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ORIGINAL RESEARCH

Effect of Dexmedetomidine as an adjunct in off pump Coronary Artery Bypass Grafting: Changes in haemodynamics and pain perception post extubation

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Abstract
Background: Dexmedetomidine has been used in neurosurgery, cardiac surgery, and bariatric surgery, as well as critical care unit as a sedative analgesic. The present study was conducted to assess the effect of Dexmedetomidine when used as an adjunct in off pump Coronary Artery Bypass Grafting on pain profile and hemodynamic changes after extubation.
Material & methods: Study was conducted in department of Anesthesia, at a tertiary care centre in Bhopal from January 2021 to August 2022 on 90 patients divided in two groups of 45 patients each. In Group A intravenous dexmedetomidine was given and in Group B intravenous saline was given during induction. Primary outcomes studied were effect on hemodynamic parameters during weaning off mechanical ventilation and extubation. Secondary outcomes were effect on postoperative pain. Statistical analysis was done using version 20. (SPSS Inc., Chicago, IL, USA). p value of less than 0.05 was judged to be statistically significant.
Results: Mean heart rate, mean systolic blood pressure, mean diastolic blood pressure at the time of extubation and at 1 hour post extubation was significantly lower in group A as compared to group B.($p<0.01$)
Mean pain scores immediately post extubation, 1 hr and 4 hr post extubation were significantly lower in group A compared to group B($p<0.01$)
Conclusion: Dexmedetomidine may be an acceptable anaesthetic for use as an adjunct in off pump coronary artery bypass surgeries due to haemodynamic stability during weaning from ventilation and significant reduction in post operative pain.
Keywords: Dexmedetomidine, off pump Coronary Artery Bypass Grafting, hemodynamics.

Introduction

Dexmedetomidine is an alpha-2 adrenoreceptor agonist used as a sedative and analgesic.[1] It also lowers blood pressure, produces bradycardia, and inhibits platelet aggregation, renin release, and insulin secretion.[1] Dexmedetomidine-induced sleep and non-rapid eye movement sleep imitate regular sleep hence patients may be readily awakened, resulting in therapeutic benefits for both the individual and health care providers.[2] Dexmedetomidine is known to have sympatholytic effects on hemodynamics at low dosages, while excessive doses may result in increased peripheral vascular resistance and blood pressure (systemic and pulmonary)[3] Dexmedetomidine may be used safely in CABG procedures to maintain steady hemodynamics during the procedure. Furthermore, dexmedetomidine was found to reduce the requirement for inhalational anaesthetics during cardiac surgery.[4]
The present study was conducted to assess the efficacy of Dexmedetomidine when used as an adjunct in off pump Coronary Artery Bypass Grafting on post-operative pain profile, hemodynamics during weaning from ventilator and extubation.

Material & methods

This comparative, observational, single-blinded study was conducted in department of Anesthesia, at a Tertiary Care Centre in Bhopal from January 2021 to August 2022.
After due approval from Institutional ethics committee, inclusion of patients for study was done. Based on previous literature calculated sample size was 90 at 0.05 level of alpha error and 95% level of significance. Patients included in study were divided in two groups of 45 patients each at administering anaesthetists

discretion:

Group A: Study Group (in which dexmedetomidine was given)

Group B: Control Group (in which normal saline was given)

Patients with Coronary Artery Disease undergoing elective Coronary Artery Bypass Grafting (CABG) surgery, patients below the age of 70 years, and with a left ventricular ejection fraction greater than 30% were included in the study. Patients having a left ventricular ejection fraction of less than 30%, those suffering from severe liver and renal disease, above the age of 70, patients having a left main coronary artery blockage of more than 80%, and those suffering from valvular heart disease, or for revision or re-exploration surgery were excluded from the study.

Drugs were prepared in identical syringes and coded by an independent researcher who was not involved in the process of decoding the observations. Drugs were administered to patients at anesthesiologists discretion. Observations were analyzed and decoded by researcher who was unaware of drug administered.

In the pre-anesthetic clinic, patients were evaluated and written informed consent obtained. As per institutional protocol the night before surgery, each patient was given an oral dose of 0.25 mg of alprazolam and 40mg of pantoprazole. On the day of surgery, the patient continued using beta-blockers, calcium channel blockers, however diuretics, angiotensin receptor blockers and angiotensin-converting enzyme inhibitors were discontinued. On arrival in the operating room, patient's heart rate, blood pressure and oxygen saturation was monitored by continuous electrocardiography (ECG), non-invasive blood pressure (NIBP) and pulse oximetry (SpO2) monitor respectively. Baseline heart rate (HR), systolic arterial blood pressure (SBP), diastolic arterial blood pressure (DBP), mean blood pressure (MBP), and arterial oxygen saturation (SpO2) were recorded. 18-gauge peripheral intravenous (IV) cannula was inserted, and radial artery cannulation using 20-gauge cannula was done for invasive blood pressure monitoring. Following the collection of baseline vitals, patients received study drugs in a dose of 0.8 µg/kg over 10 minutes through infusion pump. This was followed by induction of general anaesthsia with Inj.Fentanyl 5 µg/kg, Inj. Thiopentone 5 mg/kg and endotracheal intubation done using Inj.Vecuronium 0.1 mg/kg. CABG was conducted following routine institutional protocol. In post operative period, infusion of Dexmedetomidine was continued in a dose of 0.2 µg/kg/h in the intensive care unit till extubation.

Hemodynamic parameters were noted at the time of extubation, one hour and four hours post extubation(Table 1,2and 3). Change in haemodynamics was noted at the time of extubation in relation to the impact of dexmedetomidine administered intravenously. After extubation, the patient's pain levels were evaluated using the Wong Baker Visual Analogue Pain Scale just after extubation, at 4 hours post extubation and 6 hours post extubation(Table 4). Statistical analysis was done using SPSS version 20 software (SPSS Inc., Chicago, IL, USA version 20). Measures of skewness and Kolmogorov–Smirnov tests of normality were used in order to ascertain whether or not the data were normal. The Student's t-test and the Chi-square test were used to do the analysis on the demographic data. The analysis of the changes that took place over time was done using ANOVA.

Post hoc multiple comparison tests with Bonferroni's correction were used to investigate any statistically significant difference between two sets of data for each variable.

Data were summarized using mean and standard deviation with 95% confidence intervals, and p value < 0.05 was judged to be statistically significant.

Results

Table 1: Comparison of mean heart rate of two groups

Time	Group	Mean± SD	t value	p value
At extubation	**A**	82.4± 4.54	-3.802	<0.01*
	B	103.09± 4.22		
At 1 Hr post extubation	**A**	95.09± 2.77		
	B	104.56± 3.97	-6.191	<0.01*
At 4Hr post extubation	**A**	96.51± 2.65		
	B	96.60± 2.49	-.164	.870

*Statistically significant

Mean heart rate was lower at the time of extubation in group A as compared to group B (82.4±4.54 vs 103.09±4.22) which was statistically significant difference (p<0.01).At 1 hr post extubation mean heart rate in Group A was also significantly lower than group B(95.09±2.77 vs 104.56±3.97 , p<0.01. At 4 hr post extubation difference in mean heart rate was non-significant between the two groups (p 0.870).

Table 2: Comparison of mean systolic blood pressure between two groups

Time	Group	Mean±SD	t value	p value
At extubation	**A**	130.70±5.60		
	B	134.09±5.54	-.265	.792

At 1Hr post extubation	**A**	128.4±6.89		
	B	140.6±6.89	0.000	<0.01*
At 4Hr post extubation	**A**	132.8±5.77		
	B	142.6±5.77	0.000	1.000

Mean ±standard deviation
*Statistically significant

At extubation mean systolic blood pressure between both groups was statistically non-significant (p-0.792), At 1Hr post extubation mean systolic blood pressure was 128.4±6.89 in group A and 140.60±6.89 in group B which was statistically significant (p<0.01) and at 4Hr post extubation differences in systolic blood pressure was statistically non-significant.(p 1.000).

Table 3: Comparison of mean diastolic blood pressure between two groups:

Time	Group	Mean±	t value	p value
At extubation	**A**	64.18±6.22		
	B	69.71±6.24	-.406	.686
At 1Hr post extubation	**A**	66.04±3.95		
	B	78.2±3.90	-.215	<0.01*
At 4Hr post extubation	**A**	74.02±3.95		
	B	80.02±3.95	0.000	.830

Mean diastolic blood pressure at the time of extubation was 64.18±6.22 in group A and 69.71 ±6.24 in group B which was statistically non-significant (P-0.686). At 1 hr post extubation mean diastolic blood pressure was 66.04±3.95 in group A and 78.2 ±3.90 in group B which was statistically significant (P<<0.01)) and at 4 hr post extubation mean diastolic blood pressure was 74.02±3.95 in group A and 80.02±3.95 in group B which was statistically non-significant (P-.830).

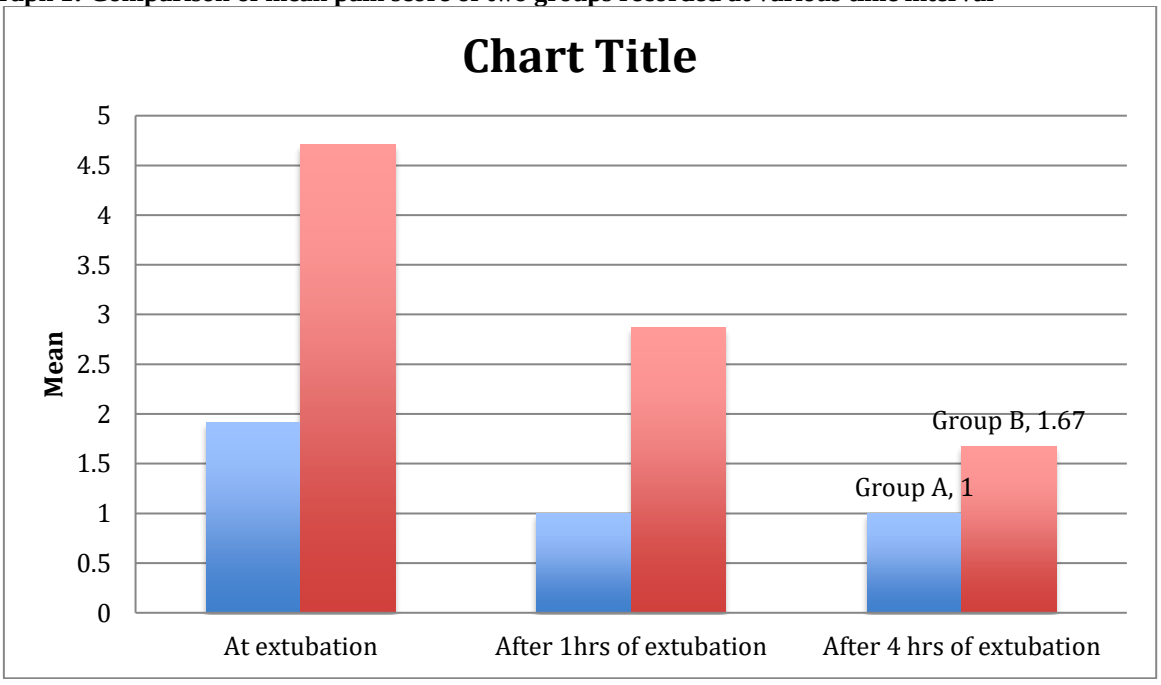
Table 4: Comparison of mean pain score between two groups:

Time	Group	Mean±SD	Std. Deviation	t value	p value
At extubation	**A**	1.91±0.29	.29		
	B	4.71±0.97	.97	-18.596	<0.01*
After 1hrs of extubation	**A**	1.11±0.32	.32		
	B	2.87±0.81	.81	-13.468	<0.01*
After 4 hrs of extubation	**A**	1.00±0.000.64	.00		
	B	1.67±0.0002	.64	-6.992	<0.01*

*Statistically Significant

At the time of extubation mean pain score was 1.91 in group A and 4.71 in group B which was statistically significant (<0.01*). After 1 hour of extubation mean pain score was 1.11 in group A and 2.87 in group B which was statistically significant (<0.01*). After 4 hour of extubation mean pain score was 1.00 in group A and 1.67 in group B which was statistically significant (<0.01*).(Graph – 1).

Graph 1: Comparison of mean pain score of two groups recorded at various time interval



Discussion

In off pump CABG aim is to extubate patients within 1-6 hours after cardiac surgery[5]

In the postoperative period.cardiovascular changes such as hypertension and tachycardia due to pain or during tracheal extubation are potentially detrimental and increase the risk of myocardial ischemia and infarction.[6] The results of the present study illustrated that dexmedetomidine 0.8 µg/kg as an initial loading dose, followed by a continuous infusion of 0.2 µg/kg/h in the intensive care unit and also maintained stable hemodynamics in the ICU patients undergoing CABG surgery.

In our study we found that mean heart rate at the time of extubation and at one hour post extubation was significantly lower in group A compared togroup B (p<0.01*). This difference was not seen at 4hr post extubation (p-0.870). This can be attributed to the cessation of effect of dexmedetomidine which has an elimination half life of 2.1-3.1 hr[7]

We observed that the mean systolic blood pressure at the time of extubation was 130.70 in group A and 134.09 in group B which was statistically non-significant (p-0.792*), At 1Hr post extubation mean systolic blood pressure was 128.4 in group A and 140.6 in group B which was statistically significant (p<0.01*) and At 4Hr post extubation mean systolic blood pressure was 132.8 in group A and 142.6 in group B which was statistically non-significant (p-1.0).

We found that the preoperative mean diastolic blood pressure at the time of extubation was 64.18 in group A and 69.71 in group B which was statistically non-significant (p-0.686), At 1Hr post extubation mean diastolic blood pressure was 66.04 in group A and 78.2 in group B which was statistically significant (p<0.01*) and At 4Hr post extubation mean diastolic blood pressure was 74.02 in group A and 80.02 in group B which was statistically non-significant (p=.830). This could be possibly due to decreasing effect after stopping of dexmedetomidine infusion.

In the present study, in group A, mean heart rate, mean systolic blood pressure and mean diastolic blood pressure were lower than group B at all time intervals, and the increase in mean heart rate, mean systolic blood pressure and mean diastolic blood pressure after all types of intense noxious stimuli was lower in group A as compared to group B, thereby showing that dexmedetomidine resulted in attenuation of pressor response to endotracheal extubation.

Our results are in agreement with the previous studies by Menda et al.,[7] Bajwa et al.[8] and Laha et al.[9] who have reported similar attenuation of the pressor response to laryngoscopy and intubation by using dexmedetomidine in a dose of 1 µg/kg and concluded that dexmedetomidine can safely be used to attenuate the hemodynamic response to endotracheal intubation.

In this study , immediately after extubation mean pain score was 1.91 in group A and 4.71 in group B which was statistically significant (<0.01*). After 4 hr of extubation mean pain score was 1.11 in group A and 2.87 in group B which was statistically significant (<0.01*). After 6 hr of extubation mean pain score was 1.00 in group A and 1.67 in group B which was statistically significant (<0.01*).

Our findings reflect those of Basaret al.[11] and Kumari et al.[12] who measured the mean pain score of two groups at various time intervals. The mean pain score at the time of extubation , at 4 hours and at 6 hours post extubation was significantly lower in dexmedetomidine group compared to placebo group.

Conclusion

Dexmedetomidine may be an acceptable anaesthetic adjunct for therapeutic usage in off pump coronary artery bypass grafting. The administration of dexmedetomidine during surgery results in better haemodynamics durig weaning and extubation and lower pain scores.

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