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Compare the Safety of Intravenous Clonidine Injection Versus Intravenous Tramadol Injection for Control of Post Spinal Anaesthesia Shivering

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ABSTRACT

Regional anaesthesia (spinal anaesthesia) is widely used as a safe anaesthetic technique for both elective and emergency operations. Shivering leads to potentially serious and life threatening complications. Tramadol is commonly used in our clinical practice for prevention of shivering in patients undergoing surgery under regional anaesthesia. Few studies suggest that, Clonidine is a 2 receptor agonist, effective in reducing the incidence of shivering and decrease oxygen consumption during recovery from anaesthesia. The study was conducted at the Department of Anaesthesiology of tertiary care center from January 2021 to November 2022. A total of 202 patients, ASA grade I and II undergoing lower abdominal surgeries were included and divided into two groups (Group T - 101 patients with intravenous tramadol 1 mg/kg diluted till 10 mL by normal saline slowly. Group C-101 patients with Intravenous clonidine 1 mcg/kg diluted till 10 mL normal saline slowly). Data was collected by using a structure proforma. Shivering control was completely achieved in 82.2% patients in Group C as against 68.3% in Group T. Proportion of cases with sedation grade 0 in Group T were 100% as against 84.2% in Group C. Proportion of cases with Recurrence of shivering in Group T were 19.8% as against 8.9% in Group C. Cases having nausea as side effect in Group T were 30.7% as against 0% in Group C. Vomiting as side effect in Group T were 30.7% as against 0% in Group C. Mean SBP of the patients from Group T and Group C during shivering was 106.57±10.46 and 114.67±9.62 respectively. Mean DBP of the patients from Group T and Group C during shivering was 69.70±9.44 and 73.66±8.93 respectively. Clonidine (1 µg/kg) and Tramadol (1 mg/kg) can effectively treat patients with post-spinal anaesthesia shivering. Clonidine offers better thermodynamics than tramadol with fewer side effects.

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Key Words
Clonidine, tramadol, spinal, anaesthesia, shivering

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INTRODUCTION

Shivering is known to be a frequent complication, reported in 40-70% of patients undergoing surgery under regional anaesthesia. Shivering is a potentially serious complication, resulting in increased metabolic rate, increased oxygen consumption (up to 100-600%) along with raised carbon dioxide (CO2) production, ventilation and cardiac output, adverse postoperative outcomes, such as wound infection, increased surgical bleeding, and morbid cardiac events. It causes arterial hypoxemia, lactic acidosis, increased intraocular pressure (IOP), increased intracranial pressure (ICP) and interferes with pulse rate, blood pressure (BP) and electro cardiographic (ECG) monitoring[1]. Shivering is an important concern in patients undergoing surgery under general anesthesia[2] as well as regional anesthesia, i.e. spinal anesthesia[3] or epidermal anesthesia[4]. Pain, uncontrolled spinal reflexes[5] and cutaneous vasodilation are the other suggested mechanisms involved in the pathogenesis of shivering[2]. Opioid receptors, a2 receptors and serotonergic receptors are involved in the pathogenesis of shivering[6]. Because of its associated discomfort[2,3], distress[3], aggravations of pain, increased metabolic demands and increased oxygen consumption[7], prevention and treatment of post-anesthesia shivering is an important component of perioperative management of the patient[2].

Different pharmacological agents studied for their potential in prevention of peri- or post-operative shivering include clonidine, tramadol, dexmedetomidine, ondansetron, granisetron, ketamine and pethidine[2,3,8-12]. Tramadol is μ receptor agonist and also inhibits the reuptake of norepinephrine and 5-hydroxytryptamine (5-HT) and also improves the release of 5-HT. This pharmacological mechanism of tramadol is postulated to be useful for the control of thermoregulation[13]. Prophylactic use of tramadol is effective in prevention of shivering post-spinal anesthesia[14]. However, in patients who do not tolerate tramadol or have a contraindication for its use, an alternative option is desired. The available evidence suggests the usefulness of a2 receptor agonist in effectively reducing shivering through their action on a2 receptors[15,16]. Clonidine, an a2 receptor agonist is effective in reducing the incidence of shivering and decrease oxygen consumption during recovery from anesthesia Kundra *et al*[8]. The anti-shivering effect of clonidine is because of the actions at three levels, hypothalamus, locus coeruleus and spinal cord. However, because of no routine use of clonidine in regular clinical settings, the above study was conducted compare the safety of intravenous clonidine injection versus intravenous tramadol injection for control of post spinal anaesthesia shivering.

MATERIALS AND METHODS

Study Place: The study was conducted at Department of Anesthesiology of tertiary care center from January 2021 to November 2022.

Study Design: Randomized double-blind study.

Inclusion Criteria: Patients undergoing lower abdominal surgeries, age between 25-55 years, ASA grade I and II, willing to give written informed consent.

Exclusion Criteria: Patients with Known allergy to local anaesthesia, tramadol and clonidine, having infections at local site, ASA III, IV or V, Bleeding disorders or patients on anticoagulant therapy, CVS/ RS/Hepatic/Renal Failure, Lower segment caesarean section patient, unwilling to give written informed consent.

Sample Size: Formula for sample size calculation:

$$n = \frac{z\left(z\frac{a}{2} \cdot z_{10B}\right)^2}{\left(u_1 0 u_2\right)^2}$$

n= u1 = 42.25, u2 = 38.99, S. D = 11.7
So, n - 202 for 2 groups combined
Therefore, n1 = 101, n2 = 101

Group T : 101 patients with intravenous tramadol 1 mg/kg diluted till 10 mL by normal saline slowly.

Group C : 101 patients with Intravenous clonidine 1 mcg/kg diluted till 10 mL normal saline slowly.

Data Analysis: Data was collected by using a structure proforma. Data entered in MS excel sheet and analysed by using SPSS 24.0 version IBM USA. A $p<0.05$ was considered as statistically significant whereas a $p<0.001$ was considered as highly significant.

Ethical Considerations: All the necessary ethical permissions were obtained from the Institutional Ethics Committee.

After induction of spinal anaesthesia, patients were observed for the occurrence of shivering until the post-operative period. Patients in one group received IV tramadol 1 mg/kg diluted till 10 ml in normal saline slowly. Patients in another group received an intravenous clonidine 1 mcg/kg diluted till 10 ml normal saline slowly immediately after the onset of shivering. Time of the onset of shivering after spinal anesthesia was noted (onset of shivering). The treatment will be started immediately after the onset

of shivering and the time of recurrence, if present (defined as the time between cessation of shivering after the first dose of the drug and recurrence of shivering), severity of shivering, Response rate (Number of patients in which shivering ceased after treatment in 15 mins), time of disappearance of shivering (in seconds). The study drug was given along with injection ondansetron. Grading of shivering was done as per Wrench *et al*[18]. Complications such as Bradycardia, hypotension, convulsions, restlessness, disorientation, drowsiness, nausea, vomiting, etc. were noted.

RESULTS AND DISCUSSIONS

Total 101 patients were included in each group i.e. Group T and Group C. Out of 101 patients from Group T, majority were from 41-50 years i.e. 35.6% followed by 26.7% from 20-30 years, 22.8% from 31-40 years and 14.9% from 51-60 years age group. Out of 101 patients from Group C, majority were from 41-50 years i.e. 34.7% followed by 33.7% from 31-40 years, 16.8% from 51-60 years and 14.9% from 20-30 years. We observed statistically non- significant difference in the respective age group ($p>0.05$). It means both the groups are comparable in our study. Proportion of cases with grade 1 of shivering in Group T were 5.9% as against 2% in Group C. Grade 2 were 34.7% as against 27.7% in Group C. Grade 3 were 52.5% as against 60.4% in Group C. Grade 4 were 6.9% as against 9.9% in Group C. We observed statistically non- significant difference with respect to shivering grade ($p>0.05$). It means both the groups are comparable with respect to grade of shivering before treatment in our study.

Proportion of cases with grade 0 of shivering in Group T were 68.3% as against 84.2% in Group C. Grade 1 were 24.8% as against 13.9% in Group C. Grade 2 were 6.9% as against 2.0% in Group C. We observed statistically significant difference with respect to shivering grade ($p<0.05$). It means shivering was not experienced by majority of the patients in Group C as compared to Group T after treatment. Shivering control was completely achieved in 82.2% patients in Group C as against 68.3% in Group T. We observed statistically significant difference with respect to shivering control ($p<0.05$). It means shivering was well controlled by intravenous clonidine injection compared with intravenous tramadol injection.

Proportion of cases with Recurrence of shivering in Group T were 19.8% as against 8.9% in Group C. We observed statistically significant difference with respect to Recurrence of shivering ($p<0.05$). It means recurrence of shivering was less experienced in Group C as compared to Group T. Proportion of cases having nausea as side effect in Group T were 30.7% as against 0% in Group C. We observed statistically significant difference with respect to cases of nausea ($p<0.05$). It means intravenous clonidine does not cause nausea as compared to tramadol. Proportion of cases having vomiting as side effect in Group T were 30.7% as against 0% in Group C. We observed statistically significant difference with respect to cases of vomiting ($p<0.05$). It means intravenous clonidine does not cause vomiting as compared to tramadol. No single patient experienced bradycardia in Group T as compared to 42.6% in Group C. We observed statistically significant difference with respect to cases of bradycardia ($p<0.05$). It means intravenous tramadol does not cause bradycardia as compared to clonidine.

Distribution According to Side Effects-Hypotension:2% patient experienced hypotension in Group T as compared to 36.6% in Group C. We observed statistically significant difference with respect to cases of hypotension ($p<0.05$). It means intravenous tramadol causes less hypotension as compared to clonidine.

Distribution According to Side Effects-Drowsiness:0% patient experienced drowsiness in Group T as compared to 17.8% in Group C. We observed statistically significant difference with respect to cases of drowsiness ($p<0.05$). It means intravenous tramadol causes less drowsiness as compared to clonidine. Mean duration of surgery of the patients from Group T and Group C was 89.65±32.42 and 93.03±31.09 minutes respectively. We observed statistically non- significant difference in the duration of surgery between two group ($p>0.05$). It means both the groups are comparable with respect to duration of surgery in our study.

Mean pulse rate of the patients from Group T and Group C 5 min after shivering was 92.18±9.58 and 81.74±11.56 respectively. Mean pulse rate of the patients from Group T and Group C 15 min after shivering was 84.83±8.30 and 71.50±11.17 respectively. We observed statistically significant difference in the pulse rate between two group ($p<0.05$). It means mild bradycardia was seen in Group C as compared to GROUP T. Mean pulse rate of the patients from Group T and Group C 5 min after shivering was 92.18±9.58 and 81.74±11.56 respectively. Mean pulse rate of the patients from Group T and Group C 15 min after shivering was 84.83±8.30 and 71.50±11.17 respectively. We observed statistically significant difference in the pulse rate between two group ($p<0.05$). It means mild bradycardia was seen in Group C as compared to GROUP T.

Mean DBP of the patients from Group T and Group C during shivering was 69.70±9.44 and 73.66±8.93 respectively. Mean DBP of the patients from Group T and Group C 5 min after shivering was 73.94±7.88 and 67.17±7.25 respectively. Mean DBP of the patients

from Group T and Group C 15 min after shivering was 77.27±7.60 and 60.97±6.74 respectively. We observed statistically significant difference in the DBP between two groups (p<0.05). It means mild hypotension was seen in Group C as compared to Group T. Mean SPO2 of the patients from Group T and Group C during shivering was 96.26±1.60 and 95.01±0.84 respectively. Mean SPO2 of the patients from Group T and Group C 5 min after shivering was 98.43±0.71 and 97.38±0.90 respectively. We observed statistically significant difference in the SPO2 between two groups (p<0.05). It means SPO2 was kept to the normal side by Group T as compared to Group C but at the end both groups showed optimum SPO2 saturation.

We included total 101 patients in each group i.e. Group T and Group C. Out of 101 patients from Group T, majority were from 41-50 years i.e. 35.6% followed by 26.7% from 20-30 years, 22.8% from 31-40 years and 14.9% from 51-60 years age group. Out of 101 patients from Group C, majority were from 41-50 years i.e. 34.7% followed by 33.7% from 31-40 years, 16.8% from 51-60 years and 14.9% from 20-30 years. We observed statistically non- significant difference in the respective age group (p>0.05). It means both the groups are comparable in our study. In our study, the mean age of the patients from Group T and Group C was 40.18±9.60 and 41.32±8.75 years respectively. We observed statistically non- significant difference in the age group (p>0.05). It means both the groups are comparable in our study. Reddy VS *et al*[19]. reported that mean age of the patients from Group T and Group C was 21.62±2.35 and 22.15±2.34 years respectively. They observed statistically non- significant difference in the age group (p>0.05). Kulshrestha S. *et al*[20]. reported that that mean age of the patients from Group T and Group C was 32.81±3.52 and 31.47±3.63 years respectively. They observed statistically non-significant difference in the age group (p>0.05) that is comparable with our study findings.

In our study, the mean duration of surgery of the patients from Group T and Group C was 89.65±32.42 and 93.03±31.09 minutes respectively. We observed statistically non- significant difference in the duration of surgery between two groups (p>0.05). It means both the groups are comparable with respect to duration of surgery in our study. Jois DS *et al*[21]. reported that the mean duration of surgery of the patients from Group T and Group C was 68.70±17.37 and 66.05±17.03 minutes respectively. They observed statistically non-significant difference in the duration of surgery between two groups (p>0.05) which is comparable to our findings.

Comparison of Safety: In our study, the proportion of cases with grade 1 of shivering in Group T were 5.9% as against 2% in Group C. Grade 2 were 34.7% as against 27.7% in Group C. Grade 3 were 52.5% as against 60.4% in Group C. Grade 4 were 6.9% as against 9.9% in Group C. We observed statistically non- significant difference with respect to shivering grade (p>0.05). It means both the groups are comparable with respect to grade of shivering before treatment in our study. In our study, the proportion of cases with grade 0 of shivering in Group T were 68.3% as against 84.2% in Group C. Grade 1 were 24.8% as against 13.9% in Group C. Grade 2 were 6.9% as against 2.0% in Group C. We observed statistically significant difference with respect to shivering grade (p<0.05). It means shivering was not experienced by majority of the patients in Group C as compared to Group T. In our study, the shivering control was completely achieved in 82.2% patients in Group C as against 68.3% in Group T. We observed statistically significant difference with respect to shivering control (p<0.05). It means shivering was well controlled by intravenous clonidine injection compared with intravenous tramadol injection. In our study, the proportion of cases with Recurrence of shivering in Group T were 19.8% as against 8.9% in Group C. We observed statistically significant difference with respect to Recurrence of shivering (p<0.05). It means recurrence of shivering was less experienced in Group C as compared to Group T. Reddy VS *et al*[19]. reported that ninety parturients experienced shivering of grades 3 and 4 after spinal anaesthesia, during the caesarean section. Parturients characteristics in respect of age, weight, body temperature and duration of surgery were similar between the groups. Response rate (shivering ceased after treatment within 15 minutes) was found to be 95.56% in the tramadol group and 86.67% in the clonidine group and the time required to cease shivering was shorter in the tramadol group than in the clonidine group. Mansi Jain *et al*[22]. also reported that proportion of cases with Grade 3 were 50% in Group T as against 46.4% in Group C. Grade 3

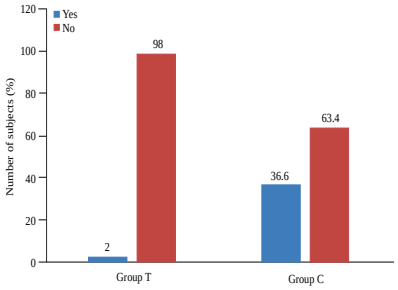

Fig. 1: Bar diagram showing Distribution according to side effects-hypotension

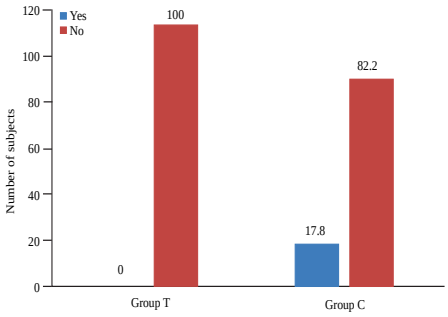

Fig. 2: Distribution according to side effects-drowsiness

Table 1: Distribution according to age group

		Group T		Group C			
		No	percentage	No	percentage	Total	P
Age group in years	20-30	27	26.7	15	14.9	42	0.12, Not significant
	31-40	23	22.8	34	33.7	57	
	41-50	36	35.6	35	34.7	71	
	51-60	15	14.9	17	16.8	32	
Total		101	100.0	101	100.0	202	

Table 2: Distribution according to grade of shivering

		Group T		Group C			
		No	percentage	No	percentage	Total	P
Grade of shivering	1	6	5.9	2	2.0	8	0.47, Not significant
	2	35	34.7	28	27.7	63	
	3	53	52.5	61	60.4	114	
	4	7	6.9	10	9.9	17	
Total		101	100.0	101	100.0	202	

Table 3: Distribution according to grade of shivering after treatment

		Group T		Group C			
		No	percentage	No	percentage	Total	P
Grade of shivering after treatment	0	69	68.3	85	84.2	154	0.023, Not significant
	1	25	24.8	14	13.9	39	
	2	7	6.9	2	2.0	9	
Total		101	100.0	101	100.0	202	

Table 4: Distribution according to shivering control

		Group T		Group C			
		No	percentage	No	percentage	Total	P
Shiveringcontrol	complete	69	68.3	83	82.2	152	0.02, significant
	incomplete	32	31.7	18	17.8	50	
Total		101	100.0	101	100.0	202	

Table 5: Distribution according to shivering recurrence

		Group T		Group C			
		No	percentage	No	percentage	Total	P
Recurrence of shivering	Yes	20	19.8	9	8.9	29	0.02, significant
	No	81	80.2	92	91.1	173	
Total		101	100.0	101	100.0	202	

Table 6: Distribution according to side effects-nausea

		Group T		Group C			
		No	percentage	No	percentage	Total	P
Nausea	Yes	31	30.7	0	0.0	31	0.0001, Highly significant
	No	70	69.3	101	100.0	171	
Total		101	100.0	101	100.0	202	

Table 7: Distribution according to side effects-vomiting

		Group T		Group C			
		No	percentage	No	percentage	Total	P
Vomiting	Yes	31	30.7	0	0.0	31	0.0001, Highly significant
	No	70	69.3	101	100.0	171	
Total		101	100.0	101	100.0	202	

Table 8: Distribution according to side effects-bardycardia

		Group T		Group C			
		No	percentage	No	percentage	Total	P
Bardycardia	Yes	0	0.0	43	42.6	43	0.0001, Highly significant
	No	101	100.0	58	57.4	159	
Total		101	100.0	101	100.0	202	

Table 9: Comparison of mean duration of surgery between Group T and Group C

Group		N	Mean	Std. Deviation	T	P	Inference
During of surgery	Group T	101	89.65	32.42	-0.755	0.451	Not significant
	Group C	101	93.03	31.09		(>0.05)	

Table 10: Comparison of mean pulse rate between Group T and Group C

PR		N	Mean	Std. Deviation	T	P	Inference
Baseline	Group T	101	80.14	10.25	-2.283	0.023	Significant
	Group C	101	83.45	10.33		(<0.05)	
During shivering	Group T	101	97.05	9.93	0.527	0.599	Not significant
	Group C	101	96.30	10.37		(>0.05)	
5 min after shivering	Group T	101	92.18	9.58	6.947	0.0001	Highly significant
	Group C	101	81.74	11.66		(<0.01)	
15 min after shivering	Group T	101	84.83	8.30	9.624	0.0001	Highly significant
	Group C	101	71.50	11.17		(<0.01)	

Table 11: Comparison of mean pulse rate between Group T and Group C

PR		N	Mean	Std. Deviation	T	P	Inference
Baseline	Group T	101	80.14	10.25	-2.283	0.023	Significant
	Group C	101	83.45	10.33		(<0.05)	
During shivering	Group T	101	97.05	9.93	0.527	0.599	Not significant
	Group C	101	96.30	10.37		(>0.05)	
5 min after shivering	Group T	101	92.18	9.58	6.947	0.0001	Highly significant
	Group C	101	81.74	11.66		(<0.01)	
15 min after shivering	Group T	101	84.83	8.30	9.624	0.0001	Highly significant
	Group C	101	71.50	11.17		(<0.01)	

Table 12: Comparison of mean DBP between Group T and Group C

DBP		N	Mean	Std. Deviation	T	P	Inference
Baseline	Group T	101	78.28	10.19	-1.742	0.083	Not significant
	Group C	101	80.71	9.68		(>0.05)	
During shivering	Group T	101	69.70	9.44	-3.064	0.002	Highly significant
	Group C	101	73.66	8.93		(<0.01)	
5 min after shivering	Group T	101	73.94	7.88	6.355	0.0001	Highly significant
	Group C	101	67.17	7.25		(<0.01)	
15 min after shivering	Group T	101	77.27	7.60	16.120	0.0001	Highly significant
	Group C	101	60.97	6.74		(<0.01)	

Table 13: Comparison of mean SPO2 between Group T and Group C

SPO2		N	Mean	Std. Deviation	T	P	Inference
Baseline	Group T	101	99.19	0.48	2.018	0.045	Significant
	Group C	101	99.06	0.42		(<0.05)	
During shivering	Group T	101	96.26	1.60	6.920	0.0001	Highly significant
	Group C	101	95.01	0.84		(<0.01)	
5 min after shivering	Group T	101	98.43	0.71	9.167	0.0001	Highly significant
	Group C	101	97.38	0.90		(<0.01)	
15 min after shivering	Group T	101	99.12	0.33	0.940	0.349	Not significant
	Group C	101	99.08	0.27		(>0.05)	

shivering was 50% in Group T as against 43.6% in Group C and this was statistically non- significant difference with respect to shivering grade (p>0.05) that is consistent with our study findings. Mansi Jain *et al*[22]. also reported the shivering control was completely achieved in 86.6% patients in Group C as against 96.6% in Group T and this was statistically significant difference with respect to shivering control (p<0.05). This is in contrast to our study findings. Biswa *et al*[23].reported the shivering control was completely achieved in 92% patients in Group C as against 88% in Group T and this was statistically significant difference with respect to shivering control (p<0.05). This is consistent with our study findings. Proportion of cases with sedation grade 0 in Group T were 100% as against 84.2% in Group C. We observed statistically significant difference with respect to sedation grade (p<0.05). It means less sedation was seen in Group T. 0% patient experienced drowsiness in Group T as compared to 17.8% in Group C. We observed statistically significant difference with respect to cases of drowsiness. (p<0.05). It means intravenous tramadol causes less drowsiness as compared to clonidine. Kulshrestha S. *et al*[20]. reported that proportion of cases with sedation grade 1 in Group T were 88.8% as against 66.66% in Group C with statistically significant difference with respect to sedation grade (p<0.05). These findings are comparable to our findings. Jois DS *et al*[21]. reported that 5 out of 40 patients in tramadol group complained of dizziness which was not seen with Clonidine group.

In our study, the proportion of cases having nausea as side effect in Group T were 30.7% as against 0% in Group C. We observed statistically significant difference with respect to cases of nausea (p<0.05). It means intravenous clonidine does not cause nausea as compared to tramadol. Also, the proportion of cases having vomiting as side effect in Group T were 30.7%

as against 0% in Group C. We observed statistically significant difference with respect to cases of vomiting ($p<0.05$). It means intravenous clonidine does not cause vomiting as compared to tramadol. Reddy *et al*[19]. reported that nausea and vomiting was commonly seen in tramadol as compared to clonidine. Shukla U *et al*[24]. reported that the proportion of cases having nausea and vomiting as side effect in Group T were 77.5% and 20.0% respectively as against 0% in Group C. They observed statistically significant difference with respect to cases of nausea and vomiting ($p<0.05$). It means intravenous clonidine does not cause nausea as compared to tramadol and these findings are consistent with our study findings. Vyas *et al*[17]. reported that significantly a greater number of patients experienced nausea and dizziness (36.7% vs. 0%, $p<0.001$ tramadol while bradycardia and hypotension were numerically more common in patients receiving clonidine (6.7% vs. 0% and 13.3% vs. 0%).

In our study, 2% patient experienced hypotension in Group T as compared to 36.6% in Group C. We observed statistically significant difference with respect to cases of hypotension ($p<0.05$). It means intravenous tramadol causes less hypotension as compared to clonidine. Kulshrestha S. *et al*[20]. reported that the bradycardia occurred in 3 patients of group C and 1 patients of group T. In group C, 5 patients suffered from hypotension and 3 patients complained of dry mouth, both of which were not present in group T. In our study the mean pulse rate of the patients from Group T and Group C 5 min after shivering was 92.18±9.58 and 81.74±11.56 respectively. Mean pulse rate of the patients from Group T and Group C 15 min after shivering was 84.83±8.30 and 71.50±11.17 respectively. We observed statistically significant difference in the pulse rate between two groups ($p<0.05$). It means mild bradycardia was seen in Group C as compared to GROUP T. The Mean SBP of the patients from Group T and Group C during shivering was 106.57±10.46 and 114.67±9.62 respectively. Mean SBP of the patients from Group T and Group C 5 min after shivering was 117.21±12.09 and 107.15±7.12 respectively. Mean SBP of the patients from Group T and Group C 15 min after shivering was 120.99±9.64 and 100.34±6.09 respectively. We observed statistically significant difference in the SBP between two group ($p<0.05$). It means mild hypotension was seen in Group C as compared to Group T.

Mean DBP of the patients from Group T and Group C during shivering was 69.70±9.44 and 73.66±8.93 respectively. Mean DBP of the patients from Group T and Group C 5 min after shivering was 73.94±7.88 and 67.17±7.25 respectively. Mean DBP of the patients from Group T and Group C 15 min after shivering was 77.27±7.60 and 60.97±6.74 respectively. We observed statistically significant difference in the DBP between two group ($p<0.05$). It means mild hypotension was seen in Group C as compared to Group T. Mean SPO2 of the patients from Group T and Group C during shivering was 96.26±1.60 and 95.01±0.84 respectively. Mean SPO2 of the patients from Group T and Group C 5 min after shivering was 98.43±0.71 and 97.38±0.90 respectively. We observed statistically significant difference in the SPO2 between two group ($p<0.05$). It means SPO2 was kept to the normal side by Group T as compared to Group C but at the end both groups showed optimum SPO2 saturation. Shukla U *et al*[24]. reported that there was no statistically significant difference with respect to heart rate, mean blood pressure, axillary temperature and oxygen saturation between the two groups. Morsali SF *et al*[1]. reported that there was statistically non-significant difference in the pulse rate, SBP, DBP and SPO2 between two groups ($p>0.05$). Mansi Jain *et al*[22]. also reported there was no significant difference in SBP in both groups after study drug administration. The DBP was significantly lower in Group C at 5, 10 and 15 mins observations. The MAP was significantly lower in Group C at 5 and 10 mins.

CONCLUSION

From the above study, it can be concluded that both clonidine and tramadol are effective in controlling post spinal anesthesia shivering. However, clonidine results in early complete cessation of shivering compared with tramadol. Recurrence of shivering was less experienced in clonidine as compared to tramadol. Clonidine also offers better thermodynamics with lesser side effects. Side effects such as nausea, vomiting and dizziness may limit the use of tramadol as an anti-shivering drug.

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