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Dr.R.Narasimhan

REVIEW ARTICLE

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Bihari S, Rajesh V and Ramakrishnan N

INVITED REVIEW ARTICLE

The Evolving Role of Bronchoscopy in the Evaluation of Pulmonary Infections in the Critical Care Unit

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ORIGINAL ARTICLE

Diagnostic Yield of Flexible Bronchoscopy in the Current Clinical Practice in a Tertiary Care Hospital

Dr. G.S. Gaude and Dr. Issac Mathew

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From the Editor's desk

Bronchoscopy is an important tool in the hands of pulmonologists. With the knowledge about various tools increasing the way the scope can be put to use is also increasing. This issue of the IJB carries three important articles of interest.

The first article is about the diagnostic yield of bronchoscopy in the current clinical practice. In this article the need to do bronchoscopy in outpatient setting has been stressed. Most important is the discussion about its role in smear negative pulmonary tuberculosis. The role of TBLB in diffuse lung diseases also has been brought out well. While the diagnostic yield for sarcoidosis is very high its role in picking up other diagnosis is debatable. A lot depends on the pathologist and cytopathologist whose opinion can be final. There is a move nowadays to go for an open lung biopsy if one thinks that non specific inflammation is likely to be a TBLB diagnosis. In the same way the role of TBNA in complimenting the diagnosis depends on the pathologist and the experience of the bronchoscopist.

Use of noninvasive ventilation in bronchoscopy is another latest thing. Many times we are confronted with a dilemma of whether to intubate or not for bronchoscopy. We have been fairly successful in doing bronchoscopy with full face mask and NIV. The article by Dr. Ramakrishnan is an eye opener.

Similarly the role of bronchoscopy in diagnosis for critical care pneumonias is undoubtable. In this issue I have brought out these important aspects which would be of interest to all. Finally as usual I appeal to all to contribute their experiences so that this organisation can grow and bring about guidelines in safe bronchoscopy practice.

Dr.R.Narasimhan
Editor in Chief

Value of Noninvasive Positive Pressure Ventilation (NPPV) During Fibreoptic Bronchoscopy

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INTRODUCTION

Flexible fibreoptic bronchoscopy (FOB) has become an indispensable tool in the optimal management of intensive care unit (ICU) patients with both diagnostic and therapeutic goals¹. Its safety and usefulness, in well-trained hands with appropriate precautions, has led to its increasing use even in unstable and mechanically ventilated patients^{2, 3}.

The main argument against liberal use of FOB in the ICU stems from the fact that FOB is associated with cardiopulmonary consequences that might prove to be life threatening in a critically ill patient. A slight increase in the PaCO₂ (averaging 1.1 kPa), and a moderate decrease in PaO₂ (averaging 1.1 to 2.5 kPa) occur during FOB in an ICU patient⁴. PaCO₂ rises by about 30%, while PaO₂ decreases by about 40% during suctioning. When suction is applied through the FOB, the delivered tidal volume and PEEP may decrease. As much as 200 to 300cc of the patient's tidal volume can be removed during each suction period. This reduction in lung volumes may produce alveolar closure and

exaggerate the abnormal gas exchange during FOB. In addition, some of the delivered volume can be lost through the swivel adaptor of the ETT. Yet another mechanism for blood gas abnormalities is reflex bronchoconstriction induced by stimulation of vagal receptors in the upper airway³. Following the procedure, gas exchange abnormalities slowly return to baseline. This may take about 15 minutes for normal lungs and several hours for patients with severe parenchymal disease. In nonintubated patients, the bronchoscope occupies about 10% of the total cross-sectional area of the trachea, thereby decreasing tidal volume and increasing the work of breathing⁵ and is associated with an alteration of the respiratory mechanics and gas exchange causing transient hypoxemia and hypercapnia.⁶⁻⁸ In 1990, the American Thoracic Society guidelines recommended avoiding BAL in spontaneously breathing patients with hypercapnia and/or hypoxemia and in patients whose PaO₂ levels cannot be corrected to at least 75 mm Hg or to an SpO₂ level of > 90% with supplemental oxygen⁹.

An increase in cardiac output both due to increase in stroke volume and heart rate has been noted during the procedure, which returns to baseline in 15 minutes after its completion.

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Value of Noninvasive Positive Pressure Ventilation (NPPV) During Fibreoptic Bronchoscopy

Elevation of arterial pressure, heart rate and pulmonary artery pressure are attributable to reflex sympathetic discharge caused by mechanical irritation of the airways¹⁰. Increased intracranial pressure (ICP) is also noted during FOB and this may be exaggerated during coughing or agitation. Bronchoscopy in patients with elevated ICP is always performed cautiously because of the induction of PEEP by the presence of a FOB within the airway. However, a study by Bajwa et al found no evidence of significant increased risk in performing FOB in this subgroup of patients with raised ICP¹¹.

Lindholm et al listed a series of recommendations for bronchoscopy in patients receiving mechanical ventilation^{6, 7}. These included use of a tracheal tube no smaller than 8.0-mm, discontinuance of PEEP, increasing the fraction of inspired oxygen to 1.0, monitoring for adequate chest excursion, suctioning for short periods only, frequent arterial blood gas analysis, and ruling out mediastinal emphysema and pneumothorax by chest radiograph after FOB.

In non-intubated patients, severe hypoxemia (defined as requiring inspired oxygen concentration of >50% to maintain arterial oxygen tension of at least 75 mm Hg) is an accepted contraindication to bronchoscopy¹². In these high-risk patients, the options are to intubate and to apply mechanical ventilation (MV) to ensure adequate gas exchange during FOB or elect to institute empirical treatment without performing a FOB.

Non-invasive ventilation has emerged as an innovative technique for the treatment of respiratory failure of varied etiologies. Noninvasive positive-pressure ventilation (NPPV) refers to the delivery of assisted MV without the need for an invasive artificial airway. NPPV has been proved to be effective

in various forms of acute respiratory failure, in particular at an early stage when it could help to avoid endotracheal intubation¹³⁻¹⁶. Rocker et al¹⁷ reported an intubation rate of 34% and a mortality of 30% in hypoxemic patients treated by NPPV. In addition, NPPV may reduce the rate of serious complications and also shorten the length of ICU stay¹³. Some clinicians have employed the potential advantage of noninvasive ventilation by extending it during FOB in hypoxemic, hypercapnic, immunocompromised patients (in whom routine FOB may not be possible without endotracheal intubation) with good success.

CLINICAL STUDIES

Antonelli et al¹⁸ evaluated the feasibility and safety of NPPV via a face mask to aid in performing FOB with BAL in eight immunosuppressed patients with gas exchange abnormalities. A full-face mask was connected to a ventilator set to deliver continuous positive airway pressure (CPAP) of 4 cm H₂O, pressure support ventilation of 17 cm H₂O, and 100% FiO₂. NPPV was initiated 10 min before starting the procedure and continued for 90 min or more after the procedure was completed. The bronchoscope was passed through a T-adapter and advanced through the nose. BAL was obtained by sequential instillation and aspiration of 5 to 25 mL aliquots of sterile saline solution through the wedged bronchoscope. Oxygen saturation, heart rate, respiratory rate, and arterial blood gases were monitored during the study. It was found that NPPV significantly improved PaO₂/FiO₂ and oxygen saturation. FOB with NPPV was well tolerated, and no patient required endotracheal intubation. Six patients responded to treatment and survived hospital admission. Although 2 patients died 5 to 7 days after FOB those were from unrelated complications of the underlying illness. It was concluded that NPPV should be considered

during bronchoscopy of immunosuppressed patients with severe hypoxemia.

The same group subsequently performed a randomized study¹⁹ comparing NPPV and conventional oxygen supplementation in hypoxemic patients undergoing diagnostic bronchoscopy. Twenty-six patients with PaO₂/FiO₂ ratios <200 who required BAL for suspected nosocomial pneumonia were studied. Thirteen were randomized during FOB to receive NPPV, and an equal number randomized to receiving conventional oxygen supplementation. The primary end points were changes in the PaO₂/FIO₂ ratio during FOB and within 60 min of terminating the procedure. At study entry, the two groups were similar in terms of age, APACHE II scores and cardio respiratory parameters. During FOB, the mean PaO₂/FIO₂ ratio increased by 82% in the NPPV group (261 ± 100 vs. 139 ± 38; p < 0.001) and decreased by 10% in the conventional oxygen supplementation group (155 ± 24 to 139 ± 38; p = 0.23). Sixty minutes after undergoing FOB, the NPPV group had a higher mean PaO₂/FIO₂ ratio (176 ± 62 vs. 140 ± 38; p = 0.09), a lower mean heart rate (91 ± 18 vs. 108 ± 15 beats/min; p = 0.02), and no reduction in mean arterial pressure in comparison to a 15% decrease from the baseline in the conventional group. One patient in the NPPV group and two patients in the control group required intubation. It was concluded that in patients with severe hypoxemia, NPPV was superior to conventional oxygen supplementation in preventing gas-exchange deterioration during FOB.

A similar²⁰ study was done to assess the feasibility and safety of NPPV via a facemask for performing FOB in patients with significant COPD. It was a prospective, open,

non-comparative trial of feasibility. It included ten consecutive COPD patients (71 ± 5 year-old, PaO₂ = 53 ± 13 mmHg and PaCO₂ = 67 ± 11 mmHg), without any sign of acute respiratory failure, admitted to the intensive care unit for pneumonia requiring a BAL. A T-adaptor was attached to the facial mask and the FOB was inserted through the nose. After FOB, the NPPV was maintained for 5 min. Heart rate and SpO₂ were measured continuously and arterial pressure at 2 min intervals. Arterial blood gas values were obtained just prior NIPPV and after 15 min and 60 min NIPPV disconnection. The duration of FOB was 11 ± 4 min. SpO₂ significantly improved during FOB (from 91 ± 4.7 to 97 ± 1.7) without oxygen desaturation below 90%. There were no changes in PaCO₂ and PaO₂ during the hour following the end of procedure. FOB under NIPPV was performed in all patients without complications and was very well tolerated in eight patients. After NPPV disconnecting, one patient required again NIPPV for 15 min. No patient required endotracheal intubation for next 24 hours and all patients survived. Maitre et al²¹ have reported similar positive results in a randomized double-blind study evaluating the application of a new CPAP device during FOB in 30 patients with a mean PaO₂/FIO₂ ratio of < 300. The open system was based on generating positive airway pressure by four funnel-shaped microchannels that generate microjets, and thus positive pressure, for use with a facemask.

A study done²² published in 2003 evaluated nonintubated, spontaneously breathing patients with severe hypoxemia in whom bronchoscopy would be traditionally contraindicated. NPPV was delivered by helmet interface in these patients. Helmet NPPV avoided gas exchanges deterioration during FOB and BAL, with good tolerance. Endotracheal intubation was not required

during the 24 h after the procedure. BAL yielded diagnostic information in three of four patients. Although an increase in heart rate and MAP were noted during the procedure, these hemodynamic changes were modest and transient, and consistent with the results of other studies^{6, 23}.

CONCLUSIONS

Use of noninvasive ventilation in hypoxemic, hypercapnic and immunocompromised patients seems to be an effective and safe way for FOB. It prevents the risk of hypoxia and avoids endotracheal intubation and related complications. As compared to oxygen supplementation alone gas exchange during and after diagnostic bronchoscopy is better with noninvasive ventilation, with better hemodynamic tolerance in patients with severe and moderate hypoxemia.

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The Evolving Role of Bronchoscopy in the Evaluation of Pulmonary Infections in the Critical Care Unit

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With increasing complexity of illness and length of stay on a mechanical ventilator in Indian critical care units (CCU), ventilator associated pneumonia (VAP) is an important nosocomial infection that needs careful evaluation and treatment. Compounding this issue is the increasing resistance to antimicrobial agents in Indian hospitals. With excessive use of broad spectrum antibiotics and poor infection control standards, India has one of the highest rates of resistance among Gram negative bacteria in the world. Up to 70% of E.coli and Klebsiella in Indian hospitals (as opposed to <10% in Western countries) are ESBL (extended spectrum beta-lactamase) producers with consequent resistance to most cephalosporins and penicillins. Pseudomonas aeruginosa is resistant to carbapenems in up to 30% of patients and pan-resistant Acinetobacter is both an endemic and an epidemic feature in many hospitals. Methicillin resistant Staphylococcus aureus (MRSA) is common in many hospitals as well.

As a result of the increasing incidence of VAP due to multi-resistant organisms in the CCU, it is difficult to design an empiric antibiotic regiment to cover for all these resistant organisms. In fact, diagnosis and therapy based on clinical criteria without cultures may result in significant under or over-treatment, and inaccurate diagnosis and treatment of VAP carries an attributable mortality of up to 40%. This clinical approach is not recommended by most guidelines, including the recent ATS-IDSA guideline for diagnosis and treatment of VAP. Obtaining an accurate culture is therefore of paramount importance. A second issue is how to de-escalate antibiotics. De-escalation is the process by which broad spectrum antibiotics are initiated empirically and then changed to narrow spectrum ones on receipt of sensitivities. This strategy is strongly recommended in order to reduce inappropriate antibiotic use, while ensuring appropriate therapy up front. Obviously having a reliable culture is essential. As obtaining a good quality culture becomes so important to both start and stop antibiotics appropriately, what is the best way to obtain them? The simplest is to obtain

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a non-quantitative endotracheal tube aspirate culture. This approach is sensitive but will often reflect colonization of the airway rather than VAP; significant overdiagnosis of VAP and overuse of antibiotics will therefore result. A recent large study showing equivalent outcomes in comparison with bronchoscopy excluded patients with MRSA or resistant *Pseudomonas* infections, both common causes of VAP. This approach is however reasonable in a situation where bronchoscopy facilities do not exist.

Having decided to perform a bronchoscopy, it is important to get the technical details right. The procedure should preferably be done prior to, and definitely no later than 24 hrs after, starting or changing antibiotics. A bronchial wash is insufficient and is little better than an endotracheal culture; broncho-alveolar lavage (BAL) of a defined area of lung that shows radiologic changes of consolidation should be done. This involves wedging the bronchoscope into the relevant bronchus, instilling saline and obtaining an adequate return. The fluid should be Gram stained and the percent of intra-cellular organisms seen within neutrophils noted –this immediately helps to decide whether additional Gram positive or Gram negative antibiotic coverage is appropriate. The fluid should then be cultured quantitatively using standard microbiologic methods: a colony count of 10,000 or more is significant. Lower colony counts prior to starting antibiotics merely reflect airway contamination, although the receipt of sensitive antibiotics for more than 24 hrs pre-procedure may reduce the colony count. A protected brush specimen is another accurate albeit much costlier technique with a lower diagnostic cut off for VAP of 1000 colonies. Close co-ordination with the

microbiologic laboratory is essential for obtaining clinically relevant data.

There is a second area in which bronchoscopy is of critical importance: the evaluation of an immunocompromised patient with a severe pneumonia. The two commonest situations are the solid organ transplant recipient or the patient with chemotherapy induced neutropenia. Opportunistic organisms such as mycobacteria, pneumocystis, nocardia, aspergillus and strongyloides can be picked up with relevant smears and cultures. In this situation, colony counts are of no relevance as demonstration of even a single organism establishes the diagnosis. Again a thorough BAL rather than a bronchial wash is indicated. In selected situation where the demonstration of lung histopathology is needed and there is no coagulopathy, a transbronchial biopsy can be performed at the same time.

As Indian critical care units deal with an increasingly resistant microbial population in increasingly sicker and immune-compromised hosts, bronchoscopy is likely to play an important role in good patient outcomes.

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Diagnostic Yield of Flexible Bronchoscopy in the Current Clinical Practice in a Tertiary Care Hospital

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ABSTRACT

Fibreoptic bronchoscopy is one of the most commonly used invasive diagnostic procedures done by the Chest Physicians for diagnostic and the therapeutic purposes worldwide. The aim of the present study was to assess the diagnostic yield and the safety of the routine bronchoscopy techniques including transbronchial needle aspiration and transbronchial biopsy in a tertiary care hospital in Northern Karnataka. A total of 1116 consecutive bronchoscopic procedure performed over a period of 3 years were analyzed retrospectively using bronchoscopic reports. Diagnostic procedures performed included bronchial washings, bronchial brushings, bronchoalveolar lavage, transbronchial biopsies, endobronchial biopsies and transbronchial needle aspiration. A total of 1090 bronoscopies were for diagnostic indications and 26 for therapeutic propose. The overall diagnostic yield was 43.2% (470/1090). Bronchoscopy performed for suspected lung cancer confirmed malignancy in 66.6% of the

cases. Bronchoscopy confirmed diagnosis of tuberculosis in 42.5% of the cases while it also identified pathogenic organisms in 52.3% of the cases in suspected pulmonary infections. It also yielded diagnosis of interstitial lung diseases in 35.9% of the cases. Forceps biopsy including TBB yielded positivity in maximum number of patients (74%) followed by bronchial brushings (56.7%), and bronchial washings and BAL (43.3%). Complications were rare (1.9%) and were only minor. This study demonstrates that routine bronchoscopy techniques including transbronchial biopsy and transbronchial needle aspiration are safe and have a high diagnostic yield.

Key words: bronchoscopy, diagnostic yield, transbronchial biopsy.

INTRODUCTION

The development of fibreoptic bronchoscope by Ikeda has been one of the most important advances in the field of pulmonary medicine (1). This can be performed under local anesthesia in various clinic/hospital settings providing maximal visualization of tracheobronchial tree (2), and

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if performed carefully, can be a thoroughly safe procedure (3). Bronchoalveolar lavage (BAL) today is a useful and safe method of sampling various cellular and biochemical components from the lungs (4). BAL has also gained considerable popularity in investigation of various interstitial lung diseases (5). Fiberoptic bronchoscopy (FOB) was shown to be of diagnostic value in opportunistic pulmonary infections occurring in immunosuppressed patients including HIV positive patients (6, 7). Besides biopsy and BAL, analysis of bronchial washings for diagnostic purpose in all kinds of respiratory diseases has been widely employed (8). The last decade have seen introduction of several diagnostic innovations in the bronchoscopy suite which includes endobronchial ultrasound, auto fluorescence bronchoscopy and electromagnetic navigation (8). However, such innovations are mainly limited to specialized centers and do not reflect the application of this technique in routine clinical practice. Despite various recent innovations, the diagnostic yield of routine bronchoscopy techniques presently is high and centers without facilities for advanced bronchoscopy techniques should continue to optimally use the current routine armamentarium. We therefore performed this study to assess the diagnostic yield of routine bronchoscopy techniques including transbronchial needle aspiration and transbronchial biopsy in the current clinical practice.

PATIENTS AND METHODS

We evaluated retrospectively all 1116 consecutive flexible bronchoscopies performed in our bronchoscope suite over a period of 3 years from July 2003 to June 2006. Patients included outpatients or well as inpatients from

different departments of the hospital. We evaluated four different aspects in each patient: indication, diagnosis obtained by bronchoscope, final diagnosis and bronchoscope related complications. The final diagnosis was obtained from hospital or outpatient records.

Flexible fibreoptic bronchoscope was performed using a standard flexible fibreoptic bronchoscope (Pentax FB 15X and FB 18X), using local lignocaine anesthesia. Atropine 0.6 mg was given half an hour prior to the procedure intramuscularly. Midazolam was rarely used. The bronchoscope was introduced transnasally or orally. Supplemental oxygen was administered if oxygen saturation was less than 95%. All the patients were monitored with pulse oximetry. The larynx, vocal cords, trachea, carina and the bronchial tree were thoroughly inspected. During the procedure, the diagnostic materials was obtained by bronchial washings, bronco-alveolar lavage (BAL), transbronchial needle aspiration (TBNA), bronchial brushings, endobronchial biopsy or transbronchial biopsy (TBB), as decided by the bronchoscopist on a case by case basis. Bronchial brushings were obtained by instilling 20 ml or more of sterile isotonic saline solution in to the bronchus of interest followed by immediate aspiration in to a trap. Specimens were sent for bacterial, mycobacterial, or fungal culture, and for cytological analysis. For BAL, 3 × 50 ml of sterile isotonic sodium chloride solution was instilled in to the middle lobe or lingula in patients with diffuse disease and in patients with heterogenous disease in to the segment with the most prominent radiological infiltrates. BAL fluid was again submitted for bacterial, mycobacterial, viral cultures and for cytological analysis.

TBNA was performed using MW 522 needle catheters (Mil-Rose Laboratories). After the needle is advanced in to the tissue, suction is applied from the proximal end of the catheter with 20 ml syringe. Once the sample

is collected the needle is flushed with 2 ml of 0.9% saline in to a test tube. Transbronchial biopsy was performed after wedging the bronchoscope in the desired segment and by maintaining in that position throughout the biopsy procedure. The biopsy forceps was then passed through the suction channel and extended to the lung periphery. As the patient exhaled, the forceps was advanced 1 to 2 cm in an open position, closed, and then removed from the bronchoscope to obtain the specimen. This procedure was repeated 2 to 3 times to obtain adequate samples. Post - bronchoscope chest x-ray was performed routinely 4 hours after TBB.

Bronchial secretion samples were centrifuged at 1500 rpm for 5 min. The supernatant was poured of and the sediment of material was pipetted on several slides and fixed with 95% alcohol. BAL specimens were routinely stained for Giemsa and special stains (e.g. Silver methenamine for fungi or pneumocystis jirovecii). Transbronchial needle aspirates and brushings were collected in a test tube in 0.9% normal saline and few drops of 95% alcohol were added to the sample. Forceps biopsy specimens were fixed in formaldehyde solution, embedded in paraffin and sectioned. Cytological specimens were stained routinely by the Papanicolaou technique and histological specimens were stained with haematoxylin and eosin. All the specimens were interrupted by a cytopathologist.

Complications were categorized as minor or major according to the BTS guidelines (10).

RESULTS

There were total of 1116 patients in the present study. The mean age was 47 years (+ 11 years, range 17-83) years) and 71.2% of patients were males. A total of 146 patients

(13.1%) were having HIV infection. Of the 1116 bronchoscopes, 26 (2.3%) were for the therapeutic and 1090 (97.7%) for diagnostic indications. Therapeutic bronchoscopies were mainly consisted of bronchial toileting in the intensive care units for lobaratelectasis.

The various diagnostic indication categories are summarized in Table 1. Most of the diagnostic bronchoscopies were performed for suspected tuberculosis (28.3%) and suspected lung carcinomas (26.1%). All these suspected tuberculosis patients were sputum smear negative for AFB on three occasions. Another important indication for bronchoscopy was suspected pulmonary infections (17.5%) and majority of these patients (85 cases) were having associated HIV infection.

Table 1. Overview of Bronchoscopies performed for different indications

Suspected diagnosis	Number	Diagnostic indications
Suspected tuberculosis	316	28.3
Suspected lung cancer	291	26.1
Suspected infections	195	17.5
Interstitial lung disease	117	10.5
Hemoptysis	51	4.6
Connective tissue disease	49	4.4
Chronic cough	33	2.9
Hoarseness of voice	27	2.4
Atelectasis in ICU	26	2.3
Chest trauma	11	1.0
Total	1116	100

In addition to bronchial washing and endobronchial biopsies, a total of 412 BAL, 29 TBNA, and 47 transbronchial biopsy (TBB) procedures were performed in both diagnostic and therapeutic indication groups. For the diagnostic indication group alone, a total of 391 BAL procedures were performed. Of the 29 TBNA's. The diagnostic yield was 27.6%

(8 cases), and all these 29 TBNA cases were central TBNA's. The diagnostic yield with 47 TBB procedures was 42.5% (20 cases) and all these cases were of interstitial lung diseases. Among the 423 forceps biopsy procedures including TBB, the diagnosis could be obtained in 313 cases (74%). Bronchial brushings yielded diagnosis in 56.7% of the cases (560 cases), while bronchial washings yielded diagnosis in 43.3% of the cases (472 cases). Diagnostic yield by various procedures have been summarized in Table 2.

Table 2. Diagnostic yield of lung cancer by various procedures

Procedure	Number	Positive yield (No)	Positive yield (%)
Forceps Biopsy	423	313	74
Bronchial washings	1090	472	43.3
Brushings	987	560	56.7
TBNA	29	8	27.7
Others	329	175	53.2

Lung cancer was found in 194 cases (66.6%) of 291 bronchoscopies in patients with suspected carcinoma. Malignancy was correctly excluded in 59 patients (20.3%). In 38 cases (13.1%) malignancy was missed and was diagnosed by further investigations. In 20 cases (6.9%), an alternative diagnosis was found while included tuberculosis, infection and interstitial chronic inflammation.

We performed 316 bronchoscopies in suspected pulmonary tuberculosis patients. All these patients were sputum smear negative for AFB on three consecutive occasions. The diagnostic yield in these patients was 42.5% (134 cases). The maximum diagnostic yield is obtained by bronchial brushings (60.5%) as compared to bronchial washings, BAL and forceps biopsy procedure. Additionally,

alternative diagnosis was obtained 29 cases (9.2%) and this included lung cancer, infections and interstitial lung diseases.

A total of 195 bronchoscopies were performed for suspected pulmonary infections and 85 (43.6%) of these patients were having HIV infection. Twelve of these patients were diagnosed to have pulmonary tuberculosis and in 100 patients (52.3%) we found various pathogenic organisms. A wide variety of micro-organisms were documented. *Pneumocystis jirovecii* were demonstrated in BAL fluid in 6 patients with HIV infection. A total of 117 bronchoscopies were performed in majority of these cases (64 cases), but the diagnostic yield was obtained in only 42 patients (35.9%).

Among 1116 bronchoscopies procedures, complications were observed in only 21 patients (1.9%). Three patients among interstitial lung diseases developed pneumothorax following transbronchial biopsy procedure and intercostal tube drainage had to be introduced in these cases. Rests of the complications were minor and were treated conservatively. A summary of the diagnostic yield is given in Table 3.

Table 3. Diagnostic yield for different diseases.

Diseases	Number	Diagnostic yield	% of diagnostic yield
Tuberculosis	316	134	42.5
Lung cancer	291	194	66.6
Lung infections	195	100	52.3
Interstitial lung diseases	117	42	35.9
Mucus plugging	26	21	80.7
No diagnosis	620	—	56.9%

DISCUSSION

In this retrospective analysis of 1116 consecutive bronchoscopies performed at a tertiary care hospital in Northern Karnataka, we found a overall diagnostic yield of 43.2%. Recently, Foos et al (11) analyzed the retrospective data of 616 bronchoscopy procedures done and reported a diagnostic yield of 57%. The diagnostic yield of bronchoscopy for detection of malignancy was 66.6%. These results are comparable with a recent systematic review, where the diagnosis of endobronchial disease by bronchoscopy in 30 studies showed the highest yield for endobronchial biopsy (74%) followed by bronchial brushings (59%) and washings (48%) (12). Foos et al (11) reported highest diagnostic yield of 92% in the cases with a macroscopically visible tumor, while another study (13) reported a diagnostic yield of 51% for peripheral lesions. In the present study (13) reported a diagnostic yield of 51% for peripheral lesions. In the present study, the highest yield was observed with endobronchial biopsy of the lesions (64%) followed by bronchial brushings (48%) and bronchial washings (40%). A lot of other studies are also available on this topic in the literature including Indian data. Recently, Anandan et al (14) also reported the highest yield in the diagnosis of malignancy by endobronchial biopsy (85%) followed by bronchial brushings (34%) and washings (12%). Another study (15) evaluated biopsy, brushings and washings in the diagnosis of lung cancer and the overall diagnostic yield rates of FOB were 98.1%, 61.5% and 58.5% for the endoscopically visible, endoscopically not visible and endoscopically not visible and endoscopically not visible + fluoroscopic guidance cases respectively. Another study (16) reported diagnostic yield of 82.7% with forceps biopsy

followed by TBNA (68.6%), bronchial brushings (68.4%) and bronchial washings (31.6%). The addition of brushings increases the diagnostic yield from 82.7% to 88.8%. Shiner et al (17) evaluated the role of bronchology in the central and peripheral lung lesions and reported diagnostic yield of 94% for the central lesions, while for the peripheral non visible lesions, the diagnostic yields were 52% for washings and brushings each and 61% for biopsy procedures. Bronchial washings and brushings were important complimentary procedures to biopsy and provided exclusive diagnosis in 12% and 25% of the peripheral tumors. Ray (1) reported diagnostic yield of 20% in the diagnosis of endoscopically nonvisualised peripheral lesions by bronchial washings. Goel et al (18) reported overall diagnostic yield of 37.1% in patients with endoscopically not visible peripheral lung tumors. Among these transbronchial biopsy yielded diagnosis in 34.3% of the cases. Gupta et al (19) performed bronchoscopic fine needle aspiration cytology for the diagnosis of endoscopically lesions and observed that it did not add to the magnetic yield as compared to the endobronchial biopsy procedure. Another study by Manickam et al (20) reported a diagnostic yield of 26.8% for the diagnosis of broncoscopically non visible lung tumors. The findings of all the studies confirm that the diagnostic yields of routine bronchoscopy techniques is high, particularly in lung cancer patients and hence they should be continued to the optimally applied in the patient management.

Bronchoscopy plays an important role in the diagnosis of smear negative pulmonary tuberculosis. In the present study the diagnosis of pulmonary tuberculosis was obtained in 42.5% of the cases. Recently Foos et al (11) reported diagnostic yield of 27% for the diagnosis of pulmonary tuberculosis by fiberoptic bronchoscopy. While another prospective study (21) published from Brazil

reported positivity of 56% in the diagnosis of tuberculosis by fiberoptic bronchoscopy. Most of these patients are unable to produce sputum and with the concomitant HIV infection, sputum production is negligible. Obviously in such patients bronchoscope plays an important role in the diagnosis of pulmonary tuberculosis. Other studies (22, 23, 24, 25) published recently also highlights the utility of bronchial washings and BAL in the diagnosis of pulmonary tuberculosis in the difficult cases and in the immunocompromised patients. Further the routine bacteriological cultures of BAL specimens gives valuable information about to co infection, which need to be treated as infections secondary due to tuberculosis, specially in patients with associated HIV infection (22). However in pediatric suspected cases of pulmonary tuberculosis the diagnostic yield by bronchoscopy is very low (4%) and should not be recommend on routine basis (26). Furthermore, infectious pathogens other than mycobacteria were detected in 53.3% of the cases of the suspected pulmonary infections in the present study, while in another study (11), the infectious pathogens could be identified in 46% of the cases, which included bacteria, viruses, pneumocystis jirovecii, and aspergillus. Another Indian study (22) identified pyogenic organisms in 51% and fungal infections in 12% of the cases, of which candidial infection was the most common fungal infections. Bronchoscopy is also a useful diagnostic tool for excluding the alternate diagnosis that has been wrongly diagnosed as pulmonary tuberculosis. In our study 12 cases who are clinically diagnosed as PTB where found to have lung malignancy after bronchoscopic evaluation. Recently Lale (27) observed that nearly 32.6% patients were wrongly diagnosed to have pulmonary tuberculosis and were infect cases of lung malignancy (30%) and pulmonary

manifestations of systematic disease (2.6%). These findings suggest that bronchoscopy has an important value of diagnosis and exclusive of pulmonary infection.

In patients with suspected interstitial lung diseases, a specific diagnosis was obtained in 35.9% of the cases by transbronchial lung biopsy. All these patients has idiopathic pulmonary fibrosis except 6 cases that were proved to have sarcoidosis. Another Indian study (28) reported diagnostic yield of 40% for TBB in patients with diffuse pulmonary diseases. The overall diagnostic yield with TBB in interstitial lung diseases varies from 46% to 79% (29, 30, 31). The experience of the pathologist is very important in giving the final diagnosis of the idiopathic pulmonary fibrosis or other varieties of idiopathic interstitial pneumonias and this has led to the low diagnostic yield in the present study. Very often the diagnosis of non-specific lung inflammation is given in TBB specimens, which is non conclusive for any disorder (28). Moreover, the clinicians should not be misled in to making a diagnosis of interstitial lung disease merely on the basis of transbronchial lung biopsy specimen, as lung malignancy should also be considered in the differential diagnosis of interstitial lung diseases (32). Singh et al (33) studied the data of transbronchial biopsy in diffuse lung diseases and observed that in almost 10% of the cases, TBB confirmed the diagnosis of lung cancer which had not been clinically considered most likely. They also could obtain the diagnosis of interstitial lung fibrosis in only 23.8% of the cases. As the diagnostic yield with TBB is low, the other tests need to be evaluated in the evaluation of diffuse parenchymal lung diseases (34).

The overall diagnostic yield of TBNA for thoracic lymph nodes sampling is 27.6% which is low compared to other studies. Foos et al (11) reported diagnostic yield of 40% for TBNA. The lower yield in the present study is

due to out inexperience with the procedure. A recent meta-analysis of TBNA also concluded that sensitivity of TBNA depends to a large extent on the study methods and patient population (35). There were no complications attributable to TBNA in this study.

Nowadays fibreoptic bronchoscope plays an important role in intensive care units for therapeutic interventions. It is useful for removal of thick tenacious secretions in patients with atelectasis on mechanical ventilation as well as for difficult endotracheal intubation (36, 37). We also performed therapeutic bronchoscopies in 26 cases in ICU for removal of retained secretions in patients with atelectasis. Thus the morbidity due to bronchiectasis or destroyed lung which can occur due to untreated lobar or lung collapse can be avoided with early intervention (38).

Bronchoscopy is a relatively safe invasive procedure, which can be performed as an OPD procedure. Overall, the bronchoscopy related complications were rare. Only three patients developed pneumothorax among interstitial lung diseases group, and required intercostal tube drainage. In a large retrospective study (39), minor complications rates amounted to 0.8% and the major life threatening complications rates to 0.5%. Another study (11) reported overall complications rate of only 1.6% in 616 bronchoscopy procedures. Singh et al (33) observed complications in 6.6% of the patients with TBB procedures - bleeding in 5.5% and pneumothoraces in 1.1% of the cases. The difference in minor complications could be attributed to some cases of mild desaturation, which are not regarded as complications by some authors (11). Secondly, there is evidence that the combination of midazolam and hydrocodone markedly reduces cough during bronchoscopy without causing relevant hypoxia (40), while the addition of

nebulised lignocaine does not provide an additional benefit (41).

To summary, routine flexible fibreoptic bronchoscopy technique continues to be safe procedures even with the inclusion of TBB and TBNA and have a high diagnostic yield in current clinical practice. TBB and TBNA are safe procedures and should be adopted for routine use in bronchoscopy suite.

Others includes CT guided FNAC lung, sputum cytology, pleural fluid cytology, pleural biopsy, open lung biopsy.

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ANNOUNCEMENTS

The American College of the Chest Physicians South India Chapter conducts a 2 day Lung Congress 2007, Chennai

August 25-26, 2007

At: GRT Convention Centre, Chennai

Contact : Dr.R.Narasimhan MD FRCP (E) FRCP (G) FCCP (USA)
Sr. Respiratory Physician, Apollo Hospitals,
21, Greams Lane, Chennai.

BRONCOCON 2008

13th Annual Conference of the Indian Association for Bronchology (IAB)

January 11-13, 2008 in Kerala at CALICUT

Workshop on 11 January at MIMS, Calicut

Conference 12th and 13th at Taj Residency, Calicut.

Contact:

Dr. A.K. ABDUL KHADER

Monu's 28/728 A, Chevayur Junction, Mavoor Road
Calicut - 673 017 Kerala.

Resi: 0495 2354885 Mob: 09447034885

Canadian Critical Care Conference

January 24-26, 2007

At: Fairmont Chateau Whistler in Whistler, BC

E-mail: Zena.Davidson@vch.ca

Website: www.canadiancriticalcare.ca

ISCCM 2007 (International Critical Care Congress & 13th Annual Conference of the Indian Society of Critical Care Medicine)

February, 7-11, 2007

At: Le Meridien, Cochin

Contact: Dr. Mohan A Mathew **Phone:** +91 484 5522251,
2319140 **E-mail:** criticare2007@gmail.com

Sleep Disorders 2007

February 12-15, 2007

At: MGM Grand, Las Vegas, Nevada

Website: www.worldclasscme.com

36th Critical Care Congress

February 17-21, 2007

At: Gaylord Palms Resort and Convention Center, Orlando,
Florida **Phone:** 1 847 827-6888

Website: www.sccm.oorg **E-mail:** egistration@sccm.oorg

Second International Meeting "Rare Pulmonary Diseases and Orphan Drugs in Respiratory Medicine (RIPID)" on "Old and New Targets for Therapies in Diffuse Lung Diseases"

February 23- 24, 2007

At: Congress Centre "Palazzo delle Stelline", Milan, Italy

Contact: Francesca Rovelli at francesca@victoryproject.it

Tel: + 39 02 89 05 35 24

1st International Respiratory Highlights

February 28-March 2, 2007

At: Grimaldi Forum, Monte Carlo

Contact: Leonetta Baldini leonetta.baldini@publiccreations.com

American College of Physicians (ACP) International Update

March 9-10, 2007

At: The WTC Mexico, Mexica conference room.

Contact: Maricruz Flores

Tel: 011-(52)-55-1250-5629 **E-mail:** acpinfo@livemed.org

The Fifth ERS Lung Science Conference

March 23-25, 2007

At: San Domenico Palace Hotel, Taormina, Sicily (Italy)

Tel: + 39 0942 613111

E-mail: san-domenico@thi.it **Website:** www.sandomenico.thi.it

27th International Symposium on Intensive Care and Emergency Medicine

March 27-30, 2007

At: Brussels exhibition and convention center, Belgium

E-mail: jilvincen@ulb.ac.be

Website: <http://www.intensive.org>

4th Annual Critical Care Symposium

April 26-27, 2007

At: Manchester, United Kingdom

E-mail: Veerappan.Chithambaram@pat.nhs.uk

ICCC 2007 (International Consensus Conference in Intensive Care Medicine)

May 3-4, 2007

At: Montreal, Canada

Website: www.thoracic.org/sections/meetings_and_courses/iccc07/index.html

E-mail: iccc2007@thoracic.org

International Workshop on Tuberculosis Vaccines

May 13-17, 2007

At: Varadero, Cuba

Contact name: Armando Acosta

E-mail: tbvaccines07@yahoo.es

Website: <http://www.bvv.sld.cu/tbvaccines07/>

ATS 2007

May 18-23, 2007

At: San Francisco, California, U.S.A.

Contact: Dr James M Beck

Tel: 212/315-8658 **E-mail:** ats2007@thoracic.org

Surfactant Congress 2007

June 2-9, 2007

At:Hamburg to Prague, Germany

E-mail: L.visser-isles@erasmusmc.nl

World Asthma Meeting 2007

June 22-25, 2007

At: Lutfi Kirdar Convention & Exhibition Center-Istanbul, Turkey

Contact: Figur Congress Organization Services

Phone: +90 212 258 60 20 **E-mail:** wam2007@figur.net

Website: www.warm2007.org

International Union Against TB & Lung Disease

June 25-28, 2007

At: Kuala Lumpur, Malaysia

Tel: +603 2162 0566 **E-mail:** tbldc@console.com.my

2nd Asia Pacific Congress of Bronchology

July 12-16, 2007

At: College of Medicine Building, Singapore

E-mail: info@apcb2007.com

Website: www.apcb2007.com

8th Annual Infectious Disease Congress

August 2-12, 2007

At: Copenhagen, Denmark

Website: <http://www.continuingeducation.net>

Contact Name: Sandra Barnhart

Continuing Education Inc.

5700 4th St. N

St. Petersburg FL 33703

727-526-1571 fax 727-527-3228

World Sleep 07 (The 5th Congress of the World Federation of Sleep Research and Sleep Medicine)

September 2-6, 2007.

At: Cairns, Queensland, Australia

Ph: (+61 2) 9254 5000

E-mail: info@worldsleep07.com

Website: www.wfsrsm.org

1st International Congress on Exacerbations of Airway Disease (ICEAD)

October 4-7, 2007

At: Ritz-Carlton Hotel, San Juan, Puerto Rico

Contact: The Macrae Group

E-mail: TheMacraeGroup@comcast.net

20th Annual Congress of the European Society of Intensive Care

October 7-10, 2007

At: The ICC, the Berlin Congress Centre, Berlin, Germany

Website: www.esicm.org

NAPCON 2007

November 22-25, 2007

At: PGIMER, Chandigarh

Contact: Dept. of Pulmonary Diseases, PGIMER, Chandigarh

Website: www.napcon2007.com

6th Annual Pulmonary, Infectious Disease and Sleep Disorders Conference

December 24-31, 2007

At: Honolulu, Hawaii

Contact: Continuing Education Inc.

Phone: 727-526-1571

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**13th Annual Conference of the
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