

Effect of Perioperative Dexmedetomidine on Postoperative Delirium in Elderly Patients Undergoing Major Surgery

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Received: 01-10-2024/ Revised: 15-11-2024 / Accepted: 21-11-2024

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Conflict of interest: Nil

Abstract

Background: Postoperative delirium is a frequent complication in elderly patients undergoing major surgery and may adversely affect postoperative recovery and hospital outcomes.

Objective: To evaluate the effect of perioperative dexmedetomidine on the incidence and clinical course of postoperative delirium in elderly patients undergoing major surgery.

Methods: A prospective randomized controlled study was conducted in 120 elderly patients undergoing major non-cardiac surgery under general anesthesia. Patients were randomized into dexmedetomidine and control groups, with 60 patients in each group. Delirium was assessed twice daily for five postoperative days using the Confusion Assessment Method.

Results: Postoperative delirium occurred in 16.7% of patients receiving dexmedetomidine versus 36.7% in controls ($p=0.022$), with shorter delirium duration (1.80 ± 0.63 vs 2.45 ± 0.91 days; $p=0.028$). Pain scores and hospital and ICU stays were significantly lower with dexmedetomidine. Hemodynamic adverse events did not differ significantly between groups.

Conclusion: Perioperative dexmedetomidine was associated with a lower incidence and shorter duration of postoperative delirium in elderly patients undergoing major surgery, although hemodynamic adverse events require monitoring.

Keywords: Dexmedetomidine; postoperative delirium; elderly; major surgery; Confusion Assessment Method; perioperative anesthesia.

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Introduction

Postoperative delirium (POD) is an acute neurocognitive disorder characterized by disturbances in attention, awareness and cognition, with symptoms developing over a short period and fluctuating during the postoperative course. Elderly patients undergoing major surgery are particularly vulnerable to POD, which may be associated with prolonged hospitalization, increased postoperative complications and delayed recovery [1,2]. Early identification of high-risk patients and systematic postoperative assessment are therefore important components of perioperative care [1].

Dexmedetomidine is a highly selective α_2 -adrenergic receptor agonist that produces sedation and sympatholysis with minimal respiratory depression. Its pharmacological profile differs from conventional sedative agents, with sedation resembling some characteristics of physiological sleep [3]. These properties, together with its analgesic-sparing effects, have generated considerable interest in its perioperative use and its

possible role in reducing postoperative neurocognitive complications. Evidence concerning the preventive effect of dexmedetomidine on POD remains variable. A systematic review and meta-analysis of randomized controlled trials suggested that perioperative dexmedetomidine may reduce POD in elderly patients, although substantial clinical heterogeneity was reported among the included studies [4].

Another meta-analysis similarly found a lower incidence of POD following non-cardiac surgery with dexmedetomidine administration [5]. However, individual randomized trials have produced both positive and neutral findings. Differences in patient characteristics, surgical procedures, dosing strategies, timing of administration and postoperative management may account for these variations. The present study was undertaken to evaluate the effect of perioperative dexmedetomidine on the incidence and clinical course of POD in elderly patients undergoing major

surgery, while also assessing postoperative recovery and hemodynamic adverse events.

Materials and Methods

A prospective, randomized, controlled, parallel-group study was conducted among elderly patients undergoing major non-cardiac surgery under general anesthesia from January 2022 to June 2023. A total of 120 patients were included, with 60 patients allocated to the dexmedetomidine group and 60 to the control group.

Inclusion Criteria

- Patients aged ≥ 65 years.
- Patients scheduled for major elective non-cardiac surgery.
- Patients undergoing surgery under general anesthesia.
- Expected duration of surgery ≥ 2 hours.
- Patients providing informed consent.

Exclusion Criteria

- Pre-existing delirium or diagnosed dementia.
- Severe cognitive impairment interfering with postoperative assessment.
- Significant bradycardia or clinically important conduction abnormality.
- Severe hepatic dysfunction or known hypersensitivity to dexmedetomidine.
- Emergency surgery or inability to complete postoperative delirium assessment.

Perioperative Intervention

Patients in the dexmedetomidine group received intravenous dexmedetomidine at 0.5 $\mu\text{g/kg/h}$

without a loading dose, beginning after induction of anesthesia and continuing until the end of surgery. The control group received an equivalent volume of normal saline. Other components of anesthetic management and postoperative analgesia were standardized as far as clinically feasible.

Assessment of Postoperative Delirium: Patients were assessed twice daily during the first five postoperative days using the Confusion Assessment Method (CAM). For mechanically ventilated patients, CAM-ICU was used. The primary outcome was the occurrence of POD within five postoperative days. Secondary outcomes included time to onset, duration of delirium, postoperative pain, length of hospital stay and hemodynamic adverse events.

Statistical Analysis: Data were analyzed using SPSS version 26.0. Continuous variables were compared between the two groups using the independent-samples t-test, while categorical variables were analyzed using the Chi-square test or Fisher's exact test, as appropriate. A p-value < 0.05 was considered statistically significant.

Results

A total of 120 elderly patients undergoing major non-cardiac surgery were included and randomized equally into the dexmedetomidine and control groups, with 60 patients in each group. Baseline demographic and clinical characteristics were comparable between the two groups. There were no statistically significant differences in age, sex, BMI, hypertension, diabetes mellitus, or ASA physical status.

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants

Variable	Dexmedetomidine Group (n=60)	Control Group (n=60)	p-value
Age (years), mean $\pm$ SD	71.8 $\pm$ 5.4	72.1 $\pm$ 5.7	0.768
Male, n (%)	35 (58.3)	34 (56.7)	1.000
Female, n (%)	25 (41.7)	26 (43.3)	
BMI (kg/m^2), mean $\pm$ SD	24.6 $\pm$ 2.8	24.9 $\pm$ 2.7	0.551
Hypertension, n (%)	32 (53.3)	34 (56.7)	0.855
Diabetes mellitus, n (%)	19 (31.7)	21 (35.0)	0.847
ASA III, n (%)	24 (40.0)	26 (43.3)	0.853

No significant differences were observed between the groups with respect to baseline demographic or clinical characteristics, indicating comparable groups at the beginning of the study.

Table 2: Intraoperative and Perioperative Characteristics

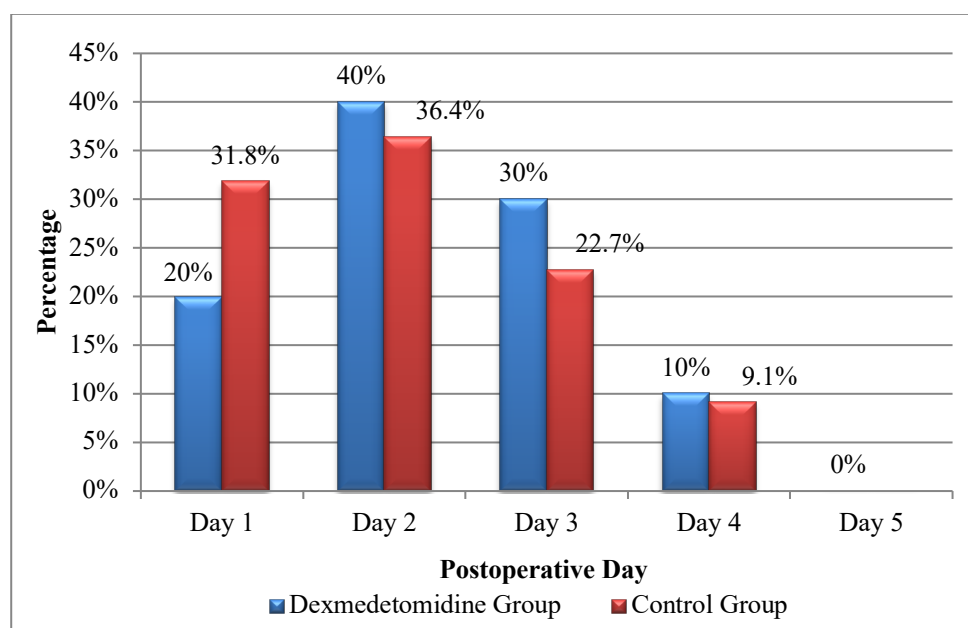
Variable	Dexmedetomidine Group (n=60)	Control Group (n=60)	p-value
Duration of surgery (min), mean $\pm$ SD	188.4 $\pm$ 35.7	192.6 $\pm$ 38.2	0.535
Duration of anesthesia (min), mean $\pm$ SD	226.8 $\pm$ 39.5	231.5 $\pm$ 41.7	0.527
Estimated blood loss (mL), mean $\pm$ SD	286 $\pm$ 74	301 $\pm$ 81	0.292
Intraoperative opioid requirement, mean $\pm$ SD	8.2 $\pm$ 1.7	9.0 $\pm$ 1.9	0.017
Postoperative opioid requirement, mean $\pm$ SD	18.6 $\pm$ 4.2	21.4 $\pm$ 4.8	< 0.001
ICU admission, n (%)	18 (30.0)	21 (35.0)	0.697

Duration of surgery, anesthesia, blood loss, and ICU admission were comparable between groups. Patients receiving dexmedetomidine had significantly lower intraoperative and postoperative opioid requirements.

Table 3: Incidence and Clinical Characteristics of Postoperative Delirium

Delirium Variable	Dexmedetomidine Group (n=60)	Control Group (n=60)	p-value
Postoperative delirium, n (%)	10 (16.7)	22 (36.7)	0.022
No postoperative delirium, n (%)	50 (83.3)	38 (63.3)	
Onset of delirium (days), mean $\pm$ SD	2.10 $\pm$ 0.74	1.68 $\pm$ 0.65	0.143
Duration of delirium (days), mean $\pm$ SD	1.80 $\pm$ 0.63	2.45 $\pm$ 0.91	0.028
Hypoactive subtype, n (%)	5 (50.0)	10 (45.5)	0.908
Hyperactive subtype, n (%)	2 (20.0)	6 (27.3)	
Mixed subtype, n (%)	3 (30.0)	6 (27.3)	

Postoperative delirium occurred significantly less frequently in the dexmedetomidine group than in the control group. Among patients who developed delirium, its duration was significantly shorter with dexmedetomidine. The difference in timing of delirium onset and distribution of delirium subtypes was not statistically significant.

**Figure 1: Incidence of Postoperative Delirium in the Two Study Groups**

Incidence of postoperative delirium in the dexmedetomidine and control groups. The incidence of postoperative delirium was 16.7% (10/60) in the dexmedetomidine group compared with 36.7% (22/60) in the control group ($p=0.022$).

Table 4: Postoperative Recovery Outcomes

Outcome	Dexmedetomidine Group (n=60)	Control Group (n=60)	p-value
Pain score at 6 h, mean $\pm$ SD	3.8 $\pm$ 0.9	4.5 $\pm$ 1.0	<0.001
Pain score at 24 h, mean $\pm$ SD	3.1 $\pm$ 0.8	3.7 $\pm$ 0.9	<0.001
Rescue analgesic requirement, n (%)	18 (30.0)	29 (48.3)	0.061
Hospital stay (days), mean $\pm$ SD	7.2 $\pm$ 1.6	8.1 $\pm$ 2.0	0.007
ICU stay (days), mean $\pm$ SD	2.1 $\pm$ 0.8	2.5 $\pm$ 1.0	0.017

Postoperative pain scores at 6 and 24 hours were significantly lower in the dexmedetomidine group. Rescue analgesic use was numerically lower but did not reach statistical significance. Both total hospital stay and ICU stay were significantly shorter in the dexmedetomidine group.

Table 5: Hemodynamic Adverse Events

Adverse Event	Dexmedetomidine Group (n=60)	Control Group (n=60)	p-value
Bradycardia, n (%)	5 (8.3)	1 (1.7)	0.207
Hypotension, n (%)	9 (15.0)	4 (6.7)	0.239
Vasopressor requirement, n (%)	6 (10.0)	2 (3.3)	0.272
Hypertension, n (%)	3 (5.0)	5 (8.3)	0.717
Tachycardia, n (%)	2 (3.3)	6 (10.0)	0.272

Bradycardia, hypotension, and vasopressor requirement were numerically more frequent in the dexmedetomidine group, whereas hypertension and tachycardia were numerically more frequent in the control group. None of these differences was statistically significant.

Discussion

The present study found that perioperative dexmedetomidine was associated with a lower incidence of postoperative delirium among elderly patients undergoing major non-cardiac surgery. Delirium developed in 16.7% of patients receiving dexmedetomidine compared with 36.7% in the control group. In addition, patients who developed delirium in the dexmedetomidine group experienced a shorter duration of symptoms. These findings suggest a potential protective effect of perioperative dexmedetomidine against postoperative neurocognitive complications.

The findings are consistent with the randomized trial by Su et al., which reported a lower incidence of postoperative delirium with dexmedetomidine in elderly patients undergoing non-cardiac surgery [6]. Similarly, Li et al. observed a reduction in delirium following intraoperative dexmedetomidine administration during major non-cardiac surgery [7]. The lower opioid requirements observed in the present study may also have contributed to improved postoperative recovery, although the independent contribution of opioid reduction cannot be established from the present data.

Evidence regarding delirium prevention with dexmedetomidine has not been uniform. Deiner et al. did not demonstrate a significant preventive effect of intraoperative dexmedetomidine on postoperative delirium or cognitive dysfunction in elderly patients undergoing major non-cardiac surgery [8]. Liu et al. also reported no significant reduction in delirium among elderly patients undergoing oral and maxillofacial surgery, despite favorable effects on some postoperative recovery parameters [9]. Differences in surgical procedures, patient characteristics, dosing strategies, and duration of drug administration may partly explain these variable findings. Meta-analyses have generally suggested a reduction in postoperative delirium with dexmedetomidine in elderly surgical populations [10,11]. However, these analyses have also highlighted heterogeneity among individual trials and the possibility of hemodynamic adverse effects. The shorter hospital and ICU stays observed in the present study are compatible with reports describing improved postoperative recovery following dexmedetomidine administration [11,12].

Hemodynamic events require particular attention when dexmedetomidine is used in older patients. In the present study, bradycardia, hypotension, and

vasopressor requirement were numerically more frequent with dexmedetomidine, although none of the differences was statistically significant. Previous studies have similarly emphasized the need for appropriate dose selection and hemodynamic monitoring during dexmedetomidine administration [10,11]. Similarly, Hu et al. reported a lower incidence of postoperative delirium with perioperative dexmedetomidine in older adults undergoing oesophagectomy, supporting the potential preventive effect observed in the present study [13].

Overall, the present findings support a possible role for perioperative dexmedetomidine in reducing postoperative delirium and improving selected recovery outcomes in elderly surgical patients. Nevertheless, patient selection, dosing, perioperative analgesic strategies, and cardiovascular monitoring remain important considerations.

Conclusion

Perioperative dexmedetomidine was associated with a significantly lower incidence and shorter duration of postoperative delirium in elderly patients undergoing major non-cardiac surgery. It was also associated with lower postoperative pain scores and shorter ICU and hospital stays, while rescue analgesic requirements were numerically lower but not statistically significant. Bradycardia, hypotension, and vasopressor use were numerically more frequent with dexmedetomidine but did not differ significantly between groups. Careful hemodynamic monitoring should therefore accompany its perioperative use in elderly patients.

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