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Interventional Bronchoscopy in Children; Planning the Path Ahead

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Recently published in the journal is an editorial by Burks *et al*¹ regarding the use of endobronchial ultrasound-guided trans- bronchial needle aspiration (EBUS-TBNA) and endoscopic ultrasound with transesophageal endobronchoscope-guided fine needle aspiration (EUS-B-FNA) in the pediatric population. The editorial provides a thoughtful analysis of the article by Gulla *et al*² that described a case series of these procedures in children, as well as analysis of other published evidence in the area. In particular, the editorial reviews the promising but limited data available in children regarding EBUS procedures, concerns regarding indications and safety of such procedures. We recently published a case series which further contributes to the evidence base regarding EBUS-TBNA in children, showing good diagnostic yield and no adverse events.³ Burks *et al* also highlights difficulties training pediatric pulmonologists to perform EBUS procedures given the limited number of appropriate cases in children. The concerns raised by Burks *et al* regarding indications and safety for EBUS and adequate training have also been raised in guidelines published by the American Thoracic Society⁴ and European Respiratory Society⁵. However, to answer the question posed by the title of the editorial “*Should endoscopic ultrasound-guided biopsies for mediastinal abnormalities be performed by pediatric pulmonologists?*” we feel that a broader view of the field of interventional bronchoscopy needs to be taken. We think that decisions regarding the potential utility of EBUS in children, and the way to identify and define this, should not be made in isolation but together with consideration of other interventional bronchoscopy techniques and their potential application in children. In this editorial we briefly review the current state of interventional bronchoscopy in adults and children, and outline a potential path for advancement of the field in pediatric practice.

The current field of interventional bronchoscopy in adult medicine encompasses a number of procedures. As described by Burks *et al* EBUS-TBNA⁶ and EUS-B-FNA⁷ are now first line investigations for mediastinal pathology in adults. When sampling mediastinal pathology a dedicated linear EBUS bronchoscope, which has a linear ultrasound transducer fixed to the end of it, is used and this allows real time EBUS guided TBNA.⁸ Radial EBUS is another established modality. In radial EBUS a conventional bronchoscope is used and an ultrasound probe, often enclosed within a

guide sheath, is passed via the working channel. The images from the probe are used to localise peripheral pathology and then the probe is withdrawn, with the guide sheath left in place, and a biopsy is then taken.⁸ Radial EBUS is the first choice investigation for investigation of peripheral pathology, where the linear bronchoscope is too large to access the location of the lesion.⁹ Another interventional bronchoscopic technique is the placement of endobronchial valves. In this technique a valve, which allows expiration of air from the treated lobe but not reinflation, is placed via a bronchoscope to facilitate lung volume reduction in conditions characterised by hyperinflation (such as emphysema).¹⁰ They are also used in patients who have a persistent air leak.¹¹ Cryoprobe is also used in adult interventional bronchoscopy. It is a probe which can be passed via the working channel of a bronchoscope. The probe rapidly cools the target area to -80° Celsius which then allows a transbronchial biopsy to be taken. Cryoprobe biopsies are being used in interstitial lung disease (ILD), where they are safer than surgical lung biopsy, however the optimal use of this technology for ILD remains a point of contention due to conflicting evidence regarding the yield of cryoprobe biopsy when compared to surgical biopsy.^{12,13} They can also be used for removal of foreign body as when the probe rapidly cools it attaches to the foreign body and then can retrieve it.¹⁴ Other techniques which are not as widely used include bronchial thermoplasty (primarily used in severe asthma)¹⁵⁻¹⁷ and probe-based confocal laser endomicroscopy imaging of airways and alveoli (a new technique under development)¹⁸⁻²⁰.

Like linear EBUS-TBNA and EUS-B-FNA all of the techniques that are widely used in adult practice, have the potential to be applied to pediatric practice. In fact many of them already are being used. The authors recently reported a small series of radial EBUS cases from Australia and Germany where it was technically feasible, however had poor results.³ Another recent series of 18 radial EBUS cases from North America in immunocompromised children showed no major complications and that it was useful in identifying the infectious aetiology of lung nodules.²¹ Cryoprobes have been used in the investigation of childhood ILD²², as well as for the removal of foreign body^{23,24}. Endobronchial valves have been used in the management of children with persistent air leak.^{25,26}

Given multiple techniques are already being used, moving forward, the field of interventional pediatric bronchoscopy will need to define the optimal use of each technique in children. To determine this for any individual technique the indications, feasibility, yield, and safety all need to be considered. We believe determining the optimal use of the various interventional bronchoscopy techniques should involve partnership between pediatric and adult pulmonologists, specific, focused education of pediatric pulmonologists and establishment of an international registry.

As Burks *et al* mention, it will be impossible to train for EBUS in the pediatric setting, and this issue is amplified when you consider the range of procedures that may be applicable to children. In addition, given each individual procedure is likely to be performed rarely at any one institution, it is unlikely a paediatrician will be able to maintain their competency across the different procedures. It is the authors opinion that pediatric centres will need to partner with adult interventional bronchoscopists who will perform the procedures. The role of the pediatric pulmonologists would be to identify cases, provide expertise on potential pathology and how that may influence sampling technique and ensure safe airway management and perioperative care for patients. Even for the rare pediatric centres which have a large enough case number to maintain skills in the various techniques, it would still be of benefit to be partnered with an adult service as this ensures any new techniques or technology can be translated to pediatric practice as appropriate.

Education of pediatric pulmonologists is crucial so that they know what less invasive procedures are possible. A potential framework for such education is a workshop that was led by the authors as part of the American Thoracic Society Pediatric Fellows Track Symposium this year. The workshop, which focused on both linear and radial EBUS, involved a short didactic session, including case presentation, and then a hands-on practical demonstration on models. In addition to education content, the workshop also modelled a positive working relationship between adult and pediatric pulmonologists. The feedback received from participants in the workshop was very positive and indicates strong interest in this field. Pre- and post-workshop surveys showed that participation in the workshop improved understanding of the potential uses and limitations of EBUS in pediatric patients.

The field of interventional bronchoscopy in adults is supported by a strong evidence base, with many techniques supported by evidence gained through randomised control trials^{15,16,27,28} and meta-analyses²⁹⁻³¹ showing the superior performance when compared to alternate techniques. Given the small number of cases in paediatrics it is unlikely it will be possible to conduct similar trials. Currently the literature in this area is made up of case reports and case series, with a high potential for publication bias. We propose that a potential way around this would be the establishment of an international registry where pulmonologists could enter case information regarding indication for procedure (including information regarding lesion location and size, other investigations), technical information regarding the procedure (technique, equipment, airway adjunct, adult vs. pediatric bronchoscopist), safety data, yield, and effect on patient management. In adult interventional bronchoscopy national level registries have helped generate evidence to inform clinical practice.³²⁻³⁴ In paediatrics, the registry should be open internationally given that the case series reported this far have come from India^{2,22,35-37}, China²³, United States of America^{24,25,38}, the Netherlands²⁶, Germany³ and Australia^{3,39}. Establishment of such a registry likely represents the most pragmatic way to generate evidence regarding the use of the different interventional bronchoscopy techniques.

The field of pediatric interventional bronchoscopy is at an exciting point where there are currently reports in the literature of various techniques being performed which spare children from more invasive procedures. Important consideration needs to be given to how we advance the field and define the optimal use of each technique. We believe the way to do this is via partnership with adult services, broader education of pediatric pulmonologists and establishment of an international registry. If these steps are taken, we believe that, like adult interventional bronchoscopy, pediatric interventional bronchoscopy can be enhanced by an evidence base that contributes to better care delivered to patients.

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