Evaluation of Leg Wrapping for the Prevention of Postspinal Hypotension in Cesarean Section under Spinal Anesthesia

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Abstract

Background: Spinal blockade provides excellent anesthesia for patients undergoing cesarean section. However, hypotension after spinal anesthesia is a common adverse effect that is commonly experienced in patients undergoing cesarean section. The aim of our study was to analyze if a simple technique like leg wrapping with elastic crepe bandage would be effective in controlling postspinal hypotension.

Materials and Methods: Sixty full-term pregnant patients who were posted for cesarean section belonging to American Society of Anesthesiologists I and II were divided into two groups. Patients in Group W had their legs wrapped with elastic crepe bandage and in the other Group N, leg wrapping was not done. All the patients were preloaded with Ringer lactate at 10 ml/kg before the spinal anesthesia. The hemodynamic parameters were monitored every 3 min until the delivery of the baby and every 5 min until the end of surgery. If hypotension occurred, then along with crystalloid loading a bolus dose of mephentermine 6 mg was given intravenously. Statistical Analysis: Statistical software “Numbers version 3.6.1 (2566)” was used for statistical calculations. Results: Frequency of hypotension in Group W (10%) was significantly less compared to Group N (60%). Vasopressor requirement was significantly less in Group W ($P = 0.009$), which was highly significant. Conclusion: Wrapping of lower extremities was a simple, easy, and an effective method of decreasing episodes of hypotension and vasopressor requirement after spinal anesthesia in cesarean patients and needs to be practiced routinely.

Keywords: Cesarean section, hypotension, prevention, spinal anesthesia

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Introduction

Cesarean section has become the most common operative procedure. The central neuraxial blockade has become the preferred anesthesia technique for cesarean sections, and the use of general anesthesia has drastically decreased. Risk of general anesthesia includes failed endotracheal intubation, failed ventilation, aspiration pneumonitis, postoperative nausea and vomiting, and neonatal depression. Even though spinal anesthesia provides excellent anesthesia, it is commonly associated with adverse effects like hypotension. The hypotension caused depends on the level of block achieved. The commonly used methods to prevent hypotension are preloading with crystalloids or colloids, use of wedge below the right hip, use of vasopressors, and mechanical compression devices (the easiest one being leg wrapping).

In addition to fluids, technique currently in use for preventing hypotension is the administration of vasopressors. The commonly used ones are ephedrine, phenylephrine, and mephentermine. Vasopressors have adverse effects such as anaphylaxis, hypertension, tachyphylaxis, and cardiac dysrhythmias. Uncontrolled use can even lead to impaired uteroplacental circulation caused by vasoconstriction. Mechanical compression of legs is a simple technique and found to be comparable with use of vasopressors in the prevention of postspinal hypotension in cesarean patients. Leg wrapping being a simple, nonpharmacological and cost-effective technique can be used on a daily basis to prevent hypotension. In this study, we evaluated the efficacy of leg wrapping with crepe bandage before spinal anesthesia in pregnant female undergoing cesarean section.
Materials and Methods

In this prospective randomized control trial approval of the Institutional Ethics Sub-committee was taken before the study. The study was conducted over a period of 6 months (January–July 2015). Inclusion criteria: Full-term pregnant patients with uncomplicated pregnancy belonging to physical status American Society of Anesthesiologists (ASA) Class I or II, scheduled for elective lower segment cesarean section under spinal anesthesia, hemodynamically stable patient with normal laboratory investigations and patients willing to be a part of the study. Exclusion criteria: Patients with physical status ASA III and more, hemodynamically unstable patients, patients with known sensitivity to local anesthetic, patients not willing to be a part of the study and contraindication for spinal anesthesia.

Randomization was done using computer-generated random number table.
- Group W: Leg wrapped (n = 30) or
- Group N: Nonleg wrapped (n = 30).

All patients were subjected to preanesthetic evaluation. Relevant laboratory investigations (complete blood count including hemogram, coagulation profile, liver function, and renal function tests) were done. They were counseled with regard to spinal anesthesia and leg wrapping as well as the operative procedure. Written informed consent was taken from each patient for participation in the study. Patient characteristics (age, height, weight, and gestational age) were recorded. All the patients were kept fasting for 8 h before surgery. For all patients, an intravenous (IV) line was secured using 20-gauge intracath in the left forearm. All patients received ranitidine 50 mg and metoclopramide 10 mg IV 30 min before the cesarean section. Baseline blood pressure and heart rate were measured in the supine with left wedged position. Baseline values were taken as the average of three successive readings. IV fluid preloading was done with 10 ml/kg of Ringer lactate solution before the spinal anesthesia. Group N patients had their lower limbs neither raised nor wrapped and just covered with drape. Group W patients (n = 30) had their lower limbs wrapped immediately before the administration of the subarachnoid block. Leg wrapping was achieved with crepe bandage (Crepe King, Manufacturer Everest Laboratories, Meerut, India) 15 cm width and 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 adequately. All patients had their leg wrapped by the same person in around 3 min to eliminate bias introduced by the method or altered force of wrapping. All patients’ legs were covered with drapes. Spinal anesthesia was given, and the patient was monitored by anesthesiologist who was unaware of the groups. Intrathecally, all patients received 2 ml of 0.5% hyperbaric bupivacaine. Spinal anesthesia was performed in the sitting position using a 26-gauge Quincke’s needle in the L3–L4 or L4–L5 interspace through midline approach under all aseptic conditions. Fluid replacement was maintained with Ringer’s lactate solution. Fifteen milligrams of injection oxytocin was given as IV infusion after the delivery of baby. Electrocardiogram and oxygen saturation was monitored continuously, and the heart rate and blood pressure were measured every 3 min for 15 min and every 5 min thereafter until the end of cesarean section. Duration of surgery, the level of sensory block achieved and blood loss was monitored.

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 of 6 mg of mephentermine. Parameters were recorded in a specially prepared pro forma.

Statistical analysis

Sample size (60) was calculated using the power of study 80% and level of significance 5%. All data collected in stipulated time and statistically analyzed. Numerical data were summarized by using arithmetic mean and standard deviation. Comparison of quantitative data was done using *t*-test. Unpaired *t*-test was used for intergroup and paired *t*-test for comparisons within group. Statistical software “Numbers version 3.6.1 (2566)” was used for statistical calculations.

Results

Sixty patients assessed for eligibility and randomised to two groups, no patient excluded from the study and all completed the study [Flow chart 1]. Patients in both groups were matched for age, weight, height, gestational age, and ASA grade; no significant differences were found. There was no difference in the groups with respect to the duration of surgery, level of sensory block achieved, and intraoperative blood loss [Table 1].

There was no significant difference in heart rate between the two groups in perioperative period [Graph 1].

Table 1: Demographic data

| Variables          | Group N   | Group W   | P    |
|--------------------|-----------|-----------|------|
| Age (year)         | 25±3.33   | 25±3.69   | 0.561|
| Height (cm)        | 160.7±3.47| 160±3.7   | 0.819|
| Weight (kg)        | 60.6±4.97 | 59.6±4.39 | 0.121|
| Gestational age (week) | 38.1±0.88 | 38.7±0.92 | 0.328|

Graph 1: Perioperative mean heart rate changes of parturient
There was a significant decrease in mean arterial blood pressure at 3, 6, 9, and 12 min. The leg wrapped group had a higher mean arterial blood pressure throughout the measured interval [Graph 2].

Vasopressor requirement per patient was significantly high in Group N as compared to Group W. In Group N, 18 patients (60%) developed hypotension and in Group W only three patients (10%) developed hypotension, thus a significant difference in frequency of hypotension between two groups [Table 2].

**DISCUSSION**

Spinal anesthesia-induced hypotension is caused by an increase in venous capacitance because of sympathectomy causing venodilatation in the lower part of the body. This decrease in arteriolar and venous tone secondary to sympathetic block causes a reduction in systemic vascular resistance and redistribution of central blood volume up to 500–600 ml to the peripheral compartment. The situation is further aggravated in pregnancy by aortocaval compression. This aortocaval compression decreased by left uterine displacement by placing wedge beneath right buttock. Placental blood flow is pressure dependent, so prolonged maternal hypotension is detrimental to the fetus and can lower fetal Apgar score.

A significant contribution to hypotension is made by venous pooling in the lower limbs and abdomen. Hence,
lots of techniques are in practice to prevent hypotension, but there is no established ideal method. Prophylactic fluid preloading/colloading, use of vasopressors such as ephedrine, mephentermine, or phenylephrine and use of varying mechanical interventions to increase central blood volume such as Esmarch bandages, compressive leg stocking, and crepe bandage being used to prevent postspinal hypotension but there is no ideal established technique.\textsuperscript{[14–19]}

The ideal fluid for preloading/colloading is still a matter of debate; crystalloid fluids are cheaper but less effective when used alone. Colloids are more reliable for preloading/colloading to prevent postspinal hypotension, but there use is questioned in view of their cost, possibility of anaphylactic reactions and risk of excessive volume expansion causing pulmonary edema. Vasopressor is known to have an association with adverse cardiac events such as tachycardia, arrhythmias. Although they increase mean arterial blood pressure, their effect on neonatal outcome is debatable.\textsuperscript{[5,13]}

We therefore investigated the simple leg wrapping with crepe bandage as a method of reducing the incidence and severity of hypotension. We found that heart rate changes were inconsistent. Some patients had an increase in heart rate with the onset of hypotension this could be because of vagal reflexes due to surgical stimulus and different levels of autonomic blockade. There was a significant decrease in the mean arterial blood pressure at the 3.6, 9, and 12 min in Group N as compared to Group W. Similar results were observed in a study by Rout et al. and Pollard and Brock-Utne in which mean arterial blood pressure was significantly decreased in nonleg wrapped group as compared to leg wrapped group.\textsuperscript{[19,20]} Bjornestad et al. found that there were no differences in the leg wrapped and vasopressor group in incidence and severity of hypotension and wrapping of legs had similar blood pressure control as that of repeated doses of phenylephrine during epidural anesthesia for cesarean section.\textsuperscript{[12]}

In this study, we found that the incidence of hypotension and vasopressor required was 10% in group A and 60% in Group N which was significant ($P < 0.01$). Various authors have the similar encouraging results, Singh et al. had coated incidence of hypotension 10% in leg wrapped group while 43.33% in nonleg wrapped group.\textsuperscript{[13]} Bhagwanjee et al. observed that there was a high incidence of hypotension requiring vasopressor therapy in the control group (83%) compared with leg wrapped group (16%) a difference which was significant, both clinically and statistically and Rout et al. found that number of hypotensive episodes was significantly reduced by leg wrapping with elasticated Esmarch bandage (18%) as compared with control (53%) of cases. However, no significant differences were observed in the dose requirement of mephentermine between the groups.\textsuperscript{[19,21]} Sun et al. also found that incidence of hypotension was 23% in leg wrapped group while 50% in control group.\textsuperscript{[22]}

Mean arterial blood pressure in leg wrapped group was significantly on higher side as compared to nonleg wrapped group which was the primary outcome of this study. While decrease in the incidence of hypotension and vasopressor requirement were the secondary outcomes of the study.

**Conclusion**

In the present scenario where the number of cesarean section are increasing, a simple, cost-effective technique like leg wrapping with elastic crepe bandage can be useful in preventing hypotension and reducing the amount of vasopressor used after spinal anesthesia. Thus, we should think globally and act locally.

**Limitations of the study**

The sample size was small for more accuracy, study need to be conducted with larger sample size. We did not study changes in cardiac output due to leg wrapping, as cardiac output is a better indicator of uteroplacental blood flow than upper arm blood pressure measurement.\textsuperscript{[5]}

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**Conflicts of interest**

There are no conflicts of interest.

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