

A RANDOMIZED STUDY TO ASSES THE EFFECT OF POSITION DURING INDUCTION OF SPINAL ANAESTHESIA ON INCIDENCE OF POSTDURAL PUNCTURE HEADACHE AFTER ELECTIVE CAESAREAN SECTION IN ADULT PARTURIENT.

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ABSTRACT:

Background: SA for CS conveys significant advantages over epidural anaesthesia as it is simple to use, with complete motor relaxation and faster onset, which allows regional anaesthesia in emergency cases reducing the requirement for GA. SA can usually be administered either in sitting or lateral position. Each of the positions has advantages and disadvantages. Objective: To compare the the incidence and severity of post dural puncture headache (PDPH) among pregnant women based on the different positions while induction of Spinal Anaesthesia with 2 ml 0.5% hyperbaric Bupivacaine. Methodology: The present randomized control trail was carried out by the department of Anaesthesiology at JSS Medical College and Hospital Mysuru from November 2017 to June 2019. All the Parturient who were classified based on the American Society of Anesthesiologists (ASA) Physical status Class II, who were scheduled to undergo elective caesarean section under Sub Arachnoid Block (SAB), who fulfilled the inclusion criteria were included in the study. A total of 63 parturient had to be included in each of the groups in the study to detect a significant relation between position for induction of spinal anaesthesia and occurrence of PDPH. Total of 140 parturient, 70 in each group to compensate for drop-outs, were included to detect a difference between the 2 groups with an alpha error of 0.05 and a power of 0.8. Results: The demographic profile and baseline vitals were similar in both the groups. Parturient comfort level during positioning for induction of spinal anaesthesia was assessed and it didn't show any significant difference (p= 0.7). That induction position for spinal anaesthesia doesn't affect the incidence of PDPH and null hypothesis was accepted. Conclusion: We started with the alternate hypothesis that induction of spinal anaesthesia in sitting position causes more postural puncture headache than when administered in lateral position. However, it was found that induction position for spinal anaesthesia doesn't affect the incidence and severity of postural puncture headache (PDPH).

Keywords: Post Dural, Headache, Position of Anesthesia, Caesarean Section

INTRODUCTION:

Spinal anaesthesia (SA) is currently the preferred technique for Caesarean Section (CS), with rapid onset of ideal surgical conditions. General anaesthesia (GA) is considered to produce more complications in parturient. The airway of the pregnant woman is considered to be difficult due to the physiological changes of pregnancy which becomes more difficult during labour and immediate post- partum. Because of this general endotracheal anaesthesia may be riskier as there is an increased chance of can't intubate, can't oxygenate situation leading to severe hypoxemia¹. Parturient are also considered to have full stomach due to delayed gastric emptying and oesophageal dysmotility which adds to the risk of aspiration under GA². SA for CS conveys significant advantages over epidural anaesthesia as it is simple to use, with complete motor relaxation and faster onset, which allows regional anaesthesia in emergency cases reducing the requirement for GA³. Placing an epidural catheter is difficult as the parturient may not be able to flex her

back properly, there are chances of intravenous catheter placement due to engorged epidural veins and there is occasional intrathecal catheter placement. CS is a relatively short duration procedure that is often followed by early mobilization of the patient; hence SA is the preferred choice over epidural anaesthesia.

Traditionally hyperbaric drugs are used for SA for CS – like hyperbaric 0.5% Bupivacaine, as one can easily predict the movement of the drug in the cerebrospinal fluid (CSF). One of the problems with Hyperbaric drugs is that they can produce very high blocks in pregnant women because of decreased volume and increased pressure of CSF which is due to engorged epidural veins as a result of aortocaval compression and high CSF pressure⁴.

SA can usually be administered either in sitting or lateral position. Each of the positions has advantages and disadvantages. In sitting position, midline identification is easier, especially in obese parturient and, with effective flexion of their back. The other advantage being better CSF flow through the needle. The disadvantage of sitting position is occasional occurrence of vasovagal (syncopal) attack. Parturient are more comfortable in lateral decubitus position without any syncopal attacks, but midline identification is more difficult⁵. However, in the obstetric population, small studies have been done which demonstrated the block performance to be easier in the sitting position, though this benefit is occasionally offset by a longer onset time as compared with that in lateral position⁶.

During the shifting of parturient from either sitting or lateral to the supine position after administration of Hyperbaric solutions, there can be further migration of the drug in the CSF. This also can be a reason for increased hypotension or bradycardia after mobilization, when using hyperbaric drugs³.

The exact mechanism of loss of CSF leading to a headache is still not known, two possible explanations can be considered. First and foremost, a decrease in CSF pressure pulls the intracranial (IC) structures on assuming the erect posture, causing symptoms. Next, a reduction in volume of CSF causes a compensatory vasodilation as suggested by the Monro-Kellie doctrine. It states that total IC volume remains constant (CSF volume+ brain volume+ IC blood volume), thus, a CSF volume loss leads to an increase in IC blood volume caused by venodilation leading to headache. PDPH can cause severe incapacitation and prolongs hospital stay adding on to the financial burden and also, untreated PDPH can lead on to severe IC haemorrhage. It continues as a distressing headache both for the patient as well as the physician. Usually it starts within three days of a dural puncture in 90% patients and within 48 hours in 66% patients developing PDPH. It presents as a severe throbbing pain over occipito-frontal regions extending to the neck and shoulders. It gets worsened on shaking the head and also, in an upright posture. It gets relieved after attaining a supine posture. Other associated symptoms are nausea/vomiting, tinnitus, vertigo, hearing loss, cranial nerve palsies, disturbances in vision, and pain in arm and thorax. Fortunately, PDPH is self-limiting and gets relieved spontaneously in some days⁶.

The study was started with the alternate hypothesis that induction of spinal anaesthesia in sitting position causes more PDPH than when administered in lateral position.

Objectives:

To compare the the incidence and severity of post dural puncture headache (PDPH) among pregnant women based on the different positions while induction of Spinal Anaesthesia with 2 ml 0.5% hyperbaric Bupivacaine

Materials and Methods:

The present randomized control trail was carried out by the department of Anaesthesiology at JSS Medical College and Hospital Mysuru from November 2017 to June 2019

All the Parturient who were classified based on the American Society of Anesthesiologists (ASA) Physical status Class II, who were scheduled to undergo elective caesarean section under Sub Arachnoid Block (SAB), who fulfilled the inclusion criteria were included in the study.

INCLUSION CRITERIA: -

- Age between 18 – 35 years
- Height 150 – 170 cm
- Body mass index < 30 kg/m²
- Singleton pregnancy

EXCLUSION CRITERIA:

- Parturient having contraindications to spinal anesthesia, viz, consent refusal, local infection, allergy to local anesthetics, bleeding disorders, spinal deformity, severe congenital or acquired heart disease, hemorrhage or hypovolemic shock
- Parturient with complications of pregnancy like preeclampsia, gestational diabetes, placenta Previa

- Known sensitivity to the study drugs
- More than 1 dural puncture attempts

METHOD OF COLLECTION OF DATA:

Based on the previous study⁶, and using formula for sample size calculation⁵¹,

$$N = 2[(\alpha + \beta) \frac{\sigma}{\mu_1 - \mu_2}]^2 / (\mu_1 - \mu_2)^2$$

$$= 2[(1.96 + 0.84)^2 \times 20^2] / 10^2$$

$$= 2 \times 31.36$$

= 63

- N = Sample size in each of the groups
- μ_1 = incidence of PDPH in Group 1
- μ_2 = incidence of PDPH in Group 2
- $\mu_1 - \mu_2$ = The difference the investigator wishes to detect i.e., 10%
- σ = Population variance (SD), conventionally taken as 20
- α = Conventional multiplier for alpha = 0.05, which is 1.96
- β = Conventional multiplier for power = 0.80, which is 0.84

N was found to be 63, i.e., 63 parturient had to be included in each of the groups in the study to detect a significant relation between position for induction of spinal anesthesia and occurrence of PDPH. Total of 140 parturient, 70 in each group to compensate for drop-outs, were included to detect a difference between the 2 groups with an alpha error of 0.05 and a power of 0.8 (10).

CHEMICALS USED: 0.5% Hyperbaric Bupivacaine (Anawin Heavy®)

INSTRUMENTS REQUIRED: 25 G Quincke's Spinal Needle

METHODOLOGY:

The informed consent was taken from 140 American Society of Anesthesiologists (ASA) physical status class II pregnant women admitted under the Department of Obstetrics and Gynecology, JSS Hospital, Mysore, requiring elective Caesarean Section (CS), satisfying the inclusion criteria. They were randomly allocated into 2 equal groups by simple random sampling using shuffled closed sealed envelope technique, namely Group S & Group L.

Group S– Hyperbaric Bupivacaine 0.5% 2ml administered in sitting position

Group L– Hyperbaric Bupivacaine 0.5% 2ml administered in lateral decubitus position

Pre-anesthetic Evaluation (PAE) of all the selected pregnant women was done on the previous day and written informed consent taken. All the parturient were informed about nil per oral status of at least 6hrs for solids and 2hrs for clear liquids. On the morning of commencement of study, all parturient were given intravenous (IV) ranitidine 50mg and metoclopramide 10mg and started with IV infusion of 10ml/kg body weight of Ringer Lactate infused 30 min before the spinal anesthesia. After connecting multipara meter monitors with ECG, pulse oximeter and Non-Invasive Blood Pressure (NIBP), basal parameters were recorded. Spinal anesthesia using 25 G Quincke's needle using 2ml of 0.5% Hyperbaric Bupivacaine was given in sitting position to Group S parturient and then turned immediately to supine posture with a wedge underneath right buttock. To parturient in L group, the spinal anesthesia was given using 2ml of 0.5% Hyperbaric Bupivacaine in right lateral position and turned immediately to supine posture with a wedge underneath right buttock. In both the groups the bevel of the needle was kept parallel to the longitudinal axis of spinal cord.

The spinal anesthesia was given by the anesthesiologist who was involved with randomization of parturient and the observer was a different anesthesiologist who entered the operation theatre after the parturient was brought to supine position. By this, the observer was blinded to the study position. Sensory block was tested by pin prick method using a blunt tip 25G needle. Motor block was studied using modified Bromate Scale (0= No paralysis, 1= Unable to raise extended leg; able to bend knees, 2= Unable to bend knee, able to flex ankle, 3=No movement). Surgery was allowed to start once the sensory block reached T₆ - T₄ level. Student's Independent t test was used to compare age, weight, body mass index (BMI) and height between two groups, and the Chi- square test was used to assess the relationship between position and postdural puncture headache (PDPH).

The Mann- Whitney U test was used to determine the significant differences in the values of quantitative variables without normal distribution, such as the day of onset of headache, headache severity score, mean sensory and motor block duration, and sensory and motor block level between the two groups. P value less than 0.05 was considered statistically significant. All statistical calculations were performed using SPSS version 16 software.

Results:

This study was conducted in the Department of Anaesthesiology, JSS Medical College Hospital, Mysuru, to determine the effect of position during induction of spinal anaesthesia (SA) on incidence of postural puncture headache after elective caesarean section. SA was given to parturient either in the sitting (group S) or the right lateral decubitus position (group L), using 2 ml 0.5% hyperbaric Bupivacaine using 25 G Quincke's spinal needle, and were immediately made supine. All characteristics, including sensory & motor block, preoperative haemodynamic were noted. They were followed up for 4 days postoperative for development of PDPH and, those who had PDPH were treated using standard protocol in our hospital.

Table 1: Social Profile of the study subjects

	Group				P Value
	Lateral		Sitting		
	Mean	SD	Mean	SD	
Age (years)	25.0	3.6	25.3	3.4	0.7
Height (cm)	157.6	5.7	159.2	5.6	0.1
Weight (kg)	65.8	7.4	66.8	8.1	0.45
BMI (kg/m ²)	26.5	2.6	26.4	2.7	0.8

There is no significant difference in the age and demographic data between the two groups ($p > 0.05$).

Table- 2: Parturient comfort level during positioning for spinal anaesthesia.

		Group			
		Lateral		Sitting	
		Count	N %	Count	N %
Parturient comfort level during positioning for spinal anaesthesia	Very Comfortable	21	30.0%	17	24.3%
	Comfortable	41	58.6%	43	61.4%
	Not Comfortable	8	11.4%	10	14.3%

Most of the parturient in both the groups, felt the positioning during induction of spinal anaesthesia as comfortable or very comfortable. Only 10 (14.3%) in the sitting group and 8 (11.4%) in the lateral group found the positioning during spinal anaesthesia uncomfortable. This was found to be statistically insignificant between the groups ($p = 0.7$).

Table- 3: Sensory & Motor block characteristics.

	Group				p
	Lateral		Sitting		
	Mean	SD	Mean	SD	
Time for onset of sensory block (sec)	66.29	17.65	47.57	12.62	<0.0001
Time for maximum sensory block (sec)	117.14	21.07	103.43	22.39	<0.0001
Duration of sensory block (min)	192.43	23.54	196.57	21.24	0.3
Time for onset of motor block (sec)	49.07	17.84	37.43	13.75	<0.0001
Time for maximum motor block (sec)	101.71	18.12	87.07	21.59	<0.0001
Duration of motor block (min)	216.71	21.13	213.43	18.31	0.3

Time for onset & achievement of maximum level of sensory and motor block was found to be statistically significantly ($p = <0.0001$) faster in the sitting group when compared to the lateral group, though not clinically significant. But the duration of sensory & motor block was similar in both groups ($p = 0.3$).

In all the 140 parturient we could achieve T₄ sensory block & Bromate- III motor block (modified Bromage scale).

Table- 11: PDPH & its Severity in the two groups.

		Group				p
		Lateral		Sitting		
		Count	N %	Count	N %	
Severity of PDPH Postoperative day 1	0	69	98.6%	68	97.1%	0.4
	2	1	1.4%	0	.0%	
	3	0	.0%	1	1.4%	
	5	0	.0%	1	1.4%	
Severity of PDPH Postoperative day 2	0	69	98.6%	66	94.3%	0.4
	2	1	1.4%	1	1.4%	
	3	0	.0%	2	2.9%	
	7	0	.0%	1	1.4%	
Severity of PDPH Postoperative day 3	0	70	100.0%	67	95.7%	0.2
	2	0	.0%	1	1.4%	
	4	0	.0%	2	2.9%	
Severity of PDPH Postoperative day 4	0	70	100.0%	68	97.1%	0.4
	1	0	.0%	1	1.4%	
	2	0	.0%	1	1.4%	

Parturient were followed up for 4 days' post-operative and those who developed PDPH were assessed using a numeric rating scale (NRS- 11)⁶. NRS- 11 is an eleven-point numeric scale for patient self- reporting of pain intensity. On the scale,

- 0 is absence of headache,
- 1-3 is mild pain (nagging, annoying and interfering slightly with activities of daily living (ADL),
- 4-6 is moderate pain (interferes significantly with ADL), and
- 7-10 is severe pain (disabling; unable to perform ADL).

Day of onset of headache was also noted. Parturient who developed PDPH were treated using standard protocol in our hospital, which is bed rest, increased fluid intake and use of analgesics like paracetamol and Non- steroidal anti-inflammatory drugs (NSAIDs). Epidural blood patch (EBP) was reserved for cases of refractory PDPH.

In our study, 1 parturiant in the lateral group and 4 in the sitting group developed PDPH. All parturient responded well to conservative treatment and none required an EBP.

In the lateral group, 1 parturiant who developed PDPH had only mild headache in the first 2 postoperative days.

In the sitting group, 2 parturient developed headaches on the 1st postoperative day- 1 had mild headache, which resolved in the next 2 days; but the other had moderate headache which became severe (score 7 on NRS- 11 scale) on the 2nd postop day, later reduced in intensity with treatment and resolved by 5th day postop. 2 other parturient also developed headaches of milder degree on the 2nd postop day which resolved with treatment within next 2- 3 days.

DISCUSSION

This study was conducted in parturient attending the Department of Obstetrics and Gynaecology, JSS Medical College and Hospital, Mysore, from November 2017 to July 2019.

It was conducted to ascertain the influence of different positions– right lateral decubitus (group L) and sitting (group S), for induction of SA with 2 ml 0.5% hyperbaric Bupivacaine using 25 G Quincke's spinal needle, in pregnant women for elective CS.

Spinal anaesthesia (SA) is the most popular technique used for caesarean section (CS). It gives excellent surgical conditions with minimal discomfort to the parturient. If an adjuvant is added to the local anaesthetic (LA), the parturient will also have reasonable duration of postoperative analgesia. General anaesthesia (GA) is restricted to a very few indications, especially where there is a contraindication for SA. Postdural puncture headache (PDPH) is one of the known delayed and distressing complications of SA which was described first by August Bier. The incidence of PDPH is more in pregnant women undergoing CS which can be as high as 30%⁷. The increased incidence in pregnancy could be due to the higher cerebrospinal fluid (CSF) pressure and increased leak. The higher CSF pressure is due to the engorged epidural veins as a result of aortocaval compression by the gravid uterus. PDPH occurs usually after 24 hours, but within 3 days of dural puncture. Its incidence within 48 hours is said to be in 66% of the patients

and within 3 days in 90% of the patients who develop PDPH^{6,7}. In majority of the women, it is generally self-limiting and relief of headache occurs in a few days.

There are many causes of headache in women after SA for CS. So, it is very important to differentiate PDPH from other causes. In our study, we have used International Headache Society criteria (ICHD- II criteria) for diagnosing PDPH. In this, patient needs to have a headache within 15 minutes after attaining erect posture and should get relief within 15 minutes of attaining supine posture. The patient should also have at least one of the following symptoms along with headache- 1) Neck stiffness, 2) Photophobia, 3) Hypoacusia, 4) Tinnitus or 5) Nausea⁸.

There are many risk factors for developing PDPH after SA. The most important ones are the needle size, needle design, direction of bevel, number of punctures, pregnancy, previous history of PDPH, age and sex⁶. Quincke- Babcock's needle with a cutting bevel increases the risk of developing PDPH compared to pencil-point needles like Whitacre and Sprotte. The reason is the fibres of the dura are cut with Quincke's needle and they retract under tension producing a large defect. Pencil- point needles produce more inflammatory reaction causing a narrow hole. Quincke's needles are much cheaper compared to pencil- point needles. Our hospital is a charity Institution and most of the patients are of low economic status. Hence, all the patients are administered SA using Quincke's needles. The incidence of PDPH is less when needle size is smaller, eg. 27- 29 gauge. The problem with these needles is that there is a decrease in the free flow of CSF, increase in the incidence of failed spinal and requirement of use of an introducer needle. Hence, in our study, we have used 25 G Quincke- Babcock's needle in all the parturient. Placing the needle perpendicular to the dural fibers has been found to produce a larger hole and increased incidence of PDPH⁹. In order to avoid this, in our study we have kept the direction of the bevel parallel to the fibers of the dura in all the parturient.

Right lateral position was adopted uniformly in all the parturient in group L to decrease the incidence of patchy block on the right side, as tilting of the vertebral column to the left is done immediately with a wedge underneath the right buttock. All the parturient in both the groups were immediately made supine after administration of SA in order to prevent decreased level of sensory block in sitting posture as we were using hyperbaric bupivacaine.

All parturient in both the study groups (n=25) were comparable with respect to demographic characteristics like age (20 to 35 years of age), height, weight and BMI. All of them completed the study. There is no statistical difference between the two groups regarding the demographic data. All parturient included in the study were from ASA PS class- II.

In our study, 1 (1.43%) parturient in the lateral (L) group and 4 (5.71%) in the sitting group developed PDPH which is statistically not significant. All parturient responded well to conservative treatment and none required an epidural blood patch (EBP).

In the lateral group, the parturient who developed PDPH had only mild headache in the first 2 postoperative days.

In the sitting group, 2 parturient developed headaches on the 1st postoperative day- 1 had mild headache, which resolved in the next 2 days; but the other had moderate headache which became severe (score 7 on NRS- 11 scale) on the 2nd postop day, later reduced in intensity with treatment and resolved by 5th postoperative day. 2 other parturient also developed headaches of milder degree on the 2nd postop day which resolved with treatment within next 2- 3 days.

The overall lower incidence of PDPH in our study might be because of the fact that needle was placed in the subarachnoid space at the first attempt in all parturient, hence avoiding multiple dural punctures and also relatively leaner parturient population led to needle placement at the first attempt. It has also been noticed that the incidence of PDPH is less in Indian women compared to the women in the west¹⁰. In all the parturient, the direction of the bevel was kept parallel to the dural fibers which also reduced the incidence of PDPH.

The above results obtained in our study show that position for induction of spinal anaesthesia doesn't have any significant bearing on the incidence of PDPH ($p > 0.05$).

Ozturk I et al¹¹ also concluded that patient position during administration of spinal anaesthesia in pregnant women doesn't affect the incidence of PDPH. In their study, the incidence of PDPH in sitting posture was 15.2% and in lateral posture was 12.9% ($p > 0.05$), which is higher than our study. Their study was a retrospective one and the needle size and number of punctures have not been mentioned.

In a study by Davoudi M et al⁶, the overall incidence of PDPH was 12.7%. 20.8% patients had PDPH in the sitting group whereas only 4.3% developed PDPH in the lateral group ($p=0.017$). This does not compare with our study. In their study, the needle size used was 24 G unlike 25 G used in our study and the study

was done on Iranian patients. It is also not mentioned in their study as how long the patients were kept in the position of administration of SA before brought to supine posture.

Zorrilla-Vaca et al¹² in a meta-analysis, found that lateral decubitus position is associated with a statistically significant reduction in incidence of PDPH compared with the sitting position ($p= 0.004$). In this meta-analysis, only patients undergoing non- obstetric surgeries were considered, unlike in our study all the parturient underwent CS.

Majd SA et al⁹ contrastingly, reached the conclusion that LP in sitting position could produce more PDPH as compared with lateral decubitus position. In this study, both male and female patients undergoing diagnostic lumbar puncture were considered.

We couldn't find any statistically significant difference in the parturient comfort level during positioning for induction of spinal anesthesia between the two groups ($p= 0.7$). 30% in the lateral group and 24.3% in the sitting group found the respective positions very comfortable, whereas, 11.4% & 14.3%, respectively found the positions uncomfortable.

Fredman et al¹³ couldn't find any significant difference between lateral and sitting positions with regards to the patients' anaesthetic experience, though the study was conducted in elderly patients more than 65 years age.

In our study, the time for onset of sensory block was 66.29+ 17.65 seconds in Group L while 47.57+ 12.62 seconds in Group S ($p< 0.0001$). This showed that it was statistically significant. The faster onset of sensory block, which was taken as the loss of pin prick sensation at T₁₀ level, in group S can be attributed to sudden movement of the parturient when making them supine resulting in turbulence inside the CSF and displacing the drug upwards. This difference was clinically insignificant.

Shahzad K et al¹⁴ found that onset of spinal anaesthesia was faster in sitting than in lateral position (4.5 vs 5.4 minutes) ($p< 0.006$), though, both positions had similar effects on sensory and motor blockade and haemodynamic stability. In this study, the onset time is much longer in both the groups compared to our study which is probably because of use of isobaric 0.5% bupivacaine in their study.

Tekye SMM et al¹⁵ found that time for onset of sensory and motor block was significantly shorter in the sitting group of patients ($p= 0.00$). This study was done to compare spinal anaesthesia in sitting posture (2.5 ml) and lower dose (1.5 ml) lateral posture for unilateral spinal anaesthesia. The early onset in sitting group could be due to the higher volume of local anaesthetic used.

CONCLUSION:

In the Present study induction of spinal anaesthesia in sitting position causes more postdural puncture headache than when administered in lateral position. However, it was found that induction position for spinal anaesthesia doesn't affect the incidence and severity of postdural puncture headache (PDPH).

The onset of sensory and motor blockade was faster when spinal anesthesia was administered in sitting position and supine positioning done soon after. Also, maximum level of block was achieved faster in parturient administered spinal anesthesia in sitting position. Duration of anesthesia is not affected by induction position for spinal anesthesia. Haemodynamics were also unaffected by induction position for spinal anesthesia. Parturient experience of anesthesia was similar in both positions.

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