

# Postoperative pain management of liver transplantation in cystic fibrosis: Is it time to start US-guided neuraxial blocks?

## ABSTRACT

Cystic fibrosis (CF) is the most common life-limiting genetic disease in Caucasians. Declining lung function is the principal cause of death, but liver involvement can lead to the need for liver transplantation. General anesthesia has detrimental effects on pulmonary function, increasing perioperative morbidity and mortality in CF patients. Regional anesthetic techniques improve outcomes by reducing anesthetic drugs and administration of opioids, and hastening extubation, awakening, and restarting respiratory of physiotherapy. There is a growing evidence that thoracic epidural anesthesia is feasible in pediatric patients. Concerns about coagulopathy and immunosuppression have limited its use in liver transplantation. Ultrasonography is becoming an adjunct tool in neuraxial blocks, allowing faster and easier recognition of the epidural space, and reducing vertebral touch and number of attempts. In pediatric patients, it is still debated whether anesthesia has detrimental effects on cognitive development. Efforts to make regional techniques easier and safer by ultrasonography are ongoing. We report the first case of continuous thoracic epidural analgesia after pediatric liver transplantation in a 10-year-old boy affected with CF with macronodular cirrhosis. Despite a challenging coagulation profile, the echo-assisted procedure was safely performed and allowed extubation in the odds ratio, postoperative awakening and comfort, and quick resumption of respiratory physiotherapy.

**Key words:** Anesthesia for liver transplantation; anesthesia in cystic fibrosis; continuous thoracic epidural analgesia; pediatric liver transplantation; ultrasound-guided regional anesthesia

## Introduction

Cystic fibrosis (CF) is the most common life-limiting autosomal recessive disease in the Caucasian population though it has been reported in all races and nationalities.<sup>[1]</sup> Decline in lung function is the most frequent cause of morbidity in CF though there is also a multi-organ involvement and liver disease has a cumulative incidence ranging between 27%

and 35%. About 5-10% of CF patients with liver disease will develop multilobular cirrhosis. Selection criteria and timing for liver transplantation in CF are controversial, but there is an increasing evidence that early liver transplantation may have better outcomes, and possibly also delay worsening of pulmonary functions.<sup>[2]</sup>

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General anesthesia has still detrimental effects on pulmonary function in major surgery in patients affected with CF.<sup>[3,4]</sup> Several studies have underscored that during brain growth, anesthesia may have long-term detrimental effects,<sup>[5]</sup> and a more extensive use of regional anesthesia has been advocated.<sup>[6]</sup> Echo-assisted regional anesthesia is a promising tool for assuring safety and ease in pediatric patients.<sup>[7,8]</sup> Our department is committed to using echo-assisted thoracic epidural anesthesia for major abdominal pediatric surgery, thus reducing the use of opioids and favoring awakening and early extubation.

## Case Report

A 10-year-old boy (124 cm, 26.5 kg) affected with CF with liver involvement (macronodular cirrhosis, portal hypertension, and splenomegaly) underwent deceased-donor liver transplantation at our institute. Past medical history revealed neonatal surgery for meconium ileus, episodes of febrile seizures, and frequent lower airway infections.

The pediatric end-stage liver disease score at transplant time was 5.9 (bilirubin 1 mg/dl, albumin 2.5 g/dl, INR 1.35, history of growth failure). He was listed for liver transplantation because of increasing portal hypertension, with development of esophageal varices and splenomegaly. Pulmonary conditions did not contraindicate surgery: Forced expiratory volume in 1 was 78%.

General anesthesia was induced with thiopental sodium 80 mg, fentanyl 50 mcg, and cisatracurium 5 mg and maintained with sevoflurane 2%, cisatracurium 2 mcg/kg/min, and cumulative dose of fentanyl of 10 mcg/kg. Fluids (10 ml/kg/h 60% normal saline and 40% glucose 5%), all administered with a Level 1<sup>®</sup> high-flow fluid warmer (Smiths Medical ASD, Rockland, USA/Canada).

The donor was a 4-year-old child who died of blunt trauma after 24 h in intensive care. Surgery was uncomplicated, and bleeding was mild. The anhepatic phase was characterized by hemodynamic and metabolic stability, and reperfusion was uneventful. Total ischemia time was about 6 h. Early signs of graft reperfusion and function were positive; temperature began to rise spontaneously to 37°C; glucose rose; lactates decreased from a peak of 5.9 to 2.0, and hemodynamics and diuresis remained stable. Biliary anastomosis was performed as a duct to duct. No packed red blood cells or plasma units were transfused.

Two hours and thirty minutes after reperfusion, we checked coagulation (INR 1.70) and platelets (109.000), registering

normal coagulation by thromboelastogram (TEG) visualization [Figure 1a]. The surgical field showed no coagulopathy. The final hematocrit was 25%. Given the operative course, the promising signs of good graft function, activated coagulation at TEG, acceptable parameters without transfusion, metabolic stability, and with the aim of early extubation in the odds ratio, we decided to place an epidural catheter to reduce the intravenous administration of opioids.

To increase the safety of the procedure, we performed echography of the thoracic vertebral spine, with good visualization of the epidural space at 2.5 cm, and no superficial vascular abnormality in the T9-T10 space [Figure 1b]. The epidural space was found with the loss-of-resistance technique at 2.5 cm from the skin with a 19 G Tuohy needle (Smiths Medical ASD, Keene, USA), and the catheter was advanced 3.5 cm into the epidural space.

After a bolus of lidocaine 2% 2 ml and bupivacaine 0.25% 4 ml per hour continuous infusion, we extubated the patient without complication and transferred him to the Intensive Care Unit (ICU) where he was already able to interact with nurses and family. Two hours after admission to the ICU, he was able to independently manage water to dampen his lips and restart respiratory therapy with the Therapep<sup>®</sup> recruiting

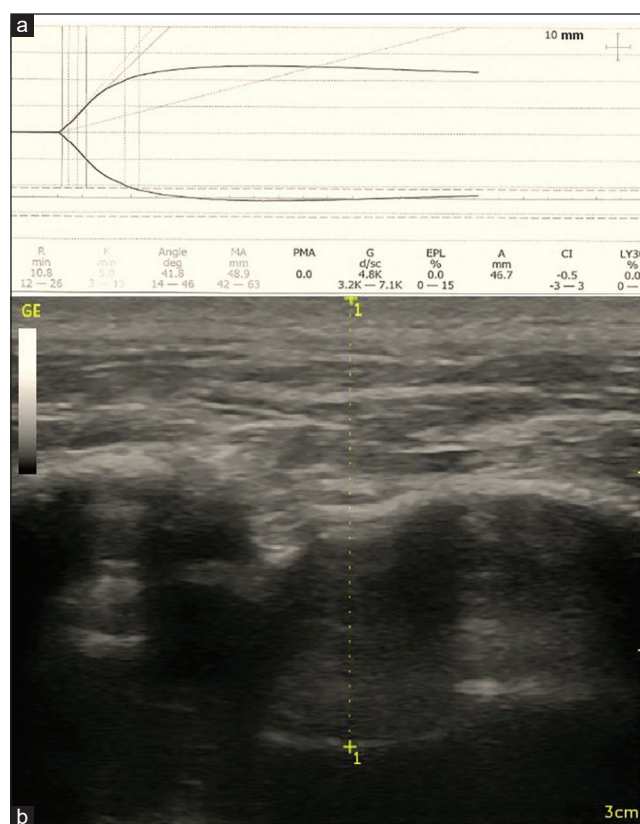


Figure 1: (a) Thromboelastogram 2.5 h after reperfusion. (b) Thoracic spine ultrasound. Epidural space at 2.5 cm

technique, actively collaborating with the respiratory therapist.

During the first 48 h, the patient received no analgesia other than epidural. The patient was completely aware and comfortable. He was started on a liquid diet on the postoperative day (POD) 1 and was able to get out of bed on POD 2. On POD 3, he was able to evacuate and was discharged from the ICU. Positive graft function continued in the following days.

Regarding possible neurological complications, there was no block or weakness of lower limbs, and the patient experienced no discomfort or back pain. Both the patient and his family expressed great satisfaction with his time spent in the ICU.

### Conclusions

We report postoperative pain management with continuous thoracic epidural infusion of local anesthetics in a pediatric CF patient who underwent liver transplantation. The 10-year-old boy had several risk factors for postoperative respiratory complications and increased length of ICU stay. Regional anesthetic techniques improve outcomes by reducing administration of general anesthetics and opioids and quickening extubation, arousal, and resumption of respiratory physiotherapy. Pain control is part of the perioperative management, playing a fundamental role in preventing respiratory complications, allowing greater tidal volumes and cough efforts, and contributing to comfort and the humane treatment of patients.

The use of thoracic epidural analgesia combined with general anesthesia for liver transplantation is controversial. Concerns about coagulopathy and postoperative immunosuppression have limited the diffusion of this technique.<sup>[9,10]</sup>

Ultrasonography is starting to be a relevant adjunct tool also for neuraxial block, allowing faster and easier recognition of the epidural space, and reducing vertebral bone touches.<sup>[7,8]</sup>

Monitoring the TEG and operative field, our main goal was to prevent coagulopathy by avoiding hemodilution,

hypothermia, metabolic acidosis, hypocalcemia, and anemia.

In CF patients, early extubation, wakefulness during the ICU stay, and respiratory therapy are fundamental for improving outcomes. We propose that epidural analgesia can be safe and favorable in select pediatric patients, even after liver transplantation, when a complete coagulation profile study is available, echo visualization of epidural space is done, and the anesthesiology team is familiar with the technique.

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### Conflicts of interest

There are no conflicts of interest.

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