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Dexmedetomidine vs. propofol sedation in the prevention of postoperative delirium in cardiac surgery – a randomized controlled trial

Mihaela Preveden
University of Novi Sad
Vanja Drljević Todić
University of Novi Sad
Jelena Vučković
University of Novi Sad
Teodora Pantić
Institute of Cardiovascular Diseases Vojvodina
Lućia Simona Perić
Institute of Cardiovascular Diseases Vojvodina
Nikola Bakić
Institute of Cardiovascular Diseases Vojvodina
Nataša Marković
Klinički centar Vojvodine
Milica Jerković
University of Novi Sad
Bojan Mihajlović
University of Novi Sad
Branislav Crnomarković
Institute of Cardiovascular Diseases Vojvodina
Andrej Preveden
andrej.preveden@mf.uns.ac.rs

University of Novi Sad
Srđan Maletin
University of Novi Sad
Đorđe Ubović
Institute of Cardiovascular Diseases Vojvodina
Dragica Andrić
University of Novi Sad
Milanka Tatić

University of Novi Sad

Aleksandar Redžek

University of Novi Sad

Ranko Zdravković

University of Novi Sad

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Abstract

Background

Postoperative delirium (POD) is a common complication after cardiac surgery. This study aimed to compare dexmedetomidine and propofol for postoperative sedation and to evaluate their effects on early POD in patients undergoing coronary artery bypass grafting (CABG).

Methods

This prospective, randomized, controlled, single-blind trial included 300 patients undergoing elective CABG with cardiopulmonary bypass. Patients were randomized 1:1 to receive postoperative sedation with dexmedetomidine (0.1–0.7 μg/kg/h) or propofol (1.5–4 mg/kg/h). POD was assessed using the Confusion Assessment Method for the Intensive Care Unit during the day of surgery and the first postoperative day. Secondary outcomes included mechanical ventilation duration, ICU and hospital length of stay, postoperative atrial fibrillation, and blood transfusion requirements.

Results

POD occurred in 53 patients (17.7%), including 23 (15.3%) in the dexmedetomidine group and 30 (20.0%) in the propofol group (p = 0.364). Dexmedetomidine was associated with lower odds of POD, although without statistical significance (OR 0.724, 95% CI 0.398–1.317; p = 0.290). The median duration of mechanical ventilation was 7.0 hours with dexmedetomidine and 7.5 hours with propofol (p = 0.159). In multivariable analysis, dexmedetomidine was independently associated with shorter mechanical ventilation duration (B=-1.217, β=-0.147; p = 0.010). No significant differences were observed in ICU or hospital stay, postoperative atrial fibrillation, or transfusion requirements.

Conclusions

Dexmedetomidine was associated with a numerically lower incidence of early POD and independently with shorter mechanical ventilation duration compared with propofol, although its effect on POD was not statistically significant.

Trial registration

ClinicalTrials.gov, NCT05849597, retrospectively registered on 09 May 2023.

Background

Delirium is an acute neuropsychiatric syndrome characterized by disturbances in attention, perception, cognition, memory, emotional status, and the sleep–wake cycle. It is typically reversible when the underlying cause is recognized and appropriately treated [1].

Postoperative delirium (POD) is an acute alteration in mental status that develops following major surgical procedures. In most cases, POD develops within the first five postoperative days. POD is one of the most common complications following cardiac surgery, affecting approximately 20–50% of patients. It is associated with prolonged hospitalization, extended intensive care unit (ICU) stay, and increased morbidity and mortality [1–3]. Although delirium is generally considered a reversible condition, it may result in long-term adverse consequences by precipitating a cascade of complications that can lead to persistent cognitive impairment, functional decline, and varying degrees of disability. Consequently, POD has a substantial negative impact on patients' health-related quality of life and their families' well-being, while also imposing a considerable economic burden on healthcare systems through increased treatment costs. Therefore, identifying patients at increased risk and implementing preventive strategies are of paramount importance, particularly in older individuals and those with significant comorbidities or undergoing high-risk surgical procedures [1,3–5].

Dexmedetomidine is a highly selective α2 adrenergic receptor agonist with anxiolytic, sedative, analgesic, and sympatholytic properties. Continuous infusion of dexmedetomidine produces a state of sedation with minimal clinically significant respiratory depression[6–8]. Unlike benzodiazepines or propofol, dexmedetomidine induces a unique form of sedation that closely resembles natural sleep, allowing patients to remain easily arousable and cooperative when appropriately titrated. This pharmacological profile is particularly advantageous in cardiac surgical patients, in whom early postoperative neurological assessment is essential [6,9].

The role of dexmedetomidine in the prevention of POD has not yet been fully elucidated. Current evidence suggests that dexmedetomidine may reduce the incidence of POD by attenuating the systemic inflammatory response through suppression of pro-inflammatory cytokine release triggered by surgical trauma, cardiopulmonary bypass, and ischemia–reperfusion injury [6,10,11]. In addition, dexmedetomidine is believed to mitigate noradrenergic hyperactivity, one of the proposed pathophysiological mechanisms underlying delirium, thereby further contributing to its preventive effects [8,12].

Dexmedetomidine also decreases the need for benzodiazepines and opioids, reducing patients' exposure to medications with well-established deliriogenic potential. Compared with propofol, dexmedetomidine has been associated with a shorter duration of mechanical ventilation and earlier extubation due to its minimal effects on respiratory drive. Consequently, dexmedetomidine may facilitate earlier liberation from mechanical ventilation and potentially reduce ICU-related complications and length of ICU stay [6,11,13].

Therefore, this randomized controlled trial aimed to compare dexmedetomidine with propofol for postoperative sedation and to determine whether dexmedetomidine reduces the incidence of early

postoperative delirium in patients undergoing CABG with extracorporeal circulation.

Methods

This was a prospective, randomized, controlled, single-blind clinical trial in which outcome assessors were blinded to treatment allocation. The study was conducted at the Clinic for Cardiovascular Surgery of the Institute of Cardiovascular Diseases Vojvodina between 01 March 2025 and 01 January 2026. The study protocol complied with the Declaration of Helsinki and was approved by the Ethics Committee of the Institute of Cardiovascular Diseases Vojvodina (approval number: 612-1/1). The procedures were performed after obtaining an informed written consent from the patients. The study adheres to CONSORT guidelines (Supplementary Table 1).

Study population

The study included a total of 300 adult patients undergoing elective coronary artery bypass grafting (CABG) with the use of cardiopulmonary bypass (CPB). Participants were equally allocated into two study groups. Patients in the dexmedetomidine group received postoperative sedation with dexmedetomidine immediately after admission to the intensive care unit (ICU), whereas those in the propofol group received postoperative sedation with propofol. The study included adult patients older than 18 years, with a preoperative left ventricular ejection fraction (LVEF) ≥ 40%, and provision of written informed consent. Patients with a history of major psychiatric disorders, epilepsy, Parkinson's disease, myasthenia gravis, or severe dementia, resting bradycardia (heart rate < 50 beats/min), permanent pacemaker dependency, second- or third-degree atrioventricular block, LVEF < 40%, and clinically significant hepatic and/or renal insufficiency were excluded from the study. Patients were additionally excluded if they declined or withdrew informed consent, failed to complete the epidemiological questionnaire, provide the required medical history, or did not adhere to the study protocol. Before surgery, all participants completed a standardized epidemiological questionnaire designed to collect demographic characteristics, relevant clinical information, and data on lifestyle habits, including cigarette smoking and alcohol consumption. In addition, baseline laboratory test results and hemodynamic measurements were obtained and documented for each patient.

Anesthesia and CPB management

General anesthesia was induced using sufentanil, midazolam, propofol, and rocuronium bromide. Following endotracheal intubation, patients were mechanically ventilated with a gas mixture containing equal proportions of oxygen and air (50:50). Anesthesia was maintained with sevoflurane, while continuous sufentanil infusion provided intraoperative analgesia. Neuromuscular blockade was maintained with supplemental doses of rocuronium bromide administered as required.

Cardiopulmonary bypass was conducted under mild systemic hypothermia (32–34°C), with mean arterial pressure maintained between 60 and 80 mmHg. Myocardial protection was provided using

intermittent antegrade cold crystalloid cardioplegia. Before weaning from CPB, patients were rewarmed to a core temperature of 36–37°C. Upon completion of the surgical procedure, all patients were transferred to the intensive care unit (ICU) for routine postoperative care.

Study design

All 300 patients included in the study were randomized in 1:1 ratio into two groups of 150 patients. Randomisation was performed using a computer-generated randomization sequence. Following ICU admission and confirmation of stable vital signs, patients were randomized in a 1:1 ratio to receive postoperative sedation with either dexmedetomidine (0.1–0.7 μg/kg/h) or propofol (1.5–4 mg/kg/h). Sedation was continued until predefined criteria for weaning from mechanical ventilation and extubation were met. The level of sedation was assessed every two hours using the Richmond Agitation-Sedation Scale (RASS), with a target RASS score of − 2 to 0.

The primary outcome of the study was the incidence of postoperative delirium during the day of surgery and on the first postoperative day. Secondary outcomes included the duration of mechanical ventilation, length of stay in the intensive care unit (ICU), total hospital length of stay, postoperative blood transfusion requirements, and occurrence of postoperative atrial fibrillation.

Postoperative delirium was assessed using the *Confusion Assessment Method for the Intensive Care Unit (CAM-ICU)*, a validated bedside instrument for the detection of delirium in critically ill patients. Patients were screened for delirium every 12 hours during the day of surgery and on the first postoperative day. The occurrence of at least one positive CAM-ICU assessment within this period was considered indicative of postoperative delirium, whereas patients with exclusively negative assessments throughout the observation period were classified as not having developed delirium. CAM-ICU assessments were performed by the on-duty physician every 12 hours during the day of surgery and on the first postoperative day in patients with a RASS score ≥ − 3. Due to the different administration characteristics of the study drugs, treating clinicians could not be blinded. However, postoperative delirium assessments were performed by investigators who were blinded to treatment allocation.

Postoperative analgesia was managed according to protocol (opioid analgesics, non-steroid anti-inflammatory drugs, paracetamol), with pain level assessment using visual analog scale (0 – no pain; 10 – unbearable pain).

The following variables were collected: age, sex, body mass index (BMI), hemoglobin, heart rate, MAP, LVEF, duration of cardiopulmonary bypass (CPB), aortic cross-clamp (ACC) and total operative time. Among the postoperative parameters, the following were registered: duration of MV (in hours), ICU and hospital length of stay (in days), blood product transfusion rates, incidence of postoperative atrial fibrillation and postoperative delirium.

Trial registration

This randomized controlled trial was retrospectively registered at ClinicalTrials.gov under registration number NCT05849597 on 09 May 2023.

Sample size calculation

An a priori power analysis was performed based on the primary outcome, the incidence of postoperative delirium. Based on a previous randomized controlled trial in patients undergoing cardiac surgery, postoperative delirium occurred in 17.5% of patients receiving dexmedetomidine and 31.5% of those receiving propofol. Assuming these event rates, a two-sided alpha level of 0.05, and a statistical power of 80%, a minimum of 146 patients per group was required to detect a statistically significant difference between the two treatment groups. Therefore, the planned sample size was set at 300 patients, with 150 patients allocated to the dexmedetomidine group and 150 to the propofol group, providing an estimated statistical power of approximately 81%.

Statistical analyses

Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR; P25–P75), as appropriate according to the distribution of the data. Categorical variables were presented as frequencies and percentages. The distribution of continuous variables was assessed using the Kolmogorov–Smirnov test. Between-group comparisons were performed using the independent-samples Student's *t*-test for normally distributed continuous variables and the Mann–Whitney *U* test for non-normally distributed variables. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. Changes in the incidence of postoperative delirium between the day of surgery and the first postoperative day were assessed using McNemar's test for paired categorical data.

Binary logistic regression analysis was used to assess the association between postoperative sedation strategy and the occurrence of postoperative delirium. Results of logistic regression analysis were expressed as odds ratios (ORs) with corresponding 95% confidence intervals (CIs). Multivariable linear regression analysis was used to identify factors independently associated with the duration of mechanical ventilation. Regression coefficients (B), standardized beta coefficients (β), and corresponding *p*-values were reported.

All statistical analyses were performed using IBM SPSS Statistics version 23 and JASP. A two-sided *p*-value < 0.05 was considered statistically significant.

Results

A total of 300 patients were randomized, with 150 patients allocated to each group and included in the final analysis.

There were no significant differences between dexmedetomidine and propofol patients in age and gender distribution and other baseline characteristics (Table 1). Both dexmedetomidine and propofol groups had similar preoperative hemoglobin levels (135.8 ± 15.7 vs. 131.1 ± 16.1 g/L, p = 0.112), heart rate (69.4 ± 10.9 vs. 71.2 ± 11.5 bpm, p = 0.092), mean arterial pressure (97.4 ± 9.2 vs. 96.9 ± 11.3 mmHg, p = 0.373), and left ventricular ejection fraction (55.2 ± 6.7 vs 54.7 ± 6.0%, p = 0.115). CPB time (62.0 ± 27.9 vs. 59.1 ± 28.5 min; p = 0.389), ACC time (53.5 ± 21 vs. 52.4 ± 21.4 min; p = 0.589), and total operative time (3.15 ± 0.73 vs. 3.22 ± 0.65 hours; p = 0.381) were similar in dexmedetomidine and propofol group (Table 1).

Table 1
Baseline and intraoperative characteristics of the study population

Characteristics	Propofol (n = 150)	Dexmedetomidine (n = 150)	p value
Age (years)	65.2 ± 8.0	66.5 ± 8.8	0.088
Male sex, n (%)	118 (78.7%)	108 (72.0%)	0.181
Body mass index (kg/m²)	28.0 ± 3.9	28.0 ± 4.0	0.567
Preoperative hemoglobin (g/L)	131.1 ± 16.1	135.8 ± 15.7	0.112
Heart rate (beats/min)	71.2 ± 11.5	69.4 ± 10.9	0.092
Mean arterial pressure (mmHg)	96.9 ± 11.3	97.4 ± 9.2	0.373
Left ventricular ejection fraction (%)	54.7 ± 6.0	55.2 ± 6.7	0.115
Cardiopulmonary bypass time (min)	59.1 ± 28.5	62.0 ± 27.9	0.389
Aortic cross-clamp time (min)	52.4 ± 21.4	53.5 ± 21.0	0.589
Total operative time (hours)	3.15 ± 0.73	3.22 ± 0.65	0.381

Primary outcome: incidence of postoperative delirium

Postoperative delirium occurred in 53 of 300 patients (17.7%) during the observation period. Delirium developed in 30 patients (20.0%) in the propofol group and in 23 patients (15.3%) in the dexmedetomidine group. Although the incidence of postoperative delirium was numerically lower in patients receiving dexmedetomidine, the difference between groups was not statistically significant (χ^2=0.825, p = 0.364) (Table 2).

Table 2
Incidence of postoperative delirium

Postoperative delirium	Propofol (n = 150)	Dexmedetomidine (n = 150)	Total (n = 300)	p value
No	120 (80.0)	127 (84.7)	247 (82.3)	0.364
Yes	30 (20.0)	23 (15.3)	53 (17.7)	
Data are presented as n (%). The p value was calculated using χ^2 test.				

Binary logistic regression analysis demonstrated that postoperative sedation with dexmedetomidine was associated with a 27.6% lower odds of developing postoperative delirium compared with propofol; however, this association did not reach statistical significance (odds ratio [OR] 0.724, 95% confidence interval [CI] 0.398–1.317, $p = 0.290$).

The incidence of delirium was evaluated according to the postoperative day. On the day of surgery, delirium was observed in 7 patients (4.7%) in the propofol group and 4 patients (2.7%) in the dexmedetomidine group ($p = 0.541$). On the first postoperative day, delirium occurred in 27 patients (18.0%) in the propofol group and 22 patients (14.7%) in the dexmedetomidine group ($p = 0.539$) (Table 3). No significant between-group differences were observed on either postoperative day.

Table 3
Incidence of postoperative delirium according to postoperative day Data are presented as n (%). The p value was calculated using Fisher's exact test.

Postoperative day	Propofol (n = 150)	Dexmedetomidine (n = 150)	p value
Day of surgery	7 (4.7)	4 (2.7)	0.541
First postoperative day	27 (18.0)	22 (14.7)	0.539

Within-group analysis demonstrated a significant increase in delirium incidence from the day of surgery to the first postoperative day in both the propofol group (McNemar test, $p < 0.001$) and the dexmedetomidine group (McNemar exact test, $p < 0.001$). In the overall study population, delirium was present in 11 patients (3.7%) on the day of surgery and in 49 patients (16.3%) on the first postoperative day, representing a significant increase over time (McNemar test, $p < 0.001$).

Secondary outcomes:

Duration of mechanical ventilation

The duration of mechanical ventilation was comparable between the dexmedetomidine and propofol groups. Patients receiving dexmedetomidine had a median ventilation duration of 7 hours (IQR 6–9), compared with 7.5 hours (IQR 6–10) in the propofol group, with no statistically significant difference between groups ($p = 0.159$). Patients receiving dexmedetomidine had a median ventilation duration of 7

hours (IQR 6–9), compared with 7.5 hours (IQR 6–10) in the propofol group (p = 0.159). In a multivariable linear regression analysis, dexmedetomidine sedation was independently associated with a shorter duration of mechanical ventilation compared with propofol sedation (B=-1.217, β=-0.147, *p* = 0.010), whereas older age was associated with prolonged mechanical ventilation (B = 0.098, β = 0.200, *p* < 0.001). The model explained 5.7% of the variance in mechanical ventilation duration (R^2=0.057; adjusted R^2=0.051) (Table 4).

Table 4
Secondary postoperative outcomes according to sedation strategy

Duration of mechanical ventilation (hours), median (IQR)	**Propofol (n = 150)**	**Dexmedetomidine (n = 150)**	**p value**
	7.5 (6–10)	**7 (6–9)**	**0.159**
ICU length of stay (days), median (IQR)	1.0 (0.9–1.2)	1.0 (0.9–1.1)	0.148
Hospital length of stay (days), median (IQR)	10 (8–13)	9 (8–13)	0.851
Postoperative atrial fibrillation, n (%)	46 (30.7)	53 (35.3)	0.461
Red blood cell transfusion, n (%)	79 (52.7)	76 (50.7)	0.817

Data are presented as median (interquartile range, IQR) or n (%). The p values were calculated using the Mann–Whitney U test for continuous variables and χ^2 test for categorical variables.

Length of ICU stay

The duration of intensive care unit (ICU) stay did not differ significantly between the dexmedetomidine and propofol groups. The median ICU stay was 1 day in both groups (IQR 0.9–1.1 days in the dexmedetomidine group and 0.9–1.2 days in the propofol group; *p* = 0.148). The mean duration of ICU stay was 1.4 ± 0.9 days in the dexmedetomidine group and 1.9 ± 4.2 days in the propofol group (Table 4).

Length of hospital stay

The duration of hospital stay did not differ significantly between the dexmedetomidine and propofol groups. The median hospital stay was 9 days in the dexmedetomidine group and 10 days in the propofol group (IQR 8–13 days in both groups; *p* = 0.851). The mean duration of hospital stay was 11.3 ± 6.6 days in the dexmedetomidine group and 11.2 ± 5.3 days in the propofol group (Table 4).

Postoperative atrial fibrillation

The incidence of postoperative atrial fibrillation (POAF) was comparable between the dexmedetomidine and propofol groups. POAF occurred in 53 patients (35.3%) in the dexmedetomidine group and in 46 patients (30.7%) in the propofol group. The difference in POAF incidence between groups was not statistically significant (χ^2=0.543, *p* = 0.461) (Table 4).

Blood transfusion requirements

Red blood cell transfusion was required in 155 patients (51.7%) of the overall study population. Transfusion rates were similar between groups, occurring in 79 patients (52.7%) in the propofol group and 76 patients (50.7%) in the dexmedetomidine group. No statistically significant difference in transfusion requirements was observed between the groups (χ^2=0.053, p = 0.817) (Table 4).

Discussion

Principal findings

The present randomized controlled trial evaluated whether postoperative sedation with dexmedetomidine compared with propofol reduces the incidence of early postoperative delirium in patients undergoing coronary artery bypass grafting with cardiopulmonary bypass. The main finding of this study was that dexmedetomidine was associated with a numerically lower incidence of postoperative delirium compared with propofol; however, this difference did not reach statistical significance. Similarly, logistic regression analysis showed lower odds of delirium development with dexmedetomidine, although without statistical significance. Postoperative delirium occurred most frequently during the first postoperative day in both groups, confirming the importance of early postoperative monitoring and preventive strategies. Regarding secondary outcomes, dexmedetomidine was associated with a shorter duration of mechanical ventilation in multivariable analysis, whereas no significant differences were observed in ICU length of stay, hospital length of stay, postoperative atrial fibrillation, or red blood cell transfusion requirements. These findings suggest that dexmedetomidine may be considered an alternative sedative strategy after CABG; however, its superiority for delirium prevention was not demonstrated.

Primary outcome: postoperative delirium

In the present study, the overall incidence of postoperative delirium was 17.7%, which is consistent with previously reported rates among cardiac surgery patients. The incidence of postoperative delirium after cardiac surgery varies widely, ranging from 5% to 50%, depending on patient characteristics, type of procedure, and the presence of comorbidities [14]. Our findings confirm that postoperative delirium remains a clinically relevant complication requiring effective prevention and early detection strategies.

Although dexmedetomidine was associated with a numerically lower incidence of delirium and reduced odds of delirium development, neither analysis reached statistical significance. These findings are consistent with some previous studies suggesting that dexmedetomidine may not provide a sufficient preventive effect when used as an isolated pharmacological intervention. A meta-analysis including 2550 cardiac surgery patients also failed to demonstrate a significant reduction in delirium incidence with prophylactic dexmedetomidine administration [15]. Furthermore, the randomized controlled DEXACET trial found no significant difference in postoperative delirium incidence between dexmedetomidine and propofol (17% vs. 21%, respectively; p = 0.54)suggesting that dexmedetomidine alone may not be sufficient to prevent postoperative delirium [16].

Several mechanisms may explain the potential neuroprotective effects of dexmedetomidine. As a selective α2-adrenergic receptor agonist, dexmedetomidine provides sedation resembling physiological sleep, with minimal respiratory depression and potential modulation of inflammatory pathways. In contrast, propofol induces sedation through GABAergic mechanisms and may be associated with deeper sedation and greater disruption of normal sleep architecture. However, in our study, these pharmacological differences did not translate into a statistically significant reduction in delirium incidence, suggesting that the development of postoperative delirium is likely influenced by multiple interacting factors beyond the choice of sedative agent [17–19].

An important finding of our study was the significant increase in delirium incidence from the day of surgery to the first postoperative day in both groups. In the overall population, delirium increased from 3.7% on the day of surgery to 16.3% on the first postoperative day, highlighting the early postoperative period as a critical window for delirium development. This observation is consistent with current concepts indicating that surgical stress, systemic inflammatory response, metabolic disturbances, sleep disruption, and changes in sedation during the first 24–48 hours after surgery represent important precipitating factors for delirium development [20]. Therefore, early monitoring and implementation of preventive measures during this period remain essential.

From a clinical perspective, our findings suggest that the choice between propofol and dexmedetomidine within standardized sedation protocols may not represent the primary determinant of postoperative delirium risk. Instead, prevention strategies should focus on a multimodal approach, including optimization of hemodynamic status, adequate analgesia, early mobilization, and preservation of normal sleep–wake cycles, in accordance with current *European Society of Anaesthesiology and Intensive Care recommendations* [21].

Previous randomized studies have reported conflicting results regarding the role of dexmedetomidine in delirium prevention. Li et al. demonstrated a significant reduction in postoperative delirium with dexmedetomidine compared with propofol, which was attributed to its specific pharmacological profile and reduced disruption of circadian rhythm [15]. Similarly, a meta-analysis by Zhong et al., including 32 studies and 6046 patients, reported that dexmedetomidine was associated with a lower incidence of delirium compared with other sedative agents, including propofol [22]. Differences between these findings and our results may be explained by variations in study populations, sedation protocols, timing of dexmedetomidine initiation, duration of administration, and methods used for delirium assessment [22].

Overall, our findings indicate that dexmedetomidine sedation was associated with a numerical reduction in early postoperative delirium after CABG, although this difference was not statistically significant compared with propofol. Further studies with larger sample sizes and risk-stratified patient populations are needed to identify subgroups that may derive the greatest benefit from dexmedetomidine-based sedation strategies.

Secondary outcomes

In addition to postoperative delirium, several clinically relevant secondary outcomes were evaluated, including duration of mechanical ventilation, ICU and hospital length of stay, postoperative atrial fibrillation, and red blood cell transfusion requirements. The duration of mechanical ventilation was numerically shorter in patients receiving dexmedetomidine compared with propofol, although the difference was not statistically significant in the primary analysis. However, multivariable regression analysis identified dexmedetomidine sedation as an independent predictor of shorter mechanical ventilation duration, suggesting a potential benefit regarding early postoperative recovery. Previous studies have suggested that dexmedetomidine may facilitate earlier extubation due to its sedative properties, minimal respiratory depression, and preservation of spontaneous breathing; however, differences in sedation protocols, dosing strategies, and patient populations may explain variations among studies [23,24].

No significant differences were observed between groups regarding ICU or hospital length of stay. Although dexmedetomidine may improve certain aspects of postoperative recovery, length of hospitalization after cardiac surgery is influenced by multiple factors, including postoperative complications, hemodynamic stability, surgical characteristics, and institutional care pathways [25].

The incidence of postoperative atrial fibrillation and red blood cell transfusion requirements was also comparable between groups. Although dexmedetomidine has been suggested to modulate sympathetic activation and inflammatory response, its effect on postoperative atrial fibrillation remains uncertain [26–28]. Similarly, transfusion requirements are primarily determined by perioperative blood loss, hemodilution during cardiopulmonary bypass, baseline hemoglobin levels, and surgical factors, which may explain the absence of differences between sedation strategies [29,30].

Overall, the secondary outcomes indicate that dexmedetomidine provides a postoperative recovery profile comparable to propofol, with a potential advantage regarding mechanical ventilation duration that requires confirmation in larger studies.

Strengths and limitations

The present study has several strengths. First, it was designed as a prospective randomized controlled clinical trial, allowing a direct comparison between dexmedetomidine and propofol sedation in a well-defined population of patients undergoing CABG with cardiopulmonary bypass. Second, the study population was relatively homogeneous, as only elective CABG procedures were included, reducing the potential influence of variability related to different types of cardiac surgery. Third, postoperative delirium was assessed using the validated CAM-ICU instrument, which enabled standardized and systematic delirium detection. Additionally, intraoperative management and postoperative sedation protocols were standardized, improving the internal validity of the study findings.

Several limitations should also be acknowledged. First, this was a single-center study, which may limit the generalizability of the findings to other institutions with different patient populations and perioperative protocols. Second, the sample size may have limited the ability to detect smaller between-

group differences in delirium incidence. Third, delirium assessment was limited to the early postoperative period, and longer follow-up may have provided additional information regarding the overall incidence and duration of postoperative delirium. Fourth, complete blinding of the treating clinicians was not feasible due to the different administration characteristics of the sedative agents. Finally, residual confounding related to individual patient susceptibility, including baseline cognitive status, frailty, and other perioperative factors, cannot be completely excluded despite randomization.

Conclusions

In patients undergoing CABG with cardiopulmonary bypass, postoperative dexmedetomidine sedation did not significantly reduce the incidence of early postoperative delirium compared with propofol, although a numerically lower incidence was observed. Dexmedetomidine was independently associated with a shorter duration of mechanical ventilation, while no significant differences were observed in ICU or hospital length of stay, postoperative atrial fibrillation, or red blood cell transfusion requirements. These findings do not support the superiority of dexmedetomidine over propofol for the prevention of postoperative delirium after CABG.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Ethics Committee of the Institute of Cardiovascular Diseases Vojvodina (approval number: 612-1/1). The procedures were performed after obtaining an informed written consent from the patients.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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None.

Authors' contributions

Conceptualization: MP, AR, MT; Methodology: MP, AP, RZ; Investigation: MP, VDT, JV, TP, LSO, NB, NM, MJ, BM, BC, SM, ĐU, DA. Writing - Original Draft: MP. Writing - Review & Editing: AP, MT, AR. All authors read and approved the final manuscript.

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Abbreviations

CABG, coronary artery bypass grafting

CAM-ICU, confusion assessment method for the intensive care unit

CPB, cardiopulmonary bypass

ICU, intensive care unit

LVEF, left ventricular ejection fraction

POD, postoperative delirium

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Figures

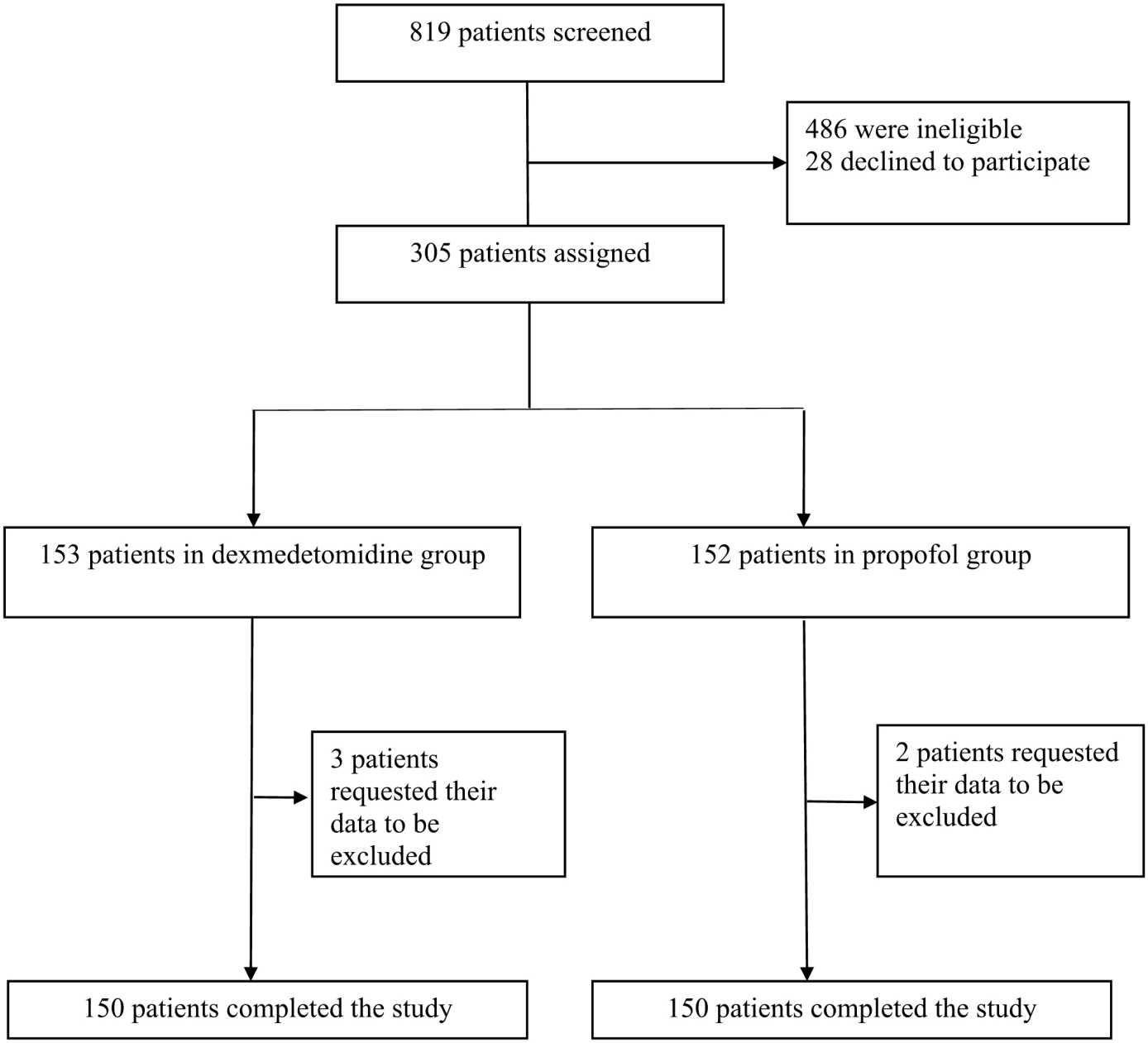


Figure 1

Flow diagram of the study

Supplementary Files

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- SupplementaryTable1.docx