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Original Research Article

To Examine the Efficiency of Butorphanol and Clonidine in Controlling Shivering During spinal Anaesthesia

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Abstract

Aim: To examine the efficiency of Butorphanol and Clonidine in controlling shivering during spinal anaesthesia.

Methods: 100 Patients aged between 18-65 years, of either sex, had American Society of Anaesthesiologists (ASA) physical status I/II, scheduled for elective lower abdominal surgeries under subarachnoid block were included in this study. Group B (n= 50) received intravenous bolus butorphanol 1 mg while group C (n= 50) received an intravenous bolus of 150 µg (1 mL) clonidine. 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.

Results: 100 patients were randomly allocated into group B (n= 50, received butorphanol) and group C (n= 50, received clonidine). We compared age (years), weight (Kg), BMI(Kg/m2), 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: The butorphanol is more effective than clonidine in the treatment of shivering because of its faster onset, lesser recurrence rate, and fewer complications reported. Intravenous administration of butorphanol is a safe and effective for prevention of shivering.

Keywords: butorphanol, clonidine, ASA, shivering

Introduction

Shivering, an involuntary, oscillatory muscular activity, is a physiological response to core hypothermia in an attempt to raise the metabolic heat production.[1] Prolonged impairment of thermoregulatory autonomic control under anesthesia along with the cold environment of operating rooms and cold infusion fluids, contributes to a fall in core body temperature, and hence shivering.[1,2] Other known causes of shivering include transfusion reactions, drug reactions, pre-existing high grade fever or bacteremia, or infusion of contaminated intravenous fluids (fungal growth in dextrose containing fluids). Perioperative hypothermia is the most common cause of shivering, though the exact incidence of each is difficult to evaluate. In a shivering patient, oxygen consumption may increase by 200%–500% along with a linear increase in carbon dioxide production.[3] Thus in a patient with limited myocardial oxygen reserve or known coronary disease, shivering may further compromise myocardial function.[4] Shivering also increases intraocular and intracranial pressure, and may contribute to increased wound pain, delayed wound healing, and delayed discharge from post anesthetic care.[2] Apart from being an uncomfortable experience, its deleterious effects warrant primary prevention and prompt control on occurrence.

Various pharmacological therapies aim to prevent or treat shivering include opioids (pethidine, nalbuphine, or tramadol), ketanserin, propofol, granisetron, doxapram, physostigmine, clonidine, and nefopam, but debate on an 'ideal anti-shivering drug' continues.[2,5] In a country like India, restrictions on drug licensing of opioids, and unavailability of many other drugs, compound the problem.[6] Tramadol hydrochloride, a □-opioid receptor agonistic drug, has a modulatory effect on central monoaminergic pathways, and thus inhibits the neuronal uptake of noradrenaline/serotonin and encourages hydroxytriptamine secretion which resets the body temperature regulation center. It has gained a reputation in many clinical trials for the control of shivering.[6–8] Clonidine, an alpha-2 agonist drug, decreases the release of noradrenaline from the axonal terminals in the hypothalamus to exert its anti-shivering effects.[9] Butorphanol, an easily available opioid, acts through k and □ receptor agonistic modulation, though only a few studies have denoted its anti- shivering properties.[10]

Material and methods

The comparative, clinical, interventional study was carried out in the Department of Anaesthesiology, Jannayak Karpuri Thakur Medical College and Hospital, Madhepura, Bihar, India for 1 year.

Inclusion criteria

Patients aged between 18-65 years, of either sex, had American Society of Anesthesiologists (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.

Methodology

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

100 Patients were included in this study. Group B (n= 50) received intravenous bolus butorphanol 1 mg while group C (n= 50) 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.11 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.

Statistical analysis

Data was recorded, entered in Microsoft excel sheet and analysed with SPSS version 25.0. 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

100 patients were randomly allocated into group B (n= 50, received butorphanol) and group C (n= 50, received clonidine). We compared age (years), weight (Kg), BMI(Kg/m2), 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=50)	Group C (n=50)	P-value
Age (years)	40.9 ± 10.3	39.1 ± 9.6	0.64
Weight (Kg)	68.1 ± 9.5	70.9 ± 9.7	0.41
BMI (Kg/m2)	25.4 ± 3.1	26.1 ± 2.9	0.22
Gender (M/F)	20/30	25/25	0.54
ASA I/II	21/9	22/8	0.41
Duration of surgery (min)	110.1 ± 41.2	103.5 ± 42.2	0.57
Baseline axillary temperature (0C)	36.84 ± 0.45	36.78 ± 0.61	0.64

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=50)	Group C (n=50)	P value
Onset of Sensory block (min)	4.12 ± 1.29	4.63 ± 1.82	0.041
Onset of motor block (min)	5.42 ± 1.54	5.65 ± 1.73	0.042
Duration of motor block (min)	222.5 ± 24.59	190.55 ± 20.28	0.027
Duration of sensory block (min)	256.45 ± 21.76	213.47 ± 18.86	0.032

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 III	6 (12%)	12 (24%)	0.041
Grade IV	1 (2%)	3 (6%)	0.042
Side effects			
Hypotension	6 (12%)	9 (18%)	0.037
Bradycardia	5 (10%)	5 (10%)	-
Nausea and vomiting	2(4%)	4 (8%)	0.41

Discussion

Shivering occurs as a thermoregulatory response to hypothermia or muscle activity with tonic or clonic patterns, and various frequencies have been noticed.[12] 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.[13,14] 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.[15] 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.[16] In study by Pravin B.,[17] 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.[18] Bansal P[13] 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 ± 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.

Conclusion

The present study concluded 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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