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Original Article

Incidence of Post-Dural Puncture Headache Following Spinal Anaesthesia: A Comparative Study of 23G, 25G, and 26G Spinal Needles

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ABSTRACT

Background: Post-dural puncture headache (PDPH) is one of the most common complications of spinal anaesthesia and is influenced by several factors, including the size of the spinal needle. The use of smaller-gauge needles has been suggested to reduce the incidence of PDPH.
Aim: To compare the incidence and severity of PDPH following spinal anaesthesia using 23G, 25G, and 26G Quincke spinal needles.
Materials and Methods: This prospective randomized comparative study included 60 patients undergoing elective lower abdominal and lower limb surgeries under spinal anaesthesia. Patients were randomly allocated into three equal groups: Group A (23G Quincke), Group B (25G Quincke), and Group C (26G Quincke), with 20 patients in each group. Patients were followed for 48 hours postoperatively for the occurrence, severity, and onset of PDPH. Data were analyzed using SPSS version 15.0, with $p<0.05$ considered statistically significant.
Results: Baseline demographic and operative characteristics were comparable among the groups ($p>0.05$). The incidence of PDPH was significantly higher in Group A (30.0%) than in Group B (15.0%) and Group C (5.0%) ($p=0.041$). Severe headache occurred only in the 23G group, while 95.0% of patients in the 26G group remained headache-free ($p=0.036$). Most PDPH cases developed within 24–48 hours. Postoperative complications were infrequent and comparable among the groups.
Conclusion: The 26G Quincke spinal needle significantly reduced the incidence and severity of PDPH compared with the 23G and 25G needles. Its routine use may improve patient comfort and postoperative outcomes following spinal anaesthesia.

Keywords*: Post-dural puncture headache, spinal anaesthesia, Quincke spinal needle, 23G needle, 25G needle, 26G needle, spinal needle gauge, cerebrospinal fluid leakage.*

INTRODUCTION

Spinal anaesthesia is one of the most widely used regional anaesthetic techniques for lower abdominal, pelvic, perineal, obstetric, and lower limb surgeries because of its rapid onset, reliable sensory and motor blockade, excellent postoperative analgesia, and favourable safety profile[1]. Compared with general anaesthesia, it preserves spontaneous respiration, reduces postoperative nausea and vomiting, facilitates earlier mobilization, and improves patient satisfaction, making it the preferred anaesthetic technique for a wide range of elective and emergency procedures[2].Despite these advantages, post-dural puncture headache (PDPH) remains one of the most common and clinically significant complications of spinal anaesthesia. PDPH results from leakage of cerebrospinal fluid (CSF) through the dural puncture site, leading to reduced CSF volume, intracranial hypotension, traction on pain-sensitive intracranial structures, and compensatory cerebral vasodilation. Although usually self-limiting, PDPH can cause considerable discomfort, delay ambulation and discharge, prolong hospital stay, and negatively affect postoperative recovery and patient satisfaction.[1,2]According to the International Classification of Headache Disorders (ICHD-3), PDPH is a postural headache occurring within five days of

dural puncture that worsens on sitting or standing and improves on lying down. It is commonly accompanied by neck stiffness, nausea, vomiting, dizziness, tinnitus, photophobia, or diplopia, with most patients recovering spontaneously or after an epidural blood patch.[1,3]The reported incidence of PDPH varies from less than 1% to over 30%, depending on patient characteristics, procedural factors, and the type of spinal needle used. Younger age, female sex, pregnancy, low body mass index, and previous PDPH are recognized patient-related risk factors, whereas multiple puncture attempts, operator experience, bevel orientation, and particularly spinal needle design and gauge are important modifiable determinants.[4,5]Among these, needle gauge is considered one of the most influential factors. Larger-gauge needles produce a wider dural defect, increasing CSF leakage and the likelihood of PDPH, whereas smaller-gauge needles reduce dural trauma and headache incidence. However, finer needles may be technically more challenging because of slower CSF flow and reduced tactile feedback, necessitating a balance between procedural ease and patient safety.[5,6]Quincke cutting needles remain widely used, especially in resource-limited settings, because of their affordability and availability. The commonly used 23G, 25G, and 26G needles differ in their balance between ease of use and PDPH risk. While the 23G needle facilitates CSF identification, it has been associated with a higher incidence of PDPH, whereas 25G and 26G needles appear to reduce headache occurrence, although previous studies have reported inconsistent findings.[7]

Therefore, the present study, "Incidence of Post-Dural Puncture Headache Following Spinal Anaesthesia: A Comparative Study of 23G, 25G, and 26G Spinal Needles," was designed to compare the incidence, severity, onset, duration, and associated clinical characteristics of PDPH among patients receiving spinal anaesthesia with 23G, 25G, and 26G Quincke spinal needles, with the objective of identifying the needle gauge associated with the most favourable clinical outcome.

MATERIALS AND METHODS

This prospective, comparative study was conducted in the Department of Anaesthesiology at a tertiary care teaching hospital after obtaining approval from the Institutional Ethics Committee. The study evaluated the incidence of post-dural puncture headache (PDPH) following spinal anaesthesia using three different sizes of Quincke spinal needles.The study was conducted over the predefined study period after obtaining institutional ethical clearance.

Sample Size

A total of 60 patients scheduled to undergo elective lower abdominal and lower limb surgeries under spinal anaesthesia were enrolled in the study. The patients were randomly allocated into three equal groups comprising 20 patients each.

- Group A (n = 20): 23G Quincke spinal needle
- Group B (n = 20): 25G Quincke spinal needle
- Group C (n = 20): 26G Quincke spinal needle

Study Population

Inclusion Criteria

Patients fulfilling the following criteria were included in the study:

- Age ≥16 years.
- American Society of Anesthesiologists (ASA) physical status I–III.
- Patients scheduled for elective lower abdominal or lower limb surgeries under spinal anaesthesia.
- Patients willing to participate and provide written informed consent.

Exclusion Criteria

Patients were excluded if they had any of the following:

- Refusal to participate.
- Coagulation disorders.
- Local infection at the site of spinal puncture.
- Psychological disorders interfering with assessment.
- History of migraine or chronic headache.
- History of cardiac, respiratory, renal, or hepatic failure.
- Hemodynamic instability (heart rate <50 beats/min or systolic blood pressure <90 mmHg).
- Known allergy to study medications.

Randomization

After enrollment, patients were randomly assigned into one of the three study groups using a computer-generated randomization schedule. Each group consisted of 20 patients receiving spinal anaesthesia with the designated Quincke spinal needle size.

Preoperative Assessment

All patients underwent a detailed pre-anaesthetic evaluation that included medical history, physical examination, systemic examination, and routine laboratory investigations as indicated. Written informed consent was obtained from each participant before surgery.

Anaesthetic Technique
Upon arrival in the operating room, an intravenous cannula (18G or 20G) was secured and standard monitoring, including electrocardiography (ECG), non-invasive blood pressure (NIBP), pulse oximetry (SpO_2), and respiratory rate monitoring, was instituted. Baseline vital parameters were recorded.All patients received intravenous ondansetron at a dose of 0.15 mg/kg as premedication.Spinal anaesthesia was performed with the patient in either the sitting or left lateral decubitus position under strict aseptic precautions. After skin preparation and draping, local infiltration with 2 mL of 2% lignocaine was administered at the puncture site. Lumbar puncture was performed through the midline approach at either the L3–L4 or L4–L5 intervertebral space using the allocated 23G, 25G, or 26G Quincke spinal needle.After confirmation of free flow of cerebrospinal fluid, 0.5% hyperbaric bupivacaine (2.0–3.6 mL) was injected intrathecally according to the surgical requirement and patient characteristics. Following completion of the procedure, patients were positioned supine.

Intraoperative Monitoring
Sensory blockade was assessed using the pinprick method, while motor blockade was evaluated using the Modified Bromage Scale. Heart rate, blood pressure, oxygen saturation, and respiratory status were monitored throughout the procedure.Bradycardia (heart rate <50 beats/min) was treated with intravenous atropine 0.6 mg, while hypotension was managed with intravenous mephentermine along with intravenous fluids as required.

Postoperative Follow-up
After surgery, patients were transferred to the postoperative ward following stabilization of vital signs. They were evaluated at 6, 12, 18, 24, and 48 hours postoperatively for the occurrence of headache, nausea, vomiting, photophobia, and other complications.

Outcome Assessment
Primary Outcome
The primary outcome was the incidence of post-dural puncture headache (PDPH) among the three study groups.PDPH was diagnosed according to the International Headache Society (IHS) criteria as a headache occurring within 6 hours to 7 days after spinal puncture that worsened within 15 minutes of assuming the upright position and improved within 30 minutes of lying down.

Secondary Outcomes
Secondary outcome measures included:
- Severity of PDPH.
- Incidence of nausea and vomiting.
- Incidence of photophobia.
- Requirement for treatment of PDPH.

The severity of headache was graded using the Modified Lybecker Classification as:
- Mild
- Moderate
- Severe

Statistical Analysis
The collected data were entered into Microsoft Excel and subsequently analyzed using SPSS software version 26.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. Comparisons among the three groups were performed using one-way analysis of variance (ANOVA) for continuous variables and the Chi-square test or Fisher's exact test for categorical variables, as appropriate. A p-value <0.05 was considered statistically significant, with a 95% confidence interval maintained for all statistical analyses.

RESULTS
A total of 60 patients were enrolled in the study and were equally allocated into three groups according to the spinal needle used: Group A (23G Quincke), Group B (25G Quincke), and Group C (26G Quincke), with 20 patients in each group.The baseline demographic and clinical characteristics were comparable among the three groups. The mean age was 39.8 ± 12.1 years in Group A, 40.6 ± 11.5 years in Group B, and 41.2 ± 10.8 years in Group C (p = 0.913). Similarly, there were no statistically significant differences with respect to sex distribution, body weight, body mass index, or ASA physical status, indicating adequate baseline comparability between the study groups (Table 1).The distribution of surgical procedures and anaesthetic characteristics was also comparable across the three groups. Lower abdominal surgeries accounted for 55.0%, 50.0%, and 60.0% of cases in Groups A, B, and C, respectively, while the remaining patients underwent lower limb surgeries. The level of spinal puncture (L3–L4 or L4–L5) and the mean dose of hyperbaric bupivacaine administered were similar among the groups, with no statistically significant differences (Table 2).The incidence of post-dural puncture headache (PDPH) differed significantly among the three groups. PDPH occurred in 30.0% of patients in the 23G group,

compared with 15.0% in the 25G group and 5.0% in the 26G group (p = 0.041), demonstrating a progressive reduction in PDPH incidence with decreasing needle diameter (Table 3, Figure 1).Assessment of headache severity using the Modified Lybecker Classification showed that most patients in all groups experienced no headache. However, moderate and severe headaches were observed predominantly in the 23G group. Mild headache occurred in 15.0%, 10.0%, and 5.0% of patients in Groups A, B, and C, respectively, whereas severe headache was reported only in one patient (5.0%) in Group A. The difference in headache severity among the groups was statistically significant (p = 0.036) (Table 4, Figure 2).Regarding the onset of PDPH, the majority of headache episodes developed within 24–48 hours following spinal anaesthesia. Although the 23G group showed a higher number of early and delayed headache episodes than the other groups, the difference in the timing of headache onset did not reach statistical significance (p = 0.118) (Table 5, Figure 3).Postoperative complications were generally infrequent. Nausea was the most commonly observed adverse event, occurring in 20.0%, 10.0%, and 5.0% of patients in Groups A, B, and C, respectively. Vomiting, photophobia, neck stiffness, and the requirement for an epidural blood patch were uncommon and did not differ significantly among the groups (all p > 0.05) (Table 6).

Table 1. Baseline Demographic and Clinical Characteristics

Variable	Group A (23G) (n=20)	Group B (25G) (n=20)	Group C (26G) (n=20)	p-value
Age (years), Mean ± SD	39.8 ± 12.1	40.6 ± 11.5	41.2 ± 10.8	0.913
Male/Female, n	12/8	11/9	13/7	0.823
Weight (kg), Mean ± SD	63.8 ± 8.6	64.7 ± 7.9	65.1 ± 8.2	0.872
BMI (kg/m²), Mean ± SD	24.1 ± 2.8	24.6 ± 2.6	24.4 ± 2.5	0.846
ASA I, n (%)	12 (60.0)	11 (55.0)	13 (65.0)	0.821
ASA II, n (%)	8 (40.0)	9 (45.0)	7 (35.0)	

Table 2. Surgical and Anaesthetic Characteristics

Variable	Group A (23G)	Group B (25G)	Group C (26G)	p-value
Lower abdominal surgery, n (%)	11 (55.0)	10 (50.0)	12 (60.0)	0.813
Lower limb surgery, n (%)	9 (45.0)	10 (50.0)	8 (40.0)	
L3–L4 puncture, n (%)	13 (65.0)	14 (70.0)	12 (60.0)	0.804
L4–L5 puncture, n (%)	7 (35.0)	6 (30.0)	8 (40.0)	
Hyperbaric bupivacaine dose (mL), Mean ± SD	2.8 ± 0.3	2.7 ± 0.3	2.8 ± 0.2	0.692

Table 3. Incidence of Post-Dural Puncture Headache

Variable	Group A (23G)	Group B (25G)	Group C (26G)	p-value
PDPH Present, n (%)	6 (30.0)	3 (15.0)	1 (5.0)	**0.041**
PDPH Absent, n (%)	14 (70.0)	17 (85.0)	19 (95.0)	

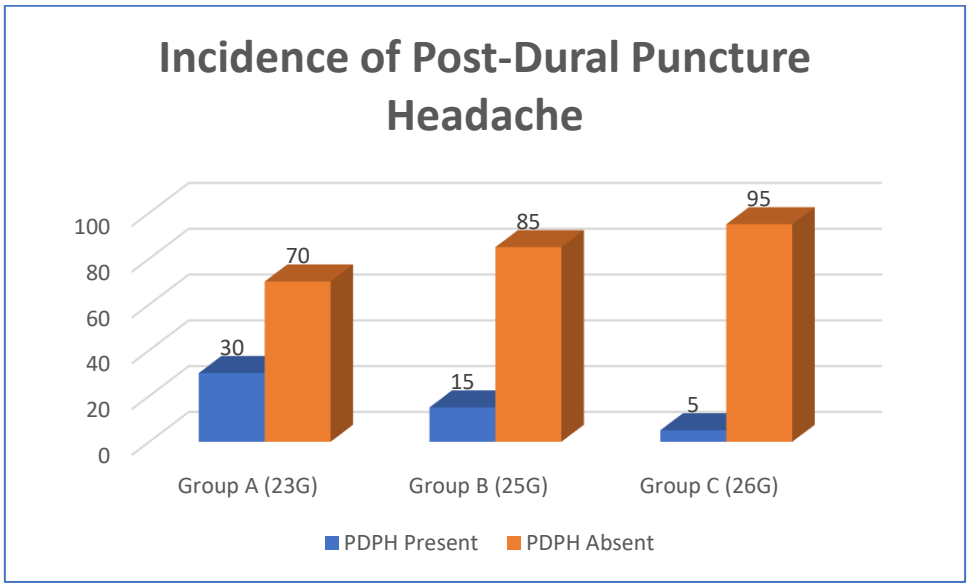

Figure 1 Incidence of Post-Dural Puncture Headache

Table 4. Severity of Post-Dural Puncture Headache (Modified Lybecker Classification)

Severity	Group A (23G)	Group B (25G)	Group C (26G)	p-value
No headache	14 (70.0)	17 (85.0)	19 (95.0)	

Mild	3 (15.0)	2 (10.0)	1 (5.0)	
Moderate	2 (10.0)	1 (5.0)	0 (0.0)	
Severe	1 (5.0)	0 (0.0)	0 (0.0)	**0.036**

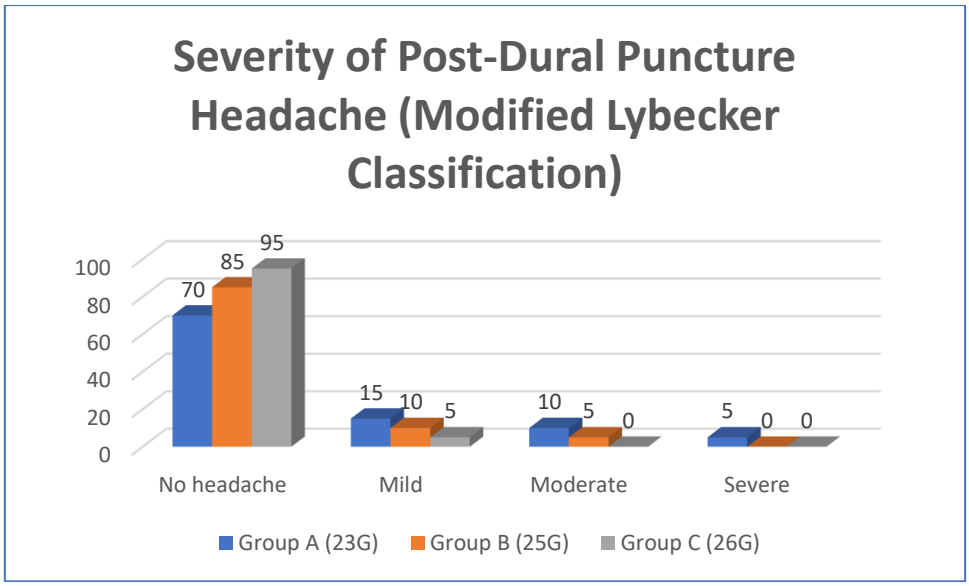

Figure 2 Severity of Post-Dural Puncture Headache (Modified Lybecker Classification)

Table 5. Time of Onset of Post-Dural Puncture Headache

Time of Onset	Group A (23G)	Group B (25G)	Group C (26G)	p-value
Within 24 hours	2 (10.0)	1 (5.0)	0 (0.0)	
24–48 hours	3 (15.0)	2 (10.0)	1 (5.0)	
>48 hours	1 (5.0)	0 (0.0)	0 (0.0)	**0.118**

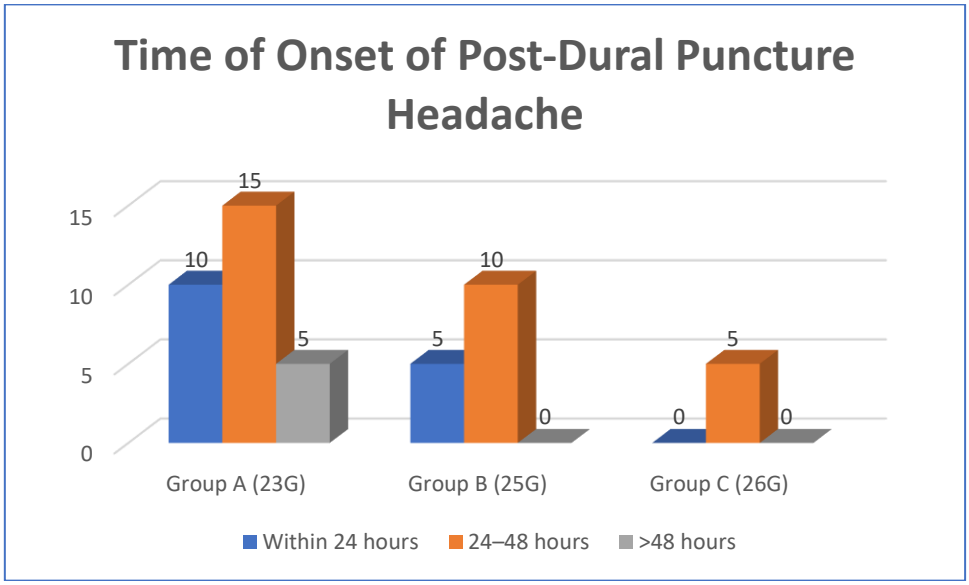

Figure 3 Time of Onset of Post-Dural Puncture Headache

Table 6. Associated Postoperative Complications

Variable	Group A (23G)	Group B (25G)	Group C (26G)	p-value
Nausea, n (%)	4 (20.0)	2 (10.0)	1 (5.0)	0.322
Vomiting, n (%)	2 (10.0)	1 (5.0)	0 (0.0)	0.351
Photophobia, n (%)	2 (10.0)	1 (5.0)	0 (0.0)	0.351
Neck stiffness, n (%)	1 (5.0)	0 (0.0)	0 (0.0)	0.362
Epidural blood patch required, n (%)	1 (5.0)	0 (0.0)	0 (0.0)	0.362

DISCUSSION

The present prospective randomized comparative study evaluated the incidence of post-dural puncture headache (PDPH) following spinal anaesthesia using 23G, 25G, and 26G Quincke spinal needles in patients undergoing lower abdominal and lower limb surgeries. The principal finding was that both the incidence and severity of PDPH progressively decreased with the use of smaller-gauge needles. Patients in the 26G Quincke group had the lowest incidence of PDPH, whereas the 23G group had the highest, supporting the concept that smaller dural punctures reduce cerebrospinal fluid leakage and consequently lower the risk of PDPH.Baseline demographic and clinical characteristics were comparable among the three groups. The mean age was 39.8 ± 12.1, 40.6 ± 11.5, and 41.2 ± 10.8 years in the 23G, 25G, and 26G groups, respectively, while sex distribution, BMI, body weight, ASA physical status, type of surgery, spinal puncture level, and intrathecal bupivacaine dose were similar (all $p>0.05$). These findings indicate successful randomization and suggest that differences in PDPH were attributable primarily to needle gauge rather than patient or procedural factors.The incidence of PDPH was significantly higher in the 23G group (30.0%) than in the 25G (15.0%) and 26G (5.0%) groups ($p=0.041$), demonstrating a clear inverse relationship between needle gauge and PDPH occurrence. Similar findings were reported by Chauhan and Gupta,[11] who compared 25G and 26G Quincke needles and observed PDPH incidences of 8.0% and 4.0%, respectively, concluding that smaller-gauge needles were associated with fewer headaches. Likewise, Trijayanti et al.[12] compared 25G, 26G, and 27G Quincke needles in patients undergoing brachytherapy and reported the highest number of PDPH cases with 25G needles, while only two cases each occurred with 26G and 27G needles, further supporting the protective effect of smaller-gauge needles. Epidemiological evidence has similarly identified needle diameter as one of the most important modifiable risk factors for PDPH, with the incidence declining substantially as needle size decreases.Headache severity also favored smaller-gauge needles. Severe PDPH occurred only in the 23G group (5%), whereas no patient in the 25G or 26G groups experienced severe headache. Furthermore, 95% of patients in the 26G group remained completely headache-free. Malik et al.[13] reported comparable findings, demonstrating lower PDPH rates with 27G Quincke and 27G Whitacre needles than with 25G Quincke needles, with severe headache being uncommon when smaller or atraumatic needles were used.

Most PDPH episodes in the present study developed within 24–48 hours after spinal anaesthesia, consistent with previous reports.[13] Postoperative complications other than headache were infrequent. Nausea was the most common associated symptom and decreased with smaller needle size, while vomiting, photophobia, neck stiffness, and epidural blood patch requirement were rare and comparable among groups.

CONCLUSION

The present study demonstrated that the incidence and severity of post-dural puncture headache decreased progressively with the use of smaller-gauge Quincke spinal needles. The 26G Quincke needle was associated with the lowest incidence of PDPH, while the 23G needle showed the highest incidence. Smaller-gauge needles also resulted in fewer headache-related complications without compromising the effectiveness of spinal anaesthesia. Therefore, the 26G Quincke spinal needle may be preferred for routine spinal anaesthesia to minimize the risk of PDPH and improve postoperative patient comfort.

Limitations

The study was conducted at a single tertiary care center with a relatively small sample size, which may limit the generalizability of the findings. Patients were followed only during the early postoperative period; therefore, late-onset PDPH and long-term outcomes could not be assessed. In addition, only Quincke spinal needles were evaluated, and comparisons with atraumatic (pencil-point) needles were not performed.

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