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LOWER LIMB ELEVATION AS AN ALTERNATIVE TO PRELOADING FOR PREVENTING HYPOTENSION DURING SPINAL ANAESTHESIA FOR BELOW UMBILICAL SURGERIES

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ABSTRACT: INTRODUCTION: Spinal anesthesia for below umbilical surgery causes almost inevitable sympathetic block and decreased venous return to the heart. It results in hypotension and decreased cardiac output. The prevention of spinal hypotension appears more likely to decrease the frequency and severity of associated adverse symptoms than the treatment of established hypotension. Physical intervention as lower limb elevation is used for prevention of hypotension and may act by minimizing venous pooling of blood in the lower limbs and lower abdomen. **AIMS:** To compare the effects of lower limb elevation as a tool for prevention of hypotension during spinal anesthesia for below umbilical surgeries. **METHODOLOGY:** Our study was conducted in department of Anesthesiology, S.S. Medical College, Rewa. Hundred patients scheduled for elective below umbilical surgeries were randomized into two groups. In group A patients, lower limbs were elevated to approximately 30 degrees and no intravenous fluid was given preoperatively, while in group B patients 10–20 ml/kg of intravenous crystalloid was given as preloading and patient was in neutral position. **RESULTS:** There was less hypotensive episodes, intravenous fluid requirement, urinary retention; nausea & vomiting in group A patients. Also there was less subjective blood loss in group A patients.

KEYWORDS: Lower limb elevation, Hypotension, Urinary retention. MeSH terms: Anesthesia Spinal, Hypotension.

INTRODUCTION: Spinal anesthesia for below umbilical surgery causes an almost inevitable sympathetic block and decreased venous return to the heart. This results in hypotension and decreased cardiac output. Hypotension is the most frequent complication of spinal anesthesia with an incidence approaching 70-100%. Untreated severe hypotension can pose serious risks to patient (unconsciousness, pulmonary aspiration, apnea or even cardiac arrest). The frequent occurrence and rapid onset of hypotension during spinal anesthesia has encouraged anesthetists to prevent or minimize the associated symptoms of vomiting, nausea, and impaired consciousness during the establishment of the block.

The prevention of spinal hypotension appears more likely to decrease the frequency and severity of associated adverse symptoms than the treatment of established hypotension. Strategies currently used to minimize or prevent hypotension are infusion of fluids to increase effective blood volume, administration of drugs to vasoconstrict the peripheral circulation and to increase the heart rate. Physical intervention such as lower elevation is also used which minimizing venous pooling of blood in the lower limbs and lower abdomen. All these methods aim to maintain blood pressure by increasing venous return to the heart or increasing the resistance of the peripheral circulation, or both. There is, however, no established ideal technique.

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Intravenous fluid administration prior to spinal anesthesia is accepted as standard practice. The choice of fluid depends on individual and institutional habit, material cost (crystalloid is considerably cheaper) and the perceived relative benefits and risks. Uncommon but potentially serious adverse effects of colloids include anaphylactoid reactions, impaired coagulation and the risk of infection such as hepatitis C from human albumin preparations. In addition, retention of urine, hypothermia & shivering due to cold fluid administered are common adverse effects.

Possible adverse effects of vasopressors such as ephedrine, phenylephrine or metaraminol include anaphylaxis, hypertension and cardiac dysrhythmias. Lower limb compression techniques may also have adverse effects such as localized ischemia, nerve injury or unacceptable discomfort to the patient. Lower limb elevation technique is safe in all respect.

MATERIAL & METHOD: After institutional ethics committee approval & informed consent, 100 patients (ASA physical status I or II), scheduled for elective below umbilical surgeries (general, orthopedic, gynecological surgeries) in S. S. Medical college and associated SGMH hospital, Rewa were enrolled in the study. Patients who were having contraindication(s) for spinal anesthesia were excluded from the study. Additionally, patients <18 years or >60 years and patients who were on vasoconstrictors or vasodilator drugs were also excluded from the study. Patients were randomized to two groups before introduction of spinal anesthesia.

In group A patients lower limbs were elevated to approximately 30 degrees on pillows after giving spinal anesthesia and no intravenous fluid was administered prior to spinal anesthesia. While in group B patients, 10–20 ml/kg of intravenous crystalloid was given as preloading and patient was in neutral position. Base line heart rate, mean arterial pressure, oxygen saturation, operating room temperature and core body temperature were recorded. These parameters were recorded every 10 min during the surgery and hourly in post-operative period up to 4 hours. Patients were also monitored for urinary retention during postoperative period. Degree of blood loss during surgery was observed in approximate terms (mild/moderate/severe). Significant fall in blood pressure ($\geq 30\%$ fall in the base line) was treated with intravenous fluid & vasopressors.

As stated and previous studied, an incidence of significant fall in blood pressure ($\geq 30\%$ fall in the base line) was in the order of 70 – 100 %. We anticipated an incidence of 75% in the control group and took a difference of 40% in the incidence of significant fall in blood pressure between two groups as being clinically meaningful. Hence we prospectively calculated that 50 patients were required in both group for Type I error of 0.05 and Type II error of 0.02. Incidences were tested statistically by using χ^2 test with Yates' correction & unpaired t-test. Data were presented as mean, SD. P value < 0.05 were considered significant.

RESULTS: Demographic data, duration of surgery, room temperature, Bupivacaine dose requirement, base line pulse rate, respiratory rate & mean arterial pressure were similar in both the groups. There was no significant change in mean pulse rate, respiratory rate & mean arterial pressure in both groups during surgery as well as in post-operative period. There was a significant episode of hypotension in group B patients which was treated with intravenous fluid and Mephenteramine (60% vs. 32%, respectively, $p = 0.009$). Requirement of intravenous fluid and Mephenteramine was significantly very less in group A patients (208.7 ± 53.25 & 992.2 ± 141.1 , respectively, $p < 0.001$) and (2.64 ± 2.75 & 8.1 ± 3.44 , respectively, $p < 0.001$).

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Urinary retention was noticed/complained by a lot of patients in group B patients (38% vs. 16%, respectively, $p = 0.024$) which was clinically significant. Nausea and vomiting resulting from hypotensive episodes were more in group B patients (38% vs. 24%, respectively, $p = 0.045$). Shivering and hypothermia was more in group B patients but not significant.

Variable	Group A (n = 50)	Group B (n = 50)	P value
Age (year)	32 ± 4	30 ± 4	0.09
Weight (kg)	67 ± 7	68 ± 8	0.55
Height (cm)	158 ± 5	157 ± 5	0.12
Room temperature (°C)	23.5 ± 1.2	23.4 ± 1.1	0.79
Bupivacaine dose (mg)	12 ± 3	12 ± 3	0.09
Duration of surgery (min)	83.67 ± 12.43	81.67 ± 16.15	0.84
Baseline mean arterial blood pressure (mm Hg)	82.50 ± 3.72	82.05 ± 5.53	0.97
Baseline mean pulse rate	73.16 ± 8.39	74.56 ± 9.21	0.63
Baseline mean respiratory rate	14.2 ± 2.28	14.2 ± 3.01	0.87

TABLE 1: CHARACTERISTIC OF THE PATIENTS AND BASELINE VARIABLES

VALUES ARE MEAN ± SD

	Pulse rate		Respiratory rate		MAP	
	Group A (mean ± SD)	Group B (mean ± SD)	Group A (mean ± SD)	Group B (mean ± SD)	Group A (mean ± SD)	Group B (mean ± SD)
Baseline	73.16 ± 8.39	74.56 ± 9.21	14.2 ± 2.28	14.2 ± 3.01	82.50 ± 3.72	82.05 ± 5.53
10 min	78.40 ± 7.67	76.08 ± 9.97	13.4 ± 2.30	13.1 ± 3.20	77.25 ± 4.48	78.65 ± 5.41
20 min	78.76 ± 12.07	78.56 ± 7.03	13.8 ± 3.02	14.6 ± 2.28	73.80 ± 3.94	74.70 ± 5.22
30 min	77.36 ± 11.59	76.40 ± 6.52	13.8 ± 2.90	14.1 ± 2.56	73.00 ± 4.38	73.75 ± 4.69
60 min	76.44 ± 9.74	72.40 ± 6.42	14.6 ± 2.45	13.4 ± 3.20	73.90 ± 4.12	72.63 ± 3.58
90 min	74.96 ± 11.01	69.28 ± 6.71	14.4 ± 2.28	13.9 ± 2.28	78.80 ± 7.40	77.13 ± 5.63
120 min	70.12 ± 10.73	69.12 ± 5.94	13.6 ± 1.82	13.2 ± 1.15	79.83 ± 4.12	78.51 ± 5.53
150 min	70.60 ± 9.99	68.00 ± 5.67	13.9 ± 2.20	13.9 ± 2.27	78.00 ± 7.24	78.25 ± 4.48

TABLE 2: EFFECT ON PULSE RATE, RESPIRATORY RATE & MEAN ARTERIAL PRESSURE IN STUDY GROUPS

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1 hour	72.40 ± 8.49	71.30 ± 5.55	14.9 ±2.34	14.9 ±2.27	76.40 ±5.84	77.25 ± 5.42
2 hour	71.90 ± 8.99	72.20 ± 4.42	13.7 ±2.20	14.1 ±2.24	77.00 ±7.54	77.54 ± 6.68
3 hour	70.50 ± 10.43	71.10 ± 4.77	13.5 ±2.23	13.7 ±2.41	79.50 ±8.26	82.25 ± 4.48
4 hour	71.60 ± 11.23	70.54 ± 5.74	12.8 ±2.54	13.5 ±2.32	77.83 ±8.78	80.15 ± 4.72
POSTOPERATIVE						

Variable	Group A (n = 50)	Group B (n = 50)	P Value
Hypotension	16 (32%)	30 (60%)	0.009
Urinary retention	8 (16%)	19 (38%)	0.024
Hypothermia	12 (24%)	20 (40%)	0.133
Shivering	19 (38%)	28 (56%)	0.109
Nausea & vomiting	9 (24%)	19 (38%)	0.045
Mephenteramine requirement (total) mg	2.64±2.75	8.1± 3.44	<0.001
Total fluid requirement (ml)	208.7 ± 53.25	992.2 ± 141.1	<0.001
Apparent blood loss	More	Less	

TABLE 3: DISTRIBUTION OF COMPLICATIONS AND MEPHENTERAMINE

DISCUSSION: Prevention and treatment of hypotension is most important aspect of spinal anesthesia. This may be associated with a number of sequels including nausea, vomiting, impaired consciousness, pulmonary aspiration, apnea or even cardiac arrest. Studies evaluating spinal anesthesia in lower segment cesarean section (LSCS) have shown that leg wrapping with elastic bandages/limb elevation might reduce the incidence of hypotension by preventing pooling of the central blood into the lower limbs^{1,2,3}. However, the effect of this maneuver in non-obstetric patients receiving spinal anesthesia for below umbilical surgeries has not been evaluated. Moreover, the effect of this maneuver as regard to total fluid requirement & urinary retention after spinal anesthesia has not been evaluated.

Hypotension occurs frequently during spinal anesthesia for below umbilical surgeries. Redistribution of central blood (up to 500–600 ml)⁴ to the peripheral compartment secondary to vasodilatation caused by spinal anesthesia may contribute to this observation.⁵ Therefore, several mechanical methods to suppress redistribution and augment venous return have been used, with varying degrees of success in preventing hypotension after spinal anaesthesia.^{1,2,3} By wrapping the legs, Van Bogaert et al¹ reported a significant reduction in hypotensive episodes (15.8%) as compared with control (45.5%) in patients receiving spinal anesthesia for cesarean delivery. Rout et al.² observed a significant reduction in the incidence of hypotension between rubber Esmarch bandage leg-wrapped (18%) and control (53%) groups after spinal anesthesia.

Similarly, Bhagwanjee et al³ also showed a significantly less frequent incidence of hypotension in leg-wrapped patients (16.7%) compared with controls (83.3%) after spinal anesthesia. Although it is clear that wrapping attenuates hypotension after the initiation of spinal anesthesia for cesarean delivery, its effect has not been adequately tested in non-obstetric patients receiving spinal anesthesia for below umbilical surgeries.

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In present study hypotension was 32% in lower limb elevation group (group A) compared with 60% in control group (group B). Lower limb elevation causes less fall in blood pressure by shifting pooled intravenous blood to central circulation. Lower limb elevation also causes less intravenous fluid requirement (208.7 ± 53.25 ml vs. 992.2 ± 141.1 ml) resulting in significant reduction in post-operative urinary retention which was 16% as compared to 38 % in control group.

There were fewer fluctuations in blood pressure in lower limb elevated group as compared to control group. Mephenteramine was given to maintain blood pressure in control group resulted in episodes of hypertension, tachycardia and more bleeding. In our study we have also assessed the blood loss by observing blood in mopes, gauge pieces & suction apparatus, where we found significant less blood loss in lower limb elevated group. Keeping the blood pressure lower without fluctuations & less intravascular volume resulted in less blood loss.

CONCLUSION: We concluded that lower limb elevation after spinal anesthesia decreases the pooling of blood in lower limbs. It results in fewer falls in blood pressure, less bleeding, less intravenous fluid requirement and less urinary retention.

REFERENCES:

1. Van Bogaert LJ. Prevention of post-spinal hypotension at elective cesarean section by wrapping of the lower limbs. *Int J Gynaecol Obstet* 1998; 61: 233–8.
2. Rout CC, Rocke DA, Gouws E. Leg elevation and wrapping in the prevention of hypotension following spinal anaesthesia for elective caesarean section. *Anaesthesia* 1993; 48: 304–8.
3. Bhagwanjee S, Rocke DA, Rout CC, et al. Prevention of hypotension following spinal anaesthesia for elective caesarean section by wrapping of the legs. *Br J Anaesth* 1990; 65: 819–22.
4. Arndt JO, Hock A, Stanton-Hicks M, Stuhmeier KD. Peridural anaesthesia and the distribution of blood in supine humans. *Anesthesiology* 1985; 63: 616–23.
5. Shimosato S, Etsten B E. The role of the venous system in cardiocirculatory dynamics during spinal and epidural anaesthesia in man. *Anaesthesiology* 1969; 30: 619–28.

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