

Frequency and Associated Factors of Post-dural Puncture Headache at a Tertiary Care Hospital of Southern Punjab, Pakistan

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Abstract

Background: Post-dural puncture headache is characterized as a headache that develops within five days following a lumbar puncture. Its onset is influenced by several contributing factors.

Objective: To determine frequency and risk factors associated with Post-dural puncture headache.

Study type, settings & duration: This descriptive study was conducted at Department of Neurology, Nishtar Hospital, Multan from February 2023 to February 2024.

Methodology: All the lumbar puncture procedures were performed under aseptic measures according to hospital protocol through midline approach between L4-5 space. Procedure-related data, including position of the patient (sitting, lateral), type of the LP needle (traumatic, atraumatic), needle size (22G or 20G), number of attempts and the years of experience of operator who performed lumbar puncture was obtained.

Results: Of 173 study cases, 43.3% were male and an overall mean age was 40.92 ± 10.07 years (range; 24-60 years). Diabetes was noted in 32 (18.5%) while Hypertension in 64 (37.0%) of our study cases. Of these 173 study cases, sitting position was noted in 72 (41.6%) and lateral position in 101 (58.4%), traumatic needle in 72 (41.6%) and atraumatic needle in 101 (58.4%). Post-dural puncture headache was noted in 43 (24.9%) of our study cases.

Conclusion: High frequency of post-dural puncture headache was noted in our study among patients undergoing lumbar puncture for CSF examination. Post-dural puncture headache was significantly associated with age, position of patient, size of needle and type of needle.

Key words: Post-dural headache, lumbar puncture, risk factors.

Introduction

Post-dural puncture headache (PdPH) is defined as a headache that occurs within 5 days after a lumbar puncture (LP), according to the International Classification of Headache Disorders and it worsens while standing or sitting and shows significant improvement when patients are lying flat.¹ Symptoms associated with PdPH may include such as; stiff neck, hearing loss, tinnitus,

photophobia, hyperacusis, and nausea.² PdPH is commonly documented among pregnant women as a common complication of lumbar puncture which is more likely due to the leakage of cerebrospinal fluid into the epidural space through a dural tear.³ Reported literature indicates, prevalence of PdPH varies from 1-40%. Incidence of PdPH varies upon various factors including age, gender and needle size.⁴ Different features contribute to the development of PdPH, including needle size, needle design, bevel direction, and the number of lumbar puncture attempts.⁵

Particularly use of smaller diameter and non-cutting needles, also known as atraumatic needles have been found to be associated with a lower proportion of headache followed by lumbar puncture.⁶ Moreover, inserting the needle with the bevel parallel to the dural fibers helps in closing the hole and reduction of leakage of cerebrospinal fluid.⁷ Multiple attempts of dural punctures as a resulting from unsuccessful attempts also influence increased rate of post-dural puncture headache.^{8,9} Characteristic features of needle designs including;

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Authors Contribution

MJ & SH conceptualized the project. MJ, SH & SS did the literature search. MJ & AS did the data collection. Statistical analysis, drafting, revision & writing of manuscript were done by MJ & SS.

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needle size and needle shapes have been updated to ensure speedy movement of cerebrospinal fluid (CSF) and injected doses of medicines. These modifications restrict the limit dural trauma and loss of cerebral spinal fluid.¹⁰

The primary mechanism in pathogenesis involves the leakage of cerebrospinal fluid CSF through the puncture site, leading to a reduction in CSF volume and pressure. This loss of CSF causes the brain to sag downward, stretching pain-sensitive structures such as the dura mater and bridging veins, which triggers the characteristic headache. To compensate for the reduced intracranial pressure, cerebral blood vessels undergo vasodilation, which further stimulates pain-sensitive nerve endings in the dura and intensifies the headache. Additionally, the dural tear may expose the subarachnoid space to blood or other substances, causing chemical and mechanical irritation that exacerbates pain.¹¹

Weji et al observed that 28.7% had developed post-dural puncture headache. Large needle size (46.5% vs. 18.6%), large number of cerebrospinal fluid drops (18.6% vs. 9.3%) and multiple attempts (34.8% vs. 27.9%) were independent factors associated with post-dural puncture headache i.e. $p < 0.05$.⁷ Demilew et al revealed that previous history of spinal anesthesia (62.5% vs. 37.5%, $p < 0.001$), use of 20- and 22-gauge needle (62.5% vs. 37.5%, $p = 0.021$), and repeated attempt (58.3% vs. 41.7%, $p = 0.05$) were the associated factors for development of post-dural puncture headache.¹²

The study was planned to measure the magnitude of the post-dural headache in present population and in identifying the common factors associated with post-dural puncture headache. By having idea of the factors involved with post-dural puncture headache, physicians would be able to prevent modifiable risk factors and thus to reduce morbidity of patients undergoing spinal puncture.

Methodology

This descriptive study was conducted at Department of Neurology, Nishtar Hospital Multan from February 2023 to February 2024 using non – probability purposive sampling technique. A total of 173 patients fulfilling the inclusion criteria were enrolled after informed consent. Sample size was statistically calculated considering frequency of post-dural puncture headache as 20.2%.¹²

Patients aged 18-60 years undergoing lumbar puncture for CSF examination (meningitis, encephalitis, TBM, GB syndrome) of either sex were included in this study. Patients with chronic renal

failure, chronic liver disease, tumors and Pregnant women were excluded from our study. Baseline demographic data like age, gender, obesity and past history of post-dural puncture headache was recorded. All the lumbar puncture procedures were performed under aseptic measures according to hospital protocol through midline approach between L4-5 space. Procedure-related data, including position of the patient (sitting, lateral), type of the LP needle (traumatic, atraumatic), needle size (22G or 20G), number of attempts and the years of experience of operator who performed lumbar puncture was obtained. All the patients were monitored for 5 days and presence of post-dural puncture headache i.e. headache (on VAS ≥ 3) occurring within 5 days after lumbar puncture (LP), which is aggravated when standing or sitting and relieved when lying flat was labelled as post-dural puncture headache. All the data was recorded on performa.

Data analysis was performed using SPSS. Quantitative variables, such as age, number of attempts, and operator experience, were presented as mean $\pm$ standard deviation, while qualitative data, including gender, obesity, patient position, needle size and type, history of and presence of post-dural puncture headache, were summarized as frequencies and percentages. Binary logistic regression assessed factors associated with post-dural puncture headache (yes/no). Univariate analysis of independent variables reported odds ratios (ORs) with 95% confidence intervals (CIs), considering $p < 0.05$ significant. Variables with $p \leq 0.10$ in univariate analysis were included in the multivariable model, with final adjusted ORs and 95% CIs reported for significant factors ($p < 0.05$).

The ethical approval was obtained from the Institutional Review Board of Nishtar Medical University, Multan vide letter no. 2541.

Results

Of total 173 study cases, 75 (43.3 %) were male patients while 98 (56.6%) were females with their mean age was 40.92 ± 10.07 years (range; 24-60 years), mean age of male patients was 43.61 ± 10.19 years while for female patients it was 38.99 ± 9.55 years ($p = 0.003$) and 90 (52.0%) were aged more than 40 years.

Among these 173 patients, 64 (37.0%) belonged to rural areas while 109 (63.0%) were residents of urban localities, 59 (34.1%) were poor and 114 (65.9%) belonged to middle income families. Diabetes was noted in 32 (18.5%) while Hypertension in 64 (37.0%) of our study cases. Mean body mass index of these patients was 24.92 ± 2.13 kg/m² and 25 (14.5%) were obese.

Table 1: Segregation of factors associated with post-dural puncture headache.

Associated Factors	Condition	Post-dural Puncture Headache		p-value	Odds Ratio
		Yes (n=43)	No (n=130)		
Gender	Male (n=75)	15	60	0.196	0.625
	Female (n=98)	28	70		
	For Cohort Head (Yes) = 0.700; For Cohort Headache (No) = 1.12				
Age	Up to 40 (n=83)	04	79	0.001	0.066
	More than 40 (n=90)	39	51		
	For Cohort Head (Yes) = 0.111; For Cohort Headache (No) = 1.68				
Obesity	Yes (n=25)	10	15	0.078	0.232
	No (n=148)	33	115		
	For Cohort Head (Yes) = 1.79; For Cohort Headache (No) = 0.77				
Position	Sitting (n=72)	39	33	0.001	28.65
	Lateral (n=101)	04	97		
	For Cohort Head (Yes) = 13.67; For Cohort Headache (No) = 0.477				
Type	Traumatic (n=72)	08	64	0.001	0.236
	Atraumatic (n=101)	35	66		
	For Cohort Head (Yes) = 0.321; For Cohort Headache (No) = 1.36				
Size	20 – G (n=71)	25	46	0.012	2.53
	22 – G (n=102)	18	84		
	For Cohort Head (Yes) = 1.99; For Cohort Headache (No) = 0.787				

Sitting position was noticed in 72 (41.6%) and lateral position in 101 (58.4%), traumatic needle in 72 (41.6%) and atraumatic needle in 101 (58.4%). Size of needle was 20 G in 71 (41%) and it was 22 G in 102 (59%) while past history of post-dural puncture headache was not noted in our study (Table). Post-dural puncture headache was noted in 43 (24.9%) of our study cases. Stratification of post-dural puncture headache with regards to gender revealed its significant association with age, position of patient, size of needle and type of needle while no association was determined with regards to gender and obesity.

Discussion

Post-dural puncture headache (PdPH) is frequently encountered complication after certain procedures which involve dural punctures including lumbar puncture and spinal anesthesia. Various factors like type of needle, patients characteristics and healthcare settings have been implicated as risk factors for varying frequency of PdPH and overall incidence may range 0.1 -36 %¹³. Female patients are reported to be at high risk than those of their male counterparts probably because of their hormonal variations and changes in CSF pressure. High incidence rates have been reported in obstetric patients who receive spinal anesthesia (ranging 10–36%). Large gauge needles, low BMI index, female gender, younger age population, number of dural

punctures, orientation of needle bevel and expertise of the healthcare facility are the major factors associated with high incidence of PDPH.¹⁴ Post-dural pressure headache is postulated to originate from lower CSF pressure occurring from its leakage from dural puncture site which leads to the development of vasodilation and lower CSF volumes. Preventive and management strategies may include; selection of smaller gauge and non – cutting needles, needle bevel parallel to dural fibers, encouraging proper hydration, ensuring bed rest & use of analgesics and application of epidural blood patch. Early diagnosis and timely management with proper understanding of these risk factors remain crucial for reduction of morbidities associated with PDPH.^{15,16}

Gender association of PdPH has been reported in literature and gender plays crucial role in the epidemiology and pathogenesis of the disease. Females are more susceptible to PdPH than males and this increased risk is partly attributed to hormonal factors, particularly estrogen, which affects vascular and pain sensitivity while pregnant women are at even more risk. Of these 173 study cases, 75 (43.3%) were male patients while 98 (56.6%) were females. Similar results have been reported in many different studies showing female gender predominance. Fasih et al¹⁷ from Karachi also reported 59.4% female gender predominance. Another study done in Hyderabad by Kumar et al¹⁸ also reported 60% female gender predominance.

Savul et al¹⁹ from Islamabad also reported 62.8% female patients.

Age also impacts the likelihood of developing PdPH. Younger individuals, likely due to higher CSF pressure and more elastic dural tissues which can lead to greater CSF leakage when the dura is punctured. Conversely, older adults have a lower risk of PdPH, as age-related changes such as reduced CSF pressure and decreased dural elasticity may result in less significant CSF leakage and brain sagging. Mean age was 40.92±10.07 years (range; 24-60 years) and 90 (52.0%) were aged more than 40 years. Fasih et al¹⁶ from Karachi also reported 35.12±16.38 years mean age. Another study done in Hyderabad by Kumar et al¹⁷ also reported 33.6±2 years mean age. Savul et al¹⁸ from Islamabad also reported 41.43 years mean age which is close to our study results.

Diabetes was noted in 32 (18.5%) while Hypertension in 64 (37.0%) of our study cases. A study done in Hyderabad by Kumar et al¹⁸ also reported 14% diabetes which is in compliance with our study results. Khan et al from Peshawar has reported 20.06% patients having headache had hypertension¹⁰ which is close to our study results. Pietrini et al¹¹ reported 28% hypertension in patients with headache which is same as that of our findings. Fasih et al¹⁷ from Karachi reported 15.57 % hypertension which is quite less than that of our study results.

Mean body mass index of these patients was 24.92±2.13 kg/m² and 25 (14.5%) were obese. A study done in Hyderabad by Kumar et al¹⁸ also reported similar results.

Size of needle was 20 G in 71 (41%) and it was 22 G in 102 (59%) while past history of post-dural puncture headache was not noted in our study. Post-dural puncture headache was noted in 43 (24.9%) of our study cases. Demilew BC et al included a total of 119 parturients and 20.2 % cases had post-dural puncture headache. Multivariable logistic regression revealed that previous history of spinal anesthesia (62.5% vs. 37.5%, $p < 0.001$), use of 20 and 22 gauge needle (62.5% vs. 37.5%, $p = 0.021$) and repeated attempt (58.3% vs. 41.7%, $p = 0.05$) were the associated factors for development of post-dural puncture headache.¹²

High frequency of post-dural puncture head was noted in our study among patients undergoing lumbar puncture for CSF examination. Post-dural puncture headache was significantly associated with age, position of patient, size of needle and type of needle. All clinicians treating such patients should always anticipate these patients for diagnosis of headache and hence management. This will decrease burden of related morbidities, improve

prognosis and positive impact on quality of life and productivity of patients.

Conflict of interest: None declared.

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