



Resources in the bronchoscopy suite and the utility of cryobiopsy

Transbronchial lung cryobiopsy (TBLC) for the assessment of interstitial lung disease (ILD) has become a more sought-after procedure as evidence has emerged to support high diagnostic yield.^[1,2] TBLC can help to mitigate the need for diagnostic lung biopsy via video-assisted thoracic surgery or open thoracotomy, making it an ideal alternative for patients with ILD, given their high degree of frailty.^[3,4] In much of the published literature, TBLC has been done under general anaesthesia,^[1] but this is not easily accessible to all bronchoscopists. The article by Buckley *et al.*^[5] in this issue of *AJTCCM*,^[5] 'The utility of transbronchial cryobiopsy performed under conscious sedation for interstitial lung diseases in a resource-constrained setting', describes an alternative approach to this procedure.

This study prospectively enrolled 20 sequential patients referred for lung biopsy for the investigation of ILD at a single centre in South Africa. TBLC was performed under conscious sedation, achieved by propofol bolus, with fluoroscopic guidance and prophylactic bronchial blocker deployment to monitor for bleeding after the biopsy. The main outcome was final diagnosis or need for subsequent surgical biopsy, based on a decision by the specialist multidisciplinary team (MDT).

The authors found that rates of adverse events were low, in keeping with previously published literature. The rate of pneumothorax not requiring chest drain placement was 10% ($n=2$), and significant bleeding occurred in 5% ($n=1$) but resolved with tamponade. Importantly, there were no sedation-related side-effects requiring inotropic support, and no conversion to general anaesthesia. A final diagnosis could be made by the MDT after histological examination in 85% of cases ($n=17$). Of the three patients without a clear diagnosis, only one proceeded to surgical biopsy. The authors conclude that TBLC is safe to perform for ILD biopsy under conscious sedation and provides a valuable diagnostic yield, although they acknowledge that the sample size was small and the TBLCs were performed by a single experienced bronchoscopist. Strengths of the study are its prospective nature and the clear description of the technique in a reproducible manner.

A second article in this issue, by Esmail *et al.*^[6] and entitled 'Feasibility and safety of transbronchial lung cryobiopsy and mediastinal lymph node cryobiopsy: Experience from a resource-limited African setting', similarly explores the use of cryobiopsy for ILD, but in addition includes cases of endobronchial ultrasound-guided transbronchial mediastinal lymph node cryobiopsy (EBUS-TMC). These procedures were performed under general anaesthesia, and cryobiopsy was only utilised when EBUS transbronchial needle aspiration was not diagnostic with rapid on-site pathology evaluation. They report on 16 patients, 8 undergoing only TBLC, 5 having only EBUS-TMC, and the remainder requiring both procedures. Their diagnostic yield was lower at ~64% for TBLC and 50% for lymph node cryobiopsy. However, this lower yield may relate to where the operators are on their learning curve, as the previous experience and number of operators involved are not reported. Further, the article describes poor ultrasound visualisation of the cryoprobe and difficulty in accessing the tract after 19G needle use, which is uncommon in our experience and in the published literature.^[7]

Both studies are to be commended for implementing advanced bronchoscopy techniques in resource-limited areas with the aim of decreasing strain on operating theatres followed by inpatient admissions. One key difference between the studies is that Buckley *et al.*^[5] performed their procedures with conscious sedation, while Esmail *et al.*^[6] used full general anaesthesia in the bronchoscopy suite.

The conclusion by Buckley *et al.*^[5] that TBLC can be done safely under conscious sedation should be interpreted with caution within the constraints of the strength of the evidence. Namely, the described sedation approach is with intermittent propofol boluses, which is not a common practice in bronchoscopist-led sedation centres, where a combination of a benzodiazepine such as midazolam and a rapid-acting narcotic such as fentanyl is traditionally used.^[8] The use of propofol in this study is important, as the line between conscious sedation and deep sedation is difficult to navigate with propofol, and patients are often sedated past the goal of an Observer's Assessment of Alertness/Sedation scale of 2 - 3. In this study, the level of sedation achieved is not reported. Further details regarding the procedure length, required patient monitoring, such as end-tidal carbon dioxide, and method of oxygenation would have been of benefit. There is some evidence to suggest that conscious sedation can be optimised with high-flow nasal oxygen,^[9] so this may be of benefit when using deeper sedation techniques. Additionally, more detailed information about the patients' respiratory status, including baseline pulmonary function, would have clarified the generalisability of the results. Patient selection is an essential aspect in balancing diagnostic yield and safety of both the procedure and conscious sedation.

The choice of propofol sedation is likely to have added to the success of the study by Buckley *et al.*, as cough from biopsy or pulmonary haemorrhage can increase the risk of the procedure but is less likely with deeper sedation. Although this may seem like an ideal sedation strategy given the procedure, it is important to highlight that even though complications may be rare, having an appropriate plan for respiratory failure, airway management and haemodynamic instability is essential. These considerations are highlighted as lessons learned in the study by Esmail *et al.*^[6]

As respiratory physicians, we are well placed to manage common complications such as pneumothorax or minor to moderate bleeding. These are often the complications that are discussed with regard to procedural safety. However, greater risk lies in complications the proceduralist may be less equipped to manage, such as those arising from the sedation approach described in the study by Buckley *et al.*^[5] The authors did not comment on these safety measures, and in our view, emergency airway plans and sedation support are essential to consider if implementing a conscious sedation approach to TBLC. In contrast, there is an abundance of evidence to suggest that EBUS-TMC can be performed safely under traditional conscious sedation^[10,11] with a low rate of complications, which could be considered for future implementation in resource-limited settings.

One key conclusion of these studies is that performing TBLC or lymph node cryobiopsies in the endoscopy suite, with conscious sedation or under general anaesthesia, would increase accessibility in

resource-limited settings. Physician-led sedation instead of general anaesthesia can save on resources, including personnel and operating theatre time, and decrease the need for specialised post-anaesthesia care. However, TBLC remains a high-cost procedure that may not be accessible to resource-limited areas owing to the cost of consumables (Erbe cryoprobes and Arndt blockers are expensive items), availability of fluoroscopy, and the costs involved in learning the procedure and managing complications.

As the field of interventional bronchoscopy advances and new techniques are developed, it is important to consider sedation as one of the core components of the procedure. One option is to improve the training of physicians to achieve safe levels of conscious sedation in bronchoscopy suites with the use of a propofol bolus or infusion. Advanced airway management training is an essential aspect of this skill, as no procedure should be performed without the ability or a strategy to manage complications. There are equally strong grounds to suggest that anaesthetic support is not a resource to compromise on in advanced bronchoscopy. Having this support does not mandate the use of general anaesthesia or even operating theatre time, but means that safe levels of deep sedation can be provided. Performing procedures under these circumstances improves airway control, simplifying the technical aspect for the bronchoscopist, which could improve learning curves, technical safety, and potentially diagnostic yield.

The authors of these studies should be commended for well written and clear articles outlining their approaches to incorporating cryobiopsy as a diagnostic tool. The diagnostic yield in these studies is similar to that in a recent randomised controlled trial that found TBLC to be comparable to surgical biopsy with a lower patient burden.^[12] Studies like these have important roles in expanding the reach of research and clinical trials. They help to provide implementation evidence and improve understanding of procedural safety in a range of practices. Before TBLC under conscious sedation can be broadly considered, further prospective data with more traditional conscious sedation methods and information on the characteristics of patients who can tolerate such procedures are needed.

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