West Kazakhstan Medical Journal
Volume 66, Issue 4, DOI 10.18502/wkmj.v66i4.17779
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Research Article

Incidence of Postdural Puncture Headache With 25G Quincke Needle Versus 25G Whitacre Needle After Spinal Anesthesia for Caesarean Section in a Tertiary Care Hospital

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Abstract

Background: Postdural puncture headache (PDPH) is the renowned complication from spinal anesthesia in caesarean section (C-section). Advancements in modifications to needle gauge and needle tip over the past five decades have led to a significant reduction in PDPH incidence. The present study aimed to compare the Whitacre needle with the Quincke needle in reducing the PDPH incidence in subjects undergoing C-section.

Methodology: A tertiary care hospital recruited 100 patients, who were randomly divided into two groups, with 50 in each group. The patient's age range was between 18 and 35 years and ASA grades I and II. The 25G-Quincke needle was used for Group A, and the 25G-Whitacre needle was used for Group B patients during C-section. The number of incidences, attempts, demographics, heart rate, mean arterial blood pressure, and efficacy data were analyzed to prevent the PDPH instances. The results were compared statistically by an unpaired t-test for continuous normal data and a Mann–Whitney U test for continuous nonnormal data. The comparison between the two groups was done by the chi-square test or Fisher's exact test for categorical data.

Results: Among the 100 patients, no statistical significance was observed in demographic data, heart rate (HR), or mean arterial blood pressure (MAP) in both groups at different time points. A significant difference between different days and PDPH was seen in group A, and no difference was observed in group B. PDPH severity was higher in group A than in group B. The duration of PDPH between 24 and 48 hours was longer in group A than group B. The number of spinal anesthesia attempts was higher in Group A (94%) than in Group B (86%).

Conclusion: The present study concludes that the PDPH incidence rate with 25G Whitacre needles was less compared to 25G Quincke needles. Thus, the pencil-point needle can be used regularly for C-section spinal anesthesia subjects.

Keywords: spinal anesthesia, spinal needle, cesarean section, postdural puncture headache

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Received: 15 June 2024
Accepted: 27 July 2024
Published: 20 December 2024

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1. Introduction

Spinal anesthesia is the most commonly practiced anesthesia method for C-sections to avoid the well-known problems that arise from general anesthesia. Spinal anesthesia became superior to general anesthesia in the prevention of nausea and shorter hospital stays. [1]. Other advantages, like intact consciousness and protective airway reflexes, also support the use of spinal anesthesia for C-sections [2]. Above all these aids, one of the most distressing conditions is postdural puncture headache (PDPH), which must be overcome with this technique. It is an unintentional dural puncture complication during epidural analgesia for medicinal neuraxial procedures. Incident rates vary broadly from 2 to 40%, depending on the type of procedure and patient issue [3–5].

PDPH are usually related to postural status and show their effect within the first 5 days of suspected dural puncture [6]. This kind of headache is often associated with neck pain or stiffness and is also subjective to hearing indications. Although the condition may be normal within 2 weeks, its impact or severity may interfere with daily routine work. These types of associated complications worsen their care for newborn children in postpartum patients [7].

The reason behind the occurrence of PDPH is associated with the needle size and type used while anesthetizing the patient. The literature says that needles like 25G Quincke showed a 20% increase in PDPH incidence rate, whereas the 27G Quincke incident rate is 12.5%, and the incident rate with 27G Whitacre needles is 4.5% [8–10]. Pathophysiology for the PDPH has not been completely analyzed yet, but a renowned fact is that there is leakage of cerebrospinal fluid (CSF) through the dural defect. The loss of the CSF causes pain in the spine and neck, tinnitus, intracranial structures become sensitive since the brain loses its support, and a rare scenario is either loss of smell or taste [11–13].

Though spinal anesthesia became popular with its advantages in providing quality analgesia, sympathetic blockade, profound muscle relaxation, and less intraoperative blood loss, fear of PDPH is limiting its use. As the PDPH incidents are directly related to gauge (G) and type of spinal needle, various efforts have been made to combat the side effects, that is, reducing the gauge and changing the tip design of the spinal needle [14].

Quincke spinal needle types usually have a terminal opening and a diamond-shaped cutting bevel end, whereas Whitacre spinal needles contain a lateral opening with a pencil point. The needle gauge and shape of the needle tip seem to play a crucial role in reducing the PDPH incidence [15]. A wise decision in choosing the needle for lumbar puncture shows fewer adverse events and speedy recovery for C-section patients, where they can be able to mobilize and give proper care to newborn babies. Several studies have revealed favorable evidence for spinal needles with a pencil-point tip, like Whitacre or Sprotte spinal needles. Nonetheless, some of the studies failed to confirm the lower incidence of PDPH when using pencil-point tip-type spinal needles [16–18].

This prospective study aims to compare the incidence of PDPH using a 25G Quincke spinal needle and a 25G Whitacre spinal needle in obstetric subjects undergoing spinal anesthesia for C-section. The main objective is to find the incidence of PDPH undergoing spinal anesthesia for C-section using 25G Quincke and 25G Whitacre needles.

2. Materials and Methods

The study was approved by the hospital ethical committee (ECR/300/Inst/AP/2013/RR-19), and all the participants were explained about the study in detail to obtain informed consent in a signed form. The study was conducted for one year, from January 2022 to December 2022. A total of 100 subjects were divided by systematic randomization numbering into two groups, 50 subjects in each. All odd-numbered patients in Group A (the control group) received spinal anesthesia with a 25G Quincke needle. And even the number of patients assigned to Group B (the study group) received spinal anesthesia with a 25G Whitacre needle. The study inclusion criteria were the 18–35-year-old age group, subjects undergoing elective C-section, ASA grade I and II subjects, and singleton uncomplicated pregnancy. The exclusion criteria followed in this study were ASA grade III and above, history of migraine or occipital neuralgia, pregnancy-induced hypertension, cardiovascular disorders, contraindications for neuraxial anesthesia, and more than three attempts.

A detailed history of the past and present was obtained from subjects; the 18G IV cannula was secured, and subjects were co-loaded with Ringer's lactate. A multi-channel parameter monitor was attached to measure heart rate, SpO2, NIBP, and ECG prior to spinal anesthesia, and preoperative readings were recorded for all the subjects. In both groups, all the subjects were given spinal anesthesia by the same postgraduate anesthetist. Following strict asepsis, spinal anesthesia was given using 10 mg of 0.5% Bupivacaine Hydrochloride with the subject in the left lateral position, using needles depending on the group the subject belongs to. Motor block adequacy was assessed by the modified Bromage scale.

Vitals were monitored and maintained intra-operatively. Mean blood pressure was monitored at three-minute intervals, and any decrease greater than 20% from baseline was treated with a 100-ml bolus of crystalloids and an incremental bolus of 6 mg intravenous ephedrine. Total 10 units of oxytocin were administered intramuscularly and by intravenous infusion after the delivery of the baby. In cases of failure of SAB, defined as the inability to obtain a free flow of CSF after three attempts or inadequate analgesia after 15 minutes of local anesthetic administration, general anesthesia was administered. The number of attempts to establish successful SAB was also noted for each needle type. During the postoperative period, subjects were followed up and questioned about the incidence of headaches and associated symptoms for a period of 3 days.

In cases of positive history, onset, duration, location, quality, aggravating and relieving factors, and associated symptoms were enquired. In cases of headaches, subjects were advised to get good hydration.

IV fluids, if necessary, were administered. An analgesic injection of Diclofenac 50 mg IM 12th hourly was given.

2.1. Severity of Postdural puncture headache

Mild PDPH: no limitation of activity, not associated with nausea and vomiting, moderate PDPH, limitation of activity, occasionally associated with nausea and vomiting. Severe PDPH: confined to bed, often associated with nausea, vomiting, and auditory and visual disturbances.

3. Statistical Analysis

Data was analyzed by Microsoft Excel and statistical software (IBM SPSS Statistics for Windows, Version 13.0 [IBM Corp., Armonk, NY]). The data was summarized by mean ± SD for continuous data and % for categorical data. The comparison between the two groups was done by an unpaired t-test for continuous normal data and a Mann–Whitney U test for continuous nonnormal data. The comparison between the two groups was done by the chi-square test or Fisher's exact test for categorical data. All p-values less than 0.05 were considered statistically significant.

4. Results

The minimum and maximum age were 20 and 33 years in group A, and 19 and 32 years in group B, respectively. The mean age was 24.8 ± 3.3 years in group A and 24.5 ± 3.1 years in group B. The minimum and maximum height, weight, and gestational age, along with mean ± SD data, are given in Table **1**. There was no significant difference observed between the two groups for the demographic data.

Table 1: Demographic data for control and study group.

	Group A (N = 50)	**Group B (N = 50)**
Age (Years)	24.8 ± 3.3	24.5 ± 3.1
Height (cms)	115.5 ± 6.2	117.8 ± 7.8
Weight (Kg)	61.1 ± 7.6	63.1 ± 7.7
Gestational Age (Weeks)	38.2 ± 1.1	38.3 ± 1.2
ASA grade (I/II)	42/8	45/5

The preoperative mean heart rate was 93.2 ± 14.6 and 90.1 ± 13.0 in groups A and B, respectively. After that, the heart rate was captured every 10 minutes, i.e., 10, 20, 30, 40, 50, and postoperatively. The respective heart rate analysis is depicted in Table **2**. There was no statistical significance observed in heart rate between the control and study groups except at the 10-minute time point.

Table 2: Comparison between 'A' and 'B' groups for the parameter heart rate at different time points.

	Group A (N = 50)	Group B (N = 50)	P-value
Preoperative	93.2 ± 14.6	90.1 ± 13	0.274
10 mins	99.0 ± 11.1	93.4 ± 10.9	0.013
20 mins	91.6 ± 10.7	89.7 ± 10.7	0.387
30 mins	89.5 ± 9.9	88.8 ± 9.9	0.703
40 mins	87.0 ± 8.5	87.9 ± 9.9	0.627
50 mins	88.3 ± 8.1	87.4 ± 9.6	0.581
Postoperative	87.3 ± 8.3	87.9 ± 8.7	0.712

The mean arterial pressure at different time points was recorded in both groups, and the data is given in Table **3**. There is no significant difference between the 'A' and 'B' groups for the parameter mean arterial pressure at all time points.

Table 3: Comparison between 'A' and 'B' groups for the parameter mean arterial pressure at different time points.

	Group A (N = 50)	Group B (N = 50)	P-value
Preoperative	83.2 ± 5.3	82.0 ± 5.4	0.264
10 mins	80.4 ± 5.3	82.5 ± 5.6	0.054
20 mins	82.3 ± 4.4	81.8 ± 5.0	0.611
30 mins	82.9 ± 4.8	81.9 ± 5.1	0.302
40 mins	82.2 ± 4.9	82.5 ± 5.4	0.772
50 mins	83.0 ± 4.4	82.1 ± 4.4	0.322
Postoperative	83.2 ± 5.2	82.7 ± 4.5	0.653

The PDPH on day 1 in group A subjects was 7 (14%), on day 2 it was 3 (6%), and on day 3 it was 0 (Table **4**). There was a significant difference between different days and PDPH in the 'A' group. The PDPH for group B on days 1 and 2 was 1 (2%) on each day, whereas on day 3 it was 0. The PDPH burden on a number of patients was reduced with 25G Whitacre needles. The mild severity of the 'A' group was seen in 10 (20%) subjects, whereas the severity in the 'B' group was in 1 (2%) subject (Table **5**). The difference in PDPH was observed from Day 1 in Group B, which is seen only in 2% of the patients.

Table 4: Comparison between different days and PDPH in a number of subjects of groups A and B.

	Days	PDPH		P-Value
Group A		**Yes**	**No**	
	1	7	43	0.019
	2	3	47	
	3	0	50	
Group B	1	1	49	1
	2	1	49	
	3	0	50	

Table 5: Severity distribution of subjects in groups 'A' and 'B'.

Groups	Mild–Severity	Percent (%)
A	10	20
B	1	2

The duration of PDPH < 24 hours was 7 (14%) in group 'A' and 2 (4%) in group 'B'. The duration of PDPH for 24 to 48 hours was 3 (6%) in group 'A', and it was 0 in group 'B'. There was no significant difference between groups 'A' and 'B' that was noted, and there was also no statistical difference in the duration of PDPH (hours) observed (Table **6**). The failed spinal were 1 (2%) in group 'A' (Table **7**), and they were 3 (6%) in group 'B'. There was no substantial difference between groups 'A' and 'B' in failure rate.

Table 6: The comparison between groups 'A' and 'B' and duration of PDPH (hours).

Groups	Duration of PDPH		P-value
	< **24**	**24 to 48**	
A	7	3	1
B	2	0	

Table 7: Comparison between groups 'A' and 'B' for failed spinal.

Groups	Failed		P-value
	Yes	**No**	
A	1	49	0.617
B	3	47	

The number of spinal anesthesia attempts was tabulated in Table **8** for both groups. It was found that 94% of the subjects in Group A completed the first attempt, and only 6% of the subjects required a second attempt. In group B, 86% required a first attempt, and 14% of the subjects underwent a second attempt. There was no statistically significant difference observed between groups 'A' and 'B' in the number of attempts.

Table 8: The comparison between groups 'A' and 'B' and attempts.

Groups	Attempts		P-value
	1	**2**	
A	47	3	0.318
B	43	7	

5. Discussion

In the recent era, 80 to 95% of C-sections are following spinal anesthesia due to its ease of technique, high success rate, fast onset, definitive end point, and high-quality motor and sensory block. Quick

postoperative analgesia without facing any kind of airway obstruction or risk of aspirations. [19] Though spinal anesthesia is considered to be safe, it is not measured as a complication-free method. Numerous studies have shown the incidence of dural puncture headaches and the failure rate of spinal anesthesia in subjects undergoing C-sections using cutting and noncutting bevel spinal needles [20]. In the present study, a comparison was done in 100 healthy subjects, ASA 1 and 2, and young participants undergoing elective C-section under spinal anesthesia. The mean age, height, and weight of the subjects in the two groups were similar, as shown in Table **1**.

The main contributing factor to the high incidence rate of PDPH is the gauge and spinal needle type used [21]. In the present comparative study, PDPH incidence is 12% (12/100). As shown in Table **4**, the incidence rate is 4% in the study group where a pencil-point needle was used, but the incidence rate increased to 20% in the control group where a Quincke-type needle was used. A statistical difference of 0.019 was observed for the number of incidences. According to the literature, postoperative headaches in patients were distributed over the frontal and occipital areas, radiating towards the neck when in an upright position and showing straining or relief while lying down [22, 23].

Literature says that the most headaches start appearing either on day 1 or 2 postoperatively. In the study by Vandam LD et al., around 75% of headaches occurred by the end of the third day, and 85% of them occurred by the sixth postoperative day [24]. In concordance with their study, PDPH occurred in eight patients on the first postoperative day (80%) and four patients on the second postoperative day (40%) after spinal anesthesia.

In a study conducted by Lynch J. et al., the mean duration of headaches lasted for 48 hours and 57.5 hours in the 25- and 22G needle tip groups, respectively [25]. In the current study, the duration of PDPH was less than 24 hours in nine patients and less than 48 hours in three patients. We observed that none of the subjects had a headache for more than 48 hours. PDPH severity ranged from mild to moderate in various research studies. The general grading system for PDPH is numerical rating score 11 (NRS-11) with an 11-point numeric scale. With this scale, patients can report the intensity of pain on their own, where 0 is considered no headache, 1-3 is mild pain, 4-6 is considered moderate pain, and 7–10 is reported as severe pain [26]. A meta-analysis conducted by Choi PT et al. [27] on parturient to regulate the onset, occurrence, and PDPH duration. They explained that the PDPH incidence rates varied from 1.5 to 11.2% based on the type of spinal needle used during the procedure. They concluded that the 27G Sprotte needles and Whitacre 25G needles have shown lower PDPH incidence than Quincke 25G needles.

In a study conducted by Brownridge P. et al. [28], the severity of PDPH was noted as 8, 3, and 2.3% of cases having undergone mild, moderate, or severe headaches, respectively. In our present study, 2% of the patients experienced a mild form of PDPH with zero limitations of activity and were not related to any kind of uneasiness like nausea and vomiting. Those 2% of subjects who suffered from mild headaches were suggested to take bed rest, adequate hydration, and simple analgesics like tablet paracetamol with caffeine combination to regain pain.

In a study conducted by Ferede YA, et al. [29], 51% of the patients experienced moderate pain, 17% of them had moderate pain, and the rest of the patients had mild pain. In the present study, mild pain was recorded in group B; the reason could be the size of the needle used for the anesthetic procedure, the extreme care taken towards leakage of the CSF, furthermore, sufficient oral hydration, and on-time patient care during the hospital stay.

Fettes W. et al. have researched mechanisms, management, and prevention of failed spinal anesthesia [30]. The results of their research revealed that pencil-point spinal needles staddled the dural fiber when compared to cutting needles, which led to the injected anesthetic solution into either subdural space or epidural space even after CSF aspiration was done successfully. However, the present study has faced only 6% failure rates in the study group, compared to 2% in the control group. We did not observe any statistical significance between the groups. Similarly, no significant difference was observed in heart rate or mean arterial pressure in both groups.

According to the literature, atraumatic needles will reduce the PDPH risk without any side effects [31]. It is advisable for health care professionals to use a traumatic needle in their daily clinical practice to avoid the onset of PDPH. The present study found that using Whitacre needles over Quincke needles reduced PDPH incidents and was also safer during surgery with Whitacre needles.

6. Limitations

Along with the advantages of Whitacre needles, a few limitations are their relatively small sample size and single-center study. In the present study, we could not use the normal population as a control group. Another limitation of this study is the lack of an objective headache assessment tool. Future studies should focus more on the widespread indications rather than restricting them to C-section alone. Also, we could investigate the use of pencil-point spinal needles in obstetric patients, even in tertiary care hospitals. Safe whitacre needles are now available for high-risk pregnancy patients; future studies can extend to high-risk pregnancy by providing them with a painless postoperative C-section.

7. Conclusion

In conclusion, the present comparative study was conducted between two different types of 25G needles: one is a cutting-edge needle (Quincke), and the other is a pencil-point spinal needle (Whitacre). We infer that the lower incidence of PDPH was observed with the Whitacre needle over the quincke needle. The efficacy data of ease of insertion, severity of pain, and number of attempts were satisfactory with the Whitacre needles. Therefore, 25G Whitacre needles are suggestable and relatively useful for anesthesia dural puncture in the C-section population.

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