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# Effect of dexmedetomidine-induced anesthesia on the postoperative cognitive function of elder patients after laparoscopic ovarian cystectomy

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ABSTRACT

*Objective:* To investigate the effect of dexmedetomidine at maintenance dose on the postoperative function of elder patients after general anesthesia for laparoscopic ovarian cystectomy.
*Methods:* We enrolled a total of 96 elder patients who were admitted to this hospital for laparoscopic ovarian cystectomy under general anesthesia between March 2015 and March 2017, and divided them into two groups, Group A (n = 48) and B (n = 48). Patients in both groups received the same methods for anesthesia induction and maintenance drugs. At the beginning of operation, patients in Group A received the intravenous injection of dexmedetomidine (0.8 μg/kg) followed by maintenance dose [0.5 μg/(kg h)] to the end of operation, while those in Group B underwent intravenous injection of 0.9% normal saline at the same rate, during which blood pressure, heart rate, oxyhemoglobin saturation and dosage of anesthetics at T1 (5 min after being delivered into the operation room), T2 (immediately after anesthesia induction), T3 (immediately after intubation), T4 (immediately after operation), T5 (immediately after end of operation) and T6 (immediately after extubation). Then, the levels of NSE, IL-6, CRP and HMGB1 were compared between two groups at 24 h before the operation, at the end, 24 h, 3 d and 7 d after operation. Besides, we also compared the postoperative cognitive functions and incidence of adverse reactions at 1 d before, 1, 2, 3 and 7 d after operation through MOCA scales.
*Results:* At T3, T4 and T6, comparisons of the average arterial pressure and heart rate showed that the differences between the two groups had statistical significance ($p < .05$). At the end of operation, and at 24 h, 3 d and 7 d after operation, we found that the levels of IL-6 and CRP in patients of two groups were all significantly elevated when compared with those before operation; at the end of operation and at 24 h and 3 d after operation, the levels of IL-6 and CRP in the Group B were higher than those in the Group A, and the differences had statistical significance ($p < .05$). At the end of operation and at 24 h and 3 d after operation, the levels of NSE and HMGB1 in two group were higher than those before operation, and a more significant elevation was identified in Group B with statistically significant differences ($p < .05$); at 7 d after operation, a decreasing trend was found in the level of HMGB1, which, however, remained higher than the preoperative level, and the level in Group B was still higher than that in Group A with statistically significant differences ($p < .05$). At 2 d after operation, we found that the scores of MOCA in the Group B were remarkably decreased in comparison with the scores in Group A with a statistically significant difference ($p < .05$). Moreover, the incidence rate of postoperative cognitive dysfunction (POCD) in the Group A was significantly lower than that in the Group B, and the difference had statistical significance ($p < .05$).
*Conclusion:* Dexmedetomidine can ameliorate the postoperative cognitive functions of elder patients who received the laparoscopic ovarian cystectomy under general anesthesia, and effectively decrease

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the incidence rate of POCD without any obvious or severe adverse reaction. Thus, it can serve as a kind of adjuvant drug for general anesthesia in clinical practice.


## 1. Introduction

With an increase in patients requiring operation treatment, the possibility of poor prognosis is also augmenting accompanied with an increase in the number of types, in which POCD has been considered as a severe but the most common type (Chalikonda, 2009). Elder patients, due to the decline in organ functions caused by aging, may suffer from an increase in possibility of POCD induced by the degenerative or pathophysiological variations in tissues and cells. POCD refers to a kind of complications in central nervous system after surgical anesthesia, mainly characterized by the mental disorder, anxiety, personality changes and damaged memory functions in clinical practice, and has been considered as a kind of functional disorder in nervous system. Currently, the pathogenesis of POCD remains elusive in clinical research (Chen et al., 2015). It has been reported that inflammatory responses and abnormal oxygen metabolism in brain are closely associated with the pathophysiological processes of POCD. Meanwhile, anesthetic depth may also affect POCD (Ehrar et al., 2012). Some studies reported that since there have not yet been effective drugs or treatment methods for POCD, which makes prophylaxis and protection of cognitive functions more important (Ehrar et al., 2012; Iirola et al., 2011; Steinmetz et al., 2009). Dexmedetomidine is characterized by many effects, such as sedation, algesia, antagonistic effect on sympathetic activity, and can inhibit the release of inflammatory cytokines, thereby protecting the brain nerves (Bekker and Weeks, 2003). In this study, we enrolled a total of 92 elder patients who underwent laparoscopic ovarian cystectomy under general anesthesia between March 2014 and March 2016 with administration of dexmedetomidine, observed the changes in biochemical indicators and cognitive functions of patients as well as the effect of dexmedetomidine at maintenance dose on postoperative cognitive functions. Detailed information of this study is reported as follows.

## 2. Materials and methods

### 2.1. General material

Inclusion criteria: patients aged above 60 years old; patients with the indications of laparoscopic ovarian cystectomy; patients without primary mental disorder or dementia; patients or their family who were informed of the content of study, and signed the written informed consent.

Exclusion criteria: patients complicated with the primary diseases in heart, lung, liver, kidney or urinary system; patients who were allergic to dexmedetomidine; patients who were alcoholism; patients who were deaf or mute; patients who voluntarily refused to participate in this study.

Case selection and grouping: We enrolled a total of 96 elder patients who were admitted to this hospital for laparoscopic ovarian cystectomy under general anesthesia between March 2015 and March 2017, and divided them into two groups according to their clinical features, Group A (n = 48) and B (n = 48). In Group A, patients' ages ranged from 65 to 85 years old, while those in Group B ranged from 63 to 85. We found that the differences in age, classification of American Society of Anesthesiologists (ASA), surgical duration and intraoperative bleeding amount showed no statistical significance between the two groups ($p > .05$), suggesting that these general materials were comparable between the two groups (Table 1).

### 2.2. Methods

Patients in both groups received the same methods for anesthesia induction and maintenance drugs. At the beginning of operation, patients in Group A received the intravenous injection of dexmedetomidine hydrochloride (Jiangsu Hengrui Medicine Co., Ltd.; SFDA approval No. H20090248; specification 2 mL: 200 μg) at a dosage of 0.8 μg/kg followed by maintenance dose [0.5 μg/(kg h)] to the end of operation, while for patients in Group B, they administrated 0.9% normal saline through the same pattern to the end of operation.

Before anesthetic induction, all patients underwent injection of crystalloid solution at a dosage of 5 mL/kg, and endotracheal intubation was chosen for general anesthesia in both groups. For patients in these two groups, they administrated the propofol through Diprifusor TCI system, in which TCI was initiated when the initial concentration of drug in plasma was 2.0 μg/mL with intravenous injection of sufentanil at a dosage of 0.15 μg/kg, and the dose of propofol was increased at 1 μg/mL every 1 min. After bispectral index (BIS) was below 75, TCI system of sufentanil was started to maintain the concentration of drug in plasma at 4 ng/mL followed by intravenous injection of rocuronium bromide at a dosage of 0.8 mg/kg and endotracheal intubation for ventilation. Through adjustment of propofol injection, BIS was maintained between 45 and 55. In Group A, dexmedetomidine was pumped at a rate of 0.5 μg/(kg h), while in Group B, normal saline in same volume was given. As for the mechanical ventilation during operation, the tidal volume was maintained at 6–8 mL/kg, ventilation rate at 12–14 times/min, and the partial pressure of carbon dioxide in endexpiratory gas ($PetCO_2$) at 35–40 mmHg. During the operation, we recorded the blood pressure (BP), heart rate (HR), saturation of pulse oximetry ($SpO_2$) and body temperature. At 40 min before the end of operation, pump of dexmedetomidine was withdrawn, and during the drug administration, ephedrine or atropine should be immediately given once the BP was lower than 30% of the baseline or HR was lower than 50 times/min.

### 2.3. Observation indexes

A. Vital signs: Blood pressure, heart rate, oxyhemoglobin saturation and dosage of anesthetics at T1 (5 min after being delivered into the operation room), T2 (immediately after anesthesia induction), T3 (immediately after intubation), T4 (immediately after operation), T5 (immediately after end of operation) and T6 (immediately after extubation).

B. Monitoring the biochemical indexes in blood: The levels of NSE, IL-6, CRP and HMGB1 were compared between two groups at 24 h before the operation, at the end, 24 h, 3 d and 7 d after operation.

C. Besides, we also compared the postoperative cognitive functions and incidence of adverse reactions at 1 d before, 1, 2, 3 and 7 d after operation through MoCA scales, including learning ability, orientation, language, calculation, attention, memory and spatial structure. The total score of MoCA scale was set as 30 points, and higher scores represented better cognitive functions. Patients with