

## RESEARCH ARTICLE

# Study to compare the incidence of post-dural puncture headache in obstetric patients using cutting and pencil-point spinal needle in spinal anesthesia

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## ABSTRACT

**Background:** Spinal anesthesia is one of the most commonly used regional anesthesia techniques. Post-dural puncture headache (PDPH) is a well-known iatrogenic consequence of spinal anesthetic and diagnostic lumbar puncture, primarily caused by loss of cerebral spinal fluid. To reduce complications, spinal needles have undergone modifications. The two most important modifiable risk variables for PDPH were needle shape and size. In young expecting mothers, post-cesarean sections are associated with an increased incidence of PDPH. **Aims and Objectives:** The aims and objectives of the study are to compare the incidence of PDPH in obstetric patients using cutting and pencil-point spinal needles following spinal anesthesia. **Materials and Methods:** This 1-year double-blind study was carried out in the Department of Anaesthesia from August 2021 to July 2022. The study comprised obstetric patients who were scheduled for elective-segment cesarean section. The subarachnoid block needle was divided into Groups A and B at random: Group A 25-gauge Whitacre spinal needle with a pencil point, whereas Group B 25-gauge Quincke spinal needle with a cutting bevel. Records were kept on age, height, weight, and gestational age. A follow-up was conducted up until the discharge date. The incidence and severity of PDPH after spinal anesthesia were examined in both groups. The results were analyzed with SPSS 20.0, and the Fischer exact and Chi-square tests were used to look for statistical significance. **Results:** The current study included 120 patients in total, 60 patients in each of Groups A and B. When a pencil point Whitacre was used, the incidence of PDPH was 2 (3.3%), however, when a cutting Quincke needle was used, the incidence was 7 (10.8%). With a  $P < 0.05$ , the relationship between the two was considered statistically significant. The pain severity was mild in both patients of Group A. Of the seven patients in Group B, four had mild pain, two had moderate pain, and one had severe pain. **Conclusion:** The pencil-point 25-G Whitacre spinal needle has a lower incidence of PDPH than the traditional 25-G Quincke needle and was suggested for patients at risk of PDPH. In light of this, the current study suggested using pencil-point spinal needles for lumbar punctures and spinal anesthesia in obstetric patients.

**KEY WORDS:** Anesthesia; Cutting Spinal Needle; Pencil-Point Spinal Needle; Post-dural Puncture Headache

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## INTRODUCTION

Spinal anesthesia, that has become popular because it is considered safer than general anesthetics and has a lesser complication rate, has additional benefits such as lower costs and easier patient control. A number of needle design parameters, including size and shape, have been changed to

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allow for quick passage of injected drugs and cerebral spinal fluid (CSF) while limiting dural damage and CSF loss.<sup>[1]</sup>

The International Classification of Headache Disorders defines post-dural puncture headaches (PDPH) as a type of headache that develops 5 days after the puncture, gets worse when standing up, gets better when resting on the back, and may come with nausea, tinnitus, and photophobia.<sup>[2]</sup> Increased estrogen levels raise the risk of PDPH by altering cerebral blood vessel tone and lowering CSF, especially in pregnant women. Spinal anesthesia-induced PDPH is a significant contributor to postpartum morbidity in mothers, resulting in longer hospital stays, higher expenditures, and delayed discharge.<sup>[3]</sup>

There are various grading systems for classifying the severity of PDPH. The most used grading system is a numerical rating score of 11. Patients can rate their discomfort using the 11-point numerical scale it contains. On a 10-point rating system, 0 represents no evidence of headache, 1–3 indicate mild pain (annoying, irritating, and not much interfering with daily activities), 4–6 indicate moderate pain (substantially interfering with daily activity), and 7–10 represent severe pain (disabling; unable to do normal activities of daily living).<sup>[4]</sup>

PDPH can occur for a variety of reasons, including patient-related or technical issues, and they can be avoided or reduced by resolving some controllable factors. Gender and age are patient-related causes. There are several technical causes, including the type of needle, the thickness of the needle, the amount of trials, and experience.<sup>[5]</sup>

The bevel orientation and insertion angle, stylet replacement, operator experience, needle size, and needle shape were among the modifiable risk factors of PDPH. In the practice of spinal anesthesia, numerous varieties of spinal needles have been reported; they can be broadly categorized as sharp or blunt-tipped. Sprotte, Whitacre (pencil-point), and grain needles are examples of blunt-tipped needles; Quincke-babcock, Atraucan, and Pitkin needles are examples of cutting tips. Perhaps the most important element in the development of PDPH is needle size. Although diameters ranging from 19 to 30 G are available, most spinal needles used today are 22–27 G.<sup>[5]</sup>

Patients with mild PDPH typically had no restrictions on their activities and did not need therapy, however, those with severe PDPH had to stay in bed. To treat severe PDPH, an epidural blood patch (EBP) was commonly utilized, which involves injecting the patient's own blood into the epidural space to patch the hole caused in the dural tissues.<sup>[5]</sup>

In the past, the use of thicker and less precise spinal needles increased the incidence of PDPH. With regard to tip design,

cutting-point needles were more easily inserted through the skin and ligaments than pencil-point needles, which made it easier to locate the durameter with them. Diagnostic lumbar punctures and spinal anesthesia are vital tools in clinical therapy, reducing side effects and the incidence of post-dissociative post-stroke headaches is crucial.<sup>[6]</sup> While pencil-point spinal needles may cause fewer symptoms of PDPH, clinical and laboratory research have not conclusively shown that Whitacre pencil-point spinal needles are superior to Quincke needles in this regard.

### Aims and Objectives

The aims and objectives of the study are to compare the incidence of PDPH in obstetric patients using cutting and pencil-point spinal needles following spinal anesthesia.

### MATERIALS AND METHODS

The present study was conducted in a tertiary care center in south India. Ethical committee approval was obtained (SMIMS/IHEC/January 31, 2016). It was a double-blind trial in which the patient was uninformed of the needle type used, and the post-operative headache assessment was performed by someone who was also oblivious of the needle type. Of 120 obstetric patients in total who were scheduled for elective lower segment cesarean section under a subarachnoid block (SAB) were divided into Groups A and B at random.

- Group A – pencil-point 25-G Whitacre spinal needle
- Group B – Cutting beveled 25-G Quincke spinal needle.

All patients scheduled for elective and emergency cesarean sections were included in the study; patients with a history of migraine or recurrent headaches, as well as those who were unwilling to participate in the study, were excluded.

Pre-operative evaluations are completed for every case that is posted for elective surgery. Vitals in the surgery room were monitored. The patient was made to sit while 1.5–2 mL of 0.75% hyperbaric bupivacaine was administered using spinal needles in the L3–L4 interspace. Patients in Group A underwent SAB using a 25-G Whitacre needle, whereas patients in Group B underwent SAB using a 25-G Quincke needle. The patients were placed supine to achieve the appropriate degree of block. Before making an incision, the degree of sensory block was assessed at the surface of the skin.

Following surgery, every patient was asked questions regarding the onset, features, course, and accompanying symptoms of any type of headache for 5 days. One of the authors, who was blind to the kind of needle used, evaluated the responses. Three characteristics of postural dysphagia (PDPH) are as follows: (1) postural, which is worsened by

sitting or standing and improved by resting supine; (2) frontal or occipital; and (3) may involve nausea, vomiting, stiff neck, diplopia, or tinnitus. If the headache did not meet the PDPH criteria, additional major intracranial causes were ruled out. Initially, bed rest, fluids, and oral paracetamol (15 mg/kg) four times a day were used to treat PDPH. The choice to conduct an EBP was made by the consultant anesthesiologist if PDPH persisted for more than 24 h with the same severity.

The SPSS 20.0 version was utilized for performing statistical analysis. Numbers and percentages were used to represent categorical variables. For continuous variables, the unpaired *t*-test was used and for categorical variables, the Fischer exact test and the Chi-square test were used. A  $P < 0.05$  was considered statistically significant.

## RESULTS

A total of 120 patients were included in the present study with 60 patients each in Group A and B. With a  $P > 0.05$ , there was no statistically significant relationship between the spinal needle groups and mean age, height, weight, or gestational age [Table 1]. Pencil-point 25-G Whitacre spinal needles have a reduced incidence of PDPH than cutting beveled 25-G Quincke spinal needles. Table 2 shows the distribution of PDPH in both groups. Given that the  $P$ -value for the relationship between the two was  $<0.05$ , it was accepted as statistically significant. Table 3 describes the severity of PDPH in both groups of patients. The association between the severity of PDPH and the spinal needle groups was statistically significant.

## DISCUSSION

German physician Karl August Bier and his assistants initially reported the signs of PDPH in 1898. Bier assumed that the headache was brought on by CSF depletion. SAB is the anesthetic technique that is currently popular throughout the world for cesarean sections due to its high success rate, ease of use, and safety for both the mother and the newborn. The most upsetting side effect of SAB, however, is PDPH, which raises costs, lengthens hospital stays, increases morbidity, and unsatisfied patients. For this reason, PDPH continues to be a “big problem” for anesthesiologists.<sup>[7]</sup>

Due to their young age and sex, obstetric patients have a higher chance of developing PDPH. Reduced epidural pressure upon fetal delivery accelerates CSF leaking through the dural aperture, depriving the brain of its buoyant support and resulting in pressure on the meninges a structure that is sensitive to pain. The Monro-Kellie hypothesis further states that as a result of the decreasing CSF volume, there is raised intracranial blood volume and compensatory vasodilatation, which causes a headache.<sup>[8]</sup>

**Table 1:** Comparison of mean age, height, weight, and gestational age with two spinal needle groups

Variables	Group A 25-G pencil tip needle	Group B 25-G cutting tip needle	P-value
Mean age	24.87	25.63	0.865
Mean height	154.32	155.91	0.513
Mean weight	64.83	63.11	0.639
Mean gestational age	38.39	38.85	0.360

**Table 2:** Distribution of PDPH in both groups

PDPH	Group A 25-G pencil tip needle (%)	Group B 25-G cutting tip needle (%)
Present	2 (3.3)	7 (11.7)
Absent	58 (96.7)	53 (88.3)
Total	60	60

PDPH: Post-dural puncture headache

**Table 3:** Distribution of severity of PDPH in both groups

Severity of PDPH	Group A 25-G pencil tip needle	Group B 25-G cutting tip needle
Mild	2	4
Moderate	0	2
Severe	0	1
Total	2	7

PDPH: Post-dural puncture headache

Several studies using various needle tip designs were conducted globally to see whether there was a difference in the prevalence of PDPH. In the present study, the incidence of PDPH was lower with the use of a 25 gauge Whitacre (3.3%) needle than with a 25 gauge Quincke beveled needle (11.7%). Both of the Group A patients had mild discomfort. Out of the seven patients in Group B, four had mild, two had moderate, whereas one patient had severe symptoms.

The study by Eskander *et al.*<sup>[9]</sup> found that, although there was no statistically significant difference, patients in Group A 25-G spinal needle [Quincke] had a higher incidence of PDPH [10%] compared to patients in the 25-G pencil-point spinal needle group (0%). Nevertheless, the incidence of non-beveled spinal needles was still lower than that of Quincke (beveled) spinal needles. In addition, the study observed that one patient (3.3%) in Group B and five patients out of 30 (16.7%) in Group A experienced mild back pain.

Quincke (cutting tip) needles had a considerably greater incidence of PDPH (9%) than Whitacre (pencil point) needles, which had a 1% incidence, according to Oberoi *et al.*<sup>[10]</sup> These results were similar to the current study.

A 25-gauge Whitacre needle showed a PDPH incidence of 0.66% (1/150) in a study by Campbell *et al.*<sup>[11]</sup> involving 300 patients. According to the study, the incidence of PDPH was shown to be minimal with pencil-point spinal needles.

The meta-analysis by Zorrilla-Vaca *et al.*<sup>[12]</sup> included 57 randomized controlled trials. Of these, 32 compared the pencil-point design with the cutting-needle design, whereas 25 compared specific gauges with similar designs. Among studies that evaluated both design types, the analysis revealed that pencil-point design was linked with a statistically significant reduction in the incidence of PDPH ( $P < 0.001$ ) when compared with cutting needles.

In a study by Bano *et al.*,<sup>[13]</sup> 100 women between the ages of 18 and 35 years who were singleton pregnancy underwent spinal anesthesia for an elective or emergency cesarean section. According to the study, the incidence of PDPH was lower in the Quincke group, occurring in 0.75% of patients using a 25-gauge Whitacre.

Regarding the frequency of PDPH, Xu *et al.*<sup>[14]</sup> conducted a meta-analysis. According to the study, cutting spinal needles was 2.5 times more likely to cause problems during spinal anesthesia and diagnostic lumbar punctures than pencil-point spinal needles. Less severe PDPH was observed with the use of a pencil-point spinal needle (2.3 times greater in the cutting group). The difference was most noticeable in pregnant women (3.2 times greater in the cutting group).

The study was done by Xu *et al.*<sup>[14]</sup> covered a total of 25 randomized controlled trials. According to the study, using a pencil-point spinal needle would lead to a decreased rate of severe PDPH (risk ratio [RR] 3.27; 95% confidence interval [CI] [2.15, 4.96];  $P < 0.00001$ ) and PDPH (RR 2.50; 95% CI [1.96, 3.19];  $P < 0.00001$ ). In addition, the pencil-point spine needle group utilized EBP less frequently (RR 3.69; 95% CI [1.96, 6.95];  $P < 0.0001$ ).

Pencil-point spinal needles were found to be superior to cutting spinal needles in lowering the incidence of post-stroke hemorrhage (PDPH), according to research by Imarengiaye and Edomwonyi,<sup>[15]</sup> Mayer *et al.*,<sup>[16]</sup> and Akyol *et al.*<sup>[17]</sup>

## CONCLUSION

The current study, along with numerous other studies, indicates that the 25-G cutting spinal (Quincke) needle group experienced a higher frequency and severity of PDPH than the non-cutting (pencil point) needle group in patients who received spinal anesthesia. As a result, the authors suggested

using a pencil-point spinal needle for spinal anesthesia and lumbar puncture procedures.

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