Original Article

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Incidence and Severity of Postdural Puncture Headache following Subarachanoid Block using 25G Quincke and 25G Whitacre Spinal Needles: A Double-blinded, Randomised Control Study

Anaesthesia Section

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ABSTRACT

Introduction: Postdural Puncture Headache (PDPH) is the most common complication of dural puncture. Clinical studies have shown that use of small guage needles with pencil point tip is associated with lower incidence and severity of PDPH than with cutting tip needles.

Aim: To compare the incidence and severity of PDPH between 25G cutting (Quincke) and 25G non cutting (Whitacre) needles.

Materials and Methods: This double-blinded, randomised controlled study was conducted at Jawaharlal Nehru Institute of Medical Sciences- Imphal, Manipur, India, from September 2019 to September 2021. A total of 150 patients of both sexes, age <60 years and American Society of Anaesthesiologists (ASA) grade I and II, undergoing lower abdominal or lower limb surgeries under spinal anaesthesia were enrolled for this study and divided into two groups with 75 patients in each group. Spinal anaesthesia was performed with 25G Quincke needle in one group (group Q) and 25G Whitacre needle used in other group (group W) to compare the incidence and severity of PDPH (severity was determined by limitation of patient activity and treatment required). Statistical Package for the Social Sciences (SPSS) software version 21.0 was used for the statistical analysis.

Results: Mean age in group Q and group W was 35.96 and 38.11, respectively, with p-value=0.14. Overall 14 patients (9.33%) developed PDPH that is, 2 (2.6%) in the Whitacre spinal needle, and 12 (16%) in the Quincke spinal needle, with p-value of 0.009. The incidence of failed spinal anaesthesia was significantly higher with Whitacre spinal needle 12 (16%) than with Quincke needle 4 (5.3%), with p-value of 0.03. Incidence of PDPH was more in female patients 12 (14.8%) compared with male patients 2 (2.9%),with p-value of 0.018. Severity of PDPH ranged from mild (n=10) to moderate (n=2) in Quincke needle group, whereas in Whitacre group patients had only mild form of PDPH (n=2).

Conclusion: Incidence and severity of PDPH was significantly lower in 25G Whitacre spinal needle than 25G Quincke needle. Failure rate of spinal anaesthesia was more in Whitacre needle than in Quincke needle.

Keywords: Failed anaesthesia, Small gauge needle, Spinal anaesthesia

INTRODUCTION

Spinal anaesthesia has been widely practiced to provide anaesthesia for lower abdominal, perineal and lower limb surgeries. Even though it has so many advantages like intact consciousness of patient and intact protective airway reflexes, it has some disadvantages too. Among those, PDPH remains one of the rare but very distressing complications to the patients. PDPH is defined as bilateral headache that is related with position, it may be throbbing in nature and variable in severity. The International Headache Society classified it as one that occurs or worsens less than 15 minutes after assuming the upright position and disappears or improves less than 30 minutes after resuming the recumbent position [1].

The overall incidence of PDPH varied from 0-37.2% as reported by various authors [2,3] and it is directly related to the needle size that is used for spinal anaesthesia, which is 20%, 12.5% and 4.5% for 25G Quincke, 27G Quincke and 27G Whitacre needles, respectively [4]. In one study the incidence of PDPH was 1.06%, 3.65%, and 2.08% with 25G Whitacre, 25G Quincke and 26G Quincke needles, respectively [5]. Usually it occurs 24-48 hours after the procedure and may last upto 1 to 2 days or even two weeks and it resolves spontaneously within two weeks [6]. Sometimes it may be associated with nausea, vomiting, vertigo, hearing disturbances and blurring of vision.

The pathophysiology of developing PDPH is loss of Cerebrospinal Fluid (CSF) through the dural defect which causes traction on pain sensitive intracranial structures, as the brain loses its support and sags and intracerebral vasodilation to compensate the reduction in Intracrainal Pressure (ICP), which causes pain [7,8].

Associated risk factors for PDPH include female sex, pregnancy, lower Body Mass Index (BMI) and younger age, large needle size and type of needle tip whether it is cutting or pencil point [9,10]. The Quincke spinal needle has a diamond shaped cutting bevel end and a terminal opening while the Whitacre spinal needle is a pencil point needle with lateral opening. Large bore needles with cutting bevel end cuts the duralfibres and leaves large defect, thus leads to large amount of CSF leakage through the punctured site, which makes it more common cause of headache. The pencil point needle separates the duralfibres rather than cutting, causes no dural defect and minimal CSF leakage which gives a lower incidence of PDPH [11,12].

Since most of the patients who develop PDPH are mild, they do not require any treatment other than reassurance. Moderately symptomatic patients require conservative treatment includes bed rest, proper hydration, supine position with head down, caffeine, oral or parenteral theophylline, analgesics (NSAIDs) and corticosteroids [13]. Aggressive treatment methods include intrathecal catheter,

epidural saline and epidural blood patch. The mode of treatment depends upon the severity of PDPH.

The present study aimed to find the incidence and severity of PDPH in patients, along with its onset, in patients undergoing spinal anaesthesia for lower abdominal and lower limb surgeries with 25G Quincke or 25G Whitacre needles.

MATERIALS AND METHODS

This randomised, double-blinded control study was conducted in Jawaharlal Nehru Institute of Medical Sciences- Imphal, Manipur, India, from September 2019 to September 2021. Approval from Institutional Ethical Committee (IEC) was obtained (No:182/5/PGT-2019). Patients were allocated randomly into two groups (group Q and group W), following a restricted block randomisation using a block size of two.

Sample size calculation: The sample size was calculated to be 75 in each group, based on the formula:

$$N = \frac{P1(1-P1)+P2(1-P2)}{(P1-P2)^2} \text{ function of } (\alpha,\beta)$$

Inclusion criteria:

- Patients aged 20-60 years undergoing lower abdominal and lower limb surgeries.
- ASA physical status I and II.
- Patients who are fit for spinal anaesthesia.
- Has signed a written informed consent form.

Exclusion criteria:

- Patient refusal.
- History of any contraindication to spinal anaesthesia.
- Patients with allergy to bupivacaine.
- Patients with history of PDPH.
- Patients with history of migraine, neurological diseases, raised intracranial tension, aspirin ingestion in preceding week.
- Patients with >1 attempts of dural puncture.

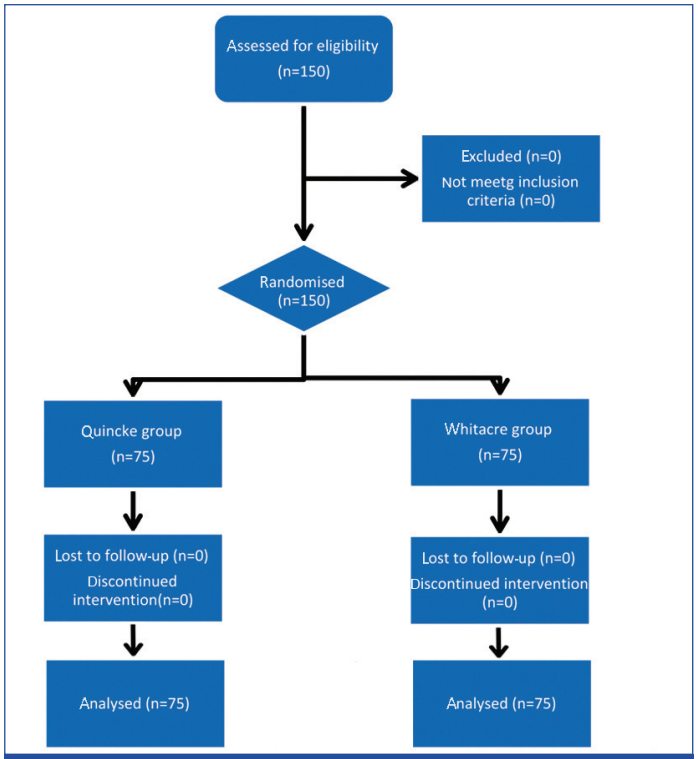
Procedure

Preanaesthetic check-up was done properly with detailed history, physical examination and with routine investigations. Nil per oral status was confirmed. Baseline parameters such as pulse rate, Non Invasive Blood Pressure (NIBP), oxygen saturation (SpO_2) and respiratory rate were monitored. An 18G IV cannula was secured in the non dominant hand and they were premedicated with Inj. ranitidine 50 mg Intravenously (i.v.) 45 minutes before surgery and Inj. ondansetron 4 mg i.v. just before spinal anaesthesia. IV Ringer lactate solution 500 mL was given to all the patients before spinal block over 30 minutes. Then spinal anaesthesia was performed in the L2-L3 or L3-L4 intervertebral space.

A total of 150 patients were randomised into two groups of 75 each [Table/Fig-1]. In group Q patients, spinal anaesthesia was performed by using 25G Quincke needle and in group W patients, spinal anaesthesia was performed by using 25G Whitacre needle. After surgery patients were observed in Postanaesthesia Care Unit (PACU) for some time and then shifted to ward to watch for any anaesthetic side-effects. Postoperatively patients were followed-up in the ward on the postoperative day 1, 2 and 3 for the incidence, onset and severity of PDPH. Patients were assessed by an observer in the postoperative period who was not involved in this study.

The presence of PDPH was identified based on the following signs and symptoms:

1. Headache that occurred after mobilisation.
2. Aggravated by erect or sitting position and straining.
3. Relieved by lying flat.
4. Mostly localised in occipital, frontal or generalised.



[Table/Fig-1]: CONSORT flowchart.

Severity of PDPH was analysed by using the following criteria,

Grading of PDPH [14]:

- No pain
- Mild pain: No limitation of activity or no treatment required.
- Moderate pain: Limited activity and requirement of regular analgesics.
- Severe pain: Confined to bed, anorexic and unable to feed baby in obstetric patients.

For those patients who developed mild PDPH, were reassured and proper hydration was initiated. Those who developed moderate PDPH were advised bed rest, head down position, proper hydration, and oral analgesics. For those patients with failed spinal anaesthesia, it was converted to either general anaesthesia or monitored anaesthesia care with sedatives according to the surgery.

STATISTICAL ANALYSIS

Statistical Package for the Social Sciences (SPSS) software version 21.0 was used for the statistical analysis. Unpaired t-test and Chi-square tests were applied for demographics. Fisher's-exact test was applied for overall incidence. The p-value of <0.05 was considered as significant.

RESULTS

Mean age in group Q and group W were 35.96 and 38.11, respectively, with p-value=0.14. Mean weight in group Q and W were 60.51 and 61.81 respectively (p-value=0.15). The gender distribution was similar between the groups [Table/Fig-2].

Group		Age (years)	Weight (kg)	Sex n (%)	
				Male	Female
Group-Q	Mean±SD	35.96±9.029	60.51±5.249	33 (44)	42 (56)
Group-W	Mean±SD	38.11±8.993	61.81±5.844	36 (48)	39 (52)
p-value		0.14*	0.15*	0.62**	

[Table/Fig-2]: Demographic distribution.
Unpaired t-test* chi square** tests applied

Overall incidence of PDPH was 9.33% (n=14), that is, 12 patients in group Q (16%), 2 in group W (2.6%), p-value of 0.009. Onset of PDPH was four patients in postoperative day 1 patients, and

the remaining 10 patients had onset of PDPH at postoperative day 2. The incidence of PDPH was higher among females (group Q 10, group W 2), p-value of 0.018. Among these 14 patients, 12 had mild PDPH, 2 patients had moderate PDPH. Failed spinal anaesthesia was reported in 12 patients in group W, and 4 in group Q [Table/Fig-3-5].

PDPH		Group Q (% within group)	Group W (% within group)	Total (% both groups)	p-value (Fisher's test)
Overall Incidence		12 (16)	2 (2.6)	14 (9.33)	0.009
1st POD (new onset PDPH)	No pain	71 (94.7)	75 (100)		0.012
	Mild	3 (4)	0	3 (2)	
	Moderate	1 (1.3)	0	1 (0.7)	
	Severe	0	0	0	
2nd POD (new onset PDPH)	No pain	67 (89.3)	73 (97.3)		0.09
	Mild	7 (9.3)	2 (2.7)	9 (6)	
	Moderate	1 (1.4)	0	1 (0.7)	
	Severe	0	0	0	
3rd POD		No patients developed PDPH			

[Table/Fig-3]: Comparison of incidence and severity of PDPH of both groups.
POD: Postoperative day; p-value <0.05 considered significant

Gender		Group Q	Group W	p-value (Chi-square test)
Female	No headache	32 (76.2%)	37 (94.9%)	0.018
	PDPH	10 (23.8%)	2 (5.1%)	
Male	No headache	31 (93.9%)	36 (100%)	
	PDPH	2 (6.1%)	0	
Total		75	75	

[Table/Fig-4]: Comparison of gender-wise incidence of PDPH.
p-value <0.05 considered significant

Anaesthesia	Group Q	Group W	p-value (Chi-square test)
Successful spinal anaesthesia	71 (94.7%)	63 (84%)	0.03
Failed spinal anaesthesia	4 (5.3%)	12 (16%)	
Total	75 (100%)	75 (100%)	

[Table/Fig-5]: Comparison of number of failed spinal anaesthesia.
p-value <0.05 considered significant

DISCUSSION

Though spinal anaesthesia is safer, it is not preferred for most of the surgeries in earlier days, mainly because of high incidence of headache attributed to CSF leak. And it is more common with the use of big gauge spinal needles, young age, females and obstetric patients [15]. The incidence of PDPH is related not only to the size and design of the spinal needle used, but also to the experience of the personnel performing the dural puncture, and the age and sex of the patient [16]. Even with 25G Whitacre spinal needle, the incidence of PDPH was significantly lower than a spinal anaesthesia with thinner 27G Quincke spinal needle [17].

Various studies have mentioned the incidence of dural puncture headache and failure rate of spinal anaesthesia in patients undergoing spinal anaesthesia using cutting and non cutting bevel spinal needles [18-20]. The incidence and severity are directly related to rate of CSF leak due to needle puncture. Studies conducted earlier shows the incidence of PDPH with Quincke needles as 36% (22G), 3-25% (25G), 0.3-20% (26G), 1.5-5.6% (27G) [18,20]. Though the incidence is as low as 0-2% with 29G Quincke needles, the incidence of failure rate is high. Present study chose 25G needle due to ease of availability in hospital and technical use.

In some studies, the authors concluded that parallel orientation of spinal needles decrease the incidence of PDPH [15,19]. However, Wu CL et al., could not demonstrate any significant difference in CSF leakage by aligning the bevel of the needle either parallel or across the dural fibers, and their observation was that the CSF leakage rate was related to the needle size [21]. Present study chose parallel technique for needle insertion.

The most important contributing factor for high incidence of PDPH was gauge and type of spinal needle used. The headache was aggravated by upright posture and straining, and relieved by lying downward. In this study, the observed onset of PDPH was four patients on the first postoperative day (28.6%) and 10 patients on second postoperative day (71.4%) after spinal anaesthesia. None of the patients from the Whitacre group developed headache on first postoperative day. No patients had developed headache after second postoperative day. Similar results were observed in a study conducted by Malarvizhi AC and SreeRanjini S, that showed the number of patients developed headache on the first and second postoperative days were 11 (Quincke-10, Whitacre-1) and 3 (Quincke -1, Whitacre-2), respectively [17]. In this study, overall 12 patients, in the Quincke group two patients in Whitacre group had mild form of PDPH with no limitation of activity and was not associated with nausea and vomiting. Two patients from Quincke group had developed moderate PDPH (14.3%). None of the patients from Whitacre group had moderate PDPH. None of the patients from both the groups developed severe headache. Patients of the Quincke needle group had mild and moderate form of headache, while the other group had only milder form of headache. Compared to Quincke needle, spinal anaesthesia with Whitacre needle was associated with less severe PDPH. Similar results were observed in another study [18] that compared severity of PDPH with 25G Quincke, 27G Quincke and 27G Whitacre spinal needles. It was found that the severity of PDPH was least in Whitacre group.

In this study, it was demonstrated that females developed PDPH more than males. The incidence of PDPH in male patients was 2.8% (two patients from the Quincke needle group and none from the Whitacre needle group), whereas in females the overall incidence was 14.8% (10 patients from the Quincke group, and two patients from the Whitacre group). Similar findings were reported by Amorim JA et al., who reported a lesser incidence of PDPH in male patients (3.6%) than female patients (11.1%) [19]. A meta-analysis also reported [21] a significantly more risk of PDPH among females than males, irrespective of needle size and bevel design.

In 2009, Fettes PDW et al., studied the mechanisms, management and prevention of failed spinal anaesthesia and showed that pencil point spinal needles straddle the duralfibres more than the cutting needles leading to partial loss of local anaesthetic solution into epidural or subdural space even after successful aspiration of CSF [20]. In the present study, failed spinal anaesthesia was observed in 12 patients (16%) in Whitacre group due to pencil point needle, whereas in Quincke group only four patients (5.3%) had failed spinal anaesthesia. The difference in failed spinal anaesthesia was statistically significant (p-value=0.03).

Limitation(s)

Operators inexperience in using pencil point needle, high cost of pencil point needle than cutting needle and subjective nature of pain which may vary according to the individual leading to inappropriate conclusion of severity make the limitations for the present study.

CONCLUSION(S)

Spinal anaesthesia with 25G pencil point needle (Whitacre) is associated with decreased incidence of PDPH in postoperative period. Even though PDPH occurs, mostly it is less severe in nature (mostly mild) when compared to 25G cutting bevel spinal needle (Quincke). It is also concluded that incidence of failed spinal anaesthesia was significantly more with pencil point Whitacre needle than cutting Quincke needle.

REFERENCES

[1] Karigar SL, Patil B. A comparative study to know the incidence of post-dural puncture headache following subarachanoid block using 27 G Quincke's and Whitacre needles- A randomised clinical trial. J Evolution Med Dent Sci. 2016;5(49):3236-39. Doi: 10.14260/jemds/2016/728.

[2] Shutt LE, Valentine SJ, Wee MYK, Page RJ, Prosser A, Thomas TA, et al. Spinal anaesthesia for caesarean section- Comparison of 22 gauge and 25 gauge Whitacre needle with 26 gauge quincke needles. Br J Anaesth. 1992;69(6):589-94.

[3] Flatten H, Reader J. Spinal anaesthesia for outpatient surgery. Anaesthesia. 1985;40(11):1108-11.

[4] Shah A, Bhatia PK, Tulsiani KL. Post dural puncture headache in caesarean section- A comparative study using 25 g quincke, 27 g quincke and 27 g whitacre needle. Indian J Anaesth. 2002;46:373-77.

[5] Hwang JJ, Ho ST, Wang JJ, Liu HS. Post dural puncture headache in cesarean section: Comparison of 25-gauge Whitacre with 25- and 26-gauge Quincke needles. Acta Anaesthesiol Sin. 1997;35:33-37.

[6] Raskin NH. Lumbar puncture headache: A review. Headache.1990;30:197-200.

[7] Olsen KS. Epidural blood patch in the treatment of post-lumbar puncture headache. Pain. 1987;30:293-01.

[8] Kuntz KM, Kokmen E, Stevens JC, Miller P, Offord KP, Ho MM, et al. Post-lumbar puncture headaches: Experience in 501 consecutive procedures. Neurology. 1992;42:1884-87.

[9] Ahmed Ghaleb. Post dural puncture headache. Anaesthesiology Research and Practice. 2010;102967:1155-61. https://doi.org/10.1155/2010/102967.

[10] Lynch J, Krings-Ernst I, Strick K, Topalidis K, Schaaf H, Fiebig M, et al. Use of a 25-gauge Whitacre needle to reduce the incidence of postdural puncture headache. Br J Anaesth. 1991;67:690-93.

[11] Van Dellen JR, Bill PL. Lumbar puncture-An innocuous diagnostic procedure? S Afr Med J. 1978;53:666-68.

[12] Afridi N, Fareed A, Fatima A. Role of prednisolone in management of post-dural puncture headache after spinal anaesthesia in obstetric patients. Anaesth Pain & Intensive Care. 2019;23(2):168-71.

[13] Baig T. Comparison of 25 gauge cutting with noncutting needles for post dural puncture headache in obstetric patients. J Anesth Clin. 2014;5:448. Doi: 10.4172/2155-6148.1000448.

[14] Lambert DH, Hurley RJ, Hertwig L, Datta S. Role of needle gauge and tip configuration in the production of lumbar puncture headache. Reg Anesth. 1997;22:66-72.

[15] Geurts JW, Haanschoten MC, Van Wijk RM, Kraak H, Besse TC. Postdural puncture headache in young patients. A comparative study between the use of 0.52 mm (25 gauge) and 0.33 mm (29 gauge) spinal needles. Acta Anaesthesiol Scand. 1999;34:350-53.

[16] Corbey MP, Bach AB, Lech K, Frørup AM. Grading of severity of postdural puncture headache after 27-gauge Quincke and Whitacre needles. Acta Anaesthesiol Scand. 1997;41:779-84.

[17] Malarvizhi AC, SreeRanjini S. Incidence of Postdural Puncture Headache (PDPH) using 25G pencilpoint and 25G quincke spinal needles in patients undergoing cesarean section- A prospective observational study. Int J Cont Med Res. 2016;3(12):3441-44.

[18] Shaik JM, Memon A, Memon MA, Khan M. Post dural puncture headache after spinal anaesthesia for cesarean section: A comparison of 25g Quincke, 27g Quincke and 27g Whitacre spinal needles. J Ayub Med Coll Abbottabad. 2008;20(3):10-13.

[19] Amorim JA, Gomes de Barros MV, Valenca MM. Post dural (post-lumbar) puncture headache: risk factors and clinical features. Cephalalgia. 2012;32(12):916-23.

[20] Fettes PDW, Jansson JR, Wildsmith JAW. Failed spinal anaesthesia: Mechanisms, management, and prevention. British Journal of Anaesthesia. 2009;102(6):739-48.

[21] Wu CL, Rowlingson AJ, Cohen SR, Michaels RK, Courpas GE, Joe EM, et al. Gender and post-dural puncture headache. Anaesthesiology. 2006;105(3):613-18. Doi: 10.1097/00000542-200609000-00027. PMID: 16931996.

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