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Effect of dexmedetomidine on analgesia and sedation of sufentanil during anesthesia induction period of gynecological surgery

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Abstract: To observe and analyze the effect of dexmedetomidine on analgesia and sedation of sufentanil during anesthesia induction period of gynecological surgery. A total of 160 patients demanding gynecologic surgery were enrolled in the study and randomly divided into study group and control group, each containing 80 patients. The control group was treated with sufentanil and normal saline, while the study group was treated with sufentanil and dexmedetomidine. Then, the therapeutic effect of the two groups was compared. NTI of the two groups was observed at A2, which was significantly lower in the study group than that in the control group. Moreover, NTI value of the two groups was significantly lower at A2 and A4 than at A1. When the NTI value was reduced to a minimum, the application time was significantly shorter in the study group than that in the control group. PTO and PPT of the two groups were higher at A4 than those at A1. At A1 and A4, The difference between PTO and PPT was significantly higher in the study group than that in the control group, $p<0.05$. The rate of adverse reactions was significantly lower in the study group than that in the control group, $p<0.05$. Dexmedetomidine has good effect on analgesia and sedation of sufentanil during anesthesia induction period of gynecological surgery, which should be popularized in clinical application.

Keywords: Dexmedetomidine, gynecological surgery, anesthesia induction period, sufentanil, analgesia and sedation.

INTRODUCTION

With the development of medical technology, laparoscopic surgery has been widely used in the surgical treatment of gynecological diseases such as ovarian cysts and uterine fibroids. With high accuracy and small trauma of laparoscopic surgery, it helps to improve the prognosis (Ni, 2018; Jiao *et al*., 2019). To effectively improve the treatment efficacy and guarantee the success of surgical treatment, the usage of effective analgesic and sedative anesthetic drugs is of great importance during laparoscopic surgery (fig. 1).

Sufentanil is now the main μ opioid receptor agonist in clinical anesthesia and postoperative analgesia in China. Although it involves a lower rate of adverse reactions such as respiratory depression than fentanyl, the adverse actions still exist and are dose-related, so it is the primary goal to reduce dosage or minimize rate of adverse reactions. Dexmedetomidine is a highly selective α2 adrenergic receptor agonist used in clinical sedation (Lu *et al*., 2017; Folk *et al*., 2015; Geng *et al*., 2018). This study analyzes the effects of dexmedetomidine on analgesia and sedation of sufentanil during anesthesia induction period of gynecological surgery.

MATERIALS AND METHODS

In the study, The 160 patients who received laparoscopic surgery from August 2016 to May 2019 in our hospital were enrolled as research objects. The patients in this study had the right to know and signed informed consent. The implementation of this study was approved by the Hospital Ethics Association. The surgery types included laparoscopic oophorectomy or hysteromyomectomy. The patient's imaging examination is shown in fig. 2 and fig. 3. The patients were randomly divided into two groups, each containing 80 patients. Serious cases of heart, liver and kidney dysfunction or chronic systemic diseases such as hyperthyroidism and diabetes were excluded from this study. All selected patients were over 18 years old. The study group had an average age of 48.7±0.2 years old, and the control group had an average age of49.4±0.5 years old. There was no significant difference in general between the two groups, $p>0.05$.

Half an hour prior to surgery, intramuscular injections of atropine and phenobarbital were administered to patients in both groups, with atropine dosage of 0.5mg and phenobarbital dosage of 0.1g. The patient was sent to the operating room, and the venous access was opened in time. After the patient calmed down, Narcktrend anesthesia/EEG awareness monitoring system was connected for monitoring Narcktrend Index (NTI), and the sedation status was evaluated. ECG monitor was connected to monitor HR, RR, ECG, SPO2 and MAP in real time while maintaining oxygen inhaling. The study group and the control group were administered with different dosage of medicine calculated based on the actual weight of the patient. The control group was given 10mL of sufentanil and normal saline via infusion pump within 10 minutes, during which the NTI was recorded. When the patient was awakened to the highest level of soberness, NTI was recorded again. Subsequently,

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0.4μg/kg sufentanil was diluted with normal saline to 10mL and the drug was administered for less than 1 minute. On this basis of control group, 1μg/kg dexmedetomidine was diluted normal saline to 10mL, which was additionally given to patient in the study group within 10 minutes.

Fig. 1: Laparoscopic surgery procedure

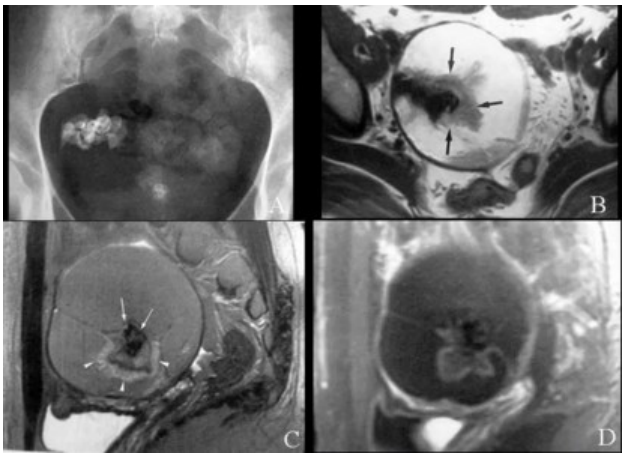

Fig. 2: Imaging examination of a patient with ovarian tumor

Dexmedetomidine hydrochloride is an α2-adrenoreceptor agonist with the chemical name: (+)-4-(S)-[1-(2, 3-dimethylphenyl) ethyl]-1H - Imidazole hydrochloride. With molecular formula: C13H16N2•HCl, molecular weight: 236.7, it is used for sedation during tracheal intubation and mechanical ventilation for patients undergoing general anesthesia. Due to possible pharmacodynamic interactions, the dosage of this product should be reduced when administered simultaneously with other anesthetics, sedatives, hypnotics or opioids (Feng *et al*., 2018; Deng, 2019). Sufentanil is a derivative of fentanyl, which mainly acts on the μ opioid receptor. It can be used in auxiliary anesthesia and anesthesia induction for cardiovascular surgery. The lipotropism of Sufentanil is approximately twice that of fentanyl, so it is easier to pass the blood-brain barrier. Moreover, it has higher plasma protein binding rate than fentanyl, but has smaller distribution volume than fentanyl. Although its elimination half-life is shorter than that of fentanyl, it has stronger affinity with opioid receptors than fentanyl, thus having greater analgesic intensity and longer duration of action (about twice that of fentanyl) (Zhang *et al*., 2015). Sufentanil undergoes extensive biotransformation in the liver, forming N-dehydrocarbyl and O-desmethyl metabolites which are excreted by the kidneys. Demethy-sufentanil has pharmacological activity, with titer about 1/10 that of sufentanil and equivalent to that of fentanyl, which is one of the reasons for the longer duration of action of sufentanil.

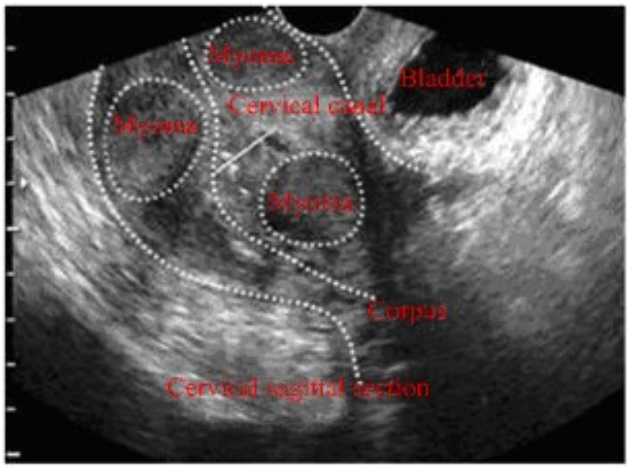

Fig. 3: CT scan of uterine fibroids

Observation indicators

The analgesic and sedative effects of the two groups were obtaine before the administration (A1), after the administration (A2), at the highest level of soberness (A3), and 5 minutes after using sufentanil (A4). At the same time, the lowest NTI value and the time required for NTI to fall to the lowest value during A3-A4 a were recorded. In addition, the PPT value (pressure pain threshold) and PTO value (pain tolerance threshold) at A1 and A4 were evaluated.

STATISTICAL ANALYSIS

The statistical analysis software SPSS 21.0 was adopted. Measurement data were expressed as mean ± standard deviation ($\bar{x} \pm s$), and count data were expressed as natural numbers (n) and percentages (%), with t-test and Chi-square used for comparison, respectively. The difference was considered statistically significant when $p<0.05$.

RESULTS

As shown in table 1, NTI at A2 is lower in the study group than in the control group; NTI values of the study group and the control group are lower at A2 and A4 than at A1, $p<0.05$.

Table 1: Comparison of NTI between the two groups of patients ($\bar{x}\pm s$)

Group	A1	A2	A3	A4
Study group	97.80±1.20	81.20±10.37	97.83±3.29	76.50±10.28
Control group	97.88±1.24	87.63±12.38	97.06±3.65	77.84±9.36
t	0.97	9.24	0.22	0.41
p	>0.05	<0.05	>0.05	>0.05

Table 2: Comparison of sedation depth and speed between the two groups ($\bar{x}\pm s$)

Group	Number of cases	Time required for NTI to reach the lowest value (s)	Lowest value of NTI
Study group	80	232.60±21.48	69.08±10.21
Control group	80	267.80±24.39	71.25±9.37
t		5.60	0.92
p		<0.05	>0.05

Table 3: Comparison of PPT and PTO values between the two groups ($\bar{x}\pm s$)

Group	PPT		PTO	
	A1	A4	A1	A4
Study Group	10.46±1.80	15.65±2.02	19.28±3.21	7.32±1.30
Control group	12.04±3.28	15.97±2.06	21.46±3.20	3.54±0.69
t	4.20	0.14	5.31	0.24
p	<0.05	>0.05	<0.05	>0.05

As shown in table 2, the time required for NTI to reach the lowest value is significantly shorter in the study group than that in the control group, $p<0.05$.

As shown in table 3, the difference between PPT and PTO at A1 and A4 is significantly higher in the study group than in the control group, $p<0.05$; PPT and PTO of the two groups are higher at A4 than at A1, $p<0.05$. At the same time, the rate of adverse reactions in the study group is 7.50% (6/80), and that is 25.00% (20/80) in the control group, $p<0.05$.

DISCUSSION

Laparoscopic surgery has been commonly applied in gynecological surgery, and pneumoperitoneum is usually established. However, such operation can affect the blood flow path of the patient's abdomen, change the blood flow rate and direction, forming a fierce stress reaction (Stretch and Bonde, 2018). This may lead to pathophysiological changes or hinder normal development of the operation, thus lowering the treatment efficacy. Therefore, the patient should be kept sedative and analgesic during the operation. In order to effectively deal with bad situations, anesthetic dosage is usually increased clinically, but excessive dosage will lead to suppressed recovery of postoperative awareness of the patient. During the operation, the purpose of using anesthetic drug is to achieve the purposes of rapid induction, good sedation and analgesia in the anesthesia, and rapid postoperative awareness recovery. Different sedative and analgesic drugs may cause different hemodynamic effects, so scientific usage of anesthetic drugs is particularly critical to the successful completion of gynecological surgery.

Sufentanil, derived from fentanyl, belongs to an opioid analgesic with stronger effect than fentanyl, It is a highly selective μ receptor agonist, which combines with receptors μ1 and μ2 to create analgesic and respiratory inhibition effect. Sufentanil is more likely to select μ1 receptor, so that the drug is more effective in analgesia and respiratory depression with enhanced safety and reliability. However, this drug does not have a sustained sedative effect, so it is necessary to co-use it with other drugs to obtain better sedative effect. Dexmedetomidine is an imidazole derivative and dexmedetomidine dextroisomer. As an α2 adrenergic receptor agonist, it has higher affinity to α2 adrenergic receptor compared with another α2 adrenergic receptor agonist clonidine by more than eight times or more (Goetze *et al*., 2015; Ferrer and Torres, 2015). The ratio of α2/α1 receptor activity is (1300-1620):1. α2A, α2B and α2C belong to three subtypes of adrenergic receptors, which are distributed in different ways and form different effects after being stimulated. However, studies have shown that there is no choice for subtype in α2 adrenergic receptor agonist, so dexmedetomidine can produce better sedative, analgesic and anti-sympathetic activity, anti-anxiety, hemodynamic stability effects, without causing problems such as restricted breathing. Also, dexmedetomidine has the advantages in both directional and wake-up functions in addition to desired sedative efficacy.

According to the study results, NTI of the two groups was observed at A2, which was significantly lower in the study group than that in the control group. Moreover, NTI value of the two groups was significantly lower at A2 and A4 than that at A1. When the NTI value was reduced to a minimum, the application time was significantly shorter in the study group than that in the control group. PTO and PPT of the two groups were higher at A4 than those at A1. At A1 and A4, difference between PTO and PPT was significantly higher in the study group than that in the control group, $p<0.05$. The rate of adverse reactions was significantly lower in the study group than that in the control group, $p<0.05$.

CONCLUSION

In summary, sufentanil is a type of opioid analgesic drug with stronger analgesic effect than fentanyl. In the course of use, it will combine μ1 and μ2 to produce analgesic and respiratory inhibition effect. Although sufentanil demonstrates greater safety, it does not have sustained sedative effect. In clinical practice, other drugs are often co-used with it to achieve sedative effect. Dexmedetomidine can enhance the analgesic and sedative effect of sufentanil during anesthesia induction period of gynecological surgery, and can create rapid sedation effect. However, special attention should be paid to respiratory depression, upon which immediate intervention is required. Given the small sample size of this study, more large-sample data studies are needed in the future to further validate the results of this study.

REFERENCES

Deng CY (2019). Effects of intravenous injection and intraoperative continuous pumping of load dose dexmedetomidine before anesthesia induction on serum cTnI and GP-BB levels in elective non-cardiac surgery patients with coronary heart disease. *Mod. J. Integr. Tradit. Chin. West. Med.,* **28**(11): 1220-1224.

Feng LZ, Xiao CW and Liu J (2018). Effects of different doses of sufentanil combined with dexmedetomidine on induction of general anesthesia in children. *Chin J. Crit. Care Med.,* **38**(4): 337-340.

Ferrer M and Torres A (2015). Noninvasive ventilation for acute respiratory failure. *Curr. Opin. Crit. Care*, **21**(1): 1-6.

Folk JJ, Landsberg DM, Robinson, KA and Spector LA (2015). Airway pressure release ventilation and respiratory failure during pregnancy a report of three cases. Journal of Reproductive Medicine: the official periodical of the American Academy of Reproductive Medicine, Association of Professors of Gynecology and Obstetrics, *Int. Fam. Plann. Res. Assoc.,* **60**(1/2): 65-70.

Frat JP, Brugiere B, Ragot S, Chatellier D, Veinstein A, Goudet V, Coudroy R, Petitpas F, Robert R, Thille AW and Girault C (2015). Sequential application of oxygen therapy via high-flow nasal cannula and noninvasive ventilation in acute respiratory failure: An observational pilot study. *Respir. Care,* **60**(2): 170-178.

Geng XQ, Chen LJ and Lin MY (2018). Effects of dexmedetomidine on anesthesia induction and postoperative outcome of Off-Pump coronary artery bypass. *China J. Mod. Med.,* **28**(31): 82-86.

Goetze S, Zhang Y and An Q (2015). Ambulatory respiratory rate trends identify patients at higher risk of worsening heart failure in implantable cardioverter defibrillator and biventricular device recipients: a novel ambulatory parameter to optimize heart failure management. *J. Int. Card. Electrophysiol.: An Int. J. Card. Arrhythmias Pacing,* **43**(1): 21-29.

Jiao T, Yang D and Cui YJ (2019). Effect of dexmedetomidine on analgesia and sedation of sufentanil during anesthesia induction in gynaecological surgery. *Spec.Health,* **16**: 129 -130.

Lu Bin, Zheng YY and Zhang JT (2017). Effect of dexmedetomidine before anesthesia induction on postoperative analgesia and sedation in elderly patients with abdominal tumor surgery. *Chin. J. Gerontol.,* **37**(16): 4033-4035.

Ni KQ (2018). Effect of dexmedetomidine on analgesia and sedation of sufentanil during anesthesia induction in gynecological surgery. *J. North Pharm.,* **15**(5): 40-41.

Stretch R and Bonde P (2018). Successful use of extracorporeal membrane oxygenation for respiratory failure in pulmonary chronic graft-versus-host disease. *ASAIO Journal*, **60**(1): 122-123.

Zhang YH, Duan GY and Zhang XW (2015). Effects of dexmedetomidine on analgesia and sedation of sufentanil during anesthesia induction in gynecological surgery. *J. Clin. Anesthesiol.,* **31**(2): 117-120.