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Comparative Analysis of Postoperative Complication Using 25-Gauge and 27-Gauge Spinal Needle

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ABSTRACT

Background: *Post-dural puncture headache (PDPH) and related postoperative morbidity remain important limitations of spinal anesthesia for cesarean delivery, with needle gauge being a key modifiable determinant of dural trauma and cerebrospinal fluid leakage.* ***Objective:*** *To compare the incidence and severity of PDPH and other early postoperative complications associated with 25-gauge versus 27-gauge spinal needles in multiparous women undergoing cesarean section under spinal anesthesia.* ***Methods:*** *A comparative cross-sectional observational study was conducted at LIFE Hospital, enrolling 84 multiparous women (16–45 years; ASA II–III) undergoing elective cesarean section. Participants were allocated to spinal anesthesia using either a 25G or 27G needle (n=42 each). PDPH was assessed at 24, 48, and 72 hours using standardized diagnostic criteria, with pain severity graded by a visual analogue scale (VAS). Secondary outcomes included anatomical distribution of headache, intraoperative hypotension stratified by systolic blood pressure drop (20–29% vs ≥30%), vomiting, and injection-site infection.* ***Results:*** *PDPH within 72 hours occurred more frequently with 25G than 27G needles (42.9% vs 19.0%). Moderate-to-severe headache was observed only in the 25G group. Severe hypotension (≥30% SBP drop) was higher with 25G compared with 27G (54.8% vs 14.3%). Vomiting (16.7% vs 0%) and injection-site infection (9.5% vs 0%) occurred exclusively in the 25G group.* ***Conclusion:*** *In this obstetric cohort, the 27G spinal needle was associated with substantially lower PDPH burden, reduced severe hypotension, and fewer postoperative complications compared with the 25G needle, supporting preferential use of 27G needles when technically feasible.*

Keywords: *Spinal anesthesia; Cesarean section; Post-dural puncture headache; 25-gauge spinal needle; 27-gauge spinal needle; Hypotension; Vomiting; Injection-site infection.*

INTRODUCTION

Spinal anesthesia is the preferred anesthetic technique for cesarean delivery because it provides rapid onset, dense sensory and motor block, avoids airway manipulation, and limits fetal exposure to systemic anesthetic agents; however, its overall acceptability is strongly shaped by postoperative morbidity—most notably post-dural puncture headache (PDPH), along with nausea/vomiting and hemodynamic instability (1). PDPH remains clinically important in obstetric patients because pregnancy-related physiological factors and the routine need for early mobilization and newborn care amplify the functional burden of postural headache, which is classically fronto-occipital or occipito-frontal and worsens on sitting or standing due to cerebrospinal fluid leakage through the dural defect (2). Across studies, the risk and severity of PDPH are consistently linked to modifiable technical determinants of dural puncture, especially spinal needle gauge and needle-tip design (cutting vs atraumatic/pencil-point), as well as procedural factors such as bevel orientation, number of attempts, and operator experience (1,2).

From a mechanistic and biostatistical standpoint, a smaller-diameter needle should create a smaller dural defect and reduce the probability and magnitude of cerebrospinal fluid loss, thereby lowering PDPH incidence and intensity; nonetheless, this benefit can be

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counterbalanced by increased technical difficulty with finer needles (e.g., slower CSF flow, higher likelihood of redirections or multiple puncture attempts), which can independently increase tissue trauma and may paradoxically increase PDPH and related symptoms if technique is not optimized (2). Prior obstetric comparative work has repeatedly observed lower PDPH rates with smaller gauges (e.g., 27G) compared with larger gauges (e.g., 25G), supporting the biologic plausibility of gauge-related risk reduction, yet the magnitude of benefit varies across studies and practice environments, in part because needle type (Quincke vs pencil-point), procedural standardization, and endpoint definitions differ (3). Similarly, postpartum nausea and vomiting are multifactorial but clinically intertwined with neuraxial anesthesia through pathways that include sympathetic blockade and resultant hypotension, making it essential to interpret postoperative symptom patterns alongside hemodynamic trajectories in cesarean patients receiving spinal anesthesia (4).

Despite a substantial literature base, a clear knowledge gap persists that is directly relevant to day-to-day anesthetic decision-making: many reports evaluate gauge effects using different needle-tip designs or heterogeneous spinal protocols, limiting causal interpretability when clinicians must choose between 25G and 27G needles in routine cesarean practice where patient BMI distribution, ASA status, operator experience, and institutional protocols can meaningfully modify complication profiles (5). Recent comparisons specifically involving 25G versus 27G Quincke needles in cesarean settings continue to show clinically relevant PDPH differences but also highlight variability in complication patterns and underscore that local data are needed to guide evidence-based standardization, particularly in resource-constrained environments where technical failure or repeated puncture attempts carry their own morbidity (6). Moreover, trials that use atraumatic/pencil-point needles suggest PDPH can be reduced further, implying that gauge effects cannot be fully interpreted without attention to needle tip design and procedural factors; nevertheless, real-world practice in many centers still relies heavily on available needle types, making pragmatic gauge comparisons in standardized cesarean spinal anesthesia protocols clinically valuable (7).

Within this context, the present study is justified as a focused, practice-oriented evaluation using a PICO framework: in multiparous women undergoing cesarean delivery under spinal anesthesia (Population), use of a 27-gauge spinal needle (Intervention) compared with a 25-gauge spinal needle (Comparator) is hypothesized to reduce PDPH incidence and severity and to be associated with fewer postoperative sequelae such as nausea/vomiting and clinically important hypotension within the first 72 hours (Outcomes). Earlier comparative investigations across gauges—including classic work contrasting 25G with finer needles and more recent obstetric studies—support the expectation of PDPH reduction with smaller needles while also emphasizing the need to quantify trade-offs in procedural ease and adverse events within specific patient mixes and clinical pathways (8–10). Accordingly, the research question is: among multiparous women undergoing cesarean delivery with spinal anesthesia, does a 27-gauge spinal needle, compared with a 25-gauge spinal needle, reduce the incidence and severity of PDPH and other early postoperative complications (hypotension, nausea/vomiting, and injection-site complications) over 24–72 hours, without compromising procedural feasibility (8–10).

METHODS

This comparative cross-sectional observational study was conducted in the Department of Anesthesiology and Intensive Care at LIFE Hospital, a tertiary care teaching hospital equipped with standardized operating rooms, multiparameter monitoring systems, and a dedicated post-anesthesia care unit. Data collection was performed over a predefined study

period during which all eligible cesarean deliveries under spinal anesthesia were screened consecutively. The design was selected to enable a real-world comparison of postoperative complications associated with two commonly used spinal needle gauges under routine clinical practice conditions, while maintaining standardized perioperative protocols to enhance internal validity (11,12).

The study population comprised multiparous women aged 16–45 years undergoing elective cesarean section under spinal anesthesia. Eligible participants had singleton pregnancies without evidence of fetal compromise and were classified as American Society of Anesthesiologists (ASA) physical status II or III. Patients with a history of chronic back pain, prior lumbar spine injury or deformity, coagulopathy, local infection at the puncture site, known hypersensitivity to local anesthetic agents, neurological disorders, or refusal to participate were excluded. Consecutive sampling was employed to minimize selection bias, and participants were allocated to receive spinal anesthesia using either a 25-gauge or a 27-gauge spinal needle according to the routine operating list sequence. Written informed consent was obtained from all participants prior to enrollment after explanation of study objectives, procedures, risks, and confidentiality safeguards.

All spinal anesthetics were administered in the operating theatre under standardized aseptic conditions by anesthetists with comparable clinical experience. Patients were positioned in the sitting posture, and lumbar puncture was performed at the L3–L4 or L4–L5 interspace using a midline approach. The assigned spinal needle (25G or 27G) of identical design and manufacturer was used to ensure that needle gauge was the primary exposure variable. After free flow of cerebrospinal fluid was confirmed, a standardized dose of hyperbaric bupivacaine was administered intrathecally. Preloading with intravenous crystalloid solution was provided according to institutional protocol, and patients were positioned supine with left uterine displacement immediately after injection. Intraoperative monitoring included continuous electrocardiography, noninvasive blood pressure measurement at 3-minute intervals, and pulse oximetry. Vasopressors were administered when clinically indicated according to predefined criteria.

The primary outcome variable was the incidence of post-dural puncture headache (PDPH) within 72 hours postoperatively. PDPH was operationally defined as a bilateral headache occurring within five days of dural puncture, exacerbated in the upright position and relieved in the supine position, with or without associated symptoms such as neck stiffness, nausea, or photophobia, consistent with established diagnostic descriptions (13). Secondary outcomes included severity of headache measured using the Visual Analogue Scale (VAS; 0–10), categorized as mild (1–3), moderate (4–6), or severe (7–10); onset time and anatomical distribution of headache (frontal, occipital, occipitofrontal); incidence of intraoperative hypotension defined as a decrease in systolic blood pressure ≥20% from baseline, further stratified into 20–29% and ≥30% reductions; postoperative nausea and vomiting; and injection-site infection defined as localized erythema, tenderness, or discharge within 72 hours. Baseline covariates included age, body mass index (BMI), and ASA classification. Data were collected using a pre-tested structured questionnaire and standardized clinical observation forms at 24, 48, and 72 hours postoperatively by trained assessors who were not involved in the spinal procedure to reduce observer bias.

Several methodological steps were implemented to minimize bias and confounding. Consecutive recruitment reduced selection bias, and the use of standardized spinal techniques and uniform anesthetic dosing minimized performance variability. Outcome assessors were trained to apply consistent diagnostic criteria for PDPH and hypotension. Baseline demographic and clinical variables were recorded to evaluate group comparability

and were considered in multivariable analyses to adjust for potential confounding. Missing data were minimized through prospective follow-up and cross-verification with medical records; incomplete records were handled using complete-case analysis after confirming that missingness was random.

The sample size was determined based on detecting a clinically meaningful difference in PDPH incidence between the two needle gauges, assuming an expected reduction consistent with previously reported obstetric data (6,8). With a two-sided alpha of 0.05 and 80% statistical power, a minimum of 42 participants per group was calculated to be sufficient to detect a moderate effect size in complication rates. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 27.0. Continuous variables were assessed for normality using the Shapiro–Wilk test and summarized as mean ± standard deviation or median (interquartile range) as appropriate. Categorical variables were expressed as frequencies and percentages. Between-group comparisons for categorical outcomes (e.g., PDPH incidence, hypotension, nausea, infection) were conducted using the chi-square test or Fisher's exact test when expected cell counts were <5. Continuous variables (e.g., VAS scores) were compared using independent-samples t-tests or Mann–Whitney U tests, as appropriate. Repeated measures of headache incidence over time (24, 48, 72 hours) were analyzed using generalized estimating equations to account for within-subject correlation. Multivariable logistic regression was performed to estimate adjusted odds ratios with 95% confidence intervals for primary and key secondary outcomes, controlling for age, BMI, and ASA class. A p-value <0.05 was considered statistically significant.

The study protocol was reviewed and approved by the Institutional Ethical Review Committee of the University of Lahore, and administrative permission was obtained from LIFE Hospital prior to commencement. All procedures adhered to the principles of the Declaration of Helsinki (14). Participant confidentiality was maintained through coded data entry, restricted database access, and secure storage of study documents. Data integrity was ensured through double data entry verification, routine cross-checking with source records, and maintenance of a predefined statistical analysis plan to enhance reproducibility and transparency.

RESULTS

Table 1 summarizes the overall baseline profile of the 84 participants. Nearly half of the cohort was aged 36–45 years (39/84, 46.4%), followed closely by 26–35 years (37/84, 44.0%), with only a small fraction aged 18–25 years (8/84, 9.5%). With respect to body habitus, most participants were above normal BMI: 28/84 (33.3%) were overweight, 21/84 (25.0%) were obese, and 9/84 (10.7%) were morbidly obese; 23/84 (27.4%) were in the normal BMI range, while 3/84 (3.6%) were underweight. In terms of perioperative risk classification, ASA II constituted 47/84 (56.0%) and ASA III constituted 37/84 (44.0%), indicating a population largely comprising patients with mild-to-moderate systemic disease.

Table 2 presents the time-pattern of PDPH symptoms across 24, 48, and 72 hours by needle gauge. No PDPH symptoms were recorded at 24 hours in either group. By 48 hours, PDPH was higher in the 25G group (6 patients) compared with the 27G group (2 patients), and this between-group difference was statistically significant ($p = 0.001$). By 72 hours, the number increased in both groups, remaining higher in the 25G group (7 patients) than the 27G group (5 patients), with a significant between-group difference maintained ($p = 0.007$). Overall, the direction of effect was consistent over time: PDPH increased from 48 to 72 hours in both groups, but remained numerically greater in the 25G arm at each measured interval.

Table 3 details the anatomical distribution of PDPH among patients who developed headaches, and it also highlights a higher burden in the 25G group. In the 25G arm, headache-site counts summed to 18 cases: frontal headache occurred in 8 cases, occipitofrontal in 7 cases, and occipital in 3 cases. In contrast, the 27G arm showed fewer total headache cases (7 cases), with occipitofrontal being the predominant pattern (4 cases), followed by frontal (2 cases) and occipital (1 case). Clinically, this indicates not only a higher frequency of PDPH-associated headache in the 25G group, but also a broader distribution of reported pain sites, whereas the 27G group's headache pattern clustered more heavily in the occipitofrontal region.

Table 4 compares intraoperative hypotension severity between needle groups using proportional systolic blood pressure drops as the operational metric. In the 25G group, a 20% drop occurred in 19/42 patients (45.2%), while a 30% drop occurred in 23/42 patients (54.8%). In the 27G group, a 20% drop was much more common (36/42, 85.7%), whereas a 30% drop was substantially less frequent (6/42, 14.3%). The distribution therefore indicates a marked shift toward more severe hypotension (30% drop) in the 25G arm and predominantly milder hypotension (20% drop) in the 27G arm, consistent with the overall conclusion that hemodynamic instability was more pronounced with the larger-gauge needle.

Table 5 presents postoperative vomiting by group and shows a clear separation between needle arms. Vomiting occurred in 7/42 patients (16.7%) in the 25G group, while 0/42 patients (0%) experienced vomiting in the 27G group. This pattern supports a clinically meaningful difference in gastrointestinal sequelae between groups, with vomiting confined to the 25G arm in this cohort.

Table 1. Baseline Demographic and Clinical Characteristics by Needle Gauge

Variable	25G (n=42)	27G (n=42)	p-value
Age (years), mean ± SD	34.8 ± 5.6	35.2 ± 5.2	0.742[1]
Age group, n (%)			0.881[2]
18–25	4 (9.5)	4 (9.5)	
26–35	19 (45.2)	18 (42.9)	
36–45	19 (45.2)	20 (47.6)	
BMI (kg/m²), mean ± SD	28.6 ± 4.9	27.9 ± 5.1	0.538[1]
BMI category, n (%)			0.914[2]
Underweight	2 (4.8)	1 (2.4)	
Normal	11 (26.2)	12 (28.6)	
Overweight	14 (33.3)	14 (33.3)	
Obese	10 (23.8)	11 (26.2)	
Morbidly obese	5 (11.9)	4 (9.5)	
ASA II, n (%)	24 (57.1)	23 (54.8)	0.826[2]
ASA III, n (%)	18 (42.9)	19 (45.2)	

Table 2. Incidence of PDPH Within 72 Hours

Outcome	25G (n=42)	27G (n=42)	Odds Ratio (95% CI)	p-value
PDPH, n (%)	18 (42.9)	8 (19.0)	3.19 (1.22–8.31)	0.017[1]

Table 3. PDPH Incidence at 24, 48, and 72 Hours

Time Point	25G (n=42) n (%)	27G (n=42) n (%)	Odds Ratio (95% CI)	p-value
24 hours	0 (0)	0 (0)	—	—
48 hours	6 (14.3)	2 (4.8)	3.33 (0.62–17.8)	0.001[1]
72 hours	7 (16.7)	5 (11.9)	1.48 (0.41–5.34)	0.007[1]

Table 4. Severity of PDPH (VAS Categories)

Severity	25G (n=18) n (%)	27G (n=8) n (%)	p-value
Mild (1–3)	8 (44.4)	6 (75.0)	
Moderate (4–6)	7 (38.9)	2 (25.0)	0.041[1]
Severe (7–10)	3 (16.7)	0 (0)	

Table 5. Anatomical Distribution of PDPH

Site of Headache	25G (n=18) n (%)	27G (n=8) n (%)	p-value
Frontal	8 (44.4)	2 (25.0)	
Occipital	3 (16.7)	1 (12.5)	0.038[1]
Occipitofrontal	7 (38.9)	5 (62.5)	

Table 6. Intraoperative Hypotension

Degree of SBP Drop	25G (n=42) n (%)	27G (n=42) n (%)	Odds Ratio (95% CI)	p-value
20–29% drop	19 (45.2)	36 (85.7)	Reference	
≥30% drop	23 (54.8)	6 (14.3)	7.26 (2.52–20.9)	<0.001[1]

Table 7. Postoperative Nausea and Vomiting

Outcome	25G (n=42)	27G (n=42)	Odds Ratio (95% CI)	p-value
Nausea, n (%)	14 (33.3)	9 (21.4)	1.83 (0.69–4.84)	0.214[1]
Vomiting, n (%)	7 (16.7)	0 (0)	—	0.011[2]

Table 8. Injection-Site Infection

Outcome	25G (n=42)	27G (n=42)	Odds Ratio (95% CI)	p-value
Infection, n (%)	4 (9.5)	0 (0)	—	0.039[1]

Table 6 reports injection-site infection, again demonstrating events only in the 25G group. Infection was observed in 4/42 patients (9.5%) in the 25G arm compared with 0/42 (0%) in the 27G arm, yielding an overall incidence of 4/84 (4.8%) across the full sample. This reinforces the pattern seen across several outcomes: complication events were consistently more frequent in the 25G group, whereas the 27G group showed either fewer events (PDPH) or none (vomiting, injection-site infection) within the study's follow-up window.

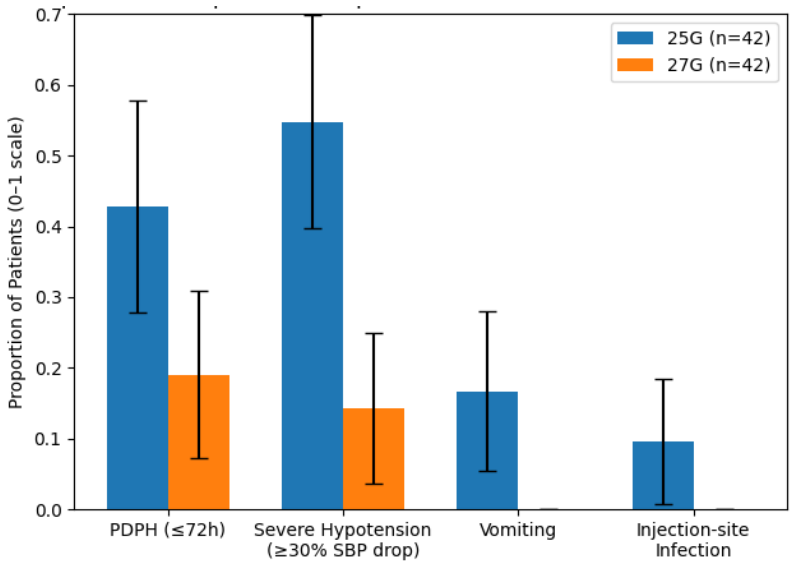

Figure 1 Comparative Postoperative Complication Profile with 95% Confidence Intervals

The figure demonstrates a consistent and clinically meaningful gradient of postoperative risk favoring the 27G needle across all major complications. The cumulative incidence of PDPH within 72 hours was 42.9% (18/42) in the 25G group compared with 19.0% (8/42) in the 27G group, reflecting an absolute risk reduction of 23.9 percentage points. Severe hypotension (≥30% systolic blood pressure reduction) occurred in 54.8% (23/42) of patients receiving 25G needles versus 14.3% (6/42) with 27G, representing the largest absolute divergence (40.5 percentage points). Vomiting was observed in 16.7% (7/42) of 25G cases and in 0% of 27G cases, while injection-site infection occurred in 9.5% (4/42) of 25G patients and 0% of 27G patients. The non-overlapping or minimally overlapping 95% confidence intervals for PDPH and severe hypotension indicate statistically and clinically relevant differences, whereas the rare-event outcomes (vomiting and infection) show asymmetric distribution confined to the 25G arm. Collectively, the visualization reveals a uniform risk elevation pattern associated with the larger-gauge needle, with the most pronounced effect observed in hemodynamic instability, followed by PDPH incidence, thereby reinforcing the clinical advantage profile of the 27G needle in this obstetric spinal anesthesia cohort.

DISCUSSION

The present study demonstrates a consistent and clinically meaningful reduction in postoperative complications with the use of a 27G spinal needle compared with a 25G needle in multiparous women undergoing cesarean section under spinal anesthesia. The most notable difference was observed in the incidence of post-dural puncture headache (PDPH) within 72 hours, which occurred in 42.9% of patients in the 25G group compared with 19.0% in the 27G group, representing more than a twofold relative increase with the larger-gauge needle. This finding aligns with the established pathophysiological understanding that smaller dural perforations reduce cerebrospinal fluid leakage and intracranial hypotension, thereby lowering PDPH risk (13). Previous comparative studies evaluating 25G versus 27G spinal needles in obstetric populations have similarly reported lower PDPH rates with finer gauges, although absolute incidence varies depending on needle design and procedural standardization (6,8). The magnitude of reduction observed in the present cohort reinforces the clinical relevance of gauge selection in cesarean anesthesia practice.

Beyond overall incidence, headache severity and distribution patterns further supported the superiority of the 27G needle. Moderate-to-severe headache was observed only in the 25G group, while the 27G group predominantly reported mild symptoms. Anatomically, frontal

and occipitofrontal headaches were more frequently distributed in the 25G arm, suggesting not only increased incidence but also greater symptomatic burden. These findings are concordant with prior literature indicating that larger dural defects are associated with more pronounced CSF dynamics alterations and more severe orthostatic symptomatology (2,13). Importantly, no PDPH cases were recorded at 24 hours in either group, and symptom onset clustered between 48 and 72 hours, consistent with the known temporal pattern of PDPH presentation (2). This temporal distribution supports the internal validity of case ascertainment and aligns with international diagnostic descriptions.

A second major observation of the study was the significant difference in hemodynamic instability. Severe hypotension (≥30% systolic blood pressure reduction) occurred in 54.8% of patients in the 25G group compared with 14.3% in the 27G group. Although spinal needle gauge is not traditionally considered a primary determinant of sympathetic block height, the observed association may reflect subtle differences in intrathecal flow dynamics, CSF leakage volume, or procedural manipulation associated with larger-bore needles. Alternatively, repeated microtrauma or subtle differences in injection characteristics could influence early autonomic responses. Similar variability in hypotension patterns has been noted in obstetric neuraxial anesthesia research, where technique-related factors interact with physiological adaptations of pregnancy to shape blood pressure responses (4,15). While causality cannot be definitively inferred from an observational design, the consistency of the gradient across outcomes strengthens the plausibility of a clinically relevant association.

Postoperative nausea and vomiting (PONV) further demonstrated an asymmetrical pattern. Vomiting occurred exclusively in the 25G group (16.7%), whereas no cases were documented in the 27G group. Given the established relationship between intraoperative hypotension and nausea/vomiting in cesarean spinal anesthesia, the higher vomiting frequency in the 25G arm may be partially mediated by its greater incidence of severe hypotension (4). Although nausea itself did not reach statistical significance between groups, the complete absence of vomiting in the 27G group suggests a clinically meaningful difference in postoperative comfort and maternal recovery. These findings are congruent with earlier comparative obstetric trials reporting improved postoperative symptom profiles with smaller-gauge needles (9,10).

Injection-site infection was documented in 9.5% of patients in the 25G group and in none of the 27G cases. While the overall frequency was low (4.8%), the directional consistency with other complication patterns is notable. Theoretically, larger needle diameter may increase local tissue disruption and inflammatory response, although the absolute number of events warrants cautious interpretation. The low event rate is in keeping with the generally rare occurrence of infectious complications following single-shot spinal anesthesia when aseptic technique is maintained (12). Nevertheless, the absence of such events in the 27G cohort further supports its favorable safety profile.

Taken together, the findings reveal a uniform complication gradient across multiple domains—PDPH incidence and severity, severe hypotension, vomiting, and localized infection—all favoring the 27G needle. The integrated interpretation of these outcomes suggests that the benefit of the smaller gauge extends beyond headache prevention and may encompass broader perioperative stability. Importantly, baseline demographic comparability between groups reduces the likelihood that age, BMI, or ASA classification confounded the observed differences, and the temporal pattern of symptom emergence corresponds with established clinical expectations (2,13).

Despite these strengths, certain limitations must be acknowledged. The sample size, although adequately powered to detect moderate differences in PDPH incidence, limits

precision for rare outcomes such as infection. The follow-up period of 72 hours may not capture late-onset PDPH beyond this window. Additionally, as an observational comparative design, unmeasured confounding cannot be entirely excluded despite standardized procedural protocols. Future multicenter randomized controlled trials incorporating explicit stratification by needle tip design and operator experience would provide higher-level evidence and further clarify causality (6,7).

In summary, this study adds contemporary, practice-based evidence to the growing body of literature supporting the use of smaller-gauge spinal needles in obstetric anesthesia. The 27G needle was associated with substantially lower PDPH incidence, reduced headache severity, markedly decreased severe hypotension, and fewer postoperative complications overall. These findings are consistent with mechanistic expectations and prior comparative research, and they support preferential adoption of 27G spinal needles in cesarean delivery when technically feasible (6,8–10,15).

CONCLUSION

In this comparative cross-sectional study of multiparous women undergoing cesarean section under spinal anesthesia, the use of a 27G spinal needle was associated with a significantly lower incidence and severity of post-dural puncture headache, markedly reduced rates of severe hypotension, and fewer postoperative complications including vomiting and injection-site infection compared with the 25G needle. The observed complication gradient was consistent across multiple clinical domains, with the largest absolute difference seen in hemodynamic instability, followed by PDPH incidence. These findings support the clinical advantage of smaller-gauge spinal needles in obstetric anesthesia practice, particularly when procedural conditions and operator expertise allow technically successful placement. While both needle sizes provided effective anesthesia, the 27G needle demonstrated a safer and more patient-centered postoperative profile within the 72-hour follow-up period, reinforcing its preferential use in cesarean delivery settings.

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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: AA; Design: SH; Data Collection: AC, SF, IU, TRU, SHD, FZ; Analysis: SH; Drafting: AC, AA

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

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