Original Article

Incidence of Post-dural Puncture Headache: A Comparison of Quinckes' Versus Whitacres' Spinal Needles

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Abstract

Background: Repeated attempts at insertion, block failure, and post-dural puncture headache are the most common drawbacks of spinal anesthesia. This study was designed to re-evaluate these untoward effects of subarachnoid block. The primary aim of the study is to compare the incidence of post-dural puncture headache with 25-gauge Quincke's and Whitacre's spinal needles. The secondary objectives include assessing the difference in attempt rate and failure rate during subarachnoid block. **Materials and Methods:** In this randomized prospective study, 100 American Society of Anesthesiologists physical status I and II adult patients of both sex undergoing surgery below umbilicus under subarachnoid block were assigned in to two equal groups of 50 each; they were to receive spinal anesthesia either with Quincke's (group QC) or Whitacre's (group WP) spinal needles. The incidence of post-dural puncture headache, number of attempts required for successful insertion, and frequency of failed subarachnoid block were recorded. Data obtained were analyzed using *t*-test and Chi-square test. A value of $P < 0.05$ was deemed as statistically significant. **Results:** All the 100 patients completed the study. Significantly high rate ($P = 0.009$) of post-dural puncture headache was recorded in Quincke group (18%) as compared to Whitacre group (2%). In addition, the number of attempts required were less with Whitacre's needle; however, no statically significant association between the type of the needle, attempt rate, and failure rate during spinal anesthesia could be detected ($P = 0.2425$). **Conclusion:** Overall to reduce the number of attempts and the incidence of post-dural puncture headache, Whitacre's 25-gauge spinal needle has better option than Quincke's 25-gauge spinal needle for subarachnoid block.

Keywords: Dural puncture, headache, Quincke's needle, subarachnoid block, Whitacre's needle

Introduction

Spinal anesthesia (SA) has become more popular because it results in a good quality of analgesia, sympathetic blockade, profound muscle relaxation, and less intraoperative blood loss. However, the fear of precipitating post-dural puncture headache (PDPH) after SA currently limits its use. Since the incidence of PDPH is directly related to gauge (G) and type of spinal needle. To combat this side effect, various efforts have been made including reducing the gauge and changing tip design of the spinal needle. Among them, Quincke's cutting tip needle and Whitacre's non-cutting, pencil point tip needle [Figure 1] to decrease PDPH, have also been tried out.[1–3] However, there are few studies reported in the literature comparing the 25-G Quincke's and 25-G Whitacre's spinal needles. Hence, the present study is an attempt to re-evaluate and compare the incidence of PDPH, the number of attempts required to administer successful subarachnoid block, and rate of block failures during SA with 25-G Quincke's and 25-G Whitacre's spinal needles.

Materials and Methods

Ethical clearance was obtained from Ethics Committee of the College. After finding the suitability, 100 American Society of Anesthesiologists physical status I and II patients of both sexes, between 20 to 60 years of age scheduled for lower limb and lower abdominal surgeries under SA were selected, briefed about the nature of the study, and written informed consent was obtained. Patients who refused to consent, with

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a known contraindication to SA, had a history of head ache or migraine, and taking any medication were excluded from the study.

Patients were assigned in to two equal groups of 50 each; they were to receive spinal anesthesia either with Quincke's (group QC) or Whitacre's (group WP) spinal needles.

They were allocated to either of the groups by computer-generated randomization table. In the operation theater, intravenous (IV) line was secured using 18-G IV cannula on the dorsum of non-dominant hand. All patients were preloaded with 10 ml/kg of Ringer's lactate solution 30 minutes before surgery. A multifaceted monitor to monitor heart rate (HR) non-invasive blood pressure (NIBP), oxygen saturation (SpO_2), and electrocardiography (ECG), was attached and baseline values recorded.

Under strict aseptic precautions, with the patient in the left lateral position using standard midline approach 25-G spinal needle (according to group) was inserted into L_3–L_4 inter space. Quincke's spinal needle was introduced with the bevel upwards and parallel to the longitudinal axis of the dural fibers in group QC and the conventional midline technique was used to insert the Whitacre's spinal needle in group WP. Hyperbaric 0.5% bupivacaine 15 mg (3 ml) was injected into subarachnoid space, after obtaining free flow of cerebrospinal fluid (CSF). Thus, the patients in group QC received spinal anesthesia with 25-G Quincke's spinal needle and the patients in group WP received spinal anesthesia with 25-G Whitacre's spinal needle. An experienced anesthesiologist performed the blocks in all patients. Failure of spinal anesthesia was defined as either inability to obtain free flow of CSF with three attempts or evidently inadequate anesthesia for surgery 15 minutes after local anesthetic injection into subarachnoid space, which were recorded as failure and general anesthesia given. All patients received oxygen 4 liters/minute by a well fitted face mask. Hypotension a decrease in mean arterial pressure (MAP) ≥20% or systolic arterial pressure ≤90 mm Hg was treated with IV fluid and 5 mg IV ephedrine. Bradycardia HR ≤50 beats/minute was treated with IV 0.6 mg atropine.

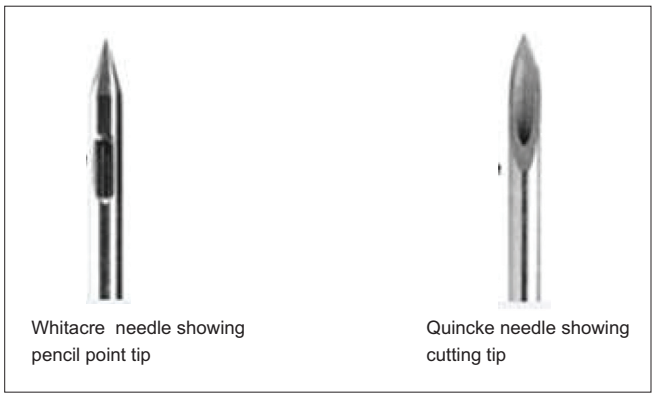

Figure 1: Tip design of Whitacre and Quincke needles

Postoperatively, all patients were enquired for headache for 5 successive days. PDPH is defined as postural headache, relieved by lying flat and aggravated by sitting, standing, coughing or staining, onset within 48 to 72 hours of SA, mostly located to occipital or frontal region, may be associated with nausea or vomiting, diplopia, neck stiffness, and tinnitus. PDPH was treated with complete bed rest, IV fluid, paracetamol 20 mg/kg IV 6th hourly. If PDPH persisted, the decision to treat with epidural blood patch was taken by the consultant anesthesiologist.

The primary aim of this study was to compare the incidence of PDPH between the groups. PDPH was assessed using standard Numeric Analogue Scale (NAS) 0-100 as score = 0 no head ache, score = 100 sever head ache possible and classified as below.[4]

1. Mild (score: 0–33) while ambulating or sitting and no limitation of activity
2. Moderate (score: 34–66) while sitting and limitation of activity
3. Severe (score: 67–100) even in supine and confined to bed even.

Statistics

Based on a pilot study with a power of 80% and an alpha error of 0.05 to achieve a 20% difference between the groups a preceding power analysis shown 50 patients per group. Accordingly, we included 50 subjects in each group. The incidence of PDPH was compared using *t*-test and Chi-square test was used to detect difference in the attempt rate and failure rate between the groups. Results were presented as mean ± standard deviation (SD), a value of $P < 0.05$ was deemed as statistically significant.

Results

All the 100 patients participated were completed the study. The demographic features of the patients with respect to age, sex, weight, height, ASA status, BMI, duration of surgery, and type of surgery [Figure 2] are comparable and there is no statistically significant difference between the groups [Table 1].

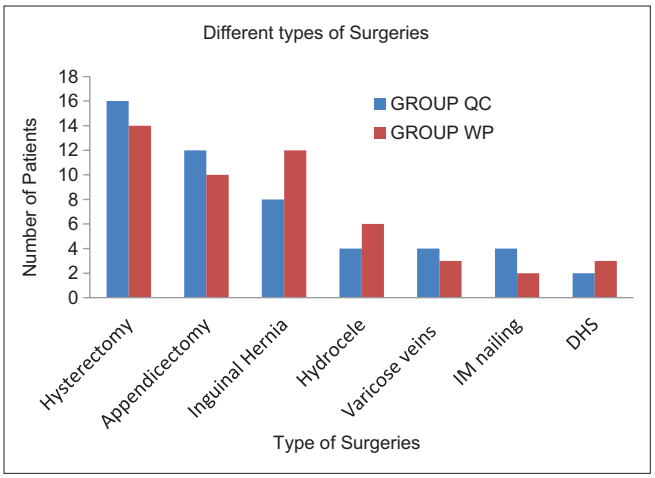

Figure 2: Different types of surgeries in both the groups. Dates: The study was conducted between September 2013 and September 2015

In the present study, nine (18%) patients in Quincke group and one (2%) patient in Whitacre group had PDPH and this difference is statistically significant using *t*-test ($P = 0.009$). Among the nine patients in Quincke group four have mild, three have moderate, two have severe PDPH, and one patient in the Whitacre group have mild PDPH [Table 2]. No patient in both the groups required a blood patch for treatment PDPH.

In this study, patients in Quincke group required: 36 (72%) one attempt, 12 (24%) two attempts, and two (4%) three attempts for successful dural puncture. Whereas in the Whitacre group, 42 (84%), six (12%), and two (4%) patients required one, two and three attempts, respectively, for successful dural puncture [Table 3]. When these values were compared using Chi-square test no statistically significant association was found between the type of needle and number of attempts [Table 3].

In our study, the incidence of failed spinal anesthesia [Table 4] in Quincke group was 4% (2/50) and in Whitacre group it was 10% (5/50). However, no statically significant association between the type of the needle and the rate of failed spinal anesthesia could be detected ($P = 0.2425$).

The mean HR, MAP, and SpO_2 did not differ between the groups, at all the recorded time intervals. Incidence of side effects such as nausea and vomiting were comparable between the groups [Table 5]. And no patient in any group complained of diplopia or tinnitus in this study.

Table 1: The demographic variables of patients in two groups

Variables	Group QC ($n=50$)	Group WP ($n=50$)	*P*
Age (years)	39.24±11.15	39.12±12.42	0.9596
Male: female ratio	22:28	23:27	-
Weight (kg)	57.72±6.54	55.82±6.19	0.1389
Height (cm)	159.78±7.74	158.38±6.68	0.3353
BMI (kg/m^2)	22.62±0.79	22.56±1.01	0.7414
ASA status I : II	45: 5	46:4	-
Surgery time (min)	80.6±32.22	80.2±26.2	0.9458

Group QC: Quincke's cutting tip needle group, Group WP: Whitacre's pencil point tip needle group, n: Number, kg: kilogram, cm: Centimeter, BMI: Body mass index, m: Meter, min: Minutes

Table 2: Incidence of PDPH in group QC and WP

Variables		Group QC ($n=50$) (%)	Group WP ($n=50$) (%)	*P*
PDPH present		9 (18)	1 (2)	0.0090
a.	Mild	4 (8)	0	0.0439
b.	Moderate	3 (6)	1 (2)	0.4767
c.	Sever	2 (4)	0	0.3174
PDPH absent		41 (82)	49 (98)	0.0090

Group QC: Quincke's cutting needle group, Group WP: Whitacre's pencil point needle group, n: Number, PDPH: Post-dural puncture headache

Table 3: Number of attempts in each group

Number of attempts	Group QC ($n=50$) (%)	Group WP ($n=50$) (%)	*P*
First	36 (72)	42 (84)	0.5399
Second	12 (24)	6 (12)	0.1216
Third	2 (4)	2 (4)	1.000

Group QC: Quincke's cutting needle group, Group WP: Whitacre's pencil point needle group, n: Number

Table 4: Incidence of failed SAB in both the groups

Variables	Group QC ($n=50$) (%)	Group WP ($n=50$) (%)	*P*
Successful	48 (96)	45 (90)	0.2425
Failed	2 (4)	5 (10)	0.2425

SAB: Subarachnoid block, Group QC: Quincke's cutting needle group, Group WP: Whitacre's pencil point needle group, n: Number

Table 5: Incidence of side effects in both the groups

Variables	Group QC ($n=50$) (%)	Group WP ($n=50$) (%)	*P*
Nausea	2 (4)	1 (2)	0.6817
Vomiting	2 (4)	1 (2)	0.6817

Group QC: Quincke's cutting needle group, Group WP: Whitacre's pencil point needle group, n: Number

Discussion

Spinal anesthesia is one of the most commonly used techniques in the practice of regional anesthesia. Because it is safe, economical, easy to use, needs less sophisticated equipment, cost-effective drugs, and postoperative care. SA is the most popular because it preserves consciousness and respiration while providing adequate analgesia and profound muscle relaxation,[5] hence, it is preferable over general anesthesia. However, among the side effects of SA, PDPH is the most upsetting one and results in delayed hospital discharge, increased cost, morbidity, and dissatisfaction to patient. Therefore, prevention and treatment of PDPH is of utmost importance to an anesthesiologist.

Leakage of CSF from the dural puncture site leads to reduction in volume and pressure of CSF leading to loss of buoyant support to the brain, thus causing traction on the meninges, which are pain-sensitive structure generating pain. In addition, a low CSF volume and pressure may lead to intracranial venous dilatation ensuing an increase in brain volume and brain sag in the upright position, which in turn will exert traction on anchoring pain sensitive structures such as basal dura, its vessels and tentorium cerebelli causing PDPH.[6] The pain from the tentorium cerebelli is carryout by the fifth cranial nerve and the pain from structure on or below the lower surface of the tentorium cerebelli is carried by upper cervical nerves, ninth, and tenth cranial nerves. PDPH due to low CSF pressure is differentiated from other headaches as it is aggravated on sitting, standing, moving, coughing, and straining. Inadequate intake of fluid and conditions causing loss of fluid from the

body such as diarrhea, vomiting, hemorrhage, excessive sweating, and lactation tend to make the condition worse.[7] Larger the hole in duramater, leakage of CSF will be more and longer the time required for repair. The number of holes in the dura also makes a difference in the loss of CSF. It takes about two weeks or more for the holes to seal off.[6]

Karl August Bier, a German surgeon, first reported the PDPH in 1898.[8] Needle tip configuration and needle gauge greatly influenced the incidence of PDPH.[9] The 25-G Quincke's needle has a cutting tip and the 25-G Whitacre's needle has a pencil point, non-cutting tip and might be expected to have a reduced incidence of PDPH. This randomized clinical trial was an attempt to compare the two different spinal needle tips that is Quincke's 25-G cutting tip needles and Whitacre's 25-G non-cutting pencil point tip needles with respect to the prevalence of PDPH, attempt rate, and failure rate of successful subarachnoid block.

Frequency and severity of PDPH is directly proportional to the leakage rate of CSF through the hole in the duramater created by the spinal needle, so in high-risk patients, the use of thinner gauge needles is reasonable. Even as the incidence of PDPH is 0–2% with a 29-G Quincke's spinal needle, the failure of subarachnoid block is common with finer gauge needles due to technical difficulties.[10-12] Therefore, 25-G Quincke's and 25-G Whitacre's needles are in widespread use. We had chosen the 25-G spinal needles for the study because of the technical ease of insertion over the finer gauge spinal needles.

In this study, the PDPH rate was 18% in Quincke group and 2% in Whitacre group and this variation was statistically significant ($P = 0.009$). Pal *et al*.,[8] in their study reported 45 out of 160 patients in Quincke group (28.12%) developed PDPH, whereas only 8 out of 160 patients in Whitacre group (5%) developed PDPH. The difference in the incidence between this study and Pal *et al*. study may be due to small sample size of our study. The incidence of PDPH with Quincke's 25-G needles compares well with several other studies, which reported 0 to 4% with highest occurrence in obstetric population.[13-15] Another study conducted to evaluate the needle gauge and tip design on technical difficulties and PDPH, concluded that the incidence were lower (1%) with 25-G Whitacre's needle and higher (14%) with 25-G Quincke's needle.[16] In another study, 25-G Whitacre's and 25-G Quincke's needles were compared to assess the influence of the shape of the needle tip on PDPH independent of the needle diameter, concluded that the incidence was 8.5% with 25-G Quincke's needle and 3% with 25-G Whitacre's needle.[17] A comparative study for PDPH in cesarean section patients, concluded that the incidence of PDPH was 1.06% with 25-G Whitacre's needle and 3.65% with 25-G Quincke's needle.[18] Vallejo *et al*.,[3] in their study on 1002 obstetric patients, undergoing elective cesarean section under SA, detect variation in incidence of PDPH, using five dissimilar types of spinal needles, and reported that the 25-G Quincke's needle had a higher rate of PDPH compared with pencil-point tip needles which included 25-G Whitacre's needle. The results of our study are almost comparable with the results of the studies mentioned above.

In the present study, patients in the Quincke group 64% required one attempt, 34% required two attempts, and 4% required three attempts for successful subarachnoid block. Whereas in Whitacre group patients, the success rate was 84% in first attempt, 14% in second attempt, and 4% o in the third attempt. When these values were compared by Chi-square test, significant association was not detected between the type of needle and number of attempts. In a study by Pal *et al*.,[8] out of 160 patients the dura could be punctured in the first attempt in 143 patients in Quincke group (89.37%) and 146 patients in group WP (91.25%). Pal *et al*.,[8] studied only female patients, we studied both sexes, the difference in the attempt rate may be due to sex difference of our study.

In the present study, the incidence of failed spinal anesthesia in Quincke group was 4% and in Whitacre group it was 10%. However, no statically significant association between the type of the needle and the rate of failed spinal anesthesia could be made out. A similar Indian study[6] conducted to assess PDPH in cesarean section patients using 25-G Whitacre's and 25-G Quincke's spinal needles reported 4% failure rate in 25-G Quincke group and 12% in 25-G Whitacre group and these failure rates were not statistically significant. Whereas in another study,[19] failure rate was more common with Quincke's needle than with Whitacre's needle (5.5% versus 3.5%). This variation of failure rates may have attributed to the difference in tactile sensation on dural puncture. Another possible explanation may be that the appearance of CSF in Quincke's needle hub is not guarantee of the needle bevel being completely within the subarachnoid space. Another possibility may be side port may straddle the dura causing leakage into the subdural or epidural space which is most commonly seen with all finer gauge needles, taking care of pain is required to avoid dislodging the needle tip in subarachnoid space leading to loss of some local anesthetic.

Conclusion

Overall, Whitacre's 25 gauge needle has better option to reduce the incidence of PDPH and attempt rate whereas Quincke's 25 gauge needle is a better option to reduce the failure rate of subarachnoid block in expected difficult cases. However, the Quincke's needle is less expensive than Whitacre's needle; the cost of Whitacre's needle has to be balanced against the cost of the treatment of PDPH.

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Conflicts of interest

There are no conflicts of interest.

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