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Original Article

Effects of dexmedetomidine on renal function, inflammatory markers, and cognitive functioning in elderly patients undergoing hip replacement surgery

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Abstract: Objective: To investigate the effects of dexmedetomidine on renal function, inflammatory markers, and cognitive outcome, and to identify factors influencing early postoperative cognitive dysfunction (POCD) in elderly patients undergoing hip replacement surgery. Methods: A retrospective analysis was conducted on 162 elderly patients who underwent hip replacement surgery at Cangzhou Central Hospital from March 2022 to May 2023. Patients were divided into a control group (without dexmedetomidine) and an experimental group (with dexmedetomidine). Measurements included creatinine (Cr), blood urea nitrogen (BUN), interleukin 1β (IL-1β), tumor necrosis factor alpha (TNF-α), interleukin 6 (IL-6), Montreal Cognitive Assessment (MoCA) score, and the incidence of POCD seven days postoperatively. Univariate and logistic regression analyses were employed to investigate the predictors of early POCD. Results: Significant differences were observed between the groups in terms of renal function, inflammatory markers, and cognitive outcome (Cr, BUN, IL-1β, TNF-α, IL-6 and MoCA scores) (all $P<0.05$). The experimental group showed a significantly lower incidence of POCD at seven days post-surgery ($P<0.05$). Logistic regression identified having a neuron-specific enolase (NSE) level seven days post-surgery ≥7.0 pg/ml as a risk factor for early POCD ($P=0.001$, $OR=3.987$, 95% CI: 1.789-8.886), whereas intraoperative use of dexmedetomidine was a protective factor ($P=0.041$, $OR=0.424$, 95% CI: 0.187-0.964). Conclusion: The use of dexmedetomidine in hip replacement surgery can mitigate postoperative renal injury and inflammatory response, enhance cognitive outcome, and significantly reduce the incidence and risk of early POCD in elderly patients.

Keywords: Renal function, inflammatory factors, cognitive function, POCD, influencing factors

Introduction

In recent years, the aging population in China has become a significant concern. With advancing age, the elderly are increasingly susceptible to osteoporosis due to deteriorating physiologic condition, leading to hip fractures and other joint disorders [1]. Hip joint replacement surgery has emerged as an effective treatment for these conditions, particularly beneficial for elderly patients as it helps restore hip function, maintain joint stability and mobility, and significantly enhance their quality of life [2]. However, the elderly experience a decline in organ function, including slower drug metabolism by the liver and kidneys, and heightened sensitivity to anesthetic drugs. This may result in delayed awakening, respiratory depression, and renal injury post-surgery. Moreover, a robust postoperative stress response can trigger systemic inflammatory response syndrome, causing significant hemodynamic fluctuation and increasing the risk of postoperative cognitive dysfunction (POCD) and other complications [3-5]. POCD, a common neurological complication in the elderly post-surgery, primarily affects social interactions, mental, and cognitive abilities, worsening their quality of life and prolonging recovery [6]. Therefore, mitigating renal injury and inflammatory responses post-hip replacement in the elderly, and reducing the incidence of POCD, are of critical clinical importance. Dexmedetomidine, a highly selective α2-adrenergic receptor agonist known for its sedative,

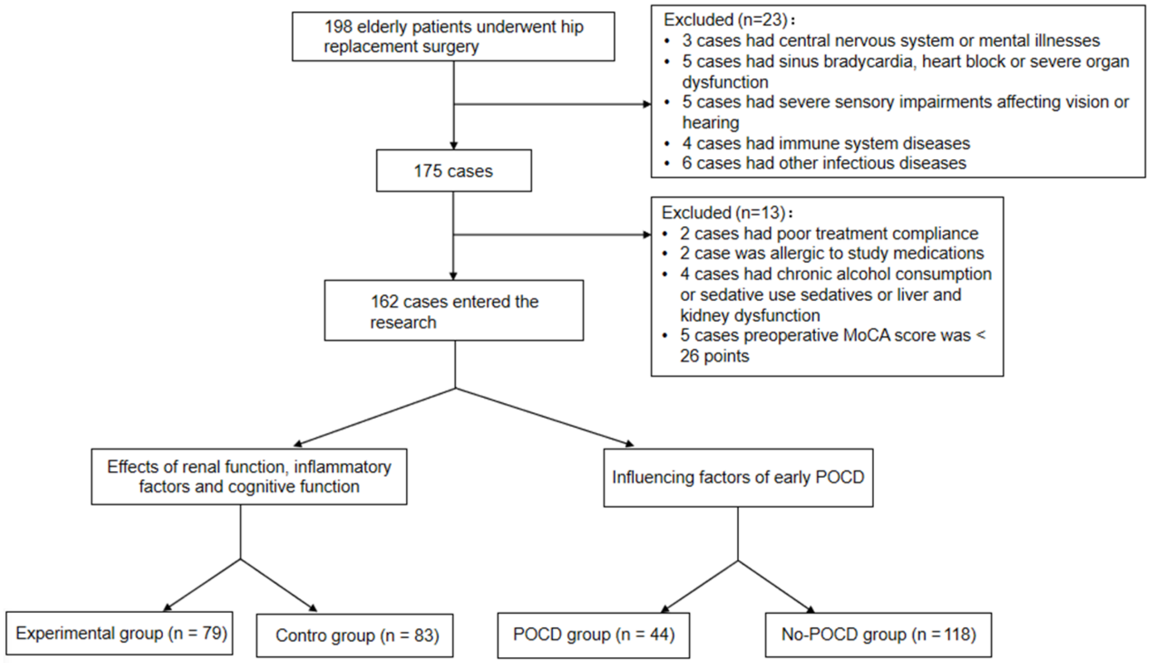

Figure 1. Flow chart of elderly patient selection.

analgesic, and anxiolytic effects, has seen increasing use in geriatric hip replacement surgery in recent years [7].

Recent studies have demonstrated that dexmedetomidine can suppress sympathetic nerve activity, thereby reducing inflammatory responses and perioperative stress, and preserving renal function [8]. It may also enhance postoperative cognitive function by modulating inflammatory responses, improving microcirculation, and minimizing cerebral damage [9, 10]. However, existing research on the effects of dexmedetomidine on renal function, inflammatory markers, and outcomes in elderly patients undergoing hip replacement surgery has limitations. Primarily, most studies have focused on individual factors without assessing the combined effects on renal function, inflammation, and cognition [11, 12]. Moreover, there is a scarcity of research examining the factors influencing early POCD in this patient group. Thus, this study aims to conduct a systematic investigation of the effects of dexmedetomidine in elderly hip replacement patients using a retrospective analysis approach. We collected and analyzed clinical data from elderly patients undergoing hip replacement surgery to evaluate the impact of dexmedetomidine on renal function, inflammatory markers, and cognitive function. Additionally, we explored factors associated with the occurrence of POCD, aiming to provide a reference for the clinical use of dexmedetomidine and the improvement of surgical outcome in this population, ultimately reducing the incidence of POCD.

Methods

Study design and patient selection

Between March 2022 and May 2023, 198 elderly patients undergoing hip replacement at Cangzhou Central Hospital were assessed through hospital electronic medical records. Following screening, 36 patients were excluded due to ineligibility criteria, leaving 162 participants for this retrospective study (**Figure 1**). This investigation received ethical approval from the Ethics Committee of Cangzhou Central Hospital (Approval No: 2020-024-01(Z)). Inclusion criteria included: (1) Age ≥60 years old; (2) ASA classification I and II; (3) Patients with hip fracture due to trauma intended to undergo hip replacement surgery; (4) No psychiatric disease or cognitive dysfunction; (5) Patients with complete data; (6) No immunosuppressant such as radiotherapy or chemotherapy was used; (7) Patients could be evaluated by POCD after surgery. Exclusion criteria included: (1) Existing central nervous system disorders or mental illnesses; (2) Chronic alcohol consumption or sedative use; (3) Liver and kidney dysfunction; (4) Sinus bradycardia, heart block, or severe organ dysfunction; (5) Severe sensory impairment affecting vision or hearing; (6) A preoperative Montreal Cognitive Assessment (MoCA) score below 26; (7) Immune system diseases; (8) Allergies to study medications; (9) Other infectious diseases; (10) Poor treatment compliance.

Anesthesia method

The 162 qualified elderly patients were divided into a control group and an experimental group, based on the anesthesia regimen used. Upon entering the operating room, each patient had an intravenous line established and received an infusion of 6-8 ml/kg lactated Ringer's, continuous oxygen via mask, and routine monitoring including electrocardiogram, heart rate, oxygen saturation, end-tidal carbon dioxide partial pressure ($PetCO_2$), and bispectral index (BIS). Anesthesia was induced with intravenous etomidate (0.2 mg/kg), sufentanil (0.4-0.6 μg/kg), and cisatracurium (0.2 mg/kg). To maintain anesthesia, a target-controlled infusion of propofol was administered to achieve a plasma concentration of 1.5-2.0 μg/ml, keeping the BIS value between 40 and 60. The experimental group received a dexmedetomidine infusion, starting with a loading dose of 0.5 μg/kg over 15 minutes, followed by a maintenance rate of 0.2-0.4 μg/(kg-h). Conversely, the control group received a matching volume of 0.9% sodium chloride solution as a maintenance infusion.

Data collection

We collected comprehensive demographic and clinical data from patients eligible for the study, including sex, age, education level, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, operation duration, and operative blood loss. Renal function markers (creatinine, Cr; blood urea nitrogen, BUN) and inflammatory factors (IL-1β, TNF-α, IL-6) were recorded at specific time points: before anesthesia induction (T0), immediately after surgery completion (T1), and one (T2), three (T3), and seven days post-surgery (T4). S100β, neuron-specific enolase (NSE) and the incidence of POCD were assessed seven days post-surgery. Cognitive function was evaluated using the MoCA scores one day prior to surgery (T1), and one day following surgery (T2), three (T3), and seven days (T4) post-surgery. Assessments were conducted between 17:00 and 18:00 by trained physicians using the MoCA, which includes sections on calculation and orientation, language, executive function, memory, attention, visual-constructive abilities, and abstract thinking. A MoCA score below 26 or a decline of two or more points from baseline was considered indicative of POCD [13].

Outcome measures

The primary outcomes included changes in Cr, BUN, IL-1β, TNF-α, IL-6, and MoCA scores at designated time points, and the occurrence of POCD seven days postoperatively. The assessment of early POCD was based on MoCA scores to determine the incidence of POCD in elderly patients following hip replacement surgery [14, 15]. Patients were categorized into POCD and non-POCD groups based on assessments seven days post-surgery, and influencing factors were analyzed using the clinical data.

Statistical analysis

Data were analyzed using SPSS version 26.0. For normally distributed data such as renal function and inflammatory markers, mean ± standard deviation was used for description, and repeated measures ANOVA was applied for analysis. MoCA scores, which were non-normally distributed, were described using the interquartile range and analyzed using a generalized estimating equation. Operative time and blood loss were expressed as mean ± standard deviation and analyzed using the t-test. Categorical data including age, sex, BMI, ASA classification, educational level, intraoperative use of dexmedetomidine, and occurrence of POCD were presented as n (%) and compared using the χ^2 test. Univariate and logistic regression analyses were used to explore factors influencing early POCD. Statistical significance was set at $P<0.05$.

Results

Comparison of clinical baseline data

Among the 162 patients enrolled in the study, 79 were assigned to the control group and 83 to the experimental group. Analysis of baseline

Table 1. Comparison of clinical baseline data

	Control group (n=83)	Experimental group (n=79)	χ^2/Z/t	P
Sex [n (%)]			0.124	0.725
Female	38 (45.78)	34 (43.04)		
Male	45 (54.22)	45 (56.96)		
Age (years)	68.27±4.00	69.13±4.79	-1.244	0.215
Body mass index (kg/m^2)	23.27±2.22	23.16±2.31	0.294	0.769
Educational level [n (%)]			1.122	0.290
Below high school	53 (63.86)	44 (55.70)		
High school and above	30 (36.14)	35 (44.30)		
ASA classification [n (%)]			0.343	0.558
I	50 (60.24)	44 (55.70)		
II	33 (39.76)	35 (44.30)		
Operation time (min)	119.94±17.76	116.63±18.59	1.158	0.249
Preoperative MOCA score (points)	28 (27.29)	28 (27.29)	-0.965	0.334
Operative blood loss (mL)	247.27±51.67	235.07±48.77	1.543	0.125

ASA, American Society of Anesthesiologists; MoCA, Montreal Cognitive Assessment.

data revealed no significant differences between the groups in terms of sex, age, BMI, educational level, ASA classification, operation time, operative blood loss, and preoperative MoCA score (all P>0.05) (**Table 1**).

Comparison of renal function

Repeated measures ANOVA indicated a significant main effect of group on creatinine (Cr) and blood urea nitrogen (BUN) levels (F=33.747, P<0.001 for Cr; F=64.474, P<0.001 for BUN), suggesting notable differences between the control and experimental groups. Additionally, the main effect of time was significant for both Cr and BUN (F=68.787, P<0.001 for Cr; F=29.264, P<0.001 for BUN), reflecting significant temporal changes in these measurements. The interaction between time and group was also significant (F=6.843, P<0.001 for Cr; F=4.555, P=0.003 for BUN), indicating varying trends in Cr and BUN levels across different time points and under different anesthesia protocols.

Pairwise comparisons within each group showed significant differences in Cr levels at the T1, T2, and T3 time points compared to T0 (P<0.05). Notably, a significant difference in Cr levels at the T4 time point was observed in the control group compared to T0 (P<0.05). For BUN levels, significant differences were noted at all subsequent time points in the control group compared to T0 (P<0.05), while in the experimental group, significant differences were observed at T2 and T3 compared to T0 (P<0.05). Further pairwise comparisons between the control and experimental groups revealed significant differences in Cr and BUN levels at all time points except T0 (P<0.05) (**Figure 2**).

Comparison of inflammatory factor levels

Repeated measures ANOVA revealed significant main effects of group on IL-1β, TNF-α, and IL-6 levels (F=235.795, P<0.001; F=537.157, P<0.001; F=238.028, P<0.001), indicating substantial differences in these inflammatory markers between the two groups. The main effect of time was also significant (F=641.845, P<0.001; F=591.608, P<0.001; F=821.285, P<0.001), showing variations over time. The interaction between time and group was significant (F=43.370, P<0.001; F=114.128, P<0.001; F=44.078, P<0.001), suggesting different trends in inflammatory responses over time and under different anesthesia protocols.

Pairwise comparisons within groups confirmed significant differences in these inflammatory factors at all measured time points compared to T0 (P<0.05). Additionally, comparisons between groups showed significant differences at all time points except T0 (P<0.05) (**Figure 3**).

Comparison of cognitive function indicators

The generalized estimation equation analysis indicated significant main effects of group on MoCA scores (Wald χ^2=148.319, P<0.001), with substantial differences between the gr-

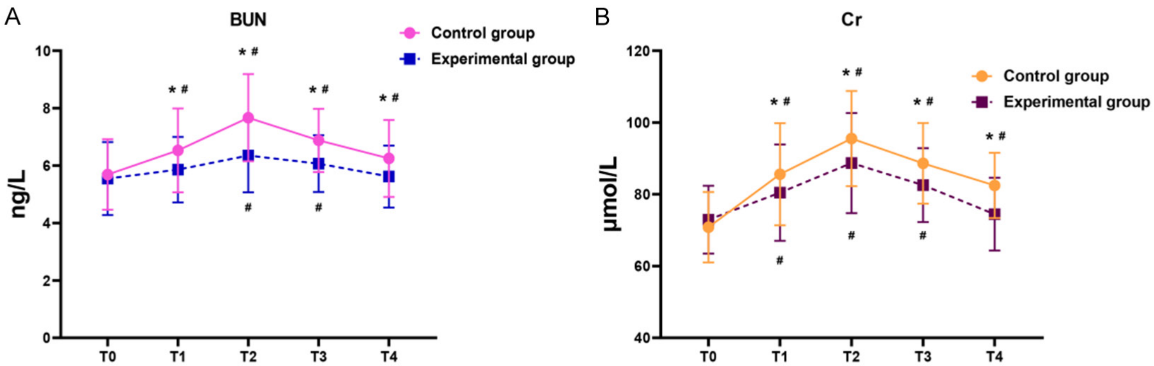

Figure 2. Comparison of renal function between the two groups. Note: * indicates comparison with experimental group, P<0.05; # indicates that compared with T0, P<0.05. T0: prior to anesthesia induction; T1: immediately upon surgery completion; T2, T3, T4: one, three, and seven days post-surgery. Cr, creatinine; BUN, blood urea nitrogen.

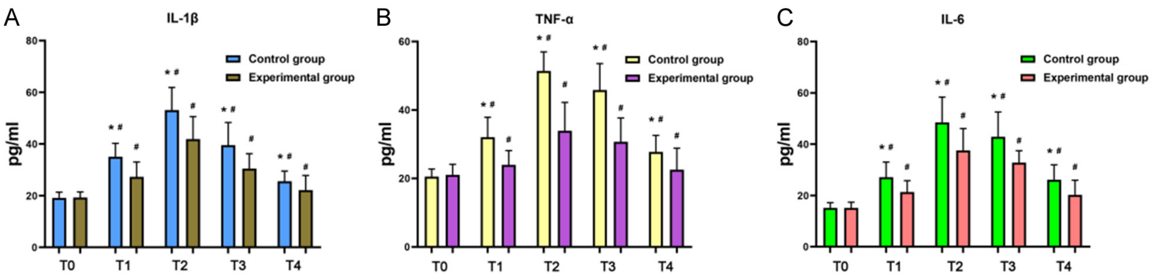

Figure 3. Comparison of the levels of inflammatory factors between the two groups. Note: * indicates comparison with experimental group, P<0.05; # indicates that compared with T0, P<0.05. T0: prior to anesthesia induction; T1: immediately upon surgery completion; T2, T3, T4: one, three, and seven days post-surgery. IL-1β, interleukin 1β; TNF-α, tumor necrosis factor alpha; IL-6, interleukin 6.

oups. The main effect of time was significant (Wald χ^2=229.586, P<0.001), reflecting changes in MoCA scores over time. The interaction between time and group was significant (Wald χ^2=40.814, P<0.001), indicating differing trends in cognitive outcome over time depending on the anesthesia method used.

Paired comparisons within each group showed significant differences in MoCA scores for the control group at each postoperative time point compared to T1 (P<0.05). In the experimental group, significant differences were noted at T2 and T3 (P<0.05). Between-group comparisons revealed significant differences in MoCA scores at all time points except T1 (P<0.05) (**Figure 4**).

Comparison of the incidence of POCD

The analysis demonstrated that the experimental group, which received dexmedetomidine, had a significantly lower incidence of POCD seven days post-surgery compared to the control group (P<0.05) (**Table 2**).

Univariate analysis of POCD after hip replacement surgery in elderly patients

Of the 162 patients analyzed, 44 were classified into the POCD group and 118 into the no-POCD group based on assessments conducted seven days post-surgery. Continuous variables such as age, BMI, operative time, operation blood loss, S100β (T4), NSE (T4), IL-1β (T4), TNF-α (T4), IL-6 (T4), BUN (T4), and Cr (T4) were converted into binary variables using optimal cutoff values derived from ROC curves. The univariate analysis identified significant associations between POCD and NSE (T4), TNF-α (T4), and intraoperative dexmedetomidine use (P<0.001, P=0.012, P<0.001, respectively) (**Table 3**).

Logistic regression analysis of factors related to POCD after hip replacement surgery in elderly patients

For the logistic regression analysis, POCD occurrence (no POCD=0, POCD=1) was used as

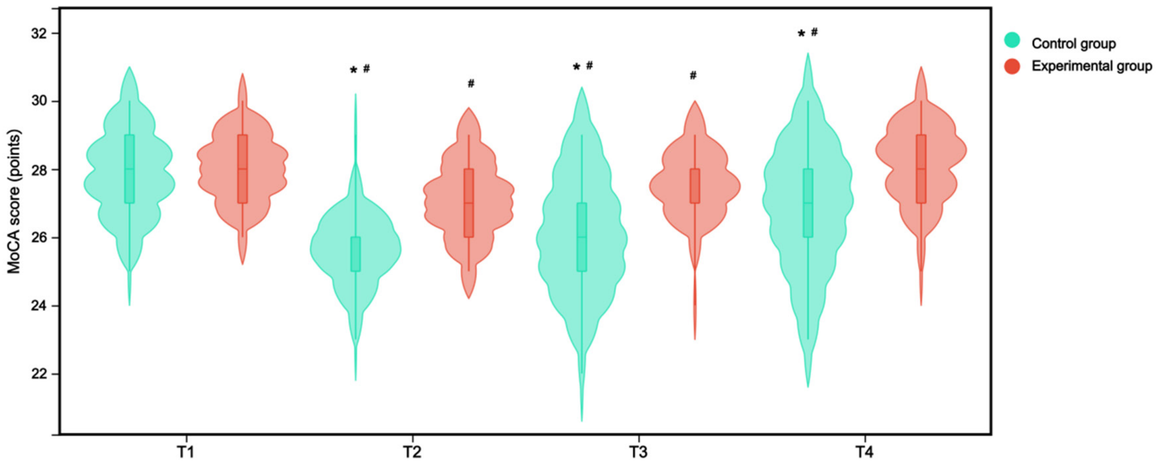

Figure 4. Comparison of MoCA scores between the two groups. Note: * indicates comparison with experimental group, P<0.05; # indicates that compared with T1, P<0.05. T1: one day prior to surgery; T2: one day following surgery; T3, T4: three and seven days post-surgery. MoCA, Montreal Cognitive Assessment.

Table 2. Incidence of POCD [n (%)]

	n	POCD	No POCD
Control group	83	32 (38.55)	51 (61.45)
Experimental group	79	12 (15.19)	67 (84.81)
χ^2			11.168
P			<0.001

POCD, Postoperative cognitive dysfunction.

the dependent variable, with significant variables from the univariate analysis (NSE (T4), TNF-α (T4), and intraoperative dexmedetomidine use) serving as independent variables. The logistic regression results indicated that an NSE (T4) level ≥7.0 pg/ml was a risk factor for early postoperative POCD (P=0.001, OR=3.987, 95% CI: 1.789-8.886). Conversely, intraoperative dexmedetomidine administration emerged as a protective factor against early postoperative POCD (P=0.041, OR=0.424, 95% CI: 0.187-0.9649) (**Tables 4, 5**).

Discussion

Hip replacement surgery is a standard treatment for hip joint degeneration. However, the procedure often involves lengthy operative times, significant blood loss, and a high risk of postoperative complications. Elderly patients undergoing this surgery typically present with comorbidities such as hyperlipidemia, hypertension, and diabetes. These factors, combined with the surgical stress, can exacerbate systemic inflammation and may even compromise the central nervous system, thereby increasing the risk of POCD [16, 17]. Dexmedetomidine, known for its sedative, analgesic, and sympatholytic properties, also modulates the systemic inflammatory response [18]. It reduces the activity of inflammatory cells, inhibits the release of pro-inflammatory cytokines, and curtails the production of reactive oxygen species. Additionally, it activates anti-apoptotic pathways, providing protection to various organs, including the brain, heart, liver, and kidneys, thus offering both organ-protective and neuroprotective benefits [19]. Hence, this study retrospectively analyzed data from 150 elderly patients who underwent hip replacement surgery at our institution to investigate the impact of dexmedetomidine on renal function, inflammatory markers, and cognitive function post-surgery, focusing specifically on the early factors influencing POCD.

Undergoing hip replacement surgery can elicit a substantial inflammatory response, leading to increased secretion of inflammatory factors and exacerbating the severity of inflammation [20]. The results of this study demonstrated a postoperative elevation in IL-1β, TNF-α, and IL-6 levels in both groups. Notably, these inflammatory markers were significantly lower in the experimental group compared to the control group, suggesting that dexmedetomidine effectively reduces the inflammatory response in elderly patients undergoing hip replacement surgery by decreasing levels of inflammatory

Table 3. Univariate analysis of postoperative POCD occurrence [n (%)]

Factor	POCD group (n=79)	No-POCD group (n=71)	χ^2	P
Age (years)			0.211	0.646
≥70.5	17 (38.64)	41 (34.75)		
<70.5	27 (61.36)	77 (65.25)		
Sex			0.039	0.843
Female	19 (43.18)	53 (44.92)		
Male	25 (56.82)	65 (55.08)		
BMI (kg/m^2)			0.417	0.518
≥24	14 (31.82)	44 (37.29)		
<24	30 (68.18)	74 (62.71)		
ASA grade			1.542	0.214
I	29 (65.91)	65 (55.08)		
II	15 (34.09)	53 (44.92)		
Educational level			2.453	0.117
Below high school	22 (50.00)	75 (63.56)		
High school and above	22 (50.00)	43 (36.44)		
Operation time (min)			2.350	0.125
≥127.5	17 (38.64)	31 (26.27)		
<127.5	27 (61.36)	87 (73.73)		
Operative blood loss (mL)			3.430	0.064
≥222.1	32 (72.73)	67 (56.78)		
<222.1	12 (27.27)	51 (43.22)		
S100β (T4) (pg/ml)			2.576	0.109
≥249.9	38 (86.36)	88 (74.58)		
<249.9	6 (13.64)	30 (25.42)		
NSE (T4) (pg/ml)			16.640	<0.001
≥7.0	33 (75.00)	46 (38.98)		
<7.0	11 (25.00)	72 (61.02)		
IL-1β (T4) (pg/ml)			2.465	0.116
≥27.5	15 (34.09)	26 (22.03)		
<27.5	29 (65.90)	92 (77.97)		
TNF-α (T4) (pg/ml)			6.283	0.012
≥26.0	28 (63.64)	49 (41.53)		
<26.0	16 (36.36)	69 (58.47)		
IL-6 (T4) (pg/ml)			3.600	0.058
≥19.0	38 (86.36)	85 (72.03)		
<19.0	6 (13.64)	33 (27.97)		
Intraoperative dexmedetomidine use			11.168	<0.001
Yes	12 (27.27)	67 (56.78)		
No	32 (72.73)	51 (43.22)		

ASA, American Society of Anesthesiologists; POCD, postoperative cognitive dysfunction; NSE, neuron-specific enolase; IL-1β, interleukin 1β; TNF-α, tumor necrosis factor alpha; IL-6, interleukin 6.

factors. This observation is consistent with findings reported by Xu et al. [21] and Liu et al. [22].

The post-surgical increase in inflammatory factors may be attributed to enhanced secretion of pro-adrenocorticotropic hormone and glucocorticoids, stimulated by hypothalamic activation during surgery. In the experimental group, dexmedetomidine was administered and has shown the capacity to lower concentrations of

Table 4. Assignment of relevant factors

Factor	Assignment of value
NSE (T4)	1= ≥7.0 pg/ml, 0= <7.0 pg/ml
TNF-α (T4)	1= ≥26.00 pg/ml, 0= <26.00 pg/ml
Intraoperative dexmedetomidine use	1= Yes, 0= No

NSE, neuron-specific enolase; TNF-α, tumor necrosis factor alpha.

pro-inflammatory factors, inhibit mononuclear macrophage cells, and modulate the release of TNF-α by activating the central α2-adrenergic receptor and the cholinergic anti-inflammatory pathway. Furthermore, dexmedetomidine regulates the release of IL-6 and TNF-α through its influence on nuclear factor kappa B. Consequently, dexmedetomidine can effectively reduce the levels of inflammatory factors in elderly patients following hip replacement surgery [12].

Stress during hip arthroplasty generates a substantial amount of inflammatory substances, leading to transient kidney damage and possibly acute kidney injury if not promptly addressed. BUN and Cr are critical indicators of renal injury. This study found that both BUN and Cr levels increased post-surgery in all patients, but those in the experimental group, who received dexmedetomidine, had significantly lower levels compared to the control group. This suggests that dexmedetomidine can effectively reduce serum Cr and BUN levels, thus improving renal function in elderly hip arthroplasty patients. Li et al. [12] also demonstrated that dexmedetomidine alleviates renal injury, which is consistent with our findings. Dexmedetomidine's protective effects on renal function are attributed to its ability to reduce metanephrine release and sympathetic nerve excitability, decrease vascular tone, enhance renal blood flow, redistribute blood flow to protect vital organs, suppress inflammatory factor expression, and activate the PI3K-Akt signaling pathway to inhibit apoptosis [23].

MoCA scale, a widely used tool for evaluating cognitive function where higher scores indicate better cognitive ability [24], showed that both groups improved post-surgery. Notably, the experimental group exhibited significantly higher MoCA scores than the control group, leading to a substantially lower incidence of POCD seven days after surgery. These results align with findings by Mei et al. [25], suggesting that dexmedetomidine can significantly enhance cognitive ability post-surgery and effectively reduce POCD incidence in elderly patients undergoing hip replacement. The development of POCD is influenced by various factors, notably the inflammatory response [26]. Surgical trauma and anesthetic stress can trigger the release of inflammatory factors, initiating a cascade of inflammatory responses that damage the nervous system. Dexmedetomidine's anti-inflammatory properties help inhibit the production and release of inflammatory factors, reducing the inflammatory response, thus improving postoperative cognitive function and decreasing POCD incidence.

In the analysis of factors influencing POCD, NSE levels (≥7.0 pg/ml) at T4 were identified as a risk factor for early POCD following hip replacement surgery in elderly patients. Elevated postoperative serum NSE levels, closely related to the extent of brain tissue damage, serve as markers for evaluating perioperative nerve tissue damage and predicting POCD [27]. Higher NSE levels indicate more severe neuronal damage, increasing the likelihood of cognitive dysfunction post-surgery. Thus, monitoring NSE levels can help identify elderly patients at risk of developing early POCD after hip replacement surgery. Fan et al. [28] demonstrated that the use of dexmedetomidine was a protective factor against POCD in elderly patients undergoing laparoscopic surgery, similar to findings in our study, where intraoperative dexmedetomidine administration also proved protective against POCD following hip replacement.

Both laparoscopic and hip replacement surgeries are associated with surgical trauma, which can trigger systemic inflammatory reactions. High concentrations of inflammatory factors can cause neurocytotoxic effects, leading to neurodegenerative diseases and POCD [29]. Dexmedetomidine administration during surgery can mitigate these inflammatory responses and brain damage, effectively reducing the risk of postoperative POCD. Thus, selecting appropriate anesthetic agents like dexmedetomidine can help minimize postoperative inflammatory responses and brain injury in elderly patients, reducing the risk of POCD.

Table 5. Logistic regression analysis of factors related to early POCD

Variable	β	S.E.	P	OR	95% CI
Intraoperative dexmedetomidine use	-0.857	0.418	0.041	0.424	[0.187, 0.964]
NSE (T4)	1.383	0.409	0.001	3.987	[1.789, 8.886]
TNF-α (T4)	0.605	0.401	0.131	1.832	[0.834, 4.022]

POCD, postoperative cognitive dysfunction; NSE, neuron-specific enolase; IL-1β, interleukin 1β; TNF-α, tumor necrosis factor alpha.

This study had certain limitations. It was conducted as a single-center study with a relatively small sample size, exclusively involving elderly patients undergoing hip replacement surgery at our hospital, without comparative data from other hospitals or regions. Future research could benefit from an expanded sample size and broader geographic scope to enhance the robustness of the findings. Additionally, as a retrospective study, our results may be subject to some bias. Future studies may also explore the effects of dexmedetomidine on other physiological functions and further investigate factors influencing the occurrence of POCD.

In conclusion, the use of dexmedetomidine in hip replacement surgery can reduce postoperative renal injury and inflammatory response, improve cognitive function in elderly patients, and effectively decrease the prevalence and risk of early POCD in this population.

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Disclosure of conflict of interest

None.

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