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COMPARISON OF INCIDENCE OF POST-DURAL PUNCTURE HEADACHE BETWEEN 25G AND 27G QUINCKE VARIETY SPINAL NEEDLE IN EMERGENCY CESAREAN SECTION

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Abstract

Background: Post-dural puncture headache (PDPH) is a common complication of spinal anesthesia, particularly in obstetric patients undergoing cesarean section. The incidence of PDPH is influenced by multiple factors, among which the size of the spinal needle plays a significant role. Larger gauge needles are associated with increased dural trauma and cerebrospinal fluid leakage, leading to a higher risk of PDPH.

Objective: To compare the incidence of post-dural puncture headache between 25G and 27G Quincke spinal needles in patients undergoing emergency cesarean section and to identify associated risk factors.

Methodology: This prospective comparative study was conducted on 100 patients undergoing emergency cesarean section under spinal anesthesia. Patients were randomly divided into two groups: Group A (n=50) received spinal anesthesia using a 25G Quincke needle, while Group B

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(n=50) received a 27G Quincke needle. Demographic data, procedural details, intraoperative hemodynamic parameters, and postoperative outcomes were recorded. Patients were followed for up to 5 days to assess the occurrence and characteristics of PDPH. Data were analyzed using appropriate statistical tests, and logistic regression analysis was performed to identify independent predictors.

Results: The overall incidence of PDPH was 14%. A significantly higher incidence was observed in the 25G group (20%) compared to the 27G group (8%) ($p \approx 0.048$). Multiple attempts and technical difficulty were significantly associated with increased PDPH incidence. Logistic regression analysis identified the use of 25G needle, more than one attempt, and difficult procedure as independent predictors of PDPH. Most cases of PDPH occurred within 24–48 hours and were mild to moderate in severity. Patient-related factors such as age, weight, and ASA status were not significantly associated with PDPH.

Conclusion: The use of 27G Quincke spinal needle significantly reduces the incidence of post-dural puncture headache compared to the 25G needle in emergency cesarean sections. Procedural factors, particularly number of attempts and technical difficulty, play a crucial role in the development of PDPH. Adoption of smaller gauge needles along with optimized technique can improve patient outcomes and reduce complications in obstetric anesthesia.

INTRODUCTION

1.1: Background

Cesarean section (c-section) a procedure performed under spinal anesthesia also known as a subarachnoid block (SAB) is used over the world, because of its several benefits over general anesthesia [1]. In comparison with general anesthesia, spinal anesthesia is the approach preferred for lower segment cesarean section because it avoids intravenous and inhalational general anesthetic agents and also the chances of failed intubation and also due to the fact it gives effective pain control, mobility, and speedy return again to daily things to do for new mothers and amplify their best of lifestyles [2]. Spinal anesthesia offers many advantages for cesarean

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delivery. The action occurs faster and offers a deep neural block. Because of the lesser amount of dose used, there is a lower risk of local anesthetic toxicity and minimal transfer of drugs to the fetus [3]. Obstetric patients have a higher incidence of having post-dural puncture headache (PDPH) [4]. A PDPH occurs due to the leakage of cerebrospinal fluid (CSF) through the hole created by a dural puncture with a spinal needle as shown in Figure 01[1]. There are many elements affecting the frequency of PDPH, these elements can also consist of age, female sex, needle size, and types, pregnancy, preceding records of PDPH, median–paramedian distinction in approach, a puncture level [5]. Women are thought to have a higher risk of PDPH, especially during pregnancy. The tone of the cerebral arteries can be affected by high amounts of estrogen in women, which increases the vascular distension response to CSF hypotension. The prevalence of PDPH is greater in young people and slim patients [6]. It normally occurs in less than 7 days after the puncture, worsens in less than 15 min after keeping the upright position, and improves within 30 min following medication. It starts fading within 14 days after spinal puncture. Headache is more common with the use of large needles owing to the increased leakage of CSF [7]. PDPH is commonly in the form of a frontal, occipital, or retro-orbital headache that starts in 12–72 h after the dural puncture and will increase when standing and decrease when lying down or resting [8]. Dural puncture leading to CSF leakage results in decreased CSF pressure, as well as, absolute reduction of CSF volume under the cisterna magna, with resultant downward motion of the brain and traction on pain-sensitive structures in the cranial cavity, particularly the pain-sensitive basal dura [7, 8]. CSF volume decreases in the course of lumbar puncture reducing the brain's supportive cushion and thereby causing headache [7]. Spinal anesthesia is a broadly used technique in present-day aesthetics. Although it is a reliable and often used anesthetic procedure, it includes complications, such as PDPH triggered through subarachnoid membrane puncture, which substantially influences postoperative well-being. Spinal anesthesia is widely considered the preferred method for cesarean sections due to its rapid onset and effective analgesia, minimizing maternal morbidity compared to general anesthesia. It has a favorable safety profile, making it

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the gold standard for elective and emergency cesarean deliveries [1]. However, complications such as post-dural puncture headache (PDPH) and hypotension remain common in spinal anesthesia for cesarean sections. PDPH occurs frequently among obstetric patients, emphasizing the need for better management strategies to mitigate these complications [2].

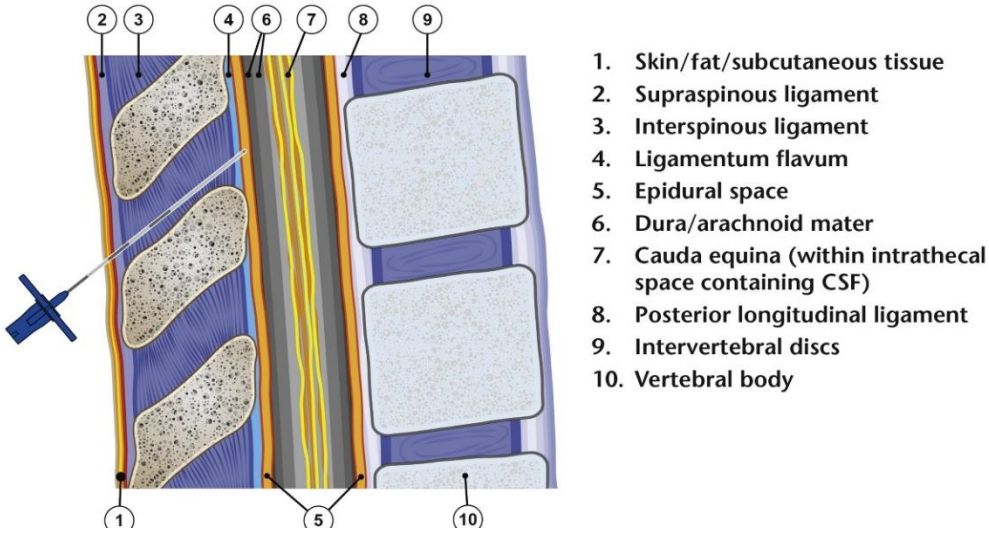

Figure 1: Anatomy of the Spinal Area during Spinal Anesthesia Procedure

1.2: Prevalence of Post-Dural Puncture Headache (PDPH) Globally

The overall incidence of PDPH in cesarean sections done under spinal anesthesia was reported at 25.7 %, with most cases occurring within the first 24–48 hours; mild PDPH was seen in 54.1 % of cases, moderate in 17.3 %, and severe in 28.6 % [3]. In the large prospective cohort of the 285 procedures, 29.5 % of patients developed PDPH, making it frequent the complication following dural puncture across the various clinical settings [4]. Among the non-obstetric patients undergoing the subarachnoid block, the incidence and the severity of the PDPH varied by the needle gauge, with findings suggesting higher rates with the larger cutting needles and lower rates with finer needle [5]. A cross-sectional study in Botswana reported an overall PDPH rate of 11.8 % following spinal anesthesia for cesarean sections, with most cases presenting within the first 24 hours and predominantly mild in severity [6]. In the parturients undergoing cesarean

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section under spinal anesthesia at another center, the incidence of PDPH was 21.7 %, highlighting substantial variability in prevalence depending on patient and procedural factors [7].

1.3: Factors Affecting the Incidence of PDPH in Spinal Anesthesia

In an Ethiopian obstetric cohort, larger spinal needle size and repeated number of dural puncture attempts were significantly associated with higher PDPH incidence, with 42.6 % of patients affected. The big needles increased PDPH likelihood (AOR = 8.6) and multiple punctures also raised the risk highlighting procedural influence on the PDPH occurrence [8]. A comprehensive review on spinal anesthesia risk factors identified that lower body mass index, previous PDPH history, multiple headache episodes, and patient-related conditions (e.g., age, sex, comorbidities) increase the likelihood of anesthesia complications, including PDPH. These findings demonstrate that both patient and procedural characteristics contribute to PDPH incidence [9].

Procedure-related analysis found that younger age, female gender, and type of dural puncture procedure influence the risk of PDPH, and larger needle gauge was shown to correlate with higher headache incidence in univariate analysis. This supports that demographic and procedural factors interact to affect PDPH risk [10]. In parturients undergoing cesarean section under spinal anesthesia in Ethiopia, larger gauge needle size, previous spinal anesthesia, andrepeated attempts were statistically significant predictors of PDPH. Mothers with these risk factors had higher likelihood of headache, underscoring the multifactorial nature of PDPH incidence [11].

In University of Gondar study 38.8 % of patients developed PDPH after the spinal anesthesia, and larger needle size repeated puncture attempts and females were significantly associated with the increased headache incidence. Use of larger needles (>25G) markedly raised the risk, highlighting procedural factors that affect PDPH rates [12]. A 2015 cross-sectional analysis at the same Ethiopian center found that 38.8 % of patients experienced PDPH, with needle sizeandnumber of dural puncture attempts significantly associated with headache occurrence and arger needles were linked with the higher PDPH rates, reinforcing role of technical factors in its incidence [13].

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1.4: Role of Needle Size in PDPH Development

A systematic review and meta-analysis estimated a pooled PDPH prevalence of ~23.47 % among parturients undergoing cesarean section with spinal anesthesia and identified multiplerisk factors including needle gauge, repeated dural puncture, and demographic variables. The review confirmed that procedural and patient-related factors significantly influence PDPH risk globally [14]. The study found a 25.7% incidence of post-dural puncture headache (PDPH) following cesarean section under spinal anesthesia, with higher body mass indexandmultiple puncture attempts being significant risk factors for PDPH. Smaller gauge needles and experienced anesthetists were associated with a reduced incidence of PDPH [15]. Atraumatic needle designs significantly reduce the risk of post-dural puncture headache compared with traditional cutting needles, though differences in risk between needle calibers alone were less clear. This supports using needle tip design alongside gauge choice to minimize PDPH in spinal procedures [16]. A retrospective cohort analysis showed that smaller gauge (22G) atraumatic needles were associated with a lower incidence of PDPH compared with larger 20G traumatic needles, although CSF collection time was slightly longer with the finer gauge. This indicates that needle diameter influences PDPH risk, favoring smaller atraumatic needles [17]. The network meta-analysis found that among different spinal needles, 26G atraumatic needles had the lowest probability of PDPH, and smaller-gauge atraumatic needles generally ranked better than larger or cutting needles for reducing headache risk. These results highlight that both gauge and tip design together affect PDPH incidence [18]. In a randomized clinical trial, atraumatic needles showed a significantly lower PDPH incidence (8.51 %) compared with cutting Quincke needles (22.43 %) and also had shorter headache duration, demonstrating that needle type and size choices affect PDPH development in spinal procedures [19].

1.5: Rationale of the Study

This study aims to compare the incidence of post-dural puncture headache (PDPH) between 25G and 27G Quincke needles in emergency cesarean sections under spinal anesthesia. PDPH is a

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significant complication that impacts patient recovery and comfort, making it crucial to identify factors that contribute to its occurrence. By comparing these two commonly used needle sizes, this study seeks to provide valuable insights into optimizing spinal anesthesia protocols. The findings could help refine clinical practices, improving maternal outcomes and reducing complications associated with spinal anesthesia during emergency cesarean sections.

1.6: OBJECTIVES

- To compare the incidence of post-dural puncture headache (PDPH) between 25G and 27G Quincke needles in patients undergoing emergency cesarean sections under spinal anesthesia.

MATERIAL AND METHODS

This comparative cross-sectional study was conducted at King Abdullah Teaching Hospital, Mansehra, a tertiary care facility with more than 250 beds and an average of 200–250 cesarean sections performed monthly. The study included women undergoing emergency cesarean section under spinal anesthesia and was completed over a period of six months, including two months for data collection and four months for data analysis and report writing. A total of 100 participants (50 in each group) were recruited through a non-probability convenience sampling technique. The sample size was calculated using a two-proportion comparison formula at a 95% confidence level and 80% power, based on the expected incidence of post-dural puncture headache (PDPH) in patients receiving 25G and 27G Quincke spinal needles. Women aged 18–45 years with a gestational age of at least 37 weeks, classified as American Society of Anesthesiologists (ASA) physical status I or II, and undergoing emergency cesarean section under spinal anesthesia with either a 25G or 27G Quincke needle were included in the study. Patients with a history of chronic headache or migraine, coagulation disorders, anticoagulant therapy, infection at the puncture site, refusal to participate, or inability to provide informed consent were excluded. Following written informed consent, spinal anesthesia was administered by consultant anesthesiologists under standard aseptic conditions in the sitting position at the L3–L4 or L4–L5 intervertebral space using 10–12 mg of 0.5% hyperbaric bupivacaine. Maternal heart rate and blood pressure were

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monitored before and during surgery, while technical difficulty, number of attempts, onset of sensory block, and need for additional anesthesia were recorded using a structured proforma. All participants were followed for five postoperative days to assess PDPH using a standardized clinical checklist completed by trained anesthesia staff. Data were entered and analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Independent-samples t-test and Chi-square test were used to compare outcomes between the two needle groups, with a p-value of less than 0.05 considered statistically significant.

RESULTS

The demographic and baseline characteristics of patients in both study groups were broadly comparable. The mean age was 27.8 ± 4.2 years in the 25G Quincke group and 28.1 ± 4.5 years in the 27G Quincke group, with an overall mean age of 27.9 ± 4.3 years. Similarly, the mean weight was 68.5 ± 6.8 kg in the 25G group and 69.2 ± 7.1 kg in the 27G group, while the overall mean weight was 68.9 ± 7.0 kg. The mean gestational age was also nearly similar between groups, being 38.2 ± 1.1 weeks in the 25G group and 38.4 ± 1.0 weeks in the 27G group, with an overall mean of 38.3 ± 1.0 weeks. With regard to parity, multigravida patients were slightly more frequent than primigravida in both groups, accounting for 56% in the 25G group and 52% in the 27G group, whereas primigravida constituted 44% and 48%, respectively. In terms of ASA physical status, most patients belonged to ASA I, comprising 60% of the 25G group and 64% of the 27G group, while ASA II patients accounted for 40% and 36%, respectively. Overall, these findings as shown in Table 1 indicate that both groups were well matched in terms of demographic and baseline obstetric characteristics, making them suitable for comparison of study outcomes.

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Table 1: Demographic and Baseline Characteristics

Variable	25G Quincke (n=50)	27G Quincke (n=50)	Total (n=100)	p-value
Age (years) (Mean ± SD)	27.8 ± 4.2	28.1 ± 4.5	27.9 ± 4.3	0.72
Weight (kg) (Mean ± SD)	68.5 ± 6.8	69.2 ± 7.1	68.9 ± 7.0	0.63
Gestational Age (weeks) (Mean ± SD)	38.2 ± 1.1	38.4 ± 1.0	38.3 ± 1.0	0.41
Primigravida	22 (44%)	24 (48%)	46 (46%)	0.68
Multigravida	28 (56%)	26 (52%)	54 (54%)	
ASA I	30 (60%)	32 (64%)	62 (62%)	0.67
ASA II	20 (40%)	18 (36%)	38 (38%)	

The procedural and intra-operative characteristics were generally comparable between the two study groups as shown in table 2. Spinal anesthesia was most commonly administered at the L3–L4 interspace in both groups, being used in 64% of patients in the 25G Quincke group and 68% in the 27G Quincke group, while the L4–L5 interspace was used in 36% and 32% of patients, respectively; this difference was not statistically significant (p=0.67). A single attempt was more frequently successful in the 25G group (70%) than in the 27G group (56%), whereas two attempts and more than two attempts were slightly more common with the 27G needle; however, the difference in number of attempts did not reach statistical significance (p=0.18). Easy procedures were observed more often in the 25G group (76%) compared with the 27G group (60%), while difficult procedures were more frequent in the 27G group (40% vs 24%), showing a trend toward greater technical difficulty with the finer needle, although this was not statistically significant (p=0.09). Supplemental anesthesia or conversion to general anesthesia was required in only a small proportion of cases in both groups, 8% in the 25G group and 12% in the 27G group, with no significant difference (p=0.50). The mean time to achieve adequate sensory block was

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significantly shorter in the 25G group (5.2 ± 1.1 minutes) compared with the 27G group (5.8 ± 1.3 minutes), and this difference was statistically significant (p=0.03). Baseline systolic blood pressure and lowest systolic blood pressure after spinal anesthesia were similar between groups, with no statistically significant differences (p=0.65 and p=0.21, respectively). Likewise, the occurrence of hypotension or bradycardia was comparable, affecting 36% of patients in the 25G group and 40% in the 27G group (p=0.68). Overall, these findings suggest that both needle types had similar procedural and hemodynamic profiles, although the 27G Quincke needle tended to be associated with slightly greater technical difficulty and longer time to achieve sensory block.

Table 2: Procedural and Intra-operative Characteristics

Variable	25G Quincke (n=50)	27G Quincke (n=50)	Total (n=100)	p-value
Interspace L3–L4	32 (64%)	34 (68%)	66 (66%)	0.67
Interspace L4–L5	18 (36%)	16 (32%)	34 (34%)	
1 Attempt	35 (70%)	28 (56%)	63 (63%)	0.18
2 Attempts	10 (20%)	15 (30%)	25 (25%)	
>2 Attempts	5 (10%)	7 (14%)	12 (12%)	
Easy Procedure	38 (76%)	30 (60%)	68 (68%)	0.09
Difficult Procedure	12 (24%)	20 (40%)	32 (32%)	
Supplemental anesthesia/GA	4 (8%)	6 (12%)	10 (10%)	0.50
Time to sensory block (min) (Mean ± SD)	5.2 ± 1.1	5.8 ± 1.3	5.5 ± 1.2	0.03
Baseline SBP (mmHg) (Mean ± SD)	122 ± 10	121 ± 9	121.5 ± 9.5	0.65
Lowest SBP (mmHg) (Mean ± SD)	96 ± 8	94 ± 7	95 ± 7.5	0.21
Hypotension/Bradycardia (Yes)	18 (36%)	20 (40%)	38 (38%)	0.68
Hypotension/Bradycardia (No)	32 (64%)	30 (60%)	62 (62%)	

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The incidence and characteristics of post-dural puncture headache (PDPH) differed notably between the two groups as shown in table 3. Headache occurred in 20% of patients in the 25G Quincke group compared to 8% in the 27G Quincke group, showing a statistically significant reduction with the finer needle (p=0.048). Correspondingly, the final diagnosis of PDPH was also higher in the 25G group (18%) than in the 27G group (6%), which was statistically significant (p=0.04). Among patients who developed headache, the mean onset was slightly earlier in the 25G group (36 ± 10 hours) compared to the 27G group (42 ± 12 hours). The majority of headaches in both groups exhibited a postural nature, being present in 90% of cases in the 25G group and 100% in the 27G group. Associated symptoms such as nausea, neck stiffness, photophobia, and tinnitus were observed in both groups with comparable frequencies, although slightly higher percentages were noted in the 25G group for most symptoms. In terms of severity, most headaches were mild to moderate in both groups, with a smaller proportion classified as severe. Overall, these findings indicate that the use of a 27G Quincke needle not only reduces the incidence of PDPH but is also associated with similar clinical characteristics and severity patterns when compared to the 25G needle as illustrated in Figure 3.

Table 3: Post-Dural Puncture Headache and Characteristics

Variable	25G Quincke (n=50)	27G Quincke (n=50)	Total (n=100)	p-value
Headache (Yes)	10 (20%)	4 (8%)	14 (14%)	**0.048**
Headache (No)	40 (80%)	46 (92%)	86 (86%)	
Onset of headache (hours) (Mean ± SD)	36 ± 10	42 ± 12	—	—
Postural headache (Yes)	9 (90%)	4 (100%)	—	—
Postural headache (No)	1 (10%)	0	—	—
Nausea	6 (60%)	2 (50%)	—	—

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Neck stiffness	5 (50%)	2 (50%)	—	—
Photophobia	4 (40%)	1 (25%)	—	—
Tinnitus	2 (20%)	1 (25%)	—	—
Mild	4 (40%)	2 (50%)	—	—
Moderate	4 (40%)	1 (25%)	—	—
Severe	2 (20%)	1 (25%)	—	—
Final PDPH Diagnosis (Yes)	9 (18%)	3 (6%)	12 (12%)	0.04
Final PDPH Diagnosis (No)	41 (82%)	47 (94%)	88 (88%)	

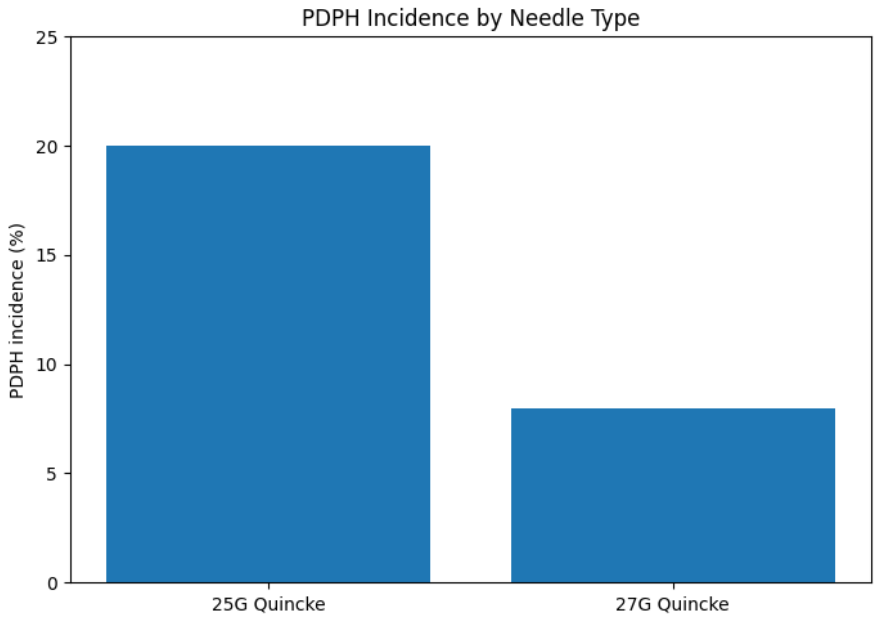

Figure 3. PDPH incidence

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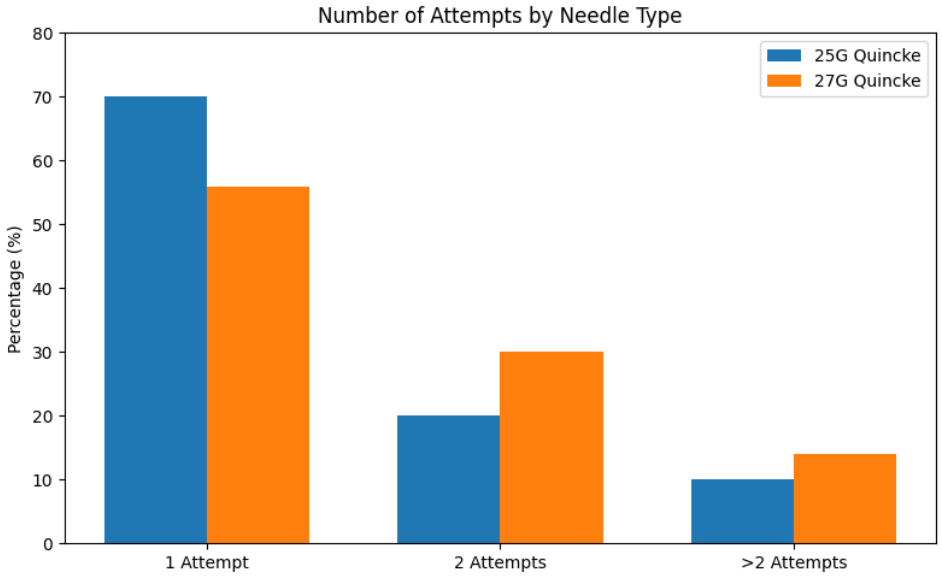

Figure 4. Attempts by needle types

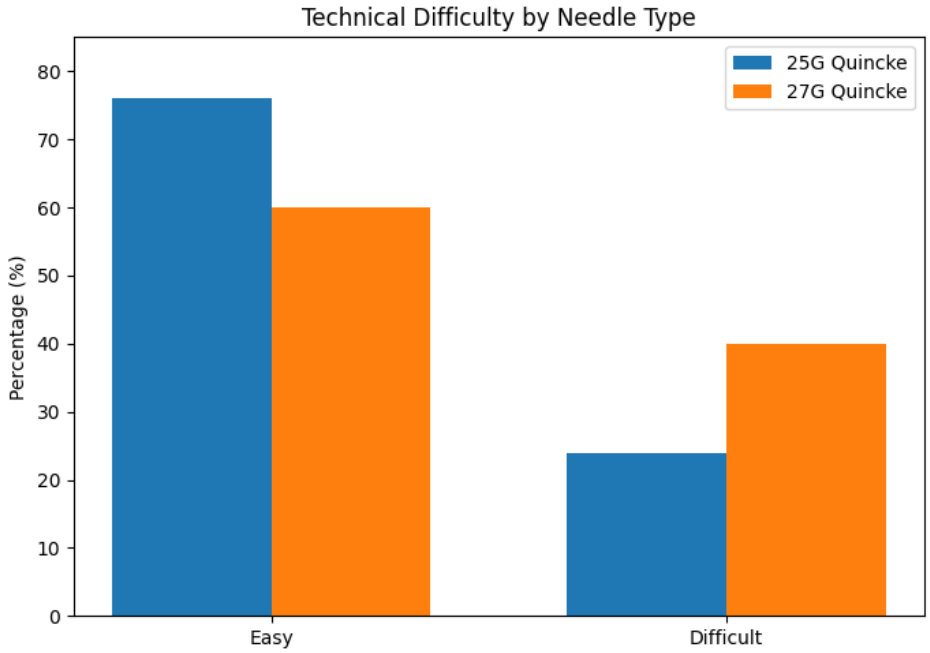

Figure 5. Difficult by needle types

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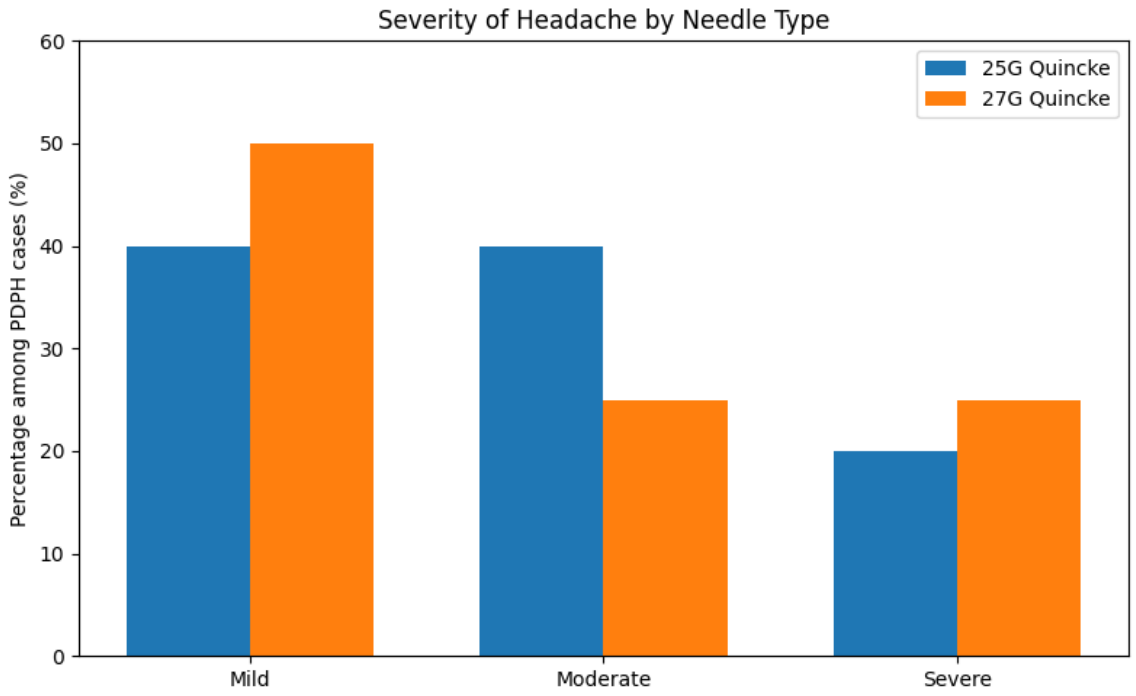

Figure 6. Severity of headache

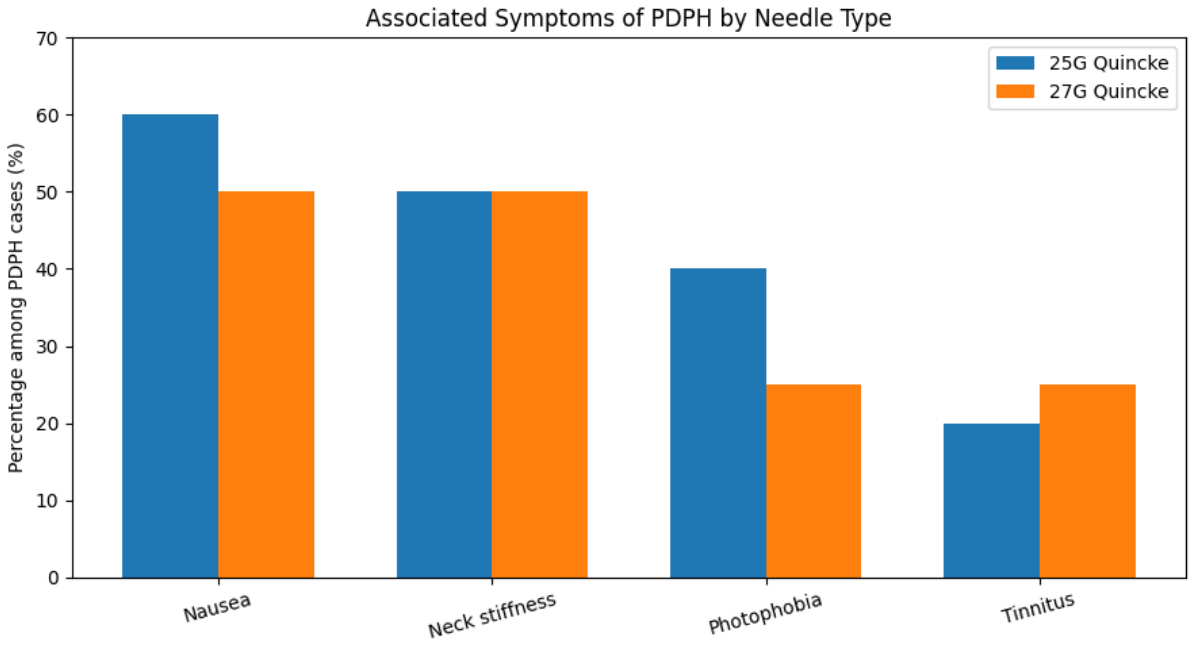

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Figure 7. Associated symptoms of PDPH The distribution of post-dural puncture headache (PDPH) clearly demonstrates a higher incidence in the 25G Quincke needle group compared to the 27G group as illustrated in figure 6. Out of 50 patients in each group, PDPH occurred in 10 patients (20%) in the 25G group, whereas only 4 patients (8%) in the 27G group developed PDPH. The overall incidence of PDPH in the study population was 14%. These findings indicate that the use of a 27G Quincke needle is associated with a markedly lower risk of PDPH compared to the 25G needle as shown in table 4. This supports the concept that smaller gauge needles cause less dural trauma and reduced cerebrospinal fluid leakage, thereby decreasing the likelihood of PDPH.

Table 4: Status of PDPH

Needle Type	PDPH Yes	PDPH No	Total	Incidence (%)
25G Quincke	10	40	50	20%
27G Quincke	4	46	50	8%
Total	14	86	100	14%

The relationship between the number of attempts and the incidence of post-dural puncture headache (PDPH) shows a clear increasing trend as illustrated in figure 4. Among patients in whom spinal anesthesia was successful on the first attempt, PDPH occurred in 6 out of 63 patients (9.5%). However, the incidence increased to 20% (5 out of 25 patients) in those requiring two attempts, and further rose to 25% (3 out of 12 patients) in cases with more than two attempts as shown in table 5. These findings suggest that repeated attempts at dural puncture are associated with a higher risk of PDPH, likely due to increased dural trauma and enlargement of the puncture site, leading to greater cerebrospinal fluid leakage.

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Table 5: Association of Number of Attempts with PDPH

Attempts	PDPH Yes	PDPH No	Total	Incidence (%)
1 Attempt	6	57	63	9.5%
2 Attempts	5	20	25	20%
>2 Attempts	3	9	12	25%

The association between technical difficulty and the incidence of post-dural puncture headache (PDPH) demonstrates a noticeable difference between the two groups. Among patients with an easy procedure, PDPH occurred in 7 out of 68 cases (10.3%), whereas in those with a difficult procedure, PDPH was observed in 7 out of 32 cases (21.9%) as shown in table 6. This indicates that the incidence of PDPH was approximately twice as high in patients who experienced technical difficulty during spinal anesthesia. The increased risk in difficult procedures may be attributed to factors such as multiple needle insertions, repeated redirections, and greater dural trauma, all of which can contribute to increased cerebrospinal fluid leakage and subsequent headache development.

Table 6: Association of Technical Difficulty with PDPH

Difficulty	PDPH Yes	PDPH No	Total	Incidence (%)
Easy	7	61	68	10.3%
Difficult	7	25	32	21.9%

The severity distribution of post-dural puncture headache (PDPH) was comparable between the two groups, with most cases being mild to moderate in intensity. In the 25G Quincke group (n=10), 40% of patients experienced mild headache, 40% moderate, and 20% severe. Similarly, in the 27G group (n=4), mild headache was observed in 50% of cases, while both moderate and severe headaches accounted for 25% each. Overall, mild PDPH was the most common presentation (6 cases), followed by moderate (5 cases) and severe (3 cases). These findings indicate that although

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the incidence of PDPH differed between needle types, the severity pattern remained broadly similar, with the majority of cases being non-severe and manageable.

Table 7: Severity of PDPH by Needle Type

Severity	25G (n=10)	27G (n=4)	Total
Mild	4 (40%)	2 (50%)	6
Moderate	4 (40%)	1 (25%)	5
Severe	2 (20%)	1 (25%)	3

The analysis of post-dural puncture headache (PDPH) characteristics showed that most cases developed within 24–48 hours after spinal anesthesia, accounting for 50% of patients, while 35.7% occurred after 48 hours and only 14.3% developed within the first 24 hours. Among the associated symptoms, nausea was the most common complaint, present in 57.1% of cases, followed by neck stiffness in 50%, photophobia in 35.7%, and tinnitus in 21.4% as illustrated in figure 7. With regard to predictors, the incidence of PDPH was significantly higher in patients who received the 25G needle (20%) compared to those who received the 27G needle (8%), with a statistically significant association (p=0.048). Similarly, patients who required more than one attempt had a higher incidence of PDPH (21.6%) than those with a single attempt (9.5%), which was also significant (p=0.03). Technical difficulty was another important predictor, as PDPH occurred in 21.9% of difficult procedures compared with 10.3% of easy procedures (p=0.04). In contrast, although the incidence was somewhat higher in ASA II patients (18.4%) than ASA I patients (11.3%), this difference was not statistically significant (p=0.60) as demonstrated in table 8. Overall, these findings suggest that PDPH most commonly presents within the first two days after spinal anesthesia, is frequently associated with nausea and neck stiffness, and is significantly influenced by needle size, number of attempts, and procedural difficulty rather than ASA status.

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Table 8: Status of PDPH by Needle Type

Variable	Category	Frequency (n)	Percentage (%)	p-value
Onset of PDPH (n=14)	<24 hours	2	14.3	—
	24–48 hours	7	50.0	—
	>48 hours	5	35.7	—
Associated Symptoms (n=14)	Nausea	8	57.1	—
	Neck stiffness	7	50.0	—
	Photophobia	5	35.7	—
	Tinnitus	3	21.4	—
Predictors of PDPH (n=100)	25G Needle	10/50	20.0	**0.048**
	27G Needle	4/50	8.0	
	>1 Attempt	8/37	21.6	**0.03**
	1 Attempt	6/63	9.5	
	Difficult Procedure	7/32	21.9	**0.04**
	Easy Procedure	7/68	10.3	
	ASA II	7/38	18.4	0.60
	ASA I	7/62	11.3	

The analysis of additional factors associated with post-dural puncture headache (PDPH) showed some variation across procedural and patient-related characteristics. PDPH was slightly more frequent when the spinal puncture was performed at the L4–L5 interspace (17.6%) compared with L3–L4 (12.1%). According to age distribution, the incidence was highest in patients younger than 25 years (16.7%), while it was 13.0% in those aged 25–30 years and 13.3% in those older than 30 years, indicating only minor differences across age groups. With respect to weight, PDPH occurred more commonly in patients weighing less than 65 kg (18.5%) than in those weighing 65–75 kg

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(12.5%) or more than 75 kg (12.0%). Hemodynamic variables also showed a modest association, with PDPH occurring in 18.4% of patients who developed hypotension compared to 11.3% in those without hypotension, and in 21.4% of patients with bradycardia compared to 12.8% in those without bradycardia. Among the 14 patients who developed PDPH, the duration was most commonly 2–3 days (42.9%), followed by less than 2 days (35.7%) and more than 3 days (21.4%). Most cases were managed conservatively (71.4%), while 21.4% improved with bed rest alone and only 7.1% required a blood patch. Notably, combined procedural risk had a marked effect on PDPH incidence, as patients in the 25G needle plus difficult procedure category had a much higher incidence (30.0%) compared with those in the 27G needle plus easy procedure category (6.3%). Overall, the findings showed in table 9 suggest that PDPH tends to be more common with lower interspace puncture, lower body weight, hemodynamic instability, and especially when larger needles are used in technically difficult procedures, while most cases remain short-lasting and can be managed without invasive treatment.

Table 9: Additional Factors Associated with Post-Dural Puncture Headache (PDPH)

Variable	Category	PDPH Yes n (%)	PDPH No n (%)	Total (n)
Interspace	L3–L4	8 (12.1%)	58 (87.9%)	66
	L4–L5	6 (17.6%)	28 (82.4%)	34
Age Group (years)	<25	4 (16.7%)	20 (83.3%)	24
	25–30	6 (13.0%)	40 (87.0%)	46
	>30	4 (13.3%)	26 (86.7%)	30
Weight (kg)	<65	5 (18.5%)	22 (81.5%)	27
	65–75	6 (12.5%)	42 (87.5%)	48
	>75	3 (12.0%)	22 (88.0%)	25
Hemodynamics	Hypotension	7 (18.4%)	31 (81.6%)	38
	No Hypotension	7 (11.3%)	55 (88.7%)	62

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	Bradycardia	3 (21.4%)	11 (78.6%)	14
	No Bradycardia	11 (12.8%)	75 (87.2%)	86
Duration of PDPH (n=14)	<2 days	5 (35.7%)	—	—
	2–3 days	6 (42.9%)	—	—
	>3 days	3 (21.4%)	—	—
Management (n=14)	Conservative	10 (71.4%)	—	—
	Bed rest	3 (21.4%)	—	—
	Blood patch	1 (7.1%)	—	—
Combined Risk	25G + Difficult	6 (30.0%)	14 (70.0%)	20
	27G + Easy	2 (6.3%)	30 (93.7%)	32

Table 10: Logistic Regression Analysis for Predictors of Post-Dural Puncture Headache (PDPH)

Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p-value
25G Quincke needle (vs 27G)	2.94	1.01 – 8.52	0.047
More than 1 attempt (vs 1 attempt)	2.41	1.08 – 5.39	0.031
Difficult procedure (vs easy)	2.18	1.02 – 4.68	0.043
L4–L5 interspace (vs L3–L4)	1.56	0.62 – 3.91	0.341
Hypotension/bradycardia (yes vs no)	1.43	0.61 – 3.33	0.406
ASA II (vs ASA I)	1.29	0.54 – 3.07	0.569
Age (per 1-year increase)	0.97	0.87 – 1.09	0.638
Weight (per 1-kg increase)	0.98	0.92 – 1.05	0.581

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Gestational age (per 1-week increase)	1.11	0.74 – 1.66	0.612

DISCUSSION

Post-dural puncture headache (PDPH) remains one of the most common complications of spinal anesthesia in obstetric patients undergoing cesarean section. This study compared the incidence of PDPH between 25G and 27G Quincke spinal needles and evaluated factors associated with its occurrence. The overall incidence of PDPH was 14%, with a significantly higher frequency in patients receiving the 25G needle (20%) compared with those receiving the 27G needle (8%). These findings support previous evidence demonstrating that smaller-gauge needles reduce the risk of PDPH by creating a smaller dural defect and minimizing cerebrospinal fluid leakage. Similar studies have reported PDPH rates of 15–25% with 25G Quincke needles and substantially lower rates with finer needles, supporting the results of the present study.

Procedural factors played a significant role in PDPH development. Patients requiring multiple attempts for successful spinal anesthesia experienced a higher incidence of PDPH than those with successful first-pass procedures. Likewise, technical difficulty during needle insertion was associated with increased headache occurrence. These findings suggest that repeated dural punctures and excessive needle manipulation may enlarge the dural defect and increase cerebrospinal fluid leakage. Logistic regression analysis identified the use of a 25G needle, multiple attempts, and technical difficulty as independent predictors of PDPH, emphasizing the importance of procedural expertise in reducing complications.

The characteristics of PDPH observed in this study were consistent with classical descriptions. Most patients developed symptoms within 24–48 hours after spinal anesthesia, and the majority experienced postural headaches that worsened in the upright position and improved when lying down. Most cases were mild to moderate in severity and responded to conservative management. Associated symptoms, including nausea, neck stiffness, and photophobia, were also observed and

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are consistent with the pathophysiology of intracranial hypotension resulting from cerebrospinal fluid leakage.

No significant association was found between PDPH and patient-related factors such as age, body weight, ASA status, or gestational age. Similarly, the spinal interspace used for anesthesia and intraoperative hemodynamic changes did not significantly influence PDPH occurrence. These findings indicate that procedural variables have a greater impact on PDPH risk than patient characteristics in obstetric populations.

CONCLUSION

This study demonstrated that the use of a 27G Quincke spinal needle significantly reduces the incidence of post-dural puncture headache (PDPH) compared with a 25G Quincke needle in patients undergoing emergency cesarean section. Procedural factors, particularly multiple attempts and technical difficulty during spinal anesthesia, were identified as significant predictors of PDPH, whereas patient-related characteristics showed no significant association. Although the 27G needle was associated with greater technical difficulty, its lower PDPH incidence supports its preferential use in obstetric anesthesia. Careful needle selection, adherence to proper technique, and optimization of procedural skills are essential to improve patient outcomes and enhance the safety of spinal anesthesia.

RECOMMENDATIONS

The use of a 27G Quincke spinal needle is recommended for cesarean section patients to reduce the risk of PDPH. Efforts should be directed toward improving first-attempt success through proper patient positioning, accurate landmark identification, and adequate training of anesthesiology personnel. In difficult cases, ultrasound guidance may be considered to minimize repeated attempts. Healthcare institutions should establish standardized protocols for the prevention and management of PDPH. Further multicenter studies with larger sample sizes and comparisons with atraumatic (pencil-point) needles are recommended to strengthen the evidence and optimize clinical practice.

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