International Journal of Research in Medical Sciences
Das P et al. Int J Res Med Sci. 2016 Oct;4(10):4408-4415
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20163302

Research Article

Effect of leg wrapping on haemodynamics and associated complications in caesarean section: a randomised prospective study

Prajnyananda Das*, Sumita Swain

Department of Anaesthesiology and Critical care, SCB Medical College, Cuttack, Odisha, India

Received: 28 July 2016
Accepted: 31 August 2016

***Correspondence:**
Dr. Prajnyananda Das,
E-mail: drprajnya_das@rediffmail.com

ABSTRACT

Background: Spinal anesthesia in cesarean section has a rapid onset of action, reliable and provides good surgical conditions, however there is risk of placental hypo-perfusion proportional to the degree of sympathetic block. Inspite of traditional preventive measures (fluid preload, fluid co-load, left lateral tilt, and ephedrine prophylaxis) post spinal hypotension is difficult to avoid. In this study efficiency of pre block leg wrapping in preventing hypotension and associated complications in parturients have been evaluated.
Methods: 60 patients posted for elective cesarean section under spinal anesthesia of ASA grade I and II under spinal anesthesia were allocated two groups with or without leg wrapping with elastic bandage. All of them received 10ml/kg ringer's lactate preloading, spinal anaesthesia in sitting position and haemodynamic monitoring done. Complications like hypotension managed with intravenous phenylephrine.
Results: There was statistically significant difference in degree of hypotension found between the two groups. Incidence of hypotension in Group A (leg wrapped) is 13.33% where as in group B (leg not wrapped) is 63.33%. There is significant difference in incidence of nausea, vomiting and shivering in both the groups.
Conclusions: Leg wrapping with elastic crepe bandage is cheap, easy, readily available, non-invasive, and non-pharmacological method, 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 and can be of great value in routine practice.

Keywords: Spinal anaesthesia, Hypotension, Phenylephrine

INTRODUCTION

Anesthesia for caesarean section whether for elective or emergency procedure has always being a challenging proposition. Greater emphasis is being placed on increased utilization of regional rather than general anesthesia in obstetrics because of risk of aspiration of gastric contents in general anesthesia, risk of failed endotracheal intubation, depressant effect of general anesthetic drugs on fetus, improved uteroplacental circulation seen with regional anesthesia and maternal awareness with regional anesthesia.[1] Spinal anesthesia in caesarean section has a rapid onset of action, reliable and provides good surgical conditions, however there is risk of placental hypoperfusion which may occur due to hypotension which is proportional to the degree of sympathetic block.[2]

Inspite of traditional preventive measures (fluid preload, fluid co-load, left lateral tilt, ephedrine prophylaxis) post spinal hypotension appears to be difficult to avoid. Use of combined prophylactic measures can decrease the incidence of hypotension but there are potential risks associated with this therapy like reactive hypertension, pulmonary edema from excess hydration.[3] It is important to control post spinal hypotension by alternative means

like wrapping the lower limbs with compression stockings or elastic crepe bandage. It is not only effective physiologically but also being non-pharmacological is devoid of side effects. In this study efficiency of pre block leg wrapping in preventing hypotension in pregnant mother have been evaluated. The study is designed to evaluate the effect of wrapping of lower limbs by crepe bandage along with preloading and 15° left lateral tilt on incidence and severity of post spinal hypotension in elective caesarean section, compare it with the conventional preloading and 15° left lateral tilt and to note problems and complication if any.

METHODS

Permission from ethical committee and informed consent from the patient was taken for this prospective randomized double blind study with a study population of 60 patients posted for elective cesarean section under spinal anesthesia. Patients of ASA grade I and II with in age group of 19 to 35 years with full term, singleton pregnancies posted for elective caesarean section under spinal anesthesia were included in this study. Patients with postpartum hemorrhage, chronic hypertension, multiple pregnancy, pregnancy-induced hypertension, diabetes mellitus, gestational diabetes mellitus, cardiovascular diseases, bronchial asthma, neurological diseases, body weight greater than 110 kg, patients with contraindications to a spinal anesthetic, history or evidence of a difficult airway and patient refusal were excluded from this study.

Group A (Case) - patients with their lower limbs wrapped and covered immediately before the administration of the subarachnoid block. (n=30).

Group B (Control) - patients with their lower limbs not wrapped, but they were covered to hide them from anesthesiologist recording haemodynamics (n=30).

Equipment used in this study**:** Elastic crepe bandages for leg wrapping. Thorough pre-anesthetic evaluation including history, physical examination, spine examination, airway examination were done day before surgery.

All routine investigations (hemoglobin, differential count, total leukocytes count, bleeding time, clotting time, serum urea, serum creatinine, serum sodium, serum potassium, fasting blood sugar) were within normal limits in all patients. All the patients were kept nil per oral for 8hrs before surgery. In all patients i.v. line was secured using 18G cannula.

All patients were premedicated with injection Ranitidine 50mg i.v. and inj. Metoclopramide 10 mg i.v. 1hour prior to surgery. i.v. preloading was done with 10ml/kg of ringer lactate solution over 15-20 min just prior to arrival to operation theatre. Pulse-oxymeter, ECG, and non-invasive blood pressure monitors were attached. In all patients base line blood pressure and heart rate were measured in the supine position with 15° left lateral tilt. 15° Left lateral tilt was attained by keeping a wedge under right hip. Baseline values were taken as the average of three successive readings before administering spinal anesthesia. Leg wrapping was done with crepe bandage (15 cm width, 4m stretched length) applied from the ankle to the mid-thigh in both legs.

During wrapping lower extremity was lifted at an angle of 45°. The crepe bandages were wrapped tight 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 systolic arterial pressure by checking for capillary pulsation in the toes. After wrapping the crepe bandage was hidden to ensure blinding.

Under all aseptic conditions spinal anesthesia was performed with 12.5mg (volume- 2.5ml) of 0.5% hyperbaric bupivacaine using a 27 G whittacre needle in the L3-L4 or L4-L5 interspace intrathecally through midline approach in the sitting position. Thereafter all the patients were placed in supine position with 15° left lateral tilt by placing a wedge under right hip. Pulse rate, electrocardiography, non-invasive blood pressure, oxygen saturation was continuously monitored intraoperatively. Oxygen was supplemented by face mask.

Fluid replacement was maintained with ringer's lactate solution. 20 units of oxytocin was put in the drip after delivery of baby and infused slowly. Any complication was noted and treated accordingly.

Specifically degree of hypotension was noted. Hypotension was defined as fall in systolic blood pressure to ≤90 mmHg or reduction of 20% of baseline. Hypotension was treated immediately by increasing the rate of IV ringer lactate administration and by bolus 50 µg phenylephrine intravenously. Parameters recorded intraoperatively for the study are

- Heartrate every 2min for 10 minutes after subarachnoid block and thereafter every 5min till end of surgery.
- Systolic blood pressure (SBP), Diastolic blood pressure (DBP) and Mean arterial pressure (MAP) every 2min for 10 minutes after subarachnoid block and thereafter every 5min till end of surgery by using NIBP.
- Time to reach maximum block height.
- Total duration of surgery.
- Nausea and vomiting.
- Shivering.

Statistical analysis

The data generated were analyzed statistically. Parametric data were presented as mean ± standard deviation for unpaired student t test and numbers (percentage) for chi-square test. Comparison of quantitative data between the

two groups was done by Unpaired Student's *t*-test. Chi-square test was used for comparison of qualitative data between the two groups. The level of statistical significance was set at $P<0.05$.

All statistics were performed on a windows based computer using the program SPSS 20.0.

RESULTS

Demographic data

By using unpaired t test, both the groups were found to be comparable with respect to age, weight and height and gestational age.

Table 1: Distribution of cases with respect to age, body weight and height, gestational age of patients in present study.

	Group A (N = 30)	Group B (N = 30)		
	Mean±SD	Mean±SD	T	P value
Age (years)	28.17±3.87	26±4.25	1.68	0.1
Weight (kg)	66.7±6.04	67±5.93	0.22	0.83
Height (cms)	148.6±4.86	144.9±24.26	0.81	0.42
Gestational age (wks)	37.9±1.1	37.8±0.82	0.07	0.95

Table 2: Comparison of baseline heart rate and systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) in patients of both groups.

	Group A (N = 30)	Group B (N = 30)	T	P value
	Mean±SD	Mean±SD		
HR	83.8±5.67	82.3±4.9	1.1	0.28
SBP	122.7±5.83	122.6±4.43	0.05	0.96
MAP	85.7±5	86.3±3.9	1.37	0.97
DBP	65.1±4.9	66.37±3.9	1.09	0.28

By using unpaired t test, there was no statistically significant difference found in above parameters between the two groups (Table 2).

Table 3: Comparison of time to reach maximum block height and total duration of surgery in both the groups.

	Group A (N=30) Mean±SD	Group B (N=30) Mean±SD	T	P value
Time of max Block height (min)	6.8±0.52	6.75±0.49	0.36	0.72
Tot duration of surgery (min)	48.5±9.68	46.3±6.69	0.99	0.32

By using unpaired t test there was no statistically significant difference found in above parameters between the two groups (Table 3).

Table 4: Comparison of heart rate (HR) change after spinal anesthesia in both the groups.

Time (min)	Group A (N=30)	Group B (N = 30)	T	P value
	Mean HR ± SD	Mean HR±SD		
2	84.2±5.5	84.9±4.8	0.77	0.44
4	86.3±5.6	89.0±4.6	2.19	0.01*
6	86.6±6.3	99.4±6.1	7.94	<0.001**
8	89.5±6.4	102.1±6.5	7.55	<0.001**
10	92.4±1.2	103±5.4	7.54	<0.001**
15	95.4±5.3	98.7±5.5	2.43	0.02*
20	94.6±5.3	96.9±4.3	1.7	0.07
25	92.4±4	94.2±3.1	1.64	0.1
30	91.6±3.5	93±3.9	1.35	0.18
35	91±3.8	92.2±5	0.96	0.34
40	90±4.5	90.8±4.1	1.19	0.23
45	88.2±4.6	88.8±4.4	0.72	0.47
50	85.9±5.3	87.1±4	1.15	0.25

**P value <0.001- highly significant, * P value <0.05 – significant

There are significant heart rate changes from 4 min to 15 min with highly significant from 6-10 min after spinal anesthesia in Group B patients compared to Group A patients (Table 4).

Table 5: Comparison of systolic blood pressure (SBP) changes after spinal anesthesia in both the groups.

Time (min)	Group A (N = 300 Mean SBP±SD	Group B (N = 30) Mean SBP ± SD	T	P value
2	121.8±5.8	121±4.2	0.51	0.62
4	118.4±6.1	114.8±4.3	2.63	0.01*
6	112.1±7.2	99.5±7.5	6.58	<0.001**
8	111.7±8.7	98.3±5.4	7.08	<0.001**
10	108.5±5.6	98±4.3	8.13	<0.001**
15	106.6±5.5	104±3.6	1.85	0.04*
20	107.5±5.1	107±3.6	0.12	0.90
25	109.5±4.5	109±3.4	0.09	0.92
30	111.7±4.3	111.2±4.6	0.33	0.73
35	110.8±4.3	110.1±3.8	0.63	0.52
40	112.6±4.5	112±4.3	0.86	0.39
45	114.5±4	114±3.9	1.54	0.26
50	115.7±4.6	115.3±3.4	0.81	0.42

** P value <0.001 – highly significant, *P value <0.05 – significant

Table 6: Comparison of diastolic blood pressure (DBP) changes after spinal anesthesia in both the groups.

Time (min)	Group A (N=30) Mean DBP±SD	Group B (N = 30) Mean DBP ± SD	T	P value
2	63.9±5.1	65.2±4.5	1.03	0.30
4	61.5±4.9	57.3±3.5	3.72	0.002*
6	55.8±4.8	45.1±5.2	8.23	<0.001**
8	55±7.7	43±5.7	6.95	<0.001**
10	50.9±4.7	42.4±4.2	7.16	<0.001**
15	49.6±4.7	46.5±6.2	2.14	0.03*
20	50.3±5.1	50±5.2	0.70	0.94
25	52.4±4.7	52±5.6	0.56	0.57
30	54±4.5	53.2±4.6	0.70	0.48
35	57±4.4	56±4.7	1.12	0.26
40	59.3±4.6	58.8±4.2	0.38	0.70
45	60.6±4.9	60.1±4.3	0.44	0.65
50	62.3±4.5	60.5±4.1	1.62	0.1

** P value <0.001 – highly significant, *P value <0.05 – significant

Table 7: Comparison of mean arterial pressure (MAP) change in both the groups.

Time (min)	Group A (N=30) Mean MAP ± SD	Group B (N = 30) Mean MAP ± SD	T	P value
2	83.5±5.4	84.7±4.2	0.92	0.35
4	80.4±5.4	77.6±3.1	2.34	0.02*
6	75.1±5.8	63.1±6.5	7.48	<0.001**
8	73.7±8.4	61.8±5.9	6.31	<0.001**
10	70.6±5.1	61.7±4.1	6.62	<0.001**
15	69.2±5	66.2±6.5	1.94	0.02*
20	70±5	68.4±5.3	0.20	0.98
25	71.8±4.4	72.4±0.6	0.32	0.74
30	74.6±4.6	74±4.6	0.75	0.45
35	77±4.6	76.2±4.5	0.73	0.46
40	79.5±4.6	79.1±4.2	0.17	0.86
45	80.7±4.7	80.1±4.3	0.11	0.90
50	82.2±4.6	80.8±3.8	1.27	0.21

** P value < 0.001 – highly significant, *P value < 0.05 – significant

There is significant Systolic Blood Pressure change from 4 min to 15 with highly significant from 6-10 min after spinal anesthesia in Group B patients compared to Group A patients (Table 5). There is significant diastolic blood pressure change from 4 min to 15 with highly significant from 6-10 min after spinal anesthesia in Group B patients compared to Group A patients (Table 6).

Table 8: Comparison of incidence of hypotension in both the groups was calculated by using chi-square test.

	Group A	Group B	P value
Hypotension	4	19	0.002
Nil	26	11	
Total	30	30	

Chi square test for hypotension: $x^2 = 9.78$, df = 1, $P < 0.05$.

Table 9: Comparison of incidence of nausea, vomiting and shivering in both the groups using chi square test.

	Group A	Group B	P value
Nausea	2	5	
Vomiting	2	9	0.03
Shivering	5	17	0.01

Chi square for Nausea & Vomiting: $x^2 = 5.6$, df = 1, $P<0.05$;
Chi square for shivering: $x^2 = 6.55$, df = 1, $P<0.05$

There is significant Mean arterial Pressure change from 4 min to 15 with highly significant from 6-10 min after spinal anesthesia in Group B patients compared to Group A patients (Table 7). There was statistically significant difference in degree of hypotension found between the two groups. Incidence of hypotension in Group A is 13.33 % where as in Group B is 63.33 % which is statistically significant (Table 8).

There is significant difference in incidence of nausea, vomiting and shivering in both the groups. Incidence of nausea and vomiting is 13.33% of pts in Group A whereas 46.66% of patients in Group B which is statistically significant. Incidence of shivering is 16.66 % of patients in Group A whereas 56.66% of patients in Group B which is statistically significant (Table 9).

Table 10: Comparison of phenylephrine doses (in mics) in both the groups.

	Group A (Mean ± SD)	Group B (Mean ± SD)	T	P value
Doses of phenylephrine (mics)	11.6 ± 35.78	41.66 ± 44.87	2.82	0.006*

*P value<0.05, by using 'upaired t test' there was statistically significant difference in requirement of phenylephrine found between both the groups.

Above table showing Group A patients required only 11.6mics of phenylephrine while Group B patients required 41.66mics of phenylephrine which is statistically significant.

Table 11: Comparison of no. of patients required rescue phenylephrine.

	Group A	Group B	P value
No. of patients required rescue phenylephrine	3	15	0.004
Nil	27	15	
Total	30	30	

Chi square for No. of patients required rescue phenylephrine: $x^2 = 8$, df = 1, P 0.004

Table above showing significant number of patients required rescue phenylephrine in Group B than Group A. 10% of patients from Group A and 50% of patients from Group B required rescue phenylephrine which is statistically significant.

DISCUSSION

Spinal anesthesia is a popular technique of anesthesia in pregnant patients posted for caesarean section. Besides an awake lady gets an opportunity to make bond with the baby soon after birth. However maternal hypotension is the most frequent complication of spinal anaesthesia which results from a decrease in arteriolar and venous tone secondary to sympathetic block.

Use of vasopressors (ephedrine or phenylephrine) improve maternal cardiovascular stability but there is concern about increase in afterload and a baroreceptor mediated bradycardia with phenylephrine in the mother with consequent reduction in maternal cardiac output.[4,5] Ephedrine may predispose to arrhythmia.[6]

Sympathectomy of the lower extremities during central neuraxial block result in peripheral vasodilatation, decreases venous return and leads to hypotension.[7] 16-20% of the total blood volume is in the legs during spinal block.[8]

Accordingly one would expect that compression would somehow decrease the magnitude and prevelance of post spinal hypotension. During spinal anesthesia relaxation of calf muscles due to sympathetic blockade leads to loss of pumping action of calf muscles and the vascular distensibility of the calf vessels has been shown to increase by 17%.[9]

Leg elevation alone or in combination with leg wrapping might cause cephalic displacement of hyperbaric solution due to flattening of the lumber curvature of the spine resulting in a higher level of sensory, motor and sympathetic blockade. Parturients at term have more blood trapped in the lower extremities and spinal anesthesia induced vasodilatation will increase the pooling of blood even more. Vasodilatation induced by spinal anesthesia increases the proportion of blood that runs to periphery (systolic run off) during systole.

Mean arterial pressure, Systolic and diastolic blood pressure were noted in both the groups over study of time course 50 min after spinal anesthesia and compared by using "unpaired student t test". In this study, in Group B, there was a decrease in systolic blood pressure, diastolic blood pressure and mean arterial pressure following spinal anesthesia, which was significantly lower than the baseline value at 4^{th}, 6^{th}, 8^{th}, 10^{th} and 15^{th} min and was not significant thereafter.

Leg wrapped patients had a non-significant decrease in systolic blood pressure, diastolic blood pressure and mean arterial pressure when compared with baseline. In leg wrapped group, the systolic blood pressure, diastolic blood pressure and mean arterial pressure remained consistently above that of control and the difference in between the groups was significant at 4^{th}, 6^{th}, 8^{th},10^{th} and 15^{th} min with highly significant between 6^{th} to 10^{th} minutes. Similar study done by Goudie et al in where they found fall in diastolic and mean arterial pressure was greater in control group than leg wrapped group which correlates with the current study.[10]

Bhagawanje S et al. in 1990[11] found Systolic arterial pressure was significantly less in control subjects at 4min, 5min, 6min following spinal injection which correlates with the current study. They also found leg wrapped patients had significant lower incidence (16.7%) of hypotension than control (83.3%). Only 2 patients in leg wrapped group required ephedrine compared to 10 patients in control (P = 0.0033) which correlates with the current study.

They also found decreased incidence of nausea and vomiting related to spinal anesthesia induced hypotension in leg wrapped patients in elective caesarean section which correlates with the current study. Rout CC et al showed that in leg wrapped group patients, systolic pressure did not significantly decreased to below baseline value.[12] Systolic blood pressure was significantly lower in the control group than leg wrapped group at 3^{rd}, 4^{th}, 6^{th},7^{th} and 10^{th} minutes following spinal injection which correlates with the current study. They also found 53% of non-leg wrapped and 18% of leg wrapped patients developed hypotension. They found, in legs wrapped group patients, the odds ratio was 5.3 (95%, CI 1.7-16.3) this means that leg wrapping results in five folds decrease incidence of hypotension. This correlates with the current study. They found decreased incidence of nausea and vomiting related to spinal anesthesia induced hypotension in leg wrapped patients in elective caesarean section which correlates with the current study.

Von Bogaert LJ et al found there was a decrease in systolic blood pressure in both the groups but the systolic blood pressure of leg wrapped patients remained significantly above the systolic blood pressure of control which correlates with the current study.[13] They also found that 45.5% in non-leg wrapped patients and 15.8% in leg wrapped patients developed hypotension (x^2 =11.02, P=0.012) which is statistically significant and this correlates with the current study. They had shown decreased incidence of nausea and vomiting related to spinal anesthesia induced hypotension in leg wrapped patients in elective caesarean section which correlates with the current study.

Adsumelli et al in their study they used sequential compression device for the study and found, greater than 20 % decrease in mean arterial pressure (MAP) occurred in 52% of patients in sequential compression device group Vs 92% in the control group (p=0.004, odds ratio=0.094, 95% CI = 0.018-0.488) which correlates with the current study but they found no significant difference in systolic and diastolic blood pressure which don't correlates with the current study, this could be due to intervention have occurred before the arterial pressure had a chance to reach its nadir.[14] They also found no significant difference in heart rate between case and control group which don't correlate with this study this could be due to different levels of autonomic blockade.

Kunal Singh et al found significant difference in change of systolic and mean arterial blood pressure between the two groups (leg wrapped and unwrapped) at 4^{th} to 12^{th} min, highly significant between 4^{th},6^{th},8^{th}min and no significant difference was observed after delivery. Leg wrapped group had higher mean arterial blood pressure throughout the measured interval.[15] Their results correlates with the current study.

They also found significant difference in change in heart rate at 6^{th} and 8^{th} min (before delivery) whereas no significant difference was observed after delivery which correlates with the current study. They found 43.33% in

non-leg wrapped patients and 10% in leg wrapped patients developed hypotension (P=0.009) which is statistically significant and this correlates with the current study. They found 3 patients (10%) in leg wrapped patients and 10 patients (33.33%) in non-leg wrapped patients require rescue phenylephrine, which is statistically significant and this correlates with the current study.

In the current study 4 patients out of 30 (13.33%) in group A and 19 patients out of 30 (63.33%) in group B developed hypotension which shows significant difference for incidence of hypotension in both the groups. In the current study, intraoperative monitoring from 4 min to 15 min shown the significant increase in heart rate in group B compared to group A ($P<0.05$) with highly significant from 6 min to 10 min ($P<0.001$). Conflicting results found by Goudie et al and Adsumelli N et al. Goudie et al. found heart rate changes are inconsistent, some patients had increase in heart rate with the onset of hypotension while others a decrease.

This absence of significant heart rate increase could be because of different levels of autonomic blockade between the groups and vagal reflexes due to surgical manipulation. No significant difference in heart rate between case and control group found by Adsumelli N et al. could be due to different levels of autonomic blockade. But Similar result was observed by Kunal Singh et al who found significant difference in change in heart rate at 6^{th} and 8^{th} min (before delivery) whereas no significant difference was observed after delivery.

In the current study it was found that 2 patients with nausea, 2 patients with vomiting in group A and 5 patients with nausea, 9 patients with vomiting in group B. Total percentage for group A and B developing nausea and vomiting were 13.33% and 46.66% respectively showing significant difference in incidence of nausea and vomiting .Incidence of shivering was significantly lower in leg wrapped patients (Group A) 15.66% patients from group A compared to 56.66% patients from group B.

Jorgensen J et al found 5 patients out of 15 in non-leg wrapped group and no patient out of 15 in leg wrapped group experienced nausea which is statistically significant and this correlates with the current study.[16]

In the current study, in group A 3 patients out of 30 (10%) required phenylephrine as compared to 15 patients out of 30 (50%) is showing significant difference of requirement of phenylephrine in both the groups. The mean dose for Group A patients was 11.6 mics. While mean dose of group B patients was 41.66mics showing significant difference.

CONCLUSION

From the current study it can be concluded that wrapping of lower limb just before spinal anesthesia is an effective method to prevent hypotension during spinal anesthesia for elective caesarean section without any unwanted side effect like hypotension, tachycardia, pulmonary embolism or any other maternal side effects. In addition to the above advantages, it reduces the incidence of nausea, vomiting and shivering intra operatively. As leg wrapping with elastic crepe bandage is cheap, easy, readily available, non-invasive, and non-pharmacological 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.

Hence wrapping of lower limb is simple, safe and effective method of preventing hypotension in patients posted for caesarean section and can be great value in routine practice.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Reisner LS, Lin D. Anesthesia for cesarean section. In: Chestnut DH. Obstetric Anesthesia. 2nd ed. St. Louis: Mosby; 1999;465-92.
2. Rocke DA, Rout CC. Volume preloading, spinal hypotension and caesarean section. Br J Anaesth. 1995;75:257-9.
3. Mitra JK, Roy J, Bhattacharya P, Yunus M, Lyngdon NM. Changing trends in management of hypotension following spinal hypotension in cesarean section. Review Article. 2013;59:121-6.
4. Cooper DW, Carpenter M, Mowbray P. Fetal and maternal effects of phenylephrine and ephedrine during spinal anesthesia for caesarean delivery. Anesthesiology. 2002;97:1582-90.
5. Loughrey JP, Walsh F, Gardiner J. Prophylactic intravenous bolus ephedrine for elective Caesarean section under spinal anaesthesia. Eur J Anaesthesiol. 2002;19:63-8.
6. Kluger MT. Ephedrine may predispose to arrhythmias in obstetric anaesthesia. Anaesth Intensive Care. 2000;28:336.
7. Butter worth J. Regional Anesth Pain Med. 1998;23(4):370.
8. Greene NM. Physiology of spinal anesthesia 3rd ed, Baltimore 1981, Williams and Wilkins.
9. Lee A, Ngan WD, Gin T. Prophylactic ephedrine prevents hypotension during spinal anaesthesia for cesarean section delivery but does not improve neonatal outcome: a qualitative symptomatic review. Can J Anaesth. 2002;588-99.
10. Goudie TA, Winter AW, Ferguson DJ. Lower limb compression using inflatable splints to prevent hypotension during spinal anaesthesia for caesarean section. Acta Anaesthesiol Scand. 1988;32:541-4.

11. Bhagwanjee S, Rocke DA, Rout CC, Kooverjee RV, Brijbal R. Prevention of post spinal hypotension following the spinal anaesthesia for elective caesarean section by wrapping of legs. Br J Anaesth. 1990;65(6):819-22
12. Rout CC, Rocke DA, Gouws E. Leg elevation and wrapping in the prevention of hypotension following spinal anaesthesia for elective cesarean section. Anaesth. 1993;48(4):304-8.
13. Von Bogaert LJ. Prevention of post spinal hypotension at elective cesarean section by wrapping of lower limbs. Int J Gynaecology and obstetrics. 1998;61(3);233-8
14. Adsumelli RS, Steinberg ES, Schabel JE, Saunders TA, Poppers PJ. Sequential compression device with thigh sleeves support mean arterial pressure during caesarean section under spinal anaesthesia. Br J Anaesth. 2003;91(5):695-8.
15. Singh K, Payal YS, Sharma JP, Nautiyal R. Evaluation of hemodynamic changes after leg wrapping in elective cesarean section under spinal anesthesia. J obstetric anaesthesia and critical care. 2014;4(1):23-8.
16. Jorgensen J, Christensen PK, Sonnenschein CH. Compression stockings as prevention of hypotension in cesarean section during spinal anaesthesia. Ugeskrift for laeger. 1996;158(11):1526-9.

Cite this article as: 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;4:4408-15.