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HEADACHES AFTER SPINAL ANESTHESIA AND THEIR LINK WITH RELATED FACTORS IN CANDIDATES FOR CESAREAN

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Abstract

Background: During a cesarean section, spinal anesthesia can result in post-dural puncture headaches.

Objective: A group of female candidates for cesarean was studied to explore the link between post-spinal anesthesia headaches and factors, including age, BMI, blood pressure, fasting blood sugar, duration of immobilization in the supine position after spinal anesthesia, and history of prior spinal anesthesia and post-dural puncture headache. The needle size, type, and technique used for spinal anesthesia remained constant throughout the study.

Methods: A cohort study was conducted on 80 women who were scheduled to undergo cesarean sections at a hospital in Iran. Researchers used the numeric pain rating scale to assess the severity of the women's headaches following spinal anesthesia. Through t-tests and chi-square tests, the potential link between headaches and related factors was analyzed.

Result: The researchers found no significant association between headaches and factors such as age, BMI, blood pressure, fasting blood sugar, duration of immobilization in the supine position after spinal anesthesia, and history of prior spinal anesthesia and post-dural puncture headache ($P > 0.5$).

Conclusion: When performing cesarean sections, anesthesia providers should consider all possible factors that could cause headaches in women who have undergone spinal anesthesia, regardless of age, BMI, blood sugar levels, blood pressure, immobilization time, or prior history of headaches.

INTRODUCTION

For pain relief during a cesarean section (CS), spinal anesthesia (SA) is typically given. According to guidelines from the American Society of Anesthesiologists (ASA), a spinal block or epidural is recommended for most cesarean deliveries. This approach minimizes the medication the

baby is exposed to while enabling the mother to participate in the birth process (Thielen et al., 2023). However, SA may result in post-dural puncture headaches (PDPH), which are typically unavoidable. Research has indicated that the incidence of PDPH can range from 0 to 42.6% after SA and can increase to 81% in cases of accidental dural puncture (Abate et al., 2021). Additionally, it has been observed that about 90% of headaches occur within 72 hours following a lumbar puncture (LP), with 66% appearing in the first 48 hours. These headaches often do not respond to pain medication (Simões et al., 2022).

Research has indicated that the pressure of cerebrospinal fluid (CSF) decreases when implementing the LP method due to CSF leakage. Consequently, the brain's blood vessels expand to compensate for the decreased fluid volume and pressure. As these vessels are susceptible to feeling pain, individuals may experience PDPH following the SA process (Samadian et al., 2023). PDPH typically occurs five to 14 days after the LP procedure. While the pain can be severe, it may also be mild or moderate (Azzi et al., 2022). Patients undergoing PDPH may feel a burning, dull, or throbbing pain in their frontal, retroorbital, and occipital regions. They may also experience uncontrollable nausea, vomiting, photophobia, tinnitus, and other clinical symptoms. When the patient is seated for 15 minutes or is coughing and sneezing, their symptoms tend to worsen. However, lying down for 15 minutes in a supine position can provide some relief. The patient often experiences a sense of relief when they lie down (Youssef et al., 2021). Based on the criteria outlined in the International Classification of Headache Disorders, it has been determined that nearly 29% of patients experience headaches as their sole symptom. This finding indicates that the specific characteristics of headaches play a crucial role in diagnosing PDPH (Girma et al., 2022).

Anesthesia providers must take great care in avoiding misdiagnosis and inappropriate treatment when dealing with PDPH issues. After all, this condition can impede daily activities for up to seven days in 40% of patients (Thakur et al., 2022). To accurately evaluate the risk of PDPH, it is crucial to consider several factors. These include age, pregnancy, the frequency of lumbar punctures, gender (predominantly female), history of primary headaches, hydration levels, the use of cutting needle tips, and the direction and size of the needle bevel (Al-Hashel et al., 2022). Spinal anesthesia or lumbar puncture needles can be categorized based on their needle tip. Cutting tips, also known as Quincke needles, have a sharp cutting tip with a hole at the end of the needle. Pencil point or noncutting tip needles include Whitacre and Sprotte (Arslantas, 2022).

Researchers have identified several factors that could lead to the development of new PDPH. These factors include Body Mass Index (BMI), Fasting Blood Sugar (FBS), Blood Pressure (BP), immobilization, duration of spinal anesthesia (SA), previous SA, and history of PDPH. Extensive research has shown that these factors are statistically significant in predicting the occurrence of PDPH (Jha et al.; Kalinauskas & Juotkutė, 2021; Negi, 2022; Ramage et al., 2022). When caring for pregnant women, anesthesia providers must prioritize preventing and treating PDPH. This condition is more prevalent in this demographic, likely due to factors such as age and gender (Monga, 2021). We conducted this research study to explore the potential link between post-spinal anesthesia headaches

and various factors, including age, BMI, FBS, BP, duration of immobilization in the supine position after spinal anesthesia, and whether the candidate had had previous SA. We hypothesized that the technique used for spinal anesthesia and the needle size and type are more influential in reducing PDPH than other factors, as our experience and previous studies support.

METHODS

Study Design

This research used a cohort study design.

Settings

A cohort study was conducted in 2021 at Besat Hospital in Sanandaj, Iran, involving 80 women who were candidates for Cesarean sections.

Research subject

The researchers purposefully recruited all elective and non-elective CS candidates admitted to the hospital during the year. The women were informed about the study's method and asked for their willingness to participate. After obtaining informed consent, those who agreed to participate were included in the study. Women with a history of chronic headaches, back pain or lumbar diseases, drug addiction, regular use of antidepressants and pain medications preoperatively, and frequent spinal punctures for reasons other than SA were excluded from the study.

Instruments

During the 12th week of pregnancy, we collected demographic information, including age, history of prior spinal anesthesia, and post-dural puncture headache of the patients. We calculated participants' BMI using the formula BMI = kg/m^2 (where kg represents weight in kilograms and m^2 represents the height in meters squared) (Misra & Dhurandhar, 2019). Additionally, we noted the patient's blood pressure at the first and second visits using their medical record. The Numeric Pain Rating Scale (NPRS), a segmented numeric version of the visual analog scale (VAS), was used to measure headache severity. Patients rated their pain on a scale of 0 to 10, where 0 indicated no pain, and 10 indicated the highest possible pain. See Figure 1 (Modarresi et al., 2022).

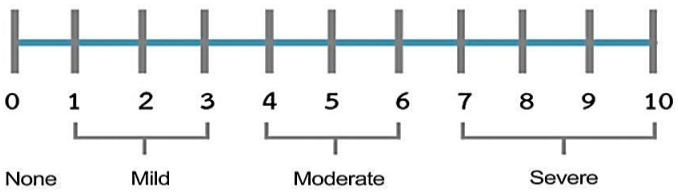


Figure 1. The Numeric Pain Rating Scale (NPRS)

Data collection

We focused on measuring the participants' FBS, BP, and BMI on the day of their surgery and observing the link between these factors and post-spinal anesthesia headaches. Female participants were given an IV infusion of 0.9% saline fluid, and their fluid intake was calculated based on weight to

maintain proper hydration during the procedure (Russell et al., 2019). While the patient was sitting in the operating room, the nurse used 10% iodine to disinfect the patient's back. Under sterile conditions, the anesthesiologist inserted a 25G Sprotte Spinal Needle perpendicularly into the patient's dura at the L3-L4 or L4-L5 intervertebral space. Once cerebral fluid flowed, the anesthesiologist injected 5% Lidocaine at 1.1 to 1.2mg/kg or 0.5% Bupivacaine at 12.5mg (2.5ml) into the dural puncture (Verma et al.). The patient's fluid intake was calculated based on weight and maintained consistently to ensure proper hydration during the procedure (Alemayehu et al., 2020).

The anesthesiologist prescribed Midazolam to sedate all patients during surgery, with a 1-2mg/kg dosage (Kumar et al.). A standard ECG monitor device, sphygmomanometer, and pulse oximeter were utilized to monitor the patient's vital signs, including BP closely. In cases where a patient's blood pressure dropped by 30% below their usual level, 10mg of intravenous Ephedrine was given to raise it (Samarah et al., 2020). Moreover, any instances of bradycardia with less than 50 beats/min were managed with 0.5mg of intravenous Atropine (Mirbagheri et al., 2020).

Patients who experienced headaches were instructed to lie in the maternity ward, where researchers monitored their supine position until the headache subsided. The severity of the headache was recorded, and in cases of persistent PDPH, patients were advised to rest in bed, stay hydrated, take NSAID pain medications, and receive an Epidural Patch for severe pain (scores 7-10 on the NPRS).

Data Analysis

The researchers thoroughly examined and analyzed the relationship between various factors, including patients' BMI before pregnancy, BMI at the 12th week of pregnancy, BMI, FBS, and BP on the day of surgery, and PDPH after CS. They employed descriptive methods, such as frequency tables, mean, mode, standard deviation, range, and median. They calculated the percentage and inferential statistics to provide a comprehensive summary of the research findings and determine the frequency of each variable. To investigate the association between headache and quantitative independent variables, the researchers conducted an independent t-test, utilizing the Kolmogorov-Smirnov test to analyze the normal distribution of the studied variables. In cases where the data did not follow the normal distribution, a nonparametric t-value was used. Additionally, we used a chi-square test to investigate the link between the two-level independent variables. All tests were conducted with a significance level of 5%. The researchers utilized SPSS software version 16 to analyze the data, ensuring accuracy and reliability in the results obtained.

Ethical Consideration

The study was approved and registered by the Ethics Committee of the Kurdistan University of Medical Sciences (Ethical code: IR.MUK.REC.1397.6675/14).

RESULTS

This descriptive cohort study recruited 80 female patient candidates for CS from Besat Hospital in Sanandaj, Iran. The study included women with an average age of 28.05 ± 5.46 years. Table 1 presents their demographic information.

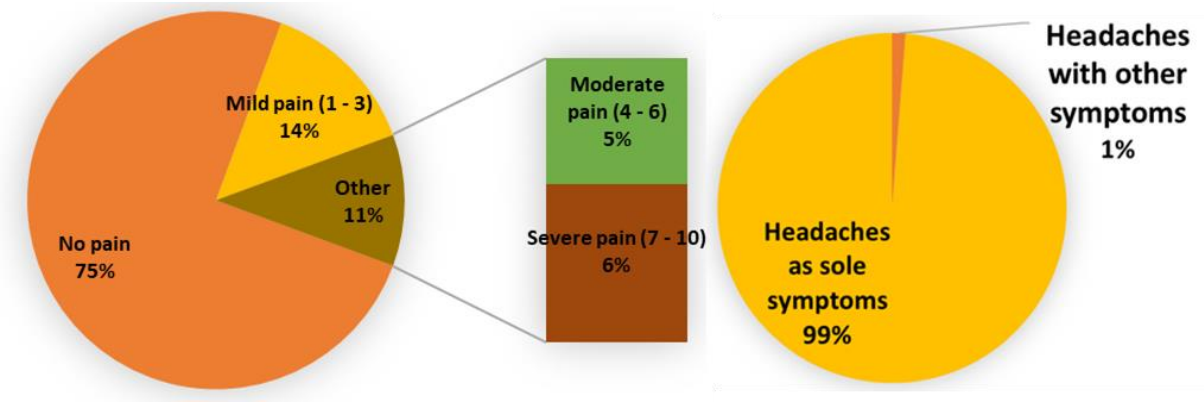
Table 1. Demographic characteristics of participants.

Variable	Mean ± SD
Age	28.05±5.46
Weight (kg)	72.11±12.30
Height (CM)	159.57±6.27
BMI (kg/m^2) at the 12th week of pregnancy	25.86±2.72
Duration of the operation (min)	38.21±7.27

Based on participant feedback, 25% reported experiencing headaches with varying intensity levels. These headaches ranged from 2 to 9 on the NPRS scale. Following the CS procedure, a participant reported experiencing headaches and other symptoms. For a more detailed breakdown of the percentage of headache severity, please refer to Figure 2.

Figure 2. The percentage of the severity of headaches experienced by patients after receiving spinal anesthesia.

The patients were carefully monitored for at least five days after SA to determine the duration



of their headaches. A t-test analysis revealed no significant link between headaches and factors such as age, BMI, FBS, or immobilization time in the supine position for patients who experienced headaches. For further details, refer to Table 2.

Table 2. The link between headaches and factors such as age, BMI, FBS, and immobilization time in the supine position after spinal anesthesia for patients who experienced headaches after spinal anesthesia.

Variables	Experiencing headaches after spinal anesthesia	Min	Max	Mean ± SD	T.Test	P.Value
Age (Year)	Yes	17.00	39.00	28.03±5.34	0.041	0.968
	No	19.00	41.00	28.08±5.65		
BMI* at the 12th week of pregnancy	Yes	21.79	34.10	26.12±2.72	0.880	0.382
	No	20.60	32.00	25.59±2.71		
BMI before CS†	Yes	24.22	37.00	30.39±2.74	0.573	0.568
	No	23.30	37.00	30.03±2.91		
FBS‡ (mg/ml) before CS	Yes	70.00	117.00	97.50±9.63	1.472	0.158
	No	78.00	149.00	93.78±13.41		
BP§ (mmHg) before CS	Yes	100.60	150.80	127.20±12.10	0.728	0.752
	No	97.40	160.80	126.34±12.05		
BP at the first visit to the ward	Yes	100.80	142.12	122.76±11.72	0.998	0.452
	No	104.73	150.75	124.71±11.38		
BP at the second visit to the ward	Yes	100.80	146.11	123.19±11.08	0.506	0.959
	No	104.72	155.75	123.33±12.39		
Time of immobilization in the supine position after SA (min)	Yes	80.00	140.00	110.25±18.36	0.135	0.423
	No	70.00	130.00	107.13±16.25		
The intensity of headache after SA	Yes	2.00	9.00	5.03±1.99	-	-
	No	-	-	-		

*BMI= Body mass index, †CS = Cesarean section, ‡FBS = Fasting blood sugar, §BP = Blood pressure

Table 3. Association between the history of Previous Spinal Anesthesia, Post-Dural-Puncture headache, and occurrence of post-spinal anesthesia headaches.

Variable		Post-spinal anesthesia headaches	No	%	χ^2	P
History of Previous SA	Yes	Yes	25	62.5	0.818	0.498
		No	15	37.5		
	No	Yes	21	52.5		
		No	19	47.5		
History of Previous PDPH	Yes	Yes	14	35.0	0.952	0.456
		No	26	65.0		

	No	Yes	10	25.0		
		No	30	75.0		

Based on the data presented in Table 3, there was no significant difference in headaches after SA between candidates with a previous SA and those with a history of prior PDPH.

DISCUSSION

This research investigated the link between headaches following spinal anesthesia and various factors such as age, BMI, FBS, BP, immobile supine position after anesthesia, prior spinal anesthesia history, and PDPH. The study focused on women who had undergone a cesarean section. The needle size, shape, and technique used for spinal anesthesia were kept constant throughout, and according to the study, nearly a quarter of the participants reported headaches of varying intensity following spinal anesthesia. This finding aligns with previous research (Abate et al., 2021; Girma et al., 2022). Our results show that most participants reported experiencing mild to moderate headaches. Our study also discovered that the proportion of individuals experiencing headaches and other symptoms was comparable to previous studies (Kafle et al., 2023; Simões et al., 2022; Tarekegn et al., 2017). Nonetheless, other medical conditions could also cause headaches after surgery, which could explain the variation in the number of cases.

The findings indicated that age did not play a significant role in causing headaches after spinal anesthesia, which aligns with the research of Tafesse and colleagues (Abdollahpour et al., 2022). Based on Doshi et al.'s research, the likelihood of experiencing PDPH decreased with increasing age among patients (Doshi et al., 2019). According to a study by Celep et al., a higher incidence of PDPH was observed in younger and female patients (CELEP et al.). The variances in our conclusions may stem from certain constraints. According to our sources, the researchers could not obtain specific details about the surgical process, such as the types of spinal needles employed on patients of varying ages, since this data was not documented. As a result, it would be more beneficial to examine patients while considering the available intraoperative data.

Our research found no significant link between BMI during the 12th week of gestation, BMI before the cesarean section, and PDPH. Our findings align with the study conducted by Beyaz et al., which also concluded that there is no connection between BMI increase and PDPH decrease in their participants (Beyaz et al., 2021). In their research, Makito et al. could not account for the impact of high BMI on patients undergoing SA, which was linked to a lower occurrence of PDPH (Makito et al., 2020). According to the study conducted by Hashemi et al., an inverse relationship was observed between PDPH and the patient's BMI, indicating an increase in BMI resulted in reduced PDPH (Hashemi et al., 2019). The reason why our research findings differ from those of other authors may be because of the spinal needles used. Other researchers used the most miniature needles for each patient, creating smaller puncture sites during LP. However, this made it simpler for fatty tissue to obstruct the flow of

cerebrospinal fluid. In contrast, we utilized the same size and type of spinal needle and anesthesia technique for all patients in our study.

Based on our findings, we did not observe any link between FBS and BP regarding post-spinal anesthesia headaches. Similarly, Aly and Elazeem's research showed no association between FBS, BP, and PDPH (Aly & Elazeem, 2019). Research conducted by Hwang et al. and Nielsen and Vamosiin revealed an inverse relationship between low glucose levels and the increased risk of PDPH (Hwang et al., 2020; Nielsen & Vamosi, 2020). Monitoring a patient's blood glucose and blood pressure after surgery can impact the accuracy of research outcomes, affecting the reliability of our findings. To maintain consistency, we conducted FBS and BP measurements for all participants on the day of their surgery and before the procedure.

Our research showed no connection between primary headaches caused by SA and PDPH, which aligns with Hashemi et al.'s study (Hashemi et al., 2019). As per the study conducted by Shivan et al., their results support the conclusion that there is no link between past PDPH and the onset of PDPH (Shivan et al., 2020). Unlike our results, Demilew et al. identified a significant statistical association between previous post-spinal anesthesia headaches and a record of PDPH in their investigation (Demilew et al., 2021). The study we conducted showed conflicting outcomes compared to the mentioned research. Possible reasons for this variation are the hydration level or underlying medical conditions that trigger headaches following SA. However, our findings suggest no link between past occurrences of PDPH and the chances of experiencing it again, which aligns with the studies mentioned.

Our research has shown no significant link between the length of time patients stay still on their backs after spinal anesthesia and their chances of getting headaches. Macones et al. advise that it is best to start moving around soon after a CS procedure to prevent complications such as blood clots, difficulties caring for a baby, and delayed bonding (Macones et al., 2019). The conclusion we have arrived at is backed by the research conducted by Choi and Chang and Shah et al. (Choi & Chang, 2018; Shah et al., 2018).

LIMITATION

However, our study had limitations, including the inability to include data from non-participants due to voluntary participation and the inability to control external factors such as environmental noise and postpartum anxiety that may contribute to patients' headaches in the hospital ward. Additionally, it is worth noting that our study only focused on a specific group of patients from one hospital - young pregnant women with unique characteristics who were candidates for spinal anesthesia. Hence, applying our discoveries to all headaches that occur after spinal anesthesia may take a considerable amount of time and effort.

CONCLUSION

This study found no significant association between post-spinal anesthesia headaches and factors such as age, BMI, blood pressure, fasting blood sugar, duration of immobilization in the supine position after spinal anesthesia, and history of prior spinal anesthesia and post-dural puncture headache. However, the incidence of post-dural puncture headaches following spinal anesthesia cannot be avoided entirely due to the nature of the procedure. Therefore, anesthesia providers should take all possible precautions to minimize the risk of PDPH and consider all possible factors that could cause headaches in women who have undergone spinal anesthesia. This study highlights the importance of pain management in cesarean sections and the need for further research on the topic to improve patient outcomes.

Our team researched extensively to develop a comprehensive strategy for identifying factors associated with post-spinal anesthesia headaches. Throughout the process, we closely monitored patients before, during, and after the spinal anesthesia to ensure optimal outcomes and impactful treatment management. Our findings demonstrated that consistent anesthesia technique and spinal needle type for all patients significantly influenced the results.

AUTHOR CONTRIBUTION

Authors' contributions: All the authors contributed equally to the study.

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Kamel Abdi : None.
Mehrdad Abdullahzadeh : None.
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CONFLICT OF INTEREST

The authors declared no conflict of interest.

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