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ORIGINAL ARTICLE

Frequency of post-dural puncture headache with median versus para-median approach in females who underwent cesarean section under spinal anaesthesia.

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ABSTRACT… Objective: To evaluate the frequency of post-dural puncture headache (PDPH) using the median versus paramedian approaches. **Study Design:** Prospective Comparative study. **Setting:** Department of Anesthesiology, Combined Military Hospital Bahawalpur. **Period:** 5th August 2024 to 4th February 2025. **Methods:** A total of 128 women who underwent spinal anesthesia for cesarean section between 16-40 years of age were included in study. Group M (Median Approach) women were undergone spinal anesthesia by median approach while Group P (Para-Median Approach) were undergone spinal anesthesia by para-median approach. All patients were assessed for development of post-dural puncture headache. **Results:** Mean ages were comparable between Group M (28.09 ± 5.52 years) and Group P (27.77 ± 5.88 years). The majority of subjects, 64.84% (n=83), were aged 16–30 years. Mean gestational age was 38.57 ± 1.31 weeks with a mean parity of 3.07 ± 1.07. Post-dural puncture headache occurred in 21 women (32.81%) following the median approach, versus only 4 women (6.25%) following the paramedian approach. **Conclusion:** This study concluded that the paramedian approach for spinal anesthesia is associated with a significantly lower occurrence of post-dural puncture headache compared to the median approach in cesarean section patients.

Key words: Cesarean Section (CS), Post-Dural Puncture Headache (PDPH) Spinal Anesthesia (SA).

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INTRODUCTION

Spinal anesthesia represents the technique of choice for elective cesarean delivery[1] owing to its favorable safety profile, rapid onset of action, and low failure incidence. The frequency of cesarean sections has escalated in recent years, driven by heightened awareness of maternal and fetal well-being as well as advancements in monitoring technologies.[2] Notably, cesarean deliveries accounted for approximately 33% of all births in the United States in 2023 and roughly 15% of births globally in 2007. A significant complication inherent to neuraxial procedures is post-dural puncture headache (PDPH), which occurs most frequently following inadvertent dural breach during epidural placement. Contemporary evidence suggests the incidence of PDPH subsequent to dural puncture may reach as high as 76–85%.[3]

The condition carries the potential to evolve into a chronic headache disorder. According to a retrospective case–control study by Li et al.[4], the incidence of chronic headache among obstetric patients following unintentional dural puncture with a 17-gauge epidural needle was 28%. Associated risk determinants comprise the characteristics of the needle employed (type, size, and bevel direction), the frequency of puncture attempts, and various patient-related factors.

PDPH is characterized by a postural headache, often with nausea and visual symptoms, and typically occurs hours to days after puncture. This leads to brain sagging and compensatory dilation of cerebral vessels. Although the loss of cerebrospinal fluid (CSF) and subsequent intracranial hypotension are well established, the exact etiology of the associated headache is not fully understood.[5] Hypothesized mechanisms include gravitational traction on pain-sensitive intracranial structures when upright, and reactive cerebral vasodilation secondary to CSF

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depletion.[6]

There are two main spinal anesthesia approaches: median and paramedian. Studies show conflicting results regarding which approach results in fewer PDPH cases, prompting further research. Consequently, we designed this study with the objective of comparing the occurrence of post-dural puncture headache following median versus paramedian approaches in females undergoing cesarean section.

METHODS

This prospective comparative study was conducted at Department of Anesthesiology, CMH, Bahawalpur from 5th August 2024 to 4th February 2025. A sample size of 128 was calculated using WHO sample size calculator; with 5% level of significance, 80% power of study and taking incidence of PDPH as 5.9% with Para-median approach & 19.6% with median approach.[7] Non-probability, consecutive sampling technique was followed for recruiting patients for this study.

Inclusion Criteria

All pregnant women with age between 16 to 40 years, Gestational age 37-41 weeks, para 0-5 who scheduled for caesarian section, who were willing to participated in the study were recruited.

Exclusion Criteria

Women with spine deformity, history of PDPH or headaches, history of excessive bleeding and woman who were unwilling for spinal anesthesia or unwilling to participate in the study were excluded.

After taking permission from ethical review board (No:1516/EC/08/2024 dated 2 Aug 24) written informed consent was obtained from the patients. Demographic data like age, BMI, gestational age, parity was noted. Quincke size 27G needle was used for spinal anesthesia in all patients. Spinal anesthesia was given by either consultant or resident anesthesiologist of at least 3 years of experience. All those patients were excluded in whom more than two attempts were made for spinal anesthesia. Local anesthesia was given before attempting the spinal anesthesia in all patients.

Group A patients underwent spinal anesthesia by median approach while Group B patients received spinal anesthesia by Para-median approach. All patients followed post operatively and presence or absence of PDPH was noted.

Data was entered in Statistical program for social science (SPSS) version 25.0. Mean and standard deviation were calculated for age, gestational age, parity, pain score and BMI. Frequency and percentage were calculated for mode of cesarean (elective/emergency) and post-dural puncture headache. The post-dural puncture headache of the two study groups were compared for any difference by applying Chi Square test and p-value ≤0.05 was considered as significant.

Effect modifiers like age, gestational age, parity, mode of cesarean (elective/emergency) and BMI were controlled through stratifications and post-stratification chi square was applied to see their effect on post-dural puncture headache. P-value ≤0.05 was considered as significant.

RESULTS

Out of 128 women, majority of the patients 83 (64.84%) were between 16 to 30 years of age with mean age of 27.91 ± 5.63 years. The mean age of patients in group A was 28.09 ± 5.52 years and in group B was 27.77 ± 5.88 years. Mean gestational age was 38.57 ± 1.31 weeks. Mean BMI was 28.50 ± 2.23 kg/m^2. Mean VAS score was 3.45 ± 1.23 as shown in Table-I

The post-dural puncture headache with median approach (group A) was significantly higher 24 (85%) than para-median approach 14% (p-0.00). We have also observed an increased occurrence of PDPH with higher age group and in obese patients (p <0.05) as shown in Table-II.

DISCUSION

Post dural puncture headache (PDPH) is a frequent adverse event following neuraxial anesthesia, affecting approximately 32% of individuals and contributing to notable discomfort. The accompanying manifestations often persist for multiple days and may become sufficiently intense to disrupt daily functioning of patinets.[8]

TABLE-I

Comparison of post dural procedure headache with median and paramedian groups

		Median Approach				Paramedian Approach			
		64 (50%)				64 (50%)			
		No PDPH		PDPH		No PDPH		PDPH	
		42 (32.6%)		22 (17.1%)		60 (46.5%)		4 (3.1%)	
Age Category	16-30	34	85.0%	11	45.8%	42	70.0%	3	75.0%
	31-40	6	15.0%	13	54.2%	18	30.0%	1	25.0%
BMI Category	>27	34	85.0%	4	16.7%	36	60.0%	2	50.0%
	≤27	6	15.0%	20	83.3%	24	40.0%	2	50.0%
GA Category	37-39	28	70.0%	24	100.0%	50	83.3%	2	50.0%
	40-41	12	30.0%	0	0.0%	10	16.7%	2	50.0%
Mode of Cesarean	Elective	19	47.5%	7	29.2%	25	41.7%	1	25.0%
	Emergency	21	52.5%	17	70.8%	35	58.3%	3	75.0%
Parity Category	1.00	19	47.5%	11	45.8%	25	41.7%	2	50.0%
	2.00	21	52.5%	13	54.2%	35	58.3%	2	50.0%

BMI (Basic Metabolic index) , GA (Gestational age)

TABLE-II

Correlation of PDPH with clinial and therapeutic parameters

		PDPH				P-Value
		No PDPH		PDPH		
		64 (50%)		64 (50%)		
Age Category	16-30	76	76.0%	14	50.0%	0.08
	31-40	24	24.0%	14	50.0%	
BMI Category	>27	70	70.0%	6	21.4%	0.00
	≤27	30	30.0%	22	78.6%	
Gestational age Category	37-39	78	78.0%	26	92.9%	0.075
	40-41	22	22.0%	2	7.1%	
Group	Median Approach	40	40.0%	24	85.7%	0.00
	Paramedian Approach	60	60.0%	4	14.3%	
Mode of Cesarean	Elective	44	44.0%	8	28.6%	0.14
	Emergency	56	56.0%	20	71.4%	
Parity Category	1.00	44	44.0%	13	46.4%	0.89
	2.00	56	56.0%	15	53.6%	

BMI (Basic Metabolic index) , GA (Gestational age)

While various strategies have been employed to mitigate the occurrence of PDPH, the condition may still arise even when optimal prophylactic methods are used.[9] The aetiology of PDPH subsequent to neuraxial anesthesia is influenced by multiple factors, including patient-specific variables, the design and gauge of the spinal needle, and the chosen procedural technique.[10] In the administration of neuraxial anesthesia, local anesthetics are typically delivered via one of two primary approaches: Median or Paramedian approach.

The incidence of PDPH exhibits a direct correlation with the calibre of the needle utilized for dural puncture. Although the use of smaller-gauge needles for subarachnoid access tends to lower the likelihood of headache development, such needles can be more technically demanding to manoeuvre and may be associated with a reduced rate of successful anesthetic delivery.[11]

Findings from several investigations indicate that the paramedian technique is superior to the median technique regarding the reduction of PDPH (3.7% versus 18.5%). The disparity between these two methods was determined to be statistically meaningful (p-value=0.05).[12] Conversely, alternative research has yielded conflicting outcomes, with one study reporting an 8% PDPH rate for the median approach and a 10% rate for the paramedian approach,

thereby suggesting no statistically significant distinction between the two groups (p=0.875).[13] Nevertheless, a systematic review encompassing data from roughly 1,200 patients ultimately determined that the median approach carried a greater propensity for PDPH compared to the paramedian method.[14]

Khan et al compared the effect of 25G vs 27 G Quincke's needle and concluded that median approach had slightly higher PDPH than paramedian approach (27.3 % Vs 22.2 %, p=0.25). Furthermore, they concluded that repeated puncture attempts, increase age (>30), sitting position and blood loss during surgery had increased risk of PDPH.[15]

Jasem et concluded that Post dural puncture Headache (PDPH) is more common in younger age groups, in female compared to male patients, low BMI, previous history of PDPH, multiple LP attempts and in patients with the previous history of headache (migraine, tension or cluster headache. PDPH onset is typically observed within 72 hours of dural puncture, predominantly within the initial 48 hours, with a duration extending up to seven days.[16] These results are also in lines of our study which show a low BMI predispose to increase chance of PDPH. However, we could not find significant difference of PDPH in different age groups.

The risk of PDPH is notably elevated among women, particularly during pregnancy and the immediate postpartum period following vaginal delivery. Age represents a significant variable, with the highest incidence occurring between 18 and 30 years and tapering off below 13 years and above 60 years. Individuals with a lower body mass index are at increased risk.[17] Paradoxically, obese and morbidly obese parturient experiences a lower frequency of PDPH, an effect hypothesized to result from increased intra-abdominal pressure serving to compress and seal the dural rent, thereby reducing CSF egress. The heightened susceptibility observed in younger females may stem from preserved dural fiber elasticity that maintains puncture site patency, as opposed to the stiffer, less compliant dura found in older individuals.[18] Pre-existing headache and a positive personal history of PDPH further elevate risk, whereas migraine diagnosis does not appear to influence PDPH incidence following regional anesthesia.[19] Finally, operator proficiency is a key consideration, as multiple attempts at dural puncture significantly augment the risk of post-procedural headache.

LIMITATION

Our study had few limitations. Firstly, this was single center study so can't be generalized to population until similar studies be carried at multiple centers and compare the result. Secondly the perception of pain is subjective and intensity of pain is different is different patient and may have missed PDPH which continued for longer period of time.

CONCLUION

The findings of this study indicate a greater frequency of PDPH associated with the median approach relative to the paramedian approach in parturient undergoing cesarean delivery. We therefore advocate for the routine utilization of the paramedian route in clinical practice to prevent PDPH and lessen the burden of this complication.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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2	**Lt Col Ahsan Ali:** Manuscript drafting.
3	**Maj Mohsin Hussain Nizamani:** Data analysis.
4	**Col Naseem Abbass:** Critical review.
5	**Maj Sajid Shehzad:** Study design.
6	**Maj Maj Danish Dhanani:** Revisions.