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The Applications of Dexmedetomidine Given Composite Dezocine Spinal Anesthesia in Patients Undergoing Total Hip Replacement Surgery

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ABSTRACT

Objective: Objective: To evaluate the applications of dexmedetomidine given composite dezocine spinal anesthesia in patients undergoing total hip replacement surgery**. Methods:** 120 cases ASA Ⅰ ~ Ⅱ grade elective surgery THA patients were divided into group A (n=40), group B (n=40), C group (n=40) from June 2015 to June 2016.Group A were routined with endotracheal intubation operation； Group B were gap into the line L_{2-3} spinal anesthesia, anesthesia after a fixed pumping 0.2 mg dezocine a mixture of 3 ml； Group C were threatmented with dextrose infusion 3μg Mi Ding mixture 3.5 ml. The levels of mean arterial pressure (MAP), heart rate (HR), oxygen saturation (SPO_2), end-tidal carbon dioxide ($PETCO_2$) and other hemodynamic parameters and plasma epinephrine (E), norepinephrine (NE), malondialdehyde (MDA) of three groups before and after 10 min of anesthesia 5min (T_0), of anesthesia (T_1), at the start of surgery (T_2), 1 Xiaoshi (T_3) after completion of anesthesia, the end of the surgery (T_4).The anesthetic complications occur of three groups were compared. **Results:** The levels of MAP, HR, SPO_2, $PETCO_2$, E, NE, MDA in T_1 ~ T_4 time were increased than T_0 stage ($P < 0.05$).The levels of MAP, HR, SPO_2, $PETCO_2$, E, NE, MDA in T_1 ~ T_4 time of Groups A were increased than Groups B， Group C ($P<0.05$).The levels of MAP, HR, SPO_2, $PETCO_2$, E, NE, MDA in T_1 ~ T_4 time of Groups A and Groups B were compared. The cognitive disorders, nausea, vomiting, restlessness, chills, a high incidence of respiratory depression of Group A were higher than Group B, Group C ($P<0.05$),will high incidence of respiratory depression of Group B were higher than Groups C ($P<0.05$)**. Conclusion:** dexmedetomidine given composite dezocine spinal anesthesia can effectively stabilize hemodynamics THA patients and reduce patient stress and blood vessels, its low incidence of postoperative complications, worthy of promotion application.

Introduction

Total hip arthroplasty (THA) is a common multiple disease in the elderly, and it is easy to increase the risk of perioperative anesthesia in patients because the old patients are always complicated with multiple system organ degeneration and there are operation of bone cement perfusion, reaming and medullary cavity flushing in THA surgery [1]. It is of great significance to choose reasonable anesthesia regimen or method to ensure the effect and safety of perioperative anesthesia for these high-risk groups. Spinal anesthesia is a commonly used anesthetic method, which is suitable for distal and lower extremity operation, with long anesthetic effect and good postoperative analgesic effect [2]. The dexmedetomidine given is currently approved for use in the treatment of critically ill patients in sedation by continuous intravenous injection [3]. There are studies [4] adding the dexmedetomidine given in local anesthetics and using it in mice by sciatic nerve block can effectively prolong the nerve sensation and motor block time in mice, and will not affect the nerve endings in mice, and no damage had been caused to their neural apparatus. Dezocine is a new type of opioid receptor mixed agitation-antagonist, and the main mechanism is to excite κ receptor. It has mild sedative and analgesic effect, but will not produce dependence to μ receptor, and can significantly reduce the patient nausea, vomiting and other gastrointestinal complications [5]. This study will explore the efficacy and safety of the dexmedetomidine given composite dezocine spinal anesthesia in patients with THA, which is reported below.

1 Materials and method

1.1 Clinical materials

120 cases ASA Ⅰ ~ Ⅱ grade elective surgery THA patients in our hospital were chosen from June 2015 to June 2016. Inclusion criteria: (1) patients ASA Ⅰ ~ Ⅱ grade; (2) older than 60 years old; (3) BMI < 30kg/m^2; (4) have signed the informed consent form; (5) all patients have approved by the Medical Theory Committee of our hospital. Exclusion criteria: (1) Insufficiency of heart, liver or kidney function; (2) Patients who had used medicine within 2 weeks before operation which can effect coagulation function, platelet and fibrinolytic system. (3) patients with mental disorders before entering the group; (4) patients who have skin infection at puncture site. They were divided into group A (n=40), group B (n=40), C group (n=40), and there was no statistically significant clinical data in each group (P>0.05), and the groups are comparable. See table 1.

Table 1 Comparison of clinical materials of the three groups ($\bar{x}$±s)

Groups	Cases	Gender		Age	Weight	Complications			
		Male	Female	（g）	（kg）	hypertension	diabetes	hyperlipidemia	chronic obstructive pulmonary disease
Group A	40	25	15	62.6±2.2	71.2±4.2	10	10	7	7
Group B	40	22	18	62.2±2.3	70.8±3.9	8	9	8	6
Group C	40	20	20	61.9±2.1	70.9±3.4	7	8	8	7
χ^2/F *data*		0.122		0.113	0.212	0.126			
P data		0.785		0.822	0.725	0.802			

1.2 Method

All patients were prohibited to have food 12h, and prohibited to drink water 4h before the operation. After entering, patients were treated by the intravenous injection of compound sodium chloride. Before entering, keep their vein opening, injected intravenous infusion of 5% glucose and sodium chloride, and after entering, injected the intravenous injection of 1.5mg/kg ketamine to induce anesthesia, and then check their MAP, HR, SPO_2, and $P_{ET}CO_2$ regularly.

Group A was treated by general anesthesia. Injected 0.3 mg/kg Etomidate+0.02 mg/kg midazolam+0.3 μg/kg Sufentanil + 0.6 mg/kg rocuronium to them, and kept intravenous drip after maintaining anesthesia. Group B used lateral position, and bend their knees and hips. First of all, used local infiltration anesthesia by 2% Lidocaine 3 ml puncture, meanwhile, used 25G pencil-head pin through the l2-3 gap into the spinal anesthesia vertically, and it was successful when the leakage of cerebrospinal fluid was observed. After the needle process succeed in Group B, use 5 ml syringe to inject 1.5ml 10% glucose water 3ml includes 0.2mg dezocine. And after the needle process in Group C, use 5ml syringe to inject 1.5ml 10% glucose water which includes o.2mg dezocine 2ml and 3μg dexmedetomidine given. And then, the Group B and Group C were treated by using 3.5cm epidural catheter, and the three groups should lie down, and keep an angle of 20° from the top to the bottom. Supervise the surface at anytime, and inhaled 2L oxygen by the nasal catheter, and controlled infusion during the operation, and the crystal gum ratio was 2:1.

1.3 Observation indicators

(1) Hemodynamic indicator: recording the average arterial pressure (MAP), heart rate (HR), Blood oxygen saturation (SPO_2), the end of breath carbon dioxide ($P_{ET}CO_2$) of the groups before the anesthesia(T_0), 10 min after the anesthesia (T_1), when the anesthesia started (T_2), one hour after the anesthesia (T_3), at the end of the operation (T_4). (2) Vascular Emergency Response: the level of plasma epinephrine (E), norepinephrine (NE) and Malondialdehyde (MDA) was determined by enzyme-linked immunosorbent assay (ELISA) in 3 groups at different time periods. (3) To record the occurrence of adverse drug reactions in 3 groups.

1.4 Statistical treatment

All data uses SPSS19.0 analysis, and both hemodynamic indicator and stress response indicator was indicated by mean standard deviation （$\bar{x}\pm s$）, and the comparison between the group of measurement data used T test. Further one-to-one analysis used LSD-t method, and adverse reactions of two groups were represented by percentages. The comparison between the group of data used χ^2 test, $P<0.05$ means it is statistically significant.

2 Results

2.1Comparison of hemodynamic indices in different anesthetic time periods in three groups

Compared to the T_0 level, the three groups' MAP, HR, SPO_2 and $P_{ET}CO_2$ level had significantly increased in T_1~T_4 ,($P<0.05$).

The patients' MAP, HR, SPO_2, $P_{ET}CO_2$ in Group A were significantly elevated in T_1~T_4 time, compared to group B and C, while the group B and C's MAP, HR, SPO_2, $P_{ET}CO_2$ were not statistically significant ($P>0.05$), see table 2.

Table 2 Comparison of hemodynamic indices in different anesthetic time periods in three groups （$\bar{x}\pm s$）

Relevant indicators	Groups	Cases	T_0	T_1	T_2	T_3	T_4
MAP	Group A	40	8.0±1.5	9.6±0.9*	10.8±0.9*	10.9±0.8*	10.1±1.4 *
（Kpa）	Group B	40	7.9±1.3	8.9±1.2 *#	9.6±0.9 *#	9.5±1.3 *#	9.5±1.1 *#
	Group C	40	7.8±1.4	8.8±1.1 *#	9.4±0.8 *#	9.5±1.2 *#	9.4±1.2 *#
HR	Group A	40	108.2±12.4	138.6±12.2*	137.8±12.1*	136.9±9.8*	136.5±8.4*
（t/min）	Group B	40	110.2±13.0	122.6±12.5*#	121.3±9.2*#	121.6±8.5*#	122.9±7.9*#
	Group C	40	109.8±12.5	121.8±11.8*#	120.7±10.2*#	121.8±8.6*#	120.7±7.5*#
SaO_2	Group A	40	98.9±1.4	122.5±7.6*	121.5±6.9*	120.2±6.2*	120.5±7.0*
（%）	Group B	40	98.7±1.5	111.9±7.3*#	104.2±5.9*#	104.2±6.4*#	103.8±5.7*#
	Group C	40	98.5±1.9	110.2±6.9*#	103.8±5.7*#	105.9±5.9*#	103.2±5.4*#
$P_{ET}CO_2$	Group A	40	4.8±0.7	6.5±0.8*	6.2±0.85*	6.6±0.9*	6.3±0.9*
（Kpa）	Group B	40	4.8±0.6	5.6±0.8 *#	5.4±0.9*#	5.3±0.7*#	5.2±0.8 *#

Group C	40	4.9±0.4	5.5±0.7*#	5.2±0.8*#	5.1±0.6*#	5.2±0.6*#

Note: compared to T_0 , *P<0.05; compare with Group A, #P<0.05.

2.2 Comparison of stress response indices in different anesthetic time periods in three groups

The E, NE, MDA level of 3 groups was significantly higher than the T_0 stage in T_1~T_4 period, in which the E, NE, MDA level of group A was significantly higher than that in Group B and C, while the E, NE, MDA level in Group B and Group C was no statistically significant (P>0.05), as shown in table 3.

Table 3 Comparison of stress response indices in different anesthetic time periods in three groups （$\bar{x}$±s）

Related indicators	Groups	Cases	T0	T1	T2	T3	T4
E	Group A	40	46.5±2.8	78.9±8.9*	98.5±7.2*	102.9±6.8*	105.2±7.5*
（ng/ml）	Group B	40	46.3±3.2	58.9±5.2*#	78.2±6.5*#	78.9±7.2*#	80.2±6.9*#
	Group C	40	46.2±3.8	57.8±5.3*#	78.9±7.2*#	79.2±8.2*#	80.5±8.2*#
NE	Group A	40	199.8±15.2	298.5±12.4*	356.6±8.1*	362.2±7.6*	368.9±10.2*
（ng/ml）	Group B	40	201.2±12.9	258.6±11.9*#	260.9±8.3*#	262.2±7.2*#	261.9±8.6*#
	Group C	40	200.8±12.2	257.8±12.5*#	258.6±7.8*#	264.8±8.3*#	260.8±9.5*#
MDA	Group A	40	4.5±0.8	6.8±0.8*	7.8±1.2*	7.5±1.1*	7.6±0.9*
（nmol/L）	Group B	40	4.6±0.6	5.7±0.9*#	5.8±0.8*#	5.6±0.9*#	5.5±0.8*#
	Group C	40	4.6±0.7	5.5±0.6*#	5.9±0.9*#	5.7±0.8*#	5.6±0.7*#

Note: compared to T0, *P<0.05; compare with Group A, #P<0.05.

2.3 Comparison of anesthesia-related complications in three groups

The incidence of cognitive dysfunction, nausea, vomiting, dysphoria, shivering and respiratory inhibition was higher in Group A than in Group B and Group C (p. <05), and the incidence of shivering in Group B was higher than Group C (P<0.05). See in table 4.

Table 4 Comparison of anesthesia-related complications in three groups（cases, %）

Groups	Cases	cognitive dysfunction	nausea and vomiting	dysphoria	shivering	respiratory inhibition
Group A	40	9（22.50）	8（20.00）	7（17.50）	13（32.50）	10（25.00）
Group B	40	1（2.50）*	1（2.50）*	1（2.50）*	6（15.00）*	3（7.50）*
Group C	40	0（0.00）*	1（2.50）*	0（0.00）*	0（0.00）*#	1（2.50）*
χ^2 data		15.927	10.691	11.357	15.759	10.836
*P*data		0.000	0.005	0.003	0.000	0.004

Note: compared with Group A, *P<0.05; compare with Group B, #P<0.05.

3. Discussion

Due to the special physiological and pathological changes, most of the patients with THA are associated with cardio-cerebrovascular and respiratory diseases, and these basic diseases greatly increase the risk of anesthesia in general anesthesia or spinal canal [6]. Spinal anesthesia is a new anesthetic method, which has the advantages of epidural anesthesia and lumbar anesthesia, and has the characteristics of rapid onset, long analgesic time and ideal blocking effect [7]. Compared with general anesthesia, the spinal anesthesia can inhibit the lower extremity vascular sympathetic nerves, diastolic lower extremity blood vessels, and increase the flow of lower limbs. Bardia etc.'s [8] meta-analysis of patients with hip fractures found that spinal anesthesia could significantly reduce the incidence of cognitive dysfunction and venous thrombosis in patients with general anesthesia. Vidal etc. [9] used the spinal anesthesia in elderly patients with lower limb surgery and it showed no anesthesia-related complications. Öztürk etc. [10] think that the spinal anesthesia can be effective in rapid onset, accurate anesthesia, and can effectively reduce the effects of respiratory system and cardiovascular, and prevent the formation of deep venous thrombosis.

According to the special physiological anatomy structure of the spinal anesthesia, it is feasible to have a spinal anesthesia in THA patients, but it also depends on the reasonable use of local anesthetic drugs [11]. Dezocine belongs to mixed opioid receptor agonist-antagonist, has good sedative and analgesic effect, no obvious cardiovascular inhibition, can effectively maintain the stability of the body hemodynamics [12]. At the same time, dezocine does not produce typical receptor dependence, can promote gastrointestinal smooth muscle relaxation, and reduces the incidence of nausea and vomiting. The dexmedetomidine given, which is newly discovered in recent years, has a high selectivity to α_2 receptors and can be used in the central nervous system to produce anti-anxiety, sedative and analgesic effects while prolonging analgesia time [13]. It is pointed out [14] that the concentration of 8μg/L in plasma can still maintain respiratory stability effectively and has good sedative effect. Therefore, the present study used dexmedetomidine given composite dezocine spinal anesthesia in the elderly patients with THA.

The results of the study shows that compared to the T_0 level, the three groups' MAP, HR, SPO_2 and $P_{ET}CO_2$ level had significantly increased in T_1~T_4 ,($P<0.05$), which shows that as traumatic treatment, THA can cause the fluctuation of hemodynamics in the body. The patients' MAP, HR, SPO_2, $P_{ET}CO_2$ in Group A were significantly elevated in T_1~T_4 time, compared to group B and C, while the group B and C's MAP, HR, SPO_2, $P_{ET}CO_2$ were not statistically significant ($P>0.05$), which shows that compared with spinal anesthesia, general anesthesia has a greater effect on hemodynamics stability in patients with THA, which may affect hemodynamics stability by increasing nerve excitability and the burden of cardio-cerebrovascular and circulatory system. The study also shows that [15], the excessive stress response can lead to the decline of the body's reserve ability and the prognosis of patients. The results of this study indicates that the E, NE, MDA level of 3 groups was significantly higher than the T_0 stage in T_1~T_4 period, in which the E, NE, MDA level of group A was significantly higher than that in Group B and C, while the E, NE, MDA level in Group B and Group C was no statistically significant ($P>0.05$), which shows that the spinal anesthesia can effectively reduce THA patients' stress action. The incidence of cognitive dysfunction, nausea, vomiting, dysphoria, shivering and respiratory inhibition was higher in Group A than in Group B and Group C (p. <05), which shows that the combination of the dexmedetomidine given and the spinal anesthesia can effectively reduce the incidence of neurological, gastrointestinal and respiratory complications in THA patients, indicating that the anesthesia regimen is safe and effective. The incidence of shivering in Group B was higher than that in Group C, and it was because that dezocine as analgesic drugs could induce prednisone. And causes the skeletal muscle contraction, causes the body body temperature to descend, thus causes the shiver to occur, but the B group simply uses more dezocine in the using of dezocine spinal anesthesia, therefore, the muscle loose intensity is big, thus increases the shiver the occurrence.

To sum up, the dexmedetomidine given composite dezocine spinal anesthesia can effectively stabilize the hemodynamics in patients with THA and relieve the patients' vascular stress reaction, and the postoperative complication rate is low, which is worthy of clinical application.

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