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A comparison of the haemodynamic effects of lateral and sitting positions during induction of spinal anaesthesia for caesarean section

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ABSTRACT

Background: Hypotension during spinal anaesthesia occurs commonly in parturients. By influencing spread of local anaesthetic, maternal position may affect the speed of onset of sensory block and thus the haemodynamic effects. The aim of this study was to determine whether inducing spinal anaesthesia for caesarean section using plain bupivacaine in the lateral position would result in less hypotension compared with the sitting position.

Methods: One hundred American Society of Anesthesiologists physical status I and II patients undergoing elective caesarean section were randomised to receive spinal anaesthesia in the lateral position (Group L) or the sitting position (Group S). Using the L3-4 interspace, patients received intrathecal plain bupivacaine, 10 mg or 12 mg according to their height, after which they were placed immediately in the supine position with left uterine displacement. Maternal blood pressure was measured every minute for 10 min, every three min for 20 min and 5-minutely thereafter. Hypotension was defined as a fall in systolic blood pressure >20% or a value <90 mmHg.

Results: There was no difference in the lowest recorded systolic blood pressure in Group L (99.2 ± 8.9 mmHg) compared with Group S (95.4 ± 12.3 mmHg, $P = 0.081$). However, the lowest recorded mean arterial pressure was greater in Group L (72.9 ± 11.2 mmHg) than in Group S (68.2 ± 9.6 mmHg; $P = 0.025$). The incidence of hypotension was lower in Group L (17/50, 34%) than in Group S (28/50, 56%; $P = 0.027$). Onset of hypotension was similar between groups.

Conclusion: Hypotension occurred less frequently when spinal anaesthesia for caesarean using plain bupivacaine was induced with patients in the lateral compared with the sitting position. Values for the lowest recorded mean arterial pressure were greater but values for the lowest recorded systolic blood pressure were similar for patients in the lateral position group.

Keywords: Spinal anaesthesia; Caesarean section; Maternal position; Blood pressure

Introduction

Hypotension is common after spinal anaesthesia in parturients.[1] It may be due in part to cephalad spread of local anaesthetic in the subarachnoid space and also to aortocaval compression by the gravid uterus. These factors are influenced by the parturient's position during and immediately after subarachnoid injection. Prophylactic measures to reduce the incidence of hypotension include fluid loading, left lateral uterine displacement and the use of vasopressors. Despite these prophylactic measures, hypotension has been shown to have an incidence of 30–90%.[2,3]

By influencing spread of local anaesthetic, maternal position may affect the speed of onset of sensory block. However, studies of different maternal positions have produced conflicting results with respect to both haemodynamic stability and speed of onset of block.[4,5] Such studies have not been reported in Nigeria and only a few, such as that by Hallworth et al. have been carried out using plain bupivacaine when investigating combined spinal-epidural (CSE) anaesthesia.[6]

The use of plain bupivacaine in obstetrics is unpopular because of its less predictable spread and greater inter-patient variability when compared with hyperbaric bupivacaine.[7,8] Its safety in the sitting position has been questioned.[2] However, the lateral position has been shown to be associated with less haemodynamic change by limiting the spread of sympathetic block.[6] Our study was therefore designed to compare the haemodynamic effects of the lateral and sitting positions during induction of spinal anaesthesia for caesarean section using plain bupivacaine.

Methods

This study was conducted at the University of Port Harcourt Teaching Hospital, Nigeria, West Africa.

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Institutional ethics committee approval and patient consent were obtained. One hundred healthy parturients with normal pregnancies scheduled for elective caesarean section were randomly assigned by blind balloting to one of two groups: Group L, lateral position, or Group S, sitting position. All patients were premedicated with intravenous ranitidine 50 mg given one hour before surgery.

Exclusion criteria were refusal to participate, hypersensitivity to bupivacaine, age <18 years, bleeding disorders, preeclampsia, gestational age <36 weeks, diabetes mellitus, febrile illness, active labour, intrauterine growth retardation intrauterine growth restriction, infection related to the site of spinal needle insertion and patients who did not achieve a sensory level of T6 or Bromage score of 3, 15 min after intrathecal injection.

Baseline vital signs including non-invasive blood pressure (BP), heart rate (HR), electrocardiogram, oxygen saturation and temperature, were recorded in the supine position with 15° left lateral tilt. A 16-gauge cannula was inserted into a forearm vein of the non-dominant hand and 0.9% saline 20 mL/kg was infused over 15 min preceding the block. The parturient was then positioned by a trained assistant into either the left lateral or sitting position with feet stretched in the axis of the operating table (hamstring stretch position)[9,10] according to the randomisation. Using a midline approach, a 25-gauge Whitacre needle was introduced into the L3-4 intrathecal space with the orifice pointing towards the floor. Plain bupivacaine 0.5%, 2 mL (patient height <1.65 m) or 2.4 mL (patient height ⩾1.65 m) was injected over 10–15 s and the patient returned immediately to the modified supine position. Time taken from subarachnoid injection to supine positioning was noted. Oxygen desaturation below 94% was treated with 4 L/min oxygen via face mask.

At this point, a second anaesthetist who was unaware of parturient group was responsible for intraoperative data collection. Non-invasive BP and HR were recorded every 1 min for the first 10 min, at 3 min for the next 20 min and at 5-min intervals thereafter. Hypotension was defined as a fall in systolic BP >20% below the baseline value or <90 mmHg. Intravenous ephedrine 5 mg was given intermittently to manage hypotension not responding to rapid infusion 0.9% saline 250 mL. Bradycardia was defined as a HR <60 beats/min. Anaesthetic assessment of the block before surgery was carried out every 2 min using loss-of-cold sensation to cotton wool soaked in ethyl alcohol and the sensory level at 15 min from intrathecal injection was noted and recorded as the upper sensory level of block. Lower limb motor block was assessed using the modified Bromage score (1 = able to raise legs above table, 2 = able to flex knee, 3 = able to move feet only, 4 = no movement in legs or feet). Loss-of-cold sensation at and including the T6 dermatomal level and a Bromage score of 3 or 4 were considered adequate for surgery. If the block failed to reach this level 15 min after intrathecal injection, general anaesthesia was administered and the parturient excluded from the study.

Additional data collected included times of intrathecal injection to surgical incision, uterine incision-to-delivery interval, time from intrathecal injection to the first occurrence of hypotension and time to the end of surgery. The lowest measurements for BP and HR within 30 min of intrathecal injection were also recorded. Values for lowest systolic and mean arterial pressure (MAP), as well as the frequency of systolic BP <90 mmHg were used as measures of the severity of hypotension. Neonatal condition was assessed using Apgar scores at 1 and 5 min. Complications including nausea, vomiting, shivering, dizziness and respiratory distress, were recorded and appropriately treated.

Statistical analysis

The primary outcome was defined as the lowest recorded systolic BP. Using data from previous studies, we calculated that a sample size of 50 patients per group would have 90% power at the 5% significance level to detect a 13 mmHg difference between groups with a standard deviation of 19 mmHg. Secondary outcomes were lowest MAP, incidence of hypotension, onset of hypotension, lowest HR, ephedrine use, upper sensory level, time to sensory level at T6 and neonatal outcome. Data were entered into a spreadsheet and analysed using the Statistical Package for Social Sciences (SPSS) 15.0 for Windows (SPSS Inc, Chicago, IL, USA) and Winpepi version 9.7 (Abramson JH, School of Public Health and Community Medicine, Hebrew University, Jerusalem, Israel). Results are expressed as mean ±SD and number of patients (%). Statistical significance was determined using the $\chi 2$ for categorical variables and the t-test for continuous variables. A P value <0.05 was considered statistically significant.

Results

Fifty patients were studied in each group. No patient was excluded because of inadequate block. Maternal

Table 1 Patient Demographics

	Group L (n = 50)	Group S (n = 50)	P value
Age (years)	31 ± 4	32 ± 4	0.3
Height (m)	1.6 ± 0.1	1.6 ± 0.1	0.1
Weight (kg)	81.1 ± 10.3	81.8 ± 11.4	0.8
Body mass index (kg/m^2)	29.2 ± 5.1	30.6 ± 4.2	0.1
Gestational age (weeks)	38.2 ± 1.4	38.5 ± 1.5	0.3
Parity	1 [0–3]	1 [0–4]	0.4

Data are mean ± SD or median [range].