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Comparative Study of Incidence of Post-Dural Puncture Headache Using 23g, 25g and 26g Spinal Needle

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ABSTRACT

Post-dural puncture headache (PDPH) frequently occurs as a result of unintentional puncture of the dura mater. Risk factors encompass female gender, youth, pregnancy, vaginal childbirth, low body mass index and non-smoking status. This study aims to compare the incidence of Post Dural Puncture Headache (PDPH) across different sizes of spinal needles, specifically 23G, 25G and 26G. The objective is to assess the following. The objective is to evaluate and compare the occurrence of post-dural puncture headache (PDPH) associated with different sizes of Quincke spinal needles, as well as to analyze the severity of PDPH associated with these needle sizes. This study is a randomized comparative trial that included 75 individuals ranging in age from 15-69 years. These patients were scheduled to undergo surgery on their abdomen and lower limbs. The patients were assigned at random to three groups, with each group consisting of 25 patients. Group A is using a 23G spinal needle, Group B is using a 25G spinal needle and Group C is using a 26G spinal needle. Prior to the procedure, a comprehensive assessment of the patient was conducted, which included obtaining their medical history, performing a general examination and conducting a systemic evaluation along with all necessary investigations. The patient's condition was monitored at intervals of 6, 12, 18, 24 and 48 hrs to assess their symptoms of headache, nausea, vomiting and sensitivity to light. The intensity of the headache is categorized, employing a modified Lybecker classification, as follows. Mild Post-Dural Puncture Headache (PDPH), Moderate PDPH and Severe PDPH. The occurrence rate of post-dural puncture headache (PDPH) is 28% in Group A (23G), 12% in Group B (25G) and 4% in Group C (26G). The association with post-dural puncture headache (PDPH) among each group exhibits a statistically significant difference ($p<0.05$). Out of the 11 patients, 1 patient in Group C (26G) experienced a mild headache, while in Group B (25G), 2 patients had light headaches and 1 patient had a moderate headache. In Group C (23G), there were 4 cases of mild headaches, 2 cases of moderate headaches and 1 instance of severe headache. The occurrence of post-dural puncture headache (PDPH) was much lower when using a 26G quincke's spinal needle compared to both 23G and 25G quincke's spinal needles. Our study found that females have a higher prevalence of post-dural puncture headache (PDPH) compared to males, however this difference is not statistically significant.

INTRODUCTION

This modern tale, which appears to have been taken from a mediaeval literature on suffering and pain, comes from a previously healthy patient who had a spinal puncture to relieve discomfort during childbirth. The hole made in the arachnoid mater causes a headache known as a post-dural puncture headache (PDPH), which is brought on by a loss of cerebral spinal fluid (CSF) and the stress that follows on the meningeal tissues.

The International Headache Society defines post-traumatic pressure headache (PDPH) as a headache that develops five days after a dural puncture and is characterized by dull bilateral pain radiating from the frontal area to the occiput. The pain gets worse within fifteen minutes of sitting or standing, gets better after fifteen minutes of lying down and is exacerbated by sneezing, coughing and straining. Along with nausea and vomiting, this headache will be accompanied by neck stiffness, dizziness, phobophobia, tenets and diploic. When the leak is sealed with an autologous epidermal lumbar patch the symptoms go away on their own in a week or less. However, fever, leukocytes and neurologic impairment are not associated with PDPH[1-7].

The most frequent side effect following an unintentional dural puncture is post-dural puncture headache (PDPH). Female sex, youth, pregnancy, vaginal delivery, having a low body mass index and not smoking are risk factors. Modified risk variables are the needle's size, design and method. To reduce complications, spinal needles have undergone modifications. It remained debatable, though, whether or not the incidence of PDPH differs noticeably depending on needle size.

Although the precise cause of post-cranial hypoxia remains unknown, CSF leakage is the primary cause of the condition. An acute phase lasting anywhere from minutes to several hours is characterized by abrupt CSF leakage and a subsequent drop in CSF pressure, which ultimately causes gravitational traction on pain-sensitive structures and intra-cranial structure shifting. Furthermore, PDPH secondary to CSF leakage is caused by adenosine receptor activation, which dilates intra-cranial arteries and veins to produce a compensatory increase in blood volume in accordance with the Monro Kellie concept[8-10].

The purpose of this study, "Comparison of Post-Dural Puncture Headache Incident in 23G, 25G and 26G Spinal Needles" is to assess the following. To evaluate and contrast the incidence of quincke spinal needle PDPH with varying sizes, as well as the degree of PDPH with varying sizes.

MATERIAL AND METHODS

Seventy five patients, ages 15-69, scheduled for lower limb and abdominal surgery, participated in this randomize comparative study. They were divided into three groups of twenty-five patients apiece at random. The study was carried out at the B.J. Medical College, Civil Hospital, Anesthesiology Department, Ahmedabad, Gujarat.

- **Group A**-23 G Quincke Spinal Needle
- **Group B**-25 G Quincke Spinal Needle
- **Group C**-26 G Quincke Spinal Needle

Inclusion criteria:

- Patients aged 16 years and above
- ASA grade I-III
- Scheduled for abdominal and lower limb surgery
- Willing to give consent

Exclusion criteria:

- Patient refusal
- Coagulation disorders
- Local infection in spine
- Psychological disorders
- Migrane
- Chronic headache
- Patients with h/o cardiac, respiratory, renal or hepatic failure
- Patient with hemodynamic instability (HR<50 min^{-1} and SBP<90mmHg)
- Allergy to medications

Prior to the procedure the patient was assessed, encompassing a general examination, systemic examination, history and any necessary investigations. The procedure's benefits and drawbacks were presented to patient's relatives. A relative of the patient gave written and informed consent. IV line fastened using an 18,20 gauge intricate. Baseline vitals are recorded along with basic monitoring procedures such as EKG, pulse oximeter, non-invasive blood pressure readings and visual assessment of respiration. Premedication was administered as an intravenous injection of ondansetron 0.15 mg kg^{-1}. Either in a sitting or left lateral posture the region from the lumber spine to the mid-axillary line is bandaged with spirit and betiding. Inject lignocaine 2% (2 cc) in L2-L3 or L3-L4 infiltration. Under stringent aseptic and antiseptic precautions, spinal anaesthesia is administered using a 23G, 25G and 26G spinal needle, midline approach and loss of resistance method at either L3-L4 or L4-L5. Following validation through consistent flow and CSF aspiration, buvipacain heavy 0.5% 2 cc to 3.6 cc injections are administered based on surgical procedures and further patient-related criteria. The patient was placed in the required supine posture and the level of motor anaesthesia by the Bromage classification and sensory level by the pinprick

method were assessed. Vital signs were assessed during the procedure. Injection Atropin 0.6 mg is used for bardycardia, while injection Mephentermine is administered when blood pressure falls.

Patient was moved to a ward after post-operative vitals were recorded. Every 6, 12, 18, 24 and 48 hrs the patient was followed up with regarding complaints of headache, nausea, vomiting and photophobia. The following is the International Headache Society's definition of post-dural puncture headache a post-operative headache that appears six hours to seven days following a spinal puncture and either gets worse or appears within fifteen mins of standing up. Within thirty minutes of applying the recumbent position, it gets better. Using a modified Lybecker classification the headache's severity is divided into three categories: mild, moderate and severe.

Statistical analysis: The collected data was combined, input into a spreadsheet using Microsoft Excel 2007 and exported to the SPSS version 15 data editor page (SPSS Inc., Chicago, Illinois, USA). The significance threshold and confidence level for each test were set at 5 and 95%, respectively.

RESULTS

In our study the groups are comparable with regards to age, sex, height, weight and type of surgery (Table 1). Twenty Eight percent of Group A, 12% of Group B and 4% of Group C have PDPH incidence. In all categories, this relationship is statistically significant. ($p<0.05$). Both the male and female PDPH incidences were statistically not significant ($p>0.05$) (Table 2).

There is just one case of severe PDPH, two cases of moderate PDPH and four cases of mild PDPH in Group A (23G). There are two mild cases and one moderate case in Group B (25G) but no severe cases. There was only 1 moderate case of PDPH in Group C (26G) (Table 3).

DISCUSSION

Post-dural puncture headache (PDPH) is a typical side effect of spinal anaesthesia. According to a research article on headache after spinal anaesthesia, the incidence of PDPH ranged from 0.3-20% in spinal anaesthesia and up to 70% after inadvertent dural puncture during epidermal anaesthesia[12]. PDPH is caused by CSF leaking that surpasses CSF production. The size of the dural leakage is directly related to the amount of CSF leaking. As a result, among other things, the needle diameter that pierces the dura mater was discovered to be a key factor influencing the occurrence of PDPH[5]. Parturient women are also thought to be at higher risk for PDPH[12].

The amount of CSF loss via the hole in the dura is determined by the type and size of the spinal needles. The Quincke type cutting needle generates greater defects in the dura fibres, resulting in a dural flap. Holst *et al*.[12] discovered a link between the amount of CSF loss and the needle type and size. They calculated the quantity of CSF loss using Quincke type 22, 25, 27 and 29 gauge needles to be 116, 54.6, 31.2 and 16.2 mL, respectively. According to several writers the overall incidence of distressing post-spinal headache ranges from 3-25%[14,15].

The gauge was the most critical factor contributing to the greater incidence of PDPH. The higher the prevalence of post-spinal headache the thicker the needle and the more traumatic the type of needle (cutting type)[16,17]. The study excluded needle sizes smaller than 26G, such as 27G and 29G. A prior study found that using fine gauge needles (29 gauge or smaller) reduces the incidence of PDPH but is related with a higher failure rate for spinal anaesthesia[17]. As a result the optimal spinal needle size is 23G, 25G and 26G.

In this study, 75 patients with ASA 2 and 3 underwent elective and emergency lower abdominal surgery under spinal anaesthesia. The demographic features of the patients in both groups were equivalent in terms of age, weight and height ($p>0.05$). In our study the incidence of PDPH was 28% in Group A (23G), 12% in Group B (25 G) and 4% in Group C (26G). The variation was statistically significant. In a double-blind study in young volunteers, Tourtelotte *et al*.[18] found a reduction of headache from 36%-12% when a 26G instead of a 23G needle was used which is comparable with our results. In our study the incidence of PDPH using 25G needle was 12%, which is comparable to the results of Ross *et al*.[19] (9%) 21 and Imarengiaye CO (10%).

In our study female population had a higher incidence of PDPH (18.42%) compared to males (10.81%). Results known to us from previous studies were that female sex was related with higher incidence of PDPH but they are not statistically significant. The results were consistent with our study. The results of Wu *et al*.[20,21] states that the risk of post spinal puncture headache in women was twice as great as that of men. Their study considered a great role for gender as a risk factor for post spinal headache. They co-related their finding to the physiological and psychosocial characteristics peculiar of women, as well as their pain perception[22]. Women seem to process nociceptive information differently from men, showing greater sensitivity to painful stimulation which facilitates the central sensitization process[23,24].

Table 1: Demographic date of study participants

	Groups		
	Group A (23G) (Mean±SD)	Group B (25G) (Mean±SD)	Group C (26G) (Mean±SD)
Age in years	27.4±9.87	28.84±8.81	24.56±6.25
Sex (M:F)	11:14	12:13	14:11
Height (cm)	158.52±9.08	159.52±9.19	161.24±9.36
Weight (kg^{-1})	61.92±8.33	63.76±6.94	59.84±9.3
Type of surgery			
Orthopedic surgery	8	5	6
General surgery	7	10	11
Cesarean section	10	10	8

Table 2: Post dural puncture headache

	Groups			p-value		
	Group A (23G) (n = 25)	Group B (25G) (n = 25)	Group C (26G) (n = 25)	A, B	B, C	C, A
Number of patients	7	3	1	-	-	-
Incidence	28%	12%	4%	0.013	0.042	0.007

Table 3: Severity of PDPH

Groups	Group A (n = 25)	Group B (n = 25)	Group C (n = 25)
Mild	4	2	1
Moderate	2	1	0
Severe	1	0	0

Patients who developed PDPH had mild or moderate headache, one patient in group A (23G) developed a severe headache. In a study of Dittmann and Renkl[25]. A decreased severity of headache was noted in 29G, 27G and 25G group of Quincke needle. There was moderate headache in 2 patients with 23G spinal needle and 1 patient with 25G spinal needle.

Once the patient had headache, he/she was instructed to:

- Take complete bed rest
- INJ Diclofenac Sodium I.M (75 mg) TDS and INJ Paracetamol (1gm vial) I.V. infusion over 15 min, every 6-8 hrs
- Plenty of fluid to hydrate patient
- Head low position

All the patients responded with this treatment and none of the patients required epidermal blood patch. There is a universal consensus about the fact that the thicker the lumbar puncture needles the higher could be the incidence of PDPH. A cutting type of needle inserted through the dural wall tears off a number of fibers in the wall and it creates permanent opening. The puncture site has typical crescent like appearance produced by the cutting type of needle. The anatomical feature of dura is such that longitudinal dispersion of its fibers plus a copious scattered of elastic fibers keeps the hole open once the dural fibers are cut[26].

CONCLUSION

The occurrence of post-dural puncture headache (PDPH) was much lower when using a 26G Quincke's spinal needle compared to both the 23G and 25G Quincke's spinal needles. Our study found that females have a higher prevalence of post-dural puncture headache (PDPH) compared to males, however this difference is not statistically significant.

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