Influence of Incision by Local Anesthetic Infiltration Laparoscopy on Postoperative Pain

Shaotian Li, Mu Song, Yue Ma*, Tingting Wang

Department of Thyroid, Breast and Hernia Surgery, The Seventh Affiliated Hospital of Southern Medical University, Foshan 528244, Guangdong, China

DOI: 10.32629/jcmr.v3i1.706

Abstract: Objective — To observe and compare the analgesic effects of different types of local anesthetics (Ropivacaine, Lidocaine) on the pain of patients in different periods after laparoscopic surgery. Methods — A total of 141 patients admitted to the Seventh Affiliated Hospital of Southern Medical University for laparoscopic surgery from Jan. 2021 to Aug. 2021 were randomly divided into 3 groups: Ropivacaine (group A), Lidocaine (group B) and Control (group C). In group A, Ropivacaine (0.5%, 10ml) was injected layer by layer around the incision after abdominal closure suture. Group B were injected with Lidocaine (1%, 10ml) around the incision. Group C applied with the same volume of normal saline around the incision instead of anesthetic. Visual analogue scale (VAS) scoring was performed 2h, 6h, 12h, 24h, 48h after surgery respectively. Patients' sore up to 5 were injected with Ambutritol, Ibuprofen and Flurbiprofen. The number of patients, frequency and dose were recorded. Meanwhile, the incidence of postoperative adverse reactions such as dizziness, headache, nausea and vomiting in 3 groups were recorded. Results — VAS scores of group A were significantly lower than those of group B and group C in all postoperative follow-up observation periods (2h, 6h, 12h, 24h, 48h), and the difference was statistically significant ($P<0.05$); VAS scores of group B was lower than that of group C at 2h and the difference was statistically significant ($P<0.05$), but there was no statistical significance in VAS scores at 6, 12, 24 and 48h after surgery compared with group C ($P>0.05$). The number of patients, frequency and dose of reuse of painkillers in group A (0) were lower than those in group B (3) and group C (11) within 48 hours after operation, and no adverse reactions such as dizziness, headache, nausea and vomiting occurred in group A, 11 in group B and 3 in group C. Conclusion — The application of Ropivacaine infiltration anesthesia in laparoscopic surgery after abdominal closure and suture can effectively reduce postoperative pain in patients, with obvious analgesic effect in early stage and long duration, which can improve the postoperative experience of patients, reduce postoperative adverse reactions. Thus, we should promote the application of such treatment protocol in clinical surgery.

***Keywords*:** Ropivacaine, lidocaine, laparoscopic surgery, postoperative analgesia

At present, laparoscopic technology is widely used in clinical practice. Because of its advantages such as less trauma, less bleeding and broad field of vision, it is favored by the majority of patients and clinicians. Pain after laparoscopic surgery is usually at mild to moderate level, but pain caused by incision is still the most concerns of patients after operation. The symptoms are abdominal puncture and drag pain in the lower diaphragmatic shoulder[1]. Postoperative pain includes somatic pain (incision pain) and visceral pain[2]. Incision pain was the main pain at 48h[3] and within one week [4] after laparoscopic surgery. Therefore, a simple, economical, safe and effective postoperative incision analgesia method is imperative to alleviate postoperative pain of incision. This study mainly investigated the effect of two commonly used local anesthetics (Ropivacaine and lidocaine) on incision pain in patients undergoing laparoscopic surgery, and a local anesthetics suitable for postoperative incision analgesia is recommended in this type of surgery.

1. Materials, objects and methods

1.1 Study & design

The scheme of this study was designed with the method of clinical randomized controlled research.

1.2 Case selection

A total of 141 patients undergoing elective laparoscopic surgery in the Seventh Affiliated Hospital of Southern Medical University from January 2021 to August 2021 were selected as the study subjects. The scheme was approved by the Ethics Committee of the Seventh Affiliated Hospital of Southern Medical University. All patients signed informed consent.

Inclusion criteria: Patients undergoing laparoscopic surgery under general anesthesia were selected for inpatient treatment without restrictions in gender. The American Society of Anesthesiologists (ASA) grade it as level I-II from those

aged 14-77 with height ranging from 140cm-190cm, weight 42kg-94kg, BMI15.81-30.09 respectively.

Exclusion criteria: Long-term use of sedative and analgesic drugs.Patients who were unable to undergo endoscopic surgery after intraoperative endoscopic exploration turned to laparotomy; Severe abdominal infection, adhesion, peritoneal stimulation signs are obvious. Patients with severe liver and kidney insufficiency, respiratory insufficiency, cardiovascular and cerebrovascular diseases, severe hypertension, diabetes, and low coagulation function cannot be conducted with surgery.

1.3 Experimental drugs

Ropivacaine hydrochloride injection with specification of 0.1g/10mL is produced by AstraZeneca Pharmaceutical Co Ltd in Sweden.The specification of Lidocaine hydrochloride injection is 0.1g/5ml, which is produced by Hubei Tiansheng Pharmaceutical Group Co., LTD.

1.4 Grouping and anesthesia methods

141 patients undergoing laparoscopic surgery under general anesthesia were randomly divided into 3 groups (47 cases in each group). Group with administration of Ropivacaine as (Group A), Lidocaine Group (Group B) and Control group (Group C). There were no statistical differences in gender, age, height, weight and BMI among the 3 groups (P>0.05). Non-invasive blood pressure (NBP), blood oxygen saturation (SPO2), electrocardiogram (ECG) and heart rate (HR), end-expiratory carbon dioxide concentration (ETCO2) were routinely measured after entering the room. Intravenous access was established. Anesthesia was induced with the use of Sufentanil of 0.5ug/kg, Propofol 2mg/kg and Cisatracurium 0.15mg/kg. Tracheal intubation was followed, and 0.5ug/ mL Propofol, 3.5ng/ml Reifentanil, 1.5% inhalation of Sevoflurane were given under target-Controlled Infusion system (TCI), and cisatracuronium was administered intermittently to maintain anesthesia. After the operation, Ropivacaine (group A, 0.5%, 10ml), Lidocaine (group B, 1%, 10ml) and normal saline (group C, 10ml) were injected around the incision. Finally, the patient was given Sufentanil ranging from 5-10ug according to BMI, and then resuscitated under anesthesia. The tracheal tube was removed after the patient displayed consciousness with spontaneous breathing restored and active reflexia and limbs demonstrating strength and then there were no symptoms of choking and agitation. The patients can be sent back to the ward as the patients show stable vital signs.

1.5 Observation indicators

A resident physician who was not involved in surgery and anesthesia operation was admitted to the ward at 2h, 6h, 12h, 24h, 48h, respectively for postoperative visit to conduct scoring by Parallel Visual Analogue Scale (VAS) method. The physician explained the significance and scoring method of VAS to the patient, and reported to the physician for record according to the autonomous scoring for patient's immediate feeling. The pain is divided into 11 grades from 0 to 10 on the VAS scale, 0 means no pain, 10 embodies severe pain, 1-3 means the pain is at mild level, which can be tolerable without affection on sleep. A score of 4-6 indicates moderate pain, which can interfere with sleep but is tolerable. A score of 7 to 10 indicates intense pain that is unbearable and requires analgesic treatment.Patients with VAS>5 were injected with Ambutritol Ibuprofen Flurbiprofen ester and other analgesics, and the frequency and dose of such drugs were recorded. At the same time, the incidence of postoperative dizziness, headache, nausea and vomiting and other adverse reactions of the patients were questioned and counted, and the wound healing of the patients was observed and recorded.

1.6 Statistical treatment

Statistical software SPSS 22.0 was used for statistical analysis.The measurement data were expressed by $x \pm s$, the comparison between groups was performed by one-way anOVA, the count data were described by case number and percentage, and the comparison between groups was performed by x^2 test.

2. Results

2.1 General information

There were no statistically significant differences in age, gender, weight, height, BMI and other general information among the 3 groups (P>0.05), indicating comparability, as shown in Table 1.

Table 1. Comparison of general information in three groups

Item	A (n=49)	B (n=49)	C (n=49)
Age (year, x ± s)	40.0±13.1	46.5±15.2	41.3±16.3
Sex (M/F)	27/20	27/20	30/17
Weight (Kg, x ± s)	60.9±11.1	61.0±12.0	63.8±11.6
Height (cm, x ± s)	164.1±8.0	162.6±6.6	164.4±7.3
BMI (x ± s)	22.6±3.6	22.6±3.3	23.5±3.3

Group A: Infiltrated with Ropivacaine (0.5%, 10ml); Group B: Infiltrated with Lidocaine (1%, 10ml; Group C: Control group, infiltrated with normal saline

2.2 Comparison of VAS scores in each group at different time periods

VAS scores of group A were significantly lower than those of Group B and Group C during all postoperative follow-up observation periods (2h, 6h, 12h, 24h, 48h), with statistical significance (P<0.05). At 2h postoperatively, VAS score of Group B was lower than that of Group C, and the difference was statistically significant (P<0.05). At 6h, 12h, 24h and 48h postoperatively, VAS score of group B showed no statistical difference compared with group C (P>0.05), as shown in Table 2.

Table 2. The visual analog scores (VAS) at different time among three groups after surgery (x ± s)

Group	2h	6h	12h	24h	48h
A	1.5±0.5	1.6±0.6	1.4±0.6	1.3±0.7	0.8±0.6
B	2.0±0.5	2.6±1.0	2.5±1.1	2.1±0.9	1.4±0.8
C	2.4±1.0	3.2±1.3	3.0±1.2	2.3±1.0	1.5±0.9

3. Safety evaluation

In the 3 groups, no analgesics were used in Group A (0/47), and 3 cases (3/47) in Group B (1 Mmbutritol injection, 2 Acetofenac tablets, and 2 Acetofenac tablets, respectively) within 48h after surgery. In Group C, 11 patients (11/47) were treated with analgesics (Ambutritol injection, Ibuprofen sustained-release tablet, Phlotriphen injection, etc.). The number of analgesics used within 48 hours after operation in Group A was less than that in Group B and Group C, and the difference was statistically significant (P<0.05). Within 48 hours after operation, there were 0 cases (0/47) of dizziness, headache, nausea and vomiting in Group A. Besides, 11 cases (11/47) in Group B and 3 cases (3/47) in Group C. The incidence of postoperative adverse reactions in Group A was lower than that in Group B and C, and the difference was statistically significant (P<0.05). The wound healing of 3 groups was good, and no obvious bleeding, infection or pus occurred, and there was no statistical significance (P>0.05).

4. Discussion

As a new form of surgery, laparoscopy integrates high technology such as electricity and optics. Surgeons operate precision medical instruments by observing monitors, thus achieving the surgical effect that can only be achieved by traditional open surgery. Due to its prominent advantages of minimally invasive surgery, less damage to surrounding tissues, less bleeding and wide field of vision, it can effectively reduce the trauma of surgery to patients, shorten the recovery period of patients, reduce the length of hospital stay, and greatly improve the postoperative experience of patients[5]. With the increasingly extensive application of endoscopic technology in clinical practice, patients' demand for good postoperative rehabilitation experience has also increased, among which reducing postoperative pain is the primary problem. Postoperative pain is an unavoidable stress response caused by surgery on the body, which is a kind of harmful stimulation. Postoperative pain may be incision pain, or visceral pain at the same time. If acute pain is not well controlled in time, it may also turn to chronic pain. The pain sites after laparoscopic surgery are mainly located in the abdominal puncture, subdiaphragmatic and referred pain in the shoulder[6]. The abdominal puncture pain is mainly caused by the injury of the abdominal wall during the operation, and the pain degree depends on the size of the incision. The mechanism of subphrenic and shoulder drag pain may be related to phrenic nerve compression, pneumoperitoneum traction and hypercapnia.

At present, Ropivacaine and Lidocaine are widely used in clinical practice. Both of them are amide local anesthetics. The former is a new long-acting local anesthetics with better blocking effect on sensory fibers than motor fibers, and the latter is a medium-effect local anesthetics. Ropivacaine is the local anesthetic with the longest acting time and the least cardiotoxicity at present. However, some scholars are concerned about whether Ropivacaine will cause insufficient blood supply at the end of the artery due to vasoconstriction[7]. According to Labaille et al. [8], different concentrations of Ropivacaine can play a good postoperative analgesic effect, and there are no postoperative adverse reactions. Liu Yanchao et al. [9] used 0.5% Ropivacaine to perform subcutaneous infiltration combined with intraperitoneal spraying on the incision after gynecological laparoscopic surgery, which produced good analgesic effect and no adverse reactions. Lidocaine has rapid onset, strong penetration and wide dispersion, but its duration is short and cardiotoxicity increases with the increase of drug concentration.

In conclusion, Ropivacaine, compared to Lidocaine, can produce good analgesic effect in the early postoperative period with a long duration, less adverse reactions and less toxicity. Therefore, layer by layer infiltration anesthesia by

use of Ropivacaine around the incision after abdominal closure and suture of laparoscopic surgery can effectively reduce postoperative pain, reduce adverse reactions and improve the quality of prognosis of patients, which is worthy of clinical application

References

[1] Qiu Guomei, He Yao, Ding Jielan, et al. Effect of preoperative and postoperative incision injection of Bupivacaine on pain after laparoscopic adnexectomy[J]. *Zhejiang Medical Education*, 2014, 13(01): 51-53.

[2] Wu Jin, Wang Zheng, Ping Yantao, et al. Influence of bupivacaine on incision pain after laparoscopic cholecystectomy [J]. *Journal of Clinical Anesthesiology*, 2010, 26(1): 30-32.

[3] Lee IO, Kim SH, Kong MH, et al. Pain after laparoscopic cholecystectomy: the effect and timing of incisional and intraperitoneal bupivacaine[J]. *Can J Anaesth*, 2001, 48: 545-550.

[4] Bisgaard T, Klarskov B, Kristiansen VB, et al. Multi-regional local anesthetic infiltration during laparoscopic cholecystectomy in patients receiving prophylactic multi-modal analgesia: a Randomized, double-blinded, placebo-controlled study[J]. *Anesth Analg*, 1999, 89: 1017-1024.

[5] Li Changpeng. Discussion on the curative effect and advantage of laparoscopic gastrointestinal surgery[J]. *The World Clinical Medicine*, 2016, 10(19): 100.

[6] Yuan Qingzhong, Pan Guozheng, Bu Qingao, et al. Effects of lidocaine and Ropivacaine on postoperative analgesia after laparoscopic cholecystectomy [J]. *Shandong Medical Journal*, 2012, 52(41): 58-59.

[7] Wang Long, Du Jianhua, Yuan Yingchuan. Clinical observation of Ropivacaine local anesthesia for postoperative thyroid analgesia[J]. *The Chinese Journal of Clinical Pharmacology*, 2015, 31(05): 333-335.

[8] Labaile T, Mazoit JX, Franco D, et al. The clinical efficacy and pharmacokinetics of intraperitoneal ropivacaine for laparoscopic cholecystectomy[J]. *Anesth Analg*, 2002, 94: 100-105.

[9] Liu Yanchao, Hou Yan, Jiang Hui. Analgesic effect of ropivacaine incision and pelvic infiltration after gynecological laparoscopic surgery[J]. *Journal of Clinical Anesthesiology*, 2011, 27: 709-711.