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ORIGINAL RESEARCH

Pattern, Interventions and Outcome of Post-Dural Puncture Headache Among Obstetric Patients in Ibadan

Idowu OK¹, Abdus-Salam RA², Lawal OO², Adeosun OA³, Raji TA⁴,
Jayeola IA³

¹Department of Anaesthesia, Faculty of Clinical Sciences, College of Medicine University of Ibadan/
University College Hospital, Ibadan, Nigeria

²Department of Obstetrics and Gynaecology, Faculty of Clinical Sciences, College of Medicine University of
Ibadan/ University College Hospital, Ibadan, Nigeria

³Department of Statistics, Federal College of Animal Health and Production Technology, Ibadan, Oyo State,
Nigeria

⁴Department of Community Medicine, Faculty of Public Health, College of Medicine University of Ibadan,
Nigeria

*Correspondence: Dr RA Abdus-Salam, Department of Obstetrics and Gynaecology, Faculty of Clinical
Sciences, College of Medicine, University of Ibadan, Ibadan, Oyo State, Nigeria.
E-mail: deolaabdussalam@gmail.com; ORCID - <https://orcid.org/0000-0002-2226-0597>.

Abstract

Background: Post-dural puncture headache (PDPH) is a complication of dura mater puncture. PDPH poses a problem in postpartum women; hence, there is a need to identify and promptly treat it using highly effective, non-invasive techniques that can be easily implemented in low-resource settings to reduce the burden and associated morbidity.

Objective: To examine the interventions and outcomes of PDPH among women who had a subarachnoid block for obstetric indications at the University College Hospital, Ibadan.

Methods: A prospective, cross-sectional study was conducted among women with a subarachnoid block for obstetric indications. A semi-structured interviewer-administered data collection form was used to assess pain at the onset of the headache and followed up to 72 hours post-treatment.

Results: This study evaluated 26 pregnant women with PDPH. Most respondents (18; 69.2%) were ≥ 30 years old, had a normal BMI of 11 (42.3%), and 26.9% of the women had a prior history of PDPH. Subarachnoid block was performed by a registrar in 24 (92.3%) women. The majority (22; 84.6%) had only one attempt at dural puncture, all in a sitting position with the 25G-sized spinal needle in 96.2%. The headache was incapacitating in 9 (34.6%) cases and got worse in the upright position in 23 (88.5%) women.

Conclusion: PDPH is a notorious morbidity in parturients, and steps should be taken to minimise the duration and effects of the condition. Prevention, prompt identification, diagnosis, and proactive treatment are desirable.

Keywords: Caesarean Section, Headache, Post-dural Puncture Headache, Postpartum headache, Subarachnoid block.

Introduction

Post-dural puncture headache (PDPH), also called post-lumbar puncture (LP) or meningeal puncture headache, is a complication of dura mater puncture. PDPH may follow diagnostic lumbar puncture, spinal anaesthesia or, more commonly, accidental dural puncture during epidural catheter insertion. The headache is usually posture-related (worse when standing or sitting erect and relieved when lying flat). According to the International Headache Society (IHS) Definition 2018, PDPH is a headache attributable to low cerebrospinal fluid (CSF) pressure within five days of a lumbar puncture caused by CSF leakage through the dural puncture. It has a definite relationship to the patient's position.^[1] The pathology of PDPH has been attributed to traction on pain-sensitive intracranial structures or compensatory intracranial vasodilation, both caused by a decrease in CSF pressure.^[2]

The incidence of PDPH varies widely, with headaches occurring in 2-40% of all LP procedures, depending on procedural and patient factors.^[3] An inadvertent dural puncture occurs in 1-1.5% of obstetric women undergoing epidural anaesthesia.^[4] However, about 5% of patients may present with an atypical headache with no postural element.

Obstetric patients are at increased risk for PDPH due to gender, age, and increased use of subarachnoid block and epidural anaesthesia for obstetric analgesia/anaesthesia, with the attending risk of an accidental dural puncture during epidural anaesthesia.^[3,4] Headaches of vascular origin or from hypertensive diseases, infections, space-occupying lesions, and dural puncture account for 25% of headaches in women in the first week after childbirth.^[5] Although PDPH is not a life-threatening condition, physical activity is restricted, and patients are often forced to stay in bed. This is potentially problematic for the postpartum mothers caring for new infants. ^[6] PDPH is

commoner in women younger than 20-40 years, those with a prior history of headaches, and low body mass index (BMI).^[7] The risk factors for PDPH include needle size, type-cutting needle, multiple failed attempts at spinal anaesthesia,^[8] and operators' skill level and fatigue. ^[9]

The symptoms of PDPH include headaches, which are usually frontal, occipital, or generalised. It may radiate to the neck and shoulder or may be associated with neck stiffness, tinnitus, partial hearing loss, nausea, and vomiting. These symptoms may be severe, limiting the activities of the new mother to care for her baby, maybe incapacitating, or be associated with prolonged hospital stays.^[3]

The management of PDPH depends upon the severity of the headache and its impact on the patient's functionality. The treatment of PDPH may be either pharmacological or non-pharmacological intervention or a combination of both. These include rehydration, acetaminophen, nonsteroidal anti-inflammatory drugs, opioids, and antiemetics.^[7] Other pharmacological treatments include intravenous or oral caffeine, oral theophylline, sumatriptan, pregabalin, desmopressin acetate, intravenous hydrocortisone, intravenous cosyntropin, intramuscular adrenocorticotrophic hormone, and acupuncture. Caffeine is recommended as a therapeutic option for PDPH; it increases cerebral vasoconstriction by blocking adenosine receptors and leads to augmented cerebrospinal fluid (CSF) production by stimulating sodium-potassium pumps.^[10] Neostigmine-atropine has also been proposed as a helpful agent in treating PDPH. Abdaleel *et al.* demonstrated this combination - of neostigmine and atropine in treating PDPH and found the drugs very effective.^[11] If not contraindicated, an epidural blood patch (EBP) is the treatment of choice for severe PDPH by taking 30 mL of blood from the patient's arm and slowly injecting it into the epidural space.^[12]

It is assumed that small needle size, number of attempts, patient's position, and the cadre of expertise of anaesthetists prevent and reduce the risk of PDPH. Despite ensuring these factors, PDPH is rarely prevented. Hence, there is a need to identify and appropriately manage patients who develop PDPH. Postoperative surveillance will identify the patient for prompt intervention. This study aimed to describe post-dural puncture headache, the treatment modalities used in its management and the outcomes among pregnant women who had a subarachnoid block for obstetric indications.

Methods

This is a prospective, cross-sectional study of postpartum women who had post-dural puncture headaches following caesarean delivery under subarachnoid block over six months. The study was conducted at the obstetric unit of the University College Hospital (UCH), Ibadan. UCH is a government-owned tertiary healthcare facility located in Ibadan, Oyo State, southwest Nigeria; it has an annual delivery rate of about 2,500 per year. The study population was obstetric patients who developed PDPH after undergoing subarachnoid block for obstetric procedures. The inclusion criteria were consenting obstetric patients who developed PDPH after subarachnoid block for obstetric procedures.

There was no sample size calculation as the study adopted a convenient, purposive sampling technique. The study instrument was a semi-structured, interviewer-administered data collection form (DCF) with six sections. The information collected included sociodemographic profile, obstetric and clinical characteristics, intra-operative, anaesthetic, and postoperative details. Headache and pain were assessed using the box numeric pain scale (BNS). The assessment was done at the onset of the headache and followed up to 72 hours post-treatment.

The data was entered and analysed using IBM SPSS version 23. The results were presented in a frequency and percentage table, bar charts, and pie charts.

Ethical approval for the study was obtained from the Ethics Review Committee of University College Hospital and the College of Medicine, University of Ibadan (UI/UCH Ethics Committee) with ethics approval number UI/EC/20/0352.

Results

Table I summarises the sociodemographic and clinical characteristics of 26 women with post-dural puncture headaches. Among the participants, 8 (30.8%) women were aged 20-29, and 18 (69.2%) were 30 years and above. The majority were self-employed (14; 53.8%). All the participants were married and mainly of the Yoruba tribe (88.5%). Only 2 (7.7%) had a BMI less than 18.5kg/m², 11 (42.3%) had an average weight, 10 (38.5%) were overweight, and 3 (11.5%) were obese with a mean BMI of 30kg/m² and above. Five (19.2%) had pre-existing/pregnancy-related medical conditions such as antepartum haemorrhage, haemoglobinopathy, premature rupture of membrane, and hypertension in pregnancy.

The American Society of Anesthesiologists (ASA) assessment was Grade II for most women (21; 80.8%). The majority of the women had pre-medication with intravenous dexamethasone. Subarachnoid block was performed by registrars in 24 (92.3%) of the participants, as shown in Table II. The majority of the participants (22; 84.6%) had only one attempt at the puncture, and all 26 (100.0%) were in a sitting position during the procedure, and a 25G-sized spinal needle was used in 25 (96.2%) of the patients. All patients with PDPH had no reinsertion of the stylet, and most participants reported cerebrospinal fluid loss as minimal.

Table I: Sociodemographic and clinical characteristics of participants

<i>Variable</i>		<i>Frequency</i>	<i>Percentage</i>
Age (years)	20-29	8	30.8
	≥30	18	69.2
Occupation	Self-employed	14	53.8
	Unemployed	1	3.8
	Employed	11	42.3
BMI (kg/m ²)	<18.5 (Underweight)	2	7.7
	18.5-24.9 (Normal)	11	42.3
	25.0-29.9 (Overweight)	10	38.5
	≥30.0 (Obese)	3	11.5
Gestational Age	<37 weeks	5	19.2
	≥37 weeks	21	80.8
Parity	0-1	14	53.8
	2-3	12	46.2
Medical/Pregnancy-related conditions	Yes	5	19.2
	No	21	80.8
Type of surgery	Elective	9	34.6
	Urgent	1	3.8
	Emergency	16	61.5
ASA Classification	II	21	80.8
	III	5	19.2
Packed Cell Volume	<30	1	3.8
	≥30	25	96.2
Pre-medication	IV Dexamethasone 4mg	3	11.5
	IV Dexamethasone 8mg	21	80.8
	Nil	2	7.7

BMI - Body Mass Index; ASA - American Society of Anaesthesiologists; IV - Intravenous

Seven (26.9%) of the women with PDPH have had a history of PDPH headache; 26 (100%) women experienced the headache before discharge (Table III).

The location of the headache was described as frontal, occipital, or both frontal and occipital headache (Figure 1). The nature of the headache was described as either dull in 8(30.8%), throbbing in 2(7.7%), and a form of pressure in 16(61.5%) of the participants. The severity of the headache at onset was measured with a pain score using the box numeric scale (BNS). Among the participants, the headache was

incapacitating - 9(34.6%) participants were unable to get out of bed, while 17(65.4%) were still able to get out of bed; the headache worsened in 23(88.5%) of the women while in an upright position and 3(11.5%) while in the recumbent position. The associated symptoms were neck stiffness in 3(11.5%) women, tinnitus in 21(80.8%), and nausea in 2(7.7%). Hypoacusis and photophobia were not seen in any woman. Figure 2 shows the interventions given for treating PDPH among the participants.

Table II: Risk factors for post-dural puncture headache

<i>Variable</i>		<i>Frequency</i>	<i>Percentage</i>
Cadre of Anaesthesiologist	Registrar	24	92.3
	Senior Registrar	2	7.7
Number of attempts at dural puncture	1	22	84.6
	2	3	11.5
	3	1	3.8
Position during procedure	Sitting	26	100.0
	Others	0	0.0
Size of the spinal needle	24G	1	3.8
	25G	25	96.2
Estimated CSF loss (number of drops)	0	18	69.2
	1	4	15.4
	2	3	11.5
	3	1	3.8

CSF - Cerebrospinal Fluid

Table III: History, pattern of headache, and clinical symptoms

<i>Variables</i>		<i>Frequency</i>	<i>Percentage</i>
Previous history of PDPH	Yes	7	26.9
	No	19	73.1
Headache at discharge	Yes	26	100.0
	No	0	0.0
Nature of headache	Dull aching	8	30.8
	Throbbing	2	7.7
	Pressure	16	61.5
Severity of headache at the onset - Pain score (BNS)	Mild (1-3)	11	42.3
	Moderate (4-6)	9	34.6
	Severe (7-10)	6	23.1
Degree of confinement to bed	Slightly confined/Gets out of bed	9	34.6
	Completely confined/Does not get out of bed	17	65.4
Headache worsening with posture	Upright posture	23	88.5
	Recumbent	3	11.5
Interval between change in posture and onset of headache	Immediate	10	38.5
	Delayed	16	61.5
Associated symptoms	Neck stiffness	3	11.5
	Tinnitus	21	80.8
	Nausea	2	7.7

PDPH - Post-Dural Puncture Headache; BNS - Box Numerical Scale

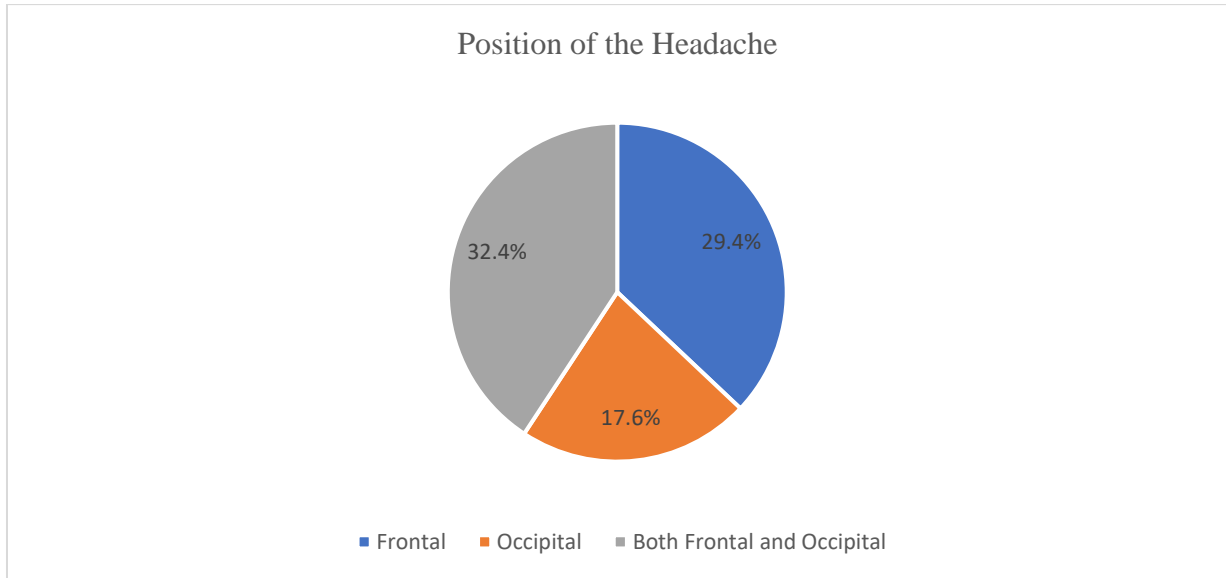


Figure 1: Location of Headache among women with post-dural puncture headache

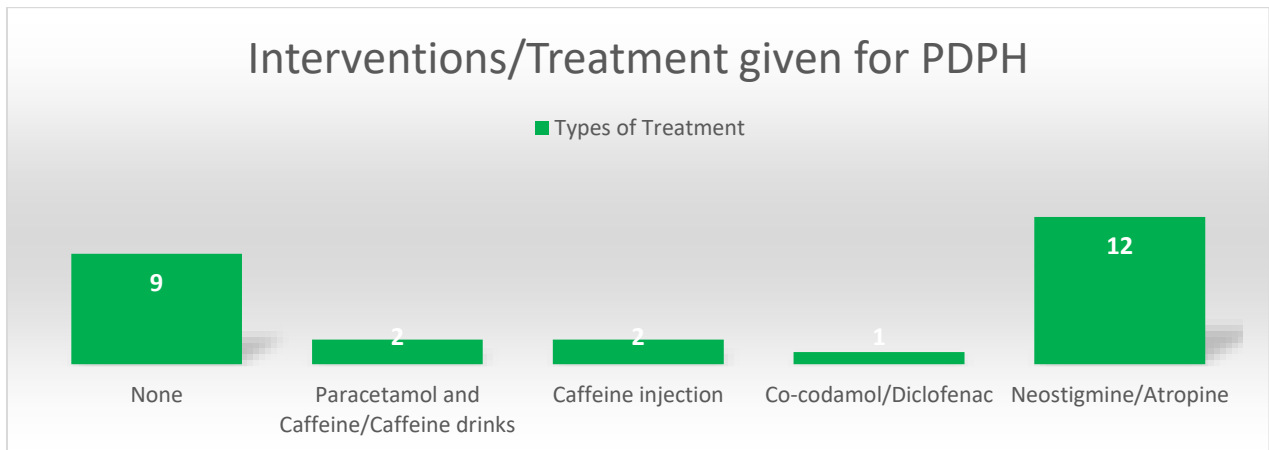


Figure 2: Interventions given for the Treatment of Post dural puncture headache

Table IV shows the proportion of cases treated and the resolution of symptoms. The interval between the onset of symptoms and relief of symptoms was < 1 hour in 3 (23.1%), 1-2 hours in 8 (61.5%), and >2 hours in 2 (15.4%) cases. The interval between intervention and relief of symptoms was <1 hour in 4 (28.6%), 1-2 hours in 9 (64.3%) cases, and >2 hours in 1 (7.1%) case. Figure 3 shows the proportion of women without headaches using a Box Numerical Scale assessment method.

Discussion

This study evaluated the pattern of post-dural puncture headaches among obstetric patients who had a caesarean section or obstetric procedures under subarachnoid block. Post-spinal puncture headache is a known complication of inadvertent tear of the dura during spinal and epidural anaesthesia, whether for diagnosis, therapy, or neuraxial block. The observed symptoms are caused by traction on pain-sensitive structures in the central nervous system due to low cerebrospinal fluid pressure (intracranial hypotension) following a cerebrospinal fluid leak at the puncture site.

Table IV: Pattern of resolution of symptoms after treatment

Variable		Frequency	Percentage
Treatment given	Yes	17	65.4
	No	9	34.6
Duration of symptoms	<1 hour	3	11.5
	1-2 hours	8	30.8
	>2 hours	2	7.7
	Not known	13	50.0
Interval between intervention and relief of symptoms	<1 hour	4	15.4
	1-2 hours	9	34.6
	>2 hours	1	3.8
	Not known	12	46.2

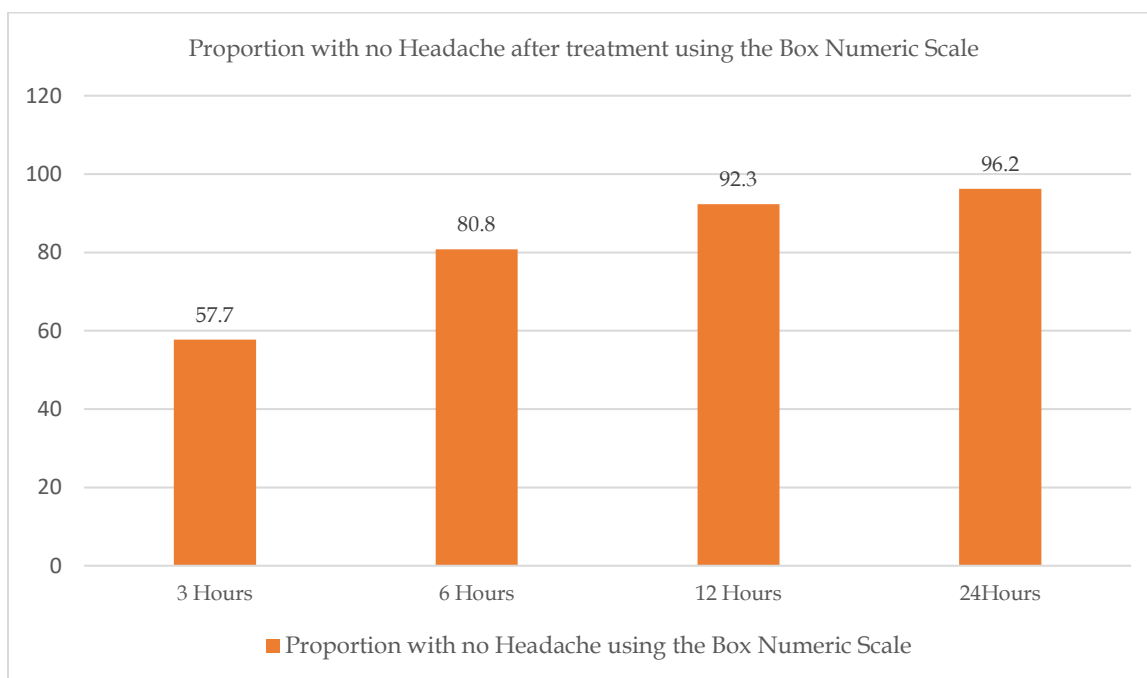


Figure 3: Proportion with no headache after treatment using the Box Numeric Scale

It is an incapacitating complication following a dura-arachnoid puncture. PDPH used to be relatively common, though it has become less common with necessary precautions. The participants in this study were pregnant women, mostly those with term gestation, who were 30 years and older, employed, and had a grade II ASA assessment. Obstetric patients are generally more likely at higher risk of PDPH than the non-pregnant female population because of their relatively younger age and widespread use of neuraxial blocks. [3] There is a higher risk of PDPH in women than in men, as a study by Fakhran *et al.* [13] reported that the

female gender correlated with the presence of an epidural collection. Camacho *et al.* [14] also reported the female gender is significantly more associated with PDPH when compared with age-matched men. [14]

The mean age of the participants in this study was 31.1 years. Bendel *et al.* [12], in their 20-year review, also reported that age is a recognised risk factor with the highest risk in the 18 - 40 years group. The mean age in the present group fell into the reported age group with the highest risk.

The occurrence of PDPH poses a burden to the postoperative postpartum woman and adversely affects her recovery and care of the newborn infant in the immediate postpartum period. In the present study, women developed PDPH even in the absence of identifiable causative factors. However, the observed proportions of women with PDPH with a dural puncture with 24G and 25G Quincke needles were 3.8% and 96.2%, respectively. This is in contrast with the report of Ferede *et al.* [15] that the incidence of PDPH following a 24G Quincke needle use was 15.1% compared to a 12.2% incidence of PDPH following the use of 25G needle sizes. The small size of the present study may explain the observed difference. Previous studies have also suggested that the Quincke needle is more associated with PDPH than the Whitacre needle. [16,17] There was also no correlation between the number of dural puncture attempts and the occurrence of PDPH in the present study. In contrast, previous studies have reported a significant association between these two factors. [15,18-20]

In the present study, PDPH was most frequently localised to the frontal or occipital areas, and the symptoms were aggravated in the sitting position but alleviated by recumbency. This finding also corroborates the report of Gupta *et al.* [21], Ferede *et al.* [15], and Gupta *et al.* [21] also reported 95.1% and 82%, respectively, as the proportions of patients that had PDPH in the sitting position. The ideal position for dural puncture is the lateral recumbent position with the knees and the neck flexed or the seated position with the neck flexed. The opening pressure in the lateral recumbent posture is more reliable than that in the sitting position, and lowering the position of the head may reduce the risk of post-dural puncture headache (PDPH). [22]

Various drugs were offered as conservative treatment options for PDPH. Most patients in the present study received a neostigmine/atropine combination. Reports have shown that the combination of

neostigmine and atropine demonstrates a rapid onset of action, providing patients with more effective analgesia than caffeine and offering quicker pain relief while avoiding the need for invasive procedures such as epidural blood patches. [11,23] A randomised, double-blind study by Ahmadzade *et al.* [24] reported that 40 µg/kg neostigmine plus atropine 20 µg/kg was proved to be safe and effective and should be considered in the early treatment of mild PDPH. The increased CSF secretion and opposition to cerebral vasodilation are suggested mechanisms by which neostigmine relieves PDPH. [25] Other drugs used in this study included caffeine, paracetamol, and cocodamol®. Caffeine sodium benzoate, as an intravenous bolus or an infusion, can be used to treat PDPH. [10] However, a Cochrane Review of 2015 concluded there was evidence that caffeine confers a temporary benefit in PDPH compared to placebo, although the quality of evidence was poor. [6]

About a third of the women in the present study had relief of symptoms 1-2 hours after intervention, and the majority (more than 4 out of 5 women) were cured of symptoms within 24 hours. These findings are also similar to the reports by Mahmoud *et al.* [25] which showed that all patients in the neostigmine/atropine group achieved a Visual Analogue Scale (VAS) ≤ 3 after two doses at 24 hours post-intervention, and none experienced a recurrence.

Post-dural puncture headache (PDPH) is a common complication of neuraxial anaesthesia that general practitioners, midwives, obstetricians, and anaesthetists might come across when caring for parturients. While often following a mild course and at times resolving with no serious intervention, PDPH can also lead to notable morbidities and, in some cases, may last for weeks. Understanding the nature of this condition, maintaining close monitoring, and facilitating interdisciplinary communication are pivotal for prompt diagnosis and effective management. Early identification and prompt treatment also

ensure the early resolution of symptoms and limit the postpartum woman's unpleasant experiences.

Before discharge, the parturient should be educated on when, where, and how to contact the hospital if they develop a headache, or in those who have had it return, or if other symptoms develop. After discharge from the hospital, following neuroaxial anaesthesia, all women, whether they had PDPH or not, require follow-up. This should occur regularly until all symptoms resolve.

The limitation of this study is the observational design. There was also no comparison of the effects of the interventions administered in managing PDPH. The sample size was also notably small, and there may be some recall bias, thus explaining the inability of some participants to accurately recall the exact time the headache stopped and estimate the duration of symptoms. Persistence of headache might have affected the recollection of timing and duration of symptoms. All our patients had a subarachnoid blockade in only the sitting position; therefore, the possible role of positioning during the dural puncture procedure could not be explored as a contributory factor to developing PDPH. Further research is needed to randomise interventions with longer follow-ups and to give more information on the interventions' role, benefits, and efficacy.

Conclusion

Post-dural puncture headaches may be problematic for the parturient. It is prudent to review and follow up with patients who had dural punctures/subarachnoid blocks to identify and appropriately manage affected patients.

Authors' Contributions: IO, ARA and AO designed the study. ARA, RA AO and OO analysed and interpreted the data. All the authors drafted and

revised the draft for sound intellectual content. All authors approved the final version of the manuscript.

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