

Effect of the transversus abdominis plane block on postoperative pain and recovery in patients with hepatic echinococcosis

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Abstract

Objectives: Hepatic echinococcosis (HE) is a severe parasitic disease that occurs worldwide, and radical surgery is the recommended therapy. This study was performed to investigate the efficacy of using a transversus abdominis plane (TAP) block during surgery on postoperative pain and recovery of patients with HE under the guidelines of an enhanced recovery after surgery (ERAS) protocol.

Methods: Fifty-eight patients from the Tibetan plateau who underwent surgery for treatment of HE by the same surgeons under the guidance of ERAS were included in the present study. A TAP block was conducted before closing the abdominal cavity.

Results: The consumption of sufentanil was significantly lower in patients of the TAP than control group. Patients had a significantly shorter time to first flatus in the TAP than control group. Other parameters showed no significant differences between the two groups.

Conclusions: Use of the TAP block could reduce the consumption of analgesic medication and promote recovery of patients from the Tibetan plateau under the guidance of an ERAS protocol.

Keywords

Transversus abdominis plane block, hepatic echinococcosis, analgesia, enhanced recovery after surgery, postoperative pain, sufentanil

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Introduction

Echinococcosis is a severe parasitic illness caused by infestation of organisms from the genus *Echinococcus* (family Taeniidae).¹ Although the disease occurs worldwide, it is endemic in South America, Eurasia, and Africa.² In China, echinococcosis mainly occurs in the pastoral parts of the western region and provinces, including the Xinjiang Uygur Autonomous Region, Ningxia Hui Autonomous Region, Qinghai, Gansu, and Sichuan Province.¹ Two of the most pathogenic zoonotic parasitic helminthic infections in humans are alveolar echinococcosis, caused by infestation of the larval stage of *E. multilocularis*, and cystic echinococcosis, caused by infestation of the larval stage of *E. granulosus*.³ The liver is the major site of echinococcosis involvement in both patients with alveolar echinococcosis and those with cystic echinococcosis; however, the parasites may disseminate to other organs such as the lung and brain, progressively leading to death unless treated.^{4,5} Because echinococcosis is a life-threatening disease, radical surgery is recommended by the World Health Organization.⁶

The transversus abdominis plane (TAP) block is a regional block of the anterior abdominal wall lying between the internal oblique and transversus abdominis muscles.⁷ It provides effective analgesia for patients undergoing lower and upper abdominal surgeries such as cesarean delivery, open appendectomy, and liver resection.^{8–10} However, no reports have described the postoperative analgesic effect of the TAP block on patients with hepatic echinococcosis (HE). Enhanced recovery after surgery (ERAS) is a comprehensive perioperative approach that aims to accelerate recovery after surgery. It has been proven feasible in many surgeries as shown by shorter hospital stays and lower mortality rates.¹¹ In the present study, patients from the Tibetan plateau (average altitude of 4500 m) who underwent surgeries

in our hospital were investigated. We investigated the application of the TAP block on surgery for HE under the guidance of an ERAS protocol in patients who lived in the plateau environment and underwent surgical treatment in plain areas.

Methods

Patients

Patients with HE who underwent abdominal surgery by the same surgeons from January 2015 to January 2016 in our hospital were enrolled in this retrospective study. The inclusion criteria were an age of 18 to 70 years, a body mass index of 19 to 30 kg/m², and an American Society of Anesthesiologists physical status of I or II.¹² The exclusion criteria were an allergy to anesthetics, a history of chronic pain, coagulation abnormalities, liver and/or kidney dysfunction, and significant systemic disease. The patients were randomly divided into the TAP group and control group. The patients, their anesthesiologists, and the staff providing postoperative care were blinded to the group assignments. The study was approved by the institutional review board of our hospital. Written informed consent was obtained from each patient.

Management of patients who lived in the plateau environment and underwent surgical treatment in plain areas

Adaptive treatments at our cooperative hospital (altitude of 1500–2000 m) were adopted prior to surgery in these patients. Treatments such as nutritional support and bloodletting therapy (<180 g/L) were conducted. Patients with coagulation disorders received anticoagulants other than hemostatic agents before surgery because of their unusual physiological features.

After these adaptive treatments, the patients were sent to our hospital in the plateau region.

Preoperative treatment

All patients stopped smoking for >14 days and fasted for 8 hours before surgery. All patients received 400 mL of an iso-osmolar carbohydrate-rich drink orally (Jiangsu Zhengda Fenghai Pharmaceutical Co., Ltd., Suqian, China) 4 hours before surgery. In addition, all patients received 5 g of cefoperazone sodium and tazobactam sodium intravenously (Hainan Tongyong Sanyang Pharmaceutical Co., Ltd., Haikou, China) for broad-spectrum antibiotic treatment and 40 mg of parecoxib sodium intravenously (Pharmacia & Upjohn, Kalamazoo, MI, USA) 30 minutes before surgery.

Anesthesia procedure

Patients in the control group received conventional general and local anesthesia. Patients in the TAP group received general anesthesia and a bilateral TAP block at the abdomen before abdominal closure. The general anesthesia was standardized for all patients and included administration of remifentanyl (4 ng/mL; Wuhan Renfu Pharmaceutical Co., Ltd., Wuhan, China) and propofol (3–4 µg/mL; AstraZeneca, Cambridge, England), the dosages of which were adjusted by an intravenous pump to control the bispectral index at 40 to 60 under target-controlled infusion. Operations including pericystectomy, endocystectomy, and liver resection were performed according to the severity of illness. The incisions were performed along the xiphoid process to the umbilicus (according to the patient's condition), parallel to the ribcage, and the left abdominis rectus was then cut. A TAP block was performed under direct macroscopic observation.

We identified the intraperitoneal and abdominal transverse muscles according to the anatomical level and found the transverse plane of the abdomen. Before closing the abdominal cavity, 0.2% ropivacaine (AstraZeneca) was administered at 10 mL per side to the patients in the TAP group. Patients in the control group received a subcutaneous injection of 20 mL of 0.2% ropivacaine at the incision. The patients' preoperative and intraoperative heart rate and mean arterial pressure were monitored in accordance with the American Society of Anesthesiologists guidelines.

Postoperative care and assessments

After surgery, the patients were transferred to the postanesthesia care unit. Patient-controlled intravenous analgesia was performed as follows. Intravenous sufentanil (Yichang Humanwell Pharmaceutical Co., Ltd., Yichang, China) was continuously administered by a pump at 0.02 µg/kg/h. The patient-controlled dose of sufentanil was 1 µg, and the lockout time was set at 30 min.¹³ Tropisetron hydrochloride (5 mg/day; Hunan Kangpu Pharmaceutical Co., Ltd., Changsha, China) was used to prevent nausea and vomiting for 48 hours after surgery. A carbohydrate-rich drink was administered at 50 mL 6 hours after surgery (total volume of <200 mL on the first day after surgery) and 400 mL on the second day after surgery. Entire enteral nutrition was applied on the third day after surgery. The urinary catheter was removed 24 hours after surgery. Pain severity was quantified using a 0- to 10-point visual analog scale (VAS) (0 = no pain and 10 = worst possible pain).¹⁴ Furthermore, 48 hours after surgery, the consumption of sufentanil, time of ambulation, first flatus, and complications such as nausea and vomiting were evaluated.

Statistical analysis

The statistical analysis was performed using SPSS statistical software (version 16.0; SPSS Inc., Chicago, IL, USA). Continuous data are expressed as mean \pm standard deviation. Continuous variables were statistically analyzed by Student's t-test. Categorical variables were assessed by chi-square analysis. A P value of <0.05 was considered statistically significant.

Results

In total, 270 patients were assessed, and 58 patients with HE were included in the study (TAP group, $n = 29$; control group, $n = 29$). Thirty patients underwent pericystectomy + endocystectomy (TAP group, $n = 14$; control group, $n = 16$), 16 patients underwent liver resection (TAP group, $n = 9$; control group, $n = 7$), and 10 patients underwent

liver resection + pericystectomy + endocystectomy (TAP group, $n = 5$; control group, $n = 5$). The remaining two patients were eliminated (one in the TAP group and one in the control group) owing to an intraoperative blood loss volume of 20% higher than the circulating blood volume and intraoperative massive bleeding (>800 mL), respectively. The patients' demographic data and intraoperative parameters showed no significant differences between the two groups (Table 1).

During the first 24 hours after surgery, the consumption of sufentanil was significantly lower in the TAP than control group (36.2 ± 5.8 vs. 48.7 ± 7.3 μg , respectively; $P = 0.008$). On the second postoperative day, however, the consumption of sufentanil was not significantly different between the two groups (28.5 ± 4.2 vs. 34.6 ± 5.4 μg , respectively). In addition, the

Table 1. Demographic characteristics and surgical parameters in the two groups.

Characteristics	TAP group ($n = 29$)	Control group ($n = 29$)	P value
Age (years)	47 ± 7.6	45 ± 8.5	0.367
Men/women	10/19	13/16	0.421
BMI (kg/m^2)	25.4 ± 4.1	26.5 ± 5.0	0.389
Weight (kg)	55 ± 7.1	53 ± 9.4	0.661
ASA status			0.597
I/II	12/17	14/15	
Before surgery			
MAP (mm/Hg)	59 ± 24.5	56 ± 28.9	0.454
HR (beats/min)	55 ± 7.5	57 ± 6.9	0.768
Duration of surgery (min)	271 ± 73	269 ± 85	0.327
During surgery			
Urine volume (mL)	654 ± 241	594 ± 340	0.157
Transfusion volume (mL)	1780 ± 650	1850 ± 710	0.382
Amount of bleeding (mL)	328 ± 177	287 ± 168	0.286
At the end of surgery			
MAP (mm/Hg)	62 ± 28.8	59 ± 32.4	0.428
HR (beats/min)	64 ± 7.2	69 ± 10.1	0.674

Data are presented as mean \pm standard deviation or number of patients. TAP, transversus abdominis plane; BMI, body mass index; ASA, American Society of Anesthesiologists; MAP, mean arterial pressure; HR, heart rate.

Table 2. Postoperative data in the two groups.

Characteristics	TAP group (n = 29)	Control group (n = 29)	P value
Time of ambulation (h)	11 ± 5.6	12 ± 6.8	0.23
Time to first flatus (h)	15 ± 6.1	19 ± 7.4	0.03
Complications			
Nausea	2	6	0.253
Vomiting	1	3	0.604
48 h after surgery			
VAS score	1.8 ± 0.5	1.9 ± 0.5	0.45
MAP (mm/Hg)	65 ± 19.5	61 ± 25.5	0.505
HR (beats/min)	56 ± 10.5	58 ± 9.4	0.448
Length of hospital stay (days)	9 ± 3.7	9 ± 4.5	0.37

Data are presented as mean ± standard deviation or number of patients. MAP, mean arterial pressure; HR, heart rate; VAS, visual analog scale.

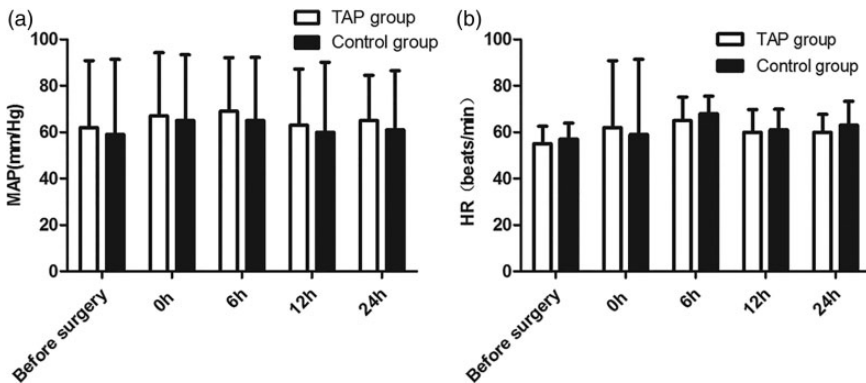


Figure 1. (a) MAP and (b) HR between the two groups before and after surgery. 0–24 h indicates the postoperative time. MAP, mean arterial pressure; HR, heart rate; TAP, transversus abdominis plane.

time to first flatus was significantly shorter in the TAP than control group ($P=0.03$) (Table 2). However, the mean arterial pressure, heart rate, VAS score, time of ambulation, complications, and hospital stay were not significantly different between the two groups (Table 2, Figure 1).

Discussion

HE is a common zoonotic parasitic disease that leads to substantial morbidity and mortality in many parts of the world.¹³ Radical surgery is the preferred treatment

and is associated with lower recurrence than conservative treatment. However, laparotomy also results in postoperative pain. We have tried many approaches to help relieve postoperative pain and found that the TAP block may be an effective method. In the present study, the patients from the Tibetan plateau were different from previous reports.

A previous study proved that the TAP block improved postoperative analgesia in patients undergoing laparoscopic cholecystectomy.¹⁵ Milan et al.¹⁶ reported that the TAP block could significantly reduce

postoperative morphine consumption. In the present study, we investigated the efficacy of the TAP block in surgery for HE. During the surgery process, a TAP block was adopted before abdominal closure at the precise target site. The consumption of sufentanil in the first 24 hours was significantly lower in patients in the TAP than control group, indicating that the TAP block can decrease postoperative pain within 24 hours after surgery. Arora et al.¹⁷ showed that the TAP block reduced postoperative pain up to 24 hours after laparoscopic hernia repair, which is consistent with our study. However, no difference in the VAS score was noted between the two groups, possibly because of Tibetans' insensitivity to pain. The marked difference in the time to first flatus between the two groups in our study indicated that the TAP block was beneficial for the recovery of intestinal function. A previous study proved that the TAP block can expedite patients' recovery and shorten their hospital stay.¹⁸ The lack of differences in the time of ambulation and hospital stay parameters between the two groups in our study may have been due to the application of the ERAS protocol.

ERAS has gained extensive attention because it aims to enhance patients' physiology through integrated applications including anesthetic, surgical, nursing, and perioperative management, thus promoting recovery. Preoperative fasting is a traditional treatment before surgery. However, this treatment has been controversial during the last decade. Hausel et al.¹⁹ showed that a carbohydrate-rich drink reduced preoperative discomfort in patients undergoing elective surgery. Ljungqvist et al.²⁰ found that patients who received carbohydrates before surgery were discharged from the hospital earlier than those who were fasted. In the present study, the complications of nausea and vomiting, the first mobilization time, and the length of hospital stay showed no significant differences

between the two groups, which also may have been partly due to the administration of a carbohydrate-rich drink to all patients preoperatively. A previous study showed that an ERAS program including eating the day after surgery and mobilization on the third day could lead to earlier recovery and a shortened hospital stay.²¹ Consistently, we found that an early start of postoperative drinking and diet were beneficial for functional recovery.

Conclusion

Use of the TAP block under the guidance of an ERAS protocol could reduce the consumption of analgesic medications and promote recovery of patients with HE from the Tibetan plateau.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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