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A Comparative Study of 25G vs 27G Quincke Needles on Incidence and Severity of Post-Dural Puncture Headache (PDPH) in Casarean Section Patients Undergoing Spinal Anaesthesia

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Abstract

Background: *Post-dural puncture headache (PDPH) is a common and distressing complication of spinal anaesthesia in obstetric patients. Needle gauge is a known modifiable risk factor influencing PDPH incidence and severity.*

Objective: *To compare the incidence, severity, and perioperative characteristics of PDPH among parturients undergoing cesarean section using 25G versus 27G Quincke spinal needles.*

Methods: *This prospective observational study was conducted at Anwar Khan Modern Medical College Hospital, Dhaka, Bangladesh, over a two-year period (January 2023–January 2025). A total of 400 patients were enrolled (200 in each group). PDPH cases were identified and analyzed for demographic, obstetric, and perioperative variables.*

Results: *The incidence of PDPH was significantly higher in the 25G group (14%) compared to the 27G group (2%). Mild PDPH occurred in 50.0% of 27G cases vs. 3.6% in the 25G group (p = 0.0059). Although time to CSF flow was longer in the 27G group, and postoperative vomiting and vertigo were more frequent in 25G cases, these differences were not statistically significant. No significant hemodynamic changes were observed between groups.*

Conclusion: *The 27G Quincke needle significantly reduces both the incidence and severity of PDPH without increasing procedural or clinical complications. Its adoption in obstetric spinal anaesthesia may enhance maternal outcomes and should be considered in local practice guidelines.*

Keywords: *Post-Dural Puncture Headache, Spinal Anaesthesia, Cesarean Section, 25G Needle, 27G Needle, Needle Gauge, Quincke Needle*

Introduction

The global increase in caesarean deliveries over the past two decades has reshaped obstetric care protocols, particularly in low- and middle-income countries like Bangladesh. According to Verma et al., South and Southeast Asia have seen a marked rise in caesarean section (C-section) rates, fueled by expanding institutional births, maternal age, and

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evolving clinical practices [1]. In Bangladesh specifically, data from Demographic and Health Surveys show a consistent year-on-year rise in C-section deliveries, often surpassing 30% in urban tertiary centers. This growing surgical burden has concurrently escalated the demand for safer and more effective anesthetic strategies tailored to the obstetric population [2].

Spinal anaesthesia has emerged as the preferred modality for cesarean section anaesthesia globally, including in Bangladesh, due to its rapid onset, technical simplicity, minimal drug transfer to the fetus, and superior maternal-fetal safety profile compared to general anaesthesia [3]. Several clinical trials and observational analyses underscore its lower maternal morbidity, decreased neonatal respiratory complications, and faster postoperative recovery time [4]. Moreover, the growing preference among parturients for spinal anaesthesia is evident in their expressed confidence and satisfaction levels, especially when preoperative counseling is effective [5].

Despite these advantages, spinal anaesthesia is not devoid of complications. Among its most distressing and commonly reported adverse effects is Post-Dural Puncture Headache (PDPH). According to the International Headache Society and the American Society of Anaesthesiologists, PDPH is defined as a bilateral, frontal or occipital postural headache that occurs within 5 days of dural puncture and worsens in the upright position, typically accompanied by neck stiffness, photophobia, or nausea [6]. Its pathophysiology primarily relates to cerebrospinal fluid (CSF) leakage from the dural puncture site, resulting in intracranial hypotension and traction on intracranial structures [7,8].

The burden of PDPH extends beyond physiological discomfort—it significantly impairs maternal functioning during a critical period of neonatal bonding. Several studies have documented associations between PDPH and reduced ability to ambulate, breastfeed, or provide newborn care [9,10]. In some cases, untreated PDPH can lead to serious complications such as subdural hematomas and seizures, requiring urgent intervention [11]. Given this spectrum of implications, anesthetic technique—especially needle selection—has emerged as a pivotal modifiable risk factor.

Needle gauge and tip design are key determinants of dural trauma and subsequent CSF leakage. Atraumatic pencil-point needles (e.g., Whitacre) and smaller gauges (e.g., 27G) are associated with significantly lower PDPH incidence compared to cutting-tip Quincke needles and larger gauges such as 22G and 25G [12,13]. However, the trade-offs associated with finer needles cannot be overlooked. Multiple studies report technical challenges with 27G needles, including delayed CSF appearance, more frequent repositioning, and increased block failure rates [14]. These drawbacks may offset the theoretical benefit in PDPH reduction, especially in high-volume or resource-constrained settings.

A growing body of evidence supports the reduction of PDPH with 27G over 25G needles. Similar trends were observed by Sattar et al., although they noted a significantly higher incidence of failed first attempts in the 27G group (15). Meanwhile, other randomized controlled trials have not found statistically significant differences between 25G and 27G in real-world clinical outcomes, suggesting that operator skill, patient positioning, and needle insertion angle may confound these comparisons [16,17]. The 2017 Cochrane review by Arevalo-Rodriguez et al. similarly highlighted that while smaller gauges reduce PDPH overall, the magnitude of benefit between 25G and 27G remains subject to procedural variability [12].

Despite these insights, there remains a conspicuous lack of prospective, randomized, or controlled studies in the Bangladeshi context specifically comparing 25G and 27G spinal needles for obstetric spinal anaesthesia. Although a single-center observational study in Dhaka demonstrated reduced PDPH incidence with 27G needles, it lacked detailed stratification by severity and procedural characteristics such as CSF acquisition time and insertion attempts. In a region with distinct anatomical, socioeconomic, and systemic practice profiles, the extrapolation of international data may not adequately inform clinical guidelines. Therefore, context-specific, prospective evidence is imperative to guide needle selection strategies that balance safety, technical feasibility, and maternal well-being in the Bangladeshi obstetric population.

This study aims to address this critical knowledge gap by evaluating the comparative incidence and severity of PDPH in parturients undergoing cesarean section with either 25G or 27G Quincke spinal needles at a tertiary care center in Bangladesh. The findings are expected to generate evidence-based insights that can refine local anaesthesia protocols and enhance postpartum maternal outcomes.

Methods

This prospective observational study was conducted from January 2023 to January 2025 in the Department of Obstetrics and Gynaecology at Anwer Khan Modern Medical College and Hospital, Dhaka, Bangladesh. The study aimed to describe the procedural and hemodynamic characteristics of post-dural puncture headache (PDPH) among women undergoing cesarean delivery under spinal anaesthesia, and to compare these characteristics between cases performed with 25-gauge and 27-gauge Quincke needles. A total of 400 parturients scheduled for lower-segment cesarean section under spinal anaesthesia were enrolled consecutively following informed written consent. Spinal anaesthesia was performed using either a 25G (Group A, n = 200) or a 27G (Group B, n = 200) Quincke needle according to routine departmental practice. All procedures were conducted by consultant anesthetists using a standardized midline technique in the sitting position. Procedural variables—including number of attempts, time to obtain cerebrospinal fluid (CSF), injection duration, preload volume, and intraoperative fluid load—were recorded prospectively. Perioperative monitoring included non-invasive blood pressure, pulse rate, and urine output. Patients were observed for up to five postoperative days for the development of PDPH. Diagnosis was based on standard clinical criteria: a postural headache beginning within five days of dural puncture, aggravated by sitting or standing and relieved by lying down, with or without associated symptoms such as nausea, vomiting, photophobia, or neck stiffness. Only patients who developed PDPH were included in the final comparative analysis. For each PDPH case, onset, duration, associated symptoms, and severity (categorized as mild, moderate, or severe using predefined institutional criteria) were documented. Exclusion criteria included pre-existing chronic headache disorders, contraindications to spinal anaesthesia, failed spinal block requiring conversion to general anaesthesia, accidental dural puncture during epidural placement, neurological disease, or unrelated intraoperative complications. Data were collected using a structured, pre-validated form. Ethical approval was obtained from the Institutional Review Board of Anwer Khan Modern Medical College and Hospital, and the study complied with the Declaration of Helsinki.

Results

Table-I

Baseline Characteristics of Participants: Age and Weight (N=400)

Parameter	Group A (25G) n=200	Group B (27G) n=200
Age (years)	28.24/ ±/ 5.08	27.76/ ±/ 5.44
Weight (kg)	81.44/ ±/ 14.01	85.30/ ±/ 14.15

The baseline demographic characteristics, including age and weight, were comparable between the two study groups. The mean age of participants in Group A (25G) was 28.24/ ±/ 5.08 years, whereas in Group B (27G) it was slightly lower at 27.76/ ±/ 5.44 years. In terms of weight, the mean body weight of Group A was 81.44/ ±/ 14.01 kg, while that of Group B was 85.30/ ±/ 14.15 kg.

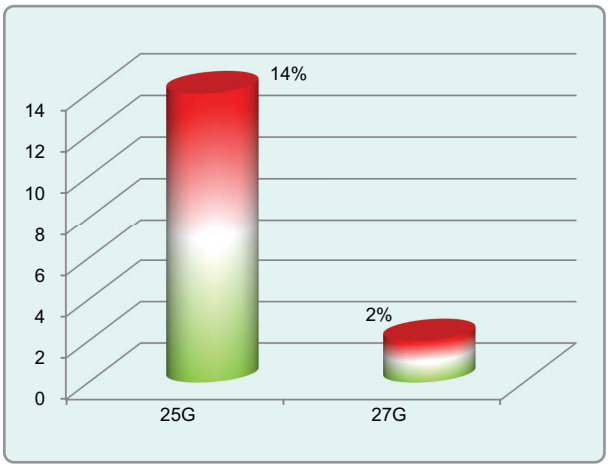

Figure 1: Incidence of PDPH among the participants (N=400)

The incidence of post-dural puncture headache (PDPH) was found to be substantially higher in Group A (25G) compared to Group B (27G). Specifically, 14% of participants in the 25G group developed PDPH, while only 2% of those in the 27G group experienced the complication.

Among the 32 participants who developed post-dural puncture headache (PDPH), obstetric characteristics varied between the groups. In Group A (25G), the majority were either gravida 1 or 2, while all PDPH cases in Group B (27G) occurred in gravida 4 patients. Regarding previous cesarean section history, half of the PDPH cases in Group A had one prior C-section, while all affected participants in Group B had

undergone two prior cesarean deliveries. Gestational age at the time of delivery was predominantly between 37–38 weeks in Group A (62.5%), whereas 75% of PDPH cases in Group B delivered between 35–36 weeks. Despite these trends, none of the intergroup differences reached statistical significance (p>0.05), indicating that obstetric and pregnancy-related characteristics did not independently account for the variation in PDPH incidence between the needle groups.

The comparison of baseline comorbidities and postoperative symptoms between the two groups did not demonstrate any statistically significant differences. Although diabetes mellitus was more prevalent in Group B (27G), the overall distribution of comorbidities between the groups was comparable (p = 0.330). No perioperative vomiting was observed in either group, indicating good intraoperative tolerance. Postoperative vomiting, vertigo, and second postoperative day headache occurred frequently in both groups; however, these differences were not statistically significant, suggesting that needle gauge size did not have a measurable impact on these postoperative symptoms.

Hemodynamic parameters, including perioperative and postoperative pulse rate and diastolic blood pressure, were also comparable between the two groups. Most patients in both groups maintained stable pulse rates and diastolic blood pressure values within acceptable ranges, with no significant intergroup differences. Similarly, perioperative and postoperative urine output did not differ significantly between groups, indicating comparable renal perfusion and fluid management.

Table V presents the characteristics of post-dural puncture headache (PDPH) episodes and related procedural factors among the affected participants. In terms of onset, most PDPH cases in Group A (25G) began between 24–28 hours postoperatively (57.1%), while half of the Group B (27G) cases had earlier onset within 23 hours; however, this difference was not statistically significant (p/ =/ 0.180). The duration of PDPH was notably shorter in Group B, with 75% resolving within 2 days, compared to 28.6% in Group A, although the difference again did not reach statistical significance (p/ =/ 0.168). Procedural factors such as preload volume, duration of local anesthetic injection, and intraoperative fluid load were also assessed. Most participants in Group A received d”700 ml/kg of preload and completed anesthetic injection within 15 seconds. Group B patients showed a higher proportion receiving larger preload volumes and longer injection durations, though these trends remained statistically nonsignificant.

Table-II

Obstetric and Pregnancy-Related Characteristics (n=32)

Category	Group A (25G) (n=28)	Group B (27G) (n=4)	p-value
Gravida			
Gravida 1	12 (42.86%)	0 (0.0%)	0.180
Gravida 2	12 (42.86%)	0 (0.0%)	
Gravida 4	4 (14.28%)	4 (100.0%)	
Previous History of C-section			
None	8 (25.0%)	0 (0.0%)	0.180
1 Previous	16 (50.0%)	0 (0.0%)	
2 Previous	4 (12.5%)	4 (100.0%)	
Gestational Age (weeks)			
35–36	8 (25.0%)	3 (75.0%)	0.168
37–38	20 (62.5%)	1 (25.0%)	

The severity of PDPH differed significantly between the two groups. In Group A (25G), the vast majority of PDPH cases were rated as moderate (85.7%), with only 3.6% classified as mild and 10.7% as severe. By contrast, Group B (27G) exhibited a markedly higher proportion of mild headaches (50.0%) and lower proportion of moderate cases (25.0%), though its severe cases (25.0%) matched closely with Group A. The overall distribution of severity was statistically significant (p = 0.0059).

Table VII compares perioperative and postoperative systolic blood pressure (SBP) measurements among patients who developed PDPH. In the perioperative period, 64.3% of Group A (25G) patients had SBP d”110 mmHg, compared to 50.0% in Group B (27G), with no statistically significant difference between groups (p = 0.82). Similarly, postoperative SBP profiles were comparable, with 50.0% of patients in both groups presenting SBP ≤110 mmHg. A slightly higher proportion of Group B patients showed elevated postoperative SBP values (≥121 mmHg), but this variation was not statistically significant (p = 0.48). Overall, SBP values remained within similar distributions across both groups during the perioperative and postoperative periods.

Table VIII outlines the time required to obtain cerebrospinal fluid (CSF) following spinal needle insertion among patients who developed PDPH. In Group A (25G), the majority of cases (78.6%) achieved CSF flow within 19–22 seconds, while in Group B (27G), 50.0% fell within this range. A higher proportion of 27G cases experienced longer CSF acquisition times (≥23 seconds; 25.0%) compared to Group A (7.1%), though these differences were not statistically significant (p = 0.40).

Table-III

Baseline Comorbidities and Postoperative Clinical Symptoms in Group A (25G) and Group B (27G)

Variables	Group A (25G) (n = 28)	Group B (27G) (n = 4)	p-value
Comorbidities*			0.330
None	8 (28.6%)	0 (0.0%)	
Diabetes mellitus	4 (14.3%)	4 (100.0%)	
Hypertension	4 (14.3%)	2 (50.0%)	
Hypothyroidism	12 (42.9%)	1 (25.0%)	
Perioperative Vomiting			NA
Yes	0 (0.0%)	0 (0.0%)	
No	28 (100.0%)	4 (100.0%)	
Postoperative Vomiting			0.285
Yes	16 (57.1%)	1 (25.0%)	
No	12 (42.9%)	3 (75.0%)	
Postoperative Vertigo			0.686
Yes	24 (85.7%)	3 (75.0%)	
No	4 (14.3%)	1 (25.0%)	
2nd Postoperative Day Headache			0.686
Yes	24 (85.7%)	3 (75.0%)	
No	4 (14.3%)	1 (25.0%)	

Table-IV

Perioperative and Postoperative Hemodynamic Parameters and Urine Output in Group A (25G) and Group B (27G)

Variables	Group A (25G) (n = 28)	Group B (27G) (n = 4)	p-value
Pulse (bpm) – Postoperative			0.710
≤ 85	16 (57.1%)	3 (75.0%)	
86–90	8 (28.6%)	1 (25.0%)	
≥91	4 (14.3%)	0 (0.0%)	
Pulse (bpm) – Perioperative			0.565
≤86	8 (28.6%)	1 (25.0%)	
87–93	8 (28.6%)	2 (50.0%)	
≥94	12 (42.9%)	1 (25.0%)	
Diastolic BP (mmHg) – Perioperative			0.686
≤70	24 (85.7%)	3 (75.0%)	
71–80	4 (14.3%)	1 (25.0%)	
Diastolic BP (mmHg) – Postoperative			0.537
≤70	20 (71.4%)	3 (75.0%)	
71–80	8 (28.6%)	1 (25.0%)	
Urine Output (ml) – Perioperative			0.827
≤200	4 (14.3%)	–	
201–500	20 (71.4%)	3 (75.0%)	
≥501	4 (14.3%)	1 (25.0%)	
Urine Output (ml) – Postoperative			0.386
≤1700	8 (28.6%)	2 (50.0%)	
1701–1900	12 (42.9%)	1 (25.0%)	
≥1901	8 (28.6%)	1 (25.0%)	

Table-V

Characteristics of PDPH and Related Procedural Factors (n = 32)

Category	Group A (25G) (n = 28)	Group B (27G) (n = 4)	p-value
Onset of PDPH (hours)			
≤23	4 (14.3%)	2 (50.0%)	0.180
24–28	16 (57.1%)	1 (25.0%)	
≥29	8 (28.6%)	1 (25.0%)	
Duration of PDPH (days)			
≤2	8 (28.6%)	3 (75.0%)	0.168
3–4	20 (71.4%)	1 (25.0%)	
Preload Volume (ml/kg)			
≤700	24 (85.7%)	2 (50.0%)	0.064
> 700	4 (14.3%)	2 (50.0%)	
Duration of Local Anesthetic Injection (sec)			
≤15	24 (85.7%)	3 (75.0%)	0.064
16–20	4 (14.3%)	1 (25.0%)	
Intraoperative Fluid Load (ml)			
≤1000	12 (42.9%)	3 (75.0%)	0.285
> 1000	16 (57.1%)	1 (25.0%)	

Table-VI

Severity of PDPH Among Study Participants (n = 32)

Severity of PDPH	Group A (25G) (n = 28)	Group B (27G) (n = 4)	p-value
Mild 1 (3.6%)	2 (50.0%)	0.0059	
Moderate	24 (85.7%)	1 (25.0%)	
Severe	3 (10.7%)	1 (25.0%)	

Table-VII

Perioperative and Postoperative Systolic Blood Pressure Among PDPH Cases (n = 32)

SBP Range (mmHg)	Group A (25G) (n = 28)	Group B (27G) (n = 4)	p-value
Perioperative SBP			
≤110	18 (64.3%)	2 (50.0%)	0.82
111–120	6 (21.4%)	1 (25.0%)	
≥121	4 (14.3%)	1 (25.0%)	
Postoperative SBP			
≤110	14 (50.0%)	2 (50.0%)	0.48
111–120	12 (42.9%)	1 (25.0%)	
≥121	2 (7.1%)	1 (25.0%)	

Table-VIII

Time Taken to Obtain CSF After Needle Insertion (n = 32)

Time Interval (seconds)	Group A (25G) (n = 28)	Group B (27G) (n = 4)	p-value
≤18	4 (14.3%)	1 (25.0%)	0.40
19–22	22 (78.6%)	2 (50.0%)	
≥23	2 (7.1%)	1 (25.0%)	

Discussion

In this prospective study, we evaluated the comparative effects of 25G versus 27G Quincke spinal needles on the incidence and severity of post-dural puncture headache (PDPH) among parturients undergoing cesarean section. The most notable finding was the significantly higher incidence of PDPH in the 25G group (14%) compared to the 27G group (2%), indicating a substantial absolute risk reduction with the smaller-gauge needle. This observation is strongly supported by previous studies that demonstrate a reduction in PDPH incidence with finer-gauge spinal needles [4,18,19].

Additionally, our study revealed that mild PDPH was significantly more prevalent among 27G cases (50.0%) compared to only 3.6% in the 25G group, while moderate and severe PDPH were predominantly seen in the 25G cohort. The overall severity distribution was statistically significant (p = 0.0059). These findings are consistent with Abid et al. and Mohammed and El Shal, who reported that larger-gauge needles were associated with more intense PDPH symptoms, whereas 27G needles typically resulted in milder headaches [20,21]. Shaikh et al. similarly found a higher frequency of moderate-to-severe PDPH in the 25G group compared to the 27G group [18].

Though differences in patient obstetric characteristics, such as gravidity, previous cesarean history, and gestational age, were observed between groups, they were not statistically significant. Literature has shown that while procedural factors such as needle type and size play a major role in PDPH, obstetric variables tend to have a less pronounced effect. For instance, Mohamed et al. and Tarekegn et al. both concluded that parity and gestational age were not significant predictors of PDPH incidence [19,22].

In terms of clinical presentation, symptoms such as postoperative vomiting, vertigo, and second-day headache were more commonly seen in the 25G group, though not significantly. These findings reflect the observations of Ferede et al. and Demilew et al., who reported similar trends of common PDPH-associated

symptoms without significant intergroup differences in hemodynamic measures [23,24]. Our analysis similarly revealed no statistically significant differences in perioperative or postoperative pulse, diastolic blood pressure, or urine output.

A notable procedural observation was the difference in CSF acquisition time: 78.6% of patients in the 25G group achieved CSF flow in 19–22 seconds, compared to 50.0% in the 27G group. Furthermore, 25.0% of 27G cases experienced CSF delays (e”23 seconds) versus 7.1% in the 25G group. These differences, while not statistically significant, are in line with prior findings that 27G needles may cause slower CSF return due to smaller bore size [21,25]. Despite procedural delays, no differences were noted in SBP trends, further affirming the hemodynamic safety of both needle sizes, consistent with Ciftci et al [26].

Additionally, while trends suggested earlier onset and shorter duration of PDPH in the 27G group, these did not reach statistical significance. This is supported by Ferede et al. and Chekol et al., who reported that finer needle gauges may be associated with earlier but less intense and shorter-duration headaches [23,27]. Our results also showed procedural trends such as higher preload volumes (>700 ml/kg) and longer injection durations (>15 seconds) more frequently in the 27G group, yet without significant correlation to PDPH occurrence, consistent with Ali et al. and Tarekegn et al [22,28].

Collectively, these findings reinforce that the choice of spinal needle gauge plays a crucial role in not only PDPH incidence but also symptom severity and procedural dynamics. While 27G needles may require slightly longer to obtain CSF, they offer a significant reduction in PDPH frequency and severity—particularly relevant in high-volume obstetric settings such as Bangladesh, where resource optimization and maternal comfort are paramount.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

Conclusion

This prospective, comparative study demonstrates that the use of 27G Quincke spinal needles in cesarean section anaesthesia is associated with a significantly lower incidence and milder severity of post-dural puncture headache (PDPH) compared to 25G needles. While procedural variables such as CSF acquisition time and fluid preload volumes showed some trends between groups, these were not statistically significant. Importantly, the use of finer-gauge needles did not compromise maternal hemodynamic stability or increase adverse clinical symptoms. These findings support a strong recommendation for the preferential use of 27G spinal needles in obstetric practice to reduce PDPH risk and enhance maternal comfort, particularly in resource-constrained settings like Bangladesh. Further multi-center studies are encouraged to validate these results and develop region-specific anaesthesia guidelines.

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