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Effect of Intravenous Dexmedetomidine on Shivering in Cesarean Section after Spinal Anaesthesia

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ABSTRACT

Introduction: One of the most common and disturbing side effects of spinal Anaesthesia is body shivering, especially during cesarean delivery, which severely affects the mother's comfort, and hemodynamic changes may result. The present study was designed to evaluate the effect of intravenously administered dexmedetomidine on the incidence and severity of shivering in patients undergoing cesarean section under spinal Anaesthesia. **Methods & Materials:** This prospective cross-sectional study was done in the Department of Anaesthesiology at 250 Bedded General Hospital, Gopalganj, for a period of six months from July, 2024 to December, 2024. The study population was the parturients undergoing cesarean section under spinal Anaesthesia during the study period. Inclusion and exclusion criteria were pre-set, set and a total of 102 patients were selected by purposive sampling. Statistical analysis was performed using SPSS version 26.0. **Result:** There was a marked decrease in the incidence of shivering in the dexmedetomidine group when compared to the control group (15.7% vs. 56.9%; $p < 0.001$). Most patients had no shivering in the dexmedetomidine group when compared to the control group (84.3% vs. 43.1%), and there were no cases of severe shivering in the dexmedetomidine group compared to 13.7% in the control group ($p < 0.001$). There was a more frequent occurrence of moderate sedation with dexmedetomidine (62.7% vs. 11.8%; $p < 0.001$). Compared to the control group, the dexmedetomidine group had significantly lower mean heart rate. However, the mean arterial pressure was similar in both groups. Bradycardia was noted more frequently with dexmedetomidine use, but the patients were asymptomatic. The incidence of adverse events was the same for both groups, but the requirement for rescue anti- shivering drugs was drastically less in the dexmedetomidine group (5.9% vs. 41.2%; $p < 0.001$). **Conclusion:** Intravenous dexmedetomidine may be regarded as a highly potent drug for decreasing the frequency as well as severity of shivering in parturients who have undergone cesarean section under spinal Anaesthesia. Also, it results in a proper level of sedation, complying with hemodynamic stability. Besides, the employment of dexmedetomidine markedly reduces the need for rescue anti-shivering medication while not resulting in an elevation of the adverse effects.

Keywords: *Dexmedetomidine, Shivering, Spinal Anaesthesia, Cesarean Section*

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INTRODUCTION

Shivering is one of the most common and unfortunate side effects that mainly follow spinal Anaesthesia for obstetric patients undergoing cesarean delivery. The reported figures of shivering cases after neuraxial Anaesthesia range between 40% and 60%, which indicates a very serious problem during the perioperative period [1]. Shivering in parturients is a source of discomfort; however, on the physiological side, it also triggers increased oxygen consumption, carbon dioxide production, and an increase in the metabolic rate. Thus, there is a risk of compromising maternal cardiorespiratory function, and it becomes also difficult to monitor various intraoperative parameters such as electrocardiography and pulse oximetry [2]. Excessive shivering, besides physiological implications, may adversely affect maternal satisfaction and the overall quality of Anaesthesia care during cesarean delivery. The mechanism of shivering development after spinal Anaesthesia is multifactorial. Neuraxial blockade interferes with the hypothalamic regulation of body temperature by inhibiting vasoconstriction and shivering responses below the level of the block, thereby redistributing core heat to the periphery [3]. Other factors that contribute are exposing the patient to a cold operating room, giving unwarmed intravenous fluids, and the pregnancy, related hormonal changes [4]. On the whole, these conditions reduce the core body temperature, and shivering, as a thermoregulatory reaction, is then initiated. Various drugs have been assessed for their effectiveness in the prevention as well as the treatment of shivering after spinal Anaesthesia. A few examples of such drugs are opioids, clonidine, tramadol, ketamine, and magnesium sulfate [5]. However, it should be noted that most of these drugs have side effects such as nausea, vomiting, very profound sedation, hallucinations, or respiratory depression; therefore, their usage in obstetric Anaesthesia is highly restricted/not routine [6]. This means a perfect agent to shivering would be one that is powerful, entirely safe for both the mother and the baby, and does not cause any marked respiratory or hemodynamic compromise. Dexmedetomidine, a highly selective 2, adrenergic agonist, has recently been the subject of a great deal of research as to its potential role in the prevention and treatment of shivering during neuraxial Anaesthesia. It can, in a dose-dependent manner, produce sedation, anxiolysis, and analgesia, but, at the same time, there is no respiratory compromise [7]. Dexmedetomidine may prevent shivering by cutting out the shivering threshold through central inhibition of noradrenergic neurons in the locus coeruleus and modulation of hypothalamic thermoregulation in the brain [8]. Therefore, from a pharmacological point of view, the use of dexmedetomidine in obstetric patients is quite logical. Several randomized controlled trials have demonstrated that dexmedetomidine is effective in reducing the frequency and intensity of shivering following spinal Anaesthesia for cesarean section. One randomized controlled study with low-dose intravenous

dexmedetomidine reported that the incidence of shivering was significantly reduced compared to the placebo group. Moreover, the use of the drug was linked to stable hemodynamic parameters and improved patient comfort [9]. Meta-analyses have also documented the effects of dexmedetomidine, which is more effective than the placebo and equal to or better than other anti-shivering medications without increasing the risk of hypotension or bradycardia at the right dose of the drug [10]. Hence, the study was performed to investigate the influence of intravenously administered dexmedetomidine on the incidence and severity of shivering in patients undergoing cesarean section under spinal Anaesthesia.

METHODS & MATERIALS

This prospective cross-sectional study was conducted at the Department of Anaesthesiology, 250 Bedded General Hospital, Gopalganj, for a period of six months from July, 2024 to December, 2024. The study population consisted of parturients who received spinal Anaesthesia during their cesarean section. Purposive sampling method was employed to select 102 patients in total based on inclusion and exclusion criteria that were set prior. The inclusion criteria were pregnant women aged 18 to 40 years, ASA physical status I or II, and undergoing cesarean section, either elective or emergency, with spinal Anaesthesia. The study excluded patients who had contraindications for spinal Anaesthesia, those allergic to dexmedetomidine, patients with pre-existing cardiac conduction abnormalities, severely ill patients systemically, or those who were on drugs affecting thermoregulation. After obtaining the informed written consent, patients were randomly allocated into two groups of equal numbers: Group D (dexmedetomidine group, n=51) and Group C (control group, n=51). Group D was administered intravenous dexmedetomidine after spinal Anaesthesia according to the institutional protocol, while Group C was given an equal volume of normal saline. The patients' heart rate, non-invasive blood pressure, oxygen saturation, and electrocardiography were continuously monitored. Core temperature was indirectly measured, and the patients were checked during the operation and after the operation for possible shivering. Shivering was scored using a standard shivering scale. Sedation was scored by the modified Ramsay Sedation Scale. Hemodynamic parameters were recorded at regular time intervals. Hypotension, bradycardia, nausea, vomiting, respiratory depression, and any other adverse events were recorded. A structured data collection sheet was used to collect the data. SPSS 26.0 was used for statistical analysis. Measurements such as age and weight were expressed as mean standard deviation, while gender distribution was presented as frequencies and percentages. Comparison between the two groups was carried out using the independent sample t-test for continuous variables and the chi-square test for categorical variables. A p-value of <0.05 was regarded as statistically significant.

RESULTS

The mean age in Group D was 26.9 ± 4.8 years, compared to 27.3 ± 5.1 years in Group C (p = 0.68). Mean body weight was 62.4 ± 6.7 kg in Group D and 61.9 ± 7.1 kg in Group C (p = 0.74), while mean height was 155.6 ± 5.4 cm and 156.1 ± 5.8 cm, respectively (p = 0.62). ASA physical status I was observed in 38 patients (74.5%) in Group D and 36 patients (70.6%) in Group C, whereas ASA II was present in 13 (25.5%) and 15 (29.4%) patients, respectively (p = 0.65) *Table I*.

Table I
Baseline Demographic Characteristics of the Study Participants (*n*=102).

Variable	Group D (n=51)	Group C (n=51)	p value
Age (years), mean ± SD	26.9 ± 4.8	27.3 ± 5.1	0.68
Weight (kg), mean ± SD	62.4 ± 6.7	61.9 ± 7.1	0.74
Height (cm), mean ± SD	155.6 ± 5.4	156.1 ± 5.8	0.62
ASA I / II	38 (74.5%) / 13 (25.5%)	36 (70.6%) / 15 (29.4%)	0.65

Shivering occurred in 8 patients (15.7%) in the dexmedetomidine group compared to 29 patients (56.9%) in the control group, while absence of shivering was noted in 43 patients (84.3%) and 22 patients (43.1%), respectively. This difference was statistically significant (p < 0.001) *Table II*.

Table II
Incidence of Shivering After Spinal Anaesthesia (*n*=102).

Shivering	Group D (n=51)	Group C (n=51)	p value
Present	8 (15.7%)	29 (56.9%)	<0.001
Absent	43 (84.3%)	22 (43.1%)	

Grade 0 (no shivering) was observed in 43 patients (84.3%) in Group D and 22 patients (43.1%) in Group C. Grade 1 shivering occurred in 5 patients (9.8%) in Group D and 12 patients (23.5%) in Group C, while grade 2 shivering was noted in 3 patients (5.9%) and 10 patients (19.6%), respectively. Grade 3 (severe) shivering occurred in no patients (0%) in Group D but in 7 patients (13.7%) in Group C. The overall difference in shivering severity between the groups was statistically significant (p < 0.001) *Table III*.

Table III
Severity of Shivering (*n*=102).

Grade	Group D (n=51)	Group C (n=51)	p value
Grade 0	43 (84.3%)	22 (43.1%)	<0.001
Grade 1	5 (9.8%)	12 (23.5%)	
Grade 2	3 (5.9%)	10 (19.6%)	
Grade 3	0 (0%)	7 (13.7%)	

Sedation scores of 1–2 were observed in 19 patients (37.3%) in Group D compared to 45 patients (88.2%) in Group C, whereas higher sedation scores of 3–4 were recorded in 32 patients (62.7%) in Group D and only 6 patients (11.8%) in Group C. This difference was statistically significant ($p < 0.001$) *Table IV*.

Table IV
Sedation Scores (Modified Ramsay Sedation Scale) (n=102).

Sedation Score	Group D (n=51)	Group C (n=51)	p value
Score 1–2	19 (37.3%)	45 (88.2%)	<0.001
Score 3–4	32 (62.7%)	6 (11.8%)	

The mean heart rate was 68.5 ± 6.9 beats/min in Group D and 74.8 ± 7.4 beats/min in Group C, showing a statistically significant difference ($p < 0.001$). Mean arterial pressure was 78.6 ± 6.1 mmHg in Group D and 80.2 ± 6.4 mmHg in Group C, with no significant difference ($p = 0.18$). Bradycardia occurred in 6 patients (11.8%) in Group D and 1 patient (2.0%) in Group C ($p = 0.05$) *Table V*.

Table V
Hemodynamic Parameters (*n*=102).

Parameter	Group D	Group C	p value
Mean heart rate (beats/min)	68.5 ± 6.9	74.8 ± 7.4	<0.001
Mean arterial pressure (mmHg)	78.6 ± 6.1	80.2 ± 6.4	0.18
Bradycardia	6 (11.8%)	1 (2.0%)	0.05

Hypotension was observed in 7 patients (13.7%) in Group D and 6 patients (11.8%) in Group C ($p = 0.77$). Nausea and vomiting occurred in 4 patients (7.8%) in Group D compared to 9 patients (17.6%) in Group C ($p = 0.13$). No cases of respiratory depression were noted in either group. The need for rescue anti-shivering medication was significantly lower in Group D (3 patients, 5.9%) compared to Group C (21 patients, 41.2%) ($p < 0.001$) *Table VI*.

Table VI
Adverse Effects and Need for Rescue Medication (*n*=102).

Outcome	Group D (n=51)	Group C (n=51)	p value
Hypotension	7 (13.7%)	6 (11.8%)	0.77
Nausea/vomiting	4 (7.8%)	9 (17.6%)	0.13
Respiratory depression	0 (0%)	0 (0%)	-
Rescue anti-shivering drug	3 (5.9%)	21 (41.2%)	<0.001

DISCUSSION

The present study consisted of 102 parturients; baseline demographic characteristics like age, weight, height, and ASA physical status were almost similar between the dexmedetomidine and control groups. The average age in the dexmedetomidine group was 26.9 ±4.8 years and 27.3 ±5.1 years in the control group. Nesioonpour et al. also found an average age of 28.1 ±5.6 years in the dexmedetomidine group and 27.6 ±5.2 years in the placebo group, with no difference being significant difference between the two groups [9]. The incidence rate of shivering in our study was 15.7% in the dexmedetomidine group and 56.9% in the control group ($p < 0.001$). For instance, Wan Md Adnan et al. recorded shivering in 3.2% of patients receiving intravenous dexmedetomidine versus 64.5% in the control group during cesarean section under spinal Anaesthesia [11]. When the severity of shivering was studied, 84.3% of patients in the dexmedetomidine group in our study were at Grade 0 shivering, whereas only 43.1% of control patients were free of shivering. Remarkably, no patients at all (0%) in the dexmedetomidine group developed Grade 3 (severe) shivering, while 13.7% of the patients in the control group did. Usta et al. in their study also indicated that severe shivering was seen in 0% of patients treated with dexmedetomidine versus 26.7% in the placebo group under spinal Anaesthesia [8]. The fact that we had fewer patients with severe shivering in the control group might be due to differences in how the ambient temperature was controlled or the use of warming perioperatively, but the benefit's direction and size are still consistent. Sedation scores obtained from the present study indicated that 62.7% of patients in the dexmedetomidine group had a Ramsay sedation score of 34, while only 11.8% of the control group achieved such scores ($p < 0.001$). Wan Md Adnan et al. found moderate sedation in 51.6% of patients treated with dexmedetomidine, and none of the patients in the control group (0%) reached the same level of sedation [11]. The sedation rate being a bit higher in our study could be due to differences in dosage; however, both studies demonstrate that dexmedetomidine offers valuable sedation without being too deep. The hemodynamic assessment revealed that our group receiving dexmedetomidine had a significantly lower average heart rate (68.5 ±6.9 bpm) than the controls (74.8 ±7.4 bpm), and bradycardia was present in 11.8% versus 2.0%, respectively. Wang et al., in a meta-analysis, reported bradycardia incidences of 8% to 14% in dexmedetomidine groups while 2% to 4% in placebo groups, almost exactly matching our results [12]. Mean arterial pressure did not differ significantly in our study (78.6 ± 6.1 mmHg vs 80.2 ± 6.4 mmHg), consistent with pooled data showing no significant increase in hypotension with dexmedetomidine. With respect to adverse events, 13.7% of patients receiving dexmedetomidine experienced hypotension in comparison to 11.8% of controls; nausea and vomiting were recorded for 7.8% of dexmedetomidine and 17.6% of control patients, respectively. According to Botros et al., the number of patients suffering from nausea and vomiting who were treated with dexmedetomidine was 10%, whereas it was 22% for the comparator group, which is consistent with the fewer gastrointestinal side effects seen in our study [6]. The need

for rescue anti-shivering medication was lower by a large margin in the dexmedetomidine group (5.9%) than in the control group (41.2%). Nesioonpour et al. also showed that rescue medication was given to 6.7% of dexmedetomidine patients and 46.7% of controls [9].

LIMITATIONS

The research was carried out at one site only with a relatively small number of participants, which might limit the extent to which the results can be applied to other populations. The study looked at only one administration of dexmedetomidine; it was not possible to evaluate dose and response effects.

CONCLUSION

Intravenous dexmedetomidine administration is a simple, convenient, and safe method to reduce the incidence and severity of shivering in parturients undergoing cesarean section under spinal Anaesthesia. Additionally, it provides sedation and hemodynamic stability. It lowers the number of cases in which a rescue anti-shivering drug is required significantly. Furthermore, it does not increase the risk of side effects.

RECOMMENDATION

Intravenous dexmedetomidine is a potentially safe and effective drug that can be used for prophylaxis of shivering in cesarean section under spinal Anaesthesia. It may contribute to maternal comfort and decrease the necessity of additional anti-shivering drugs. With adequate monitoring of hemodynamics, it can be introduced to regular clinical practice.

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CONFLICT OF INTEREST

None declared

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