Flexible bronchoscopy

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Abstract

There have been dramatic advances in the field of bronchoscopy over recent years, with a multitude of standard and specialized techniques being used by bronchoscopists in the diagnosis and management of respiratory disease, particularly in lung cancer. Standard techniques universally used in respiratory departments include endobronchial and transbronchial biopsy, bronchial washing and brushing, and bronchoalveolar lavage. Specialized techniques used in the diagnosis and staging of lung cancer include endobronchial ultrasound-guided transbronchial needle aspiration and autofluorescence bronchoscopy. In the treatment of endobronchial tumours, techniques such as photodynamic therapy, brachytherapy, electrocautery, cryotherapy and stenting are available. These are used for the palliation of more advanced tumours causing airway obstruction and, in some occasions, for treatment of early-stage endobronchial disease. There have also been exciting advances in the bronchoscopic management of non-malignant respiratory disease, such as endobronchial valves for lung volume reduction therapy in severe emphysema. This article will provide an overview of these techniques.

Keywords Autofluorescence; brachytherapy; bronchoscopy; cryotherapy; EBUS; EBUS-TBNA; electrocautery; endobronchial valves; photodynamic; radial EBUS

Key points

- Flexible bronchoscopy is a highly informative diagnostic tool and has a very low complication rate. It primarily allows visual inspection of large to medium-sized airways but also allows sampling of the peripheral lung parenchyma through bronchoalveolar lavage and transbronchial lung biopsy
- The development of endobronchial ultrasound (EBUS) has dramatically broadened the diagnostic capability of flexible bronchoscopy over the last 10 years
- EBUS-TBNA allows sampling of mediastinal and hilar lymph nodes under real-time visualization and is the pivotal test in lung cancer nodal staging and has very high diagnostic accuracy in sarcoidosis and tuberculosis lymphadenopathy
- A multitude of endobronchial therapies are available to manage malignant airway disease, in both the curative and palliative setting, delivered via a flexible bronchoscope. These include photodynamic therapy, brachytherapy, electrocautery, cryotherapy and stenting
- Flexible bronchoscopy can now offer novel therapies for non-malignant diseases including bronchoscopic lung volume reduction in emphysema and bronchial thermoplasty in severe asthma

Introduction

The flexible bronchoscope is a pivotal part of the respiratory physician's armoury. It is versatile and highly effective in the diagnosis and management of respiratory disease. The capability and technology at the fingertips of modern-day bronchoscopists are ever-expanding. Interventional bronchoscopy is a rapidly advancing field offering a variety of diagnostic and treatment options, particularly in thoracic oncology. This article will provide a brief overview of both basic diagnostic bronchoscopy and the specialized techniques now available utilizing the flexible bronchoscope.

Basic flexible bronchoscopy

The function of basic flexible bronchoscopy can be generally divided into two groups. First, flexible bronchoscopy allows visual inspection of the upper respiratory tract and the 'central' lower respiratory tract. Inspection of the nasal passages and larynx should not be forgotten as a function of flexible bronchoscopy. Nasal polyps, nasal crusting and vocal cord polyps are key diagnostic clues in accurately classifying respiratory disease. Within the lower respiratory tract, flexible bronchoscopy allows direct visualization from the subglottis to the fourth- or fifth-order bronchi. It can detect a range of pathologies including subglottic stenosis, endobronchial tumours and endobronchial sarcoidosis (typically a 'cobblestone mucosa'). Therefore, the primary function of flexible bronchoscopy is to detect endobronchial abnormalities within accessible large to medium-sized airways. Thus, diagnosis of primary lung cancer is a core capability of bronchoscopy. Any endobronchial abnormality detected during bronchoscopy can be sampled under direct vision using a biopsy, bronchial brush or bronchial wash. It does not allow visualization or examination of the peripheral lung parenchyma, peripherally located nodules or masses and extrabronchial abnormalities. However, the second function of basic flexible bronchoscopy is to facilitate sampling of the peripheral lung through two techniques: bronchoalveolar lavage and transbronchial lung biopsy. There are specific indications and pathologies for which these techniques are particularly useful (Table 1). Basic flexible bronchoscopy is a safe procedure, performed under conscious sedation and usually as a day case, with a very low complication rate. The British Thoracic Society has recently produced detailed guidelines on the use of basic flexible bronchoscopy that serve as an excellent reference document for further reading.[1]

Conventional transbronchial needle aspiration (cTBNA)

TBNA refers to the insertion of a needle through the bronchial or tracheal wall into the surrounding tissue. This can be used to

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Description of the two available techniques for sampling the peripheral lung during basic flexible bronchoscopy

	Bronchoalveolar lavage	Transbronchial lung biopsy
Technique	Instillation of saline 120–240 ml with the bronchoscope wedged in a distal bronchus and suctioning fluid back	Passing the biopsy forceps beyond the maximal reach and vision of the scope and performing a biopsy at the point of resistance
Tests available	Microscopy and culture Polymerase chain reaction Differential cell count Cytology	Histology
Conditions with a good diagnostic yield	Atypical infection, e.g. PCP Eosinophilic pneumonia: >2% eosinophils abnormal Interstitial lung disease – lymphocytosis in NSIP and HP: >20% lymphocytes abnormal Sarcoidosis – lymphocytosis Adenocarcinoma presenting as consolidation – previously known as bronchoalveolar cell carcinoma	Lymphangitis carcinomatosis Sarcoidosis Cryptogenic organizing pneumonia Eosinophilic pneumonia
Complications	Transient hypoxia Fever	Pneumothorax (approximately 1%) Higher risk of major bleeding than endobronchial biopsy
Additional comments		Can be performed under fluoroscopic guidance

HP, hypersensitivity pneumonitis; NSIP, non-specific interstitial pneumonia; PCP, *Pneumocystis jiroveci* pneumonia.

Table 1

sample an adjacent lymph node or peribronchial mass. cTBNA with a 'Wang' needle is 'blind' TBNA using endobronchial landmarks to guide the sampling site, following computed tomography (CT) to confirm the presence of an extrabronchial abnormality. cTBNA is a cheap and safe technique with a low serious complication rate of 0.3%. Paratracheal, subcarinal and hilar lymph nodes can be sampled with this technique. It can also be used to sample submucosal and necrotic masses, where endobronchial biopsies may be non-diagnostic. For sampling lymph nodes, this technique has a diagnostic yield of approximately 75% in experienced hands, although its use is restricted to significantly enlarged lymph nodes, normally larger than 2 cm in the short axis.[2]

Advanced flexible bronchoscopy

Endobronchial ultrasound transbronchial needle aspiration (EBUS-TBNA)

One of the most significant developments in respiratory medicine in the last decade has been the use of endobronchial ultrasound (EBUS). Hailed as a 'new dawn for the respiratory physician' in a journal editorial, there has been an explosion of EBUS-TBNA services around the globe. An EBUS bronchoscope is equipped with an ultrasound probe at the tip of the scope (Figures 1 and 2), which allows the operator to visualize the extrabronchial tissues when the probe is pressed against the bronchial wall. This specifically allows visualization and sampling of mediastinal and hilar lymph nodes and extrabronchial lung lesions. Once the target lymph node or lesion has been identified, a real-time, fine needle aspiration can be performed under direct visualization. This allows safe and accurate needle placement. It has been extensively evaluated and now represents the pivotal test in nodal staging in lung cancer, recommended in international guidelines.[2,3] EBUS-TBNA has also been shown to be highly accurate in the diagnosis of isolated mediastinal lymphadenopathy. It is particularly useful in cases of suspected sarcoidosis and tuberculosis (remembering that simultaneous bronchoscopy will allow bronchoalveolar lavage plus endobronchial or transbronchial biopsy, which add further diagnostic yield). In cases of suspected lymphoma, many consider the use of mediastinoscopy for larger biopsy samples a more appropriate test, although some expert EBUS centres have demonstrated good diagnostic accuracy.

Diagnosis of peripheral lung lesions

Traditionally, the yield of bronchoscopy in the diagnosis of peripheral lung lesions has been poor. However, new technologies have improved this yield and reinvigorated the role of flexible bronchoscopy in this scenario. The gold standard method for the diagnosis of a peripheral lung lesion is a percutaneous image-guided biopsy, the sensitivity of which is 92% in meta-analysis; however, there is a relatively high complication rate, particularly pneumothorax. The particular attraction of a bronchoscopic approach to a peripheral lung lesion is the low complication rate, typically less than 1% for pneumothorax.[4] EBUS can be used in the diagnosis of peripheral lung lesions. Instead of a linear ultrasound probe built within the tip of a