

Analgesic effect of preoperative dezocine-based local anesthesia in patients undergoing inguinal hernia repair

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Abstract

Objective: This study was performed to investigate the analgesic effects of intramuscular injection of dezocine-based local anesthesia in patients undergoing inguinal hernia repair.

Methods: A total of 120 patients underwent local herniorrhaphy from July 2015 to December 2016 and were randomly divided into 2 groups: the dezocine group, in which a preoperative intramuscular injection of dezocine was administered, and the control group, in which no dezocine injection was administered. The patients' pain and comfort levels were evaluated at 30 minutes, 2 hours, 6 hours, 12 hours, and 24 hours postoperatively.

Results: The visual analog scale scores at 30 minutes, 2 hours, 6 hours, 12 hours, and 24 hours were significantly lower in the dezocine than control group. In the Bruggemann comfort scale evaluation, patients who received dezocine injections showed significantly greater comfort than those in the control group at 30 minutes, 2 hours, 6 hours, 12 hours, and 24 hours. No adverse reactions occurred in the dezocine group.

Conclusions: Dezocine-based local anesthesia can attenuate postoperative pain and increase the comfort level during and after herniorrhaphy.

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Keywords

Dezocine, local anesthesia, inguinal hernia, preemptive analgesia, herniorrhaphy, visual analog scale, Bruggemann comfort scale

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Introduction

An inguinal hernia is a common condition in children and the aged population. The prevalence of inguinal hernias is higher in adults than in children, and inguinal hernias in adults are unable to be surgically cured. Surgery is currently considered the gold standard for treating inguinal hernias.^{1,2} Many patients who undergo inguinal hernia repair under local anesthesia experience acute postoperative pain and serious discomforts such as body movement disorders. Additionally, postoperative pain may induce pathological lesions that result in postoperative complications that hamper patients' quality of life.³ Extensive measures have been taken to attenuate postoperative pain and decrease the incidence of postoperative complications, most notably balanced analgesia and multimodal analgesia.⁴ Among these methods, preemptive analgesia is commonly used in clinical practice because it can induce analgesia before surgical injury occurs. The mechanism may be related to blocking of the transmission of nerve impulses to the central nervous system, thus attenuating the sensitivity of the central nervous system to algia and decreasing postoperative pain. Application of analgesics before surgery contributes to the attenuation of pain and helps to improve patients' quality of life.

Most opioids currently used for analgesia are reportedly associated with adverse effects such as vomiting, nausea, pruritus, hypersomnia, hypotension, and respiratory depression.⁵ Dezocine, an opioid with high

analgesic efficacy and the capacity to serve as both an agonist and antagonist,⁶⁻⁸ reportedly provides better analgesia than morphine, codeine, and pentazocine.⁹⁻¹¹ Additionally, its activation is receptor-independent. In this study, we investigated the clinical efficacy of dezocine in the management of postoperative pain and recovery after local herniorrhaphy.

Methods

Clinical data

Patients who underwent local herniorrhaphy from July 2015 to December 2016 in our department were included in this study. The patients were randomly divided into two groups: the dezocine group, in which a preoperative intramuscular injection of dezocine was given, and the control group, in which no dezocine injection was given. All patients provided written informed consent. The study protocol was approved by the Ethics Committee of the First Affiliated Hospital of Xinjiang University.

The inclusion criteria were as follows: age of 12 to 90 years, diagnosis of inguinal hernia and willingness to undergo surgery, no surgical contraindications such as severe lung or heart disorders, and no concurrent diseases requiring other surgeries. The exclusion criteria were as follows: a suspected inguinal hernia but no definitive diagnosis, severe surgical complications, a requirement for additional surgeries, and postoperative recurrence.

Surgical procedures

Anesthesia was induced by injections of lidocaine hydrochloride (15 mL) and ropivacaine (10 mL) diluted by an equal volume of normal saline. Initially, 20 mL was subcutaneously injected along the incision. Local massage was then performed for 3 minutes, followed by removal of the skin and subcutaneous tissues. The anesthetic agents were administered via the submembranous tissues of the abdominal external oblique muscle. Upon dissection of the external oblique muscle, 5 mL of the anesthetic agents were injected along the cremaster muscle and spermatic cord. The surgery was carried out according to a previous description.¹²

Evaluation of pain

A visual analog scale (VAS) was used to evaluate pain in resting conditions 30 minutes, 2 hours, 6 hours, 12 hours, and 24 hours postoperatively.¹³ The evaluation was performed as conventionally described.

Evaluation of comfort level

The Bruggemann comfort scale was used to determine the patients' comfort level 30 minutes, 2 hours, 6 hours, 12 hours, and 24 hours after surgery.¹⁴ This five-score system was used according to the following description: 0, persistent pain; 1, painless in a resting state and severe pain during deep breathing and/or coughing; 2, painless in a resting state and slight pain during deep breathing and/or coughing; 3, painless during deep breathing; and 4, painless during coughing.

Statistical analysis

SPSS v.17.0 software (SPSS Inc., Chicago, IL, USA) was used for the statistical analysis. The measurement data are presented as mean \pm standard deviation, and the

numeration data are presented as percentage. Analysis of variance was used to compare the measurement data. Repeated-measures analysis of variance was used to compare data collected at different time points. The chi-square test was used to compare the numeration data. A P value of <0.05 was considered statistically significant.

Results

In total, 120 patients were included in this study. The dezocine group comprised 44 male and 16 female patients aged 16 to 90 years (mean age, 54.98 ± 19.26 years), and the control group comprised 43 male and 17 female patients aged 22 to 81 years (mean age, 54.67 ± 17.89 years). The patients' ethnicities were Han Chinese, Uygur, Chinese Muslim, Mongolian, and Manchu. No statistically significant differences were found in the age and sex of the patients between the two groups (age: $F=0.078$, 95% CI = -7.036 to 6.402 ; sex: $F=3.146$, 95% CI = 1.957 to 16.620).

Table 1 shows a comparison of the VAS scores between the two groups at different time points. The VAS scores were significantly lower in the dezocine than control group at 30 minutes, 2 hours, 6 hours, 12 hours, and 24 hours ($P < 0.05$).

In the Bruggemann comfort scale evaluation, patients who received dezocine injections showed significantly better comfort scores than those in the control group at 30 minutes, 2 hours, 6 hours, 12 hours, and 24 hours ($P < 0.05$) (Table 2). No adverse drug reactions occurred in the dezocine group.

Discussion

Dezocine is an effective analgesic agent that is activated independent of receptors. The serum concentration of dezocine reaches its peak level (mean, 19 ng/mL; range, 10

Table 1. Pain scores before and after dezocine injection

Postoperative pain score																														
Group	Postoperative 30 min				Postoperative 2 h				Postoperative 6 h				Postoperative 12 h				Postoperative 24 h				P	Z	P							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV										
Dezocine	47	13	0	0	-9.719	0.000	31	28	1	0	-9.285	0.000	10	38	2	0	-6.271	0.000	9	42	5	4	-4.675	0.000	9	45	6	0	-4.493	0.000
Control	0	16	31	13	0	15	39	6	1	21	34	4	1	32	22	5	1	32	22	5	1	42	14	3	1	42	14	3		
Total	47	19	31	13	31	43	40	6	11	59	36	4	10	74	27	9	10	74	27	9	10	87	20	3	10	87	20	3		

I, no pain (score of 0); II, slight pain (score of 1-3); III, moderate pain (score of 4-6); and IV, severe pain (score of 7-10)

Table 2. Patient comfort levels before and after dezocine injection

Postoperative comfort level																														
Group	Postoperative 30 min				Postoperative 2 h				Postoperative 6 h				Postoperative 12 h				Postoperative 24 h				P	Z	P							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV										
Dezocine	1	0	5	54	-9.561	0.000	0	4	16	40	-8.901	0.000	3	10	27	20	-5.763	0.000	4	7	30	19	-4.774	0.000	1	6	32	21	-5.003	0.000
Control	33	20	7	0	28	23	9	0	16	25	18	1	6	30	21	3	6	30	21	3	8	23	23	6	8	23	23	6		
Total	34	20	12	54	28	27	25	40	19	35	45	21	10	37	51	22	9	37	51	22	9	29	55	27	9	29	55	27		

0, persistent pain; 1, painless in a resting state and severe pain during deep breathing and/or coughing; 2, painless in a resting state and slight pain during deep breathing and/or coughing; 3, painless during deep breathing; and 4, painless during coughing

to 38 ng/mL) at 10 to 90 minutes after intramuscular injection of 10 mg of dezocine. Within 5 minutes after intravenous injection of 10 mg of dezocine, the mean terminal half-life was 2.4 hours (1.2 to 7.4 hours). The mean distribution volume was 10.1 L/kg (range, 4.7 to 20.1 L/kg), and the mean total body clearance rate was 3.3 L/h/kg (range, 1.7 to 7.2 L/h/kg). Dezocine showed non-linear metabolism at doses of >10 mg. A positive correlation was observed between the dose of dezocine (5 and 10 mg) and the blood drug level. At a dose of 20 mg, the area under the curve was about 25% higher than that at a dose of 5 or 10 mg, and the total body clearance rate was 20% lower than that at a dose of 5 or 10 mg. Dezocine is now commonly used in anesthetic management because it shows good analgesic effects, low respiratory suppression, and minimal drug dependence. Additionally, dezocine has high safety and patient tolerance and can inhibit the occurrence of vomiting and nausea.¹⁵⁻¹⁷

In 1978, Fragen and Caldwell¹⁸ reported that dezocine can be used as a postoperative analgesic. With the extensive application of postoperative analgesia in clinical practice, dezocine injection is now commonly used in several surgeries, such as laparotomy and laparoscopic operations. It also exerts high efficiency for postoperative analgesia. Previous studies have shown that dezocine has fewer adverse effects than other agents.¹⁹⁻²¹ Although its specific mechanism of action remains incompletely understood, its analgesic effects are unquestionable.²²

To date, most studies on dezocine have focused on its effects in patients undergoing surgeries involving systemic anesthesia and epidural anesthesia. These studies showed that dezocine was effective for the clinical management of such surgeries.⁶ However, few studies have focused on the roles of dezocine in postoperative analgesia in patients undergoing procedures involving local anesthesia.

The postoperative pain in patients who have undergone surgical repair of inguinal hernias using local anesthesia is mainly felt in the skin, fascia, muscle, and nerves; patients also experience mental aspects of pain, including superficial pain and psychological pain. The patients usually experience sharp pain together with poor body movement, an increased heart rate, and rapid breathing, which is not tolerable to many of these patients. The pain may also affect aspects of the patients' quality of life such as rehabilitation and sleeping. It may even trigger complications. All of these adverse effects contribute to an increased hospitalization duration and treatment costs.

In this study, intramuscular injection of dezocine about 30 minutes before surgery was effective and safe for patients who underwent herniorrhaphy after local anesthesia with no severe complications. The VAS score for postoperative pain at 30 minutes, 2 hours, 6 hours, 12 hours, and 24 hours after administration of dezocine indicated that the treatment efficiency in the dezocine group was superior to that in the control group. Moreover, the Bruggemann comfort scale was used to evaluate the patients' comfort level, and the scores in the dezocine group were superior to those in the control group at all time points.

In conclusion, herniorrhaphy after local anesthesia prevents the risks of surgery using systemic anesthesia or epidural anesthesia. However, patients still experience postoperative incisional pain. Our data show that dezocine-based local anesthesia can attenuate this postoperative pain. It also increased the patients' comfort level during and after the surgery, contributing to postoperative recovery and satisfaction.

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Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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