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Original Research Article

A Comparative Study of Intravenous Dexmedetomidine and Intravenous Tramadol for Post Spinal Anaesthesia Shivering

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Abstract

Introduction: Shivering is a natural protective mechanism. The main causes of intra/post-operative shivering are temperature loss, increased sympathetic tone, pain, and systemic release of pyrogens. Spinal anaesthesia significantly impairs the thermoregulation system by inhibiting tonic vasoconstriction, which plays a significant role in temperature regulation. Several drugs have been studied for the prophylaxis as well as treatment of shivering. **Tramadol**, an opioid receptor agonist, has also proved to be effective in the treatment of shivering after general anesthesia, On the other hand **Dexmedetomidine,** a congener of clonidine, has been used as a sedative agent and is known to reduce the shivering threshold. The aim of the study was to compare the efficacy of dexmedetomidine and tramadol in the treatment of post-spinal anesthesia shivering as well as their side-effect profile.

Materials and methods: The present study was carried out in the Department of Anaesthesiology and Critical Care, PDUMC, Churu, Rajasthan from Jan-21 to Aug-21. This is a Prospective Randomized Comparative Study. Patients aged 18-60 years, American Society of Anesthesiologists I & II and scheduled to undergo elective surgeries under spinal anesthesia and developing shivering grade 3 or grade 4 were included in the study. We made two groups of cases i.e. Group T (TRAMADOL) and Group D (DEXMEDETOMIDINE). Sample size was 64, which was divided into two groups of 32 each.

Standard protocol followed to administering spinal anaesthesia. On occurrence of shivering its intensity graded using a four point scale as per Wrench. All data were collected and analysed with the help of suitable statistical parameters.

Results: Our study concluded that dexmedetomidine is more effective than tramadol for treatment of postspinal anaesthesia shivering.

Keywords: spinal anaesthesia, tramadol, dexmedetomidine, shivering

Introduction

Shivering is a natural protective phenomenon. The main causes of intra/post-operative shivering are temperature loss, increased sympathetic tone, pain, and systemic release of pyrogens.[1] The incidence of shivering has been found to be quite high, approximately 40-50% in different studies.[2] It can double or even treble oxygen consumption and carbon dioxide production.[3] Shivering also increases intraocular and intracranial pressure, and may contribute to increased wound pain, delayed wound healing, and delayed discharge from post-anaesthetic care.[4,5] Thermoregulatory responses like vasoconstriction and shivering are activated when core temperature falls below the normal range.[6] Spinal anaesthesia significantly impairs the thermoregulation system by inhibiting tonic vasoconstriction, which plays a significant role in temperature regulation. Although hypothermia may provide protection against ischemia, there is ample clinical evidence that hypothermia causes multiple physiological derangements.[**7]** shivering may contribute to increased wound pain, delayed wound healing, and delayed discharge from post anesthetic care.[8] Several pharmacologic and nonpharmacologic strategies are available for the treatment of shivering with no consensus on the gold standard therapy.[9] Several drugs have been studied for the prophylaxis as well as treatment of shivering. This includes opioids, 5-hydroxytryptamine receptor antagonists, N-methyl D-aspartate receptor antagonists, cholinomimetics and biogenic amines, pethidine, tramadol, dexmedetomidine, clonidine, dexamethasone and urapidil .[10] But unfortunately, no single drug has been found to be effective and without any adverse effects. Tramadol, an opioid receptor agonist, is an inhibitor of the re-uptake of serotonin (5-hydroxytryptamine) and norepinephrine in the spinal cord. This facilitates 5-hydroxytryptamine release, which influences thermoregulatory control. Presently it is a widely used drug for the control of shivering. The effectiveness of tramadol, which is a central effective analgesic with its weak opioid features, has also proved to be effective in the treatment of shivering after general anesthesia,[11] yet research on the effectiveness of tramadol over the shivering of patients under spinal anesthesia is lacking.

On the other hand **Dexmedetomidine,** a congener of clonidine, is a highly selective α_2-adrenoceptor agonist. The sedative properties of the drug are produced by stimulation of α_2 receptors on presynaptic neurons. The net effect is a decrease in norepinephrine release from presynaptic neurons with inhibition of postsynaptic activation, which attenuates central nervous system excitation, especially the area of the brain stem called the locus coeruleus.[12-14] It has been used as a sedative agent and is known to reduce the shivering threshold.[15] Few studies which have explored its anti-shivering potential have inferred that dexmedetomidine is an effective drug without any major adverse effect and provides good haemodynamic stability.[16-18]

The need to find a better drug which has comparable efficacy to tramadol and at the same time has fewer side effects. The aim of the study was to compare the efficacy of dexmedetomidine and tramadol in the treatment of post-spinal anesthesia shivering as well as their side-effect profile.

Material and Methods:

The present study was carried out in the Department of Anaesthesiology and Critical Care, PDUMC, Churu, Rajasthan from Jan-21 to Aug-21. This is a Prospective Randomized Comparative Study.

Source of data: Patients in the age group of 18-60 years, American Society of Anesthesiologists (ASA) I & II and scheduled to undergo elective

surgeries under spinal anesthesia and developing shivering grade 3 or grade 4 were included in the study. We conclude this study of two independent group of cases i.e. Group T (TRAMADOL) and Group D (DEXMEDETOMIDINE), the Group T : Group D ratio being 1:1 satisfying the inclusion criteria. Sample size obtained was 64, which was divided into two groups of 32 each.

Methodology:

After obtaining the approval of the Ethical committee and written Informed consent, a total of 64 patients confirming to the inclusion and exclusion criteria was included in the study. All pre-anaesthetic evaluation of the patients was performed by an anaesthesiologist a day before the surgery. The patients who developed shivering under spinal anesthesia was randomly allocated to Group T or Group D on the basis of computer-generated random table. Group T patients received tramadol 0.5 mg.kg−1 and Group D received dexmedetomidine 0.5 mcg.kg−1. The randomization scheme was generated using the Website Randomization.com. The computer-generated Group number (T or D) was put in a closed opaque envelope. The first anesthesiologist opened the envelope and added the study drug in a 10 mL normal saline and handed over to the second anesthesiologist who was blinded to the study drug. He administered the drug in 100ml Normal saline over 10 minutes intravenously and monitored the patient. Spinal anaesthesia was performed using standard protocol.

On occurrence of shivering its intensity graded using a four point scale as per Wrench(Appendix A). **Grade 0**: No shivering, **Grade 1**: One or more of the following: Piloerection, peripheral vasoconstriction, peripheral cyanosis, but without visible muscle activity, **Grade 2**:Visible muscle activity confined to one muscle group, **Grade 3:**Visible muscle activity in more than 1 muscle group and **Grade 4**: Gross muscle activity involving the whole body. Patients who developed either Grades 3 or 4 shivering were included in the study.

Time of onset of shivering was noted and recorded as 0 h. The grade of shivering along with vital parameters i.e. HR, Systolic blood pressure, Diastolic blood pressure, RR, SpO2, and axillary temperature were recorded.

Supplemental oxygen was administered to all the patients at the onset of shivering with the rate of 5 L/min using face mask. The specified drug as per the random allocation for this patient was prepared and given over 10 minutes. Assessment and recording of the above said parameters were done at 0, 5, 10, 15, 30, 45 and 60 minutes along with continuous monitoring of ECG and SpO2. Time taken for cessation of shivering was noted.

The level of sedation assessed, graded, and recorded at 0, 5, 10, 15, 30, 45 and 60 minutes simultaneously. Grading was done using the Ramsay sedation scale (Ramsay sedation scale: Score 1 - anxious, agitated or restless; Score 2 - cooperative, oriented, and tranquil; Score 3 - responds to verbal command; Score 4 - asleep with brisk response; Score 5 - asleep with sluggish response; Score 6 - asleep with no response.

Drug Response was defined as complete when shivering score declined to 0, incomplete when the scores decreased but did not abolished the shivering completely and failed if no change in scores was observed after 15 minutes of treatment. Recurrence of shivering also noted until the patient left the operation theatre. Patients who not responded or in whom recurrence of shivering occurred were treated with additional dose of dexmedetomidine (0.5 µg/kg IV) or tramadol (0.5 mg/kg IV) in the respective groups.

Results:

Table 1: The distribution of mean time taken for cessation of shivering across two study groups.

	TRAMADOL	DEXMEDETOMIDINE	P VALUE
Time taken for cessation (min)	5.72±.65	4.02±.46	0.001

1. P value for this is 0.001 and the distribution of mean time taken for cessation is significantly lower in Group D compared to Group T (P-value<0.001).

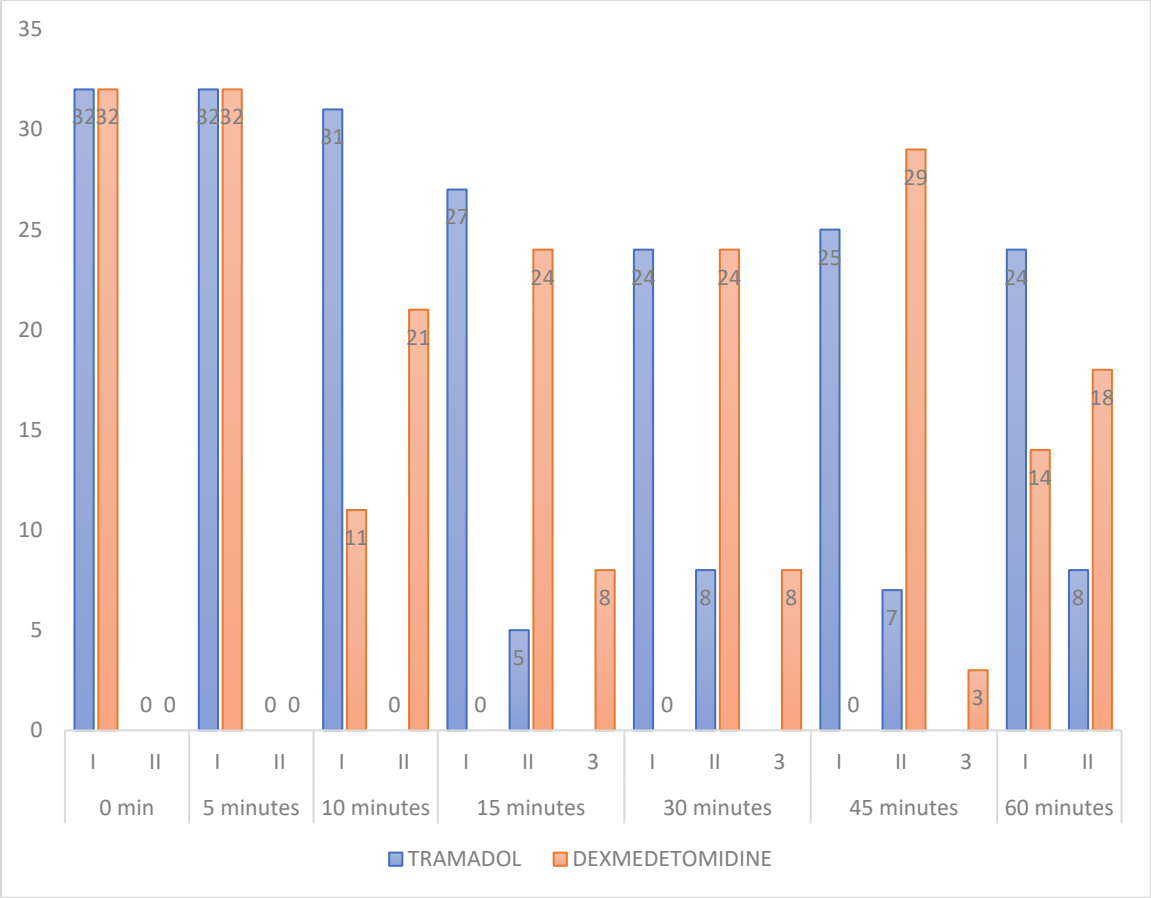

Figure 1: The distribution of sedation score across two study groups.

1. At 0 minutes, no patients in tramadol and dexmedetomidine group found for grade 2 sedation. At 5 minutes, no patients in tramadol and dexmedetomidine group had grade 2 sedation score. At 10 minutes no patients in tramadol and in dexmedetomidine group, 11 patients had grade 1 sedation and 21 patient had grade 2 sedation. At 15 minutes, 27 patients in tramadol group had grade 1 sedation and 0 patients in dexmedetomidine group. But 5 patients in tramadol group had grade 2 sedation and 24 patients in dexmedetomidine group and grade 3 account for 8 patients for dexmedetomidine group. At 30 minutes, in tramadol group, 24 and 8 patient had grade 1 and 2 sedation respectively, in dexmedetomidine group, 0 and 24 and 8 patients had grade 1, 2 and 3 sedation respectively.

2. At 45 minutes, in tramadol group, 25 and 7 patient had grade 1 and 2 sedation, in dexmedetomidine group, 0,29 and 3 patients had grade 1,2 and 3 sedation respectively. At 60 minutes, 24 and 8 patients in tramadol group had grade 1 and 2 sedation, in dexmedetomidine

group, 14 and 18 patient had grade 1 and grade 3 sedation scores. P value for this is 0.001 and the distribution of mean sedation score is significantly higher in Group D compared to Group T (P-value<0.001).

Table 2: The distribution of adverse effects across two study groups.

Adverse effects	Tramadol	Dexmedetomidine	P value
Vomitting	3(9.3%)	0	0
Nausea	4(12.5%)	0	0
Hypotension	0	1(3.1)	0
Bradycardia	0	3(9.3%)	0
Nil	25(78.1%)	29(90.6%)	0.17

Significantly higher proportion of cases from Group T had higher incidence of adverse effects than cases from Group D (P-value<0.05).

Discussion:

Lower abdominal and lower limb surgeries are usually done under spinal anaesthesia. One of the least addressed and a very distressing complaint in many of the patients is **shivering** during the surgery and in the immediate postoperative period. A number of steps are usually taken to prevent shivering during the surgery and one important step is administration of drugs to prevent shivering during surgery. It is essential to adequately sedate the patient after administration of spinal anaesthesia. Most of the sedatives have problems like hypotension, bradycardia and also provides unreliable **sedation**, that is, the dose required for every patient may vary widely. This study was formulated in such a way to address these two problems.

Dexmedetomidine, produces arousable sedation, hypnosis, anxiolytic and antishivering properties. It can cause decrease in heart rate and blood pressure. Tramadol is a semi synthetic opioid which controls shivering and also sedation. It has a high incidence of vomiting.[19]

Our study was planned in a prospective, randomized double blind manner to study the efficacy of these two drugs in the prevention of shivering.

We analysed these drugs profile under following heads:

a. Age, Body weight, Height, BMI, Gender,ASA grades

On analysing the demographic profile, the distribution of age, sex and height of the patients in both the groups are comparable.

b. Duration Of Anaesthesia and surgery

In our study mean duration of anaesthesia for tramadol group patients was 124.6min and of Dexmedetomidine group it was 125.75min. A study conducted by Mittal et al[20] show the mean duration of anaesthesia for tramadol was 127.60min and for Dexmedetomidine group was 133.60 min. In our study mean duration of surgery for tramadol group patients was 74.32min and of Dexmedetomidine group it was 78.18min.

c. Time Taken for Cessation

In our study mean time taken for cessation for tramadol group patients was 5.72min and of Dexmedetomidine group it was 4.02min. A study conducted by Mittal et al[20] show the time taken for cessation for tramadol was 5.92 min and for Dexmedetomidine group was 2.52 min.

d. Adverse effects

In our study incidence of nausea and vomiting with tramadol was 9.3% and 12.5%. incidence of nausea and vomiting with Dexmedetomidine was

NIL. However, in the study by Shukla *etal*.[21] the incidence of nausea was quite high (77.5%), whereas Wason *et al*.[22] have reported the incidence of nausea as only 4%.[22] These variations could be explained by the peculiar patient characteristics in different studies.

e. Shivering

The primary outcome measure studied was the ability of the drugs in the prevention of shivering among the study population. Among the two drugs used in the study, tramadol was found to be superior to other drugs in the prevention of shivering as only 1 patient among the 32 patients who were given tramadol had shivering. This result is in accordance with the report by **Lim fern et al[23]** study which also had a similar outcome. Tramadol group patients had the highest incidence of shivering with 12 patients in that group had shivering grade >2. a statistically poor outcome for both groups when compared with dexmedetomidine group. The reason for this difference could have been because that study was given to patients after the patients shivered as for treatment. When compared with **Mittal et al[20]** study, which was a 2 drug comparison between dexmedetomidine and tramadol, showed that both drugs were equally effective but dexmedetomidine had a faster onset of action. Venkatraman et.al[24] conducted a study to compare tramadol, clonidine and dexmedetomidine for post spinal anesthesia shivering. In this study, time taken for control of shivering in group D and group T was 5.76 ± 1.14 mins vs 6.72 ± 1.27 mins respectively. In our study, time of control of shivering in group D and group T was 4.0 ± 0.46 mins and 5.7 ± 0.66 mins respectively.

The reason of this difference (in time of control of shivering in group D and group T) from our study could be because of different demographic profile, as patients aged 18 to 45 years with Grade 2 to 4 of shivering were included in this study compared to 18-65 years of age group with shivering grade 3 and 4 were included in our study. Secondly study drugs was administered as IV bolus over 2 min in this study compared to slow IV infusion in 100 ml normal saline (NS) over 10 min in our study.

The difference in time of control of shivering in group T from our study could also be due to dose variation, as higher dose of tramadol was administered i.e 2 mg/kg compared to 0.5 mg/kg in our study. And this difference also signifies that higher dose of tramadol may reduce the " time of control of shivering "

Manohar Panneer et. Al[25]conducted a study to compare clonidine and dexmedetomidine for post spinal anesthesia shivering in patients undergoing lower limb orthopedic surgeries on 60 patients randomized into 2 Groups (30 each). In this study, the time taken to control shivering in group D and group C was 2.23 ± 0.43 min and 5.54 ± 0.58 min. In our study, time of control of shivering in group D was 4.0 ± 0.46 mins compared to 2.23 ± 0.43 min in this study.

f. Sedation

The secondary outcome measure of the study was sedation. The secondary outcome measure of the study was sedation. All the drugs used in the study for prevention of shivering can cause sedation to varying degrees. So no other sedatives or hypnotics or anxiolytics were given during the study. A sedation score of 2 (Drowsy, arousable to physical stimuli) in most of the patients in dexmedetomidine group. Sedation after the bolus dose lasted for over 90 minutes and patients were comfortable during the surgery. In tramadol group, the sedation scale was 1 mostly. This observation was similar in other studies also. **Mittal et al[20]** concluded the study as sedation due to dexmedetomidine provides additional comfort to the patient. **Bozgeyik et al[26]** had a similar observation as dexmedetomidine causes sedation and relieves anxiety. The sedation score was higher in dexmedetomidine group starting from 5 minutes as observed in **Bozgeyik et al[26]** is the similar result in our study too.

Keerthi Pet. Al[27] evaluated effects of dexmedetomidine, butorphanol and tramadol on post spinal anesthesia shivering. In this study, 68.8 % patients in Group D, had a Ramsay sedation score of 3 while 31.3 % patients exhibited a Ramsay Sedation Score of 2. Whereas in Group T, 96 % patients exhibited a Ramsay Sedation Score of 1 or 2 whereas 4 % patients had a Ramsay sedation score of 3.

Conclusion:

We conclude that dexmedetomidine is more effective than tramadol for treatment of postspinal shivering due to its higher response rate, shorter response time, lower incidence of recurrence and intraoperative sedation without any incidence of nausea and vomiting but can lead to hemodynamic alterations which is easily treatable.

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