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Original Research Article

DEXMEDETOMIDINE AND BUTORPHANOL FOR INTRA OPERATIVE SHIVERING DURING SPINAL ANAESTHESIA – AN OBSERVATIONAL AND COMPARATIVE STUDY

Authors: Dr. Sonali Savarn[1] (3rd Year Resident), Dr. Nikita Dhomne[2] (Assistant Professor) & Dr. Saifee Sakina Qutubuddin (2nd Year Resident)

Dept. of Anesthesiology, Index Medical College Hospital & Research Centre, Indore, M.P.[1,2&3]

Corresponding Author: Dr. Sonali Savarn

Abstract

Background & Methods: The aim of the study is to evaluate and compare the effect of dexmedetomidine and butorphanol on shivering during spinal anaesthesia. This study was done after obtaining Institutional Human ethics committee clearance from the institution and informed written consent from all the patients who participated in the study. It is a prospective comparative study .The sample size was 35 in each group with allocation ratio being 1:1. 70 patients of age group between 18 to 60 years corresponding to ASA 1 and 2 posted for elective surgery that develop shivering under subarachnoid blockade will participate in this study.

Results: Fall in HR < 20% of baseline was noted in 4 patients out of 35 in group B and 34 patients out of 35 after drug administration. The occurrence of decrease of heart rate was significantly more common in group D as compared to group B (97.1% vs 11.4%) (p = .001). The mean duration of surgery in group B patients was 2.07±.65 hours. The mean duration of surgery in group D patients was 2.37±.53 hours The duration of surgery in both the groups remained comparable p= .059. The recurrence of shivering was significantly more common in group B as compared to group D (25.7% vs 5.7%) (p value <.05); iv tramadol 0.5 mg/kg was given as rescue drug in case of recurrence. A significantly greater proportion of subjects in group B had sedation score 3 whereas in group D a significantly greater proportion of subjects had sedation score 4 (p value <.05).

Conclusion: Control of shivering is better with dexmedetomidine than butorphanol. The incidence of recurrence is significantly less with dexmedetomidine than butorphanol. The incidence of hemodynamic variations (bradycardia / hypotension) is significantly higher with dexmedetomidine as compared to Butorphanol. The conclusion of our study is that Dexmedetomidine at the dose of 0.5 µg/kg decreases effectively intra operative shivering in patients undergoing elective lower limb and abdominal surgery under subarachnoid blockade when compared with Butorphanol.

Keywords: dexmedetomidine, butorphanol, shivering & spinal anaesthesia.
Study Design: Observational Study.

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1. Introduction

Neuraxial anaesthesia is most commonly employed for lower abdomen, perineum and lower limb surgeries[1]. It has the advantage of easy administration technique, less adverse effects, cost effectiveness and patient remaining conscious throughout the procedure compared with general anaesthesia. One of the most common complications after neuraxial anaesthesia is per-operative shivering. The median incidence of shivering related to regional anaesthesia observed in a review of 21 studies is 55%[2].

Shivering is an involuntary oscillating muscular activity, a physiological thermoregulatory response to cold. The core temperature of human varies with circadian rhythm and normally maintained within a range of 36.5°C - 37.0°C. Temperature regulation is mediated by preoptic nucleus of anterior hypothalamus. Shivering is elicited when the preoptic region of the hypothalamus is cooled[3]. Efferent signals mediating shivering descend in the medial forebrain bundle. Traditionally, it was believed that the posterior hypothalamus served as the origin of the central descending shivering circuit. Although it is believed that the preoptic-anterior hypothalamus inhibits the posterior hypothalamus to prevent shivering, scientific proof is insufficient. Increased muscle tone is caused by descending impacts on the spinal cord caused by thermally induced changes in neuronal activity in the mesencephalic reticular formation and the dorsolateral pontine and medullary reticular formation. It is unknown whether the preoptic-anterior hypothalamus or the posterior hypothalamus provides synaptic input to the reticulospinal neurons[4].

The autonomic nervous system maintains normothermia in homeothermic mammals as even minor deviations from normal core body temperature, cellular and tissue damage will occur. Neuraxial anaesthesia inhibits tonic vasoconstriction and produces vasodilation which leads to rapid heat loss by redistribution of core heat from the trunk (below the block level) to the periphery tissues due to altered afferent thermal input from the blocked region causing core temperature to decrease hence decreasing shivering threshold[5]. The threshold for vasoconstriction and shivering are decreased by 0.6°C above the level of block and reduction is proportional to number of segments blocked. These two effects predispose patients to hypothermia and shivering.

2. Material and Methods

All the patients of ASA physical status of 1 & 2, aged between 18 to 60 years of both sexes undergoing elective lower abdominal and limb surgeries under sub arachnoid block formed the study population. SAMPLE SIZE - 70 patients (35 patients in each group).

This study was done after obtaining Institutional Human ethics committee clearance from the institution and informed written consent from all the patients who participated in the study. It is a prospective comparative study .The sample size was 35 in each group with allocation ratio being 1:1. 70 patients of age group between 18 to 60 years corresponding to ASA 1 and 2 posted for elective surgery that develop shivering under subarachnoid blockade will participate in this study.

The patients who developed shivering were assigned at random with 35 participants in each group and were called as

- **Group D** receiving (Dexmedetomidine 0.5µg/kg)
- **Group B** (Butorphanol 0.01mg/kg).

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INCLUSION CRITERIA

- Patients undergoing elective lower abdominal & limb surgeries under spinal anaesthesia.
- Patients between the age group of 18 to 60 years.
- American Society of Anesthesiologists physical status 1& 2.
- Patients giving valid consent.

EXCLUSION CRITERIA

- Patients below 18 and more than 60 years of age.
- Patients with ASA physical status 3 or more.
- Patients with severe systemic disorders.
- Patients with any psychiatric/neurological disorder.
- Patients suffering from acute infection.
- Initial core temperature <36.5 or >37.5 degree celsius.
- History of allergy to any of the study drugs.
- Contraindications to spinal anesthesia.
- Emergency surgical procedures.
- Pregnant women.
- Patient's refusal.

3. Result

Table 1. Comparison of age (in years) of the patients belonging to two groups

Age in Years	**Mean± Standard deviation**	
	Group B	Group D
	43.31±18.10	48.80±15.24

P value 0.175 [a]Independent 't' test.

The mean (SD) age of the patients in group B was [43.3(18.10) years] and in group D [48.8 (15.24) years]. The difference in the age of the subjects belonging to two groups was statistically non-significant (p value = .175)

Table 2: Distribution of the patients based on Physical status/ASA grade

Physical status		**Group B**	**Group D**	**Total**
ASA grade I	Count (%)	27(77.1%)	28(80.0%)	55(78.6%)
ASA grade II	Count (%)	8(22.9%)	7(20.0%)	15(21.4%)
Total	Count (%)	35(100%)	35(100%)	70(100%)

P value .771

In group B 27 patients belonged to ASA 1 grade and 8 patients belonged to ASA grade 2. In group D 28 patients belonged to ASA 1 grade and 15 patients belonged to ASA grade 2. In both the groups, majority of the subjects belonged to the ASA grade I. There was no

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significant difference between the groups based on physical status of the subjects belonging to two groups (p value = .771).

Table 3: Comparison of onset of shivering in the patients belonging to two groups

	Mean± Standard deviation		**P value**
	Group B	Group D	
Onset of shivering (minutes)	20.42±9.87	19.57±7.51	0.684
[a]Independent 't' test.			

The mean duration of onset of shivering in group B was 20.42±9.87 mins and in group D was 19.57±7.51mins. There was no significant difference in the time of onset of shivering between group B [20.4 (9.87)] and group D [19.57 (7.51)] (p value= .684).

Table 4: Severity of shivering in the patients belonging to two groups

	Mean± Standard deviation	**P Value**
Shivering scale score	**Group A**	**Group B**
	3.51±.50	3.48±.50

There was no significant difference in the severity of shivering (WRENCH Shivering Scale Score) between the subjects of group B [3.51 (0.507)] and group D [3.48 (0.507)] (p value= .814).

Table 5: Duration of shivering (in minutes) in the patients belonging to two groups

	Mean± Standard deviation		**P value**
	Group B	Group D	
Duration of shivering (minutes)	11.57±3.15	11.71±2.69	0.839

The mean duration of shivering after drug administration in group B was 11.57±3.15mins. The mean duration of shivering after drug administration in group D was 11.71±2.69mins. There was no significant difference in the duration of shivering between group D [11.57 (3.15)] as compared to group B [11.71 (2.69)] (p value= .839).

Table 6: Distribution of the patients based on recurrence of shivering

Recurrence of shivering			**Group B**	**Group D**	**Total**	**Chi-squa re**	**df**	**P value**
			N=35	**N= 35**				
Yes	Count (%)		9(25.7%)	2(5.7%)	9(12.9%)	10.328	1	.001

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9 out of 35 patients experienced recurrence of shivering in group B and 2 out of 35 patients in group D experienced the same. The recurrence of shivering was significantly more common in group B as compared to group D (25.7% vs 0.0%) (p value = .001).

Table 7: Comparison of respiratory rate (per minute**) in the subjects belonging to two groups**

	Mean± Standard deviation		**P value**
	Group B	Group D	
Respiratory rate (min)	12.97±1.01	14.17±1.31	.001*

The mean RR in group B was 12.97 and in group D was 14.17. The mean (SD) respiratory rate was significantly more in group D subjects as compared to group B subjects [12.9 (1.014) vs 14.1 (1.31)] cycles/minute (p value= .001*). Dexmedetomidine is known to cause awake sedation hence has minimal effect on respiration and respiratory rate as when compared to opioid group of drug which are very commonly known to cause respiratory depression.

Table 8: Distribution of the patients based on presence of fall in baseline BP

	Group B N=35	Group D N=35	Total	Chi-square	df	P value
Fall in baseline BP Count (%)	4(11.4%)	24 (71.4%)	29 (41.4%)	25.963	1	.001

4 out of 35 patients in group B observed a significant fall in BP 25 out of 35 patients in group D observed a significant fall in BP. The occurrence of hypotension (< 20% of baseline) was significantly more common in group D as compared to group B (71.4% vs 11.4%) (p value = .001). Graph 11. Distribution of the patients based on presence of fall in baseline BP.

Table 9: Distribution of the patients based on presence of fall in heart rate

FALL IN HEAR TRATE		**Group B**	**Group D**	**Total**	**Chi-square**	**df**	**P value**
Yes	Count (%)	4(11.4%)	34(97.1%)	38(54.3%)			
No	Count%	31(88.6%)	1(2.9%)	32(45.7%)			
Total	Count %	35(100%)	35(100%)	70(100%)		1	.001
					51.809		

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Fall in HR < 20% of baseline was noted in 4 patients out of 35 in group B and 34 patients out of 35 after drug administration. The occurrence of decrease of heart rate was significantly more common in group D as compared to group B (97.1% vs 11.4%) (p = .001).

Table 10: Comparison of duration of surgery (in hours) for the patients belonging to two groups

	Mean± Standard deviation		**P value**
	Group B	Group D	
Duration of surgery (hours)	2.07±.65	2.37±5.3	.059

[a]Independent 't' test.

The mean duration of surgery in group B patients was 2.07±.65 hours. The mean duration of surgery in group D patients was 2.37±.53 hours The duration of surgery in both the groups remained comparable p= .059.

Table 11: Distribution of the subjects based on Ramsay sedation score

Sedation score		**Group B**	**Group D**	**Total**	**Chi-Square**	**df**	**P value**
Score	Count	0(0.0%)	0(0.0%)	0 (0.0%)	3.264	2	.196
1	(%)						
Score	Count	2(5.7%)	2(5.7%)	4(2.9%)			
2	(%)						
Score	Count	29(82.9%)	23(65.7%)				
3	(%)			38(54.3%)			
Score	Count	4(11.4%)	10(28.6%)				
4	(%)			30(42.9%)			
Score	Count	0(0.0%)	0 (0.0%)	0 (0.0%)			
5	(%)						
Total	Count	35(100%)	35(100%)	70(100%)			
	(%)						

In group B 2 patients achieved level 2 sedation, 29 patients achieved sedation score of 3 and 4 patients achieved level 4 sedation. In group D 2 patients achieved level 2 sedation, 23 patients achieved sedation score 3 and a higher number i.e. 10 patients achieved level 4 sedation There was no significant difference in the sedation score of the subjects belonging to two groups (p value= .196).

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4. Discussion

We had included 70 patients in our study who underwent various lower abdominal and lower limb surgeries under spinal anaesthesia and reported incidences of intraoperative shivering after induction. These were divided equally into two groups of 35 patients each;
Group B(n=35) patients received iv butorphanol 0.1mg/kg
Group D (n=35) patients received iv dexmedetomidine 0.05mcg/kg. The majority of the patients in both the groups were in the age group of 21-30 years. The mean age in Group B was 43.3 ‡ 18.10 years and in Group D it was 48.80 ‡ 15.24. The mean age between the two groups was comparable (P=0.175) [7].
In Group B, 27 (77.1%) patients were in Grade 1 and 8 (22.9%) in Grade 2; and in Group D, 28 (80.0%) patients were in Grade 1 and 7 (20.0%) in Grade 2. In both the groups, the majority of the patients were in ASA Grade 1. There was no statistically significant association between groups and the ASA Grade patients (P=0.771).
Onset and duration of shivering between both the groups remained comparable. Shivering onset in group B patients was 20.4+/-9.87 mins and group D patients was 19.57+/-7.51mins . There was no significant difference found in the study groups as p = .684 . Duration of shivering after study drug administration also remained comparable p=.839[8].
The mean duration of surgery in Group B was 2.14 ‡ 0.63 hours and in Group D, it was 2.37 ‡ .53 hours. The mean duration of surgery was comparable between the two groups (P=0.108).
Decrease in blood pressure was significant in patients of group D as 25 out of 35 patients suffered from relative hypotension p=.001. In group B only 4 out of 35 patients suffered had a decrease of blood pressure[9].
Also the occurrence of decreased heart rate was seen significantly in group D patients. 97% patients in-group D had relative bradycardia as compared to 11% patients in group B. However both hypotension and bradycardia were only relative. No pharmacological intervention was required to manage the patient[10].
The recurrence of shivering was significantly more common in group B as compared to group D (25.7% vs 5.7%) (p value <.05); iv tramadol 0.5 mg/kg was given as rescue drug in case of recurrence. A significantly greater proportion of subjects in group B had sedation score 3 whereas in group D a significantly greater proportion of subjects had sedation score 4 (p value <.05).

5. Conclusion

Control of shivering is better with dexmedetomidine than butorphanol. The incidence of recurrence is significantly less with dexmedetomidine than butorphanol. The incidence of hemodynamic variations (bradycardia / hypotension) is significantly higher with dexmedetomidine as compared to Butorphanol. The conclusion of our study is that Dexmedetomidine at the dose of 0.5 µg/kg decreases effectively intra operative shivering in patients undergoing elective lower limb and abdominal surgery under subarachnoid blockade when compared with Butorphanol.

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