

Evaluation of Hemodynamic changes in Elective Cesarean section under Spinal Anesthesia

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Abstract

Background: Spinal block provides excellent anesthesia for cesarean section, but it is frequently accompanied by hypotension, which if untreated can pose serious risks to mother and baby. Over the years, many interventions have been tried to prevent hypotension, but no single technique has proven to be effective and reliable. This study was carried out with the aim to find if wrapping the legs with elastic crepe bandage in addition to traditional methods was effective in preventing post spinal hypotension.

Materials and Methods: A total of 60 full-term parturients with an uncomplicated pregnancy belonging to American Society of Anesthesiologists I or II were allocated randomly (30 in each group) to have their legs wrapped with elastic crepe bandage or no wrapping was done. All patients received intravenous (IV) crystalloid (20 ml/kg) 15 min prior to spinal injection and were placed in left lateral position. Electrocardiography and oxygen saturation was monitored continuously and heart rate, blood pressure was measured every 2 min until delivery of baby and every 5 min thereafter until end of cesarean section. Significant hypotension was treated with IV phenylephrine 50 µg bolus doses.

Results: The frequency of hypotension was significantly less ($P = 0.009$) in Group B (legs wrapped group) 3 (10%) patients when compared with Group A (nonleg wrapped) 13 (43.33%). In Group A 10 (33.33%) patients and in Group B 3 (10%) patients required rescue dose with phenylephrine which was statistically significant ($P = 0.0003$). Difference in the "mean change of arterial pressure" between Group A and B was highly significant ($P < 0.001$) recorded at 4, 6, and 8 min.

Conclusion: Incidence of hypotension can be reduced by wrapping the legs with elastic crepe bandage with a subsequent reduction in the use of potent vasopressor. Since leg wrapping with crepe bandage is cheap, easy, readily available, noninvasive, and nonpharmacological method, it can be recommended for preventing post spinal hypotension in a developing country like ours.

Keywords: Caesarean section, leg wrapping, spinal anaesthesia

Introduction

Cesarean birth has become the most common hospital-based operative procedure. The choice of anesthesia for cesarean section depends on the indication for the surgery, degree of urgency, maternal status and

desire of patient. Use of regional anesthesia has dramatically increased and use of general anesthesia for cesarean section has been steadily decreasing. ^[1] Risk of general anesthesia includes failed endotracheal intubation, failed ventilation, aspiration pneumonitis, postoperative nausea and vomiting, neonatal

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depression, and maternal awareness.^[2] Although spinal block provide excellent anesthesia for cesarean section it is frequently accompanied by hypotension generally proportional to the degree (level) of sympathectomy (height of block).^[3] Many methods to decrease the risk of hypotension have been studied, which include ensuring proper maternal position with uterus displaced off vena cava, infusion of fluids to increase effective blood volume, administration of ephedrine and phenylephrine, physical intervention such as leg wrapping.

Methodology

This prospective, double-blinded, and randomized controlled trial was undertaken after the approval by Institutional Ethics Committee. A written informed consent was obtained from each patient for participation in the study. As reported by previous studies a sample size of 27 in each group was necessary to detect a difference of this magnitude (39%) with 81% power in a two-tailed test at alpha error of 0.05. We recruited additional 10% patients keeping in view a possibility exclusion, failed block, etc. 60 full term pregnant patient with singleton uncomplicated pregnancy belonging to American Society of Anesthesiologists (ASA) Class I or II, scheduled for elective cesarean section under spinal anesthesia were randomly assigned by opening sealed envelope to either Group A (non-leg wrapping) (n = 30) or Group B (leg wrapped) (n = 30). An experienced anesthesiologist blinded to the leg wrapping, or the control group recorded the physiological variables. Patient characteristics, including age, height, weight, and gestational age was recorded. All the patients were kept fasting for 10-12 h before surgery. For all patients an intravenous (IV) line was secured using an 18G cannula in the left forearm and was premeditated with ranitidine 50 mg and metoclopramide 10 mg IV injections 30 min prior to the cesarean section.

Baseline blood pressure and heart rate were measured in the left supine wedged position. Baseline values were taken as the average of three successive readings. IV fluid preloading was then done with around 20 ml/kg of warmed ringer lactate solution over 15-20 min just prior to the spinal anesthesia. Group A patients had their lower limbs neither raised nor wrapped, but they were simply covered to hide them from anesthesiologist recording hemodynamics. Group B patients (n = 30) had their lower limbs wrapped immediately before the administration of

the subarachnoid block. Leg wrapping was achieved with crepe bandage (15 cm width, 4 m stretched length) applied from the ankle to the mid-thigh in both legs; during wrapping lower extremities were lifted at an angle of 45°. The crepe bandages were wrapped tightly enough that the women felt the tightness, yet it was comfortable and not painful. Care was taken to avoid compressing the legs to greater than arterial pressure by checking for capillary pulsation in the toes. All patients had their leg wrapped by the same person in around 3 min to eliminate bias introduced by method or altered force of wrapping. After wrapping the crepe bandages were hidden to ensure blinding.

Intrathecal all patients received 12.5 mg (volume 2.5 ml) 0.5% hyperbaric bupivacaine. Spinal anesthesia was performed in the sitting position using a 25G Quincke's needle in the L3-L4 or L4-L5 interspace through midline approach under all aseptic condition. Thereafter, the patients were placed supine with 15° left lateral tilt. Fluid replacement was maintained with ringer's lactate solution. Electrocardiography and oxygen saturation was monitored continuously and the heart rate and blood pressure was measured every 2 min until delivery of baby and every 5 min thereafter until the end of cesarean section. Duration of surgery and any intraoperative complications were recorded.

Hypotension was defined as fall in systolic blood pressure to ≤ 90 mmHg. Hypotension was treated immediately by increasing the rate of IV ringer lactate administration and by bolus 50 μ g phenylephrine intravenously. Parameters were recorded in a specially prepared proforma.

Results

Parturients in both groups were matched for age, weight, height, gestational age, and ASA grade no significant difference was found. There was no significant difference between the groups in respect to the duration of surgery from block delivery, delivery to end of surgery, total duration of surgery, time to achieve maximum sensory block height, and level of cephalad sensory block height.

Heart rate changes before delivery at 2 min interval were compared between the two groups, significant difference was found at 6th and 8th min (P = 0.016, 0.010), whereas no significant difference was observed after delivery.

The mean systolic blood pressure changes before delivery at 2 min interval when compared between two groups showed that Group B (leg wrapped group) had consistently higher systolic blood pressure throughout the measured interval. There was a significant difference in systolic blood pressure between the two groups at 4th, 6th, 8th, 10th, and 12th min and this difference was highly significant at 6th and 8th min ($P < 0.0001$). No significant difference was observed after delivery. Leg wrapped group had higher mean arterial blood pressure throughout the measured interval. There was highly significant difference at 4th, 6th, and 8th min ($P = 0.0002, 0.0001, 0.0003$), but no significant difference was observed after delivery.

In Group A, 13 (43.33%) patients developed hypotension and in Group B 3 (10%) patients developed hypotension thus significant difference in frequency of hypotension between the two groups was observed ($P = 0.009$). In Group A, 10 (33.33%) patients and in Group B 3 (10%) patients required rescue dose with phenylephrine, which was statistically significant ($P = 0.0003$).

Discussion

Hypotension following spinal anesthesia results from a decrease in arteriolar and venous tone secondary to sympathetic block, causing reduction in systemic vascular resistance and redistribution of central blood volume up to 500-600 ml to the peripheral compartment.^[4] A range of strategies are therefore being used to prevent or minimize hypotension, but there is no established ideal technique. The major interventions that have been used over the years are prophylactic fluid preloading (crystalloid or colloid), use of vasopressors like ephedrine or phenylephrine and use of varying mechanical interventions to increase central blood volume such as Esmarch bandages, compressive leg stocking, and crepe bandage.

The role of preloading with crystalloids in prevention of hypotension has been questioned whereas colloid is associated with the high cost and possibility of hypersensitivity and impaired coagulation. Use of vasopressors impairs utero-placental perfusion secondary to vasoconstriction with fetal or neonatal consequences. As a significant contribution to hypotension is made by venous pooling in the legs and abdomen, we therefore investigated the simple

leg wrapping as a method of reducing the incidence and severity of hypotension. In the present study, we found that there was a reduction in incidence of post spinal hypotension and reduction in need of rescue vasopressor administration achieved by using ordinary crepe bandage for wrapping the lower limbs. In Group A (nonleg wrapped) 43.33% and in Group B (leg wrapped) only 10% patient developed hypotension. Overall 33.33% parturient in nonleg wrapped group required rescue dose of phenylephrine, while only 10% parturients in leg wrapped group. Positive effect of wrapping the legs as a prophylactic method to prevent hypotension has also been investigated previously. van Bogaert et al. showed that the occurrence of hypotension in the control group and legs wrapped group with Esmarch elasticated bandage was 45.5% and 15.8%, respectively. Furthermore, the need of ephedrine administration was less in legs wrapped group than in the control group.^[5] Similar result was observed in a study by Rout et al., in which the number of episodes of hypotension was significantly reduced by leg wrapping with elasticated Esmarch bandages (18% of cases) as compared with controls (45.5% of cases). However, no significant differences were observed in the dose requirement for ephedrine between the groups.^[6] Bhagwanjee et al. observed that there was a high incidence of hypotension requiring vasopressor therapy in the control group (83%) compared with the leg wrapped group (16%) - a difference which was significant, both clinically and statistically.

In Group A, there was a decrease in systolic blood pressure following spinal anesthesia, which was significantly lower than the baseline value at 4th, 6th, 8th, and 10th min and was not significant thereafter. Leg wrapped patients had a nonsignificant decrease in systolic blood pressure when compared with baseline. In leg wrapped group, the mean systolic blood pressure remained consistently above the mean systolic blood pressure of control and the difference in between the groups was significant at 4th, 6th, 8th, 10th, and 12th min. Finding of the present study correlate with the study done by van Bogaert et al., who found that in all the groups, there was a decrease in systolic blood pressure, but the mean systolic blood pressure remained significantly above the systolic blood pressure of control. Similar findings were also observed by Rout et al., they showed that in wrapped groups, the mean systolic blood pressure did not significantly decreased to below baseline value. Systolic blood pressure was significantly lower

in the control group than in leg wrapped group at 3rd, 4th, 6th, 7th, and 10th min following spinal injection.

Comparison between the groups showed that there was highly significant difference in the mean arterial blood pressure at 4th, 6th, and 8th min. This is in agreement with the study done by Goudie et al. where the fall in diastolic blood pressure and mean arterial pressure was greater in the control group than in leg wrapped group. In their study, Adsumelli et al. they found 50% higher incidence of significant mean arterial pressure reduction in the control group compared with the sequential compression device group.

Conclusion

We conclude that incidence of hypotension can be reduced by wrapping leg with simple elastic crepe bandage with a subsequent reduction in the use of potent vasopressor agents and their unnecessary pharmacological action. As leg wrapping with elastic crepe bandage is cheap, easy, readily available, noninvasive, and nonpharmacological method, it can be recommended in addition with preload and left uterine displacement for preventing post spinal hypotension and its subsequent adverse effect on the mother as well as on a baby in developing countries like ours.

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