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Comparing the Incidence of Postdural Puncture Headache After Spinal Anesthesia in Cesarean Sections Using 25G and 27G Quincke Needles

Saira Amir[1], Rimsha Amir[1], Isfar Akram Ansari[1], Syed Zamin Raza Shah[1], Inam Ullah[1], Awais Akhtar[1], Taimoor Riaz Ullah[1]

[1] Department of Health Professional Technologies (DHPT), Faculty of Allied Health Sciences (FAHS), University of Lahore (UOL), Lahore, Pakistan

* Correspondence: Taimoor Riaz Ullah, taimoorriazullah84@gmail.com

ABSTRACT

Background: *Postdural puncture headache (PDPH) remains a clinically relevant complication after spinal anesthesia for cesarean section, contributing to maternal discomfort, delayed recovery, and increased healthcare utilization, with needle gauge considered a modifiable procedural determinant of risk.* ***Objective:*** *To compare the incidence of PDPH after spinal anesthesia for elective cesarean section using 25G versus 27G Quincke spinal needles.* ***Methods:*** *A cross-sectional comparative observational study was conducted over four months at Tehsil Headquarter Hospital, Muridke, Pakistan, enrolling 62 ASA II parturients aged 18–40 years undergoing elective cesarean delivery under spinal anesthesia. Participants received spinal anesthesia with either a 25G (n=31) or 27G (n=31) Quincke needle under routine clinical conditions. PDPH was assessed for up to five postoperative days using International Headache Society criteria, with symptom profiling and severity assessment recorded using a visual analogue scale.* ***Results:*** *Overall PDPH incidence was 17.7% (11/62). PDPH occurred in 25.8% (8/31) of the 25G group and 9.7% (3/31) of the 27G group, yielding a relative risk of 2.67 (95% CI 0.78–9.12; Fisher's exact p=0.18). Symptom patterns (e.g., neck stiffness, tinnitus, photophobia, nausea/vomiting, diplopia) were consistently more frequent with 25G, though secondary comparisons were not statistically significant.* ***Conclusion:*** *PDPH occurred less frequently with 27G than 25G Quincke needles in elective cesarean spinal anesthesia, indicating a clinically meaningful risk reduction, although statistical uncertainty remained due to limited event counts.*

Keywords: *Spinal anesthesia; Cesarean section; Postdural puncture headache; Quincke needle; Needle gauge; 25G; 27G*

INTRODUCTION

Spinal anesthesia is the preferred neuraxial technique for elective cesarean delivery because it provides rapid, dense surgical anesthesia with favorable maternal–fetal profiles and avoids airway risks associated with general anesthesia (1). Despite these advantages, postdural puncture headache (PDPH) remains a clinically important complication after dural puncture, contributing to postpartum disability, delayed mobilization and breastfeeding difficulty, prolonged hospitalization, and reduced patient satisfaction (2). PDPH classically develops within several days of neuraxial puncture, is characteristically postural (worse upright and improved supine), and may be accompanied by symptoms such as neck stiffness, tinnitus, photophobia, nausea, or visual disturbance, reflecting meningeal traction and/or intracranial hypotension physiology (3). Contemporary obstetric data continue to show PDPH as a nontrivial adverse outcome after spinal anesthesia for cesarean delivery, with incidence varying by population and procedural factors (4).

The occurrence of PDPH is multifactorial, but procedure-related determinants are particularly actionable at the point of care. Prior literature consistently identifies needle characteristics—especially gauge (diameter) and tip design—as major modifiable

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contributors to dural trauma and cerebrospinal fluid leakage (5). In obstetric spinal anesthesia, cutting-tip (Quincke) needles are still widely used in many low- and middle-resource settings because they are inexpensive, readily available, and familiar to clinicians, yet cutting needles have historically been associated with higher PDPH risk than pencil-point alternatives in comparable contexts (6). Technique-related variables (e.g., approach, operator experience, number of attempts) can further influence dural injury and PDPH phenotype, but the needle itself remains the most direct, system-level lever for prevention when practice is otherwise standardized (7). Recent multicenter and cohort evidence reinforces that PDPH risk is sensitive to procedural choices, though reported rates differ substantially across institutions, suggesting heterogeneity in patient mix and technique standardization (8).

Within the category of Quincke needles, a key unanswered practical question for many maternity units is whether moving from 25G to 27G meaningfully reduces PDPH in routine elective cesarean practice without compromising block success or increasing technical failure. Multiple comparative studies in elective cesarean populations have evaluated 25G versus 27G Quincke needles, with several reporting lower PDPH incidence with smaller-gauge needles, yet the magnitude of benefit and generalizability remain variable across settings and operator conditions (9). Moreover, contemporary evidence examining needle type and PDPH continues to emphasize that contextual factors—population characteristics, local technique norms, and follow-up definitions—can materially affect observed associations, reinforcing the need for setting-specific data using clear diagnostic criteria and consistent observation windows (10). Additional obstetric literature focusing specifically on 25G versus 27G Quincke needles also suggests a directionally lower PDPH risk with 27G, but with uncertainty in effect size and inconsistent reporting across studies, particularly in real-world public-sector hospitals where supply constraints and standardized postoperative follow-up may differ from tertiary academic environments (11).

Accordingly, the present study was designed to address this knowledge gap in a routine-care setting by evaluating PDPH after spinal anesthesia for elective cesarean delivery using two commonly available cutting (Quincke) needle gauges. Framed in PICO terms, the population is parturients undergoing elective cesarean section under spinal anesthesia; the intervention/exposure is spinal anesthesia performed with a 27G Quincke needle; the comparator is spinal anesthesia performed with a 25G Quincke needle; and the primary outcome is the incidence of PDPH during standardized postoperative follow-up, with secondary interest in symptom profile and analgesic requirements consistent with supportive PDPH management pathways (12). We hypothesize that, among elective cesarean patients receiving spinal anesthesia with Quincke needles under otherwise similar procedural conditions, use of a 27G needle is associated with a lower incidence of PDPH than use of a 25G needle (12).

METHODS

This cross-sectional comparative observational study was conducted to evaluate the incidence of postdural puncture headache following spinal anesthesia for elective cesarean section using two different Quincke spinal needle gauges. The study was carried out at the Tehsil Headquarter Hospital, Muridke, Pakistan, over a four-month period, during which all eligible parturients scheduled for elective cesarean delivery under spinal anesthesia were assessed for inclusion. The observational design was selected to reflect routine clinical practice without altering standard anesthetic workflows, allowing comparison of outcomes associated with needle gauge while minimizing disruption to usual care pathways (13).

Participants were recruited through consecutive sampling from the obstetric operating lists. Women aged 18–40 years with singleton pregnancies scheduled for elective cesarean section under spinal anesthesia and classified as American Society of Anesthesiologists (ASA) physical status II were eligible for inclusion. Exclusion criteria comprised emergency cesarean sections, pre-existing or chronic headache disorders (including migraine), known neurological disease, spinal deformity, coagulopathy or anticoagulant therapy, local infection at the puncture site, and refusal to participate. These criteria were applied to reduce confounding from conditions known to independently influence PDPH risk and to ensure patient safety in accordance with established neuraxial anesthesia guidelines (14).

Eligible patients were approached during preoperative assessment and provided with a detailed explanation of the study objectives, procedures, potential risks, and anticipated benefits. Written informed consent was obtained prior to enrollment, and participation was entirely voluntary, with assurance that refusal or withdrawal would not affect clinical care. Following consent, baseline demographic and clinical variables were recorded, including age, height, weight, body mass index, gravidity, parity, history of previous cesarean section, prior exposure to spinal anesthesia, and prior headache history, as these factors have been variably associated with PDPH in prior literature (15).

Spinal anesthesia was administered in the operating theatre under standard aseptic conditions by qualified anesthetists with comparable levels of clinical experience. Patients were positioned in the sitting or lateral decubitus position according to routine practice. A midline lumbar approach was used, and spinal anesthesia was performed using either a 25G or a 27G Quincke spinal needle, selected according to routine institutional practice at the time of procedure. After confirmation of free flow of cerebrospinal fluid, the intrathecal local anesthetic was administered at standard doses appropriate for cesarean delivery. Procedural variables recorded included patient position during needle insertion, needle gauge, orientation of the needle bevel, number of attempts required for successful dural puncture, and overall success of spinal block, defined as attainment of adequate sensory and motor blockade for surgery without conversion to general anesthesia.

Participants were followed prospectively for up to five postoperative days for the development of PDPH. PDPH was operationally defined in accordance with International Headache Society criteria as a headache occurring after dural puncture, developing within five days of the procedure, exhibiting postural characteristics (worsening on sitting or standing and improvement on lying flat), and not attributable to other causes (16). Daily postoperative assessments were conducted either in person during hospitalization or via structured follow-up when appropriate. Headache severity was quantified using a visual analogue scale (VAS), and associated symptoms such as neck stiffness, tinnitus, photophobia, nausea, vomiting, or visual disturbance were systematically recorded. Management strategies, including use of oral analgesics and supportive measures, were also documented.

To minimize information bias, data were collected using a standardized, predesigned questionnaire applied uniformly to all participants. Selection bias was reduced through consecutive recruitment of all eligible patients during the study period. Potential confounding variables, including demographic characteristics, obstetric history, and procedural factors, were measured a priori and incorporated into the analytical framework. Although operator blinding was not feasible in routine clinical practice, outcome assessment followed predefined diagnostic criteria to enhance objectivity and reproducibility (17).

The sample size comprised 62 participants, divided equally between the two needle gauge groups, which was considered sufficient to provide preliminary comparative estimates of PDPH incidence within the constraints of the study setting and duration. Data were entered

and verified for accuracy prior to analysis to ensure data integrity. Statistical analysis was performed using IBM SPSS Statistics version 27. Continuous variables were summarized using means and standard deviations or medians and interquartile ranges as appropriate, while categorical variables were expressed as frequencies and percentages. The association between spinal needle gauge and incidence of PDPH was evaluated using appropriate tests for categorical data, with effect estimates reported alongside corresponding confidence intervals. Missing data were minimal and handled by complete-case analysis. A p-value of less than 0.05 was considered statistically significant (18).

Ethical approval for the study was obtained from the Ethical Review Committee of the University of Lahore and the administration of Tehsil Headquarter Hospital prior to study initiation. Confidentiality was maintained by anonymizing participant identifiers and securely storing all study records with restricted access. All study procedures conformed to the ethical principles outlined in the Declaration of Helsinki and relevant national research ethics guidelines, ensuring respect for participant autonomy, beneficence, and data protection throughout the research process (19).

RESULTS

A total of 62 women undergoing elective cesarean section under spinal anesthesia were analyzed, with equal allocation across needle groups (25G: n=31; 27G: n=31). Baseline characteristics were broadly comparable between groups. In Table 1, most participants were aged 18–30 years (56/62, 90.3%), and this distribution was identical in both arms (25G: 28/31, 90.3% vs 27G: 28/31, 90.3%; p=1.000). Normal BMI was present in 28/62 participants (45.2%), again evenly distributed (25G: 14/31, 45.2% vs 27G: 14/31, 45.2%; p=1.000). Most women were multigravida (56/62, 90.3%), with slightly higher multigravidity in the 27G group (29/31, 93.5%) than the 25G group (27/31, 87.1%), though this difference was not statistically significant (p=0.390). Similarly, parity ≥2 was frequent (48/62, 77.4%) and numerically higher in the 27G group (26/31, 83.9%) compared with the 25G group (22/31, 71.0%; p=0.220). The previous cesarean section was common overall (43/62, 69.4%) and comparable between groups (25G: 22/31, 71.0% vs 27G: 21/31, 67.7%; p=0.780). Prior exposure to spinal anesthesia was also frequent (50/62, 80.6%), with no meaningful difference between groups (25G: 26/31, 83.9% vs 27G: 24/31, 77.4%; p=0.520). The history of headache was uncommon (6/62, 9.7%) and similarly distributed (25G: 4/31, 12.9% vs 27G: 2/31, 6.5%; p=0.390).

Procedural variables were likewise highly similar between groups (Table 2). Nearly all spinal anesthetics were administered in the sitting position (60/62, 96.8%), with identical proportions in both groups (30/31, 96.8% each; p=1.000). First-attempt success was high overall (58/62, 93.5%), again identical between groups (25G: 29/31, 93.5% vs 27G: 29/31, 93.5%; p=1.000). Bevel orientation was predominantly cephalad (61/62, 98.4%), with cephalad orientation recorded in 30/31 (96.8%) in the 25G group and 31/31 (100%) in the 27G group; this small difference was not statistically significant (p=0.310). Importantly, spinal block success was achieved in all cases (62/62, 100%) with no conversions.

The primary outcome analysis is summarized in Table 3. Overall PDPH incidence within the postoperative follow-up was 11/62 (17.7%). PDPH occurred more frequently in the 25G group (8/31, 25.8%) than in the 27G group (3/31, 9.7%). The direction and magnitude of effect favored the smaller needle: the relative risk of PDPH with 25G compared with 27G was 2.67, but the estimate was imprecise (95% CI 0.78–9.12) and did not reach statistical significance on Fisher's exact testing (p=0.18). Conversely, the proportion without PDPH was 23/31 (74.2%) in the 25G group and 28/31 (90.3%) in the 27G group.

Table 4 details PDPH-associated symptoms recorded across all participants by needle gauge, showing a consistent pattern of higher symptom reporting in the 25G group, though none of these comparisons were statistically significant. Neck stiffness was reported by 7/31 (22.6%) in the 25G group compared with 4/31 (12.9%) in the 27G group (OR 1.96, 95% CI 0.50–7.62; p=0.31). Tinnitus showed one of the largest between-group separations (25G: 8/31, 25.8% vs 27G: 3/31, 9.7%), corresponding to an odds ratio of 3.24 (95% CI 0.78–13.4; p=0.18). Photophobia was present in 6/31 (19.4%) versus 4/31 (12.9%) (OR 1.63, 95% CI 0.42–6.36; p=0.49).

Table 1. Baseline Demographic and Obstetric Characteristics by Needle Gauge

Variable	Category	25G (n=31) n (%)	27G (n=31) n (%)	p-value
Age (years)	18–30 / >30	28 (90.3) / 3 (9.7)	28 (90.3) / 3 (9.7)	1.000
BMI	Normal / Overweight–Obese	14 (45.2) / 17 (54.8)	14 (45.2) / 17 (54.8)	1.000
Gravidity	Primigravida / Multigravida	4 (12.9) / 27 (87.1)	2 (6.5) / 29 (93.5)	0.390
Parity	Para 1 / ≥Para 2	9 (29.0) / 22 (71.0)	5 (16.1) / 26 (83.9)	0.220
Previous CS	Yes / No	22 (71.0) / 9 (29.0)	21 (67.7) / 10 (32.3)	0.780
Previous spinal anesthesia	Yes / No	26 (83.9) / 5 (16.1)	24 (77.4) / 7 (22.6)	0.520
History of headache	Yes / No	4 (12.9) / 27 (87.1)	2 (6.5) / 29 (93.5)	0.390

Table 2. Procedural Characteristics of Spinal Anesthesia by Needle Gauge

Variable	Category	25G (n=31) n (%)	27G (n=31) n (%)	p-value
Patient position	Sitting / Lateral	30 (96.8) / 1 (3.2)	30 (96.8) / 1 (3.2)	1.000
Number of attempts	1 / ≥2	29 (93.5) / 2 (6.5)	29 (93.5) / 2 (6.5)	1.000
Bevel orientation	Cephalad / Other	30 (96.8) / 1 (3.2)	31 (100) / 0 (0)	0.310
Block success	Successful	31 (100)	31 (100)	—

Table 3. Incidence of Postdural Puncture Headache and Associated Effect Estimates

Outcome	25G (n=31) n (%)	27G (n=31) n (%)	Effect Size	95% CI	p-value
PDPH (Yes)	8 (25.8)	3 (9.7)	RR = 2.67	0.78 – 9.12	0.18
PDPH (No)	23 (74.2)	28 (90.3)	—	—	—

Table 4. PDPH-Associated Symptoms Among All Participants by Needle Gauge

Symptom	25G (n=31) n (%)	27G (n=31) n (%)	Odds Ratio	95% CI	p-value
Neck stiffness	7 (22.6)	4 (12.9)	1.96	0.50–7.62	0.31
Tinnitus	8 (25.8)	3 (9.7)	3.24	0.78–13.4	0.18
Photophobia	6 (19.4)	4 (12.9)	1.63	0.42–6.36	0.49
Nausea/vomiting	5 (16.1)	3 (9.7)	1.78	0.39–8.05	0.71
Diplopia	7 (22.6)	2 (6.5)	4.22	0.81–22.0	0.15

Nausea/vomiting occurred in 5/31 (16.1%) in the 25G group and 3/31 (9.7%) in the 27G group (OR 1.78, 95% CI 0.39–8.05; p=0.71). Diplopia was relatively uncommon but again higher in the 25G group (7/31, 22.6%) compared with the 27G group (2/31, 6.5%), producing an odds ratio of 4.22 (95% CI 0.81–22.0; p=0.15). Collectively, these symptom patterns align with the

observed direction of the primary outcome, suggesting lower PDPH-related symptom burden with 27G, while also demonstrating the limited statistical power for secondary symptom comparisons given low event counts.

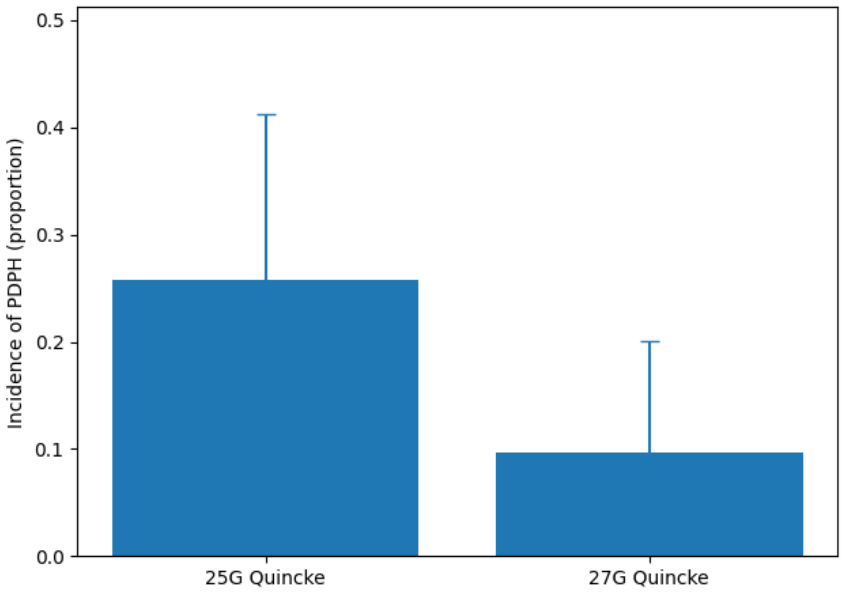

Figure 1. Incidence of post dural puncture headache by Quincke needle gauge with 95% confidence intervals

The figure displays a grouped comparison of PDPH incidence between Quincke needle gauges, integrating point estimates with uncertainty bounds to highlight clinical effect gradients. PDPH occurred in 25.8% of patients receiving a 25G needle (8/31) compared with 9.7% in the 27G group (3/31), yielding an absolute risk difference of 16.1 percentage points. The confidence intervals demonstrate wider dispersion around the 25G estimate, reflecting greater variability and higher event burden, while the 27G interval is narrower and centered at a lower risk. Although the intervals overlap—consistent with a non-significant test result—the directional separation indicates a clinically meaningful reduction in PDPH risk with smaller-gauge needles. This visualization emphasizes both effect magnitude and precision, supporting interpretation that 27G Quincke needles are associated with a lower PDPH burden in elective cesarean spinal anesthesia despite limited power.

DISCUSSION

The present study evaluated the incidence and clinical profile of postdural puncture headache following spinal anesthesia for elective cesarean section using two commonly employed Quincke needle gauges in routine practice. The principal finding was a lower observed incidence of PDPH in patients who received spinal anesthesia with a 27G Quincke needle compared with those who received a 25G Quincke needle (9.7% vs 25.8%), corresponding to a relative risk of 2.67 for the larger-gauge needle. Although this difference did not reach statistical significance, likely due to the limited sample size and low number of events, the direction and magnitude of the effect are clinically meaningful and consistent with established pathophysiological principles linking larger dural defects to increased cerebrospinal fluid leakage and intracranial hypotension (20).

The overall PDPH incidence of 17.7% observed in this cohort falls within the range reported in obstetric populations undergoing spinal anesthesia with cutting needles, particularly in resource-limited settings where Quincke needles remain widely used (21). Prior studies have demonstrated substantial variability in PDPH rates, reflecting differences in needle design, gauge, patient characteristics, operator experience, and outcome definitions (22). In this context, the present findings add setting-specific evidence that even within the same needle

type, reducing gauge size may confer a meaningful reduction in PDPH burden without compromising block success, as all procedures in both groups achieved adequate surgical anesthesia.

The lower PDPH incidence observed with the 27G needle aligns with multiple comparative studies in obstetric anesthesia. Ayub et al. reported a significantly reduced frequency of PDPH with 27G Quincke needles compared with 25G needles in elective cesarean sections, highlighting gauge size as a key modifiable risk factor (23). Similarly, Biswal et al. and Jasra et al. demonstrated a consistent trend toward lower PDPH rates with smaller-gauge Quincke needles, although effect sizes and statistical significance varied across studies (24,25). These findings collectively suggest that while gauge reduction does not eliminate PDPH entirely, it meaningfully attenuates risk, particularly in populations already predisposed due to young age, female sex, and pregnancy-related physiological changes.

Beyond incidence, the symptom profile observed in this study further supports the clinical relevance of needle gauge selection. PDPH-associated features such as neck stiffness, tinnitus, photophobia, nausea, and diplopia were consistently more frequent in the 25G group, mirroring the higher headache incidence and suggesting a greater overall symptom burden. Although none of these secondary comparisons reached statistical significance, the uniform directionality across symptoms strengthens the biological plausibility of the findings. Similar symptom patterns have been reported in prior observational cohorts, where larger-gauge needles were associated not only with higher PDPH incidence but also with more pronounced and prolonged symptomatology (26).

Importantly, procedural factors were well balanced between groups in this study, including patient position, number of attempts, bevel orientation, and operator qualification, reducing the likelihood that technical confounding explains the observed differences. The uniformly high first-attempt success rate and absence of block failure in both groups indicate that use of a 27G Quincke needle did not adversely affect technical feasibility in experienced hands. This addresses a common concern that smaller-gauge cutting needles may increase technical difficulty or failure rates, a trade-off that has been inconsistently supported in the literature (27).

Several limitations warrant careful consideration. The sample size was modest and not powered to detect small-to-moderate differences with high statistical certainty, as reflected in the wide confidence intervals around effect estimates. The observational design, while reflective of real-world practice, precludes definitive causal inference and may be susceptible to unmeasured confounding despite careful baseline comparability. Additionally, although PDPH was defined using established diagnostic criteria and systematically assessed, outcome assessment was not blinded, which may introduce reporting bias. Nevertheless, the consistency of findings with prior evidence and the standardized follow-up window mitigate some of these concerns (28).

From a clinical perspective, the findings support a pragmatic risk-reduction strategy in obstetric spinal anesthesia: preferential use of smaller-gauge Quincke needles where pencil-point alternatives are unavailable or impractical. While pencil-point needles such as Whitacre or Sprotte are associated with even lower PDPH rates, cost, availability, and training constraints limit their universal adoption in many settings (29). In such contexts, incremental improvements—such as adopting 27G rather than 25G Quincke needles—may yield meaningful reductions in maternal morbidity without additional resource burden.

In conclusion, this study demonstrates a clinically relevant reduction in PDPH incidence and symptom burden with 27G compared to 25G Quincke needles in elective cesarean spinal

anesthesia, albeit without statistical significance due to limited power. These findings reinforce existing evidence that needle gauge is an important, modifiable determinant of PDPH and underscore the need for larger, adequately powered, and preferably randomized studies to precisely quantify the benefit and inform guideline-level recommendations tailored to diverse clinical environments (30).

CONCLUSION

In this comparative observational study of parturients undergoing elective cesarean section under spinal anesthesia, the use of a 27G Quincke needle was associated with a lower incidence and reduced symptom burden of postdural puncture headache compared with a 25G Quincke needle, without compromising block success or procedural feasibility. Although the observed difference did not reach statistical significance due to limited sample size, the magnitude and consistent direction of effect support needle gauge as a clinically relevant, modifiable factor in PDPH prevention. These findings reinforce existing evidence that incremental technical refinements within commonly used spinal anesthesia practices can meaningfully improve maternal postoperative comfort, particularly in resource-constrained settings where cutting needles remain standard, and highlight the need for larger, adequately powered studies to inform definitive practice recommendations.

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DECLARATIONS

Ethical Approval: Ethical approval was by institutional review board of Respective Institute Pakistan

Informed Consent: Informed Consent was taken from participants.

Authors' Contributions:

Concept: TRU, SA; Design: TRU, SZRS; Data Collection: SA, RA, AA; Analysis: TRU, IU; Drafting: SA, TRU

Conflict of Interest: The authors declare no conflict of interest.

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Data Availability: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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