Lung Ultrasound to Verify One Lung Ventilation in Pediatric Thoracic Surgery

Andrea Martinez Velez, M.D., Alok Moharir, M.D., Joseph Tobias, M.D.

Department of Anesthesiology and Pain Medicine, Nationwide Children's Hospital, Columbus, OH

Introduction

- Lung isolation with the use of one lung ventilation (OLV) is often necessary to provide surgical exposure in pediatric thoracic surgery procedures.
- Verification of OLV may be guided by direct vision using a fiberoptic bronchoscope (FOB) and aided by auscultation.
- Preliminary data has shown that Lung Ultrasound can be used to verify OLV in adult surgical patients.
- The purpose of our study was to prospectively evaluate the usefulness of Lung Ultrasound in verifying OLV in pediatric thoracic surgery.
- Our primary hypothesis is that ultrasound will accurately confirm lung separation during OLV as compared to FOB

Methods

- Our study was conducted on 31 patients, ranging in age from 0 to 21 years.
- The technique for OLV was determined by the attending anesthesiologist providing care of the patient.
- Both the auscultator and sonographer were blinded and were not involved in the direct clinical care of the patient for surgery.
- After confirmation of OLV by FOB, the patient's face and airway management device were covered.
- The auscultator and sonographer then entered the room. The auscultator would listen for breath sounds.
- The sonographer would look for the presence of lung sliding in the ventilated lung and the absence of lung sliding and presence of lung pulse in the non-ventilated lung.
- M-mode measurements could also be used for verification, looking for the Seashore Sign in the ventilated lung and the Barcode Sign in the non-ventilated lung.

Results

- Lung Ultrasound correctly verified OLV in 30/31 patients (96.8%) using both 2D imaging and M-mode measurements.
- A high degree of variability existed in attempting to verify OLV via auscultation. Providers could verify OLV via auscultation in only 16/30 patients (53.3%).
- Auscultation was particularly unreliable in infants less than 10 kg.

Ultrasound is a rapid and non-invasive alternative to FOB and effectively confirms lung isolation during OLV in pediatric patients.

Discussion

- Lung ultrasound was shown to be a reliable means to verify one lung ventilation in pediatric thoracic surgery.
- It provided a high degree of diagnostic accuracy when compared with fiberoptic bronchoscopy and was superior to auscultation.
- This was particularly true in infants < 10 kg in which there may be sound transmittance from the ventilated lung to the non-ventilated lung.
- While a few case reports have been written, this is one of the only prospective, blinded studies studies on this topic.

References

1. *Tobias JD. Anesthesia for thoracic surgery in children. Curr Opin Anesthesiol 2001;14:77-85.*
2. *Golianu B et al. Pediatric thoracic anesthesia. Curr Opin Anaesthesiol 2005;18:5-11.*
3. *Nam JS et al. The use of lung ultrasonography to confirm lung isolation in an infant who underwent emergent video-assisted thoracoscopic surgery - a case report. Korean J Anesthesiol 2015;68:411-4.*