Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.JournalofSurgicalResearch.com

# Enhanced recovery after surgery program in patients from Tibet Plateau undergoing surgeries for hepatic alveolar echinococcosis

*Mengchang Yang, MD,*[a] *Wenjie Su, MD,*[a] *Xiaofan Deng, MD,*[b] *Jia Deng, MD,*[a] *Peng Li, MD,*[a] *and Xiangkui Li, MD*[a,*]

[a] *Department of Anesthesiology, Sichuan Academy of Medical Sciences and Sichuan Provincial People's Hospital, Chengdu, Sichuan, P.R. China*

[b] *Department of Hepatobiliary Surgery, Sichuan Academy of Medical Sciences and Sichuan Provincial People's Hospital, Chengdu, Sichuan, P.R. China*

ARTICLE INFO

*Article history:*
Received 8 February 2017
Received in revised form
12 April 2017
Accepted 25 May 2017
Available online xxx

*Keywords:*
Hepatic alveolar echinococcosis
Tibetan plateau
Enhanced recovery after surgery

ABSTRACT

*Background:* Hepatic alveolar echinococcosis (HAE) is a severe and common parasitic disease in Tibetan Plateau of China. The infected patients have to move to plain areas to receive treatments due to the poor medical conditions in plateau areas. Our aim was to investigate the application of Enhanced Recovery after Surgery (ERAS) program in perioperative management for HAE patients from Tibet Plateau and the notes for patients with landform changes.

*Material and methods:* A total of 89 HAE patients from Tibet Plateau (altitude: average of 4500 m) prior received adaptive treatments at the cooperative hospital (altitude: 1500-2000 m) and accepted surgery at plain regions (altitude: 200-400 m). The patients in ERAS group received ERAS program care and patients in conventional management group received conventional care during perioperative period.

*Results:* Patients in ERAS group displayed significant shorter hospital stay and shorter time for recovery of gurgling compared with conventional management group (ERAS group *versus* conventional management group: 10.48 ± 3.525 d *versus* 20.29 ± 8.632 d; 1.56 ± 1.236 d *versus* 2.8 ± 1.19 d; all $P < 0.01$). The number of patients with complications of bloating, nausea/vomiting, pulmonary infection, urinary tract infection, upper gastrointestinal hemorrhage, and pulmonary edema was remarkably reduced (number, ERAS group *versus* conventional management group: 14 *versus* 24; 5 *versus* 16; 7 *versus* 24; 4 *versus* 13; 0 *versus* 10; all $P < 0.05$), and the visual analog scale scores in postoperative days 1 and 2 were obviously decreased in patients of ERAS group (score, ERAS group *versus* conventional management group: 2.5 ± 1.288 *versus* 3.83 ± 1.87; 2.25 ± 0.838 *versus* 3.51 ± 1.468; all $P < 0.01$).

*Conclusions:* Patients from Tibet Plateau need to receive adaptive treatments for landform changes before receiving surgeries at plain regions. ERAS program is effective and safe for Tibetan HAE patients during perioperative period.



* *Corresponding author*. Department of Anesthesiology, Sichuan Academy of Medical Sciences and Sichuan Provincial People's Hospital, No. 32 West Second Section First Ring Road, Chengdu, Sichuan 610072, P.R. China. Tel.: +86 17708130270; fax: +86 028 87393844.
E-mail address: lixiangkui8811@126.com (X. Li).

0022-4804/$ – see front matter © 2017 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jss.2017.05.104

## Introduction

Hepatic alveolar echinococcosis (HAE) is a rare and severe parasitic disease, leading to bleak prognosis in the absence of correct and timely treatments. It results from the infection by *Echinococcus multilocularis* (E. multilocularis) at the larval stages, presenting with focal liver lesions. The infectious disease produces economic losses and leads to a public health threaten in some regions.[1] It has been reported endemically in northern hemisphere such as North America, Western Europe, and China. In China, the major affected region is Tibetan Plateau region with an average altitude of 4500 m above sea level. The infected patients have to move to plain areas to receive treatments due to the poor medical conditions at plateau areas.

Surgery has been the gold standard for patients with HAE, whereas the traditional surgery plan requires relatively long hospital stay and high costs, leading to the reluctance of a number of patients to receive treatments.[2,3] It is imperative to introduce a better management for HAE. Enhanced recovery after surgery (ERAS) has been a standard care in different forms of surgeries due to the obvious reductions of postoperative complications, hospital stay, and costs.[2] However, to date, no literature has displayed the effect of ERAS on patients from the special regions. The aim of this study was to investigate the effect of ERAS on patients with HAE from plateau areas and the notes for patients with landform changes.

## Materials and methods

### *Patients*

Two hundred twenty-four patients with HAE who underwent radical resection surgery by the same surgeons from March 2014 to December 2015 at the Sichuan Academy of Medical Sciences and Sichuan Provincial People's Hospital were investigated in this study. All the selected patients underwent partial hepatectomy through laparotomy. The right costal margin incision was made in all the patients. They received surgeries within 3 d after transferred to plain areas. After admitted to the hospital, patients received comprehensive assessments for surgery. Patients with infection, tumor, serious cardiocerebrovascular disease (such as coronary heart disease, myocardial infarction within 3 mo, cerebral embolism, cerebral hemorrhage, transient ischemic attack, cenuriasis, epilepsia, and stroke), or serious systemic disease (such as myasthenia gravis and polyradiculitis) without recommendation for surgery, glomerular filtration rate $\leq$90, and/or the evidence of kidney damage, Child–Pugh class C liver functional status, American Society of Anesthesiologists physical status III, IV were excluded. We collected the data retrospectively and divided the patients into conventional management and ERAS groups. The study was approved by the Research Ethics Committee of Sichuan People's Hospital, and consent was obtained from all the patients.

### *The management for HAE patients with landform changes*

Hyperhemoglobinemia is commonly occurred on these patients with landform changes, which may lead to various complications during the perioperative period. These patients would be firstly brought to our cooperative hospital (altitude: 1500-2000 m) to receive adaptive treatments. The treatments included nutrition support treatment and bloodletting therapy (target hemoglobin level $<$ 180 g/L). Patients with coagulation disorders (primary indication: prolonged prothrombin time and activated partial thromboplastin time) would receive anticoagulants other than hemostatics before surgery due to their unusual physiological features. After adaptive treatments, patients would be sent to our hospital at plain region.

### *Preoperative*

Patients in conventional management group received routine care such as fasting for 8-10 h, oral nutritious supplement, oral anxiolytic agents at the night before surgery, and conventional preoperative education.

The ERAS protocol used in our study was created by our team based on the existing ERAS guidelines[4-6] and modified based on the patients with different environments. A more detailed preoperative care would be used in ERAS group, such as comprehensive counseling, physiological status adjustment, and carbohydrate load with 400 mL (Suqian; Zheng Da Feng Hai Pharmaceutical Co Ltd, China) 2 h before surgery.

### *Anesthesia and intraoperative*

The same anesthesia regimen was adopted in the two groups. General anesthesia induction included midazolam (0.04-0.05 mg/kg; Enhua Pharmaceutical Co Ltd, China), propofol (1-2 mg/kg; AstraZeneca Pty Ltd, United Kingdom), fentanyl (4-6μg/kg), etomidate (0.1-0.2 mg/kg, Enhua Pharmaceutical Co Ltd), cisatracurium (0.15-0.2 mg/kg; Dongying Pharmaceutical Co Ltd). And maintenance with remifentanil (target concentration: 0.1-0.3 μg/kg/min; Renfu Pharmaceutical Co Ltd, China), and propofol (target concentration: 2-3 μg/mL) under target-controlled infusion by intravenous pumping to maintain bispectral index at 40-60.

The same antiemetic regimen in both groups included dexamethasone (5 mg; Zhuofeng Pharmaceutical Co Ltd, China) before anesthesia induction, droperidol (1-1.5 mg; Yongkang Pharmaceutical Co Ltd, China) after intubation, azasetron (10 mg; Nanjing Pharmaceutical Co Ltd, China) half an hour before the end of surgery was conducted. Ulinastatin with 10,000-20,000 units/kg (Tianpu Pharmaceutical Co Ltd, China) was used to reduce inflammation in both groups.

In conventional management group, indwelling nasogastric tube and catheter were routinely placed. Liver perfusion pressure and central venous pressure (CVP) were monitored, and fluid would be supplied to improve the blood pressure.

In ERAS group, additional 0.2% ropivacaine (AstraZeneca Pty Ltd) would be used for auxiliary nerve block. Constant temperature blanket and warm air blower were used to keep patients warm. Nasogastric tube would not be used during surgery, if gaseous distention existed, nasogastric tube would