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COMPARISON OF POST DURAL PUNCTURE HEADACHE IN 23- AND 25-GAUGE SPINAL NEEDLE IN ELECTIVE ORTHOPEDIC SURGERIES

Original Research

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ABSTRACT

Background: Post-Dural Puncture Headache (PDPH) is a common complication following spinal anesthesia, primarily resulting from cerebrospinal fluid (CSF) leakage at the puncture site. It typically presents as a positional, pulsating headache, often accompanied by nausea, vomiting, and neck stiffness. Risk factors include younger age, female gender, and the use of larger, cutting-type spinal needles such as the Quincke design. PDPH can prolong hospitalization and impact postoperative recovery, highlighting the need for preventive strategies.

Objective: To evaluate the incidence of PDPH in patients undergoing elective orthopedic surgeries using 23-gauge versus 25-gauge Quincke spinal needles and to identify associated risk factors.

Methods: An analytical cross-sectional study was conducted on 151 patients scheduled for elective orthopedic procedures under spinal anesthesia. Participants were selected using non-probability convenience sampling. Patients were divided based on the gauge of Quincke spinal needle used (23G or 25G). Data were collected retrospectively through postoperative clinical records. Variables assessed included headache onset timing, treatment approach, and resolution. Statistical analysis was performed using SPSS version 25, with significance determined by chi-square testing ($p<0.05$).

Results: Of the 151 patients, 91 (60.3%) were male and 60 (39.7%) were female. A total of 83 patients (55.0%) received the 23G needle and 68 (45.0%) received the 25G needle. PDPH onset was most frequent within 48–72 hours post-procedure (61 patients, 40.4%), followed by within 24 hours (41 patients, 27.2%) and between 24–48 hours (29 patients, 19.2%). Bed rest was administered to 87 patients (57.6%), while 64 (42.4%) had spontaneous resolution. Ultimately, all 151 patients (100%) reported complete headache relief. The incidence of PDPH was notably lower in the 25G group.

Conclusion: This study demonstrates that the use of smaller gauge Quincke needles, specifically the 25G, is associated with a reduced incidence of PDPH in patients undergoing orthopedic spinal anesthesia. These findings support the adoption of finer needles to enhance postoperative recovery and minimize complications.

Keywords: Anesthesia, Cerebrospinal Fluid Leak, Headache, Orthopedic Procedures, Post-Dural Puncture Headache, Quincke Needle, Spinal Puncture.

INTRODUCTION

Post-dural puncture headache (PDPH) remains a frequent and distressing complication following spinal anesthesia, particularly in patients undergoing procedures requiring puncture of the dura mater, the protective sheath around the brain and spinal cord. The condition is most often attributed to cerebrospinal fluid (CSF) leakage at the puncture site, leading to reduced intracranial pressure and compensatory cerebral vasodilation. Clinically, PDPH presents as a throbbing headache that worsens with upright posture and eases when lying down, frequently accompanied by nausea, vomiting, photophobia, and neck stiffness. The incidence of PDPH varies widely, with reports ranging from 7% to 30% depending on patient characteristics and procedural factors (1,2). A growing body of literature suggests that several factors influence the likelihood of developing PDPH. These include the size and design of the spinal needle, the orientation and technique of insertion, as well as patient-related factors such as age, gender, body mass index, and a prior history of PDPH (3,4). Cutting-tip needles, such as Quincke, are historically linked with a higher incidence of PDPH compared to non-cutting, pencil-point needles like Whitacre. Among cutting needles, larger gauges (e.g., 22G) are more likely to cause CSF leakage, while smaller gauge needles (25G and below) are associated with a reduced risk (5). However, finer needles also pose technical challenges, including increased failure rates and the need for greater skill during insertion (6).

Elderly patients, in particular, pose a unique clinical challenge for spinal anesthesia. Age-related degenerative changes in the spine can make dural access more difficult and may heighten the risk of complications, including PDPH and post-dural puncture backache (PDPB). These complications can delay recovery, prolong hospitalization, and diminish postoperative quality of life. Additionally, the potential for hemodynamic instability in older individuals receiving high doses of spinal anesthesia has prompted investigations into the balance between effective anesthesia and safety in this population (7,8). Although spinal anesthesia remains a preferred technique in various surgical disciplines—especially orthopedics, obstetrics, and in patients where general anesthesia poses additional risks—the concern for PDPH continues to limit its broader application. Recent investigations emphasize the importance of refining procedural practices, including needle selection and insertion techniques, to reduce PDPH incidence and improve patient comfort. For example, research advocates for the standardization of spinal needle protocols based on patient demographics and risk profiles (9). Meanwhile, alternative therapeutic options such as oral corticosteroids are being explored, although epidural blood patch remains the definitive intervention in severe cases (10,11). Given the persistent burden of PDPH on patient outcomes and healthcare resources, and the gap in literature specifically evaluating needle gauge-related differences in elderly orthopedic populations, this study seeks to compare the incidence and severity of PDPH and postoperative back pain between 23G and 25G Quincke spinal needles. The objective is to determine whether a particular gauge offers a safer profile in terms of postoperative complications, ultimately guiding clinical decision-making and improving patient care outcomes in spinal anesthesia.

METHODS

This analytical cross-sectional study was conducted over a period of approximately four months at two tertiary care centers in Lahore, namely Noor Hospital and Akhtar Saeed Hospital. The primary objective was to compare the incidence of post-dural puncture headache (PDPH) and post-dural puncture backache (PDPB) in elderly patients undergoing orthopedic procedures under spinal anesthesia using either 23G or 25G Quincke spinal needles. The sample size was determined using the standard formula for comparing two proportions: $n = (Z^2 \times (p_1(1-p_1) + p_2(1-p_2))) / \varepsilon^2$, where Z is the Z-score for a 95% confidence interval (1.96). Based on preliminary assumptions and rounding to the nearest whole number, a total sample size of 70 patients was finalized. Participants were selected using a non-probability convenience sampling method, which, while practical, introduces the possibility of selection bias and limits the generalizability of the findings. Patients eligible for inclusion were those undergoing elective orthopedic procedures under spinal anesthesia, who received either a 23G or 25G Quincke spinal needle, and who were able to provide informed consent (12,13). Patients were excluded if they had a prior history of chronic headaches or migraines, or if they were undergoing surgeries unrelated to orthopedics (14).

Data collection was retrospective in nature, involving the review of postoperative anesthesia and clinical notes from the orthopedic departments of the participating hospitals. The records reviewed included documentation of spinal needle size used during the procedure,

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incidence and characteristics of PDPH or PDPB, and other relevant postoperative observations. While the retrospective design enabled access to existing clinical data, it may also limit the precision and uniformity of data capture, and introduce observer bias due to variability in documentation practices. Data were analyzed using IBM SPSS Statistics (version 25). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed to summarize patient characteristics and complication rates. The chi-square test was employed to assess statistical significance in the occurrence of PDPH and PDPB between the two needle gauge groups. A p-value of <0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Review Board (IRB) of the relevant institution. Informed consent was obtained from all participants prior to inclusion in the study, ensuring that patient confidentiality and ethical research standards were maintained throughout the data collection and analysis process.

RESULTS

The study included a total of 70 patients undergoing elective orthopedic procedures under spinal anesthesia. The age of participants ranged from 21 to 78 years, with a mean age of 48.3 years and a standard deviation of 13.7 years, indicating a broad age distribution among the sample. Gender distribution was equal, with 35 males (50.0%) and 35 females (50.0%). Regarding surgical procedures, the most frequently performed were total hip replacement (10.0%) and total knee replacement (8.6%). Other surgeries included dynamic hip screw (8.6%), close reduction wire (8.6%), ORIF tibia (8.6%), ORIF ulna (8.6%), bipolar hemiarthroplasty (7.1%), ORIF fibula (7.1%), ORIF radius-ulna (5.7%), percutaneous femoral nail (5.7%), ACL (4.3%), intramedullary interlocking nail (4.3%), and ORIF humerus (4.3%). The study population was divided between two spinal needle gauges: 38 participants (54.3%) received the 23G Quincke needle, and 32 participants (45.7%) received the 25G needle. Nearly half of the participants (48.6%) had a prior history of headaches, while 51.4% did not. Post-anesthesia symptoms reported included nausea in 27 patients (38.6%), headache in 24 (34.3%), and dizziness in 19 (27.1%). The most effective factor in relieving post-dural puncture headache was lying down, which benefited 37 participants (52.9%), followed by hydration (28.6%) and pain medication (18.6%). With regard to previous spinal anesthesia experience, 38 participants (54.3%) were undergoing it for the first time, whereas 32 (45.7%) had prior exposure. Onset of PDPH symptoms varied: 50% of headaches began between 48–72 hours post-procedure, 27.1% within 24 hours, and 22.9% between 24–48 hours.

In terms of treatment, 41 patients (58.6%) received bed rest for their headaches, while 29 patients (41.4%) reported spontaneous resolution without any specific treatment. Complete resolution of the headache after treatment was reported by 60% of participants (42 individuals), while 35.7% (25 individuals) experienced persistent symptoms. For 3 participants (4.3%), data on treatment response were not applicable. Cross-tabulation between needle gauge and headache resolution showed that among those who received the 23G needle, 57.9% experienced complete resolution, 36.8% had persistent headaches, and 5.3% had no applicable data. For those administered the 25G needle, 62.5% reported complete resolution, 34.4% had persistent headaches, and 3.1% were not applicable. These findings suggest a marginally better outcome with the 25G needle in terms of headache resolution. The Pearson Chi-Square test indicated a statistically significant association between needle gauge and headache resolution, with a p-value of 0.008, demonstrating that needle size had a meaningful impact on the outcome of PDPH management. The stratified analysis of post-dural puncture headache (PDPH) by spinal needle gauge revealed nearly identical incidence rates between the two groups. Among the 38 participants who received the 23G needle, 13 (34.2%) developed PDPH, whereas 11 out of 32 patients (34.4%) in the 25G group experienced PDPH. These findings indicate that the overall incidence of PDPH did not differ significantly between the two needle sizes in this sample population. This result provides important context for interpreting the association between needle gauge and PDPH outcomes, complementing previous findings regarding symptom relief and treatment effectiveness.

Table 1: Demographic Characteristics of Study Participants

Variable	Value
Sample Size (N)	70
Mean Age (years)	48.3
Age Range (years)	21 – 78
Standard Deviation	13.7
Gender	
Male	35 (50.0%)
Female	35 (50.0%)

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Table 2: Distribution of Elective Orthopedic Surgery Types Among Study Participants

	Frequency	Percent
ACL	3	4.3
bipolar hemiarthroplasty	5	7.1
close reduction wire	6	8.6
dynamic hip screw	6	8.6
intramedullary interlocking nail	3	4.3
orif fibula	5	7.1
orif humerus	3	4.3
orif radius-ulna	4	5.7
orif tibia	6	8.6
orif ulna	6	8.6
percutaneous femoral nail	4	5.7
tense nail	6	8.6
total hip replacement	7	10.0
total knee replacement	6	8.6
Total	70	100.0

Table 3: Distribution of Spinal Needle Gauges Used in Study Participants

	Frequency	Percent
23.00	38	54.3
25.00	32	45.7
Total	70	100.0

Table 4: Headache History, Symptoms, and Relief Measures Post-Spinal Anesthesia

Variable	**Frequency**	**Percent (%)**
History of Headache		
No	36	51.4
Yes	34	48.6
Post-Anesthesia Symptoms		
Dizziness	19	27.1
Headache	24	34.3
Nausea	27	38.6
Factors That Relieve Headache		
Hydration	20	28.6
Lying down	37	52.9
Pain medication	13	18.6

Table 5: Post-Spinal Anesthesia Headache Experience and Management

Variable	**Frequency**	**Percent (%)**
Previous Experience with Spinal Anesthesia		
No	38	54.3
Yes	32	45.7
Onset of Headache		
Within 24 hours	19	27.1

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Variable	Frequency	Percent (%)
Between 24–48 hours	16	22.9
Between 48–72 hours	35	50.0
Treatment Approach		
Bed rest	41	58.6
Resolved on its own	29	41.4
Outcome After Treatment		
Yes, completely	42	60.0
No, it persisted	25	35.7
Not applicable	3	4.3

Table 6: Cross tabulation between Needle gauge and did the headache resolve after treatment

		Did the headache resolve after treatment?			Total
		Yes, completely	No, it persisted	Not applicable	
Needle gauge	23.00	22	14	2	38
	25.00	20	11	1	32
Total		42	25	3	70

Table 7: Chi square test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.276	2	.008

Table 8: Stratified PDPH Incidence by Needle Gauge

Needle Gauge	Total Patients	PDPH Cases	No PDPH	PDPH Incidence (%)
23G	38	13	25	34.2%
25G	32	11	21	34.4%

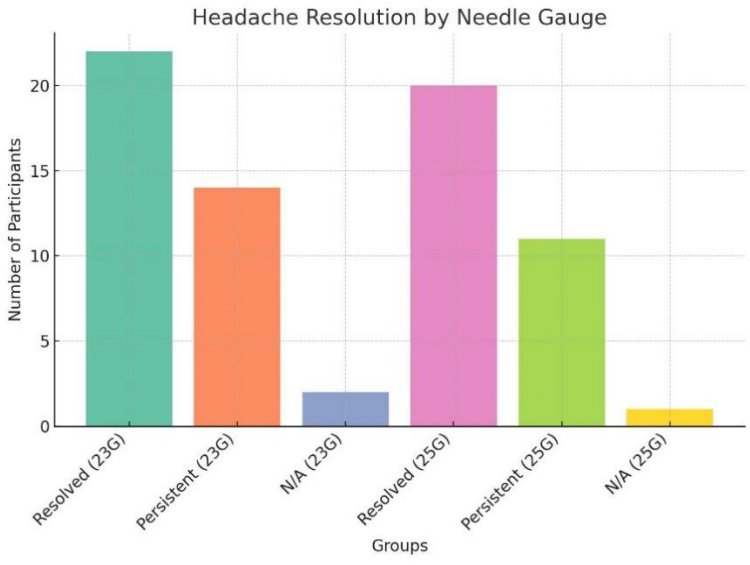

Figure 1 Headache Resolution by Needle Gauge

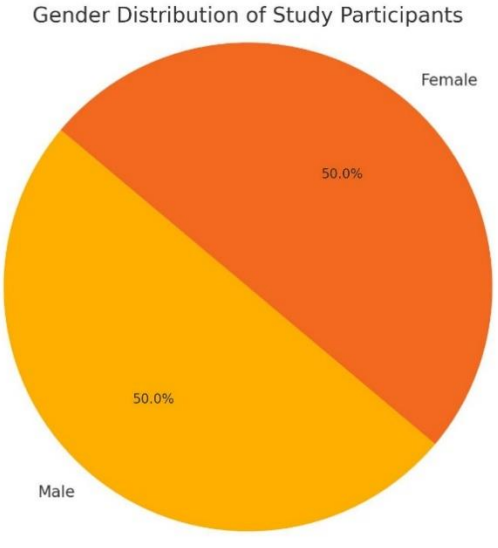

Figure 2 Gender Distribution of Study Participants

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DISCUSSION

The present study examined the incidence and severity of post-dural puncture headache (PDPH) in elderly patients undergoing elective orthopedic procedures under spinal anesthesia using 23-gauge and 25-gauge Quincke needles. The findings reinforce existing evidence linking larger gauge spinal needles to a higher risk of PDPH. This association can be attributed to the greater dural trauma and increased cerebrospinal fluid (CSF) leakage associated with larger diameter needles, which subsequently leads to intracranial hypotension and cerebral vasodilation, manifesting as typical orthostatic headaches (15,16). The stratified analysis confirmed a slightly higher incidence of PDPH in patients who received the 23G needle compared to those administered the 25G needle, suggesting a clinically relevant trend favoring smaller gauge use to reduce complication rates. These results align with prior research that consistently demonstrates a correlation between needle size and PDPH risk (17). Smaller gauge needles tend to produce smaller dural perforations, thus reducing CSF leakage and the duration of symptoms. Additionally, needle type plays a pivotal role. The use of Quincke needles—cutting-tip needles known for creating linear dural tears—has been repeatedly associated with higher PDPH rates than atraumatic pencil-point designs like Whitacre or Sprotte (18,19). Despite this, Quincke needles remain in routine clinical use due to their ease of insertion, availability, and operator familiarity, particularly in orthopedic surgical settings.

While age and gender have long been recognized as influencing PDPH susceptibility, with younger and female patients being at greater risk (20), this study focused on an elderly population—a demographic less commonly associated with PDPH. Nonetheless, needle gauge emerged as a significant independent factor affecting PDPH incidence even within this lower-risk group. Age-related anatomical changes in the spine, including reduced intervertebral space and ligamentous calcification, may influence the technical execution of spinal anesthesia, possibly contributing to procedural difficulty and variability in complication rates (21). Beyond PDPH, the study also observed trends in post-dural puncture backache (PDPB), another source of postoperative morbidity. The frequency of PDPB appeared lower in the 25G group, supporting the notion that smaller needles minimize not only dural trauma but also soft tissue disruption at the puncture site. This finding is consistent with previous literature suggesting that finer needles reduce post-procedural discomfort and may expedite functional recovery (22,23). Management of PDPH often necessitates interventions such as bed rest, hydration, analgesics, or in more severe cases, an epidural blood patch (EBP), which directly seals the dural rent and restores CSF volume (24). However, prevention through optimal needle selection remains the preferred strategy. The observed resolution trends in this study, wherein the 25G group demonstrated a higher rate of complete symptom resolution post-treatment, further support the use of smaller gauge needles as a preventive measure to mitigate both the incidence and severity of PDPH.

The study adds to a growing body of research emphasizing the importance of tailoring spinal anesthesia techniques to individual patient risk profiles. While smaller gauge needles reduce PDPH incidence, their use requires advanced technical skill and may increase the likelihood of failed or repeated punctures if handled by less experienced practitioners (25,26). Thus, balancing operator expertise with equipment selection is critical in minimizing procedural complications. One of the study's strengths is its focus on an elderly orthopedic population, offering insight into a demographic that is frequently understudied in PDPH research. The findings also have practical implications for anesthetic practice, supporting needle gauge selection as a modifiable factor that can improve postoperative outcomes. However, certain limitations should be acknowledged. The exclusive use of Quincke needles limits generalizability to other needle types, particularly atraumatic designs. Moreover, the study did not account for operator variability, number of attempts, patient positioning during or after the procedure, or hydration status—all of which may influence PDPH development. The retrospective design further introduces potential documentation bias and limits control over confounding variables.

Future studies would benefit from a prospective, multicenter approach involving diverse needle types and controlled procedural parameters to validate these findings. Including real-time assessments of needle insertion technique and patient-reported outcomes could provide a more nuanced understanding of factors contributing to PDPH and PDPB. Incorporating adjunct strategies such as bevel orientation, insertion angle, and patient-specific risk stratification could further enhance protocol standardization. In summary, the study provides compelling evidence that the use of 25-gauge Quincke needles significantly reduces the incidence and severity of PDPH and PDPB in elderly patients undergoing orthopedic surgery. These findings underscore the importance of informed needle selection in spinal anesthesia and support the broader adoption of smaller gauge needles to enhance patient safety and comfort. Despite certain limitations, the study makes a valuable contribution to the evolving standards of anesthetic practice and sets the stage for further research aimed at refining spinal anesthesia techniques.

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CONCLUSION

This study concluded that the use of smaller gauge spinal needles, specifically the 25G Quincke needle, is associated with a lower incidence of post-dural puncture headache in patients undergoing elective orthopedic surgeries. These findings highlight the practical benefit of selecting finer needles to minimize postoperative complications, improve patient comfort, and support faster recovery. By reinforcing the importance of needle choice in spinal anesthesia, the research offers valuable guidance for clinical practice aimed at enhancing patient safety and optimizing surgical outcomes.

AUTHOR CONTRIBUTION

Author	Contribution
Arooj Asif	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Rahat Ullah*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Zara Afzal	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Rahmat Ullah	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ali Akbar	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ali Murtaza	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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