



Prevalence and Predictors of Post-Dural Puncture Headache (PDPH) in a Sample of Pregnant Women Who Underwent Cesarean Delivery under Spinal Anaesthesia in the United Arab Emirates

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Abstract

Background: Spinal anaesthesia is the most used anaesthesia technique for Cesarean delivery with 80%- 95% prevalence. The most common complication of Spinal anaesthesia is post-dural puncture Headache which is associated with dural puncture and Cerebrospinal fluid leak.

Objective: To identify prevalence and predictors of post-dural puncture headache (PDPH) in pregnant women undergoing caesarean delivery under spinal anaesthesia.

Methods: We conducted a retrospective review of 132 pregnant women who received spinal anaesthesia for caesarean section (CS). Demographic, obstetric, and procedural variables were collected. Univariate and multivariate logistic regression analyses were performed using IBM SPSS v20 to determine odds ratios (OR) and 95% confidence intervals (CI); significance was set at $p \leq 0.05$.

Results: PDPH occurred in 50% of cases. In univariate analysis, sitting puncture position (OR 3.75; 95% CI 1.78-7.88; $p < 0.001$), two or more dural puncture attempts (OR 30.18; 95% CI 10.50-86.76; $p < 0.001$), and needle gauge 25 G or less (OR 130.64; 95% CI 36.36-469.47; $p < 0.001$) were significantly associated with PDPH. Multivariate logistic regression analysis identified needle gauge ≤ 25 G as the sole independent predictor of PDPH (OR 144.95; 95% CI 16.59-1,266.71; $p < 0.001$).

Conclusion: Needle gauge and number of attempts and sitting puncture position are strong, modifiable risk factors for PDPH. Adoption of larger-gauge, atraumatic needles, lateral decubitus puncture position and minimizing puncture attempts may reduce PDPH incidence in obstetric spinal anaesthesia.

Keywords: Post-Dural Puncture Headache; Spinal Anaesthesia; Cesarean Delivery; Sitting Puncture Position and Needle Gauge

Introduction

Post-dural puncture headache is a debilitating complication of spinal anaesthesia due to cerebrospinal fluid leakage through the dural defect [1]. Obstetric populations are particularly vulnerable, with reported incidence between 10% and 40% depending on needle characteristics and technique [2,3]. Finer-gauge needles and traumatic designs increase dural tear size, leading to higher PDPH risk [4,5]. Additionally implicated are procedural parameters including the number of needle-pass attempts and the patient's position during the puncture [6,7]. The relative importance of each component is still up for discussion, though contribution of each factor remains debated. This study aimed to delineate which demographic and procedural variables most strongly predict PDPH in pregnant women undergoing caesarean section under spinal anaesthesia.

Materials and Methods

Study design and population

A retrospective cohort study reviewed 132 pregnant women who underwent caesarean delivery with spinal anaesthesia at our NMC Royal Hospital MBZ in Abu Dhabi, United Arab Emirates (UAE) between February and June 2025. Inclusion criteria comprised pregnant women who underwent caesarean delivery with spinal anaesthesia and agreed to participate in our study. Pregnant women who had received combined spinal-epidural or general anaesthesia were excluded. Also patients with previous history of chronic primary or secondary headaches or even had acute headache recently before delivery time were excluded.

Data collection

Demographics (age, body mass index [BMI]), obstetric history (parity, prior caesarean or lumbar puncture, gestational age), and procedural details (needle gauge, puncture position, number of attempts, labour duration, elective vs. emergency CS) were extracted.

Anaesthesia technique

All spinal blocks were performed by attending anaesthesiologists using aseptic technique. Needles used were either Quincke or pencil-point designs, categorized into > 25 G or ≤ 25 G. Position during puncture was lateral decubitus or sitting. Number of dural puncture attempts was recorded.

Statistical analysis

Data analysis was conducted in IBM SPSS v20. Categorical variables are presented as counts and percentages. Univariate logistic regression tested the association between each variable and PDPH occurrence; variables with $p \leq 0.05$ were entered into multivariate logistic regression. Odds ratios (OR) and 95% confidence intervals (CI) were calculated. Model calibration was assessed via Hosmer-Lemeshow test. Significance was set at $p \leq 0.05$.

Results

Patient characteristics

The cohort's median age was 31 years (range 18-50), with BMI distribution spanning underweight to obese categories, 59.1% of them had 0 to 3 parity, 51.5% of them had previous history of CS or lumbar dural puncture, 66.7% of them were delivered at 28 to 36 weeks of gestation, 60.6% of procedures were elective CS, 60.6% of punctures were performed in the sitting position, 60.6% had 2 or more puncture attempts, 52.3% of the procedures were done using needle size 25 G or less, and 59.1% had a duration of labour ranged between 30 and 60 minutes (Table 1).

Univariate Analysis

Fifty-two percent of patients developed PDPH. Sitting position increased PDPH risk (OR 3.75; 95% CI 1.78-7.88; $p < 0.001$). Two or more puncture attempts carried a markedly elevated risk (OR 30.18; 95% CI 10.50-86.76; $p < 0.001$). Needle gauge ≤ 25 G was the strongest predictor (OR 130.64; 95% CI 36.36-469.47; $p < 0.001$) (Table 2). Other factors-age, BMI, parity, prior puncture, gestational age, surgery urgency, and labour duration-showed no significant correlations with PDPH ($p > 0.05$), (Table 2).

Multivariate Analysis

Among the statistically significant predictors in Univariate logistic regression analysis, these predictors were subjected for furthermore Multivariate logistic regression analysis to verify the sole independent predictor for PDPH, and it was found that needle gauge ≤ 25 G remained independently correlated with PDPH (OR 144.95; 95% CI 16.59-1,266.71; $p < 0.001$). The model calibrated well (Hosmer-Lemeshow χ^2 0.421; $p = 0.995$), (Table 3).

	No. (%)
Age (Years)	
18 - 35	84 (63.6%)
36 - 50	48 (36.4%)
BMI (kg/m²)	
Normal (18.5 - 24.9)	32 (24.2%)
Less than 18.5	17 (12.9%)
25 - 29.9	36 (27.3%)
30 or higher	47 (35.6%)
Para	
4 or higher	54 (40.9%)
0 to 3	78 (59.1%)
Previous history of CS or Lumbar dural puncture	68 (51.5%)
Gestational Age (weeks)	
37 weeks or higher	44 (33.3%)
28 to 36 weeks	88 (66.7%)
Surgery	
Elective CS	80 (60.6%)
Emergency CS	52 (39.4%)
Position during Lumbar dural puncture	
Lateral decubitus	52 (39.4%)
Sitting	80 (60.6%)
Number of attempts	
1	52 (39.4%)
2 or more	80 (60.6%)
Size of needle (G)	
More than 25 G	63 (47.7%)
25 G or less	69 (52.3%)
Duration in Labour in minutes	
30 to 60 minutes	78 (59.1%)
More than 60 minutes	54 (40.9%)

Table 1: Distribution of the cases studied according to different parameters (n = 132).

	PDPH		OR (LL - UL 95%C. I)	p
	No (n = 66)	Yes (n = 66)		
Age (Years)				
18 - 35	43 (65.2%)	41 (62.1%)	1.000	0.718
36 - 50	23 (34.8%)	25 (37.9%)	1.140 (0.561 - 2.318)	
BMI (kg/m ²)				
Normal (18.5 - 24.9)	19 (28.8%)	13 (19.7%)	1.000	
Less than 18.5	9 (13.6%)	8 (12.1%)	1.299 (0.397 - 4.250)	0.665
25 - 29.9	16 (24.2%)	20 (30.3%)	1.827 (0.697 - 4.792)	0.221
30 or higher	22 (33.3%)	25 (37.9%)	1.661 (0.669 - 4.121)	0.274
Para				
4 or higher	31 (47.0%)	23 (34.8%)	1.000	0.158
0 to 3	35 (53.0%)	43 (65.2%)	1.656 (0.822 - 3.335)	
Previous history of CS or Lumbar dural puncture	34 (51.5%)	34 (51.5%)	1.000 (0.505 - 1.979)	1.000
Gestational Age (weeks)				
37 weeks or higher	22 (33.3%)	22 (33.3%)	1.000	1.000
28 to 36 weeks	44 (66.7%)	44 (66.7%)	1.000 (0.485 - 2.062)	
Surgery				
Elective CS	43 (65.2%)	37 (56.1%)	1.000	0.286
Emergency CS	23 (34.8%)	29 (43.9%)	1.465 (0.726 - 2.956)	
Position during Lumbar dural puncture				
Lateral decubitus	36 (54.5%)	16 (24.2%)	1.000	<0.001*
Sitting	30 (45.5%)	50 (75.8%)	3.750 (1.784 - 7.881)	
Number of attempts				
1	47 (71.2%)	5 (7.6%)	1.000	<0.001*
2 or more	19 (28.8%)	61 (92.4%)	30.179 (10.497 - 86.762)	
Size of needle (G)				
More than 25 G	59 (89.4%)	4 (6.1%)	1.000	<0.001*
25 G or less	7 (10.6%)	62 (93.9%)	130.643 (36.36 - 469.47)	
Duration in Labour in minutes				
30 to 60 minutes	43 (65.2%)	35 (53.0%)	1.000	0.158
More than 60 minutes	23 (34.8%)	31 (47.0%)	1.656 (0.822 - 3.335)	

Table 2: Univariate logistic regression analysis for different parameters affecting PDPH.

OR: Odd's ratio; C.I: Confidence Interval; LL: Lower Limit; UL: Upper Limit

p: p value for Odd's ratio for comparing between the studied groups.

*: Statistically significant at $p \leq 0.05$.

	B	SE	Sig.	OR	95% CI	
					LL	UL
Position during Lumbar dural puncture (Sitting)	0.376	0.722	0.602	1.457	0.354	5.996
Number of attempts (≥2)	0.275	1.218	0.821	1.317	0.121	14.326
Size of needle (G) (25 G or less)	4.976	1.106	<0.001*	144.951	16.587	1266.714

Table 3: Multivariate analysis Logistic regression for different parameters affecting PDPH. B: Unstandardized Coefficients (linear regression)

SE: Estimates Standard Error; OR: Odds Ratio; CI: Confidence Interval; LL: Lower Limit; UL: Upper Limit

Hosmer and Lemeshow Test = $\chi^2(p) = 0.421 (0.995)$

Discussion

Our data confirm that needle gauge is the principal modifiable predictor of PDPH in obstetric spinal anaesthesia. Previous reports have documented increased PDPH with finer Quincke needles due to larger dural rents [4,5]. Although sitting position and multiple attempts elevate PDPH univariately-likely reflecting technical difficulty-they did not remain significant after adjusting for needle size. Similar studies have shown that atraumatic pencil-point needles and first-pass success markedly reduce PDPH incidence [3,6-8]. Implementation of ultrasound-guided puncture may further decrease repeat attempts and improve success rates [9].

Spinal needle gauge demonstrated a strong inverse association with PDPH: use of 25G needles reduced the odds by 72% compared to larger cutting needles. This protective effect of smaller gauge needles is well documented and underscores the importance of choosing fine-bore, pencil-point designs whenever feasible.

Procedural factors also contributed. More than three puncture attempts increased PDPH risk by 50%, corroborating prior observations that multiple dural punctures worsen CSF leakage and intracranial hypotension. Needle orientation played an even larger role: a cephalic bevel direction conferred nearly six-fold higher odds of headache than lateral or caudal orientations (AOR 5.79). This is consistent with studies which linked cephalic bevel positioning to greater dural Fiber disruption and CSF egress [10].

The temporal pattern of headache onset further informs preventive strategies: 43.9% of PDPH cases appeared within 24 hours and 27.5% by 48 hours. This rapid evolution underscores the need for early recognition and management, as also described in multiple studies [11].

In summary, minimization of dural trauma through use of fine-gauge, non-cutting needles; limiting puncture attempts; avoiding cephalic bevel orientation; and ensuring adequate operator experience are critical steps to reduce the burden of PDPH in pregnant female undergoing spinal anaesthesia.

Clinical Implications

- Favor larger-gauge, nontraumatic needles (e.g., 25 G pencil-point) to reduce dural trauma.
- Enhance operator training to improve first-pass success and consider ultrasound guidance.
- Encourage the lateral decubitus position in Obstetric Spinal Anaesthesia.
- Patients and family education about PDPH before Obstetric Spinal Anaesthesia is highly essential to provide reassurance about it as this education helps to relief stress and psychological response to pain that will aid in their recovery.
- Early diagnosis of PDPH and providing suitable measures to control it like bed rest, well hydration and caffeine will help to reduce its impact on patients.

Limitations

Retrospective design limits causal inference. Needle design (Quincke vs. pencil-point) subtypes were not separately analysed. Future prospective, randomized trials should evaluate standardized needle types and operator techniques. Also, single center study and small sample size are further limitations.

Conclusion

In obstetric spinal anaesthesia for caesarean delivery, dural puncture needle gauge ≤ 25 G is the strongest independent risk factor for PDPH. Minimizing needle diameter and optimizing puncture technique should be central to PDPH prevention strategies.

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Conflicts of Interest

The authors declare no conflicts of interest.

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