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Effects of intraoperative sedation with dexmedetomidine and cipepofol on postoperative delirium in elderly patients undergoing non-general anesthesia for limb fracture surgery

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Abstract: Objective To compare the effects of dexmedetomidine and cipepofol on postoperative delirium in elderly patients undergoing non-general anesthesia for limb fracture surgery, and provide a theoretical basis for the clinical selection of more appropriate sedative drugs. **Methods** Eighty-two elderly patients scheduled for elective non-general anesthesia limb fracture surgery at Pukou Affiliated Hospital of China Pharmaceutical University from July 2023 to July 2024 were prospectively selected and randomly assigned to two groups: dexmedetomidine group (group D, n=41) and cipepofol group (group C, n=41). According to different fracture surgical sites, corresponding nerve block anesthesia combined with intravertebral anesthesia were given in two groups. After confirming satisfactory anesthesia, sedation was administered according to randomization. Group D received dexmedetomidine [loading dose: 1 μg/kg pumped over 15 min; maintenance dose: 0.1-0.5 μg/ (kg·h)]. Group C received cipepofol [initial bolus loading dose: 0.1-0.2 mg/kg; maintenance dose: 0.06- 0.80 mg/ (kg · h)] until skin closure. The primary outcome was postoperative delirium incidence. Secondary outcomes included intraoperative hemodynamics [heart rate (HR), mean arterial pressure (MAP), pulse blood oxygen saturation (SpO_2)], postoperative pain, and complications. Observation time points: preoperative day 1 (T0), pre-sedation (T1), intra-sedation (T2), in the post anesthesia care unit (PACU) (T3), postoperative day 1 (T4), day 2 (T5), day 3 (T6), and day 5 (T7). **Results** One case of postoperative delirium occurred in group C, while none was observed in group D, with no statistically significant difference between the two groups of patients (P>0.05).At T5, resting visual analogue scale (VAS)scores were significantly lower in group D than in group C (OR=1.477, 95%CI: 1.044–2.090, P<0.05).Significant intergroup differences in active VAS scores existed at all time points (P<0.05).No significant differences in HR were observed between the two groups C (P>0.05). At T3, MAP was significantly lower in group D than in group (OR=779.410, 95%CI: 7.341–82,750.451, P<0.05). **Conclusion** Compared with dexmedetomidine, cipepofol does not significantly affect postoperative delirium incidence in elderly patients undergoing non-general anesthesia limb fracture surgery, and can provide more stable postoperative hemodynamics.

Keywords: Postoperative delirium; Cipepofol; Dexmedetomidine; Sedation; Non-general anesthesia; Elderly patients; Limb fracture surgery

Postoperative delirium is a common postoperative complication, primarily manifested as cognitive impairment, altered consciousness, and inattention, typically occurring within 24–72 hours post-surgery [1-2]. Postoperative delirium can lead to prolonged hospital stays, increase the 30-day readmission rate and the incidence of complications, reduce quality of life, and increase mortality risk [3-6].

According to the European Society of European Society of Anaesthesiology guidelines on postoperative delirium at 2017, its incidence of postoperative delirium ranges from 3.6% to 28.3% [7]. There are many factors influencing postoperative delirium, and orthopedic surgery is one of the main factors [8]. The incidence of postoperative delirium after orthopedic surgery ranges from 4% to 65% and is closely related to the type of surgery. Specifically, the incidence after elective orthopedic surgery is 9%–15%, while the incidence after hip surgery is as high as 35%–65% [9-10].

Studies have shown that compared with propofol, intraoperative sedation with dexmedetomidine can significantly reduce the incidence of postoperative delirium [11]. Propofol is a commonly used intravenous anesthetic with rapid onset, quick recovery, and potent effects, but it often suppresses respiration and circulation and causes injection pain [12]. Cipepofol, as a new generation phenolic intravenous general anesthetic, has a stronger affinity for gamma-aminobutyric acid (GABA). Besides sharing the advantages of propofol, it causes less suppression of the respiratory and circulatory systems, has minimal injection pain, and offers higher comfort [13]. Studies have confirmed that compared with propofol, using cipepofol in elderly patients undergoing orthopedic surgery can effectively reduce stress response and brain injury, promote postoperative recovery, result in faster recovery of cognitive function, and provide higher anesthetic safety [14].

Therefore, this study hypothesizes that in non-general anesthesia limb fracture surgery, the use of cipepofol for sedation does not increase the incidence of postoperative delirium compared with dexmedetomidine. This study aims to compare the effects of intraoperative sedation with dexmedetomidine versus cipepofol on postoperative delirium in patients undergoing non-general anesthesia limb fracture surgery.

1 Data and Methods

1.1 General Data

This study was approved by the Ethics Committee of the Pukou Affiliated Hospital of China Pharmaceutical University (Approval No.: 20230097). A total of 82 patients who underwent non-general anesthesia limb fracture surgery at the Pukou Affiliated Hospital of China Pharmaceutical University from July 2023 to July 2024 were prospectively selected as the study subjects.

Inclusion criteria: (1) Age 65–90 years; (2) American Society of Anesthesiologists (ASA) classification I–II; (3) Body Mass Index (BMI) 20–27 kg/m²; (4) Clear consciousness, mini-cognitive assessment instrument (Mini-Cog) score 4–5 points; (5) Preoperative informed consent, signed consent form, and willingness to cooperate with related procedures.

Exclusion criteria: (1) Preoperative limitations in independent activity, reduced activity tolerance, or inability to cooperate in delirium assessment due to visual or auditory impairments, dementia, or cognitive dysfunction; (2) History of psychiatric disorders or long-term use of psychotropic drugs; (3) History of acute cerebrovascular disease; (4) Hypoproteinemia (serum albumin<0.05); (5) Alcoholics; (6) Refuse sedative therapy.

Exclusion criteria: (1) Unplanned secondary surgery; (2) Intraoperative change of anesthesia method; (3) Midway withdrawal or loss to follow-up.

According to the computer-generated random number table, patients were randomly divided into the dexmedetomidine group (Group D) and the cyclosporine group (Group C) in a 1:1 ratio, with 41 patients included in each group. There was no statistically significant difference in age, gender, BMI, ASA grading, and surgical condition between two groups (P>0.05). See **Table 1** and **Table 2**.

1.2 Preoperative Visit

On the day before surgery, all patients received routine preoperative visits, including pain education and visual analogue scale (VAS) training. Preoperative status was recorded, including the 3-minute diagnostic interview for Confusion Assessment Method (3D-CAM) score and preoperative hemodynamic parameters: heart rate (HR), blood pressure, pulse oximetry, and blood oxygen saturation. Patients were instructed to fast for 8 hours and refrain from drinking for 4 hours prior to surgery, with no preoperative medication.

Tab.1 Comparison of general data between two groups(n=41)

Item	Group D	Group C	t/χ^2 value	P value
Age(years, $\bar{x}\pm s$)	73.22±6.94	72.49±7.09	0.472	0.638
Gender[male/female(case)]	17/24	18/23	0.050	0.823
Weight (kg, $\bar{x}\pm s$)	65.70±10.83	64.49±6.62	0.634	0.528
Height (m, $\bar{x}\pm s$)	1.64±0.08	1.64±0.07	0.130	0.897
BMI(kg/cm², $\bar{x}\pm s$)	24.4±3.19	23.98±2.59	0.659	0.512
ASA Classification [I/II(case)]	12/29	15/26	0.497	0.481

Tab.2 Comparison of operative conditions between two groups (n=41, $\bar{x}\pm s$)

Item	Group D	Group C	$t/\chi^2/Z$ value	P value
Surgical Type [Cases (%)]				
Hip and Femur	1(2.4)	1(2.4)		
Knee and Tibia-Fibula	13(31.7)	21(51.2)		
Foot and Ankle	10(24.4)	4(9.8)	6.587	0.253
Clavicle and Humerus	12(29.3)	7(17.1)		
Ulna and Radius	4(9.8)	7(17.1)		
Metacarpal	1(2.4)	1(2.4)		
Surgical Time (min)	85.0(50.0,113.0)	85.0(50.0,116.5)	0.394	0.889
Anesthesia Time (min)	122.85±59.31	118.71±45.83	0.354	0.724
Pumping Time (min,$\bar{x}\pm s$)	70.39±35.50	78.32±38.36	0.971	0.334
Blood Loss (mL)	50(15,75)	50(15,75)	0.451	0.652
Crystalloid Fluid (mL)	730.49±344.76	691.46±271.09	0.570	0.570
Colloid Fluid (mL)	390.24±209.53	414.63±190.47	0.552	0.583

Note: [a] meant the data was represented in the form of M (P_{25}, P_{75}).

1.3 Anesthesia Management

Upon entering the operating room, peripheral venous access was established, and routine monitoring of electrocardiogram, non-invasive arterial blood pressure, pulse oxygen saturation, HR, and temperature was performed. Oxygen was delivered via nasal cannula at a flow rate of 2–3 L/min. Patients with complex conditions or expected long surgical durations underwent continuous invasive arterial blood pressure and end-tidal CO_2 monitoring. After spinal anesthesia, a 6 mL/kg infusion of sodium Lactate Ringer's injection was given.

1.4 Anesthesia Methods for Fracture Surgery at Different Locations

1.4.1 Hip Fracture Surgery (Lower Limb Surgery)

Patients were placed in a supine position. Ultrasound-guided iliac fascia block was performed, and after the needle tip reached the target, 30 mL of 0.25% Ropivacaine was injected. After 10–15 minutes, when the patient's pain relief was achieved, spinal anesthesia was performed using the single-point method (L_{2-3} or L_{3-4} interspace) with intrathecal catheterization. Cerebrospinal fluid was observed to flow freely. And 2.0–3.0 mL of 0.5% hyperbaric bupivacaine was administered, followed by insertion of an epidural catheter 3 cm cranially after withdrawal of the spinal needle. After confirming no cerebrospinal fluid return, 3 mL of saline was injected and the catheter was fixed. The patient was assisted into the supine position, and the anesthesia level was adjusted to T_{10} using alcohol-soaked cotton balls, maintaining hemodynamic stability and assessing anesthesia effectiveness. If spinal anesthesia failed or the effect was unsatisfactory, general anesthesia was performed, and the patient was withdrawn from the study.

1.4.2 Non-Hip Fracture Surgery (Lower Limb Surgery)

For knee replacement surgery, the anesthesia procedure was similar to that for hip fracture surgery.

Postoperatively, ultrasound-guided single-shot femoral nerve block was performed, injecting 30 mL of 0.25% Ropivacaine after the needle tip reached the target. For tibia/fibula fracture and trimalleolar fractures, ultrasound-guided single-shot femoral nerve block (30 mL of 0.25% ropivacaine) and ultrasound-guided sciatic nerve block at the popliteal fossa (15 mL of 0.25% ropivacaine) were performed.

1.4.3 Upper Limb Fracture Surgery

Patients were placed in a supine position, with the head turned to the unaffected side. For clavicle, acromioclavicular joint, and humeral fractures, ultrasound-guided cervical nerve root block was performed. After the needle tip reached the target, 10 mL of 0.375% ropivacaine was injected. For brachial plexus (intermuscular groove approach) block, 20 mL of 0.375% Ropivacaine was used. For radius-ulna fractures or metacarpal bone fractures, ultrasound-guided brachial plexus block (intermuscular groove and axillary approach) was performed, with 15 mL of 0.375% ropivacaine for each approach. The patient was then assisted into the supine position, and anesthesia effectiveness was assessed. If nerve block anesthesia failed or the effect was unsatisfactory, general anesthesia was used, and the patient was withdrawn from the study.

1.5 Sedation plan

Group D patients were sedated with dexmedetomidine hydrochloride injection (Sichuan Meida Kanghua Pharmaceutical Co., Ltd.) during surgery, while Group C patients were sedated with propofol (Shenyang Haisco Pharmaceutical Co., Ltd.).

After evaluating satisfactory anesthesia effects, sedation was implemented according to the random grouping. Within 30 minutes of intravenous sedation medication, sedation levels were assessed every 5 minutes, then every 15 minutes thereafter. Group D: dexmedeto-midine hydrochloride was administered via intravenous pump, with a loading dose of 1 μg/kg infused over 15 minutes, and a maintenance dose of 0.1-0.5 $\mu g/kg^{-1}/h^{-1}$, with pump speed adjusted as needed to maintain light to moderate sedation, with a Modified Observer's Assessment of Alertness/Sedation (MOAA/S) score of 3 or 4, and a bispectral index (BIS) maintained at 70-90, stopping infusion 30 minutes before the end of surgery. Group C: The initial loading dose was 0.1-0.2 mg/kg, administered via a single intravenous bolus over 1 minute, followed by a continuous infusion of 0.06-0.80 $mg/kg^{-1}/h^{-1}$, with pump speed adjusted as needed to maintain light to moderate sedation, with MOAA/S score of 3 or 4, and BIS maintained at 70-90, stopping infusion at the end of skin suturing.

During surgery, attention was paid to maintaining body temperature and keeping the patient's perioperative temperature normal, with blood pressure fluctuations maintained within -20% to 20% (if blood pressure drops below baseline by 20%, 40 μg of deoxynorepinephrine was administered intravenously). If HR dropped below 45 beats per minute, 0.5 mg atropine was administered intravenously. For surgeries lasting longer than 2 hours, epidural anesthesia was administered with a test dose of 3 mL 2% lidocaine, followed by 5-minute monitoring and then a bolus of 1% lidocaine to ensure adequate anesthesia. Life signs were continuously monitored to maintain the stability of the patient's internal environment. Anesthesia effects were monitored throughout surgery to ensure level I anesthesia, and blood transfusions were performed as needed to maintain hemoglobin>10 g/dL, with blood glucose maintained between 8-12 mmol/L.

1.6 Postoperative pain relief plan

Patient-controlled intravenous analgesia (PCIA) with multimodal analgesia was used postoperatively. The analgesia pump formula consisted of: sufentanil 50-100 μg + tramadol 100-300 mg + palonosetron 0.25 mg, mixed with 200 mL of 0.9% sodium chloride. The loading dose was 3-5 mL, with a maintenance dose of 2-4 mL/h and additional doses of 3-6 mL every 30 minutes. The loading dose was administered 20 minutes before the end of surgery, and the intravenous pump was connected after surgery. Postoperative monitoring was done in the postanesthesia care unit (PACU) for 30 minutes before the patient was transferred back to the ward.

1.7 Observation indicators

The primary observation indicator was postoperative delirium in both groups of patients, while the secondary observation indicators included intraoperative hemodynamics, postoperative pain, and postoperative complications. (1) Postoperative delirium assessment: The 3D-CAM assessment was used to evaluate delirium at 4 time points: postoperative day 1 (T4), day 2 (T5), day 3 (T6), and day 5 (T7). A positive result at any time point indicated postoperative delirium. (2) Hemodynamic assessment: HR, mean arterial pressure (MAP), and percutaneous arterial oxygen saturation (SpO_2) were measured at four time points: preoperative day 1 (T0), before sedation in the operating room (T1), during sedation (T2), and in the PACU (T3). (3) Postoperative pain level assessment: The visual analog scale (VAS) was used to assess resting and activity pain scores at four time points: T4, T5, T6, and T7. The Self-Rating Anxiety Scale (SAS), Self-Rating Depression Scale (SDS), Gastrointestinal Symptoms Rating Scale (GSRS), Pittsburgh Sleep Quality Index (PSQI), and Bristol stool chart were also used. (4) Adverse reactions, such as nausea, vomiting, postoperative agitation, puncture injury, urinary retention, postoperative headache, and infection, were recorded at four time points: T4, T5, T6, and T7.

1.8 Statistical methods

SPSS 27.0 software was used for data analysis. The Kolmogorov-Smirnov test was applied to determine the normality of continuous variables. Normally distributed data were expressed as $\bar{x} \pm s$, and inter-group comparisons were performed using independent *t*-tests. Data that were not normally distributed were expressed as $M(P_{25},P_{75})$, and comparisons of repeated measures at different time points were analyzed using generalized estimating equations. Categorical data were presented as case (%), and chi-square test was used. $P<0.05$ was considered statistically significant.

2 Results

2.1 Comparison of VAS Pain Scores

2.1.1 VAS score at resting state

Generalized estimating equation (GEE) analysis of repeated measurements of resting state VAS scores showed an interaction effect between group and time (P<0.01). The VAS scores in Group D and Group C gradually decreased over time, with statistically significant differences (χ^2=13.529, P<0.01; χ^2=33.777, P<0.01). At the time point T5, the resting state score in Group D was lower than that in Group C (*OR*=1.477, 95%*CI*: 1.044-2.090, P<0.05). See **Table 3**.

2.1.2 VAS score at motion state

GEE analysis of repeated measurements of exercise state VAS scores showed no interaction effect between group and time (P>0.05). There was no statistically significant difference between the two groups (P>0.05), but differences at each time point were statistically significant (P<0.05). See **Table 3**.

Tab.3 Comparison of postoperative VAS scores at each time point between two groups [n=41, point, M (P_{25},P_{75})]

Group	Resting state				Motion state			
	T4	T5	T6	T7	T4	T5	T6	T7
Group D	0(0,1)	0(0,1)[a]	0(0,1)	0(0,0)	2(1,3)	2(1,2)	1(1,2)	1(0,2)
Group C	1(0,2)	1(0,1)	0(0,1)	0(0,0)	3(1.5,3)	2(1,2.5)	1(1,2)	1(0,1)
χ^2/P_{group} value	0.906/0.341				0.207/0.870			
χ^2/P_{time} value	41.206/<0.001				127.736/<0.001			
$\chi^2/P_{interaction}$ value	14.085/0.003				5.996/0.112			

Note: Compared with Group C, [a]P<0.05.

2.2 Hemodynamic Indicator Comparison

2.2.1 HR

GEE analysis of repeated measurement data showed an interaction effect between group and time (P<0.05). The time effect differed significantly between Group D and Group C (χ^2=88.345, P<0.01; χ^2=18.171, P<0.01). Pairwise comparisons revealed no statistically significant differences in HR between the two groups at T0 and T1, or at T2 and T3 (P>0.05), while significant differences were observed at other time points (P<0.05). Group comparison showed no statistically significant differences between the two groups at any time point (P>0.05). See **Table 4**.

2.2.2 MAP

GEE analysis of repeated measurement data showed an interaction effect between group and time (P<0.01). The time effect differed significantly between Group D and Group C (χ^2=113.106, P<0.01; χ^2=116.181, P<0.01). Pairwise comparisons revealed statistically significant differences in MAP at all time points for Group D (P<0.05), while no significant differences were found for Group C between T0 and T3 (P>0.05), with significant differences at other time points (P<0.05). At the T3 time point, the MAP of Group D was lower than that of Group C, and the difference was statistically significant (*OR*=779.410, 95%*CI*: 7.341-82750.451, P<0.05). See **Table 4**.

2.2.3 SpO_2

The generalized estimating equation (GEE) analysis of repeated measurement data showed an interaction effect between group and time (P<0.05). The time effect differed significantly between Group D and Group C (χ^2=29.862, P<0.01; χ^2=15.614, P<0.01). Pairwise comparisons revealed no statistically significant differences in SpO_2 for Group D between T0 and T1, or between T2 and T3 (P>0.05), while no significant differences were found in SpO_2 for Group C between T2 and T3 (P>0.05). Significant differences were observed at other time points (P<0.05). Group comparison showed no statistically significant differences between the two groups at any time point (P>0.05). See **Table 4**.

2.3 Comparison of Postoperative Delirium

One patient in the C group developed postoperative delirium. This patient was a 71-year-old female who underwent open reduction and internal fixation for a patellar fracture. Her preoperative Mini-Cog score was 3, with no cognitive impairment. On postoperative day 1, her resting state VAS score was 3, and her exercise state VAS score was 4. The 3D-CAM scale indicated the patient had delirium (positive for attention deficit, altered consciousness, and disorganized thinking), lasting for 9 hours. No postoperative delirium was found in the D group. There was no statistically significant difference in postoperative delirium incidence between two groups (P >0.05).

Tab.4 Comparison of hemodynamic indicators between two groups (n=41, $\bar{x}\pm s$)

Group	HR (beats/min)				MAP(mmHg)				SpO_2(%)			
	T0	T1	T2	T3	T0	T1	T2	T3	T0	T1	T2	T3
Group D	76.39±8.67	78.1±10.46	64.39±8.99[a]	65.55±11.12	98.34±1.72	104.76±13.86	83.76±12.21	87.76±12.21[a]	97.83±1.72	98.1±1.95	99.15±1.09	98.79±1.21
Group C	74.15±13.88	75.39±12.48	66.59±13.95	68.49±10.31	97.49±11.35	103.63±12.13	83.17±10.55	94.66±9.74	98.22±1.65	98.63±1.48	98.88±1.47	99.34±1.09
χ^2/P_{group} value	0.071/0.790				0.259/0.611				1.379/0.240			
χ^2/P_{time} value	84.485/<0.001				221.257/<0.001				37.692/<0.001			
$\chi^2/P_{interaction}$ value	10.327/0.016				15.442/<0.001				11.142/0.011			

Note: Compared with Group C, [a]P<0.05.

3 Discussion

The results of this study indicate that under the same depth of sedation, compared with dexmedetomidine, cipepofol did not increase the incidence of postoperative delirium in patients undergoing non-general anesthesia for limb fractures, and patients in the C group had more stable postoperative hemodynamics.

Dexmedetomidine, as a highly selective α2-adrenergic receptor agonist, has been confirmed by numerous studies to reduce the incidence of postoperative delirium [11]. Its mechanism of action includes binding to α2A receptors in the locus coeruleus of the brain, producing a sleep-like effect similar to physiological

sleep, and modulating the stress response of the hypothalamic-pituitary-adrenal axis, thereby exerting sedative, anxiolytic, and analgesic-adjuvant effects [15-16]. Furthermore, dexmedetomidine can also reduce the production of neuroinflammatory factors and has neuroprotective effects. A retrospective study also showed that compared with propofol-induced sedation, intraoperative dexmedetomidine-induced sedation reduced postoperative agitation in elderly patients undergoing orthopedic surgery [17]. Dexmedetomidine can effectively maintain hemodynamic stability in elderly patients during the perioperative period and reduce the incidence of cardiac events [18]. However, dexmedetomidine also has some limitations, such as potentially causing hemodynamic fluctuations like hypertension, hypotension, and bradycardia [19-20].

Cipepofol is a novel 2,6-disubstituted phenol derivative. As an analog of propofol, it binds more tightly to the gamma-aminobutyric acid-A ($GABA_A$) receptor, and its potency is 4–5 folds that of propofol [21-22]. Compared with propofol, cipepofol has higher hydrophobicity, lower plasma concentration, and less injection pain [23]. Studies have shown that cipepofol can effectively reduce the stress response and brain injury, promote postoperative recovery, and accelerate the recovery of cognitive function in elderly patients undergoing orthopedic surgery [14]. Its mechanism may be related to cipepofol reducing the release of inflammatory markers, inhibiting the adhesion and chemotaxis of neutrophils, and promoting the release of anti-inflammatory factors, thereby alleviating the systemic inflammatory response and reducing the incidence of postoperative delirium.

In this study, patients in the C group exhibited a more stable hemodynamic status. The loading dose of dexmedetomidine led to a transient increase in blood pressure and a reflex decrease in HR, especially in young, healthy patients. This initial cardiovascular response is most likely due to vasoconstriction induced by stimulation of peripheral αB receptors in vascular smooth muscle; however, hypotension subsequently occurs when the vasodilatory effect of central αA receptors becomes dominant. The dose-dependent bradycardia observed during dexmedetomidine treatment is primarily mediated by reduced sympathetic tone, and partly mediated by the baroreceptor reflex and increased vagal activity [24-25], which is consistent with the results of this study. Some studies have indicated that the HR in the dexmedetomidine group was mostly lower than that in the propofol group, but not below 60 beats/min [26-28]. Although the HR of patients in the dexmedetomidine group decreased in this study, the difference was not statistically significant, which might be related to the insufficient sample size. At time point T3, the blood pressure in the D group was significantly lower than that in the C group.

This study has the following limitations: (1) The single-center, small-sample-size design may affect the generalizability of the results; future multi-center, large-sample-size studies are needed for further verification. (2) Patients were not categorized by type of surgery; future research could focus on elderly patients or specific surgical types to enhance the persuasiveness of the conclusions. (3) The postoperative hemodynamic follow-up period was relatively short, failing to fully evaluate the sustained blood pressure-lowering effect of dexmedetomidine; subsequent studies should extend the follow-up time.

In summary, compared with dexmedetomidine, cipepofol has no significant effect on the incidence of postoperative delirium in elderly patients undergoing non-general anesthesia for limb fractures, and patients receiving cipepofol exhibited more stable postoperative hemodynamics.

Conflict of Interest None

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·论　著·

右美托咪啶与环泊酚术中镇静对老年患者非全麻四肢骨折术后谵妄的影响

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摘要：目的　研究右美托咪啶与环泊酚对非全身麻醉四肢骨折手术患者围手术期镇痛、血流动力学及术后谵妄的影响，以期为临床选择更合适的镇静药物提供理论依据。**方法**　前瞻性选择中国药科大学附属浦口中医院2023年7月至2024年7月择期行非全麻四肢骨折手术的82例老年患者，按照随机数字表法分为右美托咪啶组（D组，41例）和环泊酚组（C组，41例）。按照不同骨折手术部位两组实施相应的神经阻滞麻醉联合椎管内麻醉，评估麻醉效果满意后，按照随机分组实施镇静。D组患者术中使用右美托咪啶镇静，负荷量1 μg/kg泵注15 min，维持量0.1~0.5 μg/（kg·h）；C组患者术中使用环泊酚镇静，首次静脉推注负荷剂量0.1~0.2 mg/kg，维持量0.06~0.80 mg/（kg·h），直至缝皮结束时停止输注。主要观察指标为两组患者术后的谵妄情况，次要观察指标为两组患者术中血流动力学指标，包括心率（HR）、平均动脉压（MAP）、脉搏血氧饱和度（SpO_2），术后疼痛和术后并发症情况。观察时点分别为术前1 d（T0）、入室镇静前（T1）、镇静中（T2）、麻醉后监测治疗室（PACU）中（T3）、术后1 d（T4）、术后2 d（T5）、术后3 d（T6）、术后5 d（T7）。**结果**　C组患者术后谵妄1例，D组患者未发现术后谵妄，两组患者术后谵妄发生率差异无统计学意义（$P>0.05$）。在T5时点，D组患者静息状态视觉模拟评分（VAS）评分低于C组，差异有统计学意义（$OR=1.477$，95%CI：1.044~2.090，$P<0.05$）。两组患者在各时点运动VAS评分差异有统计学意义（$P<0.05$）。但两组间HR、SpO_2差异无统计学意义（$P>0.05$）。在T3时间点，D组MAP低于C组，差异有统计学意义（$OR=779.410$，95%CI：7.341~82 750.451，$P<0.05$）。**结论**　与右美托咪啶相比，环泊酚对非全麻四肢骨折老年患者术后谵妄发生率无显著影响，且使用环泊酚的患者术后血流动力学更为稳定。

关键词：术后谵妄；环泊酚；右美托咪啶；镇静；非全身麻醉；老年患者；四肢骨折手术
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Effects of intraoperative sedation with dexmedetomidine and ciprofol on postoperative delirium in elderly patients undergoing non-general anesthesia for limb fracture surgery

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Abstract: Objective　To compare the effects of dexmedetomidine and ciprofol on postoperative delirium in elderly patients undergoing non-general anesthesia for limb fracture surgery, and provide a theoretical basis for the clinical selection of more appropriate sedative drugs. **Methods**　Eighty-two elderly patients scheduled for elective non-general anesthesia limb fracture surgery at Pukou Affiliated Hospital of China Pharmaceutical University from July 2023 to July 2024 were prospectively selected and randomly assigned to two groups: dexmedetomidine group (group D, n=41) and ciprofol group (group C, n=41). According to different fracture surgical sites, corresponding nerve block anesthesia combined with intravertebral anesthesia were given in two groups. After confirming satisfactory anesthesia, sedation was administered according to randomization. Group D received dexmedetomidine [loading dose: 1 μg/kg pumped over 15

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min; maintenance dose: 0.1-0.5 μg/(kg·h)]. Group C received ciprofol [initial bolus loading dose: 0.1-0.2 mg/kg; maintenance dose: 0.06-0.80 mg/(kg·h)] until skin closure. The primary outcome was postoperative delirium incidence. Secondary outcomes included intraoperative hemodynamics [heart rate (HR), mean arterial pressure (MAP), pulse blood oxygen saturation (SpO_2)], postoperative pain, and complications. Observation time points: preoperative day 1 (T0), pre-sedation (T1), intra-sedation (T2), in the postanesthesia care unit (PACU) (T3), postoperative day 1 (T4), day 2 (T5), day 3 (T6), and day 5 (T7). **Results** One case of postoperative delirium occurred in group C, while none was observed in group D, with no statistically significant difference between the two groups of patients (P>0.05). At T5, resting visual analogue scale (VAS) scores were significantly lower in group D than in group C (OR=1.477, 95% CI: 1.044-2.090, P<0.05). Significant intergroup differences in active VAS scores existed at all time points (P<0.05). No significant differences in HR and SpO_2 were observed between the two groups (P>0.05). At T3, MAP was significantly lower in group D than in group C(OR=779.410, 95%CI: 7.341-82 750.451, P<0.05). **Conclusion** Compared with dexmedetomidine, ciprofol does not significantly affect postoperative delirium incidence in elderly patients undergoing non-general anesthesia limb fracture surgery, and can provide more stable postoperative hemodynamics.

Keywords: Postoperative delirium; Ciprofol; Dexmedetomidine; Sedation; Non-general anesthesia; Elderly patients; Limb fracture surgery

术后谵妄是一种常见的术后并发症，主要表现为认知障碍、意识改变和注意力不集中，通常发生于术后24~72 h[1-2]。术后谵妄会导致患者住院时间延长，增加30 d再入院率和并发症的发生率，降低生活质量，增加死亡风险[3-6]。

根据2017年欧洲麻醉协会发布的术后谵妄指南，术后谵妄的发生率为3.6%~28.3%[7]。影响术后谵妄的因素很多，骨科手术是影响术后谵妄的主要因素之一[8]，骨科手术术后谵妄发生率为4%~65%，并且与手术种类密切相关，其中骨科择期手术术后谵妄发生率为9%~15%，髋部手术术后谵妄发生率为35%~65%[9-10]。

研究表明，与丙泊酚相比，术中使用右美托咪啶镇静可显著降低术后谵妄发生率[11]。丙泊酚是目前常用的静脉麻醉药，起效快、苏醒快、作用强，但常会抑制呼吸循环，且具有注射痛[12]。环泊酚是新一代酚类静脉全身麻醉药，对γ-氨基丁酸(GABA)具有更强的亲和力，除了具备丙泊酚的优点外，对呼吸系统和循环系统的抑制作用更轻，注射痛不明显，舒适性高[13]。有研究证实，较之丙泊酚，环泊酚应用在老年骨科手术患者中可有效减轻应激反应与脑损伤，促进患者术后恢复，且术后认知功能恢复更快，具有更高的麻醉安全性[14]。

因此本研究提出假设：在非全麻四肢骨折手术中，相较于右美托咪啶，应用环泊酚镇静不会增加术后谵妄发生率。本研究旨在比较右美托咪啶与环泊酚术中镇静对非全麻四肢骨折手术患者术后谵妄的影响。

1 资料和方法

1.1 一般资料 本研究经中国药科大学附属浦口中医院伦理委员会批准(伦审号：20230097)，前瞻性选取2023年7月至2024年7月该院接受非全麻四肢骨折手术的82例患者作为研究对象。纳入标准：(1) 年龄65~90岁；(2) 美国麻醉医师协会(American Society of Anesthesiologists, ASA)分级Ⅰ~Ⅱ级；(3) 身体质量指数(body mass index, BMI) 20~27 kg/m^2；(4) 患者意识清楚，简易智力状态评估量表(Mini-Cog)4~5分；(5) 患者术前知情同意，签署知情同意书，愿意配合相关操作。排除标准：(1) 术前存在自主活动受限、活动耐量降低或存在视觉听觉损害、痴呆、认知功能障碍等无法配合谵妄评估者；(2) 术前有精神疾病或精神疾病史，长期使用精神类药物者；(3) 既往急性脑血管病史；(4) 低蛋白血症(白蛋白<30 g/L)；(5) 酗酒者；(6) 拒绝镇静治疗者。剔除标准：(1) 发生非计划二次手术；(2) 术中改变麻醉方式；(3) 中途退出或随访失败。按照计算机生成的随机数字表，将患者按1∶1随机分为右美托咪啶组(D组)和环泊酚组(C组)，每组纳入41例患者。两组患者年龄、性别、BMI、ASA分级、手术情况差异无统计学意义(P>0.05)。见表1、表2。

1.2 术前访视 术前1 d对所有患者进行常规访视，并进行疼痛知识宣教及视觉模拟评分法(visual analogue scale, VAS)培训。记录患者术前状态，包括术前3 min谵妄诊断量表(3-minute diagnostic interview for Confusion Assessment Method, 3D-CAM)评分，术前血流动力学指标：心率(heart rate, HR)、血压、脉搏血氧饱和度。常规禁食8 h，禁饮4 h，没有术前用药。

1.3 麻醉前管理 患者入室后开放外周静脉，常规监测心电图、无创动脉血压、脉搏氧饱和度、HR、体温等，

鼻导管吸氧，氧流量2~3 L/min，病情复杂或预计手术时间长者需连续监测有创动脉血压、呼气末二氧化碳。实施椎管内麻醉前给予乳酸钠林格6 mL/kg扩容。

1.4　不同部位骨折手术麻醉方式

1.4.1　髋关节周围骨折下肢手术　患者取平卧位，行超声引导下髂筋膜阻滞，针尖到达目标位置后，给予0.25%罗哌卡因30 mL，等待10~15 min，待患者疼痛缓解后，按照椎管内麻醉流程，采用一点法（L_{2-3}或L_{3-4}间隙）行腰硬联合麻醉，脑脊液回流通畅，给予0.5%重比重布比卡因2.0 ~ 3.0 mL，退出腰麻针向头端置入硬膜外导管3 cm，回抽无脑脊液，推入3 mL生理盐水顺畅后妥善固定，协助患者恢复仰卧位，用酒精棉球擦拭法，调整麻醉平面至T_{10}，维持血流动力学稳定，评估麻醉效果。若椎管内麻醉失败，麻醉效果不满意，则改行全身麻醉，患者退出研究。

1.4.2　非髋关节周围骨折下肢手术　麻醉流程同髋关节周围骨折，膝关节置换的患者术后在恢复室行超声引导下单次收肌管阻滞，针尖到达目标位置后推注0.25%罗哌卡因30 mL；胫腓骨、三踝骨折患者行超声引导下单次收肌管阻滞（0.25%罗哌卡因30 mL）和超声引导下腘窝上坐骨神经阻滞（0.25%罗哌卡因15 mL）。

1.4.3　上肢骨折手术　患者取平卧位，头偏向健侧，锁骨、肩锁关节、肱骨骨折行超声引导下颈神经通路阻滞，针尖到达目标位置后，给予0.375%罗哌卡因10 mL，行超声引导下臂丛（肌间沟入路）阻滞，给予0.375%罗哌卡因20 mL；尺桡骨、掌指骨骨折行超声引导下臂丛（肌间沟入路+腋路）阻滞，给予0.375%罗哌卡因各15 mL，协助患者恢复仰卧位，评估麻醉效果。若神经阻滞麻醉失败，麻醉效果不满意，则改行全身麻醉，患者退出研究。

1.5　镇静方案　D组患者术中使用盐酸右美托咪啶注射液（四川美大康华康药业有限公司）镇静，C组患者术中使用环泊酚（沈阳海思科制药有限公司）镇静。

评估麻醉效果满意后，按照随机分组实施镇静。静脉给予镇静药的30 min内，每5分钟评估镇静水平，之后每15分钟评估1次。D组：静脉泵入盐酸右美托咪啶，负荷量1 μg/kg泵注15 min，维持量0.1~0.5 μg/（kg·h），随时调整泵速维持患者处于轻中度镇静，改良的镇静评分（modified observer's assessment of alertness/sedation，MOAA/S）评分3或4分，脑电双频指数（bispectral index，BIS）维持在70~90，于手术结束前30 min停止输注。C组：首次负荷剂量0.1~0.2 mg/kg，1 min单次静脉推注后，0.06~0.80 mg/（kg·h）持续泵注，随时调整泵速维持患者处于轻中度镇静，MOAA/S评分3或4分，BIS维持在70~90，直至缝皮结束时停止输注。

术中注意保温，维持患者围手术期体温正常，维持血压波动在-20% ~ 20%（当血压低于基础血压20%，静脉推注去氧肾上腺素40 μg），当HR低于45次/min，静脉给予阿托品0.5 mg，当手术时间长于2 h，椎管内麻醉者硬膜外给予3 mL 2%利多卡因试验量，5 min后硬膜外推注1%利多卡因保证麻醉效果，注意监测患者生命体征，维持患者内环境稳定。术中时刻关注麻醉效果，保证麻醉效果Ⅰ级，必要时及时输血，维持患者血红蛋白 > 10 g/dL，维持血糖8~12 mmol/L。

1.6　术后镇痛方案　术后采用患者自控静脉镇痛，镇痛泵配方为：舒芬太尼50~100 μg+曲马多100~300 mg+帕洛诺司琼0.25 mg，加0.9%氯化钠配置200 mL，负荷量3~5 mL，维持量2~4 mL/h，追加量3~6 mL，间隔30 min。手术结束前20 min给予负荷量，手术结束接入静脉泵，入麻醉后监测治疗室（postanesthesia care unit，PACU）监护30 min后回病房。

1.7　观察指标　主要观察指标为两组患者术后谵妄情况，次要观察指标为两组患者术中血流动力学、术后疼痛和术后并发症情况。（1）术后谵妄评估：3D-CAM评估4个时间点的谵妄状态，术后1 d（T4）、术后2 d（T5）、术后3 d（T6）、术后5 d（T7）。有任一时间点阳性，则为术后谵妄。（2）血流动力学评估：术前1 d（T0）、入室镇静前（T1）、镇静中（T2）、PACU中（T3）的HR、平均动脉压（mean arterial pressure，MAP）和经皮动脉血氧饱和度（percutaneous arterial oxygen saturation，SpO_2）。（3）术后疼痛程度评估：采用VAS疼痛评分法，评估患者术后T4、T5、T6、T7时间点的静息和活动疼痛评分。采用焦虑自评量表（SAS）、抑郁自评量表（SDS）、肠道症状评定量表（GSRS）、匹兹堡睡眠质量指数（PSQI）、布里斯托大便分类法。（4）记录T4、T5、T6、T7时间点恶心呕吐、术后躁动、穿刺损伤、尿潴留、术后头痛及感染等不良反应的发生情况。

1.8　统计学方法　采用SPSS 27.0软件分析数据。采用Kolmogorov-Smirnov检验确定计量资料的正态性，符合正态分布的计量资料用$\bar{x}\pm s$表示，组间比较采用独立样本t检验，不符合正态分布的用$M(P_{25}, P_{75})$表示，重复测量资料不同时间点的比较采用广义估计方程分析。计数资料用例（%）表示，采用χ^2检验。$P < 0.05$为差异有统计学意义。

2 结 果

2.1 VAS疼痛评分比较

2.1.1 静息状态VAS评分 重复测量资料的广义估计方程分析结果显示，分组×时间之间有交互效应（$P<0.01$）。D组和C组的VAS评分随着时间延长逐渐降低，差异有统计学意义（$\chi^2=13.529$，$P<0.01$；$\chi^2=33.777$，$P<0.01$）。在T5时间点，D组静息状态VAS评分低于C组，差异有统计意义（$OR=1.477$，95%CI：1.044~2.090，$P<0.05$）。见表3。

2.1.2 运动状态VAS评分 重复测量资料的广义估计方程分析结果显示，分组×时间无交互效应（$P>0.05$）。两组组间差异无统计学意义（$P>0.05$）；各时间点比较差异有统计学意义（$P<0.05$）。见表3。

2.2 HR 重复测量资料的广义估计方程分析结果显示，分组×时间有交互效应（$P<0.05$）。D组和C组的时间效应差异有统计学意义（$\chi^2=88.345$，$P<0.01$；$\chi^2=18.171$，$P<0.01$）；两两比较显示，两组的HR在T0和T1时点、T2和T3时点比较差异无统计学意义（$P>0.05$），其他时间点两两比较差异有统计学意义（$P<0.05$）。组间比较显示，在各时间点两组HR比较差异无统计学意义（$P>0.05$）。

2.3 MAP 重复测量资料的广义估计方程分析结果显示，分组×时间有交互效应（$P<0.01$）。D组和C组的时间效应差异有统计学意义（$\chi^2=113.106$，$P<0.01$；$\chi^2=116.181$，$P<0.01$），两两比较显示，D组的MAP在各个时间点两两比较差异有统计学意义（$P<0.05$），C组的MAP在T0和T3时点比较差异无统计学意义（$P>0.05$），其他时间点两两比较差异有统计学意义（$P<0.05$）。在T3时间点，D组MAP低于C组，差异有统计学意义（$OR=779.410$，95%CI：7.341~82 750.451，$P<0.05$）。

2.4 SpO_2 重复测量资料的广义估计方程分析结果显示，分组×时间有交互效应（$P<0.05$）。D组和C组的时间效应差异有统计学意义（$\chi^2=29.862$，$P<0.01$；$\chi^2=15.614$，$P<0.01$），两两比较显示，D组的SpO_2在T0和T1时点、T2和T3时点比较差异无统计学意义（$P>0.05$），C组的SpO_2在T2和T3时点比较差异无统计学意义（$P>0.05$），其他时间点两两比较差异有统计学意义（$P<0.05$）。组间比较显示，在各时间点两组SpO_2比较差异无统计学意义（$P>0.05$）。见表4。

2.5 术后谵妄情况比较 C组患者术后谵妄1例，该患者女性，71岁，行髌骨骨折切开复位内固定术，术前Mini-Cog评分3分，无认知障碍；术后1 d访视，静息状态VAS评分3分，运动状态VAS评分4分，3D-CAM量表提示患者谵妄状态（注意力障碍、意识水平改变、思维紊乱均为阳性），持续9 h。D组患者未发现术后谵妄。两组患者术后谵妄发生率差异无统计学意义（$P>0.05$）。

表1 两组患者一般资料比较 （n=41）

Tab.1 Comparison of general information between two groups （n=41）

项目	D组	C组	t/χ^2值	P值
年龄（岁，$\bar{x}\pm s$）	73.22±6.94	72.49±7.09	0.472	0.638
性别[男/女（例）]	17/24	18/23	0.050	0.823
体质量（kg，$\bar{x}\pm s$）	65.70±10.83	64.49±6.62	0.634	0.528
身高（m，$\bar{x}\pm s$）	1.64±0.08	1.64±0.07	0.130	0.897
BMI（kg/cm^2，$\bar{x}\pm s$）	24.40±3.19	23.98±2.59	0.659	0.512
ASA分级[Ⅰ级/Ⅱ级（例）]	12/29	15/26	0.497	0.481

表2 两组患者手术情况比较 （n=41）

Tab.2 Comparison of operative conditions between two groups （n=41）

项目	D组	C组	$\chi^2/Z/t$值	P值
手术类型[例（%）]				
髋部和股骨	1（2.4）	1（2.4）	6.587	0.253
膝关节和胫腓骨	13（31.7）	21（51.2）		
足与踝	10（24.4）	4（9.8）		
锁骨和肱骨	12（29.3）	7（17.1）		
尺桡骨	4（9.8）	7（17.1）		
掌骨	1（2.4）	1（2.4）		
手术时间（min）[a]	85.0（50.0，113.0）	85.0（50.0，116.5）	0.394	0.889
麻醉时间（min，$\bar{x}\pm s$）	122.85±59.31	118.71±45.83	0.354	0.724
泵药时间（min，$\bar{x}\pm s$）	70.39±35.50	78.32±38.36	0.971	0.334
失血量（mL）[a]	50（15，75）	50（15，75）	0.451	0.652
晶体液（mL，$\bar{x}\pm s$）	730.49±344.76	691.46±271.09	0.570	0.570
胶体液（mL，$\bar{x}\pm s$）	390.24±209.53	414.63±190.47	0.552	0.583

注：[a]采用$M(P_{25},P_{75})$表示。

表3 两组患者术后各时点VAS评分比较 ［n=41，分，$M(P_{25},P_{75})$］

Tab.3 Comparison of postoperative VAS scores at each time point between two groups ［n=41，point，$M(P_{25},P_{75})$］

组别	静息状态				运动状态			
	T4	T5	T6	T7	T4	T5	T6	T7
D组	0（0，1）	0（0，1）[a]	0（0，1）	0（0，0）	2（1，3）	2（1，2）	1（1，2）	1（0，2）
C组	1（0，2）	1（0，1）	0（0，1）	0（0，0）	3（1.5，3）	2（1，2.5）	1（1，2）	1（0，1）
$\chi^2/P_{组间}$值	0.906/0.341				0.207/0.870			
$\chi^2/P_{时间}$值	41.206/<0.001				127.736/<0.001			
$\chi^2/P_{交互}$值	14.085/0.003				5.996/0.112			

注：与C组相比，[a]$P<0.05$。

表4　两组患者HR、MAP和SpO_2比较　(n=41, $\bar{x}\pm s$)

Tab.4　Comparison of HR, MAP and SpO_2 between two groups　(n=41, $\bar{x}\pm s$)

组别	HR(次/min)				MAP(mmHg)				SpO_2(%)			
	T0	T1	T2	T3	T0	T1	T2	T3	T0	T1	T2	T3
D组	76.39±8.67	78.10±10.46	64.39±8.99	65.55±11.12	98.34±1.72	104.76±13.86	83.76±12.21	87.76±12.21[a]	97.83±1.72	98.10±1.95	99.15±1.09	98.79±1.21
C组	74.15±13.88	75.39±12.48	66.59±13.95	68.49±10.31	97.49±11.35	103.63±12.13	83.17±10.55	94.66±9.74	98.22±1.65	98.63±1.48	98.88±1.47	99.34±1.09
$\chi^2/P_{组间}$值	0.071/0.790				0.259/0.611				1.379/0.240			
$\chi^2/P_{时间}$值	84.485/<0.001				221.257/<0.001				37.692/<0.001			
$\chi^2/P_{交互}$值	10.327/0.016				15.442/<0.001				11.142/0.011			

注：与C组相比，[a]$P<0.05$。

3　讨　论

本研究结果表明，在相同镇静深度下，与右美托咪啶相比，环泊酚未增加非全麻四肢骨折患者术后谵妄发生率，且C组患者术后血流动力学更为稳定。

右美托咪啶作为一种高选择性的α2肾上腺素能受体激动剂，已被大量研究证实可降低术后谵妄发生率[11]。其作用机制包括与大脑蓝斑核内α2 A受体结合，产生类似生理性睡眠效应，调节下丘脑垂体-肾上腺轴的应激反应，从而发挥镇静、抗焦虑和辅助镇痛作用[15-16]，此外，右美托咪啶还能减少神经炎症因子的产生，具有神经保护作用。一项回顾性研究也表明，与丙泊酚诱导的镇静相比，术中右美托咪啶诱导的镇静减少了接受骨科手术的老年患者的术后躁动[17]。右美托咪啶能够有效维持老年患者围手术期的血流动力学稳定，降低心脏事件的发生率[18]。然而，右美托咪啶也存在一些局限性，例如可能引起高血压、低血压和心动过缓等血流动力学波动[19-20]。

环泊酚是一种新型2,6-二取代苯酚衍生物，作为丙泊酚的类似物，其与γ-氨基丁酸A型(GABAA)受体的结合更为紧密，效价强度是丙泊酚的4~5倍[21-22]。与丙泊酚相比，环泊酚的疏水性更高，血浆浓度更低，注射疼痛更轻[23]。研究表明，环泊酚在老年骨科手术患者中可有效减轻应激反应与脑损伤，促进术后恢复，并加快认知功能的恢复[14]。其机制可能与环泊酚减少炎性标志物的释放，抑制中性粒细胞的黏附和趋化作用，以及促进抗炎因子的释放有关，从而减轻全身炎症反应，降低术后谵妄的发生率。

本研究中，C组患者表现出更为稳定的血流动力学状态。右美托咪定的负荷剂量导致血压一过性升高和HR反射性下降，尤其是在年轻健康患者中。这种初始心血管反应最可能是由于刺激血管平滑肌中的外周αB受体诱导的血管收缩；然而，当中枢αA受体的血管舒张作用占主导地位时，随后发生低血压。右美托咪定治疗中观察到的剂量依赖性心动过缓主要由交感神经张力降低介导，部分由压力感受器反射和迷走神经活动增强介导[24-25]，本研究结果与其一致。有研究表明，与丙泊酚组相比，右美托咪定组的HR大多较低，但不低于60次/min[26-28]。尽管在本研究中右美托咪啶组患者的HR有所下降，但差异无统计学意义，可能与样本量不够有关。在T3时点D组血压显著低于C组。

本研究存在以下局限性：(1) 单中心、小样本量的设计可能影响结果的普适性，未来需开展多中心、大样本量的研究以进一步验证；(2) 未对患者进行手术分类，未来研究可聚焦于老年人或特定手术类型，以提高结论的说服力；(3) 术后血流动力学随访时间较短，未能充分评估右美托咪啶血压续降作用，后续研究应延长随访时间。

综上所述，与右美托咪啶相比，环泊酚对非全麻四肢骨折老年患者术后谵妄发生率无显著影响，且使用环泊酚的患者术后血流动力学更为稳定。

利益冲突　无

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