

LETTER TO THE EDITOR

The role of point-of-care ultrasound and issues related to one-lung ventilation in neonates



O papel do ultrassom *point-of-care* e questões relacionadas à ventilação unipulmonar em neonatos

Dear Editor,

We read with interest the report by Rodrigues et al.¹ on neonatal left lung upper lobectomy under One-Lung Ventilation (OLV). The authors should be commended for their management and, specifically, for the use of Point-Of-Care Ultrasound (POCUS) to confirm lung isolation. Indeed, POCUS has proven superior (95% accuracy) over auscultation (62% accuracy) in identifying tracheal versus bronchial intubation in adults.² We herein would like to briefly expand on some key lung ultrasound “signatures” and comment on some possible challenges associated with the authors’ technique.

Lung ultrasound is based primarily on artifacts:

- 1) “A lines”: horizontal lines/artifacts that run deeper to the pleural line, and at equidistant intervals (i.e., skin-pleural line distance = pleural line-first A-line distance, and so on). “A line pattern” is found in normal lungs and/or non-interstitial pathologies (e.g., pneumothorax, COPD/asthma exacerbation, pulmonary embolism);
- 2) “B lines”: vertical lines/artifacts generated by fluid (such that the more fluid the larger/more numerous the B lines) originating from pleural line and extending to bottom of the screen. “B line pattern” is found in interstitial pathologies (e.g., pulmonary edema, ARDS, pneumonia/pneumonitis);
- 3) “Lung-sliding”: shimmering of pleural line that moves sideways in a synchronized fashion with inspiration/expiration. The presence of lung-sliding confirms apposition of the visceral and parietal pleurae, therefore ruling out pneumothorax at that location. Similarly, the “seashore” and “barcode” signs described by the authors reflect the presence and absence, respectively, of lung-sliding using M mode. Finally, “lung-pulse” also confirms apposition of the pleurae (similar to lung-sliding), hence excluding pneumothorax.

In their report, the authors state that “In a collapsed lung, the pleural line moves with the heartbeat, originating the lung-pulse sign”. In fact, lung-pulse may or may not be present depending on the cause of lung collapse. In pneumothorax, for instance, lung-sliding/lung-pulse are absent, and other features (A line pattern + B lines absent + “lung-point”) will confirm the diagnosis. Conversely, and as alluded to earlier, the presence of lung-pulse confirms apposition of the pleurae, thus ruling out pneumothorax.

Finally, we respectfully disagree that a 3 mm ETT cannot be coupled with a Bronchial Blocker (BB). The use of an extra-luminal 3Fr Fogarty or Arndt 5Fr balloon catheter is well described³ and would mean placing it in the left mainstem bronchus in this case. Additionally, whereas the authors were able to avoid occluding the right upper lobe orifice with their ETT, what happens if the right upper lobe orifice is very close to or above the carina? In that case, we believe a BB in the left mainstem would be a superior choice.

Another point is whether the described technique is applicable in case of right lung exclusion. For the most part, it probably is, but there are certain concerns. Advancing the ETT into the smaller left (compared to right) mainstem bronchus (the ratio left mainstem/tracheal diameter is ~0.65–0.7 in adults), as advocated by the authors, would risk excessive mucosal pressure, potentially resulting in ischemia, swelling, and/or even granuloma formation. Even a moderate period of intubation (with 3 mm ETT) of the left mainstem bronchus had resulted in tracheomalacia with subsequent collapse of the left mainstem bronchus in a premature neonate.⁴ Unlike OLV in adults with chronic lung disease, during pediatric OLV, several cycles of one-lung alternating with two-lung ventilations may be required to eventually achieve sustained adequate oxygenation. Thus, a potential (unverified) disadvantage of endobronchial intubation with a single-lumen ETT, as opposed to using a BB, is the need to repeatedly slide the ETT in and out of the mainstem bronchus. Taking into consideration the very cramped/awkward positioning of a small patient in a lateral position, most anesthesiologists will likely find that repositioning (which may require repeatedly securing/loosening the ETT) and reconfirmation of an ideal endobronchial intubation with an ETT may be more cumbersome/challenging (especially on the left side) than simply deflating/re-inflating the bronchial balloon. That said, simply advancing the ETT into the chosen mainstem bronchus for surgery that lasts a mere few hours is a simple technique that is worth trying, especially for those practitioners uncomfortable with bronchial blocker placement.

Author's contribution

Glenio B. Mizubuti and Anthony M.-H. Ho both conceived, drafted and critically revised the manuscript, and approved the final version submitted for publication in the Brazilian Journal of Anesthesiology.

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Conflicts of interest

The authors declare no conflicts of interest.

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Glenio Bitencourt Mizubuti , Anthony M.-H. Ho 

Queen's University, Department of Anesthesiology and Perioperative Medicine, Kingston, Ontario, Canada

* Corresponding author.

E-mail: Anthony.Ho@Kingstonhsc.ca (A.M. Ho).

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Lung exclusion in neonates - techniques and the role of ultrasound



Exclusão pulmonar em neonatos - técnicas e o papel do ultrassom

Dear Editor,

We carefully read the comments and suggestions given by Mizubuti et al. and appreciate the interest shown in our article and the excellent review on lung Ultrasound (US). We would like to discuss some of the issues raised.¹

As stated, lung US provides an added value in confirming the position of the Endotracheal Tube (ETT), but as we said in our report, there are some limitations on its use being one of them, the presence of pneumothorax. Lung sliding confirms the apposition of both visceral and parietal pleurae and ventilation (as there is movement between them). Lung pulse also confirms the apposition of both pleurae, thus excluding pneumothorax, and rules out ventilation, as there is no movement between them, being a good signal of endobronchial intubation.^{2,3}

Concerning the question of coupling a 3 mm orotracheal tube with a Bronchial Blocker (BB), bronchial blockers should be placed under fibroscope view, and we should bear in mind that due to the small diameter of the ETT, during the fibroscope use, poor or no ventilation will be possible. Although this is our technique of choice in infants and small children for left lung exclusion, unfortunately, our smallest fibroscope available is 2.8 mm. This precluded the use of this technique in our case, as a 3.5 mm ETT plus BB outside the ETT would be too large for a neonate trachea. We suggest the use of the CT scan to determine the trachea and main

bronchus diameter and prevent the use of a too big ETT or ETT + BB combination, though not completely ruling out the risk of injury.⁴

In our case report, lung exclusion was performed using a single-lumen endotracheal tube and we agree that this is not the ideal lung exclusion technique and has several disadvantages as we pointed out in our report. One of which, as highlighted by Mizubuti et al., would be the possible exclusion of the right upper lobe orifice if it was positioned above or very close to the carina. A problem that we might not be able to overcome also using an extraluminal BB on the right main bronchus.⁵ Aiming to confirm the right upper lobe ventilation, we needed a more accurate method than auscultation and the US arises as a more reliable and precise technique.²

The risk of bronchial injury and even tracheomalacia in the case of bronchial intubation should always be considered, especially in neonates. The possible need to reposition of the ETT may be more cumbersome and cause tracheo-bronchial injuries, however, we cannot ignore that this problem happens even with the use of BB. Bronchial blocker insufflation may cause excessive pressure on the bronchial mucosa, which may be a concern, especially in longer surgeries.⁵

Nevertheless, we agree that the technique proposed by Mizubuti et al. would also be a good option for OLV in neonates. Still, there is little evidence on the best technique for OLV in neonates and infants, as most of our knowledge comes from case reports and case series.

Author's contributions

Both authors drafted and revised the manuscript and approved the final version for publication.