Volume 4, Issue 2, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

RISK FACTORS OF POST-DURAL PUNCTURE HEADACHE FOLLOWING LUMBAR PUNCTURE

Mudassir Yaqoob[*1], Amjad Abbas[2], Muhammad Zahid Hayat[3], Abu Hanzala[4], Noor Ul Ain Aqeel[5], Muhammad Ahmad Arif[6]

[*1,2,3,4,5,6]*Department of Health Professional Technologies, The University of Lahore*

[*1]mudassarna786@gmail.com,[2]amjadabbas5004@gmail.com,[3]zahidmunna3@gmail.com, [4]abuhanzalalatif797@gmail.com, [5]noorulainaqeel12@gmail.com, [6]malikahmadarif77@gmail.com

DOI: https://doi.org/10.5281/zenodo.18493522

Keywords

Post-Dural Puncture Headache, Lumbar Puncture, Spinal Anesthesia, Risk Factors, Cerebrospinal Fluid

Article History

Received: 06 December 2025
Accepted: 21 January 2026
Published: 05 February 2026

Corresponding Author: *
Mudassir Yaqoob

Abstract

Background:

Post-dural puncture headache (PDPH) is the most frequent problem that happens after a lumbar puncture (LP). As per the International, the Classification of Headache Disorders (ICHD-III) describes a type of headache that feels like pain in the front or back of the head. Within 5 days after the LP symptoms that get worse when you stand up but get better or go away when you lie down. It might come with ringing in the ears and trouble hearing. Sensitivity to light or feeling sick. It usually gets better on its own in one week in most cases. Our study aims to identify both modifiable and non-modifiable risk factors contributing to the occurrence of PDPH in order to guide preventive measures and improve patient outcomes.

Methodology:

A descriptive cross-sectional study was conducted over a period of four months with a sample size of 68 patients. Data were collected using a structured questionnaire and analysed through SPSS version 27.0.1. Variables included age, gender, BMI, hydration status, history of headaches, needle size/type, number of puncture attempts, and operator experience.

Results:

The findings indicated that younger patients, females, and individuals with low BMI were more prone to PDPH. Procedural factors such as multiple puncture attempts, larger needle gauge, and less operator experience significantly increased the incidence of PDPH. Hydration status and history of headaches were also found to be strong predictors.

Conclusion:

The study concludes that both patient-related (age, gender, BMI, headache history) and Procedure-related factors (needle type, number of attempts, operator skill, hydration) play a critical role in the development of PDPH. Preventive strategies should focus on using smaller traumatic needles, ensuring adequate hydration, and improving operator expertise.

INTRODUCTION

A lumbar puncture (LP) is a routine medical procedure, especially used for problems related to the nervous system. The main purpose of this procedure is to diagnose conditions by analysing

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

cerebrospinal fluid (CSF), checking the pressure of CSF, and sometimes using a special injection for imaging. It can also be used to relieve pressure in the brain or to give medication directly into the spine. Serious complications are rare, but a common issue that can happen is a headache after the procedure, known as post-dural puncture headache (PDPH). The rate at which it starts can vary. It's estimated to be between 4% and 11%, and in some cases, it can be as high as 33% to 50% in certain groups of patients. (Rodriguez-Camacho M et a1., 2023).

A diagnostic lumbar puncture (DLP) is a common medical procedure. It is important for figuring out problems with the nervous system. A headache is the most common problem. After DLP, the frequency rates of patients vary from 3% to 40%. After a spinal tap a headache (PDPH) likely happens because spinal fluid leaks into the space around the spine through the hole made after the needle goes into the tough covering of the brain. Losing cerebrospinal fluid leads to a decrease increased pressure inside the skull (ICP), which causes the blood vessels in the brain to widen as a response. (Nowaczewska M et a1., 2019).

The occurrence of PLPS after spinal anesthesia is quite common. Lower than what was seen after the diagnostic LP. The difference might be due to a piece of spider web-like tissue. puts the needle in while the fluid is coming out for testing When the needle is taken out, it is pulled back through the protective layer around the spinal cord, which causes a leak of spinal fluid in spinal anesthesia. On the other hand, this thread of spider web couldn't get in. The needle is used to put in fluid, and it doesn't come back out. Changing the thin, pointed tool inside the needle should move it to the end of the needle. Remove or cut the thread to make it happen less often PLPS. (Strupp M et a1., 2018).

A post-dural puncture headache (PDPH) is the most frequent problem that happens after a lumbar puncture (LP) about 40 out of 100 times. As per the International, the Classification of Headache Disorders (ICHD-III) describes a type of headache that feels like pain in the front or back of the head. Within 5 days after the LP symptoms that get worse when you stand up but get better or go away when you lie down. Please provide the text you would like me to simplify. It might come with ringing in the ears and trouble hearing. Sensitivity to light or feeling sick. It usually gets better on its own in one week in most cases, PDPH goes away on its own, with about 72% of people feeling better within 5 days. Gentle treatments for PDPH include resting in bed rest, pain relief, and drinking fluids. (Castrillo A et a1., 2015).

Neuraxial pain relief and anesthesia are commonly used to help manage pain. During childbirth About 5.5% of women in the UK, 6.0% in Canada, and 6.5% in the USA. In the USA, 8.2% of women have their babies with a type of pain relief called neuraxial anesthesia. In France, the number is the same. One of the most common and serious problems is a headache that happens after a needle has been placed in the spine (post-dural puncture headache or PDPH). This happens in 0.38 to 6.3% of spinal procedures and is a frequent reason for lawsuits in the USA. Post-dural A puncture headache is very painful and can sometimes cause other injuries to the brain. (Tomala S et a1., 2023).

MATERIAL AND METHODS

The research was conducted using a Cross-sectional Study Design to evaluate the variables associated with the condition. This design allowed for the systematic observation of risk factors at a specific point in time. The data was collected from the University of Lahore teaching hospital, Lahore. This setting provided a diverse patient population undergoing various diagnostic and therapeutic procedures.

The study was conducted over a duration of 4 months after the official approval of the research synopsis. During this period, a total sample size of 68 patients was selected to participate in the study. A convenience (non-probability) sampling technique was used to recruit participants who met the specific study criteria. This method ensured that the data collection process was efficient while maintaining the focus on patients undergoing lumbar puncture.

The sample selection followed strict inclusion and exclusion criteria to ensure the reliability of the research findings. Inclusion criteria encompassed adults aged 18 years and above undergoing a lumbar puncture for diagnostic or therapeutic purposes. Only patients capable of providing informed consent for participation and follow-up were included in the final sample. These criteria helped in identifying the

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

most relevant demographic for evaluating post-procedural complications.

Specific exclusion criteria were applied to minimize the influence of confounding variables on the results. Patients with pre-existing chronic headaches or migraines were excluded to ensure the headache observed was procedure-related. Furthermore, individuals who had undergone prior lumbar punctures within 1 week were not included in the study. Any cases with incomplete or missing procedural data were also removed from the final analysis.

Ethical considerations were strictly maintained throughout the research process at the University of Lahore. The rules and regulations set by the ethical committee were followed, and the rights of the participants were respected. Written informed consent was taken from all participants, and all data collection was kept entirely confidential.

The data collection procedure involved a pre-approved questionnaire comprising questions related to risk factors of post-dural puncture headache. Data was analyzed using the SPSS version 27.0.1 software to ensure statistical accuracy in the final report. Statistical techniques were used to obtain results in the form of tables, analyzing each question and demographic information.

RESULTS

A total of 68 patients were included in the study, with 36 female patients and 32 male patients. Both groups were comparable with respect to baseline demographic characteristics. The occurrence of post-dural puncture headache in 68 Patients (100.0%).

The mean age is 42.04 years, while the average BMI is approximately 25. Active smoking shows a low mean proportion, and headache intensity averages 4.86 on the measurement scale.

Female predominance is clinically relevant, as females are consistently reported to have higher PDPH risk, particularly in reproductive age groups. Females represent a slightly higher proportion at 52.9%, while males constitute 47.1% of the sample. More than half (52.9%) fall within the normal BMI category (18.5–24.9). About 30.9% are overweight.

Migraine is the most common type at (41.2%), followed by tension-type (32.4%) and cluster headaches (26.5%). The distribution shows a diverse pattern of headache types.

Non-Cutting needles were used more frequently (55.9%) compared to Cutting needles (44.1%). The sample shows a moderate predominance of the subcutaneous method.

The participants had a prior history of headache is nearly equal, with 51.5% reporting no history and 48.5% reporting previous headaches.

Participants which underwent One attempt (89.7%) and (10.3%) underwent more than one attempt.

Table 5.1 Descriptive statistics

Statistics						
	Age	BMI	Active Smoking	Lumber Puncture Needle Gauge	CSF to capillary glucose ratio	Headache Intensity
Mean	42.04	24.996	.309	24.59	.6118	4.86
Std. Deviation	13.655	5.0759	.4654	1.489	.12671	2.357

Table 5.2 Gender Distribution

Gender		
	N	%
Male	32	47.1%
Female	36	52.9%

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Table 5.3 BMI Classification

BMI Classification		
	N	%
Below 18.5	2	2.9%
18.5-24.9	36	52.9%
25.0-29.9	21	30.9%
30.0-34.9	5	7.4%
35.0-39.9	4	5.9%

Table 5.4 Type of Headache

Type of Headache		
	N	%
Cluster	18	26.5%
Migraine	28	41.2%
Tension-type	22	32.4%

Table 5.5 Type of Anesthesia Needle

Type of Anesthesia Needle		
	N	%
Cutting	30	44.1%
Non-cutting	38	55.9%

Table 5.6 History of Headache

History of Headache		
	N	%
No	35	51.5%
Yes	33	48.5%

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Table 5.7 Number of Attempts

Number of Attempts		
	N	%
One Attempt	61	89.7%
More than One Attempt	7	10.3%

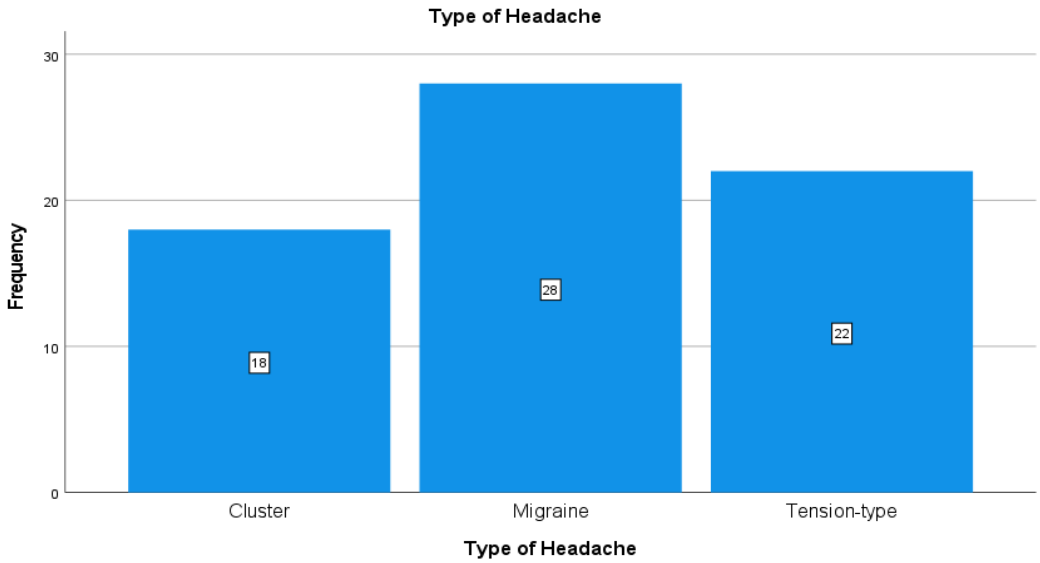

Figure 5.1 Bar Chart of type of Headache

This pie chart displays the proportions of different types of headaches reported by participants. Migraine is the largest category (41.2%), followed by tension-type (32.4%) and cluster headaches (26.5%). The figure visually emphasizes the varied distribution, with migraine being the most prevalent.

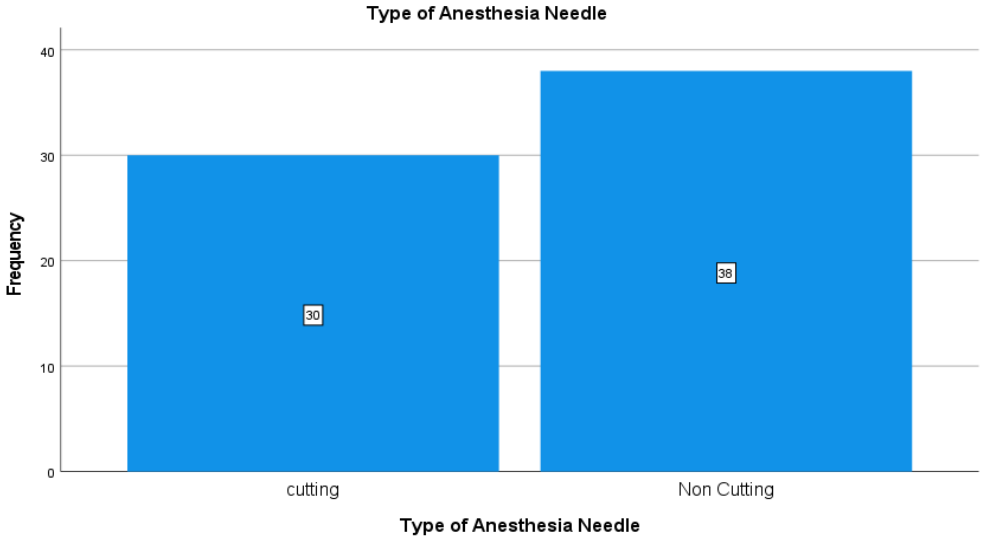

Figure 5.2 Bar chart of type of Anesthesia Needle

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

This figure displays the usage frequency of anesthesia needle types. Non-Cutting needles were used more often (55.9%) compared to Cutting needles (44.1%). The bars show a modest but clear preference for the subcutaneous technique. The chart highlights procedural variations in anesthesia selection.

DISCUSSION

Lumbar puncture (LP) is an essential diagnostic procedure in neurological practice; however, post-dural puncture headache (PDPH) remains the most common and clinically significant complication. The present study comprehensively evaluated the frequency of PDPH and its association with demographic, clinical, procedural, and post-procedural variables.

The mean age of participants was 42.04 ± 13.66 years (Table 5.1), indicating that LP was most frequently performed in middle-aged adults. This age distribution is consistent with studies reporting higher LP utilization among adults presenting with suspected central nervous system infections, inflammatory disorders, and cerebrovascular conditions (Bezov et al., 2010).

The mean body mass index (BMI) was 24.99 ± 5.08 kg/m², placing the average participant at the upper limit of the normal BMI range. BMI classification showed that 52.9% (n = 36) had normal BMI (18.5–24.9), 30.9% (n = 21) were overweight, 7.4% (n = 5) had BMI 30–34.9, 5.9% (n = 4) had BMI 35–39.9, and only 2.9% (n = 2) were underweight. Literature consistently reports that individuals with lower or normal BMI are more susceptible to PDPH due to reduced epidural fat and lower resistance to CSF leakage (Peralta et al., 2015).

Active smoking had a mean value of 0.309 ± 0.465, indicating that the majority of participants were non-smokers. Smoking status has shown inconsistent associations with PDPH, and its low prevalence in this cohort likely limited its clinical impact.

The CSF-to-capillary glucose ratio averaged 0.612 ± 0.127, confirming physiological CSF glucose dynamics and excluding metabolic disturbance as a contributor to post-LP headache. Headache intensity showed a mean score of 4.86 ± 2.36, representing moderate pain severity consistent with PDPH reported in prior studies (Ahmed et al., 2006).

The study include 36 females (52.9%) and 32 males (47.1%). Female predominance is clinically relevant, as females are consistently reported to have higher PDPH risk, particularly in reproductive age groups. A history of prior lumbar puncture was reported by 20.6% (n = 14) of participants, while 79.4% (n = 54) had no previous exposure. First-time LP patients may experience increased anxiety and muscular tension, potentially increasing dural trauma during needle insertion.

The most striking finding was the high incidence of PDPH, affecting 61.8% (n = 42) of participants, while 38.2% (n = 26) did not develop headache. This rate substantially exceeds the commonly reported range of 10 to 40% in studies utilizing atraumatic needles and standardized preventive measures. Almost half of the participants (48.5%, n = 33) had a previous history of headache, while 51.5% (n = 35) did not. Regarding headache subtype, 32.4% (n = 22) reported migraine, 22.1% (n = 15) tension-type headache, 20.6% (n = 14) cluster headache, and 25% (n = 17) reported no headache. Migraine has been identified as an independent risk factor for PDPH due to central sensitization and altered nociceptive processing.

Vascular risk factors were absent in 66.2% (n = 45) and present in 33.8% (n = 23) of participants. Hypertension was present in 39.7% (n = 27), diabetes mellitus in 22.1% (n = 15), dyslipidemia in 17.6% (n = 12), and hyperuricemia in 17.6% (n = 12). Active alcoholism was rare, affecting only 1.5% (n = 1) of participants.

A substantial 72.1% (n = 49) of participants consumed caffeine prior to LP, while 27.9% (n = 19) did not. Caffeine is a known cerebral vasoconstrictor and is commonly used in PDPH management; however, despite high caffeine intake, PDPH incidence remained elevated, indicating limited preventive efficacy when used alone.

Hydration status was adequate in only 36.8% (n = 25), inadequate in 32.4% (n = 22), and unknown in 30.9% (n = 21) of participants. Inadequate hydration is a recognized risk factor for PDPH, and the large proportion of inadequately hydrated or undocumented cases likely contributed significantly to headache.

Most procedures (75%, n = 51) were performed in the lateral decubitus position, while 25% (n = 17)

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

were performed in the sitting position. Although lateral positioning is generally associated with reduced PDPH risk, positioning alone was insufficient to prevent headache in this cohort.

Following LP, 27.9% (n = 19) reported no symptoms, while 22.1% (n = 15) experienced hearing changes, 14.7% (n = 10) neck stiffness, 13.2% (n = 9) nausea, 11.8% (n = 8) vomiting, and 10.3% (n = 7) other symptoms

Management strategies varied: 29.4% (n = 20) received fluids, 20.6% (n = 14) analgesics, 16.2% (n = 11) bed rest, 16.2% (n = 11) caffeine, while 17.6% (n = 12) received no treatment.

CONCLUSION

Post-Dural puncture headache remains a common and clinically significant complication following lumbar puncture. The findings of this study indicate that multiple patient-related and procedural factors contribute to the development of this condition, particularly pre-existing headache disorders, hydration status, and procedural practices. Although preventive measures such as smaller-gauge needles and caffeine use were commonly employed, they did not consistently prevent headache occurrence. Variability in post-procedural management further influenced patient outcomes. These results emphasize the importance of standardized preventive and management strategies to minimize patient discomfort and improve the overall safety of lumbar puncture procedures.

REFERENCES

Al-Hashel, J., Rady, A., Massoud, F., & Ismail, I. I. (2022). Post-dural puncture headache: a prospective study on incidence, risk factors, and clinical characterization of 285 consecutive procedures. BMC neurology, 22(1), 261.

Ferede, Y. A., Nigatu, Y. A., Agegnehu, A. F., & Mustofa, S. Y. (2021). Incidence and associated factors of post dural puncture headache after cesarean section delivery under spinal anesthesia in University of Gondar Comprehensive Specialized Hospital, 2019, cross sectional study. International Journal of Surgery Open, 33, 100348.

Girma, T., Mergia, G., Tadesse, M., & Assen, S. (2022). Incidence and associated factors of post dural puncture headache in cesarean section done under spinal anesthesia 2021 institutional based prospective single-armed cohort study. Annals of Medicine and Surgery, 78.

Islam, M. T. (2024). Incidence and Risk Factors for Post Dural Puncture Headache (PDPH) in Patients Undergoing Subdural Anesthesia. The Insight, 7(01), 103-110.

Kakde, A., Chia, P., Tan, H. S., Sultana, R., Tan, C. W., & Sng, B. L. (2024). Factors associated with an inadvertent dural puncture or post-dural puncture headache following labour epidural analgesia: A retrospective cohort study. Heliyon, 10(6).

Makito, K., Matsui, H., Fushimi, K., & Yasunaga, H. (2020). Incidences and risk factors for post-dural puncture headache after neuraxial anaesthesia: A national inpatient database study in Japan. Anaesthesia and Intensive Care, 48(5), 381-388.

Nowaczewska, M., Kukulska-Pawluczuk, B., Kaźmierczak, H., & Pawlak-Osińska, K. (2019). Post-lumbar puncture headache—does hydration before puncture prevent headache and affect cerebral blood flow? Journal of Clinical Medicine, 8(10), 1710.

Rodriguez-Camacho, M., Guirado-Ruiz, P. A., & Barrero-Hernández, F. J. (2023). Risk factors in post-dural puncture headache. Revista Clínica Española (English Edition), 223(6), 331-339.

Weji, B. G., Obsa, M. S., Melese, K. G., & Azeze, G. A. (2020). Incidence and risk factors of postdural puncture headache: prospective cohort study design. Perioperative Medicine, 9(1), 32.

Tomala, S., Savoldelli, G. L., Pichon, I., & Haller, G. (2023). Risk factors for recurrence of post-dural puncture headache following an epidural blood patch: a retrospective cohort study. International Journal of Obstetric Anesthesia, 56, 103925.