Original Article

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Comparative Evaluation of Effect of Dexmedetomidine Versus Normal Saline on Blood Glucose Levels in Diabetes Mellitus Patients Undergoing Spinal Anaesthesia Surgeries

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Abstract

Context: Surgical trauma gives rise to a stress response in the human body resulting in hyperglycaemia in the perioperative period. This adversely affects the patient's outcome. Hyperglycaemia is particularly detrimental in patients with diabetes mellitus. Dexmedetomidine, an alpha 2 adrenoreceptor agonist attenuates this surgical stress response and helps in preventing perioperative hyperglycaemia.

Aims: The aim of our study was to monitor and compare the effect of dexmedetomidine versus normal saline on blood glucose levels intraoperatively and postoperatively in patients with diabetes mellitus undergoing spinal anaesthesia surgeries. Other objectives were, to compare haemodynamic changes, ramsay sedation scores intraoperatively andthe requirement of analgesia in the postoperative period between both the groups.

Methods: A double blind prospective randomized controlled study was conducted in a tertiary hospital. Out of 60 patients with diabetes mellitus, 30 random patients were administered with intravenous dexmedetomidine after giving spinal anaesthesia. The other half of patients received a placebo. Vital parameters and blood glucose levels were monitored and compared in both the groups.

Statistical analysis used: Data was tabulated and compared using unpaired T-test.

Results: Statistically significant differences were found in mean heart rate and blood pressure between both the groups. The differences in the blood sugar values in the intra operative period and the postoperative period between both the study groups were also statistically significant. Requirement of additional postoperative analgesics were also considerably less in the dexmedetomidine group.

Conclusion: Intravenous dexmedetomidine attenuates the surgical stress response by inhibiting the adrenal surge and prevents hyperglycaemia.

Keywords: Dexmedetomidine; Surgical stress; Hyperglycaemia.

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Introduction

Surgery is a stressful condition. In response to skin incision, blood loss, major intercompartmental fluid shifts, pain and infectionthere is increased cortisol levels along with other catabolic hormones resulting in substrate mobilization, gluconeogenesis, protein breakdown etc.[1,2] Patients suffering from diabetes mellitus have an impaired glucose metabolism which predisposes them to hyperglycaemia.[3] Alpha 2 adrenoreceptor agonists such as clonidine and dexmedetomidine inhibit the sympathetic response as a result of surgical stress.

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Other methods used in this aspect are, high dose benzodiazepines, opioids and regional anaesthetic techniques.[4] Dexmedetomidine is also widely used for procedural sedation and for sedation in the critically ill.[5,6,7]

Methods

After obtaining approval from the ethical committee, a prospective double blind randomized clinical study was conducted in a tertiary hospital, Pune, India. 60 patients aged 30-70 years with controlled diabetes mellitus and belonging to ASA physical status II, posted for elective surgeries under spinal anaesthesia were enrolled. Preop evaluation was done for each patient and HBA1c values were measured to exclude those with uncontrolled diabetes mellitus. Patients with severe cardiovascular disease, renal or hepatic dysfunction, mental retardation, or coagulation abnormality were excluded from the study.

Written informed consent was obtained from each patient and on the day of surgery, standard monitors were attached in the OR and vital parameters were noted. Blood sugar level was measured as the preop value using a portable glucometer. Patients were preloaded with normal saline and spinal anaesthesia was administered using standard protocol. After obtaining adequate sensory and motor level, 30 patients selected randomly by chit technique were administered with intravenous dexmedetomidine infusion (group D) at 0.5 mcg/kg over 10 minutes. The other 30 patients (group P) were administered normal saline of similar volume as placebo. Vital parameters along with degree of sedation using Ramsay sedation scores were closely monitored for each patient throughout the intraoperative period. After 1 hour of injection of dexmedetomidine/ placebo, an intraoperative measurement of blood glucose level was taken. Further readings of blood glucose levels were taken at 1 hour, 3, 6 and 12 hours postoperatively. Adverse effects such as hypotension, bradycardia, hypoglycaemia, and nausea and vomiting were watched for.

Statistical analysis

Results were tabulated and were analysed using unpaired T test and SPSS software.

Results

The gender, age group, and HBA1C values of patients in group D were comparable with those in group P. preoperative Blood glucose levels of all the patients were also comparable amongst both the study groups. Heart rate, systolic, diastolic and mean arterial blood pressures of patients belonging to group D were lower when compared to those of group P and these differences were statistically significant. Ramsay sedation scores of the patients showed that patients in group D were better sedated compared to those in group P and this difference was again statistically significant. Requirement of postoperative analgesia was significantly higher in the patients who did not receive dexmedetomidine intraoperatively. None of the patients in either group had any adverse effects in the postoperative period.

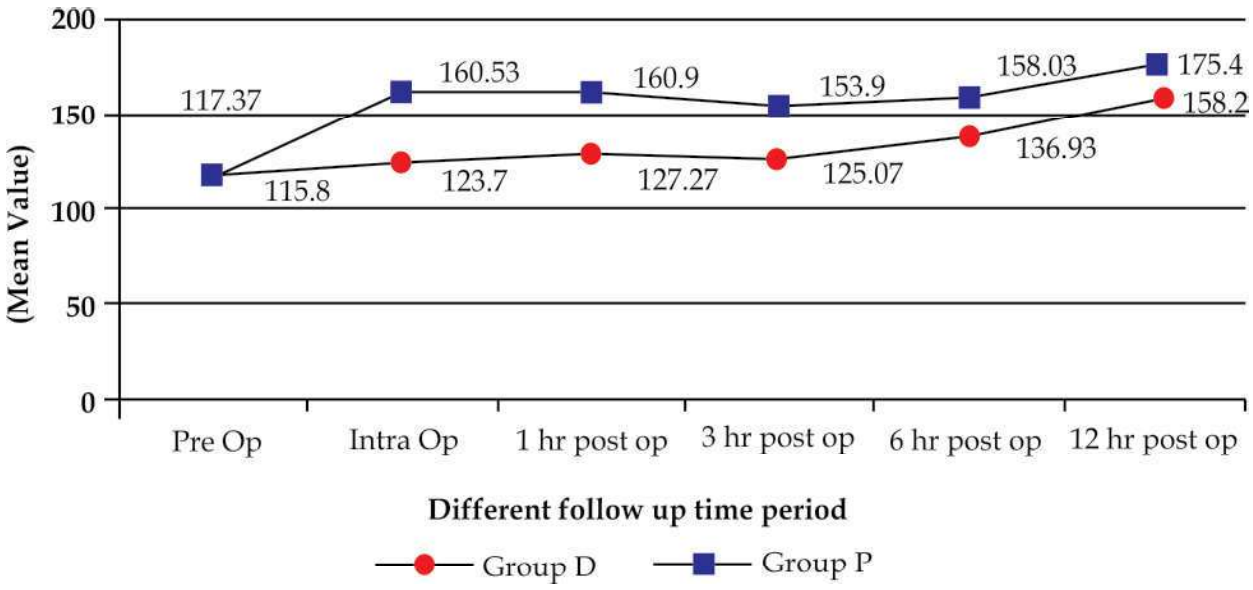

Fig. 1: Trend line diagram of comparison of mean BSL (mg/dl) between two groups.

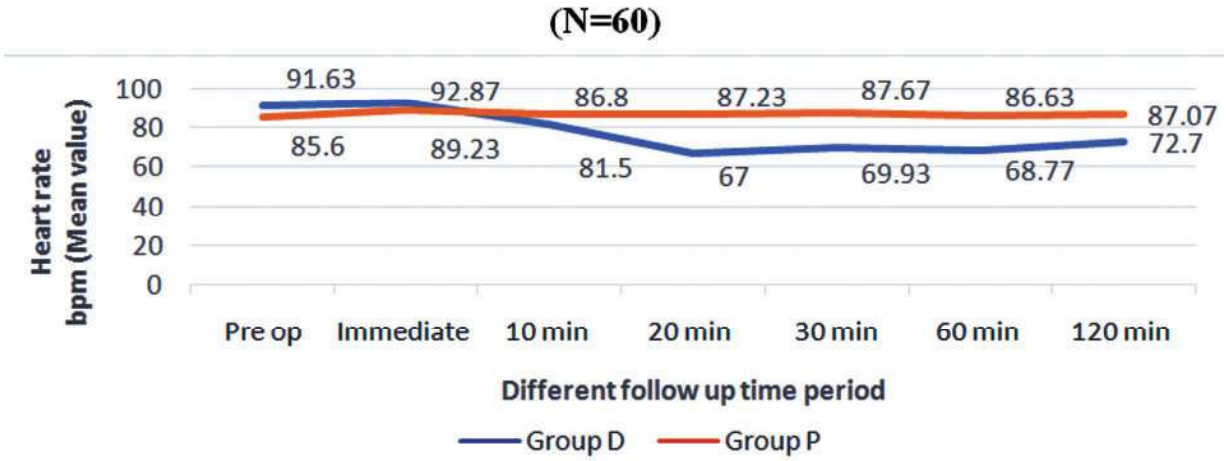

Fig. 2: Trend line diagram of comparison of mean heart rate between two groups.

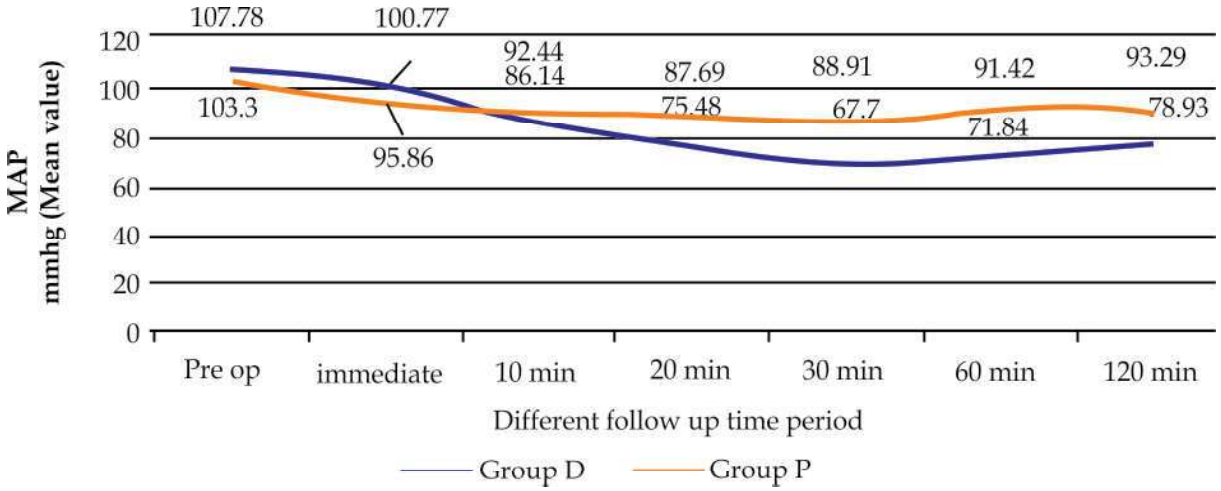

Fig. 3: Trend line diagram of comparison of mean MAP between two groups.

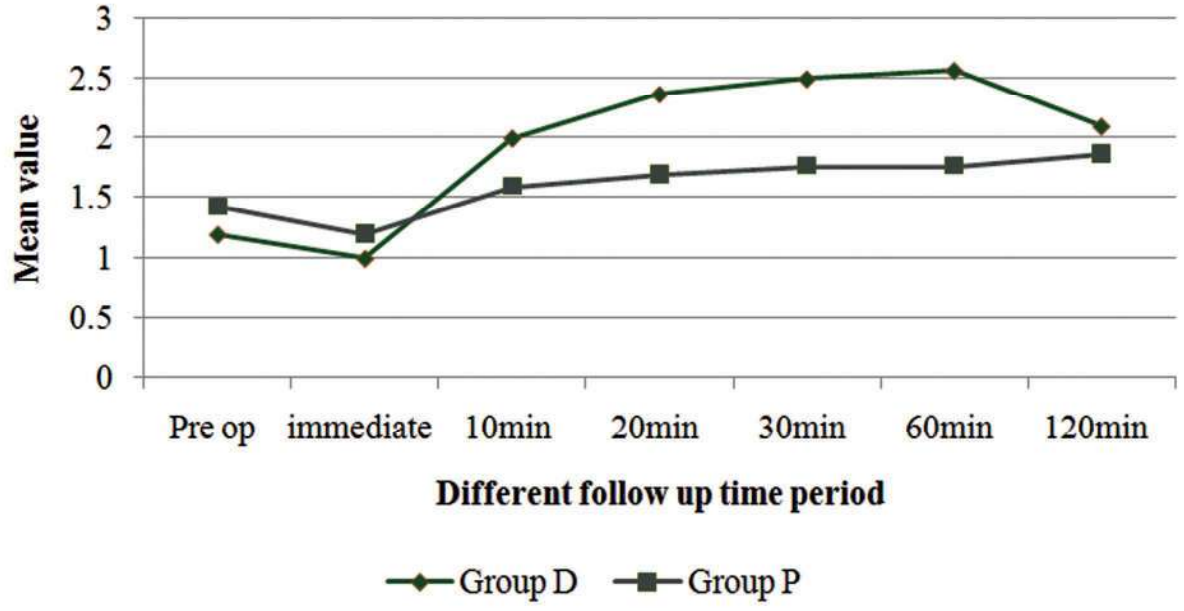

Fig. 4: Trend line diagram of comparison of mean Ramsay Sedation Score(RSS) between two groups (N=60).

Discussion

Surgical stress response has adverse effects on the patient's outcome depending on the intensity of surgical trauma. Perioperative hyperglycemic response has a direct relation with morbidity and mortality. These surges in blood glucose levels are mostly due to the endogenous sympatho-adrenal response. It is very much necessary to blunt the surgical stress response.

In our study, we have administered intravenous dexmedetomidine in patients undergoing spinal anesthesia surgeries to control the hyperglycemic response intraoperatively. Although, regional anesthetic technique itself controls the BSL rise intraoperatively, additional use of alpha 2 adrenergic receptor agonists has a better outcome.

Total number of patients studied were sixty, of age group of 30-70 years and belonging to ASA physical status II with controlled diabetes mellitus with respect to HBA1C. the surgeries under spinal anaesthesia with a duration of 1.5-2.5 hours were considered. Each patient in Group D received 0.5mcg/kg of intravenous dexmedetomidine after administration of spinal anaesthesia. All patients of group P received placebo (normal saline). We observed BSL preoperatively, at 1hour post injection intraoperatively and postoperatively at 1,3,6 and 12 hours in both the study groups.

Table 1 shows that mean age of patients (group D – 54.27 ± 10.53 years, group P – 53.47 ± 9.13 years, p value – 0.754) and HBA1C values (Group D - 5.98%, Group P - 5.91%) are comparable in both the groups. In the study conducted by **Hui Yun et al**[8], the mean HBA1C levels were 7.4% and 7.2% in the saline group and dexmedetomidine, respectively and were at slightly higher levels compared to ours. As shown in table 1, the mean BSL in preoperative period were comparable in both groups (Group D – 115.80 ± 11.97mg/dl, Group P - 117.37 ± 11.58 mg/dl; p value – 0.608). Mean BSL in the intraoperative period after 1 hour of dexmedetomidine injection was 123.70 mg/dl while in the placebo group it was 160.53 mg/dl. In the post-operative period after the 1st hour, the mean BSL in group D was 127.27mg/dl while it was 160.90 mg/dl in group P. Similarly, the mean BSL values in the subsequent postoperative period i.e., at 3 hours, 6 hours and at

Table 1: Comparison of results between Group D and Group P.

		Group D	Group P	p- value
Mean Age(years)		54.27 ± 10.53	53 .47 ± 9.13	0.754
Mean HBA1C(%)		5.98 ± 0.27	5.91 ± 0.27	0.372
Mean Blood sugar levels (BSL) (mg/dl)	preop	115.80 ± 11.97	117.37 ± 11.58	0.608
	Intraop	123.70 ± 11.14	160.53 ± 12.01	<0.001*
	1hr post op	127.27 ± 12.81	160.90 ± 16.67	<0.001*
	3hr post op	125.07 ± 13.49	153.90 ± 16.37	<0.001*
	6hr post op	136.93 ± 15.69	158.03 ± 17.34	<0.001*
	12hr post op	158.20 ± 14.16	175.40 ± 21.07	0.001*
Mean Heart Rate (beats per minute)	Immediately after injection	92.87 ± 8.52	89.23 ± 8.44	0.102
	10 min	81.50 ± 8.03	86.80 ± 5.93	0.005*
	30 min	69.93 ± 11.69	87.67 ± 7.03	<0.001*
	120 min	72.70 ± 13.32	87.07 ± 11.58	<0.001*
Mean MAP(mmhg)	Immediately after injection	100.77 ± 6.14	95.86 ± 7.27	0.006*
	10min	86.14 ± 10.05	92.44 ± 5.52	0.004*
	30min	67.70 ± 3.38	88.91 ± 8.09	<0.001*
	120min	78.93 ± 6.38	93.29 ± 6.42	<0.001*
Mean Ramsay sedation score	Immediately after injection	1.26 ± 0.44	1.20 ± 0.41	0.586
	10min	2.00 ± 0.00	1.60 ± 0.50	<0.001*
	30min	2.50 ± 0.51	1.77 ± 0.43	<0.001*
	120min	2.10 ± 0.31	1.87 ± 0.35	0.008*
Requirement of postop analgesia		12 (40%)	20 (66.7%)	0.038*

12 hours were lower in group D when compared to group P and the differences were statistically highly significant. Similar findings were obtained by **Hui Yun et al**[8] where the BSL levels were maintained for upto 24 hours in the Dexmedetomidine group with respect to normal saline. In their study, two patients in the group which had received normal saline were treated with dextrose injection for symptomatic hypoglycemia in the postoperative period while, another two patients had to be treated with insulin for hyperglycemia within first 24 hours of postoperative period. But, in our study we have monitored the BSL upto 12 hours postoperatively and none of our patients had hypoglycemic or hyperglycemic episodes in the observation period. **SS Harsoor et al**[l9] in 2014, had studied 40 cases of abdominal surgeries under general anaesthesia. 20 patients received dexmedetomidine i.v infusion throughout the surgery with an initial bolus dose. The findings were compared with the other group which received placebo. It was observed that after the 1st hour in the postoperative period, the mean blood glucose level in the placebo group was 136.95 ± 19.76 mg/dL while it was 118.2 ± 16.24 mg/dL in the dexmedetomidine group. It was found that this difference in mean BSL was statistically significant. The vital parameters such as heart rate (HR), systolic (SBP), diastolic (DBP) and mean arterial (MAP) blood pressures were observedand the results are shown in the table.

The observations were statistically, highly significant (p value <0.005) in the intraoperative period. Owing to the sympatholytic action of intravenous dexmedetomidine, the mean HR and mean blood pressure values of patients belonging to the dexmedetomidine group were less when compared to the placebo group and these were statistically significant. **SS Harsoor et al**[9] had observed in their study that there was reduction in heart rate in the dexmedetomidine group as compared to the placebo group and this was statistically significant. Although the mean systolic, diastolic, and mean arterial blood pressures were comparable in both of their study groups.

Dexmedetomidine induces sedation which is usually termed as "cooperative sedation" (conscious sedation).[7] We monitored Ramsay sedation score (RSS) in the intraoperative period and the findings are stated in table 1. It was observed that after 10 minutes intraoperatively in group D, the mean RSS was 2 while mean RSS of patients in group P was 1.60 and this was statistically significant. Patients in group D were better sedated and were cooperative with changes in position and verbal commands. Few of the patients of the placebo group were found to be anxious regarding the surgical procedure.

Dexmedetomidine is known for its analgesic effect when administered at a dose of 0.5 mcg/kg. In our study, as shown in table 1, 40% of patients of group D required postoperative analgesia while 66.7% of group P patients required postoperative analgesia and this was statistically significant. In the study conducted by **Hui Yun et al**[8], they found that 60% of normal saline group compared to 10% of dexmedetomidine group required additional analgesics postoperatively, which was a statistically significant. Postoperative pain also contributes to the surgical stress response and may impair the postoperative recovery process. Hence dexmedetomidine administration was found to be beneficial in this aspect.

Conclusion

This study aimed at studying the role of intravenous dexmedetomidine in preventing the surgical stress response. We conclude that dexmedetomidine, when administered in patients with controlled diabetes mellitus undergoing surgeries under spinal anaesthesia, prevents the hyperglycaemic response in the intraoperative period and upto 12 hours postoperatively. Further, haemodynamic parameters i.e., heart rate and blood pressure are better controlled in the intraoperative period. Dexmedetomidine provides sedation and patients remain cooperative to verbal commands and do not undergo respiratory depression. Careful monitoring while administering dexmedetomidine proves beneficial and the anaesthesiologist can avoid any adverse effects in the intraoperative and postoperative period.

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