



POST INTRATHECAL BUPIVACAINE HEAVY INDUCED SHIVERING AND ITS ASSOCIATED FACTORS DURING C- SECTION IN AN INDIAN TERTIARY CARE HOSPITAL: A PROSPECTIVE OBSERVATIONAL STUDY.

Anaesthesiology

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ABSTRACT

Background: Intrathecal Bupivacaine Heavy induces Shivering during caesarean section. Shivering increases patients' discomfort, oxygen consumption, surgical bleeding and metabolic heat production as Hypothermia. In spite of morbidity and mortality, there is dearth of data about shivering due to intrathecal Block. **Methods:** Institutional ethical committee approved this study protocol. The study was conducted in 60 female's patients scheduled for both elective and emergency caesarean section under intrathecal block. We included American society of anesthesiologists I and II group patients of age 20 - 40 years posted for caesarean section. 2 ml of 0.5% Bupivacaine heavy (Anawin heavy) was given and several physiological vital Parameters were observed at different time intervals. **Results:** The overall incidence of intraoperative shivering after caesarean section under spinal anaesthesia was 25%. Statistically significant fall in surface temperature was observed from 15-45 minutes. Out of 60 patients who had shivering, 45 patients were treated by non-pharmacological methods like used warming blanket, given warm Intravenous fluids, forced air warmer and 15 patients were controlled by intravenous tramadol (0.5mg/kg). Statistically significant likely risk factors were hypothermia and hypotension. **Conclusion:** Incidence of post spinal shivering was 25% and the mean time of onset of shivering was 25 minutes with hypothermia and hypotension as main associated factor and intravenous tramadol controlled it.

KEYWORDS

Post Spinal Shivering, Caesarean Section, Spinal Anesthesia and Hypothermia.

INTRODUCTION

Spinal anaesthesia for surgery in human beings was first given by August Bier (1861–1949) on 16 August 1898.¹ It avoids general anaesthesia and the risk of failed intubation.² Most commonly used spinal anaesthetics are Bupivacaine Heavy 0.5%. It is given generally in combination with several drugs like- fentanyl, sufentanyl and pethidine as an analgesic. But, Bupivacaine shows several complications like hypotension, bradycardia, hypothermia, nausea, vomiting, urinary retention, shivering, bacterial meningitis, paresthesia and post dural puncture headache.³

Shivering is a common problem with Bupivacaine Heavy with an incidence up to 56.7%. It is a physiological response to increase the metabolic heat production in the face of hypothermia.^{4, 4} It also increases oxygen consumption, carbon dioxide production and causes lactic acidosis.⁵ The main cause for Bupivacaine Heavy induced shivering is decreased sympathetic tone below the blocked level and heat loss due to vasodilatation.⁶ Heat gets redistributed from center to the peripheral part.⁷ This decreases the shivering threshold and also increases the sweating threshold.⁸ It ultimately causes fall in shivering threshold by 0.5 degree Celsius, constriction of vessels and shivering above the level of block.^{8,9}

The autonomic nervous system in homeothermic mammals is responsible to maintain normothermia.^{10,11} Risk factor implicated in shivering are: duration of operative procedure, height of sensory block, age of the patients, temperature of the infused fluids, operating room and core temperature.^{12,13} The range of axillary temperature is 35.5°C - 37°C. The axillary temperature less than 35°C are termed as hypothermia.¹⁴

shivering can be manage in an intraoperative normothermia by giving warm IV fluid, forced air warming and warm blankets or administering pharmacological treatment like intravenous Tramadol, fentanyl, sufentanyl and pethidine.¹⁵

Shivering is an unpleasant experience to the patient. Its ill effects may further worsen the situation and hence deserves prevention and adequate control. Hence, the present study aims to assess the incidence of shivering and likely associated risk factors for shivering in obstetric patients.

MATERIAL AND METHODS

The present study was done in the Department of Anaesthesia, after acquiring approval from the Institutional Ethical committee. The study was conducted on 60 female patients scheduled for elective and emergency caesarean section. We included ASA I and II patients of age group 20-40 years posted for lower segment caesarean section. Patients who refused for the procedure, ASA III and IV patients, patients with deformity of spine and known sensitivity to drugs, pre-existing neurological disorders and raised intracranial pressure and patients with coagulation disorders were excluded from this study. A written informed consent was taken from all patients. All patients were pre medicated with an antiemetic (4 mg Ondansetron) and 10 mg metoclopramide before 30 minutes of surgery for the prevention of nausea and vomiting.

In the preoperative room; vital parameters like Electrocardiogram, heart rate, systolic blood pressure, diastolic blood pressure, oxygen saturation and surface body temperature were noted. An intravenous line was secured with 18 or 20 Gauges cannula and warm Intravenous fluid ringer lactate (RL, 500 ml) was given in pre-operative period and patients were explained about the procedure of intrathecal block.

Intraoperative room; the ambient temperature was set at 22°C to 28°C in OT. All patients were kept warm by one layer of surgical drape, Warm IV fluids were also used. Under all aseptic technique, Intrathecal block was given with spinal drug Bupivacaine Heavy 0.5% (dose is calculated according to the wt. of the patient) using 25G Quincke spinal needle in the sitting position at level of L3-L4 or L4-L5 space through the midline approach. During the intra operative period parameters observed were time of onset of sensory block, height of sensory block, time of onset of shivering and grade of shivering by shivering score. HR, BP, SpO2 were recorded every 5 minutes and temperature was recorded every 15 minutes throughout the surgery in the axilla with arm held close to the body by digital thermometer.

Grades of shivering: by Tsai and Chu

0- No shivering.

1- Piloerection with no visible shivering.

2- Muscular activity observed in 1 muscle group.

3- Muscular activity in more than 1 muscle group.

4- Shivering which is generalized involving the entire body

Statistical Analysis

All the data were presented in terms of range, mean, median, standard

deviation (SD), and relative frequencies (%) as appropriate. Student t-test was applied to compare the quantitative variables. Statistical significance was attributed for probability value ($p < 0.05$). Statistical package for the social Science (SPSS) 20 version was used for statistical calculations.

RESULTS

Socio-demographic and physical characteristics of the study participants

Out of 60 patients we witnessed, the mean age of the patients was 26.9 years with a standard deviation of 3.9 years and also the mean weight of the patients was 59.0 kg with a SD of 8.3 kg in this study, 51 (85%) of the patients had an age between 20 – 30 years and 9 (15%) of the patients had an age between 31 – 35 years. All patients were either ASA I or ASA II. The most frequent diagnosis for caesarean section was previous LSCS (25%) and the least one was pre-eclampsia (3.33%) as described in (Table-1).

Shivering was noted in 15 patients with overall incidence of 25% as shown in (Figure-1). With majority having 45(75%) of patients shivering in grade 2 and very few had 15(25%) of patients shivering in grade 3 as shown in (Table-2). Onset of sensory block was between 3-4 minutes with a mean of 3.4 minutes as shown in (Table-3).

Significant fall in grade of shivering after spinal anaesthesia in caesarean section from 5 minutes – 60 minutes as shown in (Table-4). Onset of shivering was between 15-45 minutes with a mean of 25 minutes. There was significant fall in surface temperature from 15-45 minutes as evident from (Table-5). And the patients with T6 level of block had high incidence of shivering (Table-6).

Duration of surgery was between 50-80 minutes with a mean of 62.9 minutes. 25% patients were treated with tramadol while 75% patients were managed with non-pharmacological method. (Figure-2)

Factors Associated With Intraoperative Shivering:-

Several factors like Age, ASA grading, duration of surgery, amount of fluid used, axillary temperature, heart rate, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and SpO₂ of the patients has shown association with shivering in the several literature. However, variables like patient's age, the amount of fluid used and duration of surgery do not show association with shivering in present study. In this study axillary temperature, heart rate, systolic blood pressure, diastolic blood pressure and mean arterial blood pressure of the patient show significant association with shivering in multivariate logistic regression (Table-7).

Significant fall in heart rate after spinal anaesthesia in caesarean section from 5 – 15 minutes, from 40 – 50 minutes and 65 – 70 minutes is depicted in (Table-7:1). Statistically significant fall in systolic blood pressure after initiation of spinal anaesthesia from 5 – 45 minutes is shown in Table-7:2. Significant fall in diastolic blood pressure after spinal anaesthesia from 5 – 60 minutes and 70 minutes is shown in Table-7:3. Statistically significant fall in mean arterial pressure after Intrathecal block from 5 – 60 minutes and 70 minutes as depict in (Table-7:4). Significant fall in oxygen saturation at different time after spinal anaesthesia 15 minutes and 25 minutes as show in (Table-7:5).

DISCUSSION

The overall incidence of shivering was observed to vary from 29-54 % of patients in various studies undergoing spinal anaesthesia in caesarean section which was more than in our study 25%.^{16,17,18}

There are several associated factors of shivering including duration of surgical procedure, height of sensory block, age of the patients, temperature of the infused fluids and operating room.

Shivering is one of the most common complication after intrathecal block, there is no clear complication of shivering after spinal anesthesia. However, there is possible complication of shivering during spinal anesthesia.^{19,20} The main complication of shivering is an increase in oxygen consumption, metabolic heat production, carbon dioxide production. It also interferes with monitoring of HR, BP, ECG and oxygen saturation.³⁻⁵

This study was done to know the incidence of shivering, associated risk factors and treatment modalities.

In this study, the incidence of shivering after intrathecal block in

caesarean section was 25%. It was less than with other studies 42.2% in Onyekwulu et al, 43.3% in Safavi M et al, 53.8% in Yimer HT et al and 55% in Crowley LJ et al was done.^{21,22,23}

In this study the overall incidence of shivering is low compared to other studies. We used Non-pharmacological method like warming blankets, forced-air warmer, given warming intravenous fluid and pharmacological method intravenous Tramadol (0.5mg/kg) for preventing shivering.^{24,25}

In this study Maximum no. of patients had grade 2 shivering. It was accordance with other study done by Safavi M et al and Onyekwulu F A et al. Therefore, present study data was in accordance with these studies as Shown in table-8.^{21,16}

The mean onset of shivering in the present study was 25 minutes while 14 minutes in the study was performed by Kishore N et al, 20 minutes in the study was designed by Luggya TS et al and 20 minutes the study was done by Mittal G et al.^{26,27} Therefore, present study data was in accordance with all these studies.

In this study the incidence of post spinal shivering is according to height of sensory block. There were 17 (28.3%) patients at T4, 1 (1.7 %) patient at T5, 37 (61.7%) patients at T6, 2 (3.3%) patients at T7, 3 (5.0%) patients at T8 compared to other study was done in 2016 by Safavi M et al, There were 2 (6.7%) patients at T5, 8 (26.7%) patients at T6, 6 (20%) patients at T7, 6 (20%) patients at T8, 5 (16.7%) patients at T9 and 3 (10%) patients at T10. There was no statistically significant, therefore, present study data was accordance with this study.²¹

In our study Duration of shivering was observed between 10 - 50 minutes with a mean of 27 minutes and SD $\pm$ 13.25.

Grade of shivering was significant between 5 to 60 minutes of time interval and Table-9, shows the mean surface temperature is fall from 15 - 45 minus at interval time in present study compared to other study was done by safavi M et al the mean surface temperature is fall from 45 - 90 minus at different time interval. Therefore present study was accordance with this study.

Surface temperature was significantly lowered as observed from 15 - 45 minutes at different time intervals.²¹

In our study was significant fall at different time interval in heart rate, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and saturation.

The limitation of our study is we used surface temperature of body for monitoring and not the core temperature.

CONCLUSION

The present study, the incidence of intraoperative shivering after intrathecal block in caesarean section was comparable to other studies (25%). Majority of the patients belonged to the young age group between 20 – 30 years. Hypothermia, hypotension were strongly factors for shivering. We have recommended should be used intravenous tramadol (0.5mg/kg) and IV fluids.

Statistically significant likely risk factors were hypothermia and hypotension.

Table-1. Socio-demographic and physical characteristics of the study participants.

Variable	Patients with shivering (n=60)
Age (in Years)	
20 – 30	51 (85%)
31 – 35	9 (15%)
ASA status	
ASA I	5 (8.3%)
ASA II	55 (91.7%)
Mean arterial pressure (mmHg)	88.5 $\pm$ 28.5
Axillary temperature (°F)	95.8 $\pm$ 1.8
Mean duration of surgery (minutes)	62.9 $\pm$ 7.4
Saturation (%)	97.5 $\pm$ 2.5
Indication of caesarean section-	

Previous LSCS	15 (25%)
Primigravida with cephalic under	14 (23.33%)
Fetal distress	6 (10%)
Cephalic oligohydramnios	5 (8.33%)
Cephalic presentation	4 (6.66%)
Cervical incompetence	4 (6.66%)
Placenta accreta	3 (5%)
Twins pregnancy	2 (3.33%)
Pre eclampsia	2 (3.33%)

Table-2. Percentage distribution of patients according to grades of shivering.

Grades of shivering	No of patients	Percentage
Grade 2	45	75%
Grade 3	15	25%

Table-3. Percentage distribution of patients according to onset of sensory block.

Onset of sensory block(minutes)	No. of patients	Percentage
3	34	56.67%
4	26	43.33%
Total	60	100%

Table-4. Grade of shivering at different time interval after spinal anaesthesia.

Grade of shivering Times (minutes)	No of patients	Mean	±SD	t	p-value
0	60	0.02	0.13		
5	60	0.10	0.35	-2.316	0.024
10	60	0.42	0.53	-6.272	0.000
15	60	0.83	0.64	-10.607	0.000
20	60	1.27	0.58	-16.951	0.000
25	60	1.62	0.61	-20.114	0.000
30	60	1.80	0.61	-21.576	0.000
35	60	1.60	0.64	-18.271	0.000
40	60	1.28	0.56	-16.166	0.000
45	60	0.87	0.60	-10.399	0.000
50	60	0.55	0.57	-6.936	0.000
55	55	0.25	0.44	-3.730	0.000
60	49	0.29	0.46	-3.786	0.000
65	22	0.1	0.3	-1.451	0.162
70	19	0.1	0.2	-1.000	0.331
75	3	0.0	0.0	0.000	1.000
80	2	0.50	0.71	-1.000	0.500

Table-5. Surface temperature at different time interval after initiation of spinal anaesthesia

Surface temperature(°F)					
Time(min utes)	No of patients	Mean	±SD	t	p-value
0	60	96.9	0.3		
15	60	96.2	0.5	12.591	0.000
30	60	95.8	0.5	15.468	0.000
45	60	96	0.4	14.416	0.000
60	60	96.8	0.1	1.187	0.083
75	22	96.8	0.2	1.113	0.278
90	2	96.8	0.4	3.000	0.205

Table-6. Percentage distribution of patients according to height of sensory block.

Ht. of sensory block	No. of cases	Percentage
T4	17	28.3%
T5	1	1.7%
T6	37	61.7%
T7	2	3.3%
T8	3	5%
TOTAL	60	100%

Maximum no. of patients achieved T6 level and few had T4 level. Incidence of shivering was more in patients with T6 level signifying that height of sensory block is no risk factor of shivering.

Table-7 Variable associate factor:-

Table-7:1. Heart rate at different time after initiation of spinal anaesthesia.

Heart rate Time (minutes)	No. of patients	Minimum	Maximum	Mean	±SD	t	p-value
0	60	68.0	120.0	89.6	9.8		
5	60	72.0	128.0	91.0	11.0	-2.677	0.010
10	60	73.0	126.0	91.9	11.8	-2.753	0.008
15	60	76.0	124.0	93.2	11.6	-3.690	0.000
20	60	76.0	198.0	93.7	17.8	-1.947	0.056
25	60	76.0	122.0	91.4	11.0	-1.561	0.124
30	60	72.0	120.0	89.4	11.2	0.212	0.833
35	60	70.0	118.0	87.8	10.5	1.496	0.140
40	60	65.0	120.0	86.8	10.6	2.551	0.013
45	60	65.0	120.0	86.9	11.9	2.468	0.017
50	60	70.0	118.0	87.1	11.1	2.127	0.038
55	55	70.0	118.0	87.2	11.4	1.919	0.060
60	49	70.0	118.0	86.7	11.0	1.487	0.144
65	22	75.0	104.0	85.2	7.8	2.195	0.040
70	19	71.0	99.0	80.2	6.8	5.843	0.000
75	3	70.0	90.0	77.3	11.0	3.402	0.077
80	2	76.0	77.0	76.5	0.7	2.200	0.272

Table-7:2. Systolic blood pressure at different time after initiation of spinal anaesthesia.

SBP Time (minutes)	No. of patients	Minimum	Maximum	Mean	±SD	t	p-value
0	60	99.0	130.0	117.2	8.1		
5	60	95.0	128.0	113.7	7.7	12.237	0.000
10	60	94.0	126.0	110.7	7.4	12.975	0.000
15	60	90.0	126.0	108.5	7.4	12.039	0.000
20	60	96.0	130.0	108.0	7.6	10.121	0.000
25	60	96.0	129.0	108.1	7.9	8.063	0.000
30	60	96.0	198.0	110.7	13.7	3.441	0.001
35	60	98.0	131.0	110.7	7.7	5.206	0.000
40	60	93.0	134.0	112.1	7.7	4.292	0.000
45	60	97.0	136.0	113.8	7.5	3.030	0.004
50	60	99.0	140.0	115.3	8.5	1.678	0.099
55	55	100.0	140.0	115.8	8.3	1.110	0.272
60	49	100.0	141.0	116.2	7.9	0.421	0.676
65	22	100.0	138.0	117.7	7.5	-0.310	0.759
70	19	108.0	126.0	116.5	5.8	-0.193	0.849
75	3	110.0	118.0	113.3	4.2	-0.918	0.456
80	2	115.0	118.0	116.5	2.1	-9.000	0.070

Table-7:3. Diastolic blood pressure at different time after initiation of spinal anaesthesia.

DBP Time (minutes)	No. of patients	Minimum	Maximum	Mean	±SD	t	p-value
0	60	68.0	108.0	76.0	6.5		
5	60	61.0	100.0	74.5	6.2	4.902	0.000
10	60	53.0	100.0	71.8	6.7	9.552	0.000
15	60	58.0	108.0	70.4	7.2	9.516	0.000
20	60	52.0	110.0	69.2	8.5	7.763	0.000
25	60	53.0	106.0	68.3	8.2	8.555	0.000
30	60	54.0	100.0	68.4	7.5	8.621	0.000
35	60	50.0	98.0	69.2	7.2	7.783	0.000
40	60	54.0	96.0	70.5	7.1	6.258	0.000
45	60	58.0	92.0	71.4	6.2	6.005	0.000
50	60	56.0	97.0	72.4	6.7	4.625	0.000
55	55	58.0	88.0	73.1	5.9	3.704	0.001
60	49	59.0	83.0	73.2	4.7	2.923	0.005
65	22	58.0	85.0	73.7	5.8	1.861	0.077
70	19	62.0	88.0	72.0	6.4	2.634	0.017
75	3	76.0	77.0	76.3	0.6	-0.285	0.802
80	2	72.0	78.0	75.0	4.2	0.273	0.830

Table-7:4. Mean arterial pressure at different time after initiation of spinal anaesthesia.

MAP Time (minutes)	No. of patients	Minimum	Maximum	Mean	±SD	t	p-value
0	59	80.0	115.0	88.8	6.2		

5	59	70.0	109.0	86.8	6.3	6.390	0.000
10	58	68.0	108.0	84.4	6.3	10.421	0.000
15	59	69.0	116.0	83.1	6.8	9.443	0.000
20	59	67.0	117.0	81.6	7.6	9.372	0.000
25	59	70.0	113.0	81.1	7.3	9.006	0.000
30	59	68.0	108.0	81.3	7.0	8.297	0.000
35	59	67.0	105.0	82.0	6.7	7.863	0.000
40	59	60.0	108.0	83.0	7.2	6.600	0.000
45	59	69.0	100.0	84.5	6.2	5.192	0.000
50	59	74.0	102.0	85.7	6.6	3.623	0.001
55	54	75.0	100.0	85.9	5.7	3.101	0.003
60	48	72.0	101.0	86.1	5.2	2.831	0.007
65	22	73.0	99.0	86.2	5.9	1.620	0.120
70	19	75.0	94.0	84.6	5.8	2.168	0.044
75	3	88.0	91.0	89.7	1.5	-1.139	0.373
80	2	86.0	91.0	88.5	3.5	-0.059	0.963

Table-7.5. Oxygen saturation at different time after initiation of spinal anaesthesia.

SpO ₂ Time(mi nutes)	No of patients	Minimum	Maximum	Mean	±SD	t	p-value
0	60	98.0	100.0	100.0	0.3		
5	60	98.0	100.0	100.0	0.3	0.000	1.000
10	60	98.0	100.0	99.9	0.3	0.814	0.419
15	60	97.0	100.0	99.8	0.6	2.206	0.031
20	60	95.0	100.0	99.9	0.7	1.224	0.226
25	60	96.0	100.0	99.8	0.8	2.034	0.046
30	60	99.0	100.0	99.9	0.3	1.000	0.321
35	60	98.0	100.0	99.9	0.4	1.070	0.289
40	60	99.0	100.0	99.9	0.3	0.704	0.484
45	60	98.0	100.0	99.9	0.3	0.629	0.532
50	60	10.0	100.0	98.5	11.6	1.010	0.316
55	55	99.0	100.0	100.0	0.1	-0.444	0.659
60	49	99.0	100.0	100.0	0.2	0.000	1.000
65	22	98.0	100.0	99.9	0.4	1.000	0.329
70	19	99.0	100.0	99.9	0.2	1.000	0.331
75	3	100.0	100.0	100.0	0.0	0.000	1.000
80	2	100.0	100.0	100.0	0.0	0.000	1.000

Table-8. Comparison of grades of shivering in present study and other studies

Grade of shivering	Safavi M et al ²¹	Onyekwulu FA et al ¹⁶	Present study
Grade 1	4 (23%)	0 (0%)	0 (0%)
Grade 2	10 (56.82%)	28 (59.6%)	45 (75%)
Grade 3	2 (11.76%)	19 (40.4%)	15 (25%)
Grade 4	1 (5.88%)	0 (0%)	0 (0%)

Table-9. Comparison of mean surface temperature at different time intervals in present study and other study

Time intervals (mins)	Mean of surface temperature	
	Safavi M et al ²¹	Present study
0	35.95 (96.71)	96.9
15	35.96 (96.72)	96.2
30	35.97 (96.74)	95.8
45	35.96 (96.72)	96.0
60	35.88 (96.58)	96.8
75	35.76 (96.36)	96.8
90	35.72 (96.29)	96.8
105	35.8 (96.44)	
120	35.75 (96.35)	

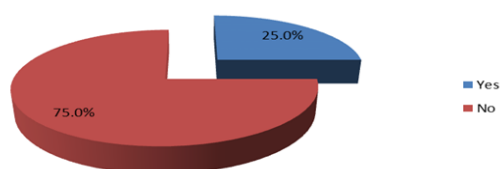


Figure 1: Percentage distribution of overall incidence of shivering after cesarean section

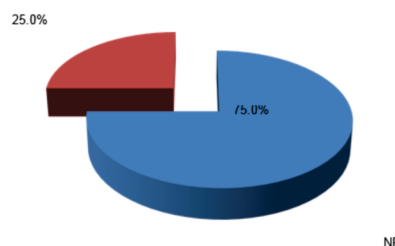


Figure-2: Percentage distribution of patients treated by non-pharmacological method and pharmacological method.

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