Section: Anaesthesiology

Original Research Article

A COMPARATIVE STUDY OF EFFECT OF POSITION (SITTING VERSUS LATERAL DECUBITUS) DURING SPINAL ANAESTHESIA ON THE INCIDENCE OF POSTDURAL PUNCTURE HEADACHE IN PATIENTS UNDERGOING LOWER LIMB ORTHOPAEDIC SURGERIES

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Abstract

Background: The most common method of anesthesia for Lower limb surgeries is spinal anesthesia, and postdural puncture headache (PDPH) remains a major complication of this procedure. Nowadays, postdural puncture headache is a major cause of morbidity in patients undergoing surgeries under spinal anesthesia. This headache is the most popular reason for claims against anesthesiologists. The position after spinal anesthesia has been evaluated as a contributory factor in the occurrence of postdural puncture headache, but the position before spinal anesthesia has not been evaluated much. **Aim:** To compare the incidence of Post-Dural Puncture Headache following spinal anaesthesia in lateral decubitus position and sitting position in patients who underwent lower limb surgeries under spinal anaesthesia. **Patients and Methods:** This study is performed in Owaisi group of hospitals in 100 patients between the age 19 yrs and 35yrs undergoing lower limb surgeries. The intensity of post-dural puncture headache was assessed postoperatively using a Visual Analogue Scale (VAS) immediately on postoperative day (POD) one to POD 5. VAS is 10 point numeric scale with 0 considered as no pain and 10 considered as severe pain ever experienced. **Results:** The incidence of post dural headache is more in the sitting group compared to that of lateral decubitus position.

INTRODUCTION

Regional anaesthesia is most commonly used technique in the lower limb surgeries. Spinal anaesthesia is preferred to epidural anaesthesia and most commonly used technique during lower limb surgeries because Spinal anaesthesia is quicker and easier to place, allows adequate operating conditions in a shorter time, provides denser block, is more cost effective, less riskier in systemic drug toxicity and is less likely to fail and more reliable Spinal anaesthesia is usually conducted in the sitting or in the lateral position and rarely in the prone position. The lateral decubitus position is more convenient and more appropriate than other positions in ill or frail patient.

Similar to other neuraxial techniques, spinal anaesthesia has some technical complications, such as postdural puncture headache (PDPH), hematoma, and damage to neural structures. Post-Dural Puncture Headache is a well-known complication of spinal anaesthesia. Postdural puncture headache usually presents as a severe expanding pain over the frontal and occipital regions that extends to the neck and shoulders. The pain is worsened by shaking the head and when in an upright position. It is relieved by lying down. Fortunately, PDPH is generally self-limiting, and spontaneous recovery may occur in a few days.

Post-Dural Puncture Headache was first described by August Bier in 1898. The incidence of Post-Dural Puncture Headache after spinal anaesthesia is 1% - 6%. The risk factors of post-dural puncture headache after spinal anaesthesia are needle size, direction of bevel, needle design, number of attempts of lumbar puncture, age, sex, pregnancy, and previous history of PDPH.

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Objective

The objective of this study is to compare the incidence of Post-Dural Puncture Headache following spinal anaesthesia in lateral decubitus position and sitting position in patients who underwent lower limb surgeries under spinal anaesthesia.

MATERIAL AND METHODS

This is a prospective randomized clinical trial. This study is performed in Owaisi group of hospitals, Hyderabad after obtaining ethical clearance from the institutional ethics committee.

A written informed consent was obtained from all patients. A total of 100 patients both male and female patients aged between 19 and 35 years with the American society of anaesthesiologists (ASA) physical status 1 and 2 were enrolled in this study. The patients were randomly divided into two groups Sitting (S) group and Lateral decubitus group (L). Patients who had a contraindication for spinal anaesthesia are exempted from the study. The patients with a history of migraine headaches and chronic use of analgesics were also excluded from the study. After the pre anaesthetic checkup, routine monitoring with pulse oximetry, blood pressure, ECG was instituted. All Patients received 500ml crystalloid solution as co-loading. Spinal anesthesia was administered with 0.5% hyperbaric Bupivacaine with 25-gauge Quincke spinal needle with median approach. The needle was introduced with the bevel parallel to the meningeal fibres at the L3-L4 inter-spinous space using a standard precaution and procedure.

The intensity of post-dural puncture headache was assessed postoperatively using a visual analogue scale immediately on postoperative day (POD) one to POD 5. Visual analogue scale is 10 point numeric scale with 0 considered as no pain and 10 considered as severe pain ever experienced.

RESULTS

Table 1: Patient Demographs

Gender	S group	L group	Total
Male	27	29	56
Female	23	21	44
Total	50	50	100

P value: 0.84

Table 2: Age group

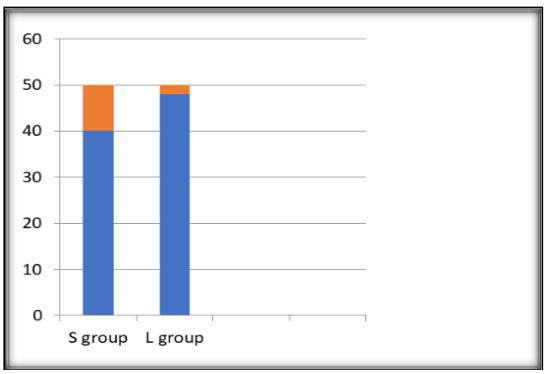
Age group	S group	L group	Total
19-20	2	1	3
21-30	26	28	54
30-35	22	21	43
Total	50	50	100

P value: 0.8

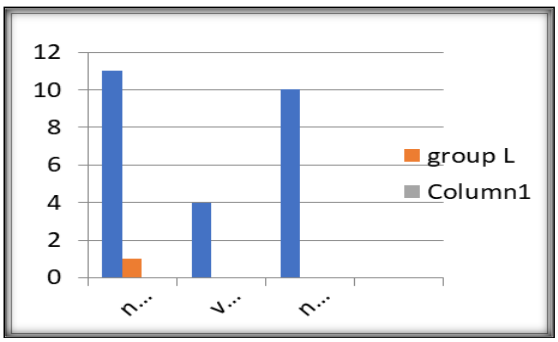
Table 3: Incidence of POST-DURAL PUNCTURE HEADACHE in two groups

Variable	PDPH	NO PDPH	TOTAL
S group	10	40	50
L group	2	48	50
Total	13	87	100

P value: 0.02



Graph 1: Incidence of PDPH



Graph 2: Incidence of nausea and vomiting in two groups

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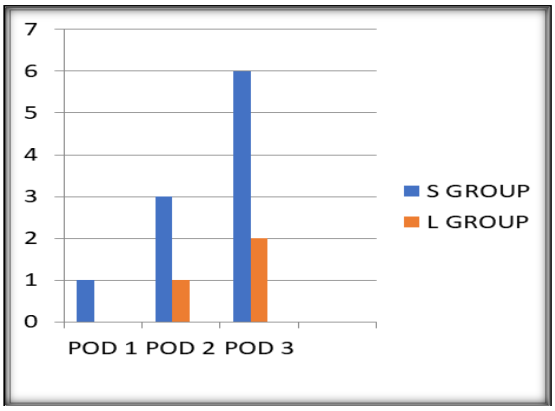
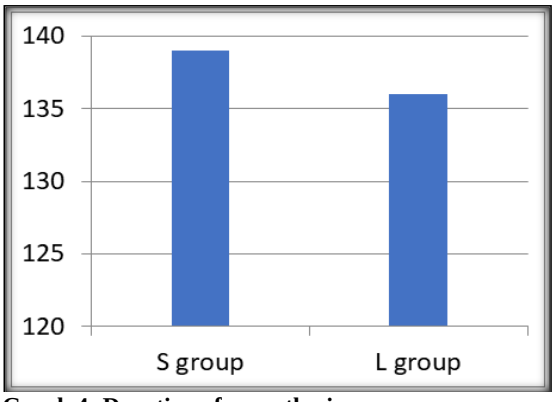
Table 4: Incidence of nausea and vomiting

variable	Group S	Group L
nausea	11	1
vomiting	4	0
Nausea & vomiting	10	0



Graph 3: Incidence of POST-DURAL PUNCTURE HEADACHEin Various Times



Graph 4: Duration of anaesthesia

Duration of anaesthesia

Table 5: Duration of anaesthesia

Variable	S group	L group
Sensory block level(L4, L5)	5.6	4.5
Duration of block (min)	139	136

A total of 100 patients who had been scheduled for elective surgeries with ASA 1 and 2 status randomly distributed into two groups.

The overall incidence of post-dural puncture headache was 12 (12 patients out of 100). Ten patients (20%) had post-dural puncture headache in the sitting group and only 2 patients (4%) in the lateral group. (table 3)

The intensity of the post-dural puncture headache was higher in the sitting group on the first day, second day and third postoperative days. The highest sensory block level in the sitting group was T5 and that in the lateral group was T4 (thoracic vertebrae) respectively. The mean sensory block duration in the sitting group was 139 and that in the lateral group was 136 min.(table 5). One of the non-specific symptoms of post-dural puncture headache are nausea and vomiting.

None of the patients with post-dural puncture headache required an epidural blood patch to relieve symptoms.

DISCUSSION

Post-dural puncture headache (PDPH) is a major complication of neuraxial anaesthesia that can occur following spinal anaesthesia. Although post-dural puncture headache usually resolves spontaneously, it has the potential to cause significant morbidity, extend the length of hospital stay or evolve into chronic headache.

The well-known risk factors of PDPH include young age, female sex, and pregnancy. Young adults are at higher risk of developing this condition than older individuals (14% vs. 7%) because with increasing age, the dura may be less elastic and less likely to gape. Women, particularly during pregnancy, are considered at increased risk for Postdural puncture headache. Its high incidence may be attributed to increased estrogen levels, which influence the tone of the cerebral vessels, thereby increasing the vascular distension in response to CSF hypotension. Some evidence suggests that morbidly obese patients have a decreased incidence of PDPH. The increase in epidural pressure observed in obese compared to thin patients may lessen the pressure gradient from the intrathecal space to the epidural space, decreasing the loss of CSF.

The type and size of needle are also important factors in PDPH, given that research clearly demonstrates that larger dural tears result in a higher incidence of this condition. Cutting needles (Quincke needles) are associated with a higher incidence of PDPH compared to blunt or pencil-point needles (Sprotte and Whitacre needles). Electron microscopy has shown that pencil point needles are more traumatic to the dura than the cut bevel needles. It is postulated that a pencil point needle produces an irregular tear in the dura and the subsequent inflammatory reaction reduces CSF leakage more effectively than the clean U-shaped puncture seen with a cutting-bevel needle, which decreases the risk of PDPH. Schmittner *et al.* and Gisore *et al.* confirmed the significantly lower incidence of PDPH with pencil-point needles compared to Quincke cutting needles in similar studies (1.7% vs. 6.6%, P = 0.02 and 4.5% vs.

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24.2%, P = 0.042). A modification of the Quincke (Atraucan) needle is also available, with a cutting point and a double bevel to cut a small dural hole and then dilate it. Several studies have confirmed that the bigger the needle, the greater the incidence of PDPH. With Quincke needles, the incidence and severity of PDPH is directly related to the size of the needle. A similar effect may occur with pencil-point needles.

Lynch J, Arhelger S et al.[25], conducted a study in young orthopaedic patients comparing Quinke and Whitakare needle and concluded that Post dural puncture headache is more common with thicker needles.

Another needle-related factor that results in a reduced incidence of PDPH is the orientation of the needle bevel parallel to the long axis of the spine, resulting in decreased disruption of dural fibers. This longitudinal bevel orientation separates the dural fibers rather than cuts them, which facilitates closure of the dural hole on withdrawing the needle. A longitudinal orientation of the needle bevel has been confirmed to reduce the risk of PDPH compared to perpendicular insertion. Regarding the direction of the bevel of a Tuohy needle, Norris *et al.* reported a decreased incidence of PDPH when the bevel entered the epidural space along the long axis of the spine and then was rotated 90 degrees before inserting the catheter compared to keeping a perpendicular approach.

Preventing post-dural puncture headache should be the primary goal of clinicians dealing with this procedure. In fact, proper attention to procedure-related factors can significantly reduce its incidence.

This study showed that the incidence and intensity of post-dural puncture headache was higher in the sitting position than in the lateral position. This study used a rigorous definition of post-dural puncture headache as a post-dural headache in the frontal or occipital area, and its symptoms are aggravated by assuming the sitting position and are alleviated by recumbency.

The factor associated with post-dural puncture headache following spinal anaesthesia which has not been studied extensively is its association with different position used to perform spinal anaesthesia i.e. sitting, lateral and prone position. Very few literatures have been found in relation to it.

Post-dural puncture headache is a direct consequence of the puncture hole in the dura, which results in the loss of cerebrospinal fluid (CSF) at a rate exceeding production. The average adult produces about 500 mL of CSF per day, or 21 mL per hour (0.3 mL/kg/hr), with 90% coming from the choroid plexus, and 10% from the brain substance itself. A total of about 150 mL of CSF circulates at any one time and is absorbed by arachnoid villi. The cause of postdural puncture headache is not entirely certain. As little as 10% loss of CSF volume can cause an orthostatic headache. There are two basic theoretical mechanisms which explain PDPH. One is reflex vasodilatation of the meningeal vessels due to the lowered CSF pressure. The other is the traction on the pain sensitive intracranial structures in the upright position. The traction on the upper cervical nerves like C1, C2, C3 causes the pain in the neck and shoulders. Traction on the fifth cranial nerve causes the frontal headache. Pain in the occipital region is due to the traction of the ninth and tenth cranial nerves. The spinal duramater is a tough membrane and is the outer layer of the meninges surrounding the brain and the spinal cord. When the duramater is perforated, the CSF leaks through it until it is closed either by intervention or through healing. Failure to close the dural perforation may lead to adhesions, continuous CSF leakage, and risk of infection.

After perforation of the dura, there will be leakage of CSF. In neurosurgical experience even minor perforations need to be closed, either directly or through the application of synthetic or biological dural graft material. Failure to close the dural perforation may lead to adhesions, continuing CSF leak, and the risk of infection. It was thought that the closure was facilitated through fibroblastic proliferation from the cut edge of the dura. Work published in 1959 dismissed the notion that the fibroblastic proliferation arose from the cut edge of the dura. This study maintained that the dural repair was facilitated by fibroblastic proliferation from surrounding tissue and blood clot. The study also noted that dural repair was promoted by damage to the pia-arachnoid, the underlying brain, and the presence of blood clot.

CSF pressure in the sitting position is 40cm of H2O and that in the lateral position is 5-20 cm of H2O. In the sitting position, this higher CSF pressure can make a larger hole in the dura and can cause a prolonged CSF leak. The needle is perpendicular to the outer dura fibre in the sitting position, thus causing a larger hole and more CSF leakage.

Another study done by *Majd SA, Pourfarzam S, et al.* [4] where lumbar puncture was done for diagnostic purpose in sitting and lateral position by 21-gauge Quincke needle observed more post-dural puncture headache in sitting position (45 %) than in lateral position 16.6%. This high incidence can be due to larger diameter of Quincke needle.

They assume that it is easy to perform dural puncture in sitting position and which is less traumatic so healing is delayed. In a prospective study done by *W.P.J. van Oosterhout et al.*[23] to find out the incidence of post-dural puncture headache in migraine and in non-headache subject after lumbar puncture found that post-dural puncture headache was more prevalent in the

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subgroup that underwent Lumbar puncture in sitting position vs in lateral supine position.

Our study is in agreement with the above studies with incidence of post-dural puncture headache is more in the sitting group.

In our study, we included the patients undergoing orthopaedic surgeries of lower limb. Because of the pain and inability caused by the fracture the patient could not move normally so time taken for the patient to lie down from the sitting position after performing the block has increased which may further increase the incidence of PDPH. In a study conducted by *Kyu Chang Lee et al.* to evaluate the incidence of post-dural puncture headache with maintenance of sitting position immediately after giving spinal anaesthesia found higher incidence of post-dural puncture headache(4%) in patients those were maintained in sitting position for 3-5 minutes compared to patients those were immediately resumed lying down position (0%). The reason concluded was increase in transdural pressure in sitting position between subarachnoid space and epidural space. They presumed that due to the maintenance of the sitting position, the CSF hydrostatic pressure would be greater, resulting in elevated CSF leakage and a greater incidence of PDPH.

Shahzad K, Afshan et al.[21]. concluded that sensory and motor blockade in spinal anaesthesia given in sitting position and lateral decubitus position are same. In our study also, there was no difference between sensory and motor techniques in both the techniques.

Similar to the work of *Moosavi Tekyes et al.*[7], the incidence of nausea and vomiting was more common in the sitting position group in the our study .The incidence of nausea and vomiting (concomitant symptom of PDPH) in the sitting position patients was remarkably more common than that in the left lateral decubitous position patients.

CONCLUSION

- The result of this study suggests that the incidence of post-dural puncture headache among the patient underwent lower limb orthopaedic surgeries under spinal anaesthesia which is performed in the sitting position is more common than that in the left lateral decubitous position However, the study is done in a small group of patients. More studies are required to confirm it.
- The patients were followed upto Post operative day 5 so delayed onset of post-dural puncture headache can be missed.
- Thus, more studies are necessary to assess the effect of position on the incidence of post-dural puncture headache.

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