

Analgesic effect of dexmedetomidine after laparoscopic hernia repair under general anesthesia in adults

Ying Hu¹, YunFeng Jiang¹, BingWei Hu¹, HongLei Tao, JuanYing Chen², YuanMing Ding^{2*}

Abstract

Objective: To investigate the analgesic effect of small amount of dexmedetomidine on adult patients undergoing laparoscopic hernia repair under general anesthesia. **Methods:** 124 adult patients undergoing laparoscopic hernia surgery under general anesthesia were randomly divided into control group and study group, 62 cases in each group. Blood samples were collected at 4 h (T1), 12 h (T2) and 24 h (T3) to measure inflammatory factors and immune function indexes. Pain and sedation scores at 6 h (T1), 12 h (T2) and 24 h (T3) after operation were observed and recorded. Meanwhile, the corresponding clinical indicators and agitation grade were compared. **Results:** compared with T0, the levels of CRP, TNF - α and cor in the control group increased at T1, T2 and T3, while the levels of CD4 +, CD8 +, CD4 + / CD8 + were decreased in the control group, while the contents of CRP, TNF - α and cor in the study group were increased at T1 and T2, while the contents of CD4 +, CD8 +, CD4 + / CD8 + in the study group were decreased ($P < 0.05$); compared with the control group, the contents of CRP, TNF - α and cor in the study group at T1, T2 and T3 were lower, while the contents of CD4 +, CD8 +, CD4 + / CD8 + were lower than those in the control group. Compared with T1, the sedation scores at T2 and T3 in the control group were lower, and the pain and sedation scores at T2 and T3 in the study group were lower ($P < 0.05$); compared with the control group, the pain and sedation scores at T2 and T3 in the study group were lower ($P < 0.05$); the cough reaction and agitation scores of the study group were lower than those of the control group, and the agitation grade was better than that of the control group ($P < 0.05$). **Conclusion:** it has a good sedative and analgesic effect on adults after laparoscopic hernia repair.

Keywords: dexmedetomidine; adult; laparoscopic hernia repair under general anesthesia; analgesia

With the continuous clinical application of micro surgery, laparoscopic surgery has the advantages of small injury and fast recovery, which has been widely used in adult surgical treatment, especially the laparoscopic adult inguinal hernia surgery is of great significance to avoid postoperative injury in adult patients [1]. However, severe postoperative pain

stimulation can lead to restlessness in adult patients, affect the emotional changes and prognosis of adult patients, and delay the process of postoperative recovery. The application of effective measures to block the stimulation into the peripheral and central nervous system and reduce the postoperative pain and analgesic dosage has become the focus of anesthesiologists [2]. Many kinds of drugs have been used to prevent or treat the pain during the recovery period of general anesthesia. However, it is easy to have side effects such as respiratory depression, nausea and vomiting. With the deepening of research work, dexmedetomidine hydrochloride is a part of

1.Department of Anesthesiology, Tong De hospital of Zhejiang Province, Hangzhou city, Zhejiang Province, China 310012

2.Department of general surgery, Nanxun District Lianshi people's Hospital of Huzhou City, Huzhou City, Zhejiang Province, China 313013

*Correspondence Author:

YuanMing Ding, 263583350@qq.com, Nanxun District Lianshi people's Hospital of Huzhou City, Zhejiang ,China 313013

opioid agonist, which has great affinity to μ receptor and has strong analgesic targeting, which is 25-40 times stronger than morphine [3]. It has been reported in the literature that the analgesic effect of dexmedetomidine has a dose effect relationship within a certain dose range. If the dose is further increased, the analgesic effect will be reduced [4]. The analgesic effect of dexmedetomidine on adult patients undergoing laparoscopic hernia repair under general anesthesia was studied.

1. Clinical data and methods

1.1 clinical data and inclusion criteria

Methods: 124 adult patients undergoing laparoscopic hernia surgery under general anesthesia in the Department of Anesthesiology of our hospital from January 2016 to December 2019 were selected and randomly divided into the control group and the study group, with 62 cases. The control group received intravenous infusion of normal saline during anesthesia induction, including 29 males and 2 females, aged 22-26 years, with an average age of (23.91 ± 1.25) years, weighing 60-70kg and average weight The study group was given dexmedetomidine 3 μg / kg during anesthesia induction, including 28 males and 3 females, aged 22-27 years, with an average age of (23.87 ± 1.20) years, weighing 61-70kg and average weight of (65.41 ± 2.37) kg. The baseline data of gender, age and weight between the two groups were comparable ($P > 0.05$).

Inclusive criteria: 1) elective laparoscopic inguinal hernia surgery under general anesthesia, ASA grade I; 2) the age of adult patients ranged from 22 to 26 years old, with no gender limit; 3) reaching an agreement with the family members of adult patients, informed consent, signing drug consent and operation informed consent; 4) no abnormality in the whole body examination, clear consciousness, no intelligence and expression disorder; 5) medical ethics of our hospital It is approved by the committee, which does not violate ethics.

1.2 exclusion criteria

1) The age of adult patients was more than 21 years old or less than 26 years old; 2) there were pulmonary inflammation and respiratory tract inflammation, abnormal liver and kidney function; 3) allergic constitution or contraindications, intolerance of surgical treatment and anesthesia; 4) preoperative arrhythmia, cardiac conduction dysfunction, coagulation disorders and nervous system diseases; 5)

epilepsy or language communication disorder.

1.3 anesthesia operation

All patients were fasting for 6 hours and drinking for 4 hours. The operating room temperature was 23-25 °C. After entering the room, 8% sevoflurane was inhaled with a mask, and the oxygen flow rate was 4 L / min. until the consciousness of adult patients disappeared, the oxygen flow rate was reduced by 1.5 L / min, and sevoflurane was adjusted by 2% - 3%. ECG, blood pressure and pulse oxygen saturation were monitored by the monitor. Bisxp monitor made by American aspect company was connected to monitor bispectral index BIS Venous access to the upper extremity. Anesthesia induction: Remifentanyl (Hubei Yichang humanwell Pharmaceutical Co., Ltd., Chinese medicine Zhunzi h20030199) 1 μg / kg, the study group was given dexmedetomidine 3 μg / kg during induction; the control group was given equal volume of normal saline during induction. Tracheal intubation and anesthesia machine were used for intermittent positive pressure mechanical ventilation, and ventilation related parameters were adjusted. Anesthesia maintenance: 2% ~ 3% sevoflurane was inhaled, and remifentanyl 0.1 ~ 0.25 μg was infused by tci-i target controlled infusion pump produced by Beijing thought hi tech Development Co., Ltd/(kg.min)According to the anesthesia depth index (cerebral state) Index (CSI), hemodynamic changes and surgical stimulation intensity, adjust the inhalation concentration of sevoflurane and remifentanyl pump rate, and remifentanyl. After the adult patients' spontaneous breathing tidal volume is greater than 6ml / kg, SpO₂ \geq 92%, the hemodynamic circulation is stable, and the swallowing cough reflex recovers, the tracheal tube is removed, and the adult patients are sent to the recovery room after they are fully awake.

1.4 determination of hematological indexes

At T0, 6h, t1h, T2 and T3, 5ml venous blood was collected from elbow of all adult patients before dexmedetomidine infusion (T0), 6h after operation (T1), 12h (T2) and 24h (T3) after operation. All the patients were placed in a dry tube and centrifuged immediately at 3000r / min. the upper serum was collected and packed separately. The detection indexes were as follows: 1) inflammatory factor index: including serum C-reactive protein (CRP) Protein (CRP), tumor necrosis factor α (TNF - α), cortisol (COR), CRP and TNF - α were measured by enzyme linked

immunosorbent assay (ELISA) The instrument was sm600 enzyme labeled instrument of Shanghai Yongchuang medical device Co., Ltd., and the cor content was detected by enhanced chemiluminescence immunoassay. The instrument was Hitachi 7600-120 automatic biochemical analyzer. CRP and TNF - α kits were provided by Shanghai Xinyu Biotechnology Co., Ltd. and cor kit was provided by Beijing taigekexin Biotechnology Co., Ltd, Immune function index: including the content of T lymphocyte subsets (CD4 +, CD8 +, CD4 + / CD8 +) were determined by immunofluorescence method. The kit was provided by Suzhou boshengji Pharmaceutical Technology Co., Ltd., and was carried out according to the operation procedure.

1.5 clinical observation indexes

The pain and sedation scores were recorded at 6 h (T1), 12 h (T2) and 24 h (T3) after operation. The pain scores were evaluated by visual analogue score (VAS) Scale, VAS) [5], the score was 0-10, 0 was no pain, < 4 was mild pain, 5-6 was moderate pain, > 7 was severe pain, 10 was severe pain, the higher the score was, the more severe the pain was; Ramsay Sedation score was used: 1, awake; 2, mild sleepiness; 3, moderate sleepiness, easy to wake up; 4, difficult to wake up; The lower the score, the better the effect.

1.6 clinical indicators

The extubation time, eye opening time, cough response score and agitation score were recorded. The extubation cough response score was evaluated by the Minogue scale [7], and the criteria were as follows: 1 score was no cough response and muscle stiffness; 2 was mild cough response but could be easily extubated; 3 was moderate cough response; 4

was severe cough response or muscle stiffness; 5 was extreme irritability Restlessness score [8]: 1 point, the patient's quiet cooperation is divided into two points: when asked, the patient complained of discomfort but without behavioral response; 2 points, frequently expressed discomfort actively; 3 points, frequent behavioral reactions, such as limbs disorderly movement, even to pull out the catheter.

1.7 agitation classification

The grade of restlessness in the awakening period of all adult patients was compared [9]: level 0 was quiet; grade I was mild limb agitation; grade II was no irritation with restlessness and resistance behavior; grade III was severe restlessness behavior, requiring multiple people to take care of.

1.8 statistical methods

SPSS 17.0 software was used to analyze the data, Use of measurement data $\bar{x} \pm s$ The data of inflammatory factors and immune function indexes at different time points between the two groups were compared by one-way ANOVA, LSD-t test and Mann Whitney U test for grade data, $P < 0.05$.

2. Results

2.1 serum inflammatory factors between the two groups

Compared with T0, the levels of CRP, TNF - α and cor in the control group increased at T1, T2 and T3, while those in the study group increased at T1 and T2 ($P < 0.05$); compared with the control group, the levels of CRP, TNF - α and cor in the study group were lower at T1, T2 and T3 ($P < 0.05$).

Tab.1 Comparison of serum CRP, TNF- α and Cor at different time points in 2 groups($\bar{x} \pm s$, N=62)

group	point of time	CRP(mg/L)	TNF- α (pg/L)	Cor(ng/L)
control group (N=62)	T ₀	5.86 \pm 3.57	14.59 \pm 3.15	193.36 \pm 40.12
	T ₁	16.29 \pm 4.86*	27.31 \pm 4.20*	289.61 \pm 48.67*
	T ₂	12.33 \pm 4.29*	22.84 \pm 4.02*	267.82 \pm 42.31*
	T ₃	9.12 \pm 3.97*	18.36 \pm 3.75*	230.69 \pm 38.85*
Research Group (N=62)	T ₀	5.91 \pm 3.45	15.07 \pm 3.24	195.87 \pm 41.18
	T ₁	12.30 \pm 4.37*#	20.16 \pm 3.75*#	240.31 \pm 45.51*#
	T ₂	8.64 \pm 4.11*#	18.22 \pm 3.11*#	230.16 \pm 42.96*#
	T ₃	5.32 \pm 3.85#	16.39 \pm 2.67#	200.07 \pm 39.64#
F ₁	—	33.899	63.166	29.618
F ₂	—	19.575	14.277	8.116

Note: F1 is the comparison of the control group and F2 is the comparison of the study group. By one-way ANOVA, the contents of serum CRP, TNF - α and cor in the two groups of adult patients at different time points

were different, * $P < 0.05$ compared with T0, # $P < 0.05$ compared with the control group

2.2 status of serum immune function indexes between the two groups

Compared with T0, the contents of CD4 +, CD8 +, CD4 + / CD8 + in the control group were lower than those in the control group at T1, T2 and T3, and the

contents of CD4 +, CD8 +, CD4 + / CD8 + in the study group at T1 and T2 were lower ($P < 0.05$); compared with the control group, the contents of CD4 +, CD8 +, CD4 + / CD8 + in the study group were higher at T1, T2 and T3 ($P < 0.05$).

Tab.2 Comparison of serum CD4⁺, CD8⁺, CD4⁺/CD8⁺ at different time points in 2 groups($\bar{x} \pm s$, N=62)

group	point of time	CD4+	CD8+	CD4+/CD8+
control group (N=62)	T ₀	36.28±5.12	26.93±4.57	1.35±0.13
	T ₁	26.12±4.59*	18.86±3.87*	1.12±0.10*
	T ₂	29.64±4.36*	20.64±4.03*	1.20±0.13*
	T ₃	32.14±4.38*	23.59±4.27*	1.28±0.16*
Research Group (N=62)	T ₀	35.97±4.89	27.03±4.62	1.35±0.15
	T ₁	29.67±4.01*#	21.60±4.25*#	1.20±0.12*#
	T ₂	32.19±4.25*#	23.36±4.31*#	1.27±0.13*#
	T ₃	34.67±4.62#	26.69±4.44#	1.34±0.13#
F ₁	—	25.679	21.361	17.138
F ₂	—	11.774	10.774	8.307

Note: F1 is the comparison of the control group and F2 is the comparison of the study group. By one-way ANOVA, the contents of serum CRP, TNF - α and cor in the two groups of adult patients at different time points were different, * $P < 0.05$ compared with T0, # $P < 0.05$ compared with the control group

2.3 clinical observation indexes between the two groups

After one-way ANOVA, compared with T1, the sedation scores at T2 and T3 in the control group

decreased, while the pain and sedation scores at T2 and T3 in the study group decreased ($P < 0.05$); compared with the control group, the pain and sedation scores at T2 and T3 in the study group were lower ($P < 0.05$).

Tab.3 Comparison of serum Pain and RASS scores at different time points in 2 groups($\bar{x} \pm s$, N=62)

group	point of time	Pain score	Sedation score
control group (N=62)	T ₁	3.76±0.91	2.71±0.65
	T ₂	3.52±0.87	2.43±0.59*
	T ₃	3.34±0.88	2.01±0.43*
Research Group (N=62)	T ₁	3.79±0.89	2.69±0.67
	T ₂	3.22±0.69*#	2.13±0.46*#
	T ₃	2.65±0.72*#	1.80±0.42*#
F ₁	—	4.125	7.708
F ₂	—	10.789	14.352

Note: F1 is the comparison of the control group and F2 is the comparison of the study group. By one-way ANOVA, the contents of serum CRP, TNF - α and cor in the two groups of adult patients at different time points were different, * $P < 0.05$ compared with T0, # $P < 0.05$ compared with the control group

2.4 corresponding clinical indicators between the two groups

There was no difference in operation time, eye opening time and extubation time between the two

groups ($P > 0.05$); the cough reaction score and restlessness score of the study group were significantly lower than those of the control group ($P < 0.05$).

Tab.4 Comparison of clinical index in 2 groups($\bar{x} \pm s$, N=62)

group	Number of cases	Operation time(min)	Eye opening time(min)	Extubation time(min)	Cough response score	Agitation score
control group (N=62)	62	35.26±10.23	12.26±5.23	7.26±1.96	2.21±0.89	1.76±0.74
Research Group (N=62)	62	33.16±9.87	12.37±5.48	7.33±1.87	1.34±0.76*	1.15±0.65*
<i>t</i>	—	0.823	0.081	0.144	4.133	3.448
<i>P</i>	—	0.414	0.935	0.886	0.000	0.001

Note: there were differences in cough response score and agitation score between the two groups, compared with the control group, * $P < 0.05$

2.5 grade of agitation between the two groups

The grade of restlessness in the study group was significantly better than that in the control group ($P < 0.05$).

Tab.5 Comparison of degree of agitation in 2 groups(n, %)

group	Number of cases	Grade 0	Grade I	Grade II	Grade III
control group (N=62)	62	24(38.71%)	28(45.16%)	6(9.68%)	4(6.45%)
Research Group (N=62)	62	40(64.52%)	20(32.26%)	2(3.22%)	0(0.00%)*
<i>Z</i>	—	—	—	—	-2.245
<i>P</i>	—	—	—	—	0.025

Note: compared with the control group, * $P < 0.05$

2.6 safety analysis

All adult patients were followed up, no cases dropped off, no malignant adverse reactions occurred during anesthesia, no vomiting, convulsion, bronchospasm, apnea and other adverse reactions occurred in the two groups of adult patients after surgery, which had no impact on the study.

3. Discussion

Laparoscopy has the characteristics of small injury, rapid recovery and good prognosis, and has been continuously used in clinical adult surgical treatment [10]. Due to the special psychological characteristics of adult patients, postoperative pain after general anesthesia will increase the fear and tension of adults, and increase the incidence of metabolic disorder, hypoxemia or urinary retention after operation * [11]. At present, there are many factors that affect the pain during the recovery period of general anesthesia. Previous studies on adult pain are relatively few. Anesthesiologists believe that adult patients are less sensitive to pain, so they do not pay enough attention to postoperative analgesia. With

the deepening of pain research, in recent years, it has been found that adult patients can feel pain, which may be more obvious than adults. Postoperative pain has adverse effects on the respiratory, circulatory and immune systems of adults, and directly or indirectly affects the surgical treatment [12]. There have been many reports on the peripheral analgesic effect of opioids [13], but there are many adverse reactions such as respiratory inhibition. In this context, new analgesics have been developed and listed in China, and dexmedetomidine hydrochloride is gradually recognized because of its outstanding pharmacological properties. It has been reported that dexmedetomidine has the advantages of small dosage, long analgesia time, good effect and stable respiratory and circulation during general anesthesia [14].

The surgical injury caused by laparoscopic surgery can cause stress response of the body, which leads to the release of serum cytokines and inflammatory mediators, and has an impact on the inflammatory response of the central nervous system. Serum CRP concentration can reflect the degree of surgical injury and postoperative stress reaction state. COR is a sensitive index reflecting body stress.

Clinically, abnormal cor concentration is often used to evaluate the stress response [15]. Different analgesic methods have different effects on stress response. According to animal experiments, opioid drugs combined with opioid receptors to block the release of inflammatory substances can reduce pain threshold, reduce postoperative pain during recovery period and the dosage of analgesic drugs [16]. Dexmedetomidine is a partial agonist of opioid receptor, which mainly activates μ and κ receptors in opioid receptor. Dexmedetomidine has effective analgesic effect and low drug dependence. Compared with the control group, the levels of serum CRP, TNF- α and cor in the study group were lower than those in the control group, and the reduction degree of postoperative pain and sedation score was greater, and the degree of agitation was better. It shows that dexmedetomidine can effectively reduce the inflammatory factors caused by surgical injury, improve the stimulation of body inflammation for pain, reduce the degree of agitation, and promote the development of pain The prognosis.

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