

Study of Incidence of Shivering in Patients undergoing Lower Segment Caesarian Section (LSCS) under Spinal Anaesthesia with Bupivacaine vs Bupivacaine with Fentanyl

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Received: 15-04-2022 / Revised: 20-05-2022 / Accepted: 05-06-2022

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Conflict of interest: Nil

Abstract

Background: Shivering is a normal thermoregulatory mechanism in patients undergoing central neuraxial anaesthesia. Shivering is common in women undergoing caesarian section under spinal anaesthesia and can interfere with patients monitoring. It can cause discomfort to patient and also increases tissue oxygen demand. The aim of the study was to evaluate the incidence of shivering with addition of 10-25mcg of fentanyl to bupivacaine in patients undergoing LSCS under spinal anaesthesia.

Material and Method: A total of 60 healthy women belonging to ASA grade I and II were enrolled in our study that were scheduled for both elective as well as emergency caesarian section under spinal anaesthesia. They were randomly divided into 2 groups. Group C with 30 patients were given 0.5% hyperbaric bupivacaine (2.5-3ml) and group F with 30 patients were given 0.5% hyperbaric bupivacaine (2.5-3ml) with 10-25mcg fentanyl.

Results: The overall incidence of shivering in group F was lower (5 out of 30 patients) as compared to group C (13 out of 30 patients). There was significant difference in the incidence of shivering between group F and group C (16.66% in group F ; 43.33% in group C , P<0.012). The severity of shivering was also reported less in group F as compared to group C.

Conclusion: Patients which received 10-25mcg fentanyl with bupivacaine had less incidence and severity of shivering than those who did not receive fentanyl with bupivacaine.

Keywords: Fentanyl, Bupivacaine, Shivering.

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Background

Shivering is an involuntary repetitive activity of the skeletal muscles that is a common postoperative complication. It is a physiological response to hypothermic

condition that aims to elevate and augment basic metabolic heat production. Vigorous shivering increases metabolic heat production up to 600% above basal level [1].

In about 55% of women undergoing caesarian section under spinal anaesthesia the incidence of shivering has been reported. It has various adverse effects and causes disturbances in early child mother relationship. It is therefore important that initially some measures should be taken either by using medications or by physical methods to control shivering [2].

Surgery causes heat loss due to exposure to cold operation theatre environments, evaporation from exposed sites and administration of unwarmed fluids leading to Core hypothermia that causes shivering as a compensation mechanism. Hypothermia leads to postoperative shivering, prolonged hospital stay, surgical wound infection, decreased immunity and coagulopathy, and increased incidence of cardiac morbidity [3,4].

Post spinal shivering is an unpleasant, thoroughly discomforting and frequent complication after surgery ranging from a mild form of having skin eruptions to a severe form with generalised continuous skeletal muscle contractions with prevalence of up to 50–80 % [5].

The shivering mechanism under spinal anaesthesia is due to dip in core temperature which causes peripheral vasodilation, raised cutaneous blood flow, frequent heat loss through skin, cold conditions in the room or sometimes due to cold anaesthetic solutions that affects the thermosensitive receptors located in the spinal cord [6].

Shivering may cause the alterations with anaesthesia monitoring like electrocardiogram (ECG) and Pulse oximetry (SpO₂). It is related with various patients complications like oxygen consumption may be increased up to 600% and carbon dioxide production is also elevated, increases the risk of hypoxemia, increase in blood pressure and heart rate and elevation in production of lactic acid and

catecholamine release. Intracranial pressure, intraocular pressure and wound pain is also increased due to shivering [7].

Therefore, it might increase the postoperative complications especially in high-risk patients. Moreover, shivering is one of the leading causes of discomfort for postsurgical patients.

This study was being done to evaluate the incidence of shivering in patients undergoing LSCS under spinal anaesthesia using bupivacaine with and without fentanyl (10-25 mcg) and to study any side effect (respiratory depression, sedation, bradycardia, hypotension, nausea and vomiting) of study drug during the intraoperative and postoperative period.

Material and methods

A prospective, comparative, double Blind, randomized controlled study was carried out at Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar from July 2021 to June 2022. A total of 60 Lower Segment Caesarian Section patients (LSCS) in the age group between 19-40 yrs belonging to American Society of Anaesthesiology (ASA) category I and II were enrolled in the study. Written informed consent was taken from each patient included in the study. The patients were randomized into two equal groups with 30 patients in each group.

Inclusion criteria

1. Patients belonging to American Society of Anaesthesiology (ASA) Category I and II.
2. Patients in the age group between 19-40 yrs.
3. Patients posted for elective and emergency LSCS.
4. Patients with BMI up to 35.

Exclusion criteria

1. Patients with allergy to Bupivacaine or Fentanyl.

2. Patients with Fetal distress.
3. Less than 35 weeks pregnancy.
4. Febrile Patients.

Group F (Fentanyl group): n=30; will receive 0.5% hyperbaric Bupivacaine (2.5-3ml) with 10-25 mcg Fentanyl (0.25 micrograms/kg)

Group C (Control group): n=30; will receive 0.5% hyperbaric Bupivacaine (2.5-3ml) without Fentanyl

All patients were cannulated and preloaded with Ringer's Lactate 10-15 ml /kg (500-1000 ml) preoperatively. All intravenous fluids administered were stored at room temperature. Patients were taken to the operation room (OR) and before giving spinal various vital parameters were noted via monitors (SpO₂, B.P, H.R). The ambient temperature in the OR was adjusted in between 22-25°C. Under strict aseptic guidelines the patients were given spinal anaesthesia in the sitting position by using 27 G Quincke's needle through midline approach into the L3-L4 or L4-L5 space. Local anaesthetic (as per group F & C) were injected in subarachnoid space after observing free flow of CSF through spinal needle. The patients were kept in supine position after performing spinal block. Patients were given oxygen at the flow rate of 3-4 L /min.

Prior to surgery, sensory block was accessed by pin prick and motor blockade was evaluated by Bromage scale.

Crossley and Mahajan scale [8]. was used to evaluate severity and incidence of shivering in patients in which scores are as;

0= No shivering

1= No visible muscle activity but piloerection, peripheral vasoconstriction or both are present

2= Muscular activity in only one muscle group

3= Moderate muscular activity in more than one muscle group but not generalized shaking

4=Violent muscular activity that involves whole body

Severity and incidence of shivering was recorded at every 30 mins intraoperatively and postoperatively for 2 hours. The body temperature in all the patients was measured via probe kept under axilla.

Hypotension was defined as systolic blood pressure less than 90 mm Hg or decrease in systolic blood pressure by more than 30 mm Hg or a fall in mean arterial pressure by more than 20% from baseline. This was managed by intravenous mephentermine bolus of 6 mg. Bradycardia was defined as HR less than 50 beats per minute and was managed by intravenous atropine 0.3 mg. Ondansteron 0.1 mg /kg was used in patients who develop nausea and vomiting.

Demographic data, incidence and severity of shivering, temperature etc was recorded, tabulated and analyzed statistically.

We examined sedation and other post-operative complications in the patients during post-operative period by Brussels sedation scale.

Brussels sedation scale [9]

1 = Unroutable

2 = Responds to pain stimulation but not to auditory stimulation

3 = Responds to auditory stimulation

4 = Awake and calm

5 = Agitated

Statistical analysis

The data was coded and entered into Microsoft excel spreadsheet. Analysis was done using SPSS version 26 (IBM SPSS Statistics Inc., Chicago, Illinois, USA). Windows software program. Descriptive

statistics included computation of percentages, means and standard deviations. The analysis of variance (ANOVA) was used for quantitative and t – test used for quantitative data whenever two groups were used to compare. Level of significance was set at $P < 0.05$.

Results

In our study there was no statistically significant difference in age, gestational age & ASA grading present among both the groups. Body weight of patients was found to be statistically significant (p value - 0.001), though clinically it was not significant.

Table 1: Demographic Data

Variables	Mean \pm SD (Group C)	Mean \pm SD (Group F)	t-value	p-value
Age (in Years)	24.77 \pm 3.62	26.33 \pm 3.31	1.75	0.086
Weight (in Kgs)	69.53 \pm 7.26	76.13 \pm 5.41	3.99	0.001**
Gestational Age (in Weeks)	38.37 \pm 1.45	38.23 \pm 1.55	0.344	0.732

**= $p < 0.01$ i.e., significant

Table 2: Vital Parameters Group C

Group C	Preop (Mean \pm SD)	Intraop (Mean \pm SD)	Post-op (Mean \pm SD)	F-value	p-value
Temperature	98.43 \pm 0.19	98.29 \pm 0.30	98.29 \pm 0.25	4.01	0.023*
SPo2	98.10 \pm 1.03	97.87 \pm 1.22	98.20 \pm 1.21	0.674	0.514
RR	17.73 \pm 2.73	18.10 \pm 2.06	17.60 \pm 2.03	0.646	0.528
HR	81.73 \pm 4.70	81.03 \pm 8.04	83.96 \pm 5.83	2.628	0.081
BP Systolic	122.17 \pm 11.28	121.70 \pm 13.80	123.77 \pm 10.49	0.462	0.632
BP Diastolic	77.87 \pm 6.34	78.27 \pm 10.93	79.37 \pm 748	0.405	0.669

($p < 0.05$ - significant)

Current study revealed that patient vital parameters like heart rate, respiratory rate, blood pressure was not statistically significant at every interval in control group.

Temperature recording was found to be statistically significant (p value – 0.023).

Table 3: Vital Parameters Group F

Group F	Preop (Mean \pm SD)	Intraop (Mean \pm SD)	Post-op (Mean \pm SD)	F-value	p-value
Temperature	98.43 \pm 0.22	98.34 \pm 0.39	98.42 \pm 0.27	1.33	0.272
SPo2	98.17 \pm 0.79	97.60 \pm 1.35	98.13 \pm 1.14	2.49	0.092
RR	15.53 \pm 1.83	16.63 \pm 2.72	15.17 \pm 1.70	4.55	0.015*
HR	79.00 \pm 3.62	82.57 \pm 9.86	78.30 \pm 5.40	4.93	0.011*
BP Systolic	123.67 \pm 6.64	121.77 \pm 17.44	119.40 \pm 10.05	2.4	0.099
BP Diastolic	78.77 \pm 5.19	77.63 \pm 11.09	76.33 \pm 5.76	1.54	0.224

*= $p < 0.05$ i.e., significant

Current study revealed that patient vital parameters like heart rate and respiratory rate were statistically significant while blood pressure and body temperature were not statistically significant at every interval in fentanyl group.

Table 4: Side effects

Side effects	Group F (n=30)	Group C (n=30)	p value
Nausea	3 (10%)	2 (6.66%)	0.512
Vomiting	2 (6.66%)	1 (3.33%)	0.399
Hypotension	5 (16.66%)	3 (10%)	0.343
Bradycardia	2 (6.66%)	1 (3.33%)	0.399
Shivering	5 (16.66%)	13 (43.33%)	0.012*
Respiratory depression	2 (6.66%)	1 (3.33%)	0.399
Sedation	8 (26.66%)	2 (6.66%)	0.010*

*= $p < 0.05$ i.e., significant

Table 4 shows side effects observed in both the study groups. Comparatively higher incidence of sedation but lower incidence of shivering was observed with addition of fentanyl. Statistically it was found to be significant $p < 0.05$. [P value 0.010 & 0.012]

Table 5: Incidence of shivering

	Group F (n=30)	Group C (n=30)	p value
Incidence (%)	5 (16.66%)	13 (43.33%)	0.012*
Intra-operatively	3 (10.00%)	8 (26.66%)	0.043*
First 30 min	2 (6.66%)	5 (16.66%)	0.130
Second 30 min	1 (3.33%)	3 (10.00%)	0.175
Post-operatively	2 (6.66%)	5 (16.66%)	0.130
First 30 min	1 (3.33%)	3 (10.00%)	0.175
Second 30 min	1 (3.33%)	1 (3.33%)	1.000
Third 30 min	0 (0.00%)	1 (3.33%)	0.052

*= $p < 0.05$ i.e., significant

Table 5 shows incidence of shivering, which was more in control Group (group C) as compared to fentanyl group (Group F).

Table 6: Severity of shivering as per crossley and mahajan scoring – 0/1/2/3/4

Severity	Group F (n=30)	Group C (n=30)	p value
Grade 0	25 (83.3%)	17 (56.7%)	0.110
Grade 1	1 (3.33%)	3 (10%)	0.175
Grade 2	2 (6.66%)	5 (16.66%)	0.130
Grade 3	2 (6.66%)	5 (16.66%)	0.130
Grade 4	0 (0%)	0 (0%)	-

*= $p < 0.05$ i.e., significant

Table 6. shows severity of shivering, which was more in control Group (group C) as compared to fentanyl group (Group F).

Table 7: Shows Brussels Sedation Scale

Sedation (Brussels sedation scale)			
SCORE	GROUP F (n=30)	GROUP C (n=30)	p value
1	0(0.00%)	0 (0.00%)	-
2	0(0.00%)	0 (0.00%)	-
3	2(7.00%)	0(0.00%)	0.03*
4	5(17.00%)	1(3.00%)	0.02*
5	1(3.00%)	1(3.00%)	1.00

Table 7. shows Comparatively higher incidence of sedation was observed with addition of fentanyl in group F as compared to group C.

Discussion

The present study was a hospital-based prospective, comparative, double Blind, randomized controlled study carried out at Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar. A total of 60 Lower Segment Caesarian Section patients (LSCS) in the age group between 19-40 yrs belonging to American Society of Anaesthesiology (ASA) category I and II were enrolled in the study. The patients were randomized into two equal groups with 30 patients in each group.

Shivering is spontaneous, involuntary, rhythmic, oscillating, tremor-like muscle hyperactivity that increases metabolic heat production up to 600% after general or regional anaesthesia [1].

Post anaesthetic shivering may cause discomfort to patients, increase intracranial and intraocular pressure and aggravate wound pain by stretching incisions. Shivering increases tissue oxygen demand which is accompanied by increase in minute ventilation and cardiac output to maintain aerobic metabolism. This may be deleterious in patients with impaired cardiovascular reserve or a limited respiratory capacity. Shivering may also interfere with the monitoring of patients by causing artefacts

of the ECG, blood pressure, and pulse oximetry [2].

In patients undergoing Spinal anaesthesia the normal thermoregulatory system of body is impaired which plays an important role in temperature regulation.

Spinal anaesthesia results in redistribution of core heat to the periphery from the trunk (below the level of block).

Both these effects predispose patients undergoing spinal anaesthesia to hypothermia and shivering.

Shivering is common in women undergoing caesarian section under spinal anaesthesia. In about 55% of women undergoing caesarian section under spinal anaesthesia the incidence of shivering has been reported. It has various adverse effects and causes disturbances in early child mother relationship. It is therefore important that initially some measures should be taken either by using medications or by physical methods to control shivering [2].

Our study results revealed that the incidence as well as severity of shivering was reduced after the addition of 10 - 25mcg fentanyl to 0.5% hyperbaric bupivacaine in patients undergoing caesarian section under spinal anaesthesia. Our study results are consistent with other similar studies.

Sadegh *et al* conducted a study and concluded that the incidence of shivering was comparatively less when 25mcg of

fentanyl was added with 0.5% hyperbaric bupivacaine [10].

Golmohammadi *et al* conducted a study on incidence of shivering during caesarian section in patients under spinal anaesthesia with or without fentanyl showed that the patients administered with fentanyl reported less shivering incidence intraoperatively and postoperatively [11].

Chu *et al* conducted a study and revealed the combination of bupivacaine with a dose of fentanyl as low as 7.5 µg did not produce actual clinical effects and as the dose of fentanyl was increased to 12.5 µg or 15 µg the quality of surgical analgesia was better and the incidence of shivering was decreased significantly [12].

Techanivate *et al* conducted a study and showed that 20 µg fentanyl added to hyperbaric bupivacaine can reduce the incidence and severity of shivering without increasing other side effects such as hypotension, nausea and vomiting [13].

Belzarena *et al.* conducted a study on 120 patients undergoing cesarean section to investigate the clinical effects of intrathecally administered fentanyl along with 0.5% Bupivacaine. The combination of bupivacaine and a low dose of fentanyl (0.25 micrograms/kg) provides excellent surgical anesthesia with short-lasting postoperative analgesia and very few negative side effects like intraoperative respiratory depression and increased sedation observed in groups who received higher doses of fentanyl [14].

In the current study the overall incidence of shivering in group F was lower (5 out of 30 patients) as compared to group C (13 out of 30 patients). There was significant difference in the incidence of shivering between group F and group C, (16.66% in group F ; 43.33% in group C , $P < 0.012$). The severity of shivering was also reported less in group F as compared to group C.

Patients which received 10-25mcg fentanyl (0.25 micrograms/kg) with bupivacaine had less incidence and severity of shivering than those who did not receive fentanyl with bupivacaine.

Assessment and evaluation of side effects in the current study revealed comparatively higher incidence of sedation with addition of fentanyl though most of the patients were arousable on command with stable vitals and clinically it was not significant. Incidence of respiratory depression was found in few patients in fentanyl group though it was transient and completely recoverable. Hypotension and bradycardia were seen in few patients. One patient in fentanyl group developed bradycardia (H.R-48/min) associated with hypotension (SBP - 86mmHg) and required inj.atropine 0.3 mg along with inj.mephentermine 6 mg. Side-effects, such as hypotension, nausea and vomiting, were recorded and treated accordingly. Hypotension was defined as a decrease in MAP of more than 20% from baseline. This was treated by crystalloid infusion and if necessary mephentermine 6 mg was administered i.v. The amount of mephentermine given in each group was recorded.

Conclusion

Patients which received 10-25mcg fentanyl (0.25 micrograms/kg) with bupivacaine had less incidence and severity of shivering than those who did not receive fentanyl with bupivacaine. Fentanyl addition to bupivacaine not only reduced the incidence and severity of shivering but also provided surgical analgesia as well as post-operative analgesia.

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