

# Analysis Impact of two Different Temperatures of 0.5% Heavy Bupivacaine on the Incidence of Shivering in Spinal Anaesthesia: A Comparative Study

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## Abstract

**Background:** In spinal anaesthesia profound nerve block can be produced in a large part of the body by injecting small amount of drug in subarachnoid space therefore less chances of drug toxicity by local anaesthetic. Injection of ice-cold epidural local anaesthetic increases shivering compared with epidural solutions that are pre-warmed to 30° C. The present study was undertaken for assessing whether there is any effect of two different temperatures (4 °C and 37°C) of 0.5% heavy bupivacaine on the incidence of shivering in spinal anaesthesia. **Subjects and Methods:** A total of 70 subjects were included in the study having two groups of 35 parturients in each group. Group T<sub>4</sub> (n=35)–Hyperbaric bupivacaine (0.5%) 2.4ml cooled to the temperature of 4°C, and Group T<sub>37</sub> (n=35) – Hyperbaric bupivacaine (0.5%) 2.4ml warmed to the temperature of 37 °C. The anaesthesiologist performed the spinal block after thorough hand washing and preparing the back of the patient under all aseptic precautions as per the hospital protocol. Subarachnoid block was given with the patient in sitting position after infiltration at local area with 2% lignocaine. The patient was placed in supine position. Oxygen at a flow rate of 5L/min was given via simple face mask. Intraoperative fluid management was done with warm fluid. Heart rate, NIBP, SpO<sub>2</sub> and temperature was monitored and noted. The core temperature was measured using a rectal thermometer with cover. All the results were analysed by SPSS software. **Results:** Mean time of onset of sensory block among the patients of the T<sub>4</sub> and T<sub>37</sub> group was 73.05 seconds and 64.88 seconds respectively. Non-significant results were obtained while comparing the onset time of sensory block among the two study groups. Non-significant results were obtained while comparing the shivering onset and core body temperature at different time intervals, non-significant result were obtained. **Conclusion:** Injection of cold or warm bupivacaine has no effect on the incidence of shivering.

**Keywords:** Shivering, Spinal Anesthesia

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## Introduction

In spinal anaesthesia profound nerve block can be produced in a large part of the body by injecting small amount of drug in subarachnoid space therefore less chances of drug toxicity by local anaesthetic. Regional anaesthesia causes less postoperative pain, nausea, vomiting, early patient mobilisation and shorter hospital stay.<sup>[1-3]</sup>

Injection of ice-cold epidural local anaesthetic increases shivering compared with epidural solutions that are pre-warmed to 30o C. This result was not repeated in non-pregnant

patients, however, where no difference in the incidence of shivering was observed between those given warm or cold epidural injections.<sup>[4,5]</sup>

Major factors determining the spread of intrathecal local anaesthetic are baricity, density, viscosity of the drug and position of the patient. Whether shivering seen during spinal anaesthesia in labour is due to the temperature of injectate is unclear.<sup>[6]</sup> Hence; under the light of above mentioned data, the present study was undertaken for assessing whether there is any effect of two different temperatures (4 °C and 37°C) of 0.5% heavy bupivacaine on the incidence of shivering in spinal

anaesthesia.

## Subjects and Methods

The represent study was undertaken for assessing whether there is any effect of two different temperatures (4 °C and 37°C) of 0.5% heavy bupivacaine on the incidence of shivering in spinal anaesthesia. Ethical approval was obtained from institutional ethical committee and written consent was obtained from all the patients after explaining in detail the entire study protocol. A total of 70 subjects were included in the study having two groups of 35 parturients in each group.

### Inclusion criteria:

Healthy full term non labouring parturients belonging to ASA physical status I and II (American Society of Anaesthesiologist), with singleton pregnancy scheduled for elective caesarean section (CS) under subarachnoid block (SAB).

Group T<sub>4</sub> (n=35)–Hyperbaric bupivacaine (0.5%) 2.4ml cooled to the temperature of 4°C

Group T<sub>37</sub> (n=35) – Hyperbaric bupivacaine (0.5%) 2.4ml warmed to the temperature of 37°C

Hyperbaric bupivacaine 2.4 ml of 0.5% concentration was used for spinal anaesthesia. In group T<sub>4</sub> the drug was cooled to the temperature of 4°C in refrigerator while it was warmed to the temperature of 37°C in water-bath for use in group T<sub>37</sub>. In the operating room each patient was attached to 3 lead ECG monitor, pulse oximeter and an automated non invasive blood pressure monitor. Baseline value of heart rate (HR), non invasive blood pressure (NIBP), core body temperature (T<sub>c</sub>) and oxygen saturation (SpO<sub>2</sub>) were taken. Rectal temperature was taken as a measure of core body temperature and was monitored with the help of rectal probe with cover. In all the parturients pre-loading was done with lactated ringer's solution in a dose of 20ml/kg. The lactated ringer's solution was warmed with fluid warmer before giving to the patient.

The anaesthesiologist performed the spinal block after thorough hand washing and preparing the back of the patient under all aseptic precautions as per the hospital protocol. Subarachnoid block was given with the patient in sitting position after infiltration at local area with 2% lignocaine. Intervertebral space L3-L4 or L4-L5 was selected for giving the subarachnoid block. A 23G Quincke's spinal needle was inserted and after free flow of CSF was seen, 0.5 % bupivacaine 2.4 ml (12mg) was injected over 20 seconds in parturients of all the three groups. The anaesthesiologist who performed the spinal block was otherwise not involved in the study thereafter. The completion of injection was considered as "Time 0".

The patient was then placed in supine position. Oxygen at a flow rate of 5L/min was given via simple face mask. Intraoperative fluid management was done with warm fluid.

Heart rate, NIBP, SpO<sub>2</sub> and temperature was monitored and noted. The core temperature was measured using a rectal thermometer with cover. All the results were analysed by SPSS software.

## Results

Mean age of the patients of the T<sub>4</sub> group and T<sub>37</sub> group was 27.17 years and 27.14 years respectively. Mean weight of the patients of the T<sub>4</sub> and T<sub>37</sub> group was 65.74 Kg and 66.25 Kg respectively. Mean duration of surgery among the patients of T<sub>4</sub> and T<sub>37</sub> group was 58 minutes and 57.85 minutes respectively. Mean total duration of analgesia among patients of T<sub>4</sub> and T<sub>37</sub> group was 115.71 minutes and 117.22 minutes respectively. Mean time of onset of sensory block among the patients of the T<sub>4</sub> and T<sub>37</sub> group was 73.05 seconds and 64.88 seconds respectively. Non-significant results were obtained while comparing the onset time of sensory block among the two study groups. Non-significant results were obtained while comparing the shivering onset and core body temperature at different time intervals, non-significant result were obtained.

## Discussion

Caesarean Section (CS) has been a part of human culture since ancient times and there are tales in both Western and non-Western cultures, of this procedure resulting in live mothers and offspring. Spinal anaesthesia is usually preferred over general anaesthesia, as it is simple and safe, having less postoperative pain, less nausea & vomiting, early patient mobilisation & shorter hospital stay. Spinal anaesthesia also provides greater maternal safety, fetal benefits, higher parental satisfaction and consumer demand. Therefore it is a popular and safe anaesthetic technique for caesarean section both in elective as well as in some emergency procedures.<sup>[5-7]</sup> Hence; under the light of above mentioned data, the present study was undertaken for assessing whether there is any effect of two different temperatures (4 °C and 37°C) of 0.5% heavy bupivacaine on the incidence of shivering in spinal anaesthesia.

Mean age of the patients of the T<sub>4</sub> group and T<sub>37</sub> group was 27.17 years and 27.14 years respectively. Mean weight of the patients of the T<sub>4</sub> and T<sub>37</sub> group was 65.74 Kg and 66.25 Kg respectively. Mean duration of surgery among the patients of T<sub>4</sub> and T<sub>37</sub> group was 58 minutes and 57.85 minutes respectively. Callesen et al had demonstrated that use of plain bupivacaine 0.5 % adjusted to 37°C results in a higher and more predictable sensory blockade than bupivacaine at room temperature and 4°C groups.<sup>[8]</sup> Horasanl et al also demonstrated that, use of 3 ml 0.5 % plain levobupivacaine for spinal anaesthesia in the sitting patient led to higher sensory block when a 37°C solution was compared to 23°C solution.<sup>[9]</sup>

**Table 1: Demographic profile of the patients**

Parameter	GROUP T4	GROUP T37	p-value
Age (years)	27.17±3.72	27.14±3.72	0.791
Weight (Kgs)	65.74±7.55	66.25±7.75	0.885
Height (cm)	156.31±3.64	158.22±3.76	0.070
Duration of surgery (min)	58.00±5.02	57.85±6.99	0.242

**Table 2: Comparison of Characteristics of Sensory Block**

Variables	Group T <sub>4</sub> (n=35)	Group T <sub>37</sub> (n=35)	p-value
Onset time of sensory block (sec) (OTSB)	73.05±25.62	64.88±26.27	0.435
Time to achieve maximum sensory block height (min) (TMSB)	6.26±0.299	6.21±0.252	0.641
Total duration of analgesia (min) (TDA)	115.71±16.40	117.22±6.79	0.908

**Table 3: Correlation of Onset of Shivering With Core Body Temperature (T<sub>c</sub>)**

Parameter	Group T <sub>4</sub> (n=35)	Group T <sub>37</sub> (n=35)	P-value
Shivering Onset (min)	9.87±1.82	12.16±2.89	0.000*
Core body Temperature at Baseline	36.50±0.93	36.27±1.06	0.641
2 min	36.42±0.95	36.07±1.26	0.319
4 min	36.38±0.96	36.08±1.16	0.513
6 min	36.31±0.98	36.02±1.15	0.573

Temur et al had investigated the influence of 4°C, or room temperature levobupivacaine 0.5%, on spinal anaesthesia. They demonstrated that, intrathecal 4°C levobupivacaine led to statistically longer time needed to reach maximum sensory level, and reach the maximum motor block, lower sensory blockade level, and lower blockade duration in comparison with the room temperature levobupivacaine. [10]

In the present study, Mean total duration of analgesia among patients of T4 and T37 group was 115.71 minutes and 117.22 minutes respectively. Mean time of onset of sensory block among the patients of the T4 and T37 group was 73.05 seconds and 64.88 seconds respectively. Non-significant results were obtained while comparing the onset time of sensory block among the two study groups. Non-significant results were obtained while comparing the shivering onset and core body temperature at different time intervals, non-significant result were obtained. İzdeş et al had investigated the influence of 4°C, room temperature, or 37°C plain levobupivacaine 0.5%, on spinal anaesthesia and showed that, intrathecal 4°C plain levobupivacaine led to statistically longer time needed to reach maximum sensory level. However they demonstrated that intrathecal 4°C plain levobupivacaine led to statistically longer

sensorial blockade time compared with the other groups. [11] Patients given spinal or epidural anaesthetics cannot re-establish core temperature equilibrium, because peripheral vasoconstriction remains impaired. Shivering in these patients produces relatively little amount of heat, because it is restricted to the small muscle mass cephalad to the block. [9-11]

These may be uninhibited spinal reflexes, sympathetic over-activity, postoperative pain, adrenal suppression, pyrogen release and respiratory alkalosis. Due to shivering and thermal discomfort, the quality of parturients suffers. Moreover, shivering per se may aggravate postoperative pain, simply by stretching of surgical incision. The incidence of shivering in this group of patients has been reported to be as high as 50%. Sympathetic blockade and cutaneous vasodilation with the resultant heat loss has been regarded as the cause of shivering. However, Bromage et al has argued on the basis of their observation that shivering usually appears within minutes after injection and long before sufficient time has elapsed for significant heat loss to have occurred. He postulated that the spinal cord response was secondary to misinterpretation of afferent thermal clues due to differential blockade of warm sensation and cold sensation. [12,13]

## Conclusion

From the above results, the authors concluded that injection of cold or warm bupivacaine have no effect on the incidence of shivering. However; further studies are recommended.

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