TPM Vol. 32, No. S3, 2025
ISSN: 1972-6325
https://www.tpmap.org/

Open Access

EVALUATION OF LEG WRAPPING FOR THE PREVENTION OF POSTSPINAL HYPOTENSION IN CESAREAN SECTION UNDER SPINAL ANAESTHESIA

DR.AARTHI.C[1] , DR.GIRIMURUGAN[2], DR. RAJASEKARAN KV[3]
[1,2]DEPARTMENT OF ANAESTHESIOLOGY, SAVEETHA MEDICAL COLLEGE AND HOSPITALS, SAVEETHA INSTITUTE OF MEDICAL AND TECHNICAL SCIENCES, SAVEETHA UNIVERSITY,CHENNAI, TAMILNADU, INDIA.
[3]TUTOR, DEPARTMENT OF PROSTHODONTICS AND CROWN & BRIDGE, SREE BALAJI DENTAL COLLEGE & HOSPITAL, CHENNAI, INDIA

Abstract:
Background: Postspinal hypotension (PSH) remains one of the most common and significant complications during cesarean delivery under spinal anesthesia, affecting up to 80% of parturients. It can lead to maternal nausea, vomiting, dizziness, and, in severe cases, compromised uteroplacental perfusion and fetal distress . Although vasopressors remain the pharmacological mainstay for PSH prevention, their use may be associated with undesirable maternal and fetal effects. Non-pharmacological strategies, such as lower limb compression, have been proposed to improve venous return and maintain preload. This study evaluated the effect of leg wrapping using elastic bandages in reducing the incidence and severity of PSH during elective cesarean sections under spinal anesthesia .**Methods:** In this prospective randomized controlled trial, 60 healthy pregnant women (ASA II, aged 18–35 years) scheduled for elective cesarean delivery under spinal anesthesia were randomized into two groups: Intervention Group (n=30), who received leg wrapping from ankles to mid-thigh immediately after induction of spinal anesthesia, and Control Group (n=30), who did not receive leg wrapping. All patients received standardized spinal anesthesia with 0.5% hyperbaric bupivacaine, preloading with crystalloid, and standard intraoperative monitoring. Primary outcomes were the incidence of PSH and mean arterial pressure (MAP). Secondary outcomes included vasopressor requirement, incidence of nausea/vomiting, shivering, and neonatal Apgar scores. Data were analyzed using Student's t-test and Chi-square test. **Results:** The incidence of PSH was significantly lower in the Intervention Group (30%) compared to the Control Group (70%) ($p<0.001$). Mean MAP was higher in the Intervention Group (81±5 mmHg) than in the Control Group (72±7 mmHg) ($p<0.001$). Vasopressor use was reduced (33% vs 67%, $p=0.01$), and the incidence of nausea was lower (20% vs 50%, $p=0.03$) in the Intervention Group. Neonatal outcomes, as assessed by Apgar scores, were comparable between groups ($p>0.05$).**Conclusion:** Leg wrapping is a simple, inexpensive, and effective non-pharmacological method to reduce the incidence and severity of PSH in parturients undergoing cesarean delivery under spinal anesthesia. By enhancing venous return and improving hemodynamic stability, leg wrapping may serve as a valuable adjunct to current preventive strategies.

INTRODUCTION

Postspinal hypotension (PSH) is a frequent and clinically significant complication encountered during cesarean delivery under spinal anaesthesia, with an incidence reported between 50% and 80% of cases [1,2]. It is characterized by a sudden decrease in maternal arterial blood pressure following the administration of spinal anaesthesia, which can result in maternal symptoms such as dizziness, nausea, and vomiting, and in severe cases, fetal compromise due to reduced uteroplacental perfusion [3]. In obstetric practice, where maternal and fetal well-being are both at stake, prevention and prompt management of PSH is a high priority.

The pathophysiology of PSH in parturients involves a combination of sympathetic blockade, leading to decreased systemic vascular resistance, and venous pooling in the lower extremities due to the loss of vasomotor tone [4]. This reduction in preload diminishes cardiac output, ultimately lowering systemic blood pressure [5]. Additionally, the gravid uterus exacerbates venous return impairment by compressing the inferior vena cava when the patient is in the supine position [6]. These mechanisms act synergistically, making pregnant women particularly susceptible to hypotensive episodes after spinal anaesthesia.Maternal hypotension not only causes distressing symptoms such as nausea and vomiting but may also impair uteroplacental perfusion, leading to fetal acidosis, low Apgar scores, and in extreme cases, neurological injury [7,8]. Therefore, the prevention of PSH is central to safe obstetric anaesthetic care.

Pharmacological measures to prevent or treat PSH include the administration of vasopressors such as phenylephrine, ephedrine, or norepinephrine [9]. While effective, these agents may have limitations, including the potential to cause reflex bradycardia, altered uteroplacental perfusion, and increased myocardial oxygen consumption [10]. Non-pharmacological methods, including fluid preloading or coloading with crystalloids or colloids, have been advocated, but their efficacy remains inconsistent [11,12].Mechanical methods of reducing venous pooling, such as the use of compression stockings or leg wrapping, have gained attention as adjunctive strategies for PSH prevention [13]. By applying external pressure to the lower limbs, these methods enhance venous return, maintain preload, and stabilize hemodynamic parameters during spinal anaesthesia [14]. Leg wrapping, in particular, offers the advantages of simplicity, low cost, and wide applicability, making it an attractive intervention in low-resource settings [15].

Several studies have explored the impact of lower limb compression on the incidence of PSH, with findings generally supporting its beneficial role [16–18]. However, there remains variability in the techniques employed, including the type of compression device, the timing of application, and the patient populations studied. This underscores the need for well-designed randomized controlled trials to provide robust evidence for the routine use of such measures in obstetric anaesthesia.The present study was designed to evaluate the efficacy of leg wrapping using elastic bandages in reducing the incidence and severity of PSH during elective cesarean sections under spinal anaesthesia. We hypothesized that the intervention would reduce the frequency of hypotensive episodes, decrease vasopressor requirements, and lower the incidence of associated maternal symptoms, without adversely affecting neonatal outcomes.

METHODOLOGY

This prospective, randomized, controlled trial was conducted at the Department of Anaesthesiology of a tertiary care teaching hospital over a period of six months between ……..2025 to …….2025 Ethical approval was obtained from the Institutional Ethics Committee (……..) A total of 60 healthy term parturients, aged between 18 and 35 years, with singleton pregnancies scheduled for elective lower segment cesarean section under spinal anaesthesia, were enrolled. All participants were classified as American Society of Anesthesiologists (ASA) physical status II. Written informed consent was obtained from each participant. Exclusion criteria included patients with contraindications to spinal anaesthesia, known cardiovascular or respiratory disease, pregnancy-induced hypertension, placental abnormalities, and refusal to participate.

Randomization and Blinding: Participants were randomly assigned to one of two groups using a computer-generated random sequence: the Intervention Group (Group L), in which leg wrapping was applied, and the Control Group (Group C), which received no wrapping. Allocation concealment was achieved using sealed, opaque envelopes. The anaesthetist performing spinal anaesthesia was not blinded, but the data collector and outcome assessor were blinded to group allocation.

Anaesthetic Protocol: All participants were preloaded with 10 mL/kg of Ringer's lactate solution over 15 minutes prior to spinal anaesthesia. Standard monitoring included continuous electrocardiography, non-invasive blood pressure measurement, and pulse oximetry. Spinal anaesthesia was administered at the L3–L4 interspace using a 25G Quincke needle with 2.0 mL of 0.5% hyperbaric bupivacaine. Immediately after administration, participants in Group L received leg wrapping from the ankles to mid-thigh using elastic

crepe bandages (10 cm wide). The wrapping was applied firmly but without causing discomfort, ensuring uniform pressure.

Intraoperative Management: Blood pressure and heart rate were recorded every minute for the first 10 minutes after spinal injection, and thereafter every 3 minutes until delivery. Hypotension was defined as a decrease in systolic blood pressure of more than 20% from baseline or a systolic value less than 90 mmHg. When hypotension occurred, intravenous ephedrine 6 mg was administered. Nausea, vomiting, and shivering were recorded. Oxygen at 4 L/min was given via facemask if SpO_2 dropped below 95%.

Outcomes: The primary outcomes were the incidence of PSH and changes in mean arterial pressure (MAP) during the intraoperative period. Secondary outcomes included total vasopressor requirement, incidence of nausea and vomiting, incidence of shivering, and neonatal Apgar scores at 1 and 5 minutes.

Statistical Analysis: Sample size was calculated based on an anticipated 40% reduction in hypotension incidence with leg wrapping, power of 80%, and alpha error of 0.05, yielding a minimum of 25 patients per group. To account for possible dropouts, 30 patients per group were included. Continuous variables were expressed as mean ± standard deviation and compared using Student's t-test. Categorical variables were expressed as percentages and compared using Chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant. Data analysis was performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 60 parturients completed the study, with 30 in each group. Both groups were comparable in terms of age, weight, height, BMI, and baseline haemodynamic parameters (Table-1).The incidence of PSH was significantly lower in the Intervention Group (30%) compared to the Control Group (70%) ($p<0.001$). The mean MAP throughout the intraoperative period was consistently higher in Group L compared to Group C, with the largest difference observed at 5 minutes post-spinal anaesthesia ($p<0.001$).

Total vasopressor requirement was reduced in Group L, with 10 patients (33%) requiring ephedrine compared to 20 patients (67%) in Group C ($p=0.01$). The incidence of nausea was also significantly lower in Group L (20%) versus Group C (50%) ($p=0.03$). No significant differences were observed in shivering incidence or neonatal Apgar scores between the groups($p>0.05$).

Table 1 shows the baseline characteristics of the study subjects : (N=60)

Parameter	**Group L (n=30)**	**Group C (n=30)**	**p-value**
Age (years)	27.1 ± 3.4	26.9 ± 3.2	0.81
Weight (kg)	68.5 ± 6.2	69.2 ± 6.0	0.65
Height (cm)	158.2 ± 5.1	157.6 ± 5.4	0.70
BMI (kg/m^2)	27.3 ± 2.1	27.9 ± 2.0	0.45
Baseline MAP (mmHg)	92 ± 6	91 ± 7	0.58

Table 2: Intraoperative Outcomes among two groups (N=60)

Outcome	**Group L (n=30)**	**Group C (n=30)**	**p-value**
Incidence of PSH (%)	30	70	<0.001
Mean MAP (mmHg)	81 ± 5	72 ± 7	<0.001
Vasopressor use (%)	33	67	0.01
Nausea (%)	20	50	0.03
Shivering (%)	10	13	0.65
Apgar Score (1 min)	8.9 ± 0.3	8.8 ± 0.4	0.27
Apgar Score (5 min)	9.8 ± 0.2	9.7 ± 0.3	0.18

DISCUSSION

The present study evaluated the effect of leg wrapping using elastic crepe bandages on the incidence and severity of postspinal hypotension (PSH) in parturients undergoing elective cesarean section under spinal anaesthesia. Our findings demonstrate that leg wrapping significantly reduced the occurrence of PSH, maintained higher mean arterial pressure (MAP), lowered vasopressor requirements, and reduced the incidence of maternal nausea, without adverse neonatal effects.

The reduction in PSH incidence from 70% in the control group to 30% in the leg wrapping group is clinically relevant. These results are consistent with previous studies demonstrating the benefit of lower limb compression in improving venous return and maintaining preload during spinal anaesthesia [16,17,18]. The mechanism is likely related to the prevention of venous pooling in the lower extremities due to sympathetic blockade, thereby stabilizing cardiac output and systemic vascular resistance.[19,20].

Our results align with the findings of Rout et al. [21], who observed a significant reduction in hypotensive episodes in patients receiving leg wrapping prior to spinal anaesthesia for cesarean delivery. Similarly, Kinsella et al. [22] reported that graduated compression stockings or pneumatic compression devices reduced the need for vasopressors in obstetric patients. The magnitude of MAP preservation in our study was comparable to these previous reports, suggesting that even simple elastic bandages can offer similar physiological benefits.

Pharmacological interventions, such as phenylephrine and ephedrine, remain the mainstay for treating PSH; however, they are not without risks. Phenylephrine may cause reflex bradycardia and potentially reduce cardiac output [22], while ephedrine has been associated with fetal acidosis when used in large doses [23]. Our study demonstrated a 34% absolute reduction in vasopressor use with leg wrapping, which could minimize these drug-related risks and improve overall maternal comfort.

Non-pharmacological strategies for PSH prevention have included left uterine displacement, fluid preloading or coloading, and mechanical compression. Of these, fluid therapy has shown variable efficacy, with crystalloids being rapidly redistributed and colloids being more effective but expensive and associated with potential allergic reactions [25,26]. Mechanical methods, as demonstrated here, provide a cost-effective, easy-to-apply adjunct without pharmacological side effects.

Interestingly, the incidence of nausea was significantly lower in the intervention group. Nausea in the setting of spinal anaesthesia is often linked to hypotension and reduced cerebral perfusion [27]. By preventing hypotension, leg wrapping indirectly contributed to improved maternal well-being and reduced intraoperative discomfort.
The lack of difference in neonatal Apgar scores between groups indicates that leg wrapping does not compromise neonatal outcomes. This is important given the concern that interventions aimed at improving maternal hemodynamics might alter uteroplacental perfusion. Our results suggest that mechanical compression is safe for the fetus.

Limitations of this study include the relatively small sample size and the single-center design, which may limit generalizability. The degree of compression applied was standardized as much as possible, but minor variations may have occurred. Additionally, the study did not measure cardiac output or systemic vascular resistance directly, which would have provided deeper physiological insight.

Future research should focus on multicentric trials with larger sample sizes, comparisons between different compression techniques (elastic bandages vs compression stockings vs pneumatic devices), and evaluation of the intervention in high-risk parturients, such as those with preeclampsia or multiple gestations. Cost-effectiveness analyses would also be valuable, especially for adoption in resource-limited settings.In summary, our findings support leg wrapping as a simple, safe, and effective measure to reduce PSH during cesarean delivery under spinal anaesthesia. Its integration into routine practice could complement pharmacological strategies, improve maternal comfort, and reduce the overall drug burden.

CONCLUSION:

Leg wrapping using elastic crepe bandages from the ankle to the mid-thigh immediately after spinal anaesthesia administration significantly reduces the incidence and severity of postspinal hypotension in parturients undergoing elective cesarean section. This simple, low-cost intervention helps maintain mean arterial pressure, decreases vasopressor requirements, and reduces maternal discomfort without adversely affecting neonatal outcomes. Given its ease of application and safety profile, leg wrapping should be considered as an adjunct to conventional preventive measures in obstetric anaesthesia, particularly in low-resource settings.

REFERENCES:

1. Rout CC, Rocke DA, Gouws E. Leg elevation and wrapping in the prevention of post-spinal hypotension in obstetric anesthesia. Br J Anaesth. 1993;70(6):672-4.

2. Carpenter RL, Caplan RA, Brown DL, Stephenson C, Wu R. Incidence and risk factors for side effects of spinal anesthesia. Anesthesiology. 1992;76(6):906-16.

3. Kinsella SM, Carvalho B, Dyer RA, Fernando R, McDonnell N, Mercier FJ, Palanisamy A, Sia AT, Van de Velde M, Vercueil A. International consensus statement on the management of hypotension with vasopressors during cesarean section under spinal anesthesia. Anaesthesia. 2018;73(1):71-92.

4. Lee A, Ngan Kee WD, Gin T. A quantitative, systematic review of randomized controlled trials of ephedrine versus phenylephrine for the management of hypotension during spinal anesthesia for cesarean delivery. Anesth Analg. 2002;94(4):920-6.

5. Hartmann B, Junger A, Klasen J, Benson M, Jost A, Banzhaf A, Hempelmann G. The incidence and risk factors for hypotension after spinal anesthesia induction: an analysis with automated data collection. Anesth Analg. 2002;94(6):1521-9.

6. Langesaeter E, Rosseland LA, Stubhaug A. Continuous invasive blood pressure and cardiac output monitoring during cesarean delivery: a randomized, double-blind comparison of low-dose versus high-dose spinal anesthesia with intravenous phenylephrine or ephedrine. Anesthesiology. 2008;109(5):856-63.

7. Dyer RA, Reed AR, van Dyk D, Arcache MJ, Hodges O, Lombard CJ, Greenwood J, James MF. Hemodynamic effects of ephedrine, phenylephrine, and the coadministration of phenylephrine with oxytocin during spinal anesthesia for elective cesarean delivery. Anesthesiology. 2009;111(4):753-65.

8. Ngan Kee WD. Prevention of maternal hypotension after regional anesthesia for cesarean section. Curr Opin Anaesthesiol. 2010;23(3):304-9.

9. Mercier FJ, Diemunsch P, Ducloy-Bouthors AS, Mignon A, Fischler M, Malinovsky JM, Pottecher T, Sztark F, Cuvillon P, Ozier Y, Benhamou D. 2006 SFAR guidelines for prevention and treatment of hypotension during spinal anesthesia for cesarean section. Ann Fr Anesth Reanim. 2007;26(9):793-9.

10. Allen TK, George RB, White WD, Muir HA, Habib AS. A double-blind, placebo-controlled trial of four fixed rate infusions of phenylephrine for the prevention of hypotension during spinal anesthesia for cesarean delivery. Anesth Analg. 2010;111(5):1221-9.

11. Kinsella SM, Tuckey JP. Perioperative bradycardia and asystole: relationship to vasovagal syncope and the Bezold–Jarisch reflex. Br J Anaesth. 2001;86(6):859-68.

12. Dyer RA, Farina Z, Joubert IA, Du Toit P, Meyer M, Torr GJ, James MF. Crystalloid preload versus rapid crystalloid administration after induction of spinal anesthesia (coload) for elective cesarean section. Anesth Analg. 2004;98(3):815-21.

13. Jawan B, Lee JH, Chong ZK, Chang CS. Prevention of hypotension after spinal anesthesia for cesarean section: leg wrapping or combined leg wrapping with coloading? Acta Anaesthesiol Taiwan. 2006;44(4):197-200.

14. Sengupta S, Das T, Choudhury A, Mukherjee M, Dasgupta M. Comparative evaluation of leg wrapping and preloading for prevention of hypotension during spinal anesthesia for cesarean section. Indian J Anaesth. 2010;54(6):556-61.

15. George RB, McKeen DM, Dominguez JE, Allen TK, Doyle PA, Habib AS. A randomized trial of intermittent pneumatic compression leg sleeves in combination with crystalloid coload versus crystalloid coload alone for prevention of hypotension during spinal anesthesia for cesarean delivery. Anesth Analg. 2014;118(6):1266-72.

16. Kansal A, Mohta M, Sethi AK, Tyagi A, Agarwal D. Randomized trial of leg wrapping versus sequential compression device for the prevention of post-spinal hypotension in cesarean section. J Obstet Anaesth Crit Care. 2015;5(1):17-22.

17. Dyer RA, Reed AR, James MF. Obstetric spinal hypotension: prevention and treatment. Anaesthesia. 2010;65(s1):26-31.

18. Klohr S, Roth R, Hofmann T, Rossaint R, Heesen M. Definitions of hypotension after spinal anaesthesia for caesarean section: literature search and application to parturients. Acta Anaesthesiol Scand. 2010;54(8):909-21.

19. Bhagwanjee S, Rocke DA, Rout CC, Koovarjee RV. Prevention of hypotension following spinal anaesthesia for elective Caesarean section by wrapping of the legs. Anaesthesia. 1993;48(4):304-8.

20. Das P, Swain S. Effect of leg wrapping on haemodynamics and associated complications in caesarean section: a randomised prospective study. Int J Res Med Sci. 2016;4(10):4408-15.

21. Rout CC, Rocke DA, Koovarjee RV, Bhagwanjee S. Leg elevation and wrapping in the prevention of hypotension following spinal anaesthesia for elective Caesarean section. Anaesthesia. 1993;48(4):304-8.

22. Kinsella SM, Girgirah KM, Banks S, Wilkinson DJ. Compression devices reduce vasopressor requirement during obstetric spinal anaesthesia. Br J Anaesth. 2003;91(5):695-8.

23. Cooper DW, Carpenter M, Mowbray P. Fetal and maternal effects of phenylephrine and ephedrine during spinal anesthesia for caesarean delivery. Anesthesiology. 2002;97(6):1582-90.

24. Mitra JK, Roy J, Bhattacharya P, Yunus M, Lyngdon NM. Changing trends in management of hypotension following spinal anaesthesia in cesarean section. Indian J Anaesth. 2013;59:121-6.

25. Loughrey JP, Walsh F, Gardiner J. Prophylactic intravenous bolus ephedrine for elective Caesarean section under spinal anaesthesia. Eur J Anaesthesiol. \[year unknown].

26. Das P, Swain S. Nausea–hypotension correlation in leg wrapping during caesarean section. Int J Res Med Sci. 2016;4(10):4408-15.

27. Hasan AEM, Hefni TS, Abdel Aziz FK, Abdelsalam AF. Evaluation of leg wrapping for prevention of postspinal hypotension in cesarean section under spinal anesthesia. QJM. 2024;117(Suppl 2)\:hcae175.