



## Research Paper: Post-dural Puncture Headache in Cesarean Section; Frequency and Risk Factors: A Report From the North of Iran



Ali Mohammadzadeh Jouryabi<sup>1</sup>, Vali Imantalab<sup>1</sup>, Abbas Sedighinejad<sup>1</sup>, Cyrus Emir Alavi<sup>1</sup>, Gelareh Biazar<sup>1\*</sup>, Mandana Mansour Ghanaie<sup>2</sup>, Mahin Tayefeh Ashrafiyeh<sup>1</sup>, Faezeh Emami<sup>1</sup>

1. Department of Anesthesiology, Anesthesiology Research Center, Al-Zahra Hospital, Guilan University of Medical Sciences, Rasht, Iran.

2. Department of Obstetrics and Gynecology, Reproductive Health Research Center, Al-Zahra Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran.

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**Running Title** Post Dural Puncture Headache in CS

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### ABSTRACT

**Background:** Spinal Anesthesia (SA) as a safe, reliable, and cost-effective method is widely used for Cesarean Section (CS). However, it is sometimes complicated by Post-Dural Puncture Headache (PDPH).

**Objectives:** We investigated the frequency of PDPH in CS under SA and related risk factors in an academic referral hospital in the north of Iran.

**Materials & Methods:** This descriptive cross-sectional prospective study was conducted at Alzahra hospital as an academic referral center affiliated with the Guilan University of Medical Sciences on 147 eligible cases During from May 2019 to October 2019. Then questionnaires containing questions about patients' demographic data and some PDPH-related factors were filled out via face-to-face interviews. The collected data were analyzed by SPSS v. 21 using Chi-squared and Fisher's exact test.

**Results:** The incidence of PDPH was 6.1%. Early ambulation, the number of attempts, and having a history of headache were significantly associated with a higher incidence of PDPH ( $P=0.001$ ), while body mass index ( $P=0.106$ ), age ( $P=0.093$ ), and residents' experience ( $P=0.384$ ) had no significant association. None of our cases experienced a severe or persistent headache.

**Conclusion:** The main predisposing factors for PDPH were found to be the history of HA, early ambulation, and the number of dura punctures. Women at risk for PDPH should be objectively screened before CS under SA.

**Keywords:** Cesarean section, Post-dural puncture headache, Spinal anesthesia

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#### \* Corresponding Author:

**Gelareh Biazar**

**Address:** Department of Anesthesiology, Anesthesiology Research Center, Al-Zahra Hospital, Guilan University of Medical Sciences, Rasht, Iran.

**Tel:** +98 (911) 1350987, **Fax:** +98 (13) 3369024

**E-mail:** [gelarehbiazar1386@gmail.com](mailto:gelarehbiazar1386@gmail.com)

## Highlights

- Post-Dural Puncture Headache (PDPH) is a major complication of spinal anesthesia. The incidence of PDPH was 6.1% in our report.
- A history of headache, the number of attempts, and early ambulation were significantly associated with the occurrence of PDPH in the cesarean section.

## Introduction

**C**esarean Section (CS) is considered when the mother or baby or both are at risk and there are no acceptable conditions for normal vaginal delivery. Spinal Anesthesia (SA) has been used widely in CS [1, 2].

Because of several advantages, such as preventing general anesthesia-related neurotoxicity, which has strongly been recently focused on, cost-effectiveness, ease to perform, early-onset, lower risk of aspiration, and avoidance of airway manipulation, this method is preferred for non-complicated elective cesarean delivery [3-5]. However, despite several advantages of SA, it is sometimes complicated by Post-Dural Puncture Headache (PDPH) [6]. Headaches can be more complicated than most people realize. Different kinds of headaches can have their set of symptoms, happening for unique reasons, and need different treatments [7, 8]. Performing SA, following a dural puncture, a marked Cerebrospinal Fluid (CSF) leakage may occur, resulting in a significant intracranial pressure drop [9]. As CSF production is slower than the loss, it could not immediately be replaced, resulting in a downward stretching of the intracranial pain-sensitive structures that causes headache and pain in the neck and shoulders. The other postulated mechanism is the vasodilation of meningeal vessels through adenosine release [10]. So far, no standard preventive guideline has been recommended. However, it is expected that this complication responds well to rest, hydration, caffeine, and simple analgesics, such as paracetamol [11, 12]

According to the International Classification of Headache Disorders, the diagnostic criteria for PDPH, are the dull throbbing pain with a frontal-occipital distribution, get worsening when sitting or standing, and relieving when lying down. PDPH develops within 5 days after dural puncture and disappears spontaneously within one week or up to 48 h after an epidural blood patch. Rarely, it may last for months or even years. The headache may be accompanied by neck stiffness, tinnitus, hyperacusis, photophobia, and nausea [13]. The incidence of PDPH is reported from 0.4%-25% [14]. This complication may

affect the patient's acceptance of the method and causes an unpleasant anesthesia experience, increased risk of chronic headache, decreased mother ability to take care of the baby, prevention of early ambulation, and consequently, the risk of pulmonary emboli and deep vein thrombosis [15, 16].

Female gender, pregnancy, needle size, needle tip shape, type of needle tip, younger age, multiple punctures, and needle bevel direction are well-described risk factors for this complication [9, 17, 18]. The issue as a common and annoying problem has been investigated in some centers; however, limited data are available on some other influencing factors, such as the history of headaches and individuals habits [1, 19-21]. Moreover, because of the differences among studies regarding their studied samples, characteristics of the treatment center, for example, private centers compared to educational hospitals, and the medical team experience, their results could not be generalized to the other centers. Therefore, due to the importance of the issue, each hospital should be aware of its conditions and perform interventions regarding some influencing factors if required and possible. In this research, we prospectively investigated the frequency of PDPH and some influencing factors in parturients undergoing CS under SA.

## Materials and Methods

After the permission of the Ethics Committee of Guilan University of Medical Sciences (GUMS), this descriptive cross-sectional prospective study was conducted at Al-zahra hospital, an academic referral center affiliated with the GUMS. During the study period (six months) from May 2019 to October 2019, 147 eligible cases were enrolled. Then, questionnaires containing questions about patients' demographic data and some considered PDPH-related factors were filled out via face-to-face interviews.

Inclusion criteria: Women aged 18-45 years with stable hemodynamic status undergoing CS under SA were enrolled in the survey. Exclusion criteria: Patients suffering from chronic pain (suffering from persistent pain for

more than 12 weeks and more than 15 days in a month despite medication or treatment), those with psychiatric diseases (suffering from a mental illness diagnosed by a psychiatrist that greatly disturbs his/her thinking, moods, and/or behavior), cases treated with analgesic drugs before SA (regular consumption), changing anesthesia plane to general anesthesia, and any contraindication for SA were considered as exclusion criteria.

### Sample size

According to Nazemi et al. who reported the rate of 6% for PDPH and considering the significance level of 0.05 and the accuracy of 0.05, a sample size of 147 subjects was considered in this study [22].

During the study, 677 pregnant women were interviewed, of whom 124 cases refused to participate due to personal reasons, 21 cases were excluded due to the need for GA, and 167 cases did not meet the mentioned inclusion criteria as most of them were not in a stable status and not cooperative. A large number of patients were not in stable conditions and not communicative and 218 cases refused to answer our phone calls during the follow-ups after discharge from the hospital. Finally, 147 eligible cases were studied.

After obtaining informed consent, eligible cases were interviewed and demographic data, maternal medical history, and physical examination were documented by senior anesthesia residents under supervision. In the operating room, the standard monitoring was performed and preloading with 500 mL of crystalloids was started. In stable hemodynamic status, the spinal block was performed with a 25-gauge Quincke needle in a sitting position. To perform a subarachnoid block in CS, both sitting and lateral positions are commonly used. However, in a sitting position, the landmarks are easily identified; thus, it is technically safer and preferred in terms of the need for fewer attempts and more maternal satisfaction [23, 24].

After confirmation of the dural puncture with clear CSF flow, 2.5 ml of bupivacaine 0.5% was injected and the subject laid flat quickly. Any adverse effects, such as hypotension, nausea and vomiting, and shivering were documented, as well. The same protocol was considered for all women. The procedure was performed by the on-duty anesthesia resident regardless of his level. Another resident not present on that day followed up the patients for up to 7 days. In the hospital, by face-to-face visits and after discharge from the hospital by making phone calls, the cases were followed up on days one, three, and seven. They were also recommended to return to the

hospital or call in any complicated state not restricted to the mentioned days. They were questioned about any type of headache experience and its characteristics.

According to the PDPH definition, cases with frontal or occipital HA, worsening while standing, and alleviated by lying flat were diagnosed as PDPH. The patients were advised to drink liquids and rest in the supine position and take two Novafen capsules containing acetaminophen 325 mg plus caffeine 40 mg plus ibuprofen 200 mg, manufactured by Alhavi Pharmaceutical Company, every 8 hours if needed. The patients could score their pain severity from 0 to 10; 0 represented “no pain”, while 10 represented the highest degree of pain. The scores 8-10 were considered as severe pain. Moreover, if patients’ symptoms were resistant to the conventional pharmacological and non-pharmacological treatments it was marked as persistent HA and the patient was recommended to refer to the hospital for more evaluation. In conditions with no improvement, the epidural patch was considered.

### Statistical analysis

The collected data were analyzed by SPSS v. 21 using Chi-squared and Fisher’s exact tests. The data were presented as Mean±SD. Statistically, a P-value of less than 0.05 was considered significant.

### Results

The data of 147 eligible cases were analyzed. The Mean±SD age of our cases was 30.68±5.95 years (range: 17-46 years), their mean body mass index (BMI) was 33.33±6.2 kg/m<sup>2</sup> (range: 22.07-48.54 kg/m<sup>2</sup>), 12 cases (8.16%) developed HA, and 9 cases (6.1%) were diagnosed with PDPH. None of them experienced a severe or persistent HA and recovered within 4 to 5 days. Also, 27.9 % of SA were done by junior residents and 72.1% by senior residents. HA mostly was resolved by rest and hydration and only 3 patients required medications. No significant relationship was found between PDPH development and the level of residents (P=0.384), BMI (P=0.106), age (P=0.093), and the experience of SA (P=0.509). However, the occurrence of PDPH was statistically related to early ambulation (P=0.0001), the number of attempts (P=0.001), and the history of HA (P=0.0001) (Table 1).

### Discussion

In this study, the frequency of PDPH was 6.1%, which is almost close to the minimum border of the reported range (0.4- 25%) [25]. It was the first research focusing

**Table 1.** Comparison of the risk factors between cases with and without PDPH\*

Variables	Status	No. (%)		P
		Patients With PDPH	Patients Without PDPH	
Ambulation time	12 hours	5(55.6)	4(44.4)	0.0001†
	18 hours	4(2.9)	134(97.1)	
Residents' experience (level) of	1	3(7.3)	38(92.7)	0.384
	2	5(8.5)	54(91.5)	
	3	1(2.1)	46(97.9)	
Number of dura punctures	1	1(1.1)	92(98.9)	0.001†
	2	5(11.9)	37(88.1)	
	3	3(30)	7(70)	
	4	0(0)	2(100)	
History of PDPH	Yes	4(36.4)	7(63.6)	0.0001†
	No	0(0)	71(100)	
Experience of SA**	Yes	4(4.9)	78(95.1)	0.509
	No	5(7.7)	60(92.3)	
BMI*** ( $\frac{\text{kg}}{\text{m}^2}$ )	<25	0(0)	11(100)	0.106
	25-30	0(0)	39(100)	
	30-35	6(12.8)	41(87.2)	
	35-40	1(3.7)	26(96.3)	
	40<	2(8.7)	21(91.3)	
Age (y)	30>	7(9.7)	65(90.3)	0.093
	30<	2(2.7)	73(97.3)	

\* Post-Dural Puncture Headache; \*\* Spinal Anesthesia; \*\*\* Body mass index; †Significance level <0.05.

on this issue in a referral academic center in the North of Iran, with an annual admission rate of more than 4000 CS cases. We found that the history of previous PDPH, early ambulation, and the number of attempts could significantly affect the PDPH occurrence. However, the resident's experience, having a history of SA, and BMI were not found as predisposing factors.

It was expected that the number of attempts could be a predictor for PDPH due to multiple punctures and more CSF leakage. However, considering that the resident's experience was not an affecting factor, it seems that multi-puncture was not the result of inexperience. Etezadi et al. in a similar study reported the incidence of

10.8% for PDPH, which was not significantly affected by BMI, age, history of HA, and coffee or tea consumption. They declared that this adverse event might be partly independent and unpredictable [1]. Davoudi et al. reported that an overall incidence of 12.7% for PDPH and also found that the frequency of PDPH in CS was significantly correlated with sitting position compared to lateral decubitus [26]. Gisore et al. from Kenya reported that the overall incidence of 20.35% for PDPH in their academic hospitals. They concluded that the use of Quinke needles was the main reason for the high incidence rate of PDPH [6]. Mohammad et al. reported the incidence of the rate of 32.58% for PDPH in CS under SA from an academic center. They recommended the use

of pencil-point needles or smaller sizes to achieve better outcomes [27]. Khraise et al. reported that repeated punctures and the history of tension headache were the main risk factors for PDPH in the woman who underwent CS under SA [9]. Vallejo et al. found that the type and size of the needle were important influencing factors in PDPH, while Khraise et al. did not find any direct effect [9]. A significant correlation between BMI and PDPH development was reported by Faure et al. [10]. Khraise et al. in line with our study did not support this observation [9]. Seeberger et al. demonstrated an inverse correlation between age and the incidence of PDPH [28]. In line with our findings, Rasooli et al. [10] in a teaching hospital reported that early ambulation led to a higher incidence of PDPH. The similarity between the methods of the two studies should be noted; both were performed in academic hospitals and the residents' experience, the drugs, and ASA class were the same. However, the frequency of PDPH was 1.27% in their study, markedly lower compared to ours. This superiority might be due to the differences between methods. In their study, the procedures were performed by attending and residents compared to our research, in which only residents were involved under the supervision of specialists. Additionally, the assessment accuracy might be different [10].

Tarekegn et al. from Ethiopia reported the prevalence of 42.6% for PDPH in cases undergoing CS under SA, which is almost seven times higher than our study. Larger used needles and repeated punctures were the reasons for this higher rate of incidence [29]. They also did not come across the previously confirmed risk factors for PDPH development, such as lower BMI, history of PDPH, and younger age. Siddiqui et al. from Pakistan reported an incidence of 8.7% for this complication in an academic center. It should be noted that emergency cases in hypovolemic and dehydrated status were not excluded and underwent SA by inexperienced residents during odd hours [30]. Firdous et al. found that the paramedian approach had an inverse association with PDPH occurrence [31]. In contrast, Uler et al. reported no significant relationship between this variable and PDPH [14]. It should be noted that the inclusion criteria were different between the two studies. In contrast to Firdous et al., Uler et al. only enrolled those with the ASA class II, and BMI >35 kg/m<sup>2</sup>, and cases with multiple gestations and any abdominal mass or ascites were excluded. Checkol et al. in a meta-analysis reported that the prevalence of PDPH following SA in CS was 23.47% and reported a relationship between normal BMI, multiple attempts, and needle size less than or equal to 22 gauge and the occurrence of PDPH [32].

In the literature, contrary results have been reported regarding predisposing factors for PDPH. This discrepancy emphasizes the fact that the real pathophysiology of PDPH has not been completely understood yet and also the necessity of performing this study in different areas. Moreover, it should be noted that the individuals' definition and perception of pain are different and could be influencing factors. Also, people have different pain thresholds and sensitivity and willingness to report pain, according to gender, age, and race, which are different in studies [33, 34]. This study was limited to a single center with a small sample size. Additionally, the significant number of drops could be considered a major limitation.

## Conclusion

Based on our findings, the frequency of PDPH was found to be 6.1%, which could be an acceptable result as it is in the ranged 0.4%-25%. We found that the occurrence of PDPH in a parturient candidate for CS under SA was associated with the history of HA, early ambulation, and the number of dura punctures. Women at risk for PDPH are suggested to be objectively screened before CS under SA.

## Ethical Considerations

### Compliance with ethical guidelines

This study was approved by the Ethical Institutional Committee of Guilan University of Medical Sciences (Code: IR.GUMS.REC.1398.398).

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### Authors' contributions

Conception and design: Gelareh Biazar and Vali Imantab; Analysis and interpretation: Cyrus Emir Alavi; Drafting of the article: Mahin Tayefeh Ashrafiyeh; Critical revision of the article for important intellectual content: Ali Mohammadzadeh Jouryabi; Final approval: Abbas Sedighinejad; Collection and assembly of data: Faezeh Emami; Supervision: Mandana Mansour Ghanaie.

### Conflict of interest

The authors declared no conflict of interest.

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