

Incidence of Post-Dural Puncture Headache with Quincke versus Whitacre Spinal Needles in Arthroscopic Knee Surgeries: A Prospective Observational Study.

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ABSTRACT

Background and Aims: Post-dural puncture headache (PDPH) is a well-recognized complication of spinal anaesthesia and can significantly affect postoperative recovery. Needle design and gauge play an important role in determining its incidence. The incidence of Postdural puncture headache in adults, especially young adults is much higher than other age groups (14 % vs 7 %). This is because with increasing age, the dura may be less elastic and less likely to gape. The incidence of post dural puncture headache is high among patients who are mobilised early after the surgery(1). In arthroscopic knee surgeries, patients are advised early mobilisation mostly immediately 12 to 18 hours after surgery. This study includes adults in the age category of 18 to 45 years of age (younger age group) and also who have undergone arthroscopic knee surgeries where early mobilisation after surgery is done. Studies in this population are very limited .Hence this study was undertaken to address this gap. . It would also be helpful in the proper post-operative management of adults undergoing arthroscopic knee surgeries and prevent development of postdural puncture headache. The primary objective is to find out the incidence of post dural puncture headache following subarachnoid block using Quincke and Whitacre spinal needles among patients undergoing arthroscopic knee surgeries. The secondary objective is to compare the severity of post dural puncture headache with Quincke and Whitacre spinal needles among patients undergoing arthroscopic knee surgeries.

Methods: This prospective observational study was conducted in the Department of Anaesthesiology at Baby Memorial Hospital, Calicut. A total of 118 patients aged 18–45 years with ASA physical status I or II undergoing arthroscopic knee surgeries under spinal anaesthesia were included. Patients were divided into two groups based on the spinal needle used: Group Q (25G Quincke needle) and Group W (25G Whitacre needle), with 59 patients in each group. Patients were followed for three postoperative days for the incidence and severity of PDPH. The data was coded and entered in Microsoft excel and analysed using

Statistical Package for Social Sciences (SPSS) version 22.0. Chi-square test was used for the comparison of the incidence of PDPH with Quincke and Whitacre and other variables like age, sex were assessed using Unpaired t-test. Fishers exact test was applied for overall incidence. The p value of less than .05 is considered as significant.

Results: The overall incidence of PDPH was 8.47%. PDPH occurred in 7 patients (11.9%) in the Quincke group and 3 patients (5.1%) in the Whitacre group. On postoperative day 1, PDPH occurred in 4 patients (6.8%) in the Quincke group and none in the Whitacre group ($p = 0.042$). On postoperative day 2, mild headache was present in 3 patients (5.1%) in each group ($p = 0.999$). By postoperative day 3, no patients reported headache. Moderate PDPH was observed only in the Quincke group.

Conclusion: The Whitacre spinal needle was associated with a lower incidence and severity of PDPH compared with the Quincke needle. The use of atraumatic needles may help reduce postoperative complications and improve patient comfort following spinal anaesthesia. Even though Arthroscopic knee surgeries are associated with early mobilization on the same day of surgery there is no significant increase in the incidence of PDPH with either of the needles.

Keywords: Post-dural puncture headache, Quincke needle, Whitacre needle, arthroscopic knee surgery

Introduction:

Spinal anaesthesia, also known as subarachnoid block, is a form of regional anaesthesia and a kind of neuraxial block involving injection of opioids, local anaesthetics or other permissive drug into the subarachnoid space (2,3). It is one of the most commonly used regional anaesthesia techniques for surgeries involving the lower abdomen and lower limbs. The first spinal anaesthetic was delivered by an accident. Its history can be traced back in the late 19th century by James Leonard Corning. He reported on spinal anaesthesia in 1885 for the first time. The first planned spinal anaesthesia was administered by August Bier in 1898. He had personal knowledge of the symptoms of post spinal puncture headache. Bier reported complications including back and leg pain, vomiting and headache. Even at this early stage, he had associated the loss of cerebrospinal fluid with post spinal headache(4). Spinal Anaesthesia offers several advantages including rapid onset, reliable sensory and motor blockade, reduced systemic drug exposure, and cost-effectiveness.

Despite these advantages, spinal anaesthesia is associated with certain complications. One of the most common and distressing complications is post-dural puncture headache (PDPH). PDPH typically occurs due to leakage of cerebrospinal fluid (CSF) through the dural puncture site, resulting in decreased intracranial CSF pressure. PDPH (Postdural Puncture Headache) is one of the earliest recognized complications of regional anaesthesia, with a long and notable history. Dr. August Bier first observed this adverse effect in the first patient to successfully undergo spinal anaesthesia on August 16, 1898. Bier documented: "Two hours after the procedure, the patient experienced pain in the back and left leg, vomiting, and severe headache. While the pain and vomiting subsided, the headache persisted the following day".

The incidence of PDPH varies widely depending on factors such as patient age, sex, needle size, needle design, and operator experience. Cutting needles such as the Quincke needle create a dural tear,

whereas atraumatic needles such as the Whitacre needle separate rather than cut dural fibres, thereby reducing CSF leakage.

Patients undergoing arthroscopic knee surgeries often undergo early postoperative mobilisation, which may increase the likelihood of PDPH. Limited studies have specifically evaluated PDPH in this surgical population.

This study was conducted to evaluate the incidence and severity of PDPH following spinal anaesthesia using Quincke and Whitacre needles in patients undergoing arthroscopic knee surgeries.

Materials and Methods

The study was conducted in the department of Anaesthesiology, Baby Memorial Hospital, Calicut, Kerala. Adult patients of American Society of Anaesthesiology (ASA) Physical Status I and II aged between 18 to 45 years posted for arthroscopic knee surgeries under spinal anaesthesia were the study population. This is a prospective observational study. The study was commenced after obtaining approval from the ethical committee, scientific committee and informed consent from patients who fulfilled the inclusion criteria. The inclusion criteria included patients aged 18-45 years of age, patients undergoing arthroscopic surgeries of knee and ASA physical status of I and II patients. Patients with history of any contraindication to spinal anaesthesia, patients with history of postdural puncture headache and more than 3 attempts at dural puncture were excluded. Spinal anaesthesia is given by consultants with more than 5 years of experience.

Sample size: Sample size was calculated using the formula:

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 pq}{2 d^2}$$

$Z_{\alpha/2}$ = is the Z value at an α error,
 Z_{β} = is the Z value at a β error,

p = average percentage of the character = $(p_1 + p_2) / 2$, where p_1, p_2 are the percentage of the character in each group
 d = clinically relevant effect size

According to study (by. Devanathan Baluswamy, Surmila Khoirom, Nmeirakpam Charan, Sonia Nahakpam, Ningobam Joanna Devi, Srinivasan Divyabharathi, Laishram Rani Devi, Mohd Ayub Ali: incidence and severity of post dural puncture headache following subarachnoid block using 25 G Quincke and 25 G Whitacre spinal needles: a double blinded, randomised control study), (19))

$$P = \frac{p_1 + p_2}{2}$$

$$= \frac{16 + 2.6}{2}$$

$$= 9.3$$

to detect 15 % reduction in incidence of headache as statistically significant, sample size in each group is 59

$$z = 1.96$$

$$z_{\beta} = 0.84$$

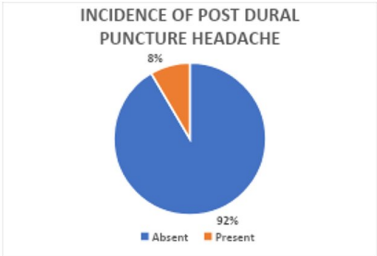
After securing an 18G intravenous cannula and preloading with crystalloid solution, spinal anaesthesia was performed at the L2–L3 or L3–L4 interspace under aseptic precautions using either a 25G Quincke or 25G Whitacre needle. Patients were followed up for three postoperative days for Incidence of PDPH, Severity of headache. Severity of headache was classified as 1. Mild: Minimal limitation of activity 2. Moderate: Requires regular analgesics 3. Severe: Confined to bed and unable to perform activities

Statistical Method: Data were entered into Microsoft Excel and analysed using SPSS version 22.0. Chi-square test was used for categorical variables and Unpaired t-test was used for continuous variables. A p-value < 0.05 was considered statistically significant.

Results

A total of 118 patients were included in the study, with 59 patients in each group. Demographic characteristics: The two groups were comparable in terms of age, sex distribution, and ASA status. Mean age: Whitacre group: 27.69 ± 5.18 years, Quincke group: 26.93 ± 6.23 years. ($p = 0.471$) Sex distribution was also similar between groups.

Incidence of PDPH: The overall incidence of PDPH was 8.47% (10/118 patients). Whitacre group: 3 patients (5.1%), Quincke group: 7 patients (11.9%). Below given figure 1 depicts the overall incidence.

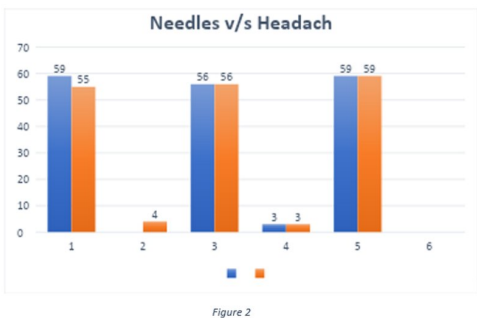


PDPH by postoperative day: Below given data depicts the day wise incidence of post dural puncture headache and figure 2 gives the graphical representation

Postoperative Day 1:
Whitacre: 0 patients, Quincke: 4 patients (6.8%). $p = 0.042$

Postoperative Day 2:
Whitacre: 3 patients (5.1%), Quincke: 3 patients (5.1%). $p = 0.999$

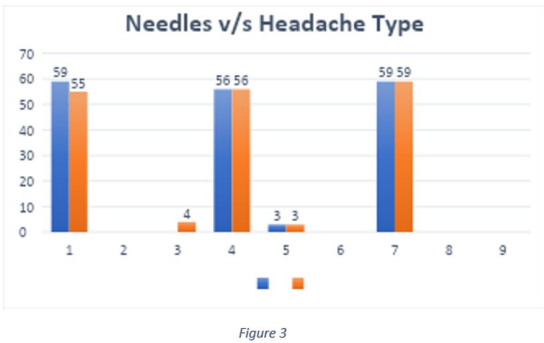
Postoperative Day 3:
No patients reported headache



Severity of PDPH: The severity of headache is as follows. Figure 3 gives corresponding graphical representation

On postoperative day 1:
Whitacre group: No headache
Quincke group: 4 patients with moderate PDPH

On postoperative day 2:
Both groups: mild PDPH in 3 patients each
No severe headache was observed.



Discussion

Post-dural puncture headache remains a common complication following spinal anaesthesia and can delay recovery and discharge. The design of the spinal needle plays a crucial role in determining the incidence of PDPH. In the present study, the overall incidence of PDPH was 8.47%. In a recent study on incidence and severity of post dural puncture headache following Subarachnoid block using 25 G Quincke and 25 G Whitacre spinal needles: a double blinded study, randomised control study, the incidence is 16% and 2.6 % respectively. (5) In the present study the incidence of PDPH was higher in the Quincke group (11.9%) compared to the Whitacre group (5.1%), supporting the evidence that atraumatic pencil-point needles reduce the risk of PDPH. On postoperative day 1, the Quincke group showed a significantly higher incidence of PDPH compared with the Whitacre group. However, by postoperative day 2, the incidence was similar between groups, and all symptoms resolved by postoperative day 3. These findings are consistent

with previous studies which have shown that atraumatic needles such as Whitacre reduce both the incidence and severity of PDPH compared with cutting needles like Quincke. The proposed study by Vibhu Srivastava to evaluate the frequency of PDPH during spinal anaesthesia using 27-g Quincke vs 27G Whitacre needle in obstetric/non obstetric patient has found the headache severity was from mild to moderate and no epidural blood patch was applied in any of the groups. (6) Although the Whitacre needle required slightly more attempts for successful dural puncture, its advantage in reducing PDPH makes it a preferable option in clinical practice. In a meta-analysis by Hong Xuit is suggested that pencil-point spinal needle was significantly superior compared with cutting spinal needle regarding the frequency of PDPH, PDPH severity, and the use of EBP (7). In view of this, it is recommended to use pencil-point spinal needle in spinal anaesthesia and lumbar puncture. In the study conducted by U.W. Gosch Post-dural puncture headache in young adults: comparison of two small-gauge spinal catheters with different needle design the results demonstrate a potential benefit of the catheter over-needle technique for the reduction of the duration and intensity of PDPH. (8)

Conclusion

The use of 25G Whitacre spinal needles is associated with a lower incidence and severity of post-dural puncture headache compared with 25G Quincke needles in patients undergoing arthroscopic knee surgeries. Therefore, atraumatic pencil-point needles should be preferred during spinal anaesthesia to reduce postoperative complications and improve patient comfort.

Conclusion

Conflict of interest: NIL

Financial support: NIL

Discussion

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