

A prospective, randomized clinical trial for comparison of pethidine and dexmedetomidine for the control of intraoperative shivering under spinal anaesthesia

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Abstract

Introduction: Pharmacological methods using variety of drugs like pethidine, morphine, tramadol, clonidine, doxapram, ketansarine, nefopam, neostigmine, magnesium sulfate have been tried in post spinal shivering. Aim of the present study was to compare the two drugs pethidine and dexmedetomidine for the control of intraoperative shivering under spinal anaesthesia.

Materials and Methods: A prospective randomized study where total 80 patients of either gender aged between 20-60 years, ASA grade of I -II and patients who develop shivering of grade 2-3 (Crossley and Mahajan scale) after spinal anaesthesia were enclosed within the study after getting informed consent. The patients were randomized into two groups of 40 patients each. Group D- Dexmedetomidine group received single intravenous bolus dose of dexmedetomidine 0.5mcg/kg over 5 min. Group P -Pethidine group patients received 0.5mg/kg Pethidine IV over 5 min.

The time was accurately noted in seconds from drug administration to the disappearance of shivering. Patients were monitored at intervals of 1 minute, 3min, 5min and thenceforth 10, 20 and 30 minutes until finish of surgery. Patients were intently monitored for failure of the drug, recurrence of shivering and side effects such as nausea, vomiting, bradycardia (<50/min), hypotension (>20% of baseline), giddiness and sedation score will be recorded. Chi-square test was accustomed to evaluate categorical factors.

Results: Dexmedetomidine group had significant reduction in time needed to control shivering and disappearance of shivering after drug administration.

Conclusion: Through this study we tend to found that the time taken for control of shivering was shorter with Dexmedetomidine as compared to Pethidine. Side effects were less with Dexmedetomidine as compared to Pethidine.

Introduction

Spinal anaesthesia is widely used as a safe anaesthetic technique for both elective and emergency surgeries. Shivering is understood to be a frequent complication, reportable in 40 to 70% of patients undergoing surgery underneath regional anaesthesia.^{1,2} Shivering besides being physiologically stressful to the patient also causes unpleasant to the anesthesiologists and surgeons. Shivering can occur in patients receiving regional anaesthesia as well as those patients recovering from general anaesthesia. It causes several undesirable physiologic consequences including increase in oxygen consumption, hypercarbia and increase in minute ventilation. It induces arterial hypoxemia, lactic acidosis, increased intra-ocular pressure, intracranial pressure and interfere with patient monitoring.² Shivering may negate orthopedic procedures like fractures and dislocations and may also cause damage to dental prosthesis.³

Various non-pharmacological and pharmacological methods are available for the control of shivering during anaesthesia. Fluid warmers,⁴ ambient operation theater temperature, space blankets,⁵ surgical drapes and active circulating water mattress are some of the non pharmacological methods. Pharmacological methods using various drugs like Tramadol^{6,7} Clonidine, Doxapram, Dexmedetomidine, Pethidine, Nefopam, Neostigmine, Magnesium sulphate⁸ have been tried. In the pursue a lot of safe and efficacious drug we tend to compared 2 effective and safe drugs Dexmedetomidine and Pethidine, intravenously administered for treating shivering in patients who received spinal anaesthesia for numerous surgical procedures.

Our aim was to compare the efficacy of two drugs 0.5mcg/kg of Dexmedetomidine and 0.5mg/kg of Pethidine with respect to study time from drug administration to control of shivering, Recurrence of shivering after

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administration of drug, Adverse effects of these drugs and any haemodynamic changes during the procedure.

Materials and Methods

A prospective randomized study was carried out in the department of Anaesthesiology, B.L.D.E (Deemed to be University) Shri. B. M. Patil Medical College, Hospital and Research Centre, Vijayapura, on those patients who developed intra-operative shivering following spinal anaesthesia for numerous surgical procedures.

Patients of either gender aged between 20-60 years, ASA grade of I -II and patients who develop shivering of grade 2-3 (Crossley and Mahajan scale) following spinal anaesthesia were enclosed within the study once getting informed consent. Patients with fever, drug allergic reaction, thyroid illness and neuromuscular diseases, Surgery lasting quite four hours, Patients who develop shivering even before administering spinal anaesthesia, Patients requiring supplementation with general anaesthesia were excluded from the study. All patients who were included in the study were pre-medicated with tablet Diazepam 10mg on the night before the surgery and tablet Diazepam 5mg on the morning of the surgery, administered orally with sips of water two hours prior to the planned surgery. They were preloaded with 500ml of Ringers Lactate solution. Patients were taken into the operation theatre and baseline parameters were recorded using monitors. Baseline temperature was recorded employing a thermometer in the axilla placed in the vicinity of the axillary artery. Operation theatre temperature was kept at 22-25C. All patients in our study received spinal anaesthesia in left lateral position using 25G Quincke needles by means of midline approach within the L3-L4 intervertebral space under strict sterile precautions and local anaesthesia to the skin. Following free flow of CSF, 0.5% Bupivacaine (hyperbaric) was injected counting on need of surgery (3-4ml). Patients were administered 5 litres of oxygen by Hudson mask and were adequately covered with sterile surgical drapes.

Shivering of grades 2 and 3 as proposed by Crossley and Mahajan Scale of Shivering was considered to need treatment. When patients developed shivering of higher than mentioned grades, they were randomly assigned to one of the 2 study groups –

Group D- Dexmedetomidine group receiving single intravenous bolus dose of 0.5mcg/kg over 5 min.

Group P –Pethidine group patients receiving 0.5mg/kg Pethidine IV over 5 min.

The study drug was then administered intravenously as per the assigned group. The time from drug administration until the disappearance of shivering was accurately noted in seconds. Patients were monitored at intervals of 1minute, 3min, 5min and thenceforth 10, 20 and 30 minutes until the end of surgery. Patients were intently monitored for failure of the drug, recurrence of shivering and side effects like nausea, vomiting, bradycardia (< 50/min), hypotension (>20% of baseline), giddiness and sedation score were recorded. Sedation score was evaluated with a four point scale as per Filos.

Bradycardia, hypotension was treated with Atropine and Mephentermine respectively and vomiting with Metoclopramide, in titrated doses when required.

Grade of Shivering

Crossley and Mahajan Scale, Temperature at the beginning of shivering, Time from drug administration to control of shivering, vanishing of shivering on treatment, Recurrence of shivering after drug administration, any haemodynamic changes, adverse effects of drugs were recorded.

Statistical Analysis

Descriptive data are presented as frequencies (percentages) for discrete variables and as means (SDs) for continuous variables. Chi-square test was accustomed to evaluate categorical factors. We used comparison of means using T test, Anova for comparison between and within groups and diagrammatic presentation. All statistical tests were 2-tailed, and factors were considered statistically significant at $p < 0.05$. IBM SPSS version 22 and CDC Epi Info version 7 was used for analysis.

Results

During the study period 80 patients (40 in pethadine group and 40 in dexmedetomidine) were included into study. All variables of both groups (group P and group D) are shown in table-1. Mean age of the study population was 40 ± 4.5 years. Forty six (57.5 %) were men. We found Pethidine group had 62.5% and Dexmedetomidine had 67.5% of grade 3 shivering. The grades of shivering was comparable between the two groups with no statistical difference. We found dexmedetomidine group had significant reduction in time required to control shivering and vanishing of shivering after drug. Recurrence of shivering was more with pethidine group and it is statistically significant.

Incidence of nausea was noted in group P where pethidine was used as anti shivering agent and it is also statistically significant.

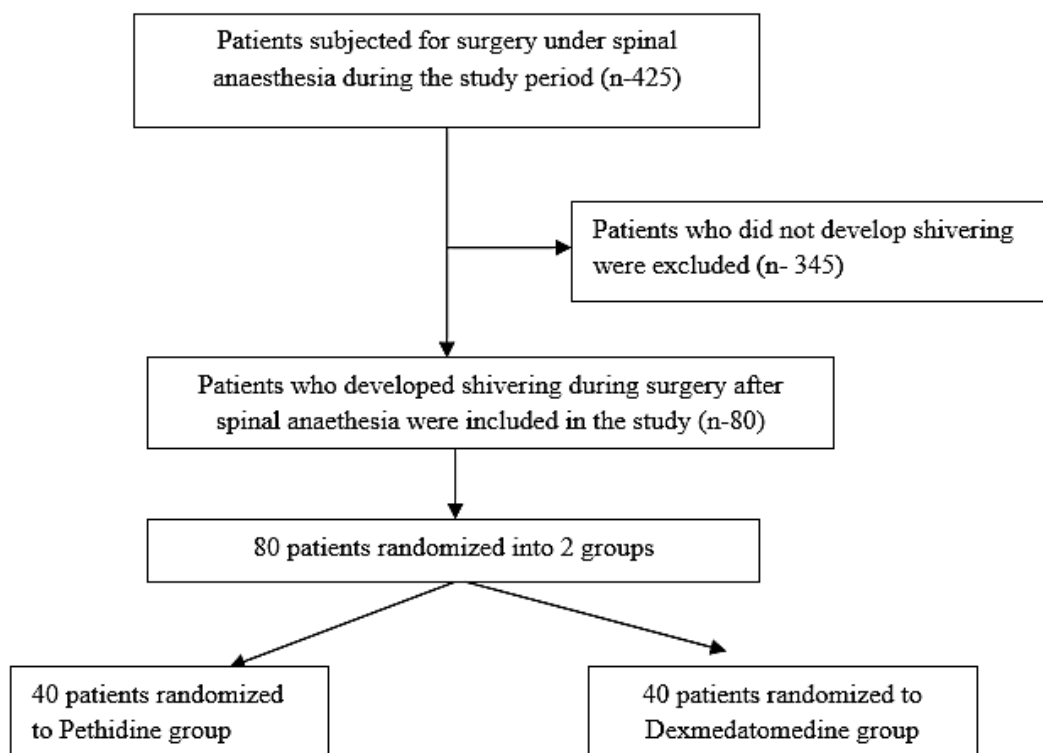
Discussion

Spinal anaesthesia is a safe and popular technique of anaesthesia used in different surgeries worldwide. Spinal anaesthesia is a type of central neuraxial blockade, with Epidural anaesthesia being the other commonly used technique. Shivering's physiological role is to provide heat, but its occurrence is inconsistent and incompletely understood in relation to anaesthesia.

The likely mechanism under regional anaesthesia could either result from decreased core body temperature, misinformation from receptors, or physiological setpoints impairment.²

Table 1: Comparison of a range of variables between Pethidine and Dexmedatomedine group

Variables	Group P(n=40) %	Group D(n=40) %	P value
Gender			
Male	25(62.5)	21(52.5)	0.366
Female	15(37.5)	19(47.5)	
Age	39.6(11.7)	40.5(10.6)	0.698
Temperature			
Pre Operative	37.2(0.4)	37.2(0.5)	0.917
During shivering	36.4(0.4)	36.4(0.5)	0.959
Grade of Shivering			
Grade 1	0(0)	0(0)	0.693
Grade 2	15(37.5)	13(32.5)	
Grade 3	25(62.5)	27(67.5)	
Heart rate			
During shivering	85.1(14.4)	79.5(5.8)	0.024
After control of shivering	83.5(10.2)	72.4(6.1)	<0.001
Time required to control shivering after drug	413(16.8)	205.3(18.1)	<0.001
Disappearance of shivering (in seconds)	515.1(9.9)	295.6(8.6)	<0.001
Post drug complication			
Recurrence	6(15)	1(2.5)	0.048
Nausea	5(12.5)	0(0)	0.021

**Fig. 1:** Flowchart depicting recruitment of cohort

Various factors contribute to reduce core body temperature in patients with spinal anaesthesia. These include sympathetic block causing peripheral vasodilation, increased cutaneous blood flow leading to increased heat loss through skin, cold operating room, rapid i.v. infusion of

cold i.v. fluids, direct effect of cold anaesthetic solution on the spinal cord's thermo-sensitive structures.^{2,8}

The effectiveness of pethidine in treating postoperative shivering is difficult to find an adequate explanation. It has been reported to be effective in treating amphotericin B

related shaking chills and infusions of granulocytes and platelets.

A randomised trial was conducted by Mahesh T, Lavanya K on 40 patients of ASA I and II status to compare effectiveness of pethidine and tramadol in controlling shivering after neuraxial block.¹³ This study revealed that tramadol reduced the occurrence of post anaesthetic shivering more significantly than pethidine. Whereas in our study we compared dexmedetomidine versus pethidine and found dexmedetomidine to be more effective

Rajagopalan Venkataraman et al conducted a prospective, randomized, double blind control study on 90 patients who developed shivering under spinal anaesthesia.¹⁴ They were randomly allocated into three groups each containing 30 patients. The drugs compared were tramadol 1mg/kg given to one group, clonidine 1mcg/kg received by one group and dexmedetomidine 0.5 mcg/kg received by last group. They concluded that dexmedetomidine is better than tramadol and clonidine in the control of shivering because of its faster onset and less recurrence rate.

Our present study also found dexmedetomidine to be more effective in controlling shivering than opioid pethidine.

Zahedi. H in their study comparing effect of tramadol and pethidine for post anaesthetic shivering revealed tramadol to be more superior than pethidine as it induced a faster termination of post anaesthetic shivering.¹⁵

Hatem Saber Mohamed (2015) conducted a prospective, randomized, double blind controlled study on 100 ASA I and II patients scheduled for elective lower abdominal and lower limb surgeries, under spinal anaesthesia.¹⁶ Patients who developed post spinal anaesthesia shivering of grade 3 or 4 were included in the study and randomly allocated into two groups one receiving dexmedetomidine 0.5mcg/kg iv other receiving Nefopam 0.15mg/kg iv. They came to a conclusion that Nefopam was better as compared to dexmedetomidine for control of intraoperative shivering under spinal anaesthesia.

Clayton and Hirsch reported after general anaesthesia that in 73 percent of patients, pethidine 25 mg arrested shivering within 5 minutes after general anaesthesia.

Later, pethidine was shown to be superior to both morphine and fentanyl in this respect.

A more recent study shows that 11 out of 14 patients stopped shivering within 5 minutes after pethidine 25 mg i.v. and that pethidine was effective in reducing the increased metabolic demand of shivering. In demonstrating the effectiveness of pethidine, our results agree with these studies and suggest that pethidine may be marginally superior to doxapram in this regard.⁹

Following spinal anaesthesia, our study had a mean temperature of $36.4C \pm 0.5$ for group Dexmedetomidine and $36.4C \pm 0.4$ for group Pethidine at which shivering occurred. This result was in line with the study of Aditi Dhimar and his associates.⁶

In our study, shivering was controlled in patients in the Pethidine group in 413 ± 16.8 seconds after drug administration, while in patients in the Dexmedetomidine group it was 2

05.3 ± 18.1 seconds. The results between the two groups were statistically significant with P value (0.00). This result was likely with Aditi Dhimar's study and associates for intraoperative and postoperative shivering control, complete shivering disappearance occurred in 5 minutes in the Tramadol group compared with the Pethidine group where it took 20 minutes comparable to our study. In a study by Blaine Easley R et al,¹⁰ all children stopped shivering within 5 minutes of completion of Dexmedetomidine administration. The onset of effect was 3.5 ± 0.9 min, which was comparable with our study. In a study by Geeta Mittal, et al, Shivering control was 2.52 ± 0.44 in the Dexmedetomidine group and 5.92 ± 0.81 in the Tramadol group, which was comparable to our group.¹¹

In our study, the incidence of nausea and vomiting with dexmedetomidine was 0%. The results match that of Sukhinder Jit Singh Bajwa et al's other studies.¹²

In our study, the rate of recurrence of shivering in Pethidine was 15% compared to 2.5% in the Dexmedetomidine group which is comparable to Aditi A. Dhimar et al.⁶ reported similar more recurrence rate with Pethidine as in our study (50%) but the dose used in their study was 1 mcg/kg.

Conclusion

Both dexmedetomidine (0.5mcg/kg) and pethidine (0.5mg/kg) are effective in treating patients with post spinal anaesthesia shivering but time taken for control of shivering was shorter with dexmedetomidine as compared to pethidine. Dexmedetomidine causes lesser side effects as compared to Pethidine, arousable sedation caused by dexmedetomidine provides additional comfort to the patient.

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