

Application of remifentanyl for conscious sedation and analgesia in short-term ERCP and EST surgery

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Abstract

This study aims to observe and evaluate the use of remifentanyl in conscious sedation and analgesia for the safety and comfort of patients undergoing short-term endoscopic retrograde cholangiopancreatography (ERCP) and endoscopic sphincterotomy (EST).

Sixty-eight patients who underwent ERCP and EST were randomly divided into two groups: research group and control group. Patients in the research group were intravenously injected with remifentanyl (80–2/3* age) for 1 to 2 minutes, combined with the intravenous injection of propofol (20–30 mg) during the course of treatment. ERCP surgery was performed when Ramsay sedation scale (RSS) score reached 2–3. During the surgery, patients were closely monitored for cough symptoms, aspiration, and respiratory and circulatory system performance, and timely treatment was performed. Sedative drugs were not given in patients in the control group.

In research group, the circulatory and respiratory depression of patients was mild, only one patient needed to be treated, and there was no arrhythmia requiring treatment. Five patients had respiratory depression (blood oxygen saturation decreased to <90%), which was immediately corrected. There were no interruptions during surgery due to body movement, cough, or aspiration.

The use of remifentanyl for conscious sedation and analgesia can be broadly applied in short-term ERCP, which greatly improves patient comfort during the surgery. This approach may bear promise for a widespread use in future clinical practice.

Abbreviations: ASA = American Society of Anaesthesiologists, DBP = diastolic blood pressure, ECG = electrocardiogram, ERCP = endoscopic retrograde cholangiopancreatography, EST = endoscopic sphincterotomy, HR = heart rate, RSS = Ramsay sedation scale, SBP = systolic blood pressure.

Keywords: conscious sedation and analgesia, ERCP, EST, remifentanyl

1. Introduction

Endoscopic retrograde cholangiopancreatography (ERCP) is an endoscopic process used to visualize the biliary pancreatic ductal system through the injection of a radiopaque contrast medium.^[1] Anesthesia support during ERCP is widely accepted, and it has become a standard practice. Since its introduction in 1974,^[2,3] endoscopic sphincterotomy (EST) has been extensively used for the endoscopic extraction of bile duct stones. Its advantages include small trauma, quick recovery time, short hospital stay, and stable efficacy.^[4] ERCP combined with EST is a simple and easy method of interventional therapy for the diagnosis and treatment of bile duct stones.^[5,6] However, in general, one surgery cannot completely remove the stones, and most patients need two or three operations, which greatly increases the pain of

the patient. Moreover, this disease often reoccurs due to complications, and are often associated with anatomical parameters (common bile duct [CBD] diameter) and stone characteristics (stone size, the use of mechanical lithotripsy [ML], difficult lithiasis) at first presentation.^[7]

General anesthesia is often utilized to reduce pain during ERCP combined with EST. Since the patient has duodenal nipple incision and undergoes placement of a nasal bile duct, the operation time is usually short. Although tracheal intubation and general anesthesia are safe and effective, these costs more and patients take a longer time to regain consciousness.^[8] Patients often refuse surgery without anesthesia due to less comfort. Remifentanyl has been used in conscious sedation and analgesia for almost 2 decades.^[9] It is often used in combination with propofol, which provides sufficient analgesia during colonoscopy, satisfactory hemodynamic stability, minor respiratory depression, and rapid recovery; and allows patients to be discharged approximately 15 minutes after the procedure.^[10] Furthermore, it has also been effectively used in mechanically ventilated patients in the intensive care unit.^[11,12] This study aimed to investigate the use of remifentanyl with propofol for conscious sedation and analgesia in patients receiving short-term ERCP and EST for bile duct stone removal, and determine whether this approach improves patient safety and comfort.

2. Materials and methods

This study was approved by the Ethics Committee of our hospital. All patients voluntarily participated in this study, and a signed informed consent was obtained from each patient before the surgery.

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2.1. Patients

A total of 58 patients undergoing ERCP and EST in our hospital from September 2016 to December 2016 were recruited. These patients were randomly divided into two groups using the random number method: research group, and control group. All patients in both groups underwent preoperative CT or nasal cholangiography examinations, which revealed the presence of remaining stones or fragments.

2.2. Anesthesia

All patients were fasted and were not allowed to drink for 8 hours. These patients were intramuscularly injected with 20 mg of butyl bromide scopolamine at 30 minutes before surgery and 10 mL of oral lidocaine at 3 minutes before surgery. Systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), electrocardiogram (ECG), blood oxygen saturation, and breathing were conventionally and continuously monitored. Patients in the research group were given conventional nasal oxygen (3–5 L/min), intravenous injection of remifentanyl (80–2/3 *age) for 1 to 2 minutes, and 20 to 30 mg of intravenous propofol. ERCP and EST were performed when the Ramsay sedation scale (RSS) score reached 2–3 (degree of sedation).^[2] In the control group, no sedative drugs were given.

2.3. Observation indexes

Patients were observed before anesthesia (T₁), during the insertion of the endoscope (T₂), and at the end of surgery (T₃). At each time point, blood pressure, as well as heart rate and oxygen saturation values, were recorded (Table 1). The cooperation of patients have great difficulty tolerating the surgery, including body movement, cough and other interruptions, were compared between the two groups (Table 2). Two hours after the surgery, patients were queried regarding the satisfaction of surgical comfort.

2.4. Statistical analysis

Analyses were performed using SPSS 19.0 software. Variables with repeated measurement were compared using one-way ANOVA. Enumeration data were compared using *t*-test. A *P*-value cutoff of 0.05 was used to indicate statistical significance.

3. Results

A total of 58 patients undergoing ERCP and EST were included in this study. These patients were randomly divided into two groups: research group and control group. Patients in both groups underwent preoperative CT or nasal cholangiography examination, which revealed the presence of remaining stones or fragments. As shown in Table 3, the research and control groups were comparable with respect to demographic data and initial

Table 1

Two groups of patients with blood pressure during the oxygen saturation and heart rate comparison (mean±SD (Standard deviation), n=28).

Observation index	Group	T ₁	T ₂	T ₃
SBP, mm Hg	R	142.16±8.77	113.27±7.34	122.11±6.58
	C	145.22±9.34	166.56±6.83*	157.93±8.44*
DBP, mm Hg	R	79.45±7.22	65.58±6.85	67.68±6.48
	C	81.41±8.72	93.54±6.81*	95.78±8.70*
SpO ₂ , %	R	98.3±0.8	95.3±4.2	97.2±1.9
	C	98.4±0.6	96.8±3.7	97.3±2.3
HR, counts/min	R	82.3±6.7	71.4±8.3	76.8±7.7
	C	81.6±7.1	93.4±9.7*	85.6±8.2*

Compared with R group.

DBP = diastolic blood pressure, HR = heart rate, SBP = systolic blood pressure

* *P*<0.05.

parameters. Furthermore, there were no significant differences between these two groups in terms of gender, age, weight, and American Society of Anaesthesiologists (ASA) classification (*P*>0.05, Table 3). Intraoperative circulatory fluctuations and respiratory depression in patients between these two groups were compared before and after surgery (Table 1). Even though SBP and DBP at T₁ between the research and control groups are comparable, SBP, DBP, and HR were significantly lower at T₂ and T₃ in the research group. This suggests that conscious sedation and analgesia by remifentanyl with propofol helps reduce intraoperative circulatory fluctuations.

Next, other clinical parameters in the research and control groups were further compared. Patients in the research group successfully completed the operation, and no interruption of surgery due to body movement, cough, or aspiration occurred (Table 2). In contrast, patients in the control group had difficulty to cooperate, and were administered with propofol for deep sedation/anesthesia. This may be because the patient was conscious, and that there was significantly more respiratory depression in the research group. Overall, patients in the research group had significantly more comfort compared to patients in the control group (Table 2).

4. Discussion

Remifentanyl is a new type of potent, short-acting mu-opioid receptor agonist, which is safe and controllable, and has a rapid onset of action.^[13,14] Its pharmacogenetics allows for quicker postoperative recovery.^[15,16] Furthermore, it allows patients to be relatively conscious while maintaining appropriate analgesic sedation. Intraoperative wake-up anesthesia was primarily used for localizing brain functional regions during neurosurgical operations, and for assessing neurological function in scoliosis surgery.^[17] In this study, we revealed that the application of this

Table 2

Comparison of two groups of patients.

Group	Sinus bradycardia	Respiratory depression	Body movement	Cough	Surgery interruption	Comfort
R	0	5	0	0	0	28
C	0	0*	7*	6*	3*	13*

Compared with R group.

* *P*<0.05.

Table 3**General clinical phenotype comparison between two groups of patients (mean \pm SD [Standard deviation], n=28).**

	Gender (male/female)	Age (years)	Weight (kg)	ASA classification (I/II)
R group	13/15	67.36 \pm 9.14	63.57 \pm 7.23	9/19
C group	12/16	66.75 \pm 8.62	62.38 \pm 6.86	10/18

ASA = American Society of Anaesthesiologists.

technology in ERCP and EST surgery greatly improved patient safety and comfort during the removal of bile stones. Furthermore, it provided sufficient analgesia, satisfactory hemodynamic stability, minor respiratory depression and rapid recovery; and allowed patients to be discharged earlier.

Through observing intraoperative circulatory fluctuations and respiratory depression, patients in the research group had obvious advantages compared with patients in the control group. Furthermore, there was no interruption of surgery due to body movement, cough, or aspiration; and the postoperative follow-up of patients revealed great satisfaction. Respiratory depression in patients in the research group can be corrected through instructions, which may be related to the following: (1) patients were conscious during the operation, and were therefore able to follow instructions; (2) throat protective reflex was not significantly inhibited.^[18] Even though it only occurred in a small number of patients, patients should be closely monitored during surgery to prevent the occurrence of sinus bradycardia and more difficult-to-treat respiratory distress.

Compared with the control group, patients and surgeons in the research group had higher satisfaction, indicating that the ERCP and EST procedure is very effective. Although the establishment of venous access and the induction of anesthesia require a certain amount of time, the total duration of the surgery was not extended, but was rather shortened. This could be due to the higher compliance of patients after appropriate sedation/analgesia.

Patients are often required to take the prone position during ERCP and EST, because this would affect ventilation function. During surgery, oxygen can only be administered through the nasal cannula, and the operation is often performed under the intervention of radiation, which makes respiratory management difficult.^[19,20] Using remifentanyl for analgesic sedation can not only greatly improve patient comfort, but also make hemodynamics more stable. It causes slight respiratory depression that can be easily corrected, and thereby may have very broad applications for other surgeries.

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