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A Comparative Study to Evaluate the Efficacy of Intravenous Dexmedetomidine versus Clonidine for Post Spinal Anaesthesia Shivering in Caesarean Section

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Abstract

Background: Lower segment caesarean section is widely performed under spinal anaesthesia and shivering is a common complication encountered. Clonidine and Dexmedetomidine are α – 2 agonists with anti-shivering property.

Aim: The aim was to compare the efficacy, hemodynamic and adverse effects of intravenous Dexmedetomidine versus Clonidine for post spinal anaesthesia shivering in LSCS.

Materials and Methods: A randomized double blind study was carried out in 70 parturients of ASA Physical Status II between 18 – 35 years who underwent LSCS under spinal anaesthesia and developed grade 2 or above level of shivering (wrench grading) in the intraoperative period. Group C (n=35) received intravenous Clonidine 1 mcg/kg and Group D (n=35) Dexmedetomidine 0.5 mcg/kg. Assessment included hemodynamics, time taken for complete cessation of shiveringand sedation scores.

Results: Mean time taken in Group D for cessation of shivering was 2.26 ± 0.44 minutes and in Group C, it was 5.48 ± 0.91min ($p < 0.001$). In Group C drug failed to control shivering in 17.4% and had recurrence in 20.69% while there was no failure ($p < 0.001$) and recurrence ($p = 0.01$) in Group D. Ramsay sedation scores were better with Group D when compared with Group C ($p = 0.005$). The incidence of hypotension and bradycardia was 22.8% in Group C and in Group D 2.86% ($p = 0.012$).

Conclusion: We conclude that Dexmedetomidine (0.5 mcg/kg) has early onset of action with less failure rate and recurrences with better hemodynamic stability and sedation when compared to Clonidine (1.0 mcg/kg) for post spinal shivering in LSCS.

Keywords: Shivering; Caesarean section; Spinal anaesthesia; Clonidine; Dexmedetomidine.

Keymessage: The study aimed to observe the efficacy of intravenous Dexmedetomidine versus Clonidine for post spinal anaesthesia shivering in LSCS. The hemodynamic responses and sedation achieved by Dexmedetomidine and Clonidine when used as antishivering agent were also compared.

Introduction

Shivering is seen in patients who receives regional anaesthesia as well as those recovering from general anaesthesia. Shivering that develops following spinal anaesthesia is a common problem and may occur in 19%–33% of patients receiving spinal anaesthesia.[1,2] Lower segment caesarean section is widely performed under spinal anaesthesia.

Shivering is a very unpleasant and distressing

experience for the patients associated with many adverse physiological effects. The undesirable physiological consequences include increase in oxygen consumption, carbondioxide production and minute ventilation. It may induce arterial hypoxemia, lactic acidosis, increased intra ocular pressure and intra cranial pressure and interfere with patient monitoring like ECG (electrocardiogram), NIBP (non-invasive blood pressure), pulse oximetry etc. Shivering may damaged entalprosthesis and negateorthopedic procedures like fractures and dislocations which can be detrimental to patients with low cardiopulmonaryreserve.[3]

Spinal anaesthesia is known to decrease vasoconstriction and shivering thresholds. Spinal anaesthesia induced vasodilation causes redistribution of heat from core to periphery and so shivering is preceded by corehypothermia and vasoconstriction above the level of block.[2,4] The interesting fact about corehypothermia following spinal anaesthesia is that it may not trigger sensation of cold as the cutaneous vasodilatation resulting from sympathetic blockade increases the skin temperature leading to asensation of warm thal though it is accompanied by thermoregulatory shivering.[5]

Various methods are available for the control of shivering, which maybe non- pharmacological or pharmacological. Intraoperative hypothermia can be minimized byanytechniquethat can limit cutaneous heat loss to the environment such as those due to cold operating room, evaporation from surgical incisions and conductive cooling produced by administration of cold intravenous fluids. Fluid warmers,[6] ambient operation theatre temperature, space blankets,[7] surgical drapes and active circulating warm water mattress have also been used. Pharmacological methods by using variety of drugs like Pethidine, Morphine, Tramadol,[8,9] Clonidine, Dexmedetomidine, Ketamine, Neostigmine, Magnesium sulfate[10] have been tried. These drugs are easily available and cost effective.

There is always aquest for more safe ran defficacious drug. In our study, we compared two α2 adrenergic agonists, Clonidine and Dexmedetomidine administered intravenously for treating shivering in patients who received spinal anaesthesia for caesarean section.[11]

Aims of Study

The major aim of the study was to compare the efficacy of intravenous Dexmedetomidine versus intravenous Clonidine for post spinal anaesthesia shivering in caesarean sectionalong with their side effects.

Materials and Methods

After approval of the Institutional Ethics Committee, a prospective double blinded randomized study was conducted in 70 parturients belonging to ASA Physical Status II, aged between 18 to 35 years posted for lower segment caesarean section under spinal anaesthesia who developed grade 2 and above level of shivering in the intraoperative period (as per Wrench grading). They were divided into two groups of 35 each by using computer generated randomization table.

All parturients underwent pre-anaesthetic examination including history elicitation, detailed systemic examination and airway examination. They were kept fasting for 6 hours. Informed written consent was obtained after explanation of the anaesthesia technique. After establishing wide bore venous access parturients received injection ranitidine 50 mg intravenously and injection metoclopramide 10 mg intravenously 30 minutes before surgery. In the operating room, baseline parameters of heart rate, non-invasive blood pressure, oxygen saturation, end tidal carbon dioxide and axillary temperature were recorded. The operating room temperature was maintained at 22–24 degree Celsius and fluids were administered at room temperature. No external warming devices were used. Oxygen was administered via face mask at 6 litres/minute.

The parturients received spinal anaesthesia under aseptic precautions with 25 or 26 gauge Quincke spinal needle through L_3– L_4 intervertebral space with 2ml of 0.5% hyperbaric bupivacaine to achieve a desirable level of T6.Hemodynamic parameters will be recorded every 3 minutes for 1st 15 minutes and every 5 minutes for next 30 minutes and there after every 10 minutes throughout the surgery. The parturients were observed for shivering in the entire intraoperative period by an anaesthesiologist who was blinded to the study group. The shivering was graded on a scale of 1–4 as per Wrench grading of shivering.

Parturients developing grade 2 and above levels of shivering were included in the study. They were randomly divided in two groups. Group C received Clonidine 1 mcg/kg intravenously and Group D received Dexmedetomidine 0.5 mcg/kg intravenously diluted to 5ml with normal saline

in coded syringe by an anaesthesiologist who is not involved in the study. Time taken to control shivering, response rate (shivering ceased after treatment within 15 minutes), and recurrence if any before the end of the surgery were noted. Sedation was assessed using Ramsay sedation score (RSS) and recorded after cessation of shivering. Any incidence of nausea, vomiting, hypotension, and bradycardia was identified and treated. The parturients who do not respond to the drug within 15 minutes or in whom it recurs before the end of surgery were treated with injection Pethidine 25mg intravenously as a rescue drug to control shivering.

Hypotension [SBP below 90 mmHg or a fall in Mean arterial blood pressure >20% of baseline values] was treated with rapid infusion of crystalloids [200ml] bolus followed by intravenous injection Mephenteramine 6mg if hypotension persisted. Bradycardia [<60beats/min] was treated with injection atropine 0.01mg/kg intravenously. Nausea and vomiting were treated with intravenous injection. Ondansetron 4 mg.

The qualitative parameters were represented using frequencies and percentage and the quantitative parameters were depicted using Mean (Standard Deviation) and Median (Inter Quartile Range). Student's t test was used for normally distributed quantitative data and Mann Whitney U test was used for skewed data. Chi – square or Fisher's exact probability test wasused for qualitative variables. Data was analyzed by using SPSS 22 Version Software and p value less than 0.05 was considered statistically significant.

Results

A total of 70 parturients aged between 18–35 years who under went caesarean section under spinal anaesthesia using 2 ml of 0.5 % hyperbaric Bupivacaine and developed grade 2 and above levels of shivering were randomly assigned into two groups of 35 each.

In Group C, mean age was 24.71 ± 3.94 years and in Group D, mean age of subjects was 25.86 ± 3.29 years (p=0.192). Mean Height and weight of both the groups were comparable. Baseline hemodynamic data were recorded in both groups. Demographic data were comparable in both the groups and none of them were statistically significant.

In Group C, mean Temperature before the starting of surgery was 37.04 ± 0.22 0C versus 37.06 ± 0.240C in Group D was similar in both groups (p=0.682).Mean Time of onset of shivering after spinal anaesthesia in Group C was 18.17 ± 2.73 minutes where as in Group D, it was 18.00 ± 2.80 minutes which was also similar (p=0.796). The mean Temperature during onset of shivering was 36.18 ± 0.190C in Group C and in Group D, it was 36.21 ± 0.220C which was of no statistical significance (p=0.57).

The mean duration of shivering or the time taken for complete cessation of shivering after administration of study drug was 5.48 ± 0.911 minutes in Group C and 2.26 ± 0.443 minutes in Group D. There was strong statistical significant difference in mean duration of shivering between two groups. (p<0.001).(Fig.1)

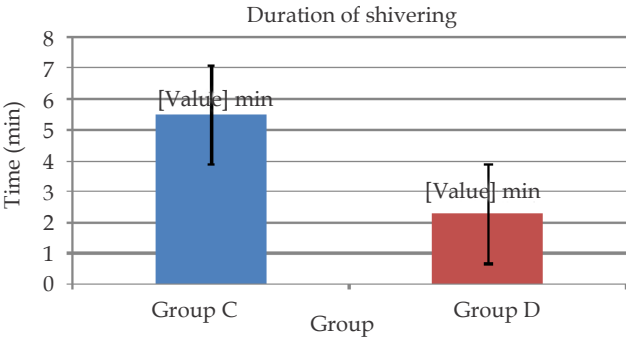

Fig. 1: Bar diagram showing Duration of shivering comparison between two groups.

In Group C, drug failed in subsiding shivering of 17.14% parturients whereas no failure was noted in Group D. This has strong statistical significance (p<0.001).(Fig.2)

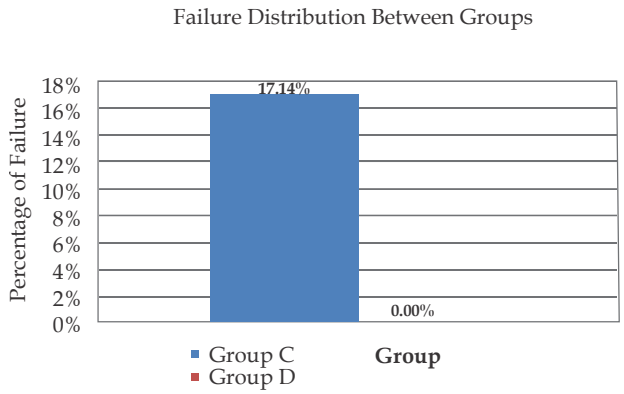

Fig. 2: Bar Diagram Showing Failure Distribution between two groups.

In Group C, 20.69% had Recurrence of shivering before the completion of surgery when compared to 0% in Group D. There was moderate significant statistical difference in recurrence between two groups (p=0.01). (Table 1)

In Group C, 0% had Nausea/ Vomiting compared to 2.86% in Group D which is not statistically significant (p=0.314). In group C 22.86%

Table 1: Recurrence Distribution between two groups.

		Group					
		Group C		Group D		Total	
		Count	%	Count	%	Count	%
Recurrence	Nil	23	79.31%	35	100.00%	64	91.43%
	Yes	6	20.69%	0	0.00%	6	8.57%

Table 2: Nausea/Vomiting, Bradycardia and Hypotension Distribution between two groups.

		Group				Chi Square
		Group C		Group D		
		Count	%	Count	%	
Nausea/ Vomiting	Nil	35	100.00%	34	97.14%	χ 2 =1.014, df =1, p = 0.314
	Yes	0	0.00%	1	2.86%	
Bradycardia	Nil	27	77.14%	34	97.14%	χ 2 =6.248, df =1, p = 0.012*
	Yes	8	22.86%	1	2.86%	
Hypotension	Nil	27	77.14%	34	97.14%	χ 2 =6.248, df =1, p = 0.012*
	Yes	8	22.86%	1	2.86%	

had Bradycardia and Hypotension and in group D it was only 2.86 %. There was moderate significant difference in Bradycardia and hypotension between two groups (p=0.012).(Table 2)

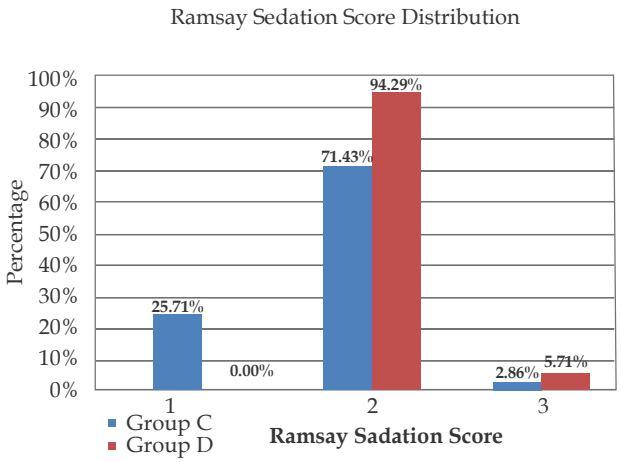

Fig. 3: Bar Diagram Showing Ramsay Sedation Score Distribution between two groups.

In Group C, 25.71% had RSS score of 1, 71.43% had RSS score of 2 and 2.86% had RSS score of 3. In Group D, 0% had RSS score of 1, 94.29% had RSS score of 2 and 5.71% had RSS score of 3. There was strong significant difference in Ramsay sedation scale between two groups (p=0.005).(Fig. 3)

Discussion

Shivering is seen as one of the most common complications after regional anaesthesia as well as those recovering from general anaesthesia. Shivering incidence following spinal anaesthesia seems to be 19%–33%. It is a very unpleasant and distressing experience for the patients which is also associated with adverse physiological effects including increase in oxygen consumption, increased carbon dioxide production and increased minute ventilation. This in turn induces arterial hypoxemia, lactic acidosis, increased intra ocular pressure and intra cranial pressure. Shivering will also interfere with the monitoring parameters like Electrocardiogram, Noninvasive blood pressure and Pulse oximetry etc. Spinal anaesthesia is known to decrease thresholds of vasoconstriction and shivering. There will be redistribution of heat from core to periphery following spinal anaesthesia induced vasodilation. Various pharmacological and non- pharmacological methods are available for the control of shivering. Pharmacological methods was done using a variety of drugs like Pethidine, Morphine, Tramadol,[8,9] Clonidine, Dexmedetomidine, Ketamine, Magnesium sulphate[10] However, there is always a quest for more safer and efficacious drug. There is comparatively less studies on Dexmedetomidine and Clonidine as antishivering agents in caesarean section.[11]

The present study was done in 70 patients in two groups of 35 each who developed post spinal shivering in Lower segment caesarean section. Group 'C' received intravenous clonidine 1microgram/kg whereas Group 'D' received intravenous dexmedetomidine 0.5microgram/kg.[12]

Earlier studies were conducted by Manohar Panneer et al with intravenous Dexmedetomidine (0.5 microgram/kg) and Clonidine (1 microgram/kg) for postspinal shivering in patients undergoing lower limb orthopedic surgeries and a similar study was done by Rajagopalanvenkatraman et al[13] with intravenous Dexmedetomidine (0.5 microgram/kg), Clonidine (1 microgram/kg) and

Tramadol (1 milligram/kg)[14] which showed that Dexmedetomidine is a good anti shivering agent compared to Clonidine with minimal side effects if any which is easily treatable.[15,16] Dexmedetomidine is having the added advantage of giving good sedation.

In our study, the time taken to stop shivering after administration of study drug in clonidine group was 5.48±0.91 minutes and who received Dexmedetomidine was 2.26±0.44 minutes which is statistically significant (p value<0.001). We observed that Dexmedetomidine has faster onset of action compared to Clonidine. Our results are in correlation with study done by Manohar Panneer et al on post spinal shivering in patients undergoing lower limb orthopedic surgeries. They noticed that the mean time taken for clonidine was 5.54± 0.58 minutes and Dexmedetomidinewas 2.23±0.43 minutes which also proved that Dexmedetomidine has faster action in terms of antishivering property.[17]

In our study, the response rate and the percentage of patients whose shivering stopped by treatment within 15 minutes were compared and found to be 100% in Dexmedetomidine group and 82.86% in clonidine group with failure in 6 patients out of 35 (failure rate 17.14%). Hence, we observed that Dexmedetomidine has better efficacy in treatment of shivering when compared to clonidine. Our results were similar to the study done by Manohar Panneer et al where response rate with Dexmedetomidine was 100% and with clonidine was 82.86% respectively and failure rate was 17.14% with Clonidine. This showed that Dexmedetomidine is more efficient than clonidine in treatment of post spinal shivering.[18]

Recurrence of shivering before the end of surgery was also noted in our study and recurrence rate was calculated. There was no recurrence in Dexmedetomidine group. However, in Clonidine group, 6 cases had recurrence out of 29 cases who responded to Clonidine. The recurrence rate was 20.69% which is statistically significant. Patients treated with Dexmedetomidine had less recurrence of shivering when compared with Clonidine. In a study done by Rajagopalan Ventraman et al, they reported recurrence rate of 3.3% in Dexmedetomidine group and 10% with Clonidine. Here more recurrence was noticed in Dexmedetomidine group probably due to prolonged duration of surgery.[17]

The side effect profile of both the drugs was studied and we noted that one patient who received Dexmedetomidine 0.5 microgram/kg had episodes of hypotension and bradycardia and in patients who received Clonidine, there was 22.86% incidence of hypotension with bradycardia which is statistically significant (p = 0.012).

Only one patient in Dexmedetomidine group complained of nausea which is statistically insignificant. This is in accordance with the study done by Manohar Panneer et al where they noticed that the incidence of hypotension and bradycardia is less with Dexmedetomidine when compared to clonidine which they attributed to less selective action of clonidine on alpha 2 receptors.[19]

We studied sedation properties of both the drugs and noticed that none of the patients in either of the group had profound deep sedation (sedation score > 3) or respiratory depression.[20] In Dexmedetomidine group, 94.3% had Ramsay sedation score of 2 and 5.7% had sedation score of 3. In clonidine group, 25.7% had no sedation and 71.4% achieved Ramsay sedation score of 2 and 2.9% had sedation score of 3. These findings were in agreement to the work done by Rajagopalan Venkatraman et al where they noted higher sedation scores with use of Dexmedetomidine, 70% had a sedation score of 2 and 23% had a score of 3(17).[21] They concluded that sedation achieved during treatment of shivering was beneficial in these patients under spinal anaesthesia and contributed it to the alpha 2 agonist properties of drug. However, no respiratory depression was observed in both groups. The limitation of our study was that we took relatively smaller size sample. A larger study may be needed to evaluate the side effects.

Conclusion

Dexmedetomidine 0.5 microgram/kg intravenously is more efficient than intravenous Clonidine 1 microgram/kg in treatment of shivering with respect to faster onset of action, better response rate, lesser recurrence rate and decreased side effects and an added advantage of better sedation.

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