]

The paramedian approach may result in decreased incidence of PDPH as there is less leakage of CSF because of valvular mechanism created due to perforation of dura matter and arachnoid matter at different angles.[18,19] As female gender and pregnancy are well-known risk factors for PDPH, we hypothesized to conduct our study on obstetric patients posted for elective cesarean section under spinal anesthesia.

Rabinowitz A *et al*. conducted a prospective randomized study on 40 patients posted for hip surgery under Continous Spinal Anesthesia (CSA) and compared the two approaches for success rate of CSA which revealed that the first attempt success rate was 85% in paramedian approach as compared to 45% in median approach.[20] In our study. the first attempt success rate was 96% in Group P as compared to 86% in Group M.

Haider *et al.* conducted a randomized clinical study on 50 patients posted for elective below umbilical surgery and compared the incidence of Postdural Puncture Headache (PDPH) in median

and paramedian approaches. Only 4% in Group P had PDPH as compared to 28% in Group M. Thus they concluded the paramedian approach has lesser incidence of PDPH as compared to median approach.[21] Even in our study, the incidence of PDPH is less in Group P (4%) as compared to Group M (18%).

Sheybani *et al.* also studied two approaches of subarachnoid block for the incidence of postdural puncture headache and low backache. Results of the study showed that the incidence of PDPH is less in paramedian approach (12%) as compared to median approach (15%).[22] Our study results also show lesser incidence of PDPH and low backache in Group P (4% and 0%) as compared to Group M (18% and 14%) respectively.

Behery A and Mohammed E had done a randomized clinical trial on 120 elective cesarean section patients for the incidence of PDPH and low backache. Results of the study showed that the incidence of PDPH was less in paramedian approach (5.2%) as compared to median approach (19.6%). Similarly the incidence of low backache was less in Group P (1.7%) as compared to Group M (7.1%).[11] Our study also revealed the similar results.

Janik R and Dick W conducted a randomized study on 250 patients undergoing transurethral prostate surgery under spinal anesthesia for incidence of PDPH and reported a significantly higher rate of PDPH with paramedian approach than the median approach in younger age patients.[23] However, our study done on young patients shows contrarary results.

Li JY *et al*. compared the incidence of Postdural Puncture Headache (PDPH) between median and paramedian approaches of spinal anesthesia on 700 women posted for cesarean section under spinal anesthesia which revealed lower incidence of PDPH in paramedian approach (0.9%) as compared to median approach (4.3%).[24] Our study, also revealed the similar results.

Mosaffa F *et al*. conducted a double blind randomized controlled trial on 150 patients undergoing orthopedic surgery under spinal anesthesia and compared the incidence of PDPH among median and paramedian approach. The study concluded that there is no significant difference in PDPH incidence between the two and therefore, recommended the use of paramedian approach in elderly patients with degenerative changes in the spine and intervertebral spaces.[25]

The main limitation of this study is smaller sample size. The number of patients may be small to draw any firm conclusion regarding superiority of paramedian approach over median approach in reducing PDPH incidence in patients undergoing elective cesarean section under spinal anesthesia. In fact, the results of our study proposes the need for conducting more studies with larger sample size to establish whether median or paramedian approach is better in reducing PDPH.

Conclusion

We conclude that the incidence of postdural puncture headache and low backache is less in paramedian approach as compared to median approach. However, it needs further investigation with more randomized control trials to know the superiority of paramedian approach over median in reducing the incidence of postdural puncture headache.

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Conflict of interest: Nil.

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