Original Research Article

Comparison of butorphanol and clonidine for control of intraoperative shivering under spinal anaesthesia at a tertiary hospital

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Abstract

Background: Spinal anaesthesia is world-widely used as a safe anaesthetic technique elective as well as emergency surgeries. Spinal anesthesia is known to decrease the vasoconstriction and shivering thresholds leading to shivering. In present study we compared butorphanol and clonidine for control of intraoperative shivering after spinal anaesthesia at our tertiary hospital. **Material and Methods:** Present study was a comparative, clinical, interventional study conducted in patients aged between 18-68 years, of either sex, had American Society of Anaesthesiologists (ASA) physical status I/II, scheduled for elective lower abdominal surgeries under subarachnoid block. 60 patients were randomly allocated into group B (n= 30, received sintravenous bolus butorphanol) and group C (n= 30, received intravenous bolus of clonidine). **Results:** 60 patients were randomly allocated into group B (n= 30, received butorphanol) and group C (n= 30, received clonidine). We compared age (years), weight (Kg), BMI(Kg/m^2), Gender (Male/Female) and ASA grade between both groups and no statistically significant difference was noted among them. We noted earlier onset of sensory as well as motor block and prolonged duration of sensory as well as motor block in butorphanol group as compared to clonidine group and difference was statistically significant. Incidence of shivering was more in clonidine group as compared to butorphanol group and difference was statistically significant. Also hypotension was more in clonidine group as compared to butorphanol group and difference was statistically significant. Similar incidence of bradycardia was noted in both groups. **Conclusion:** We noted that butorphanol is more effective than clonidine in the treatment of shivering because of its faster onset, lesser recurrence rate, and less complications reported.

Keywords: Butorphanol, clonidine, intraoperative shivering, spinal anaesthesia.

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INTRODUCTION

Spinal anaesthesia is world-widely used as a safe anaesthetic technique elective as well as emergency surgeries. Spinal anesthesia is known to decrease the vasoconstriction and shivering thresholds leading to shivering. There is core to periphery redistribution of heat due to spinal-induced vasodilatation and shivering is preceded by core hypothermia and vasoconstriction above the level of block.[1] Perioperative hypothermia is the primary cause for shivering which occurs due to neuraxial blockade induced inhibition of thermoregulatory center, peripheral vasodilatation due to sympathetic blockade, cold operating room and cold iv fluids.[2] In the postoperative period, mechanisms other than heat loss such as uninhibited spinal reflexes, sympathetic over-activity, postoperative pain, adrenal suppression, pyrogen release and respiratory alkalosis with subsequent decrease in the core temperature contribute to the origin of shivering.[3]

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Shivering depends on various factors, including age, gender, type of anesthesia, volume and temperature of intravenous fluid, duration of surgery, and temperature of operating theater.[4] Butorphanol is agonist- antagonist opioid analgesic and acts on central mono-aminergic pathways to inhibit the neuronal uptake of noradrenaline/serotonin.[5] Clonidine, the α2-agonist has properties that are potentially beneficial for premedication for anxiolysis, preoperative sedation, to reduce sympathetic activity, to diminish incidence of shivering and oxygen consumption during recovery from anesthesia, to decrease anesthetic and analgesic requirement and to minimize postoperative pain, nausea, and vomiting.[6,7] In present study we compared butorphanol and clonidine for control of intraoperative shivering after spinal anaesthesia at our tertiary hospital.

MATERIAL AND METHODS

Present study was a comparative, clinical, interventional study conducted in Department of Anesthesiology, Dr Patnam Mahender Reddy Institute of Medical Sciences. Study duration was of 6 months.

Inclusion criteria

Patients aged between 18-68 years, of either sex, had American Society of Anaesthesiologists (ASA) physical status I/II, scheduled for elective lower abdominal surgeries under subarachnoid block,

Exclusion criteria

Patients with history of severe cardiac or pulmonary disease, uncontrolled hypertension, morbid obesity, neurologic or psychological disease, hepatic or renal dysfunction, thyroid disease or metabolic disorders,

Patients requiring intraoperative blood transfusion, acute infections or fever.

Patients with deranged coagulation profile, deformity of spinal column, infection at the site of lumbar puncture,

Patients with known hypersensitivity to study drugs,

Patients had refusal to the technique, uncooperative patient, patients not willing to participate

After approval of Institutional Ethical Committee and written informed consent, 60 were enrolled. Patients were randomly allocated using a computer generated table of random numbers. Group B (n= 30) received intravenous bolus butorphanol 1 mg while group C (n= 30) received an intravenous bolus of 150 µg (1 mL) clonidine. All enrolled patients were admitted prior to day of operation and received tablet al. prazolam 0.5 mg orally, night before surgery. After arrival in the operation theatre, monitoring for heart rate, electrocardiogram, pulse-oximetry, non-invasive arterial blood pressure and axillary temperature were commenced and noted. They were infused lactated Ringer solution at rate of 10 mL/kg over 15 minutes, before initiation of subarachnoid block and no means of active rewarming was used. Under all aseptic precautions, in supine position with 10º Trendelenburg tilt, subarachnoid block was given at L2-L3 or L3-L4 intervertebral space with 3.5 ml of 0.5% hyperbaric bupivacaine (17.5 mg). All patients were given midazolam 2 mg, followed by study drug solution according to group allocation and supplemental oxygen was given at rate of 4 mL/min via face mask. The sensory and motor block characteristics were assessed till required surgical anaesthesia was achieved. The onset of sensory blockade, duration of sensory blockade, onset of motor block, duration of motor block was noted. The hemodynamic parameters of systemic arterial pressure, heart rate, ECG and pulse-oximetry were monitored at 5 minute intervals till end of surgery and then in recovery room.

Intraoperatively shivering was recorded at 5-minute interval up to 60 minutes of surgery, using a scale validated by Wrench.[8]

Grade 0: No shivering,

Grade 1: Piloerection but no visible muscular activity,

Grade 2: Visible muscular activity confined to one muscle group,

Grade 3: Visible muscular activity in more than one muscle group but not generalized,

Grade 4: Gross muscular activity (Shivering) involving the whole body.

The prophylaxis for shivering was regarded as ineffective if the patient exhibits grade-3 shivering any time during the study. Patients, who developed grade 3 or more of shivering were treated with tramadol (50 mg intravenously) with ondansetron 4 mg. The subarachnoid block characteristics, hemodynamic parameters, shivering with its onset time and grade, time of disappearance, level of sedation and any other intraoperative adverse events were recorded for statistical analysis. Data was recorded, entered in Microsoft excel sheet and analysed with SPSS version 21. The results were documented as Mean ± SD, percentage. The chi-square test was used to compare the difference of demographic data. The statistical significance in mean difference was calculated using repeated-measures ANOVA. A p value of <0.05 was considered to indicate statistical significance.

RESULTS

60 patients were randomly allocated into group B (n= 30, received butorphanol) and group C (n= 30, received clonidine). We compared age (years), weight (Kg), BMI(Kg/m^2), Gender (Male/Female) and ASA grade between both groups and no statistically significant difference was noted among them.

Table 1: General characteristics

General characteristics	Group B (n=30)	Group C (n=30)	P-value
Age (years)	41.9 ± 11.3	40.1 ± 10.6	0.84
Weight (Kg)	69.1 ± 10.5	71.9 ± 10.7	0.47
BMI (Kg/m2)	24.4 ± 3.1	25.1 ± 2.9	0.19
Gender (M/F)	14/16	15/15	0.64
ASA I/II	21/9	22/8	0.41
Duration of surgery (min)	108.1 ± 43.2	102.5 ± 44.2	0.67
Baseline axillary temperature (^{0}C)	36.64 ± 0.35	36.58 ± 0.41	0,84

We noted earlier onset of sensory as well as motor block and prolonged duration of sensory as well as motor block in butorphanol group as compared to clonidine group and difference was statistically significant.

Table 2: Spinal anaesthesia characteristics

Spinal anaesthesia characteristics	Group B (n=30)	Group C (n=30)	P value
Onset of Sensory block (min)	4.02 ± 1.19	4.43 ± 1.62	0.047
Onset of motor block (min)	5.12 ± 1.34	5.35 ± 1.53	0.049
Duration of motor block (min)	220.5 ± 25.59	191.55 ± 21.28	0.024
Duration of sensory block (min)	258.45 ± 23.76	215.47 ± 19.86	0.039

Incidence of shivering was more in clonidine group as compared to butorphanol group and difference was statistically significant. Also hypotension was more in clonidine group as compared to butorphanol group and difference was statistically significant. Similar incidence of bradycardia was noted in both groups.

Table 3: Incidence of shivering and side effects

Variables	Group B	Group C	P- value
Shivering grade			
Grade III	4 (13%)	7 (23%)	0.034
Grade IV	1 (3%)	2 (7%)	0.042
Side effects			
Hypotension	3 (10%)	5 (17%)	0.031
Bradycardia	3 (10%)	3 (10%)	-
Nausea and vomiting	1 (3%)	2 (7%)	0.48

DISCUSSION

Shivering occurs as a thermoregulatory response to hypothermia or muscle activity with tonic or clonic patterns, and various frequencies have been noticed.[3] The main causes of intra/post-operative shivering are temperature loss, increased sympathetic tone, pain, and systemic release of pyrogens.[9] Various risk factors associated with shivering include age, type, duration of anesthesia, level of sensory blockade and temperature of the operating room and infusion fluids.[10,11] The treatment of shivering includes both pharmacological and non-pharmacological methods. The non-pharmacological management is by external heating like the use of forced air warming, warming blankets, warmed fluids etc., Most frequently used pharmacological interventions include clonidine, pethidine, tramadol, nefopam, butorphanol and ketamine.[12] Clonidine is an alpha-2 (α2) agonist, exerts its anti-shivering effects at three levels. At hypothalamus, it decreases the thermoregulatory threshold for vasoconstriction and shivering, at locus coeruleus - a pro-shivering center in pons, it reduces spontaneous firing, and at the spinal cord level, it activates the α2-adrenoreceptors and release of dynorphin, norepinephrine, and acetylcholine.[13] In study by Pravin B.,[14] both clonidine and butorphanol groups were comparable with respect to demographic profile, duration of surgery and mean time for onset of shivering. Time required for control of shivering was more with clonidine (331.33 ± 70.65 seconds) as compared to butorphanol (81.17 ± 37.38 seconds). The incidence of recurrence was significantly more with clonidine as compared to butorphanol (P< 0.001). The percentage of side effects such as hypotension and bradycardia was significantly higher with clonidine as compared to butorphanol. The incidence of sedation was not statistically significant between two groups. Similar results were noted in present

study. Astha Palan also noted that butorphanol is better than Clonidine for control of shivering which occurs intra-operatively under spinal anaesthesia. The advantages of Butorphanol are faster control with lower incidence of recurrence of shivering and lower incidence of side effects such as hypotension and bradycardia.[15] Bansal P[11] noted that butorphanol and tramadol were more effective than clonidine in suppressing shivering. Butorphanol, tramadol, and clonidine completely controlled rigors in 83%, 73%, and 53% of cases, respectively, and incompletely suppressed rigors in 16%, 26%, and 46% of cases, respectively. Time taken to terminate rigors was significantly higher for clonidine (3.3 ± 0.9 minutes) than for butorphanol and tramadol (2.1 ± 1.0 minutes and 1.8 ± 0.5 minutes; P, 0.001). Butorphanol and tramadol are superior to clonidine for management of postoperative shivering due to higher rates of success, earlier onset of action and lesser recurrence with comparable levels of safety. A higher fall in systolic and diastolic BP and an increase in heart rate was found in the clonidine group after treatment of shivering than in other two groups. Limitation of present study were small sample size, unable to measure core body temperature. Larger studies are required to confirm findings of present study. Also, incidence of shivering can be reduced if we use external warming devices for all patients.

CONCLUSION

We noted that butorphanol is more effective than clonidine in the treatment of shivering because of its faster onset, lesser recurrence rate, and less complications reported. Intravenous administration of butorphanol is a safe and effective for prevention of shivering.

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