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Comparison of the Level of Sensory Blockade Achieved When Spinal Anaesthesia is Performed for Caesarean Section Before and After Urinary Bladder Catheterisation: A Randomised Controlled Study

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Abstract

Background: Spinal anaesthesia has a prominent place in obstetric anaesthesia. Factors affecting the sensory level and the depth of anaesthesia and associated complications have been topics for much discussion. One such topic is whether keeping the patient supine for bladder catheterisation after the spinal injection would enhance spread of the anaesthetic agents upwards in the subarachnoid space leading to grave complications.

Objectives: To observe whether there was a clinically significant difference in the sensory levels achieved, changes in blood pressure and pulse rates when bladder catheterization was done before as opposed to after spinal anaesthesia, for caesarean section.

Method: 106 pregnant women undergoing cesarean section were randomised into two groups, with one group receiving spinal anaesthesia before bladder catheterisation and the other receiving spinal anaesthesia after catheterisation.

Results: The initial sensory level of T4 was achieved by 76% and 53.4% women who were catheterized before and after spinal anaesthesia respectively. The systolic and diastolic blood pressure dropped, and the pulse rate increased in both groups. There was no significant difference in either the spinal sensory level achieved, or the blood pressure and pulse rate changes observed whether the bladder was catheterized before or after spinal anaesthesia.

Conclusions: There was no difference in either the spinal sensory level achieved or the haemodynamic changes irrespective of whether the bladder was catheterized before or after spinal anaesthesia.

Keywords: Caesarean section, Spinal anaesthesia, Bladder catheterization, Sensory level, Blood Pressure, Pulse rate.

INTRODUCTION

The rate of caesarean sections have been rising both in developed and developing countries over the last two decades. A study in China, has shown an increase from 8.9% in 1993–1994 to 24.8% in 2001–2002 [1],

and in the United Kingdom from 12.5% in 1990 to 18.3% in 1999 [2]. A study in Singapore, has shown a high caesarean rate of 25.2% [3]. In addition, caesarean sections are being performed increasingly under regional anaesthesia rather than general anaesthesia [4,5]. Today most caesarean sections are

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done under spinal anaesthesia [6] by introduction of a local anaesthetic and an opioid (generally heavy Bupivacaine and Fentanyl) [7] to the cerebrospinal fluid.

Factors that affect the sensory level and depth of spinal anaesthesia and its complications have been topics for much discussion [8]. One such factor is the position the obstetric patients should adopt after the spinal anaesthetic is administered. [9]. It is common practice to position pregnant women with a slight head up tilt using a pillow under the shoulders or upper chest to minimise the upward spread of the drugs delivered into the subarachnoid space. The height of the blockade varies on the position adopted within the first 15 minutes of a spinal anaesthetic. It is well established that higher the block of the spinal anaesthesia, greater the incidence and the severity of complications. Severe and rapid hypotension [9,10,11] and respiratory depression are feared complications associated with a higher subarachnoid block particularly in obstetric patients.

Urinary bladder catheterisation is a routine procedure performed prior to a caesarean section [12] to prevent bladder injury and the woman is generally laid on her back, hips flexed 90° -120°, with knees bent and spread apart for this procedure. If this positioning is done after the spinal anaesthesia, there is a theoretical possibility of the local anaesthetic spreading cephalad leading to an unacceptably higher blockade. Therefore, spinal anaesthetic administration after bladder catheterisation is preferred by some.

On the other hand, catheterizing the pregnant woman after the spinal anaesthetic will prevent discomfort and pain associated with catheterization and will help reduce anxiety and fear that occurs before an operative procedure.

The objective of this study was to observe whether there was a significant difference in the sensory levels achieved, and in the haemodynamic variables when pregnant women were positioned supine with knees drawn up for bladder catheterization after the spinal anaesthesia, in comparison to pregnant women who were catheterized before spinal anaesthesia.

METHOD

The sample included pregnant women who were delivered by Caesarean sections (urgent and elective) in November and December 2010 at Teaching Hospital, Peradeniya, Sri Lanka. Ethical approval for this study was obtained from the ethics committee of the Teaching Hospital, Peradeniya and informed written consent was obtained from all participating pregnant women.

The inclusion criteria included pregnant women aged between 18 and 40 years, with a weight between 50-90 kg and a height between 140 – 170 cm. Women with severe obstetric or medical complications, any (mild/moderate/severe) cardiovascular disease. e.g. mild preeclampsia, or mild pregnancy induced hypertension were excluded. Women with absolute or relative contraindications to a spinal anaesthetic, those with spinal abnormalities, and those who had undergone previous spinal surgeries, in whom the lumbar puncture had to be done in spaces other than L₃-L₄ due to any reason were also excluded.

A total of 106 participants, compatible in height, weight and age (Table 1) were randomised into two groups by a computer-generated random number chart after obtaining informed written

Table 1: Comparison pre-anaesthesia parameter in the two groups (unpaired t tests have been performed to show that there was no difference in the baseline parameters between the two groups)

Comparison of pre-anaesthesia parameter between the two groups (mean ± SD)					
	Age (years)	Height (cm)	Weight (kg)	SBP (mmHg)	DBP (mmHg)
Catheterised before spinal anaesthesia	28 ± 4.1	148.9 ± 5.9	63.1 ± 5.1	122.5 ± 14.4	77.6 ± 10.5
Catheterised after spinal anaesthesia	29 ± 3.9	151.3 ± 6.1	61.7 ± 3.4	126.7 ± 9.9	77.2 ± 6.9
t values	1.9917	1.3204	0.3281	2.001	2.002
p value	0.105	0.1124	0.1213	0.1936	0.8508

consent.

One group had bladder catheterisation before the spinal anaesthetic while the other group were catheterized after the spinal anaesthetic. The spinal anaesthetics were performed by the principal researcher at L₃-L₄ space with the patient in the seated position. All other factors affecting the height of a spinal block were strictly controlled. All patients were preloaded with 500 ml of 0.9% Saline. All participants were administered 2.5 ml of 0.5% Heavy Bupivacaine and 0.2 ml Fentanyl. After the procedure, all were laid supine and propped up on two pillows of the same thickness and 20° of lateral tilt was maintained to avoid aortocaval compression. Oxytocin 5 units were given as an intravenous bolus with the delivery of the baby and an intravenous infusion of 20 units started as a slow infusion. The highest sensory level achieved the blood pressure heart rate, respiratory rate and SpO₂ every 2 minutes up to 12 minutes after the spinal anaesthetic, were recorded by a blinded observer, who was a senior medical officer in Anaesthesia. Thereafter, these parameters were recorded at 15, 20,

53.4% (n=54) of the patients catheterized after the procedure achieved a sensory level of T₄. The final sensory levels achieved by the two groups are shown in percentages in the Table 2. There was no significant difference in the final sensory level achieved in the two groups. ($X^2 = 4.368$, $p = 0.113$).

The pre-anaesthesia blood pressures were not significantly different in the two groups (1). Both groups showed a significant drop in systolic (SBP) and diastolic (DBP) blood pressures from the preoperative value when paired t tests were done. In the group catheterized before the spinal anaesthesia, SBP dropped by 19.62 mmHg ($p < 0.0001$) and the DBP by 19.08 mmHg ($p < 0.0001$). In the group catheterized after the spinal anaesthesia, SBP drop was 16.08 mmHg ($p < 0.0001$) and the DBP 17.03 mmHg ($p < 0.0001$). However, the drop in blood pressure was not significantly different in the two groups [SBP (unpaired $t = 0.4834$, $p = 0.6392$) and DBP (unpaired $t = 1.136$, $p = 0.2823$)] (Figure 1 & 2).

Although there was no difference in the

Table 2: Percentages of patients reaching Thoracic (T) segments of anaesthesia

	Catheterization before spinal anaesthesia	Catheterization after spinal anaesthesia
<i>T</i> ₃	16.7	23.3
<i>T</i> ₄	76.6	53.4
<i>T</i> ₅	6.7	23.3

25 and 30 minutes.

The patients were monitored for the progression of the block, dangerous hypotension (decreased by 20% or more from baseline), bradycardia, numbness of the arms and hands (would indicate that the block is too high), breathing difficulties (would indicate that the block is too high) and changes in the level of consciousness. Any complications that arose as a result of the spinal anaesthetic ascending too high were treated intravenous ephedrine 5mg boluses at a time.

RESULTS

Seventy six percent (76% - n=52) of the patients who were catheterized before the spinal anaesthesia and

magnitude of blood pressure drop between the two groups, the SBP drop was significantly slower in the group catheterized after the spinal anaesthesia (mean time 8.1 min $\pm$ 1.1 min) compared to the group catheterized before the spinal anaesthesia (mean 6.6 min $\pm$ 0.9 min (unpaired $t = 1.521$, $p = 0.037$)). But, the DBP did not show this feature. . The general protocol for management of a spinal anaesthesia patient if the blood pressure drops more than 20% of the figure recorded at baseline, is administration of intravenous ephedrine. In the present study there were two women in the two groups who had to be given intravenous ephedrine.

Figure 1: The drop in systolic blood pressure recorded over time after spinal anaesthesia.

Each point indicates Mean $\pm$ SEM for the sample of 106 pregnant women.

Figure 2: The drop in diastolic blood pressure recorded over time after spinal anaesthesia.

Each point indicates Mean $\pm$ SEM for the sample of 106 pregnant women.

There was a rise in the pulse rate from the preoperative value in both groups (paired t test), with a mean rise to 105 bpm from 93 bpm ($p < 0.0001$) in the group catheterized before the spinal anaesthesia and from 88 bpm to 100 bpm ($p < 0.0001$) in the group catheterized after the spinal anaesthesia. However, the rise in pulse rate was not significantly different in the two groups (unpaired $t = 0.952$, $p = 0.7655$). The magnitude of the rise of pulse showed a similar pattern in the individual patients in the two groups with more than 50% showing a rise less than 10 beat per minute (Figure 3).

DISCUSSION

A randomized controlled trial was conducted in order to ascertain whether there was a difference in the sensory level achieved and changes in blood pressure and pulse when bladder catheterization was performed before and after induction of spinal anaesthesia. We conclude that there was no difference in either the spinal sensory level achieved or the changes in blood pressure and pulse rate when the bladder was catheterized before and after spinal anaesthesia. The preferred sensory level for a spinal

Figure 3: Magnitude of rise in pulse rate in the two groups of patients

anaesthetic for a caesarean section is thoracic 4 segment for temperature sensation [9]. Several factors affect the spread of the injected local anesthetic solution within the CSF and the ultimate extent of the block obtained [9,10,11,13]. Some of the factors that are important for spread includes patient positioning immediately after injection [9]. CSF volume correlates inversely with level of anaesthesia, and therefore, increased intraabdominal pressure or conditions that cause engorgement of epidural veins (pregnancy, ascites, large abdominal tumours) decrease CSF volume and are associated with higher blocks. Curvature of spine also affects the spread. Regarding height - taller patients require more drug to achieve a given level. The present study did not find a difference in the level of spinal block achieved between those with pre and post anaesthetic catheterisation. A previous study done on 117 patients also reports that that pre-incisional intra-abdominal pressure was not associated with maximum sensory block level [13]. Spinal anaesthesia produced a significant drop in both systolic and diastolic blood pressures by (approximately 30 mmHg in the case of SBP and DBP) presumably blocking the sympathetic outflow from the spinal cord. This is an expected and known outcome of spinal anaesthesia. Similarly, the tachycardia observed would have been a baro-reflex response brought about by the drop in blood pressures.

A recent study conducted on 511 mothers who underwent caesarean section concluded that age of the mother, her body mass index, the amount of weight gained during pregnancy, gravidity, baseline SBP and heart rate, history of hypotension, preloading with fluid, adding sufentanil to bupivacaine and sensory block height were the main risk factors for spinal anaesthesia-induced hypotension [8]. We also observed that the systolic blood pressure drop was slower in the group catheterized after the spinal anaesthetic was introduced, probably due to the positioning for catheterization which delayed the upward spread of the spinal anaesthetic. However, in the rare instance when the drop in blood pressure was substantial, it was handled by administration of intravenous ephedrine, the commonly used vasopressors [14]. Spinal anaesthesia is now considered a safe and efficacious technique for obstetric anaesthesia and in the hands of experienced anaesthetists it has made a significant improvement in maternal morbidity [15].

According to our findings, we concluded that there is no significant difference in the sensory levels, changes in blood pressure or pulse rates between pregnant women catheterised before or after administration of the spinal anaesthetic. This is a very useful finding in the practice of spinal anaesthesia for obstetric patients because it is safe to catheterise after the administration of the spinal anaesthesia which will

minimise discomfort to the pregnant women with no increased risk of a drop in blood pressure.

Author declarations

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Author contributions

All three authors participated in the conceptualization, study design and resource allocation as well as reviewing and editing the manuscript. SN collected the data and wrote the first draft of the manuscript with SDI.

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Availability of data and materials

Data will be made available on request from authors

Ethics approval and consent to participate

Ethical clearance for this study was obtained from the Ethical Review Committee of the Teaching Hospital, Peradeniya.

Competing interests

None

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