



# Effects of dexmedetomidine combined with ultrasound-guided nerve block on hemodynamics, immune function and cortisol levels in patients undergoing inguinal surgery

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## ABSTRACT

**Objective:** To investigate the effect of dexmedetomidine combined with ultrasound guided nerve block on the hemodynamics, immune function and cortisol level in the patients undergoing inguinal surgery. **Methods:** A total of 120 patients who underwent unilateral inguinal surgery in our hospital were randomly divided into control group and observation group, 60 cases in each group. The control group was induced by intravenous anesthesia with sufentanil. The observation group was given dexmedetomidine combined with ultrasound guided ilioinguinal/iliac hypogastric nerve block. Hemodynamics, immune function and cortisol levels were compared between the two groups before and after anesthesia induction. **Results:** After anesthesia, in surgical incision and recovery time, the levels of HR in the two groups were significantly lower than that before the anesthesia, and the levels of HR in the observation group were significantly lower than that in the control group. After anesthesia, in surgical incision and recovery time, the levels of CD3+, CD4+ and CD4+/CD8+ in the control group were significantly lower than that of the group before anesthesia. After anesthesia, the levels of CD3+, CD4+ and CD4+/CD8+ in the observation group were significantly lower than that of the group before anesthesia. In surgical incision and recovery time, there was no significant difference in the levels of CD3+, CD4+ and CD4+/CD8+ in the observation group before anesthesia. After anesthesia, in surgical incision and recovery time, the levels of CD3+, CD4+ and CD4+/CD8+ in the observation group were significantly higher than that of the control group. The levels of serum PI3K, ET -1, CRP and cortisol of the two groups were significantly higher than those before anesthesia, and the levels of PI3K, ET -1, CRP and cortisol in the serum of the patients in the observation group were significantly lower than those in the control group. **Conclusion:** The effect of dexmedetomidin combined with ultrasound guided nerve block anesthesia on the patients with inguinal surgery can effectively maintain the hemodynamic stability of the patients and have less influence on the immune function and the stress response. The security is higher.

## 1. Introduction

The inguinal region is a triangular area on both sides of the anterior lower abdominal region. This area is prone to indirect inguinal hernia, direct hernia, cryptorchidism, hydrocele and such

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other diseases[1–4]. At present, surgical treatment is commonly used in clinical practice. General anesthesia with tracheal intubation during operation has disadvantages such as large dose of general anesthetics, long postoperative recovery time and adverse reactions, etc. In recent years, ultrasound guided technology has been widely applied to nerve block in all parts during surgery[5–8]. The combination of local anesthetics such as dexmedetomidine and ketamine and various nerve block treatments can reduce the dosage of local anesthetics and improve the effect of nerve block[9–11]. In this study, the effects of dexmedetomidine combined with ultrasound

guided ilioinguinal/iliac hypogastric nerve block on hemodynamics, immune function and cortisol level in patients undergoing inguinal surgery were observed, to provide a clinical basis for the surgical anesthesia in the inguinal region, as the following report.

## 2. Data and methods

### 2.1 General information

A total of 120 patients undergoing unilateral inguinal surgery in department of urology in our hospital from June 2014 to December, 2016 were selected for this research. Diagnostic criteria: conform to the Chinese Medical Association's diagnostic criteria for unilateral inguinal surgery[12]. The selected patients were randomly divided into the control group and the observation group. There were 60 cases in the observation group, 46 male, 14 female, with the age range from 26-68 years, 18 cases of indirect inguinal hernia, 16 cases of indirect inguinal hernia, 9 cases of cryptorchidism, 17 cases of hydrocele, ASA grade: 19 cases of I grade and 41 cases of II grade. In the control group, there were 60 cases, 44 male, 16 female, with the age range from 28-69, 18 cases of indirect inguinal hernia, 15 cases of indirect inguinal hernia, 8 cases of cryptorchidism, 18 cases of hydrocele. ASA grade: 22 cases of I grade and 38 cases of II grade. Inclusion criteria: (1) those who met the criteria of unilateral inguinal operation; (2) those who had no respiratory tract infections; and those who had no neurological diseases. Exclusive criteria: (1) those aged below 18 years or older than 70 years old; (2) those who has allergic reactions to drugs used in this study; (3) the contraindication of nerve block. The study has been approved by the ethics committee of our hospital and all patients were informed consent.

### 2.2 Methods

Detailed medical history of the patients was totally understand, and the results of the auxiliary examination were reviewed after surgery. All patients were fasted more than 6 h, no drink liquid more than 2 h before surgery. The venous channels were given after entering

the operation room. The each index change was monitored closely. Oxygen mask in 4-6 L/min. Patients in the control group were given intravenous anesthesia induction with sufentanil 0.3 g/kg and propofol 2.0 mg/kg. Patients in the observation group were treated with dexmedetomidin combined with ultrasound guided ilioinguinal/iliohypogastric nerve block induction: Intravenous infusion of dexmedetomidine 1 g/kg for 15 min; Propofol 2 mg/kg was injected into the vein to induce. After the patients did not respond to pain stimulation, ultrasound (ultrasonic diagnostic apparatus, Nanjing Baden medical Limited by Share Ltd) was used to guide nerve block inguinal area of the patient. The drug was stopped immediately after completing the surgery. No analgesic sedative drugs were given in both two groups after surgery.

### 2.3 Observation indexes

The hemodynamic indexes of the two groups, including heart rate (HR), mean arterial pressure (MAP) and blood oxygen saturation (SpO<sub>2</sub>), were observed at different time points before and after anesthesia induction. Peripheral blood of 15 mL was collected from two groups patients at the time points before and after anesthesia induction, thus, T lymphocyte subsets, phospholipid inositol 3 kinase (PI3K), endothelin -1 (ET-1), CRP and cortisol level were detected. Specific methods: the serum levels of CD3+, CD4+ and CD8+ in two groups patients were detected by flow cytometry (SEM technology Co., Ltd.), and the ratio of CD4+/CD8+ was also calculated. The levels of phosphatidylinositol 3 kinase and CRP were detected by enzyme linked immunosorbent assay. The levels of endothelin-1 and cortisol were detected by radioimmunoassay. All operations are carried out strictly inline with the instructions of the instruments and kits.

### 2.4 Statistical treatment

All data were analyzed by SPSS 17.0 statistical software. Measurement data were expressed by (Mean ± SD). t test was used in comparison between groups, and  $P < 0.05$  indicates statistically significant difference.

Table 1.

Comparison of hemodynamic level between two groups at different time points.

Group	n	Time	HR (min)	MAP (mmHg)	SPO <sub>2</sub> (%)
Control group	60	Pre-anesthesia	116.04±10.37	81.68±8.61	96.25±9.92
		Post-anesthesia	96.85±8.46*	81.02±8.13	96.18±9.04
		Surgical Incision	95.67±8.75*	80.62±8.22	95.69±9.12
		Recovery	109.04±12.16*	81.54±9.11	97.26±9.68
Observation group	60	Pre-anesthesia	114.93±11.98	80.91±9.27	97.14±9.37
		Post-anesthesia	89.01±9.68* <sup>△</sup>	81.42±9.25	96.59±9.42
		Surgical Incision	88.34±10.02* <sup>△</sup>	80.53±9.31	96.89±9.84
		Recovery	102.65±12.01 <sup>△</sup>	81.60±9.20	96.57±9.82

Note: Comparison with the levels of pre-anesthesia, \* $P < 0.05$ ; Comparison with the levels of control group, <sup>△</sup> $P < 0.05$ .

Table 2.

Comparison of T lymphocyte levels between two groups at different time points.

Group	n	Time	CD3+(%)	CD4+(%)	CD8+(%)	CD4+/CD8+
Control group	60	Pre-anesthesia	55.85±5.67	43.65±4.01	36.18±3.51	1.19±0.12
		Post-anesthesia	46.87±4.72*	38.51±3.58*	36.31±3.75	1.05±0.10*
		Surgical Incision	47.05±5.11*	38.64±3.82*	36.67±3.56	1.05±0.09*
		Recovery	46.82±4.92*	39.01±3.68*	36.54±3.67	1.05±0.11*
Observation group	60	Pre-anesthesia	55.96±6.02	44.08±4.12	36.63±3.84	1.20±0.15
		Post-anesthesia	49.19±6.08 <sup>△</sup>	41.11±4.68 <sup>△</sup>	36.02±3.85	1.13±0.16 <sup>△</sup>
		Surgical Incision	55.52±5.86 <sup>△</sup>	44.69±4.75 <sup>△</sup>	36.10±3.38	1.21±0.14 <sup>△</sup>
		Recovery	55.37±6.10 <sup>△</sup>	44.58±4.66 <sup>△</sup>	35.88±3.69	1.22±0.15 <sup>△</sup>

Note: Comparison with the levels of pre-anesthesia, \* $P < 0.05$ ; Comparison with the levels of control group, <sup>△</sup> $P < 0.05$ .

Table 3.

Comparison of PI3K and ET-1 levels between two groups at different time points.

Group	n	Time	PI3K(ng/mL)	ET-1(μmol/L)
Control group	60	Pre-anesthesia	5.18±0.73	124.06±13.02
		Post-anesthesia	12.64±0.92*	168.36±18.25*
		Surgical Incision	12.76±1.15*	167.53±17.92*
		Recovery	12.98±1.02*	168.16±18.64*
Observation group	60	Pre-anesthesia	5.09±0.62	121.98±12.97
		Post-anesthesia	6.06±0.63* <sup>△</sup>	133.13±14.53* <sup>△</sup>
		Surgical Incision	6.10±0.71* <sup>△</sup>	132.62±14.55* <sup>△</sup>
		Recovery	6.05±0.70* <sup>△</sup>	132.95±14.08* <sup>△</sup>

Note: Comparison with the levels of pre-anesthesia, \* $P<0.05$ ; Comparison with the levels of control group, <sup>△</sup> $P<0.05$ .

Table 4.

Comparison of CRP and cortisol levels between two groups at different time points.

Group	n	Time	CRP (mg/L)	Cortisol (μg/L)
Control group	60	Pre-anesthesia	8.98±0.75	116.15±40.16
		Post-anesthesia	19.87±2.98*	169.65±15.53*
		Surgical Incision	19.34±2.71*	169.84±16.02*
		Recovery	19.68±3.35*	171.46±16.11*
Observation group	60	Pre-anesthesia	9.09±0.78	117.01±39.65
		Post-anesthesia	12.81±1.27* <sup>△</sup>	139.36±14.25* <sup>△</sup>
		Surgical Incision	13.07±1.15* <sup>△</sup>	137.98±13.73* <sup>△</sup>
		Recovery	12.89±1.47* <sup>△</sup>	140.57±13.81* <sup>△</sup>

Note: Comparison with the levels of pre-anesthesia, \* $P<0.05$ ; Comparison with the levels of control group, <sup>△</sup> $P<0.05$ .

### 3. Results

#### 3.1 Hemodynamic comparison

Before anesthesia, there was no significant difference in the levels of HR, MAP and SPO2 between the two groups ( $P>0.05$ ). The levels of HR in the two groups after anesthesia, surgical incision and recovery were significantly lower than those in the group before anesthesia. The HR level in the observation group was significantly lower than that of the control group, and the difference was significant ( $P<0.05$ ). There was no significant change in the levels of MAP and SPO2 at different time points between the two groups ( $P>0.05$ ). As shown in Table 1.

#### 3.2 Comparison of the level of T lymphocyte subsets

The results showed that there was no significant difference in the levels of CD3+, CD4+, CD8+ and CD4+/CD8+ ratio between the two groups before anesthesia ( $P>0.05$ ). The difference was not statistically significant ( $P>0.05$ ). The levels of CD3+, CD4+, and CD4+/CD8+ ratio in the two groups after anesthesia, surgical incision and recovery were significantly lower than those in the group before anesthesia. After anesthesia, the levels of CD3+, CD4+ and CD4+/CD8+ in the control group were significantly lower than those in the control group before anesthesia. The above indexes of the observation group recovered when skin incision and recovery, and there was no significant difference compared with that before anesthesia ( $P>0.05$ ). The serum levels of CD3+ and CD4+ and the ratio of CD4+/CD8+ in the observation group after anesthesia, surgical incision and recovery, were significantly higher than those in the control group, and the difference was significant ( $P<0.05$ ). There was no significant difference in CD8+ level between the two groups at different time points ( $P>0.05$ ). As shown in Table 2.

#### 3.3 Comparison of PI3K and ET-1 levels

The results showed that there was no significant difference in serum PI3K and ET-1 levels between the two groups before anesthesia

( $P>0.05$ ). The serum PI3K and ET-1 levels in the two groups after anesthesia, surgical incision and recovery were significantly higher than those in the group before anesthesia. The serum PI3K and ET-1 levels in the observation group were significantly lower than those of the control group. The difference was significant ( $P<0.05$ ). As shown in Table 3.

#### 3.4 Comparison of CRP and cortisol levels

The results showed that there was no significant difference in serum CRP and cortisol levels between the two groups before anesthesia ( $P>0.05$ ). The levels of serum CRP and cortisol in the two groups after anesthesia, surgical incision and recovery were significantly higher than those before anesthesia, and the serum levels of CRP and cortisol in the observation group were significantly lower than those in the control group, and the difference was significant ( $P<0.05$ ). As shown in Table 4.

### 4. Discussion

Ilioinguinal/iliac hypogastric nerve block has the advantages of simple operation, safe and easy to implement, which can effectively reduce the dosage of general anesthesia and reduce the adverse reaction. It can be used for anesthesia and analgesia in many inguinal region operations[13–16]. Dexmedetomidine is an effective 2- adrenergic receptor agonist. It is a local anesthetic, commonly used for postoperative analgesia and sedation in patients. It can prolong the duration of analgesia and reduce the dosage of opioid analgesics[17]. It is found that ultrasound guided nerve block combined with dexmedetomidine anesthesia guidance has significant analgesic effect on children's inguinal area, which can effectively reduce postoperative pain and restlessness and improve the safety of clinical anesthesia[18]. In this study, the effect of dexmedetomidine combined with ultrasound guided ilioabdominal inguinal nerve block on hemodynamics, immune function and cortisol levels in the patients undergoing inguinal surgery were investigated, And further explore the clinical effect of ultrasound-guided nerve block combined with dexmedetomidine anesthesia induction.

The results of this study showed that the levels of HR in the two groups after anesthesia, surgical incision and recovery, were significantly lower than that before anesthesia ( $P<0.05$ ). It is indicated that ultrasound guided nerve block combined with dexmedetomidine anesthesia has good anesthetic effect in patients undergoing inguinal surgery. The study found that dexmedetomidine helps maintain cardiovascular stability during anesthesia induction. And these results are in accordance with previous reports[18].

T lymphocytes differentiate and mature in the thymus. They can be distributed through the lymph and blood circulation to the immune organs and tissues, playing as an immune role. The results of this study showed that the levels of CD3+, CD4+ and CD4+/CD8+ in the control group after anesthesia, surgical incision and recovery were significantly lower than those before anesthesia. After anesthesia, the levels of CD3+, CD4+ and CD4+/CD8+ in the observation group were significantly lower than those in the group before anesthesia ( $P<0.05$ ). Compared with before anesthesia, there was no significant difference in the levels of CD3+, CD4+ and CD4+/CD8+ in the observation group when surgical incision and recovery ( $P>0.05$ ). The levels of serum CD3+, CD4+ and CD4+/CD8+ in the observation group were significantly higher than those in the control group ( $P<0.05$ ). These results indicated that the ultrasound-guided nerve block combined with dexmedetomidine for anesthesia induction in inguinal region is effective in stabilizing T lymphocyte level. Related researches found that dexmedetomidin can selectively activate 2- adrenergic receptor, inhibit the release of adrenaline and norepinephrine, thus reduce the response to stress, and reduce the effect of immunosuppression[20]. The nerve block induced by ultrasound has little effect on the levels of T lymphocyte subsets and serum immunoglobulin level, and is conducive to the recovery of patients[20]. The results of this study coincide with the previous reports.

The study also found that the levels of serum PI3K, ET-1, CRP and cortisol in the two groups after anesthesia, surgical incision and recovery, were significantly higher than before anesthesia, the levels of PI3K, ET-1, CRP and cortisol in the observation group were significantly lower than those in the control group, and the difference was statistically significant ( $P<0.05$ ). The results showed that ultrasound guided nerve block combined with dexmedetomidine anesthesia induction could reduce the level of inflammatory stress response in patients undergoing inguinal surgery. It has been found that dexmedetomidine can reduce the level of inflammatory factor in patients by activating choline anti-inflammatory channel[21]. Therefore, it can be concluded that the effect of combined anesthesia induction on stress response in patients is related to these mechanisms.

To sum up, dexmedetomidine combined with ultrasound guided nerve block anesthesia can effectively maintain the hemodynamic stability of patients, with less influence on immune function and stress response, which can be used in clinical application.

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