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A Comparison Of Magnesium Sulphate and Dexmedetomidine for Control Of Shivering in Neuraxial Anaesthesia.

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ABSTRACT

Background: Shivering is one of the most common complications of neuraxial blockade. Some patients find shivering sensation worse than surgical pain. Therefore, both prevention and treatment of established shivering should be regarded as clinically relevant intervention in the perioperative period.

AIM: The present study was done to evaluate and compare the efficacy, hemodynamics and adverse effects of Magnesium sulphate and Dexmedetomidine when used for control of intra operative shivering during neuraxial anaesthesia.

Materials And Method: A prospective double blind study was conducted by enrolling 253 patients undergoing lower abdominal and lower limb surgeries under neuraxial anesthesia in age group 20 to 60year with written informed consent. Patients developing intraop shivering were randomly divided into two groups Group A (50patients)- received Magnesium sulphate 50mg/kg IV bolus and Group B (50patients)- received Dexmedetomidine 0.5microgram/kg IV. Study was done until 50 patients were studied by both the study groups.

Results: The study shows a highly statistically significant difference (P value 0.001) between both groups in terms of heart rate, systolic blood pressure, diastolic blood pressure, core body temperature, time to disappearance of shivering and mean respiratory rate between both the groups.

Conclusion: In the above study Dexmedetomidine was more efficacious than Magnesium sulphate interms of maintaining hemodynamics and control of shivering in neuraxial anaesthesia.

KEY WORDS: Dexmedetomidine, Magnesium sulphate, Neuraxial anaesthesia, intra operative Shivering .

INTRODUCTION

Shivering, a common and uncomfortable complication during surgery occurring in approximately 6% to 65% of patients. Shivering is involuntary movements of single or more muscle groups[1]. Reasons like pain, reduced sympathetic activity, uncontrolled spinal reflux, cytokines release and adrenal suppression also cause shivering but altered thermo-regulation due to hypothermia due to 0.5 - 1°C reduction in central heat is the common factor

Shivering interferes with monitoring of SpO2, NIBP, ECG by increasing oxygen consumption, increase in cardiac output and respiration, which may cause cardiac failure in geriatric patient or in patients with cardio respiratory illness.[2]Lactic acidosis, increased production of carbon dioxide and muscle fatigue, occur which may increase pain at surgical site[2]Impaired sensory signals and decrease in actual heat production in regional anaesthesia doubles the patient's re-warm-up period compared to general anesthesia.[3]

Non-pharmacological measures like warm blankets, humid oxygen inhalation, controlling the operation theatre temperature are effective when the core body temperature is greater than 35°C.[4] On the other hand pharmacological methods decrease the shivering threshold.

ISSN 2515-8260 Volume 09, Issue 07, 2022

Various drugslike meperidine, clonidine, ketanserin, magnesium sulfate, physostigmine etc. are effective but show unwanted effects like reduced consciousness, respiratory center depression, nausea, vomiting and itching, which is uncomfortable for the patient under regional anesthesia .[5]

AIM OF THE STUDY

The present study was done to evaluate and compare the efficacy, hemodynamics and adverse effects of Magnesium sulphate and Dexmedetomidine when used for control of intra operative shivering.

OBJECTIVES OF THE STUDY: Objective is to compare

1. The hemodynamics when the study drugs are used.
2. Mean core body temperature.
3. The time interval for disappearance of shivering.
4. Mean respiratory rate and side effects.
5. Recurrence of shivering.

MATERIALS AND METHODS

A prospective double blind study was conducted by enrolling 253 patients undergoing lower abdominal and lower limb surgeries under neuraxial anesthesia in age group 20 to 60year with written informed consent. Under neuraxial anaesthesia patients developing intraop shivering were randomly divided into two groups Group A (50patients)- received Magnesium sulphate 50mg/kg IV bolus and Group B (50patients)- received Dexmedetomidine 0.5microgram/kg IV. Study was done until 50 patients were studied by both the study drugs

INCLUSION CRITERIA: Patients aged between 20 and 60 years, lower limb and lower abdominal surgeries with ASA grade I and II were enrolled.

EXCLUSION CRITERIA: Hypersensitivity to the drugs, Cardiovascular disorders, any hepatic diseases or renal impairment, Neurological and psychiatric diseases, any neuromuscular diseases and Perioperative febrile conditions.

Procedure: Patients were randomly allocated to either groups and shifted to the operating room, noninvasive minimum mandatory monitors SpO2, ECG, HR, NIBP, Temperature were connected and base line readings taken, intravenous cannula secured and infusion of normal saline 10ml/kg started. The patient was positioned and regional anaesthesia given under aseptic precautions and the surgical procedure was started once adequate level of block was attained. During the surgery any event of shivering was noted and either iv Magnesium sulphate 50mg/kg or iv Dexmedetomidine 0.5mcg/kg bolus was given slowly over a period of 3-5 minutes. After the study drug was given baseline heart rate, systolic, diastolic blood pressure was monitored for every 5 mins for one hour then every 10mins for another half hour and then every half hourly till the end of procedure.

STATISTICAL ANALYSIS

Data Entry was done using Microsoft excel 2013 and analysis done using SPSS V16. Qualitative data was expressed in frequencies and percentages and Quantitative data in mean and standard deviation. Non parametric statistics i.e. Chisquare test, Fishers exact test was used

ISSN 2515-8260 Volume 09, Issue 07, 2022

to find the significant association between the two qualitative variables. Unpaired t test was used to find the statistical significance between quantitative variables. Bar diagrams and pie chart were used to represent the data. P value of <0.05 was considered statistically significant.

RESULTS

There was no statistical difference in both the groups with respect to age, gender, height, weight, ASA status, procedure done and duration of the surgery.

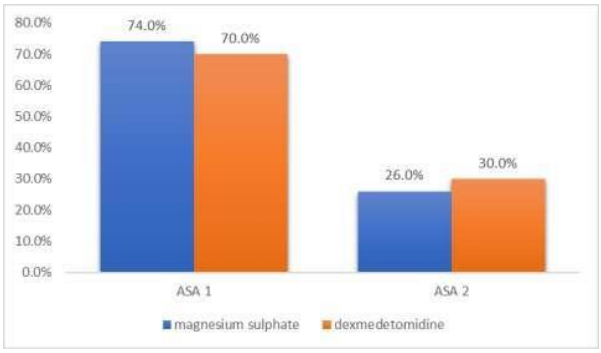

CHART 1: BAR CHART SHOWING DURATION OF SURGERIES IN BOTH GROUPS

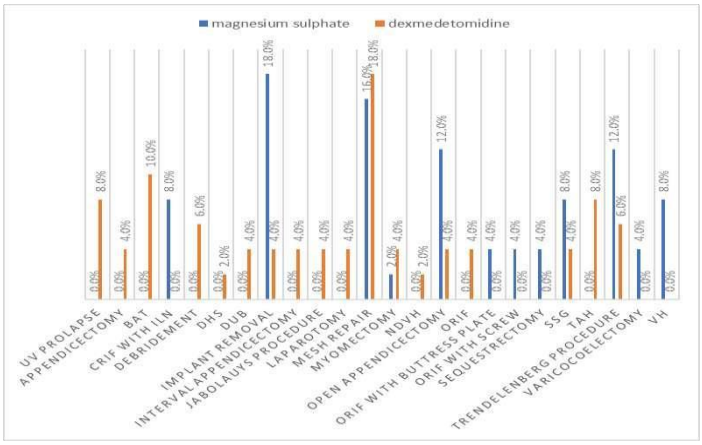

CHART 2: BAR CHART SHOWING TYPE OF SURGERIES IN BOTH GROUPS

HAEMODYNAMICS

HEART RATE

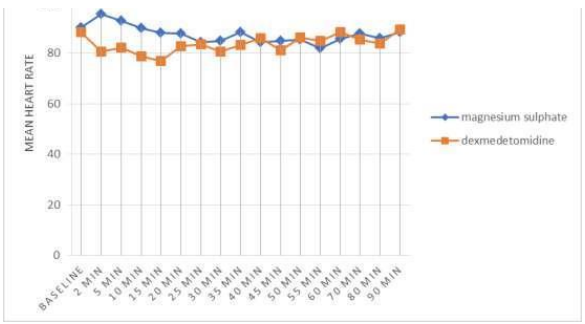

FIGURE 1: LINE DIAGRAM SHOWING MEAN HEART RATE

ISSN 2515-8260 Volume 09, Issue 07, 2022

The above study shows a highly statistically significant difference (P value 0.001) between both groups at 2,5,10&15mins after the study drug is given. The mean heart rate being more in Magnesium sulphate group.

SYSTOLIC BLOOD PRESSURE

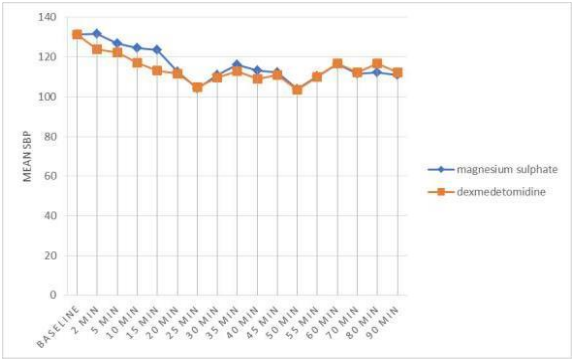

FIGURE 2: LINE DIAGRAM SHOWING MEAN SYSTOLIC PRESSURE

There was statistical significance in SBP at 10,15,35,40,80mins after the study drugs were given with dexmedetomidine group showing lower SBP compared to magnesium sulphate.

DIASTOLIC BLOOD PRESSURE

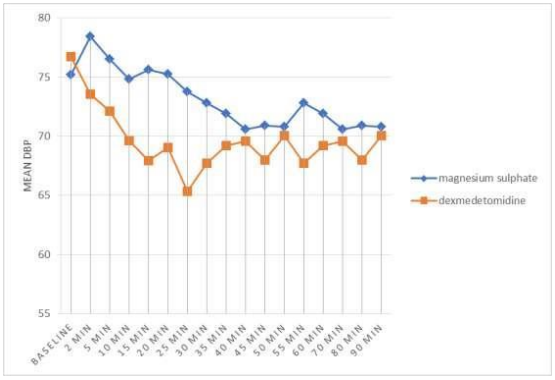

FIGURE 3: LINE DIAGRAM SHOWING MEAN DIASTOLIC BLOOD PRESSURE

Statistical significant difference was seen with dexmedetomidine showing lower DBP at 2,5,10,15,20,25,30,55mins.

CORE BODY TEMPERATURE

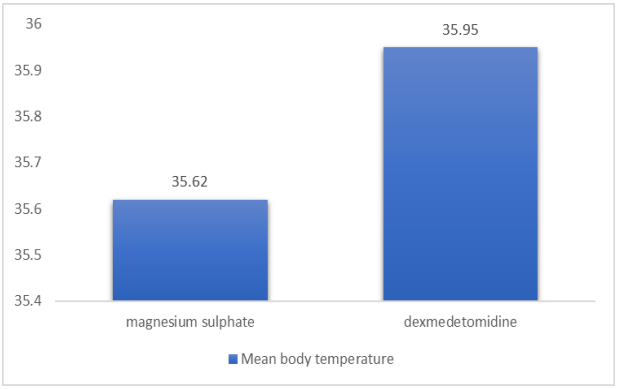

CHART 3 : BAR CHART SHOWING MEAN BODY TEMPERATURE

ISSN 2515-8260 Volume 09, Issue 07, 2022

Mean body temperature was 35.62±0.14 for magnesium sulphate group and 35.95±0.13 for dexmedetomidine group and was highly statistically significant P=<0.0001(t test = 12.21).

TIME INTERVAL FOR DISAPPEARENCE OF SHIVERING

The mean time taken for the disappearance of shivering in the dexmedetomidine group was 2.18 ± 0.26 mins which was statistically highly significant(P=<0.0001) when compared to mean time in the magnesium sulphate group 3.88 ± 0.25 mins.

MEAN RESPIRATORY RATE

The mean respiratory rate in the dexmedetomidine group 21.99 ± 0.21 was lower than the magnesium sulphate group 23.96 ± 0.44 and was statistically significant.

COMPARISON OF SHIVERING SCORE

There was no statistically significant difference in the mean shivering scores across the groups.

COMPARISON OF SIDE EFFECTS

	magnesium sulphate	Dexmedetomidine
Nausea	2 (4%)	2 (4%)
Nausea and sedation	1 (2%)	3 (6%)
None	47 (94%)	45 (90%)
Total	50 (100%)	50 (100%)
Chi square test = 1.04 , p= 0.59 , Not statistically significant		

Table 1: Comparison of side effects

Most of the participants did not have complications. The occurrence of side effects across the groups were comparable and the most common side effect upon usage of these drugs being nausea and sedation.

RECURRANCE OF SHIVERING

	magnesium sulphate	Dexmedetomidine
Yes	1 (2%)	0 (0%)
No	49 (98%)	50 (100%)
Total	50 (100%)	50 (100%)
Chi square test = 1.0, p=0.31 , Not statistically significant		

TABLE 2: SHOWING RECURRANCE OF SHIVERING

ISSN 2515-8260 Volume 09, Issue 07, 2022

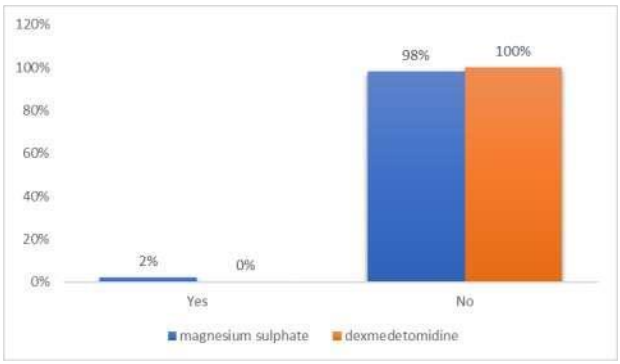

CHART 4: SHOWING RECURRANCE OF SHIVERING

There was no statistically significant difference in the recurrence of shivering across the groups and the recurrence of shivering was seen only in 1 case in magnesium sulphate group was given and none had shivering in dexmedetomidine group.

DISCUSSION

Shivering is often neglected and no universal protocols are established for its prevention. Though numerous research articles have laid emphasis on various pharmacological methods of prevention of shivering but nothing concrete has been incorporated into routine practice to prevent its occurrence. In regional anesthesia sensory signals from below the level of block to the central nervous system are impaired along with actual decrease in heat production and patient will be in hypothermia until the effects of blocking disappear. So under regional anaesthesia the patient's re-warm-up period is almost doubled when compared to general anesthesia.[4, 5]. Non-pharmacological methods aim to keep the skin warm as the body's thermoregulation tolerates the central hypothermia when the skin is warmed. But this method is effective when the core body temperature is greater than 35 °C[6]. Pharmacological methods mainly decrease the shivering threshold. All these drugs even though effective in reducing shivering based on various mechanisms have unwanted effects which are uncomfortable for the patient under regional anaesthesia [7]. As a result of these complications, alternate drugs to prevent and treat intraoperative shivering have always been considered.

The comparability of the demographic factors such as age, weight, height, gender distribution, ASA status in the present study has ruled out any visible or confounding bias which could have affected the results of the study. Physical factors such as operating room temperature (24–25 °C) and temperature of the infused fluids are considered potential risk factors of shivering [8], but these factors were very well controlled in the present study. Though, shivering is a protective mechanism to preserve body heat no definite linear relationshipexists between body temperature and occurrence of shivering [9] .

Antishivering mechanism of dexmedetomidine has been studied but not adequately. The α-2 receptor agonists are known to prevent shivering to a moderate extent without any associated respiratory depression as with other antishivering drugs like meperidine[10,11]. Dexmedetomidine exerts its dual effects while avoiding vasoconstriction and increasing the level of the shivering threshold[10,12]. This is due to its sympatholysis via central and peripheral pathways [13].

ISSN 2515-8260 Volume 09, Issue 07, 2022

It decreases the central thermo sensitivity by suppressing the neuronal conductance[14]. This is mediated by the increased potassium conductance through Gi-coupled proteins which causes hyper polarization of neurons [1,15,16,17] . Augmentation of neural suppression response is further mediated by restriction of calcium entry into nerve cells which causes inhibition of neurotransmitter release [1] . The increased accumulation of calcium ions on the neuron's surface in the posterior hypothalamus lowers the firing rate of heat gain units by stabilizing the cell membrane [2]. It suppress the spontaneous firing rate of neurons in the locus coeruleus and neurotransmitter mediated firing of neurons in the dorsal raphe nucleus when administered intravenously [3].All these central actions of dexmedetomidine are possible due to a high density of α-2 adrenoceptors in the hypothalamus and activation of these receptors produces hypothermia by reduction of heat generated by metabolic activity[17] .

The present study was comparable to a study on spinal anaesthesia conducted by Usta et al.,in significantly decreasing the shivering incidence when dexmedetomidine was used [18] . The results of our study were also similar to that of Manohar panneer et.a[19] and Geeta mittal et.a[20] in time taken to control shivering and its recurrence by dexmedetomidine. However there were two incidences of bradycardia in the present study which were attended with ing Atropine 0.6mg once with no further recurrence of bradycardia.

Magnesium is often used in protocols to stop shivering. Magnesium sulfate reduces the smooth muscle tone and subsequently causing vasodilation, leading to a reduced incidence of shivering.[21,22,23] . In the present study magnesium was affective in lowering the shivering threshold and also showed significant haemodynamic stability with no adverse effects such as hypotension, bradycardia, nausea, vomiting, or significant oxygen deficiency during spinal anaesthesia. Though magnesium has low adverse effect profile the magnitude effect of shivering reduction being less than other pharmacologic agents provides little incentive for its use.

In this study, neither dexmedetomidine nor Magnesium sulphate caused any significant adverse effects such as hypotension, bradycardia, peripheral oxygen deficiency, nausea,vomiting, or shivering but the effects of Dexmedetomidine were statistically better than Magnesium sulphate .

CONCLUSION

In the present study, of the two drugs Dexmedetomidine took lesser time for shivering cessation and also maintained higher mean body temperature and lower levels of heart rate and respiratory rate when compared to Magnesium sulphate during Neuraxial anaeshesia.

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