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Original Research Article

Effects of preoperative dexmedetomidine on the occurrence of postoperative delirium in adult cardiac surgery patients

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ABSTRACT

Background: Postoperative delirium (POD) is a serious complication in elderly patients undergoing cardiac surgery. This study was aimed at investigating the effect of perioperative administration of dexmedetomidine for general anesthesia maintenance on occurrence and duration of POD in elderly patients after cardiac surgery.
Methods: This randomized control trial was done in central India after the institution's ethical committee gave their approval. One hundred and sixty-four patients were enrolled after cardiac surgery. Each patient gave their written consent after being fully informed. Patients over 60 years' old who were going to have heart surgery were included in the study.
Results: The difference in POD incidence between the dexmedetomidine and propofol groups was not statistically significant (p=0.0758). When compared to patients receiving propofol, patients receiving dexmedetomidine had a median delirium onset time that was delayed (second day vs. first day) and a shorter median delirium duration (2 days versus 3 days). Additionally, the patients receiving dexmedetomidine showed a lower VAS score and less use of opiate analgesics. Regarding other postoperative results, no difference was seen.
Conclusions: Dexmedetomidine administration during cardiac surgery decreased the incidence, postponed the onset, and shorten the duration of POD in elderly patients.

Keywords: Dexmedetomidine, Postoperative delirium, Anesthesia, Cardiac surgery, Elderly patients

INTRODUCTION

A frequent central nervous system condition known as delirium is marked by severe attentional impairments. It frequently happens in the first few days following surgery. Postoperative delirium is caused by numerous risk factors. The pathophysiology of postoperative delirium is still unknown as of this writing. One hypothesis, the cholinergic theory, claims that the theories of stress response and inflammatory response need more research. Age-related increases in delirium prevalence range from 11% to 51% among older surgical patients.[1] Despite the fact that delirium symptoms are typically brief, they have a detrimental impact on patients' long-term results and are linked to higher mortality rates, cognitive dysfunction, a longer hospital stay, and a lower quality of life.[1,2] Preventing postoperative delirium is crucial as the population ages and the number of older individuals undergoing surgery rises. Antipsychotics, acetylcholinesterase inhibitors, and sleep-wake cycle regulators, for example, have all been studied for effectiveness in reducing postoperative delirium.[3,4] The outcomes of these investigations are contradictory, nevertheless. There is currently no strong evidence to support the use of pharmaceuticals for either prevention or therapy.[1] Dexmedetomidine is a highly selective 2 adrenergic agonist with a variety of postoperative effects that could be advantageous. These outcomes include

opioid-sparing qualities, a reduction in the need for anaesthesia, and neuroprotective outcomes.[5] Dexmedetomidine, for instance, affects the hypothalamic-pituitary-adrenal axis to attenuate the systemic stress response. ICUs typically use dexmedetomidine as their first-line sedative. However, it is still unclear how it will affect patient outcomes. Dexmedetomidine (0.1 g/kg/h) administered intravenously in a significant randomized controlled trial with 700 patients undergoing non-cardiac surgery decreased the incidence of postoperative delirium.[6]

However, Deiner et al's subsequent randomised controlled experiment revealed that dexmedetomidine had no impact on postoperative delirium.[7] There hasn't yet been a meta-analysis of randomised, controlled trials that looked at whether giving dexmedetomidine before surgery lessens postoperative delirium. Thus, we compared the effects of dexmedetomidine treatment during surgery with a placebo (another sedative medication) on the likelihood of developing postoperative delirium.

METHODS

This randomized control trial was done in164 patients central India at the department of anesthesia and general surgery, Pacific Institute of Medical Sciences, Udaipur, Rajasthan, from 2021 to 2022. After the institution's Ethical Committee gave their approval. Each patient gave their written consent after being fully informed. Patients over 60 years' old who were going to have heart surgery were included in the study. Patients were taken out of this study if they had: a history of psychiatric diseases; an inability to communicate; a history of POD; preoperative sick sinus syndrome, severe bradycardia (heart rate 50 beats per minute), second-degree or above atrioventricular block without a pacemaker; and severe hepatic or renal insufficiency. Patients were put into two groups—the dexmedetomidine group and the propofol group—based on random numbers generated by a biostatistician and SAS 12.0. (SAS Institute, Cary, NC). The people in both groups were given 0.05 mg/kg of midazolam, 1-2 microgm/kg of fentanil, 1.5–2 mg/kg of propofol, and 0.2 mg/kg of cisatracurium. Intravenous infusion was switched to a maintenance syringe pump at a rate of 50–80 mg/kg/h for propofol and 0.05–0.08 microgm/kg/h for fentanil, with 0.4–0.6 g/kg/h of dexmedetomidine (DEX group) or without dexmedetomidine (PRO group). The patient state index was used with a Sedline® monitoring sensor to track how deep the anaesthesia was (PSI, Masimo, Irvine, CA, USA). Patients in the intensive care unit (ICU) were given propofol (25–50 mg/kg/h) to help them sleep after surgery. Before surgery, patients were told how to use the VAS (0 for no pain to 100 for the worst pain possible) and the iv PCA pump (50 mg morphine and 8 mg ondansetron in 100 ml saline, every pump press resulting in a 2 ml infusion).

The data were shown as mean SD, and the SAS statistical package was used to look at them. The chi-squared test was used to look at different percentages. Hodges-method Lehmann's is used to estimate the difference between two medians and the 95% CI for that difference. P values of less than 0.05 were thought to be statistically significant.

RESULTS

Characteristics of the two research groups' demographics.

Four patients in the PRO group declined to participate in the assessment due to personal reasons. Demographic information revealed a similarity between the two groups. Overall, all of the patients in both groups were older than 60 (range: 62–82), and there were no significant differences in preoperative medications, comorbidities, or surgical features ($p>0.05$).

Table 1 is a detailed presentation of these facts.

In the propofol and dexmedetomidate groups, POD was present in 33 of 84 (39.3%) and 21 of 80 (26.3%), respectively. Comparing patients receiving dexmedetomidine to their placebo controls, the median onset time of delirium was delayed and the duration of delirium was decreased (Table 2). When compared to the propofol control group in these delirium patients, there was a tendency towards a shorter extubation time in the dexmedetomide group ($p=0.00$). However, there was no distinction between hospital and ICU stays in terms of length of stay (Table 2).

Results following surgery in the two groups Both study groups had identical lengths of hospital and intensive care unit stays, as well as requirements for permanent pacemakers, blood product transfusions, and inotropic/vasoconstrictor support (Table 3). The average of the previous five days was used to analyse the 24-hour VAS score and morphine intake. Furthermore, included was the VAS score range and morphine consumption. When compared to the propofol control group, patients in the dexmedetomidine group had considerably reduced VAS pain levels and morphine needs (Table 3).

Postoperative complications Only non-cardiovascular adverse effects were noted in the current investigation because cardiovascular adverse effects were mostly influenced by preoperative illnesses and comorbidity. The overall incidence of unfavorable non-cardiovascular outcomes was similar (Table 4).

Table 1: Baseline demographics and surgical characteristics of the two study groups.

Characteristics	DEX group (n=84)	PRO group (80)
Age, years, mean (SD)	74.7 (7.2)	74.2 (7.7)
Female, n (%)	21 (25)	24 (30)

Continued.

Characteristics	DEX group (n=84)	PRO group (80)
Preoperative medications, n (%)		
Statins	65 (77.4)	66 (82.5)
Beta-blockers	45 (53.6)	44 (55)
Aspirin	60 (71.4)	58 (72.5)
Angiotensin converting enzyme inhibitors	33 (39.3)	29 (36.3)
Calcium channel blockers	25 (29.8)	29 (36.3)
Antidepressants	12 (14.3)	13 (16.3)
Hemoglobin, g/l, mean (SD)	135.5 (21.2)	137.3 (19.7)
Creatinine, micro-M, mean (SD)	86.6 (23.2)	87.3 (22.9)
Surgery types, n (%)		
Coronary bypass grafting	55 (65.5)	52 (65)
Number of distal anastomoses, median (range)	3 (1–5)	3 (1–5)
Mitral valve	8 (9.5)	10 (12.5)
Aortic valve	50 (59.5)	51 (63.4)
Tricuspid valve	3 (3.6)	2 (2.5)
Replacement ascending aorta	10 (11.9)	11 (13.6)
Hypothermic circulatory arrest	6 (7.1)	6 (7.5)
Cardiopulmonary bypass time, min, mean (SD)	110.8 (25.2)	115.1 (28.9)
Cross-clamp time, min, mean (SD)	84.2 (22.4)	87.7 (24.8)

DEX: dexmedetomidine; PRO: propofol

Table 2: Delirium and other postoperative outcomes in patients with delirium.

Outcomes	DEX group	PRO group	P value
Number of delirium (%)	33 (39.3)	21 (26.3)	0.0758
Delirium onset, day, median (range)	2 (1–4)	1 (1–4)	0.0419
Delirium duration, day, median (range)	2 (1–4)	3 (1–6)	0.0238
Extubation time, hour, median (range)	6 (2–24)	10 (2–209)	0.0000
ICU stay time, hour, median (range)	26.8 (22.9–36.8)	29.6 (23.8–35.9)	0.057
Hospital stay time, day, median (range)	20.5 (15.9–34.5)	29.8 (21.2–36.5)	0.1424

DEX: dexmedetomidine; PRO: propofol

Table 3: Postoperative outcomes in the two study groups.

No. of patients (%)	DEX group (n=84)	PRO group (n=80)	P value
Iontrope/vasoconstrictor use	80 (95.2)	80 (100)	0.4810
Reexploration for bleeding	44 (52.4)	45 (56.3)	0.6191
Permanent pacemaker insertion	6 (7.1)	7 (8.8)	0.7033
Atrial fibrillation	7 (8.3)	6 (7.5)	0.8435
Blood product transfusion	55 (65.5)	57 (71.3)	0.4270
24-hour pain evaluation (VAS score), median (range)	30 (0–80)	35 (0–85)	0.0309
24-hour morphine consumption (mg), median (range)	12 (8–35)	21 (12–40)	0.0222

DEX: dexmedetomidine; PRO: propofol

Table 4: Non-cardiovascular postoperative adverse effects.

No. of patients (%)	DEX group	PRO group	P value
Return to operation room	2 (2.4)	2 (2.5)	0.9606
Reintubation within 5 days	1 (1.2)	3 (3.8)	0.2882
Acute kidney injury or failures	2 (2.4)	2 (2.5)	0.9606
Nausea	14 (16.7)	20 (25)	0.1882
Infection	0	0	1.00

DEX: dexmedetomidine; PRO: propofol

DISCUSSION

POD, which affects 11% to 51% of surgical patients, including those who had heart surgeries, is a very common complication with high surgical prevalence.[8] In this article, we found that when compared to general anaesthesia based on propofol, demedetomidine did not lower the incidence of delirium. Additionally, demedetomidine had no impact on postoperative side effects that weren't cardiovascular. Both the extubation time and the amount of morphine needed for opiate analgesia were significantly different.

Dexmedetomidine intraoperative use is one example of anaesthesia management that has been unmistakably linked to a reduction in POD prevalence. Using prophylactic low-dose dexmedetomidine reduced the incidence of POD in ICU patients by an impressive 13% absolute reduction (from 22% to 9%), according to a recent clinical research study conducted in the People's Republic of China on 700 patients.[9] In patients who had undergone cardiac surgery, a more recent study from the same team found no evidence of a significant anti-delirium effect of intraoperatively administered dexmedetomidine.[10] Additionally, compared to morphine and propofol, dexmedetomidine used for ICU sedation significantly reduced the incidence of POD from 15% to 8.5% and from 31.5% to 17.5%, respectively, after cardiac surgeries.[11,12] However, a recent review found that the vast differences and heterogeneity among the pooled studies made it unlikely that dexmedetomidine treatment would significantly reduce the incidence of delirium.[13] Dexmedetomidine treatment did not significantly reduce the incidence of delirium in this study. Our findings demonstrated that the temporary effects of dexmedetomidine general anaesthesia on surgical stress.

The pathophysiology of delirium following general anaesthesia or surgery is still unknown, but dexmedetomidine's potential mechanisms for inducing a delirium-sparing effect have been thoroughly reviewed and well-interpreted.[11,12] And these mechanisms relieved the vicious cycle that surgery and anesthesia-induced postoperative pain, fatigue, and acute stress, as well as improved sleep quality after general anaesthesia or in critically ill patients, significant opioid- sparing effects without respiratory depression, significant remission of postoperative fatigue, and significant opioid- sparing effects without respiratory depression.[14-16] Dexmedetomidine's many advantageous characteristics could have contributed to the outcome of the current study. Despite the fact that postoperative sedation with propofol and general anaesthesia with propofol have been scheduled standards of clinical practise following cardiac surgery, the current study suggested that dexmedetomidine might be a desirable adjuvant and alternative.

One year after surgery, major adverse cardiac events (MACE) were found to be strongly associated with both postoperative frailty and POD, with POD being a stronger predictor of MACE than frailty.[17] Preoperative exercise capacity was strongly associated with the incidence of potential POD in patients undergoing elective cardiac surgery, according to other researchers.[18,19]

Limitations

However, there was no discernible difference in the incidence of POD.

CONCLUSION

When compared to propofol-based general anaesthesia in elderly patients undergoing cardiac surgery, the perioperative administration of dexmedetomidine-based general anaesthesia in the ICU resulted in a shorter extubation time and less need for the opiate analgesic morphine.

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