

Original Article

Effect of dexmedetomidine on myocardial protection and changes of homocysteine and D-dimer in patients with gestational hypertension after cesarean section

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Abstract: Objective: This study aimed to explore the preventive effect of dexmedetomidine on myocardial injury in patients with gestational hypertension after cesarean section and changes of homocysteine and D-dimer. Methods: According to the principle of randomized control, 104 patients with gestational hypertension who underwent cesarean section in our hospital were divided into study group (SG) and control group (CG), with 52 cases in each group. CG was pumped with normal saline before anesthesia, and SG was pumped with dexmedetomidine. The following outcomes were compared between the two groups, including operation time, intraoperative blood loss, hospitalization time, spontaneous breathing recovery time, eye opening time, extubation time, cTnI, CK-MB, LDH, Ramsay score, heart rate (HR) and mean arterial pressure (MAP). Results: There was no significant difference in the operation time, intraoperative blood loss and postoperative hospital stay between the two groups ($P>0.05$). After treatment, spontaneous breathing recovery time, eye opening time and extubation time in SG were significantly shorter than those in CG, and the difference was statistically significant ($P<0.05$). However, in CG, HR and MAP at T1, T2 and T3 were lower than those at T0 ($P<0.05$), which were also lower than those of SG at the same time points ($P<0.05$). HR and MAP at T2, T3 were not different from those at T0 in SG ($P>0.05$). Ramsay score of SG was lower than that of CG at each time point, and the cTnI, CK-MB and LDH at T2 and T3 and the homocysteine (Hcy) level at T1, T2, and T3 were lower than those of CG at the same time point ($P<0.05$). Conclusion: The use of dexmedetomidine in patients with gestational hypertension after cesarean section can enhance the sedative effect, accelerate the recovery, protect the myocardium, reduce stress response and improve coagulation function, which is worthy of clinical promotion.

Keywords: Dexmedetomidine, myocardial protection, gestational hypertension, cesarean section, homocysteine, D-dimer

Introduction

Gestational hypertension is a disease that occurs during pregnancy. It is mainly characterized by hypertension, edema, and proteinuria, with an incidence rate of more than 5%. In severe cases, symptoms such as headache, abdominal pain, blurred vision, etc. may occur. If not properly treated, it can easily cause many serious complications such as coma and systemic spasm, which will result in adverse effect on the patients and the fetus, so as to make the pregnancy outcome develop in a bad direction [1, 2]. Currently, cesarean section is often adopted in clinical practices to ensure the safety of pregnant and hypertensive patients

and reduce the risk of complications [3]. However, cesarean section may cause a strong stress response in patients, leading to certain damage to the myocardium and inducing various cardiovascular diseases [4]. Metoprolidine, an α_2 -adrenergic receptor agonist, antagonizes the α_2 -adrenergic receptors in the central nervous system, producing anti-sympathetic and anti-anxiety effects. It also slows heart rate (HR), lowers blood pressure, and protects the normal function of important organs such as heart and kidney [5, 6]. This study aims to explore the effect of dexmedetomidine on myocardial protection in patients with gestational hypertension after cesarean section and changes of cTnI, CK-MB and LDH.

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Table 1. Comparison of general data in both groups

Groups	Age (years)	Gestational weeks	BMI (kg/m ²)	ASA	
				Grade I	Grade II
CG (n=52)	27.51±3.15	38.34±1.14	23.12±3.28	24	28
SG (n=52)	27.66±3.27	38.25±1.23	23.17±3.19	23	29

Materials and methods

General data

According to the principle of randomized control, 104 patients with gestational hypertension who underwent cesarean section in our hospital were divided into study group (SG) and control group (CG), with 52 cases in each group. The patients were 20-37 years old, with an average age of 27.55±3.23 years. The gestational age was 36-41 weeks, with an average gestational age of 38.29±1.16 weeks; the body mass index was 18-27 kg/m², with an average index of 23.15±3.22 kg/m². According to the American Society of Anesthesiologists (ASA) classification, there were 47 cases of Grade I and 57 cases of Grade II. The general data of the two groups were in accordance with the normal distribution and the difference was not different ($P>0.05$), which was comparable (Table 1).

Inclusion and exclusion criteria

Inclusion criteria: those who met the diagnostic criteria for gestational hypertension in the sixth edition of Obstetrics and Gynecology [7]; those with a single child; those with a gestational age greater than 28 weeks; those with normal blood pressure before pregnancy. This study has been approved by the Ethics Committee of Beijing Chaoyang Hospital, Capital Medical University. The patients were informed and voluntarily signed informed consent.

Exclusion criteria: those with severe dysfunction of vital organs such as heart and lung; those with diabetes and coagulopathy; those who had a history of allergies to research drugs; those who had taken drugs that had an effect on fibrinolytic activity and coagulation function before surgery.

Methods

All patients were prepared before surgery and were fasted for solids and liquids 8 hours

before surgery. The patients were established an intravenous access after entering the room, and vital signs such as heart rate, respiration, pulse and blood pressure as well as changes in the electrocardiogram were observed.

If the patient's vital signs are stable, general anesthesia can be performed. The anesthesia plan was as follows:

The patient was placed in the left lateral position, and the epidural puncture was performed. The L2-3 lumbar intervertebral space was selected as the puncture site. The puncture was successfully placed into the subarachnoid space. The catheter placement position was corrected when the cerebrospinal fluid was discharged. After fixing the catheter, the patients were returned to the horizontal position and 1.5 mL 0.5% of ropivacaine was injected into the catheter. The patient's high block level was tested during surgery. If the T8 was not reached, 0.5 mL of ropivacaine was continued to be added. SG was given dexmedetomidine hydrochloride injection at 15 min before anesthesia (Shanfeng East Kangtai Pharmaceutical Co., Ltd., national drug standard H20183318, specification: 2 mL: 200 µg). After anesthesia was completed, it was slowly instilled at a rate of 0.5 µg/(kg.h) until the end of the operation.

Evaluation outcomes

(1) The operation time, intraoperative blood loss and hospitalization time were observed and recorded. (2) Spontaneous breathing recovery time, eye opening time and extubation time, etc. were compared between the two groups to evaluate the recovery of the patients. (3) HR, mean arterial pressure (MAP), plasma cTnI, CK-MB and LDH levels were measured before the anesthesia (T0), before the incision (T1), after surgery (T2), and 1 day after surgery (T3), respectively. (4) The Ramsay score was used to evaluate the sedative effect of patients at 2, 4, 8, 12, and 24 h after surgery. The score was 1-6, of which 1 indicated insufficient sedation, 2-4 indicated proper sedation, and 5-6 indicated excessive sedation.

Statistical analysis

SPSS 22.0 software was used for data processing, and measurement data were ex-

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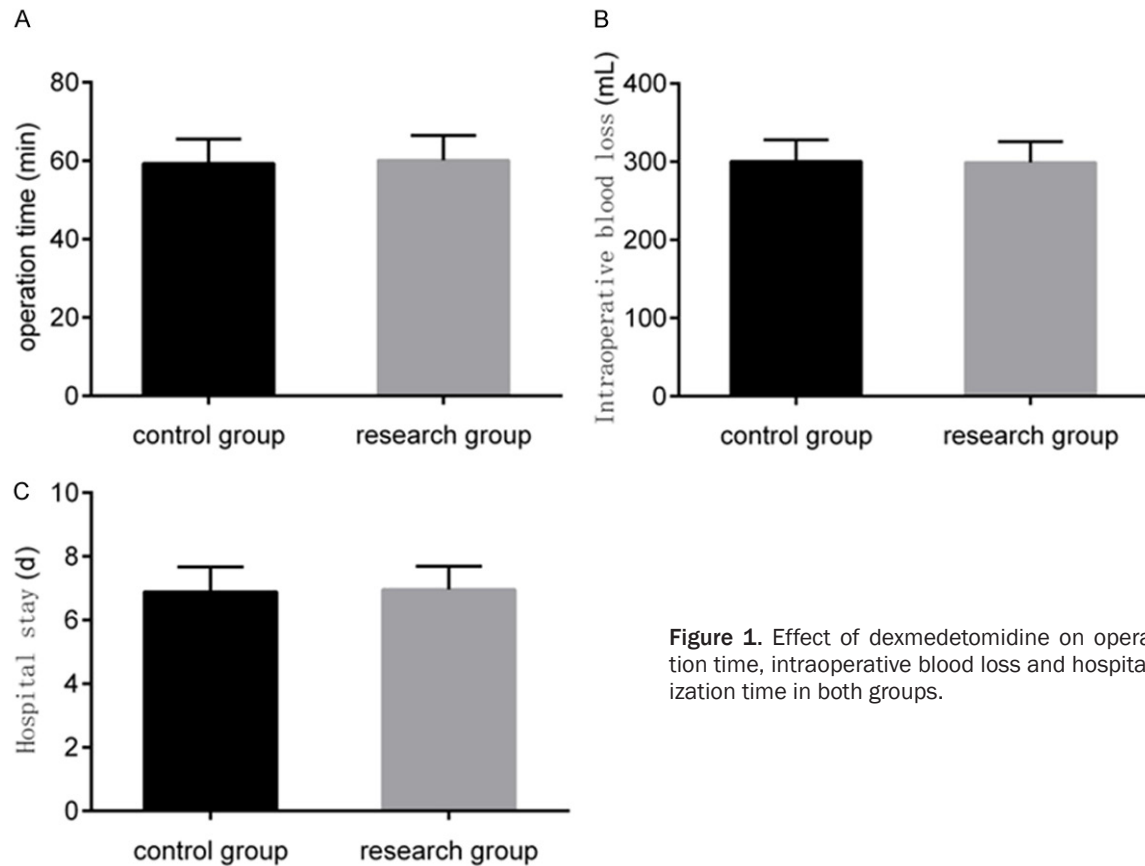


Figure 1. Effect of dexmedetomidine on operation time, intraoperative blood loss and hospitalization time in both groups.

pressed as mean \pm standard deviation ($\bar{x} \pm sd$) and compared with *t* test. The enumeration data were shown as a percentage and compared with χ^2 test. $P < 0.05$ was considered statistically significant.

Results

Effect of dexmedetomidine on the operation time, intraoperative blood loss and hospitalization time in both groups

There was no significant difference in operation time, intraoperative blood loss and postoperative hospital stay between the two groups ($P > 0.05$), which indicated that the use of dexmedetomidine in patients with gestational hypertension after cesarean section did not increase the operation time, had less effect on intraoperative blood loss, and did not increase the patient's hospitalization time (**Figure 1**).

Effect of dexmedetomidine on the recovery of patients in both groups

The spontaneous breathing recovery time, eye opening time, and extubation time of SG were

significantly shorter than those of CG ($P < 0.05$), which indicated that the use of dexmedetomidine in patients with gestational hypertension after cesarean section can promote recovery of spontaneous breathing and shorten eye opening time and extubation time, thereby promoting the patients' recovery (**Figure 2**).

Effect of dexmedetomidine on the intraoperative hemodynamic level in both groups

In CG, HR and MAP at T1, T2 and T3 were lower than those at T0 ($P < 0.05$), which were also lower than those in SG ($P < 0.05$) at the same period. There was no difference in HR and MAP between T2 and T3 in SG ($P > 0.05$), which indicated that the use of dexmedetomidine can stabilize hemodynamic level in patients with gestational hypertension after cesarean section (**Figure 3**).

Effect of dexmedetomidine on Ramsay scores in both groups

The Ramsay scores of SG were lower than those of CG at each time point ($P < 0.05$), which

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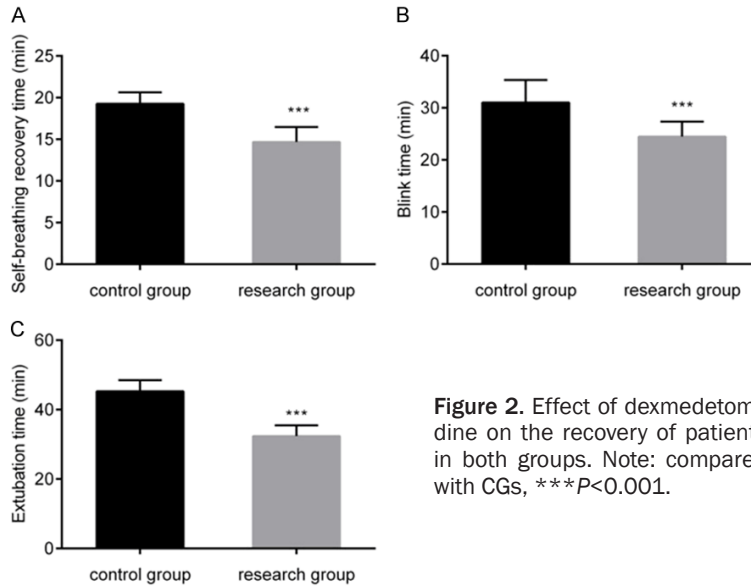


Figure 2. Effect of dexmedetomidine on the recovery of patients in both groups. Note: compared with CGs, *** $P < 0.001$.

indicated that the use of dexmedetomidine can reduce Ramsay scores in patients with gestational hypertension after cesarean section and enhance the sedative effect (Figure 4).

Effect of dexmedetomidine on plasma cTnl and CK-MB levels in both groups section

In SG, the cTnl and CK-MB levels at T2 and T3 were lower than those in CG ($P < 0.05$), which suggested that dexmedetomidine can reduce the level of myocardial injury markers in cesarean section of gestational hypertension (Figure 5).

Effect of dexmedetomidine on plasma LDH levels in both groups

In SG, LDH at T1, T2 and T3 were lower than those in CG ($P < 0.05$), which indicated that dexmedetomidine can reduce plasma LDH levels in patients with gestational hypertension after cesarean section and improve their stress undergoing surgery (Figure 6).

Discussion

Gestational hypertension is a common disease in obstetrics, and its incidence is increasing. Severe gestational hypertension is a common critical illness in obstetrics, with the prevalence rate of 2.5% to 3.0%. This greatly increases the risk of complications and seriously threatens the health and safety of mothers and fetuses, which have become one of the major risk fac-

tors for death in pregnant women and newborns [8, 9]. Currently, cesarean section is still the preferred way of childbirth for patients with gestational hypertension, but the operation will cause trauma to the body, trigger a strong stress reaction, and cause certain damage to cardiac function and coagulation function [10, 11]. Therefore, how to reduce the risk of stress and complications during the surgery has become the focus for obstetricians [12]. In this study, dexmedetomidine was used for patients with gestational hypertension after cesarean section. The result

showed that dexmedetomidine can enhance the sedative effect, accelerate the recovery, protect the myocardium, reduce stress response and improve coagulation function.

Dexmedetomidine is an α_2 adrenergic receptor agonist with high selectivity and high specificity. It can produce a sedative effect similar to natural sleep, but does not inhibit respiratory function, which has a certain protective effect on vital organs such as the heart and brain [12, 13]. It has a better clinical application and is increasingly used in patients with gestational hypertension after cesarean section [14]. This study showed that spontaneous breathing recovery time, eye opening time and extubation time in SG were shorter than those in CG. The HR and MAP fluctuations of SG were smaller than those of CG. The Ramsay scores of SG were lower than those of CG at each time point. This showed that the use of dexmedetomidine in patients with gestational hypertension after cesarean section can enhance the sedative effect, accelerate the recovery and protect the myocardium. The reason is that dexmedetomidine, as a new anesthetic agent, has central anti-anxiety and anti-sympathetic effects, which can increase the activity of α_2 adrenalin receptor, thus achieving a sedative effect similar to natural sleep [15, 16]. When the drug enters the body, it can excite the α_2 receptor of the presynaptic membrane, thus inhibiting the secretion and synthesis of adrenaline and hindering the spread of pain signals [17]. At the

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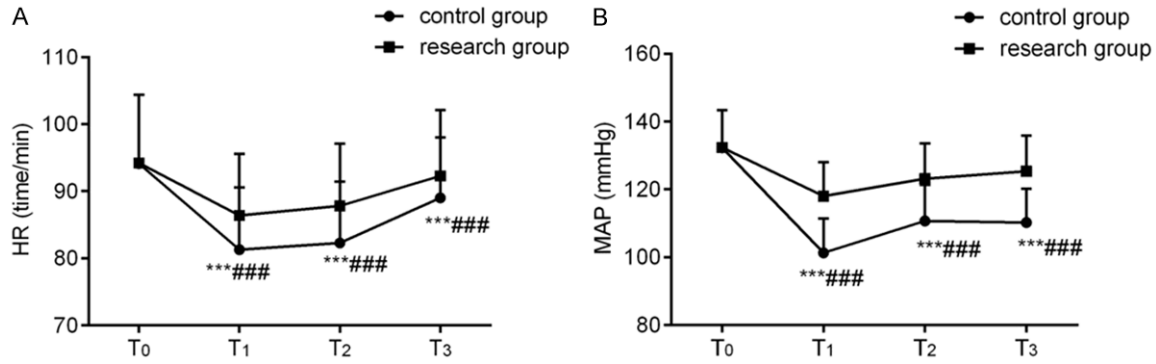


Figure 3. Effect of dexmedetomidine on intraoperative hemodynamic level in both groups. Note: compared with T₀ of this group, ###P<0.001; Compared with CG at the same time point, ***P<0.001.

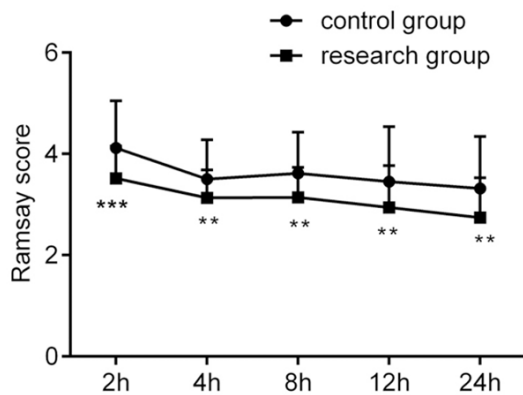


Figure 4. Effect of dexmedetomidine on Ramsay scores in both groups. Note: Compared with CG at the same time point, **P<0.01, ***P<0.001.

same time, it acts on post-membrane receptors to activate synapses and inhibit sympathetic nerve activity, thereby stabilizing MAP and HR, and speeding up the binding rate with the α_2 receptor in the spinal cord to achieve analgesic effect [18, 19].

Surgical stress can lead to the increases of heart rate, blood pressure, and myocardial oxygen consumption. Because of the heavier heart load, caesarean section is more likely to cause myocardial ischemic injury in patients. Studies have shown that myocardial ischemic injury develops gradually, and in the implementation of cesarean section, myocardial oxygen consumption as well as myocardial cell membrane permeability increased, leading to the increase in sensitive indicators of myocardial damage, such as cTnI, CK-MB and LDH [20, 21]. Therefore, the concentration of cTnI, LDH, CK and CK-MB in plasma can be measured to

reflect the degree of myocardial damage and drug protection after administration.

The results of this study showed that the plasma levels of cTnI, CK-MB and LDH at T₂ and T₃ of SG were significantly lower than those of CG, indicating that continuous administration of dexmedetomidine before surgery could provide protection for women with no obvious myocardial injury before caesarean section. The reason may be that dexmedetomidine can excite the presynaptic adrenergic receptors in the heart, promote the reduction of coronary norepinephrine levels in the ischemic myocardium, and accelerate the recovery of myocardial function during ischemia-reperfusion injury. The α_2 -adrenergic receptor agonist can also inhibit the release of norepinephrine, produce unique analgesic, sedative, anti-sympathetic effects, stabilize hemodynamic index, and play a neurological and organ protective role.

In summary, the use of dexmedetomidine in patients with gestational hypertension after cesarean section can enhance the sedative effect, accelerate the recovery, protect the myocardium, reduce stress response and improve blood coagulation function, which is worthy of clinical promotion.

Disclosure of conflict of interest

None.

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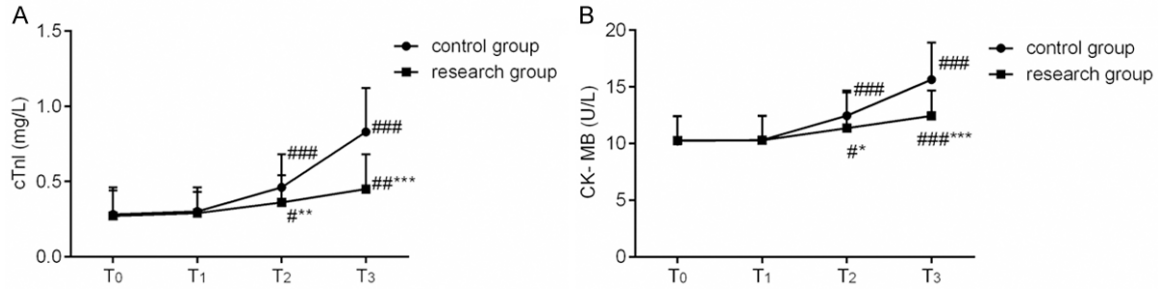


Figure 5. Effect of dexmedetomidine on plasma cTnI and CK-MB levels in both groups. Note: Compared with T₀ of this group, #P<0.05, ##P<0.01, ###P<0.001; Compared with CG at the same time point, *P<0.05, **P<0.01, ***P<0.001.

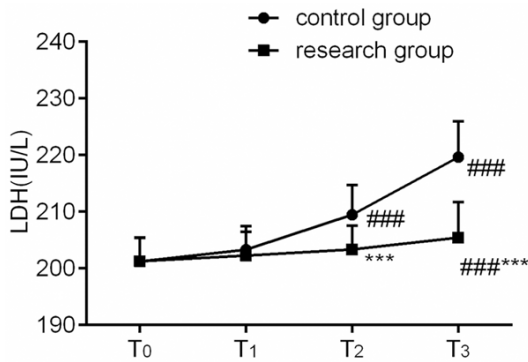


Figure 6. Effect of dexmedetomidine on plasma LDH levels in both groups. Note: Compared with T₀ of this group, ###P<0.001; Compared with CG at the same time point, ***P<0.001.

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