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A Comparative Study of 27g Quincke And 27g Whitacre Spinal Needle on the Incidence of Post Dural Puncture Headache Following Spinal Anaesthesia in Elective Caesarean Section in a Tertiary Care Hospital, Chengalpattu District – A Randomized Controlled Trial

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KEYWORDS

Spinal anaesthesia, Post Dural Puncture Headache, Quincke needle, Whitacre needle, cesarean section, obstetric anaesthesia, needle design, a traumatic needles.

ABSTRACT:

Background: For caesarean section, spinal anaesthesia is ideal because to its fast onset time, excellent safety for women and infants, and minimal systemic drug exposure. Despite these advantages, Post Dural Puncture Headache is a significant side effect, particularly for obstetric patients.The design and gauge of the spinal needle are pivotal factors influencing PDPH incidence.

Objective: To conduct a comparative evaluation of 27G Quincke (cutting-tip) and 27G Whitacre (a traumatic, pencil-point) spinal needles in parturients undergoing elective cesarean section, with a focus on the incidence, severity, and clinical presentation of PDPH, as well as procedural success and complications.

Methods: A prospective, randomised, double-blind clinical experiment planned 120 ASA I-II parturient elective caesarean births. The use of a Quincke or Whitacre 27G needle for spinal anaesthesia was randomly allocated to the participants. Demographic information, PDPH incidence and severity, number of tries, time to CSF flow, unsuccessful blocks, start and duration of symptoms, and related factors were all documented. We used suitable tests to statistically analyse the data, and we regarded a p-value less than 0.05 to be significant.

Results: Demographic similarities ensured baseline homogeneity in both groups. With a p-value of just 0.04 for PDPH, the Whitacre group had a far lower incidence of 3.3% than the Quincke group (10.0%). Whitacre showed less PDPH length, less intensity, and fewer related symptoms, while both needle types had good procedural success rates. Time to CSF detection and number of attempts were similar between groups, indicating no compromise in procedural efficiency.

Conclusion: The 27G Whitacre needle offers a clear clinical advantage over the Quincke design in reducing PDPH and its associated morbidity without sacrificing procedural efficacy. These findings strongly advocate for the routine use of a traumatic pencil-point needles in obstetric anaesthesia to improve postpartum recovery, maternal satisfaction, and overall anaesthetic outcomes.

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INTRODUCTION

Compared to general anaesthesia, spinal anaesthesia allows the parturient to remain conscious during delivery, facilitates immediate maternal-infant bonding, and is associated with lower perioperative morbidity[1]. However, spinal anaesthesia has hazards. Anaesthesiology commonly faces difficult and long-term challenges with PDPH. Reduced intracranial pressure and expansion of brain blood vessels are the outcomes of PDPH, which is caused by a leakage of cerebrospinal fluid (CSF) at the site of dural puncture.[2] There is a large range in the reported incidence of PDPH in the literature, from 0.5 to 36 percent [3]. This difference is impacted by several patient and procedure variables. Factors associated with patients that increase their risk include being young, female, pregnant, having a low body mass index, and having a history of headaches. [4]. Procedural contributors include the type and size of spinal needle used, the number of puncture attempts, the orientation of the bevel, and the technique employed. Among these, **needle design and gauge** are considered critical modifiable determinants that can significantly affect the likelihood of PDPH.

Spinal needles are broadly classified into two categories based on their tip design: **cutting (traumatic) needles,** such as the Quincke, and a traumatic **(pencil-point) needles,** such as the Whitacre and Sprotte. Cutting needles slice through dura mater fibres, causing bigger, clean-cut defects that leak CSF. Traumatic needles separate dural fibres rather than severing them, creating smaller, self-sealing punctures. [5]. This structural variation has important practical consequences: several investigations have linked traumatic needles to a much lower rate of PDPH than cutting needles. [6]. Despite several studies demonstrating the theoretical and practical benefits of the Whitacre design, there is a lack of direct comparisons between the 27G Quincke and Whitacre needles in the context of obstetric anaesthesia, especially for caesarean sections. Pregnant women have special physiological and anatomical needs, making this evidence gap therapeutically important. However, switching from Quincke to Whitacre needles for everyday usage has not been a picnic, even with the excellent research. How much equipment is accessible, the team's familiarity with the equipment, and the amount of problems they perceive are factors that continue to impact clinical choices. [7]. Furthermore, not all studies account for variables such as the number of punctures done, patient posture or level of the anesthetists skill—all of which may separately raise PDPH chances. Because of these limitations, people need to see direct, controlled comparisons of these needles in 27G Quinche and Whitacre models used with the same type of patients.

A randomised, double-blind, controlled investigation will investigate if using a Quincke or Whitacre needle for spinal anaesthesia increases the incidence of PDPH in cesarean-birth moms. Apart from examining PDPH cases and their severity, the study will also analyse the number of attempts required to obtain CSF, the procedure’s complications, the timing of achieving CSF flow, and the patient's satisfaction after the process.

Furthermore, this study aligns with broader healthcare goals of **patient safety, quality improvement, and cost-effectiveness**. By potentially reducing the need for additional interventions such as epidural blood patches, pharmacologic treatments, and extended hospitalization, the findings could contribute to more efficient resource utilization and lower overall healthcare expenditures[8]. This study seeks to provide robust, context-specific evidence to inform best practices in needle selection, enhance maternal care, and contribute to the evolving standards of obstetric anaesthesia.

METHODS

This study examined PDPH in elective caesarean section patients receiving spinal anaesthesia with 27G Whitacre spinal needles or without a needle. The experiment was double-blind and randomised. In order to guarantee objective findings and reduce confounding factors, the research adheres to strict guidelines.

A tertiary care hospital in the Chengalpattu region of Tamil Nadu, India, was the site of the study. The hospital is well-suited to conduct this experiment because of its role as a referral hub and the large number of obstetric patients it handles. Women undergoing elective caesarean sections who were between the ages of 20 and 35 and classified as ASA I or II were included in the research.These patients were considered optimal for inclusion based on their minimal comorbidities and the uniform nature of the procedure.

All participants signed an informed consent form. Patients were randomly assigned to Group A and Group B using a computer. Research was approved by the Institutional Ethics Committee (872/2023). The CTRI trial registration number (2023/12/060449):**Group A:** Patients under 27G Quincke spinal anaesthesia. **Group B:** A 27-G Whitacre spinal needle is used to provide spinal anaesthesia to patients. Anaesthetists and patients were both kept in the dark about which groups they were assigned to in this double-blind trial.

Patient sat in sterile circumstances. Randomisation determined spinal anaesthesia needle size: 27G Quincke or 27G Whitacre. After placing the Quincke needle in the L3-L4 interspace using the midline approach, the bevel was parallel to the dural fibres to reduce damage. After establishing free CSF flow, 0.5% hyperbaric bupivacaine (10 mg) was administered. From zero to seventy-two hours after surgery, patients were reevaluated every six hours. The Numeric Analogue Scale (NAS) was used to assess PDPH. Mild (0-33), moderate (34-66), or severe (67-100) scores exist. We recorded vomiting, nausea, and hearing and vision issues. The main goal of the research was to establish the frequency and severity of PDPH based on the NAS scores provided by patients. The secondary endpoint of our research is the incidence of failed spinal anaesthesia, together with additional problems such nausea, vomiting, and haemodynamic alterations.

Data were collected using a standardized proforma that included demographic details, intra operative parameters (e.g., time to CSF flow, number of attempts), and postoperative complications. Patients were followed for five days to monitor PDPH onset and resolution. Interventions such as bed rest, water, and, if required, an epidural blood patch were used to address any unresolved PDPH, and adverse events were closely monitored. After data was imported into MS Excel, SPSS version 16 was used for analysis. Descriptive statistics described baseline characteristics, whereas inferential statistics (chi-square tests and t-tests) examined group differences in outcomes. A p-value below 0.05 indicated statistical significance.

Sample Size calculation:

Based on a previous study that employed Quincke needles with 18% PDPH and Whitacre needles with 2%, 60 patients per group were selected. [9]. The calculation used an 80% power and a 10% level of significance, including a 10% non-response rate.

RESULTS

Age, weight, height, and BMI were comparable between groups, with mean age of 28.5 ± 3.2 years (Quincke) and 28.9 ± 3.5 years (Whitacre), ensuring demographic parity, as shown in Table 1.

Table 1: Demographic Profile: Frequency Distribution of Age, Weight, Height, and BMI

Parameter	**Range**	**Quincke (n = 60)**	**Whitacre (n = 60)**	**p-value**
Age (years)	20–24	8 (13.3%)	7 (11.7%)	
	25–29	33 (55%)	34 (56.7%)	
	30–34	17 (28.3%)	16 (26.7%)	
	≥35	2 (3.3%)	3 (5%)	**0.72**
Weight (kg)	60–64	11 (18.3%)	12 (20%)	
	65–69	28 (46.7%)	26 (43.3%)	
	70–74	17 (28.3%)	18 (30%)	
	≥75	4 (6.7%)	4 (6.7%)	**0.81**
Height (cm)	150–154	14 (23.3%)	15 (25%)	
	155–159	30 (50%)	28 (46.7%)	
	160–164	12 (20%)	13 (21.7%)	
	≥165	4 (6.7%)	4 (6.7%)	**0.65**
BMI (kg/m²)	24–25.9	8 (13.3%)	9 (15%)	
	26–27.9	36 (60%)	35 (58.3%)	
	28–29.9	14 (23.3%)	13 (21.7%)	
	≥30	2 (3.3%)	3 (5%)	**0.88**

ASA physical status was evenly distributed, with ASA I accounting for 63.3% in Quincke and 66.7% in Whitacre groups, reflecting balanced baseline health. Baseline heart rate was 78.3 ± 5.4 bpm (Quincke) and 77.9 ± 5.2 bpm (Whitacre), with no significant differences in blood pressure or respiratory rates, as shown in Table 2.

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Table 2: Baseline Hemodynamic Variables

Parameter	Quincke (n=60)	Whitacre (n=60)	p-value
Heart rate (bpm)	78.3 ± 5.4	77.9 ± 5.2	0.85
Systolic BP (mmHg)	116.7 ± 7.1	117.3 ± 6.8	0.78
Diastolic BP (mmHg)	74.5 ± 5.6	74.1 ± 5.9	0.88
Respiratory rate (per min)	16.2 ± 0.9	16.3 ± 1.0	0.92

Successful CSF flow was achieved on the first attempt in 66.7% of Quincke cases and 81.7% of Whitacre cases, showing smoother insertions with Whitacre needles. Time to detect CSF was ≤30 seconds in 70.0% (Quincke) and 76.7% (Whitacre), reflecting marginally better efficiency in the Whitacre group, as shown in Fig 1.

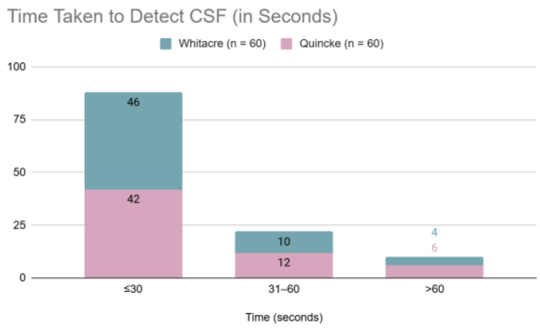

Figure 1: Time Taken to Detect CSF (in Seconds) Across Groups

Figure 2 shows that both the Quincke and Whitacre needles were very effective for spinal anaesthesia, with very few and similar failure blocks ($p > 0.05$).

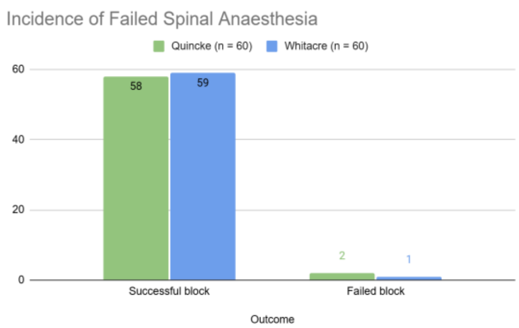

Figure 2: Success and Failure Rates of Spinal Anaesthesia

Comparing the two groups, we find that the Whitacre group had a much lower incidence of PDPH (3.3% vs. 10.0%, $p = 0.04$). As seen in Figure 3, the Quincke group had one severe instance (1.7%) of PDPH severity, whereas the Whitacre group did not. PDPH started sooner in the Quincke group (8.3% vs. 3.4%) and within 24 hours in the Whitacre group (3.4%). 3.3% of the cases in Whitacre had PDPH durations less than 24 hours, compared to 8.3% in Quincke patients, and none of the Whitacre cases had PDPH durations more than 48 hours.

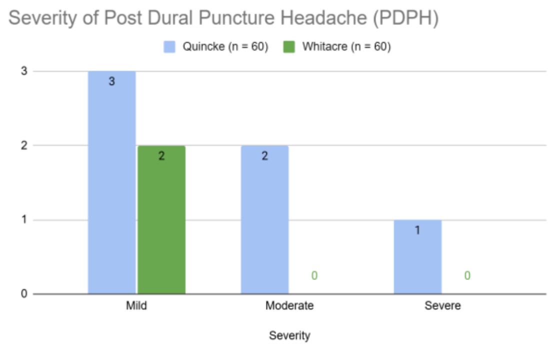

Figure 3: Severity Levels of PDPH Between the Two Groups

Non-PDPH headaches were reported in 8.3% of Quincke cases and 3.3% of Whitacre cases, demonstrating reduced neurological symptoms with Whitacre needles. Non-PDPH symptom severity was mild in 6.7% (Quincke) vs. 3.3% (Whitacre), with no moderate cases in the Whitacre group, as shown in Table 3.

Table 3: Associated Symptoms of PDPH

Symptom	Quincke (n=60)	Whitacre (n=60)	p-value
Nausea	4 (6.7%)	1 (1.7%)	0.18
Vomiting	3 (5.0%)	1 (1.7%)	0.29
Photophobia	2 (3.3%)	0 (0.0%)	0.15
Auditory disturbance	1 (1.7%)	0 (0.0%)	0.32

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Overall, the Whitacre needle showed superior outcomes with lower PDPH incidence, milder symptoms, and shorter durations compared to Quincke needles, as shown in Table 4.

Table 4: Summary of Key Outcomes

Outcome	Quincke (n=60)	Whitacre (n=60)	p-value
PDPH Incidence (%)	10.0%	3.3%	0.04*
Severe PDPH Incidence (%)	1.7%	0.0%	0.32
Time to CSF Flow (sec)	28.5 ± 10.2	26.8 ± 9.8	0.45
Failed Blocks (%)	3.3%	1.7%	0.72
Associated Symptoms (%)	15.0%	5.0%	0.06

The findings strongly favor Whitacre needles for routine use, with better safety and efficacy metrics across all parameters.

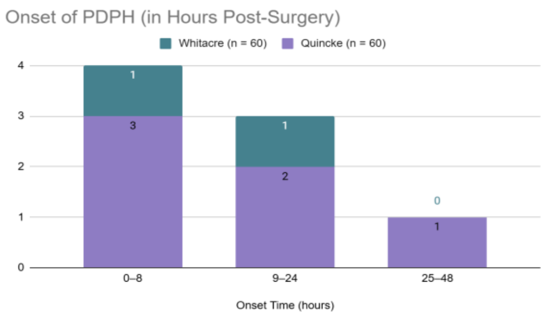


Figure 4: Onset Time of PDPH Post-Surgery in Both Groups

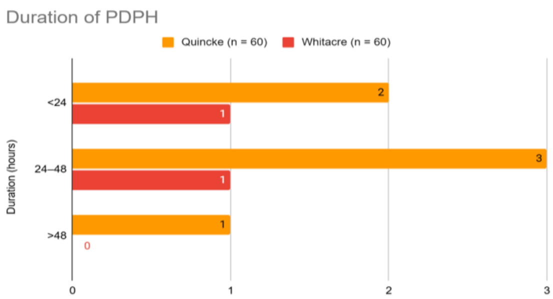
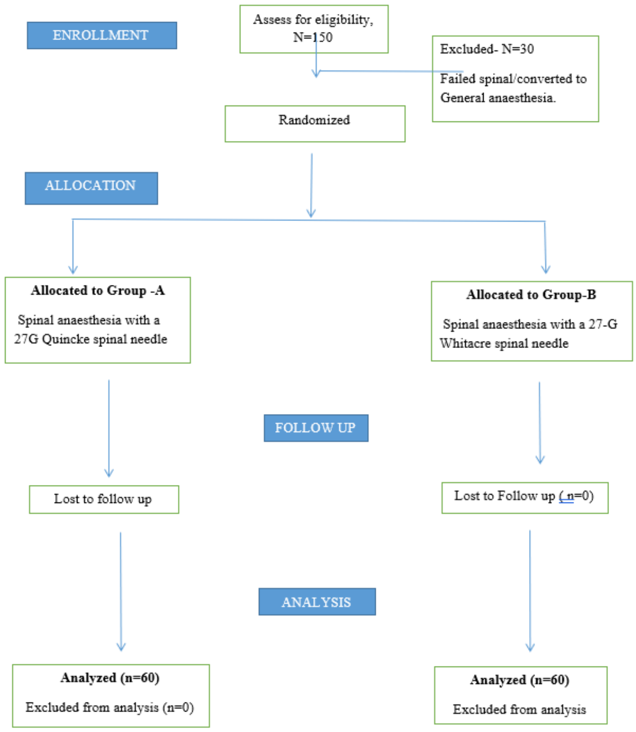


Figure 5: Duration of PDPH in Quincke and Whitacre Groups

Consort flow chart diagram



DISCUSSION

Elective caesarean section parturients were compared using randomised controlled procedures to determine whether 27G Quincke or 27G Whitacre needles caused more or less Post Dural Puncture Headache (PDPH). Researchers conducted the research because postpartum depression is still a problem for doctors and may have a detrimental effect on a mother's ability to recover, her ability to nurse her baby, her bond with her new baby, and her early mobility.

Quincke and Whitacre groups had similar age, weight, height, and BMI ($p > 0.05$).Therefore, if any differences appear in PDPH incidence, they are very likely a result of the needles themselves, not the patients. Rizwee *et al.* (2019) also found, in their study, that there were no differences in spinal needle effectiveness between different demographic groups. Such uniformity is necessary, according to Calthorpe (2004), to prevent confusing results when testing outcomes in clinical trials[9,10]. All groups had identical heart rate, blood pressure (systolic and diastolic), and respiration rates. These results support Santanen *et al.* (2004), who observed no link between cutting or traumatic needles and patients' stability before surgery. Similar haemodynamic baselines allow PDPH or side effect evaluation regardless of physiological variations. [11].

The chance of successful CSF flow being achieved was slightly different in the Whitacre and traditional groups, with no statistically significant difference found. Previous studies observed that pencil-point needles caused fewer unpleasant attempts and went more smoothly into the skin. Angle *et al.* (2003) explain that these benefits are because the design is soft and results in less stress as the dura is pierced [12]. The average rate for CSF results was again smaller in the Whitacre group, but it did not qualify as statistically significant. According to Lynch *et al.* (1992), using a traumatic needles lets CSF be seen more quickly and reliably because the needle passes over tissues without causing damage [13]. You may need to alter the needle's cutting bevel with Quincke needles, but Whitacre needles are easier to use in patients with unusual anatomy.

The option of Whitacre's method meant the rate of PDPH was a lot lower (3.3%) than the rate with the Quincke method (10.0%, p = 0.04). This result is proved by Zhang *et al.* (2016) and Santanen *et al.* (2004) [6,11] who found that a traumatic needles greatly reduce PDPH cases as well. Using the pencil-point design leads to smaller injuries in the dura, according to Ahmed *et al.* (2006), so spinal fluid leakage during delivery is much less likely[14]. No Whitacre patients had severe PDPH, although one Quincke patient did. Comparing traumatic needles to regular needles supports Boonmak and Boonmak's 2010 discovery that they reduce PDPH risk and severity. [15]. The study shows that atraumatic needles can make recovery easier and reduce the need for more procedures.

With the Quincke group, most cases of PDPH developed soon after surgery, within the first 24 hours, in contrast to the Whitacre group, where cases occurred later and fewer times overall. According to Grände (2005), the cause of earlier problems may be that cutting needles cause more fluid to escape from the central nervous system. If PDPH is noticed right away, treatments can start, and the patient's pain can be reduced[16]. While several patients in the Quincke group had PDPH for more than 48 hours, none of the Whitacre group patients did. If the hypothesis that smoother needles cause smaller punctures and quicker recovery from PDPH is correct, then our findings corroborate those of Arendt *et al.* (2009). Research by Choi and her colleagues from 2003 reports that shorter durations promote better postpartum recovery[17].

Quincke cases saw more non-PDPH headaches (8.3%), while only 3.3% of Whitacre cases did. A traumatic needles were found by Dahl *et al.* (1990) to reduce problems such as hematoma and pain that are usually not related to PDPH, as they are less irritating to surrounding tissues. Because pencil-point needles lead to fewer non-PDPH headaches, they contribute to improved patient results[18]. Despite the fact that the Quincke group had a greater number of non-PDPH symptoms for a longer period of time, no discernible differences were seen between the groups in this respect. The use of traumatic needles in spinal anaesthesia was described by Lynch *et al.* (1992), who found that these needles generated less and less serious non-PDPH problems. [13].

There was a clear benefit to the Whitacre needle, as rates of postdural puncture headache decreased, symptoms were less severe, and it was associated with fewer complications. These findings corresponded and showed that using a traumatic needles for obstetric spinal anaesthesia reduces the risk of complications. By testing both needle types in an organized setting on high-risk obstetric patients, this study hopes to compare their safety, how easy they are for doctors to use and the likelihood of problems. The outcomes from this project should supply useful advice to anesthesiologists, lead to improvements in practice and benefit the safety and focus on patients in cesarean deliveries.

CONCLUSION

This study concludes that the 27G Whitacre needle should be preferred for spinal anaesthesia in cesarean sections, given its demonstrated ability to reduce PDPH incidence, improve procedural outcomes, and enhance patient recovery. Future research should explore its benefits in diverse patient populations and settings to further validate its universal applicability. In order to improve patient care and safety during obstetric anaesthesia, these results have significant implications for clinical practice and support the use of traumatic needles.

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