

## The evolution of flexible bronchoscopy: From historical luxury to utter necessity!!

Flexible bronchoscopy since its inception in 1966<sup>[1]</sup> has had an exponential growth in pulmonology and clinical medicine. The advantages of maneuverability, feasibility of wide spectrum of diagnostics and therapeutics, patient comfort and ease of conscious sedation has established flexible bronchoscopy as the most important weapon in a pulmonologists' armamentarium. It has not only helped in diagnosing pulmonary pathologies but has also helped in understanding the pathophysiology of some diseases.<sup>[2]</sup> Hence, it is now an essential part of a pulmonology training program. With the evolution of pulmonology over the years, there has been a simultaneous evolution in the indications and applications of flexible bronchoscopy.

The flexible bronchoscope was created to diagnose lung cancer early due to increased involvement of upper lobes and inability to visualize upper lobes with the rigid bronchoscope.<sup>[1]</sup> Lung cancer was the indication behind its development and still is one of the commonest indications worldwide for flexible bronchoscopy.<sup>[3-5]</sup> Flexible bronchoscopy has a huge impact on the management of lung cancer. It helps in both diagnosing and staging lung cancer as well as palliation by debulking endobronchial lesions and treating airway stenoses by deploying metallic airway stents.<sup>[6,7]</sup>

Hemoptysis and pulmonary infections are the most common indications for a flexible bronchoscopy.<sup>[3-5]</sup> It is a useful tool in the evaluation of a non-resolving pneumonia. Bronchoalveolar lavage (BAL) helps in diagnosing pulmonary infections in both immunocompetent and immunosuppressed hosts. BAL is the gold standard for diagnosing *Pneumocystis jirovecii* pneumonia.<sup>[8]</sup> Many PCR-based tests help in diagnosing opportunistic infections in the immunocompromised patient.<sup>[9]</sup> A BAL galactomannan level if available has good sensitivity and specificity for invasive aspergillus infections and may help avoid endobronchial and trans bronchial biopsies.<sup>[8]</sup>

After the newer classification of idiopathic interstitial pneumonias and the development of novel treatment options, it is important to subtype an interstitial lung disease to optimize the management. BAL, endobronchial and transbronchial lung biopsy (TBLB) can help subtype the interstitial lung disease when used in the correct clinical setting.<sup>[10]</sup> A differential and subset cytology of a bronchoalveolar lavage may help in diagnosing eosinophilic pneumonias and sarcoidosis.<sup>[8]</sup>

Endobronchial and transbronchial biopsies improve diagnostic yields in endobronchial lesions, localized pulmonary lesions and sarcoidosis.<sup>[8]</sup> Transbronchial lung biopsies help detect rejection in lung transplant recipients.<sup>[8,11]</sup> Advance diagnostics with the use of radial probe endobronchial ultrasound is possible using flexible bronchoscopy.<sup>[12]</sup> The yields of the conventional procedures improve with the endobronchial ultrasound with guide sheath aiding in localization of intrapulmonary and extrapulmonary lesions near the airway.<sup>[12]</sup> A flexible bronchoscope with a convex probe endobronchial ultrasound at its tip has caused a huge paradigm shift in the diagnostics and clinical management in pulmonary medicine.<sup>[13,14]</sup> It has earned its place as a standard of care in evaluation of mediastinal lymphadenopathy.<sup>[15,16]</sup>

With an exponential evolution in the diagnostics, the advances in therapeutic modalities with a flexible bronchoscope have experienced a similar rise. The advent of electrosurgery, cryosurgery, argon plasma coagulation, endobronchial laser, balloon tracheoplasty/ bronchoplasty and airway stenting has bridged the gap between a pulmonologist and a thoracic surgeon very effectively. A variety of airway pathologies are successfully treated with the help of these modalities. Successful endobronchial foreign body retrievals are also carried out using flexible bronchoscopy.<sup>[17]</sup>

The flexible bronchoscope has proven its worth outside the endoscopic suite in the operating rooms and the intensive care unit (ICU). Flexible bronchoscopy is considered as a gold standard for endotracheal intubation in securing airway in both operating room and the ICU.<sup>[18]</sup> In the ICU, flexible bronchoscopy helps in isolating organisms causing pulmonary infections and ventilator associated pneumonia. It helps to diagnose alveolar hemorrhage and the source of hemoptysis.<sup>[8]</sup> It helps to treat lobar collapse and improve ventilation.<sup>[8]</sup>

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A recent analysis by Gupta *et al.* has reported an increase in number of flexible bronchoscopies performed by around 300% over a period of three and a half decades.<sup>[19]</sup> It is an analysis of around 24000 bronchoscopies performed on an outpatient basis under conscious sedation. It very clearly depicts the evolution of flexible bronchoscopy in the Indian scenario. The commonest indication was hemoptysis and bronchogenic carcinoma followed by pulmonary infections and sarcoidosis.<sup>[19]</sup> The analysis also highlighted that flexible bronchoscopy is a safe procedure.

Although incidence of severe forms of tuberculosis has decreased in India, it is still a high burden country for drug-resistant tuberculosis for both multidrug resistant and extensively drug-resistant tuberculosis.<sup>[19,20]</sup> BAL aids in diagnosis of tuberculosis in smear-negative patients.<sup>[21,22]</sup> The feasibility of performing Gene Xpert for MTB/Rif on BAL makes it an important tool in diagnosis of multidrug-resistant tuberculosis and helps guide therapy.<sup>[23]</sup>

Sarcoidosis is a systematic granulomatous disorder and involves the pulmonary system most commonly.<sup>[24]</sup> The rising indication of flexible bronchoscopy for diagnosis of sarcoidosis was also reported.<sup>[19]</sup> Although, endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is a highly sensitive modality to diagnose sarcoidosis, a conventional transbronchial needle aspiration when combined with endobronchial biopsy and transbronchial lung biopsy has a superior yield than EBUS-TBNA alone.<sup>[25]</sup>

The utility of flexible bronchoscopy is ever growing and has certainly promoted from a luxury to a sheer necessity in pulmonary medicine. With the advent of bronchoscopic lung volume reduction techniques in chronic obstructive pulmonary disease and bronchial thermoplasty in asthma, flexible bronchoscopy has sneaked in the management of common pulmonary diseases. A new bronchoscopic technique to assess the local gas exchange status of lungs is also reported with the help of endo-oximetry and endocapnometry.<sup>[26]</sup> From the advantage of viewing upper lobes of lungs to wide array of indications of flexible bronchoscopy today, it would not be unusual if a near 300% or higher increase in number of bronchoscopies is reported in the decade to come.

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