Regional ventilation characteristics in infants after liver transplantation: A pilot study

Xiaolan Chen[2], Chen Chen[1], Leiqin Gao[1], Yuan Gao[1], Yuxiao Deng[1], Zhe Li[1] and Zhanqi Zhao[3]

[1]Shanghai Jiao Tong University School of Medicine Affiliated Renji Hospital, Shanghai, China. slamy1987@126.com
[2] Shanghai Pulmonary Hospital, Shanghai, China.
[3]Furtwangen University, VS-Schwenningen, Germany.

Abstract: In the present study, we explored the ventilation variations in infants after pediatric liver transplantation with electrical impedance tomography.

1 Introduction

Pediatric liver transplantation (PLT) is currently the most effective treatment for end-stage liver disease in children [1]. The liver and lungs are anatomically adjacent, and pulmonary complications are a common and major risk factor for postoperative mortality and prolonged stay in the intensive care unit (ICU) in PLT patients [2,3]. However, due to the limitations of bedside respiratory monitoring techniques in children, the postoperative respiratory status of PLT recipients is poorly studied.

The present study aimed to describe the physiological changes of ventilation variations during controlled mechanical ventilation (MV), spontaneous breathing trial (SBT), and weaning process and to explore the phenotypic pattern of the postoperative ventilatory status after PLT by EIT.

2 Methods

The prospective observational study was approved by the Local Ethics Committee (LY2002-025-B). Informed consent was obtained from the patients' parents prior to the study. A total of 5 patients (9.23±2.17 months; height, 65.23 ± 6.99 cm; weight, 6.72 ± 2.98 kg) who were transferred to the ICU under postoperative anesthesia were included. All patients underwent 5 phases measurements with EIT (VenTom-100, MidasMED Biomedical Technology, Suzhou, China): 1) MV (Assist-Control mode); 2) pressure support ventilation (PSV) of 15/5 cmH_2O; 3) SBT (low-level PSV 12/3 cmH2O for 2h); 4) right after weaning; 5) day 2 after weaning. Successful SBT was defined as: 1) $SPO_2 \geqq 95\%$; 2) Exhale tidal volume ≧ 5ml/kg (ideal weight); 3) Respiratory rate: 20-60bpm (<6 months) or 15-45bpm (6 to 24 months). Clinical data such as gender, age, Pediatric End Stage Liver Disease (PELD) score, and respiratory parameters such as the PaO2/FiO2 ratio and vital signs were collected.

EIT records at 5 phases were collected. The tidal impedance variation (TIV) was evaluated.

3 Results

The left lung ventilation of all 5 patients was poor on the first day of MV after surgery. After extubation, the right side ventilation of 3 patients increased compared with that before (Fig. 1). However, one patient had extremely uneven ventilation distribution after extubation, which showed that the left lung ventilation increased and the right lung ventilation significantly decreased (Pat. 4, Fig. 2). We screened the chest X-ray and found that the right diaphragm of this patient moved up (Fig. 2).

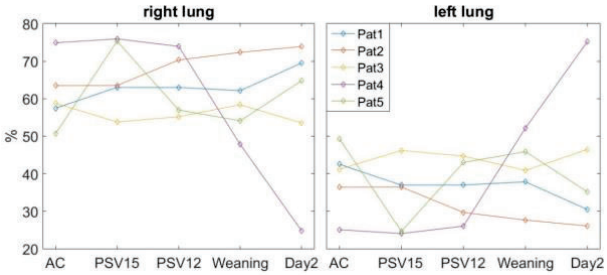

Figure 1. Variations of ventilation distribution between right and left lungs after pediatric liver transplantation. X-axis: five phases

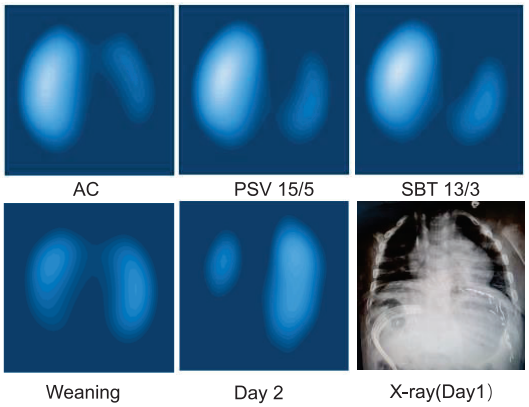

Figure 2. Representative EIT images of ventilation distributions and the Chest X-ray of Patient 4

4 Discussion and Conclusions

We conducted ventilation monitoring for the first time in infants after PLT. We found that the gas distribution of all patients was mainly on the right side and their recovery varied from patient to patient. We speculate that due to the injury of the left diaphragm caused by PLT, positive pressure ventilation would result in higher gas flow into the right lung. After the recovery of spontaneous respiration, the right diaphragm compensation makes more increased ventilation than before. Nevertheless, the current findings suggest there is a need for bedside monitoring of respiratory recovery after PLT to provide intervention promptly.

References

[1] M Spada et al. *World J Gastroenterol* 15:648–74, 2009.
[2] C Araz et al. *Transplant Proc*. 36:214-7, 2004
[3] OO Nafiu et al. *Anesthesiol Res Pract* 2017:3728289,2017