

## COMPARISON OF INCIDENCE OF POST-DURAL PUNCTURE HEADACHE IN PATIENTS UNDERGOING SPINAL ANESTHESIA FOLLOWING MEDIAN VS PARAMEDIAN APPROACH

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**Abstract:** *Post-Dural Puncture Headache (PDPH) is a common complication after spinal anesthesia, particularly in obstetric populations. The choice of needle insertion technique, either midline or paramedian, may impact the incidence of PDPH. Previous studies have shown conflicting results, necessitating further investigation in specific patient populations. This prospective study aimed to compare the incidence of PDPH between the midline and paramedian approaches. One hundred twenty-two participants were included and divided equally into two groups (Group M and Group P). Patient demographics, including age, body mass index (BMI), gender distribution, type of surgery, and ASA physical status, were recorded. The occurrence of PDPH within the first three postoperative days was assessed and compared between the two groups. The mean age of the study population was  $37 \pm 9.55$  years, with no significant difference between Group M and Group P ( $p = 0.09$ ). BMI, gender distribution, type of surgery, and ASA physical status also showed no significant differences between the groups. Regarding PDPH incidence, 6.6% of participants in Group M and 4.9% in Group P experienced PDPH. The overall incidence of PDPH in the entire sample was 5.7%. However, the  $p$ -value for comparing the occurrence of PDPH between the two groups was 0.698, indicating no statistically significant difference. This study found no significant difference in the incidence of PDPH between the midline and paramedian approaches. These results align with previous studies that have explored the association between needle insertion techniques and PDPH incidence.*

**Keywords:** Post-Dural Puncture Headache, Spinal Anesthesia, Paramedian Approach, Median Approach, Asa Physical Status

### Introduction

Spinal anesthesia is commonly used in various surgical procedures for its specific advantages and characteristics compared to general anesthesia. Here are some reasons spinal anesthesia may be preferred over general anesthesia (Capdevila et al., 2020). Spinal anesthesia provides regional anesthesia, meaning it numbs a specific body region, usually below the level of the intended surgery (Pozza et al., 2023). This allows for effective pain control during and after the procedure (Plaat et al., 2022). Unlike general anesthesia, spinal anesthesia does not require a complete loss of consciousness. Patients receiving spinal anesthesia remain awake and conscious during the surgery, which can reduce the risks associated with general anesthesia, such as postoperative nausea and vomiting (Munoli, 2020).

Additionally, the patient's breathing remains unaffected, as the anesthesia only affects the lower part of the body. Spinal anesthesia typically has a faster onset than general anesthesia, allowing for a

prompt start of the surgical procedure (Fedorov et al., 2023). The duration of spinal anesthesia is generally shorter, leading to a quicker recovery time and earlier mobilization of the patient (Siddiqi et al., 2022).

Despite its advantages, spinal anesthesia is not without potential complications. Some complications associated with spinal anesthesia include post-dural puncture headache (PDPH), hypotension, urinary retention, infection, bleeding, and nerve injury (Peterson et al., 2021). PDPH is one of the most common complications of spinal anesthesia. It occurs when the dura mater, a protective membrane covering the spinal cord, is unintentionally punctured during the procedure. The resulting headache can be severe and require specific management strategies (Manassero et al., 2020).

Post-dural puncture headache (PDPH) is a recognized complication following spinal anesthesia, occurring after a dural puncture (Guglielminotti et al., 2019). Various factors, including patient characteristics, needle size, technique, and the approach used, can

influence the incidence of PDPH. The median and paramedian techniques are commonly employed among the different approaches utilized in spinal anesthesia. The median approach involves needle insertion in the midline between the spinous processes, while the paramedian approach entails a slight deviation from the midline, often to the right or left of the spinous processes (Choi et al., 2023).

Previous studies have investigated the potential differences in PDPH incidence between the median and paramedian approaches, but the results have been inconclusive, yielding conflicting findings. Some studies suggest that the paramedian approach may have a lower incidence of PDPH than the median approach. This could be attributed to avoiding midline penetration, bypassing the region's tightly packed dural fibers. However, other studies have found no significant difference in the incidence of PDPH between the two approaches (Imbelloni et al., 2021; Smith et al., 2019).

A comprehensive examination is warranted to elucidate potential discrepancies in PDPH incidence between the median and paramedian approaches. This research aims to compare the incidence of post-Dural puncture headaches in patients undergoing spinal anesthesia following the median vs. paramedian approach.

## Methodology

The comparative study was conducted at the Department of Anesthesiology, Aziz Bhatti Shaheed Hospital, Gujrat, Pakistan, from June 2022 to March 2023. The hospital's ethical committee approved this study, and also from the College of Physicians and Surgeon Pakistan (CPSP). The sample size of 122 patients was calculated by World Health Organization (WHO) sample size calculator with the following assumptions: Level of significance ( $\alpha$ ) = 5%, Power of test = 90%, P1 (anticipated post-dural puncture headache) = 4%. P2 (anticipated post-dural puncture headache) = 8% (Nisar et al., 2016).

The participants were divided equally into two groups. Group M (median approach) comprised 61 participants, and Group P (paramedian approach) had 61 participants.

The study population consisted of patients aged 18-50, both genders, with American Society of Anesthesiologists (ASA) Class I/II status and a body mass index (BMI) below 30 kg/m<sup>2</sup>. The participants underwent elective lower limb or lower abdominal surgery under spinal anesthesia. Only patients undergoing elective procedures without overt signs or symptoms of hypovolemia in the perioperative period were included to ensure homogeneity.

Exclusion criteria encompassed patients who refused to participate, had allergies to the drugs used, had a

history of postural puncture headache associated with spinal anesthesia, had contraindications to spinal anesthesia, or required more than three attempts at spinal anesthesia.

Before commencing the block, facilities for resuscitation and backup of general anesthesia were confirmed. Monitors (ECG, NIBP, and SpO<sub>2</sub>) were attached, and IV access was secured. The back was cleaned using an antibacterial solution. All blocks were performed in the sitting posture after appropriately preloading with Lactated Ringer's solution. Observing aseptic measures, the skin was infiltrated with 2% lignocaine solution at the appropriate lumbar space. Patients were thoroughly informed about both procedures, including possible complications and benefits, and had the option to decline participation. Random assignment to the two groups was accomplished using the sealed envelope technique. Informed consent was obtained, and patient data was collected using a specially designed proforma.

Group M received spinal anesthesia with a midline approach, which involves the passage of the needle through supraspinal, interspinal, and ligamentum flavum. At the same time, Group P underwent the paramedian approach, which avoids supra and interspinal ligaments and hits ligamentum flavum directly after passing through paraspinal muscles.

Spinal anesthesia was administered at the L3-4 or L4-5 level using a 25/26-gauge Quincke needle, and 2.5 ml of hyperbaric bupivacaine was injected for both approaches. The bevel of the needle was oriented parallel to the longitudinal fibers of the dura.

Post-dural puncture headache (PDPH) was defined as a bilateral throbbing headache reported by patients within 6-72 hours after spinal anesthesia administration. The diagnostic criteria for PDPH included a history of spinal anesthesia, duration of headache, location (frontal or occipital), aggravation by standing or movement, and relief upon lying down. The Visual Analogue Scale (VAS) was used to assess pain severity. The VAS consists of a diagram printed on an A4 sheet, with lines precisely measuring 10 cm in length. The printed sheet was folded at the dotted line, ensuring that the numbered side was not visible to the patient. The patient was then instructed to mark the line on the unfolded side corresponding to their perceived pain level, ranging from no pain to the worst pain imaginable. The VAS score was subsequently measured by unfolding the sheet and recording the corresponding numerical score.

Data analysis was performed using SPSS-20 software. Quantitative variables such as age and degree of paresthesia were expressed as mean  $\pm$  standard deviation (S.D.). Frequencies and percentages were calculated for post-Dural puncture headache, ASA physical status, and type of surgery. Independent

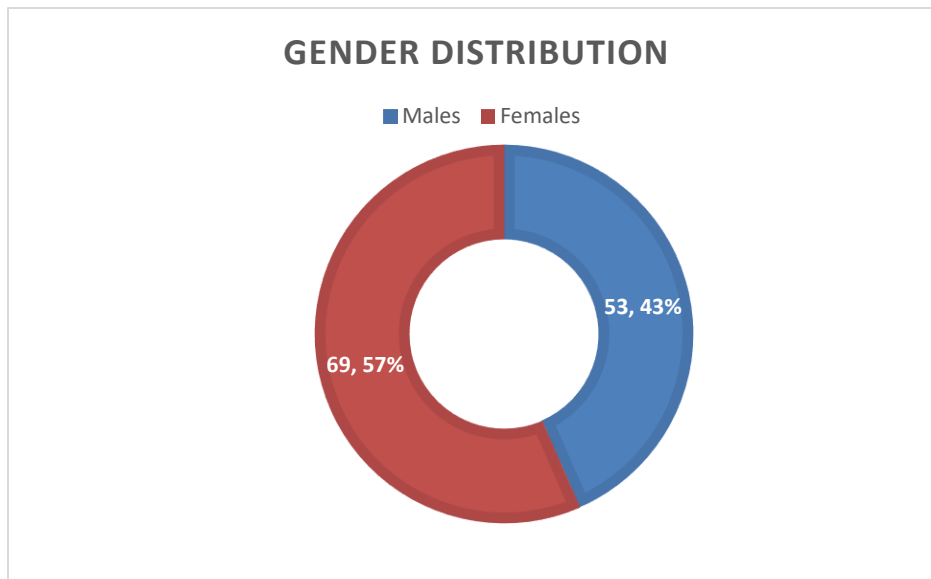
sample t-tests were used to compare quantitative variables, while chi-square tests were employed for qualitative variables. A p-value of  $\leq 0.05$  was considered statistically significant.

## Results

A total of 122 participants were included in the study and divided equally into two groups. The mean age of the study population was  $37 \pm 9.55$  years, with 53 males and 69 females in the study group (figure 1). The first variable examined was age, where Group M had a mean age of 38.85 years ( $\pm 9.26$  S.D), while Group P had a slightly lower mean age of 36.95 years ( $\pm 8.61$  S.D). The p-value associated with this comparison was 0.09, suggesting a trend toward a significant difference, although not reaching statistical significance. Next, we considered the body mass index (BMI) as a measure of body composition. The mean BMI in Group M was 28.2 ( $\pm 1.5$  S.D), whereas, in Group P, it was slightly lower at 27.9 ( $\pm 2.6$  S.D). However, the p-value of 0.68 indicated no significant difference between the two groups regarding BMI. The distribution of gender within the two groups was also examined. In both Group M and Group P, males accounted for approximately 43% of the participants, with 26 males (42.8%) in Group M and 27 males (43.5%) in Group P. Similarly, females constituted the majority in both groups, with 35 females (57.2%) in Group M and 34 females (56.6%) in Group P. The p-values for gender comparison were 0.55 and 0.87, respectively, indicating no significant differences between the groups based on gender distribution. We also analyzed the type of surgery undergone by the participants. In Group M, 39.5%

were C-sections, 33.5% were abdominal surgeries, and 27% were orthopedic surgeries. Similarly, the corresponding percentages in Group P were 37.2%, 35.3%, and 27.5%, respectively (Figure 2). The p-values for these comparisons were 0.52, 0.088, and 0.98, suggesting no significant differences in the distribution of surgery types between the two groups. Finally, we considered the ASA physical status classification, which indicates the participants' overall health. In Group M and Group P, most individuals fell under ASA physical status I, accounting for 78.5% and 77.5% of the participants, respectively. ASA physical status II was less prevalent, with 21.5% in Group M and 22.5% in Group P. The p-values associated with these comparisons were 0.12 and 0.36, respectively, indicating no significant differences in ASA Physical status between the two groups as there is no significant difference between groups, so we can compare these two groups for the incidence of PDPH (Table 1).

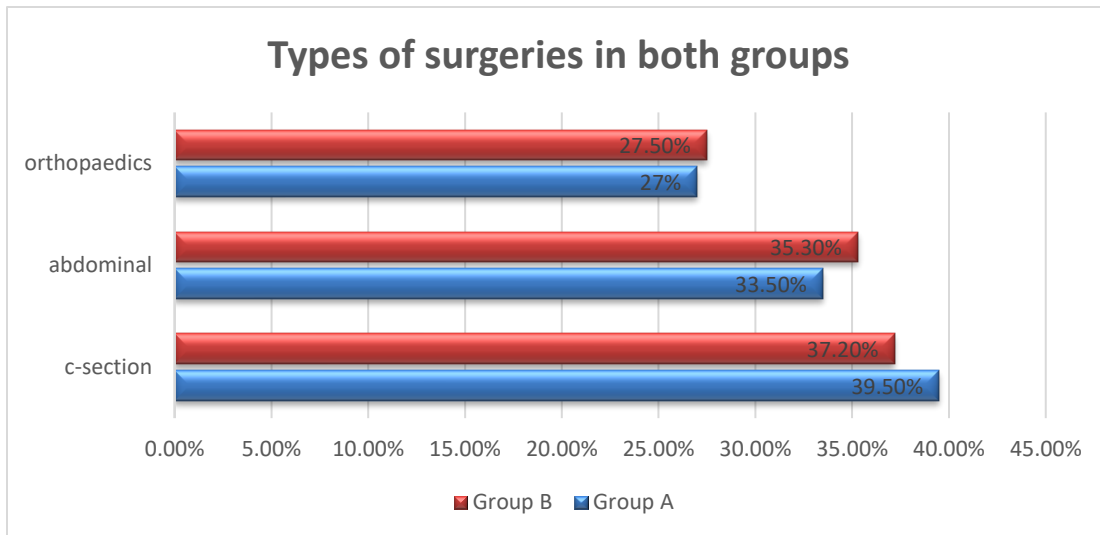
The table presents the occurrence of Post-Dural Puncture Headache (PDPH) in Group M and Group P, as well as the total count and percentages for the entire sample ( $n=122$ ). Additionally, the p-value is provided to assess the statistical significance of any observed differences. Within Group M, consisting of 61 participants, 4 individuals (6.6%) reported experiencing PDPH. In Group P, comprising the same number of participants, 3 individuals (4.9%) reported PDPH. When considering the entire sample, 7 experienced PDPH. The p-value calculated for comparing the occurrence of PDPH between Group M participants (5.7%) and Group P was 0.698, suggesting no statistically significant difference (Table 2, figure 3).



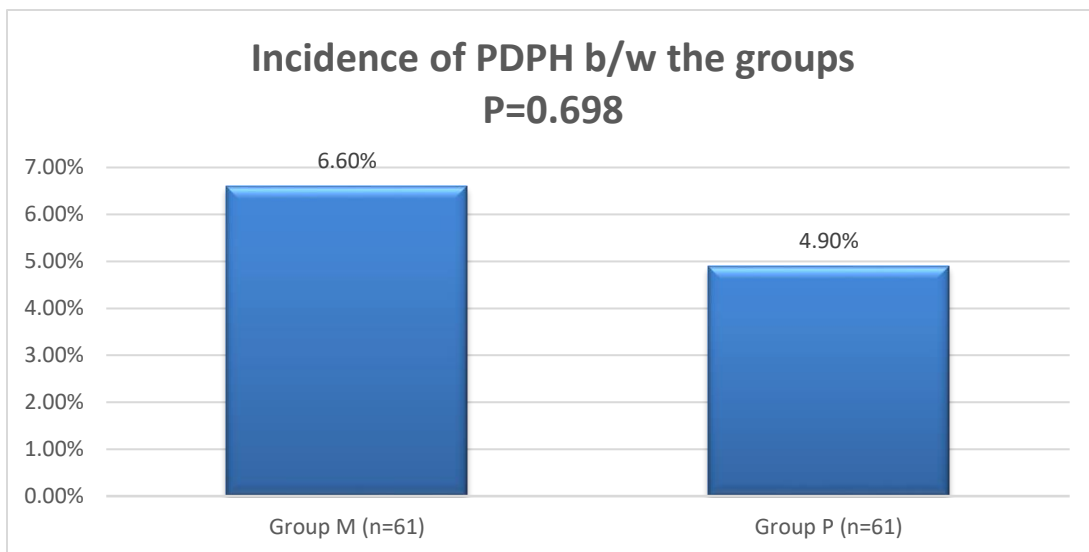
**Figure 1** Distribution of gender in the study population

**Table 1 Demographic variable of study groups:**

variables	constructs	Group M (n=61)	Group P (n=61)	p-value
<b>Age (mean ± S.D)</b>		38.85 ± 9.26	36.95 ± 8.61	0.09
<b>BMI (mean ± S.D)</b>		28.2 ± 1.5	27.9 ± 2.6	0.68
<b>Gender (n, %)</b>	Male	26 (42.8%)	27 (43.5%)	0.55
	Female	35 (57.2%)	34 (56.6%)	0.87
<b>Type of surgery (n, %)</b>	c-section	24 (39.5%)	23 (37.2%)	0.52
	abdominal	20 (33.5%)	22 (35.3%)	0.088
	orthopedics	16 (27%)	17 (27.5%)	0.98
<b>ASA physical status (n, %)</b>	I	48 (78.5%)	47 (77.5%)	0.12
	II	13 (21.5%)	14 (22.5%)	0.36



**Figure 2 Comparison of types of surgeries in both groups**



**Figure 3 shows the incidence of Post Dural Puncture Headaches in both groups.**

[Citation Butt M.R., Javed, H.M., Ashfaq, M.A., Zahid, M.M, Iqbal, A., Khalid, M. (2023). Comparison of incidence of post-dural puncture headache in patients undergoing spinal anesthesia following median vs paramedian approach. *Biol. Clin. Sci. Res. J.*, 2023: 338. doi: <https://doi.org/10.54112/bcsrj.v2023i1.338>]

**Table 2 Incidence of PDPH between the groups:**

PDPH	Group M (n=61)	%age	Group P (n=61)	%age	Total (n=122)	%age	P-value
Yes	4	6.6	3	4.9	7	5.7	<b>0.698</b>
No	57	93.4	58	95.1	115	94.3	

## Discussion

In our study, we investigated the incidence of Post-Dural Puncture Headache (PDPH) in two groups of participants (Group M and Group P) with similar sample sizes (61 participants each) from a total of 122 individuals. The mean age of the study population was  $37 \pm 9.55$  years, and there was no significant difference in age between the two groups ( $p = 0.09$ ). Similarly, there were no significant differences in body mass index (BMI) between the groups ( $p = 0.68$ ) or in the distribution of gender ( $p = 0.55$  and  $0.87$ ). Regarding the type of surgery, the distribution of surgical procedures was comparable between the groups, with no significant differences ( $p = 0.52$ ,  $0.088$ , and  $0.98$ ). Most participants in both groups had ASA physical status I, indicating a generally healthy population, and there were no significant differences in ASA physical status between the groups ( $p = 0.12$  and  $0.36$ ).

Regarding PDPH incidence, we found that 6.6% of participants in Group M and 4.9% in Group P experienced PDPH. The overall incidence of PDPH was 5.7% when considering the entire sample. However, the p-value for comparing the occurrence of PDPH between Group M and Group P was 0.698, indicating no statistically significant difference.

A study revealed that 8/75 patients in the Paramedian group, compared to 7/75 participants in the Median group, had classic PDPH. The outcome revealed no notable distinctions between the two groups ( $P=0.875$ ) (Mosaffa et al., 2011).

Another clinical experiment used a median and paramedian method for spinal anesthesia on 125 patients scheduled for elective C-sections. Three days after surgery, headaches were monitored. In the paramedian group, there were 9.8% more headaches than in the median group (9.4% vs. 9.8%,  $p>0.05$ ). The authors concluded that the paramedian technique is acceptable and does not increase the risk of headaches and hemodynamic abnormalities in pregnant women who have trouble situating themselves (SADEGHI et al., 2009).

There were debatable outcomes in another randomized control experiment. According to the study, only 4% of the paramedian and 28% of the median group had PDPH. The difference is statistically significant ( $p=0.05$ ) and clinically significant. Although the paramedian method has

been shown to have a lower incidence of PDPH than the midline approach<sup>8</sup>,

According to certain studies, the midline technique is related to a higher incidence of PDPH, which have contradictory results.

In a study conducted by Haider et al. involving 50 patients undergoing various elective surgeries under spinal anesthesia, a statistically significant difference in the incidence of Post-Dural Puncture Headache (PDPH) was observed between the median and paramedian approaches. The researchers concluded that using the paramedian approach with the Quincke level needle significantly reduces the occurrence of PDPH. These findings highlight the potential benefits of employing the paramedian technique in reducing the incidence of PDPH, providing valuable insights for clinical practice in spinal anesthesia (Haider et al., 2005).

In their study, Mosaffa et al. found no significant difference in the incidence of Post-Dural Puncture Headache (PDPH) between the median and paramedian approaches. As a result, they recommend the paramedian approach, particularly for older patients with degenerative changes in the spine and intervertebral spaces, as well as for those who may have difficulty assuming the proper position for the median approach. The paramedian approach offers easier positioning, which can lead to reduced pain for the patient and a higher success rate for spinal anesthesia. These findings provide valuable guidance for healthcare professionals in selecting the appropriate approach for spinal anesthesia, considering patient characteristics and ease of positioning (Mosaffa et al., 2011).

However, other patient populations or age categories are frequently included in these investigations. Age, BMI, gender distribution, type of surgery, or ASA physical state was not significantly different across the groups in our investigation, which supports the validity of our conclusions.

## Conclusion

In conclusion, our study found no significant difference in the incidence of PDPH between Group M and Group P. Although more patients experience PDPH in the Median group, the difference is not statistically significant. These results are consistent with previous studies that have explored the association between different approaches and PDPH

[Citation Butt M.R., Javed, H.M., Ashfaq, M.A., Zahid, M.M, Iqbal, A., Khalid, M. (2023). Comparison of incidence of post-dural puncture headache in patients undergoing spinal anesthesia following median vs paramedian approach. *Biol. Clin. Sci. Res. J.*, 2023: 338. doi: <https://doi.org/10.54112/bcsrj.v2023i1.338>]

incidence. Further research with larger sample sizes and more diverse populations may be beneficial to confirm these findings.

### Conflict of interest

The authors declared absence of conflict of interest.

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