ORIGINAL RESEARCH PAPER
VOLUME-6 | ISSUE-5 | MAY - 2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

TO EVALUATE THE EFFICACY OF DEXMEDETOMIDINE FOR PREVENTION OF SHIVERING DURING SPINAL ANAESTHESIA

Anaesthesiology

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ABSTRACT

Aim: To evaluate the efficacy of dexmedetomidine for prevention of shivering during spinal anaesthesia

Methods: 100 patients (ASA grade 1 and 2 age 20-60 year) scheduled under spinal anaesthesia with injection bupivacaine 0.5% heavy.They were administered saline (group C, n=50) or dexmedetomidine (group D ,n=50).Motor block was assessed by Modified Bromage scale. The presence of shivering was assessed by blinded observer after completion of subarachnoid injection.

Results: Shivering was observed in 4 patients (8%) in group D and 24 patients (48%) in group C ($p<0.0001$).The intensity of shivering was lower in group D than with group C ($p<0.0001$).Sedation scores were higher in group D than in group C ($p<0.0001$)

Conclusion : Dexmedetomidine infusion rendered a significant reduction in the frequency and severity of shivering associated with spinal anaesthesia with better sedation profile and with acceptable side effects

KEYWORDS:

Dexmedetomidine, shivering, spinal anesthesia

INTRODUCTION

Temperature disturbances are common during both neuraxial and general anaesthesia. Shivering occurs in response to hypothermia.It is an involuntary,oscillatory muscular activity that can double or triple the oxygen consumption and carbon dioxide production. Shivering that develops following spinal anesthesia is common problem due to impairment of thermoregulatory control. It occurs in 19%-13% of patients receiving spinal anaesthesia.[1,2] The main cause of shivering intra and postoperative period are temperature loss,decreased sympathetic tone and systemic release of pyrogens.[3]It causes several undesirable physiological consequences including increase oxygen consumption,carbon dioxide production and minute ventilation.There is peripheral redistribution of heat due to spinal induced vasodilatation and shivering is preceded by core hypothermia following spinal anaesthesia may not trigger sensation of cold as the cutaneous vasodilation resulting from sympathetic blockade increases skin temperature leading to sensation of warmth although accompanied by thermoregulatory shivering.[4] Various pharmacological and non-pharmacological methods are available for control of shivering. Our study was designed to evaluate the efficacy of dexmedetomidine, an α_2 adrenoceptor agonist for prevention of shivering during spinal anaesthesia.

MATERIALS AND METHODS

After obtaining a written informed consent the study was conducted on ASA grade I and II patients of both genders aged between 20-60 years who were scheduled to undergo elective surgery of less than 2 hours duration under spinal anaesthesia.Patients with thyroid disease, psychiatric,renal,hepatic, neromuscular,cardiopulmonary diseases,a history of allergy to agents to be used, a need for blood transfusion during surgery,an initial core temperature >37.5°C% or <36.5°C,a known history of alcohol use, use of vasodilators,or having contraindications to spinal anaesthesia were excluded from the study. Patients under study went thorough preoperative assessment .An i.v. cannula was secured and monitors were attached.Preloading done with 10mg/kg of ringer lactate in both group of patient. Subarachnoid block given with inj.bupivacaine 0.5% heavy 3cc at L3-L4 or L4-L5 space using 25G Quinckes needle. All patients were covered by single layer of surgical drape over chest, abdomen, thighs and calves intraoperatively and with cotton blanket postoperatively over entire body. No other warming devices were used. Operating room temperature kept between 21 to 23°C.The patients were randomised to one of the two groups,who receive saline (group C,n=50) or dexmedetomidine (group D,n=50).Just after intrathecal injection,all drugs were infused intravenously. Dexmedetomidine was diluted to a volume of 50 ml (4µg/ml).Group D was given an i.v. bolus of dexmedetomidine 1µg/kg adminstered by a syringe pump over a 10 minutes period followed by an infusion of of 0.5 µg/kg/hr dexmedetomidine during the surgery.Group C received an equal volume of saline by infusion pump.Normal saline was kept at room temperature.

The infusion were stopped at the completion of the closure of skin.Supplemental oxygen(4 lit/min) was delivered via facemask during operation. The onset of motor and sensory blockade were assessed during the procedure.Motor block was assessed using a modified Bromage scale (0,no motor block;1,hip blocked;2,hip and knee blocked;3,hip,knee, and ankle blocked).Full motor recovery was scored 0 on the Bromage scale.Sensory block was assessed by the pinprick test.

The presence of shivering was assessed by a blinded observer after the completion of subarachnoid drug injection.Shivering was graded on a scale, 0=no shivering,1=piloerection or peripheral vasoconstriction but no visible shivering,2=muscular activity in only one muscle group,3=muscular activity in more than one muscle group but not generalized,and 4=shivering involving the whole body. The incidence and severity of shivering were recorded during operation and in recovery room.If scores were three or greater at 15 minutes after spinal anaesthesia,the prophylaxis was regarded is ineffective, and 50mg tramadol was administered i.v. Side effects such as headache, allergy, hypotension,bradycardia,waist and back pain,sedation score,total spinal block,and difficulty in micturation, nausea and vomiting were recorded.

Table 1 : Demographic Variables in Group D and Group C (mean ± SD)

Variable	Group- D (n=50)	Group – C (n=50)	P - value
Age in years	40.06 9.805	41.9 10.053	0.825
Sex (male / female)	32/18	26/24	0.224
Weight (Kg.)	61.98 6.626	63.32 6.62	0.909
ASA Grade (I /II)	45/5	42/8	0.372
Duration of Surgery (In minutes)	103.98 17.611	103.74 19.66	1
Onset of sensory block (seconds)	212.88 20.699	207.7 20.21	0.800
Onset of motor block (seconds)	181.9 20.871	175.38 20.01	0.730

There was no significant difference between two groups.

If patients heart rate falls below 50 bpm,0.6mg i.v atropine was administered. Hypotension was defined as decrease in mean arterial pressure (MAP) of more than 20% from baseline (baseline MAP was calculated from three measurements taken in ward before surgery). Hypotension was treated with 6mg mephenteramine via i.v. bolus and then with further i.v. infusion of ringer lactate solution as required. The quantity of mephentermine given in each group was recorded. If patient developed nausea and vomiting ,10mg of inj.metoclopramide was administered. Postoperatively all patients were monitored, given oxygen via facemask and were covered with one layer of drapes and one cotton blanket.

The post operative anaesthesia care unit was maintained at 25°C to 26°C and constant humidity. If shivering scores were greater than or equal to 3,50mg tramadol was administered through i.v.The degree of sedation assessed on 0=fully awake and oriented ,1=arouse to voice,2=arouse with gentle tactile stimulation,3=arouse with vigorous tactile stimulation and 4=response to vigorous tactile stimulation. Heart rate ,blood pressure, oxygen saturation, body temperature(in axilla),grades of shivering, sedation score and side effects were recorded before commencement of surgery and then at intervals of 5,10,15,20,30,45,60 minutes and half hourly thereafter for rest of procedure intraoperatively. All these vital parameters were observed and recorded half hourly for another 2 hours in postoperative room. The statistical software(SPSS Version 16,EPSS, Inc) was used for analysis of data & Microsoft word & Excel have used to generate graphs, table etc.

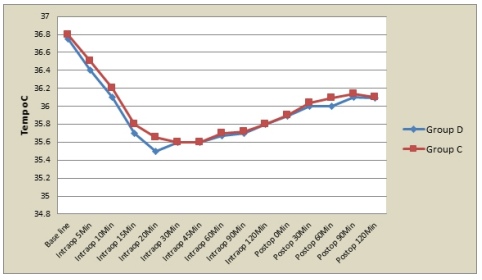

Figure 1: Body Temperature – there was no difference in body temperature between both groups during intraoperative and postoperative period (p=0.3092)

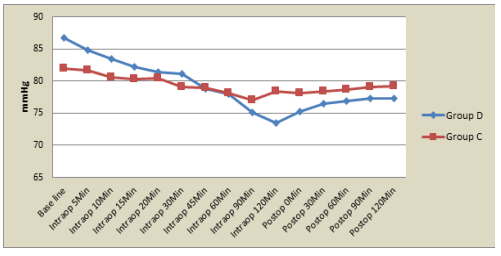

Figure 2: Comparison of Mean Arterial Pressure in Groups (P-value =0.88945)

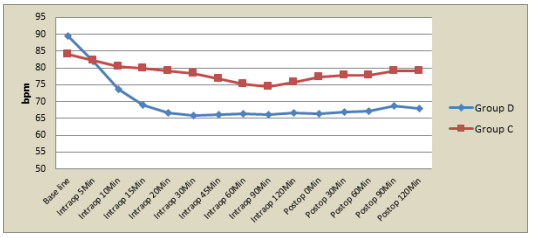

Figure 3: Comparison of Mean Heart Rate in Groups (P-value <0.0001)

RESULTS

The groups were similar regarding age, height, weight, duration of surgery, duration of motor and duration of sensory blockage(Table 1).There was no statistically significant difference in body temperature between two groups during intraoperative and postoperative period (p=0.3092)(Figure 1).Shivering was observed in 24 patients in group C & 4 patients in group D(p<0.0001).Out of 4 patients in group D,3 patients had grade 1 and 1 patient had grade 2 shivering(Table 2).The intensity of shivering was lower in group D than group C (p<0.0001).Sedation score 1 was observed in 20 ,sedation score 2 in 13 and sedation score 3 in 6 patients in group D.9 patients with sedation score 1 & 1 patient with sedation score 2 were present in group C. Mean arterial pressure and heart rates were lower in group D following infusion of dexmedetomidine during intra & post operative period(Figure 2 & 3).In group D, 4 patients and in group C, 1 patient had bradycardia which did not need any treatment. Dryness of mouth was reported in 1 patient in group D & absent in group C.Nausea and vomiting seen in 2 patients in group D treated with 10 mg of inj.metoclopramide i.v. There was no hypotension and respiratory depression in any patients of both the groups(Table 3).

Table 2- Grades of shivering in both groups

Grades of shivering	Group D(n=50)	Group C(n=50)
Grade 0	46	26
Grade 1	3	19
Grade 2	1	3
Grade 3	0	2
Grade 4	0	0

Chi-square value =20.192 df=3 p<0.0001

Table 3-Side effects in both the groups

Side effects	Group D (n=50)	Group C (n=50)	P value
Bradycardia	4	1	0.1686
Dryness of mouth	1	0	0.315
Nausea and vomiting	2	1	0.557
Hypotension	0	0	0

No significant difference was found between both groups

DISCUSSION

Perioperative shivering is a distressing experience for the patients.The mechanism which leads to shivering after regional anaesthesia is not very clear,but probable mechanism could be decrease in core body temperature secondary to sympathetic block[3];peripheral vasodilatation; increased cutaneous blood flow, which leads to increase heat loss through skin;cold temperature of operation theatre;rapid infusion of cold i.v. fluids and effect of cold anaesthetic drugs upon the thermosensetive receptors in the spinal cord.There are many pharmacological and non pharmacological methods used to prevent heat loss and decrease shivering.Core temperature monitoring is used to asses and monitor the intra operative hypothermia ,hyperthermia and pharmacogenetic entity of malignant hyperthermia[4].The number of factors including age, duration of surgery, temperature of operating room,and infusion

solution ,are risk factors for shivering and hypothermia.So in our study, patients less than 20 years ,over the age of 60 years and with duration more than 2 hours were excluded.The temperature of operating room was maintained at 21 to 23°C and warmed crystalloid solutions were infused.Various drugs have been used to treat or prevent postoperative shivering. Pharmacological therapies, such as pethidine, tramadol, physostigmine, clonidine, ketamine, and magnesium, have been used so far to prevent shivering[5,6,7,8]. Although clonidine has been used safely and effectively to treat shivering, other drugs, such as urapidil,[9] may not be appropriate because the incidence of hypotension is high during spinal anaesthesia. Meperidine, the most widely used agent to prevent shivering ,may cause nausea and vomiting as well as respiratory depression during and after spinal anaesthesia.[10] Hypertension and tachycardia have been reported with ketamine.[7] The search continues for drugs that sufficiently improve the tolerance of thermoregulation without simultaneously producing excessive sedation, respiratory depression, or hemodynamic instability. Hence, dexmedetomidine may be a good choice among them because of its dual effects of anti-shivering and sedation.α_2 adrenergic agonists decrease the central thermosensitivity by suppressing the neuronal conductance.[11] α_2 adrenergic agonists suppress the spontaneous firing rate of neurons in locus coeruleus and neurotransmitter mediated firing of neurons in the dorsal raphe nucleus when administered intravenously.[12] All these central actions of α_2 agonists are possible due to high density of α_2 agonists in the hypothalamus and activation of these receptors produce hypothermia by reduction of heat generated by metabolic activity.[13] Dexmedetomidine is an short acting α_2 adrenergic agonists with less hypotensive effects and an added sedative effect.

The median incidence of shivering related to neuraxial anaesthesia in the control groups of 21 different studies is 55% (interquartile range of 40-64%),which is nearly similar to that of the control group in our study (48%).Elvan and colleagues[14] reported that dexmedetomidine infusion during surgery was effective in the prevention of post-anaesthetic shivering in patients undergoing elective abdominal hysterectomy. Bicer and colleagues[15] found the incidence of shivering as 15% with dexmedetomidine and 55% with placebo following general anaesthesia. Bajwa et al [16]reported that dexmedetomidine in a dose of 1 μg/kg decreased the incidence of shivering (5%) as compared to placebo group (42.5%) in patients undergoing laproscopic surgery under general anaesthesia.Our results are similar to their study with the incidence of shivering in dexmedetomidine group was 8% and 48% in control group. Dexmedetomidine reduces shivering by lowering vasoconstriction and shivering thresholds.[17-18]In our study, mean heart rate values measured during intraoperative and post operative period were significantly lower in the dexmedetomidine group compared to control group. This significant decrease in heart rate could be due to activation of α_2 adrenoreceptor in the CNS. In our study intraoperative and postoperative mean arterial pressure in dexmedetomidine group was comparable with intraoperative and post operative mean arterial pressure in control group. This could be due to good intravascular volume status of the patient by adequate preloading with ringer lactate and less intraoperative blood loss during surgeries. There was no difference between the core temperature of patients in both the groups during intraoperative and post operative periods. In our study the difference in sedation scores between group D and group C was statistically significant. None of our patients had respiratory depression during the operation or in the recovery room. The incidence of bradycardia was 8% in group D and 2% in group C. The major limitation to our study include short duration of surgery in both groups and the anti shivering effect of dexmedetomidine needs to be seen in surgeries of longer duration where chances of developing hypothermia are more. Also we did not asses the efficacy of different doses of dexmedetomidine in prevention of shivering ;further studies are needed to evaluate the effects of dexmedetomidine with various doses.

CONCLUSION

Dexmedetomidine infusion given at rate of 1μg/kg by a syringe pump over 10 minutes period followed by an infusion of 0.5 μg/kg/hr in the intraoperative period rendered a significant reduction in the frequency and severity of shivering associated with spinal anaesthesia with a better sedation profile and with acceptable side effects

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