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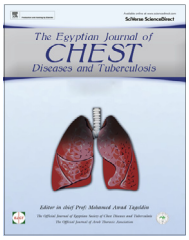

ORIGINAL ARTICLE

Diagnostic utility and complications of flexible fiberoptic bronchoscopy in Assiut University Hospital: A 7-year experience

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Abstract *Background:* Few studies with small number of patients reported their experience with flexible fiberoptic bronchoscopy (FFB). We aimed to report our 7-year experience with the diagnostic yield and complications of FFB at Assiut University Hospital.

Materials and methods: A retrospective review of bronchoscopy reports and corresponding patients' charts over 7 years from January 2006 to December 2012 performed at the Department of Chest Diseases, Assiut University Hospital, was done. Indication for procedures, suspected diagnosis, final diagnosis, and complications were reported.

Results: Of 3980 bronchoscopies, 3660 (92%) were diagnostic. Mean age was 45 ± 18 years and 68% were males. Malignancy and infection, including tuberculosis (TB), were the 2 main indica-

Abbreviations: AFB, acid fast bacilli; aPTT, activated partial thromboplastin time; BAL, bronchoalveolar lavage; BB, bronchial biopsy; BOOP, bronchiolitis obliterans organizing pneumonia; BTS, British Thoracic Society; BW, bronchial wash; CT, computed tomography; EBUS, endobronchial ultrasound; FFB, flexible fiberoptic bronchoscopy; ICU, intensive care unit; ILD, interstitial lung disease; IM, intramuscular; PT, prothrombin time; PTB, pulmonary tuberculosis; TB, tuberculosis; TBB, transbronchial biopsy; TBNA, transbronchial needle aspiration; UIP, usual interstitial pneumonia.

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tions for FFB (47% and 23.8%). The overall diagnostic yield was 67%. A total of 1690 bronchoalveolar lavage (BAL), 1303 brushing, 188 transbronchial biopsies (TBB), and 645 bronchial biopsies (BB) were performed. Malignancy was confirmed in 70% of suspected cases. Tuberculosis was diagnosed in 58.5% of suspected cases, whereas bacterial pneumonia was diagnosed in 48.5%. Bronchoscopy diagnosed 38.4% of patients with interstitial lung disease. The diagnostic yield was 55% for sarcoidosis and 33% for usual interstitial pneumonia. The overall complication rate was 1.61%. Mortality rate was 0.05%.

Conclusions: Our results confirm that flexible fiberoptic bronchoscopy is a valuable diagnostic tool, with a low rate of complications, particularly in patients with lung cancer. The diagnostic yield in our locality is almost similar to that reported in other series.

Introduction

The flexible fiberoptic bronchoscopy (FFB), has greatly enhanced the diagnosis and understanding of lung diseases, and has evolved into the most commonly used diagnostic procedure in pulmonary medicine [1]. Several medical centers all over the world have discussed their experience with the diagnostic yield of FFB, with controversial results [1–4]. In the developing countries however, there have been few reports [5,6] of using bronchoscopy as a diagnostic procedure. Moreover, these reports are either descriptive or had a relatively small number of patients. Therefore, the aim of this study is to report our 7-year experience with the diagnostic yield and complications of FFB at Assiut University Hospital, a tertiary University hospital in Upper Egypt.

Methods

Patients

Assiut University hospital is a large tertiary referral hospital in Upper Egypt, to which many patients are referred for diagnostic bronchoscopy. All consecutive FFB were retrospectively reviewed using bronchoscopy reports and corresponding patients' charts over 7 years from January 2006 to December 2012, at the department of Chest Diseases, Assiut University Hospital. The study was approved by the hospital's ethics committee and a written consent was obtained from each patient prior to the procedure.

Each FFB was completed by a pulmonary physician or a fellow under a consultant's supervision. Demographic data were recorded including: age, gender, indication for procedure, pre-medication, radiographic findings, suspected diagnosis, bronchoscopy findings, final diagnosis, and complications of bronchoscopy. Suspected diagnosis was based on clinical and radiographic findings whereas final diagnosis was based on microbiological and histopathological diagnosis. Patients included outpatients as well as inpatients from our department as well as different departments of the hospital.

Bronchoscopy procedure

Patients were maintained without oral intake for at least 6 h prior to the procedure. Platelet count $>60{,}000/\mu L$ was ensured, along with normal prothrombin time (PT) and activated partial thromboplastin time (aPTT) which were required if transbronchial biopsy, endobronchial biopsy, or brushings were performed. The procedure was performed using a flexible fiberoptic bronchoscopy (Pentax SB 15; Pentax, Japan) under local anesthesia, via nasal or oral route with the patient lying in supine position. In the situation of unstable or intubated patients, the procedure was performed in the intensive care unit (ICU). Subjects were premedicated with 0.4 mg IM atropine 30–45 min prior to the procedure, except patients with contraindications. Just before insertion of the bronchoscope, 2–3 ml of 2% viscous lidocaine was applied to the nose. Midazolam (0.07 mg/kg) was administered intravenously in incremental doses to achieve conscious sedation, before and after the insertion of the bronchoscope.

All patients were supplemented with oxygen through nasal cannula and were continuously monitored with electro-cardiogram and pulse oximetry. Liquid xylocaine 2% was administered through the bronchoscope directly to the vocal cords and the bronchial tree as needed.

During the bronchoscopic procedure, diagnostic materials were obtained by bronchial washings (BW), bronchoalveolar lavage (BAL), transbronchial needle aspiration (TBNA; lymph nodes or lung), bronchial brushings, endobronchial biopsy or transbronchial biopsy (TBB), as decided by the bronchoscopist on a case-by-case basis. Bronchial secretions or washings were obtained commonly during most procedures by instilling 10 ml or more of sterile isotonic NaCl solution into the bronchus of interest followed by immediate aspiration into a trap. Specimens were sent to the laboratory for bacterial, fungal or viral culture, and for cytological analysis. For bronchoalveolar lavage, 3×50 ml of pyrogen-free-sterile 0.9% NaCl solution was instilled into the middle lobe or lingual in patients with diffuse disease and in patients with heterogeneous disease into the segment with the most prominent radiological infiltrate. BAL fluid was recovered by suction or gravity. Centrifuged BAL preparations were routinely stained with Giemsa and special stains (e.g., silver methenamine for detection of fungi or *Pneumocystis jiroveci)*. Ten milliliter of BAL fluid was sent for bacterial, mycobacterial, and fungal culture and 5–10 ml for viral culture. The rest was sent for cytology analysis. Mouth flora and Candida grown from BAL were not regarded as relevant pathogens and therefore not included in the analysis.

Transbronchial bronchial biopsy (TBB) was performed blindly and as per the international recommendations [7]. Biopsy specimens were fixed in formaldehyde solution, embedded in paraffin, and sectioned. Post-bronchoscopy chest X-ray was performed routinely 4 h after TBB. In situations where

Table 1 Diagnostic indications of bronchoscopy.

Indication	No. of patient	(%)
Suspected malignancy	1720	(47.0)
Suspected infection	870	(23.8)
Tuberculosis	513	(14.0)
Pneumonia	357	(9.8)
Hemoptysis	519	(14.0)
Abnormal radiological finding	390	(11.0)
Interstitial lung disease	294	(8.0)
Atelectasis	96	(3.0)
Others*	161	(4.2)
Total	3660	(100.0)

* Others; persistent cough, pleural effusion, evaluation of a paralyzed hemidiaphragm.

TBNA has to be performed, TBNA was performed prior to other procedures such as brushing, BW, and TBB, to avoid contamination. A 13-mm 21-gauge cytology needle (NA-2C-1; Olympus Corporation) was used for TBNA. Specimen handling, cytopathology evaluation, and technical details of TBNA have been described elsewhere [1]. Cytological specimens were stained routinely by the Papanicolaou technique and histological specimens were stained with hematoxylin and eosin. All the specimens were interpreted by a cytopathologist. Rapid onsite pathology was not available. All subjects were kept under constant supervision for post-bronchoscopy complications including death, for 4 h following the procedure. Complications were categorized as minor or major according to the BTS guidelines [7].

Statistical analysis

Data collected were encoded into MS Excel 2010 for windows XP professional. Age was presented as mean ± standard deviation. Due to the descriptive nature of this study, all other data were presented as percentages (%). Calculations and graphs were done using Excel.

Results

A total of 4100 patients underwent FFB procedures. Eighty-eight patients (2%) were excluded due to incomplete follow up data. Only few number of patients, 32 (0.01%) underwent bronchoscopic procedures at the ICU, were also excluded.

Of 3980 bronchoscopies, 3660 (92%) were diagnostic and 320 (8%) were therapeutic. Only results of diagnostic bronchoscopies are shown in this study. The mean age was 45 ± 18 years and 2487 (68%) were males. Cigarette smokers accounted for 66% of the studied patients. Indications for diagnostic bronchoscopy are shown in Table 1.

Most of the diagnostic bronchoscopies were performed for suspected malignancy (47%), followed by suspected infection (23.8%). The overall diagnostic yield was 67% (2453/3660). Of 3660 diagnostic bronchoscopies, a total of 1690 BAL, 1303 brushing, 188 TBB, and 645 BB were performed.

Of 1720 patients suspected to have malignancy, 1204 (70%) patients were confirmed, using various bronchoscopic procedures, where BB were positive in 800 (66.4%), brushing in 651 (54%), and BAL in 513 (42.6%) patients. Endobronchial malignancies were diagnosed in 845 patients (94.7%) out of 892 who had a macroscopically visible tumor. Malignancy was proved by other investigations (e.g. CT-guided biopsy, surgical biopsy) in 203 (11.8%) patients. In the remaining 313 (18.2%) patients, an alternative diagnosis was found, which included infection, granulomatous disease, interstitial pulmonary disease, aspiration pneumonia, and nonspecific inflammation.

Pneumonia was suspected in 357 (9.8%) patients, while 513 (14%) were suspected for active TB. Bacterial pneumonia was diagnosed microbiologically in 173 (48.5%), *P.* jiroveci pneumonia in 5 (1.4%), and Candida species in 28 (7.8%) patients. In 18 (5%) patients, an alternative diagnosis was confirmed, mainly TB and 5 patients had interstitial lung disease (ILD). In the remaining 133 (37.3%) samples, no organisms were isolated.

Overall, FFB was diagnostic of pulmonary TB in 300 (58.5%) patients. On the other hand, TB was excluded in 213 (41.5%) patients, out of whom 87 (17%) patients were treated for pneumonia. BAL of 126 (42%) samples (38 of them (30%) were smear-negative sputum) were positive with Acid fast bacilli (AFB) stain whereas, BAL culture was positive in 165 (46.2%) samples. TBB revealed a histopathologic diagnosis consistent with TB granuloma in 23 (6.4%) patients.

For patients bronchoscoped due to hemoptysis, 228 (44%) were confirmed to have existing pathology; 126 with malignancy, 34 with pneumonia, 26 with chronic bronchitis, 21 with tuberculosis, 16 with nonspecific inflammation, and 5 with granulomatous disease.

Out of 390 patients with abnormal radiologic finding, 294 had ILD whereas 96 had atelectasis. (Table 1) FFB confirmed the diagnosis of ILD in 113 (38.4%) patients via the use of TBB. Diagnostic yields of 48/145 (33%), 21/54 (39%), 21/45 (47%), 14/30 (46.7%), 6/11 (55%), and 3/9 (33.3%), were re-

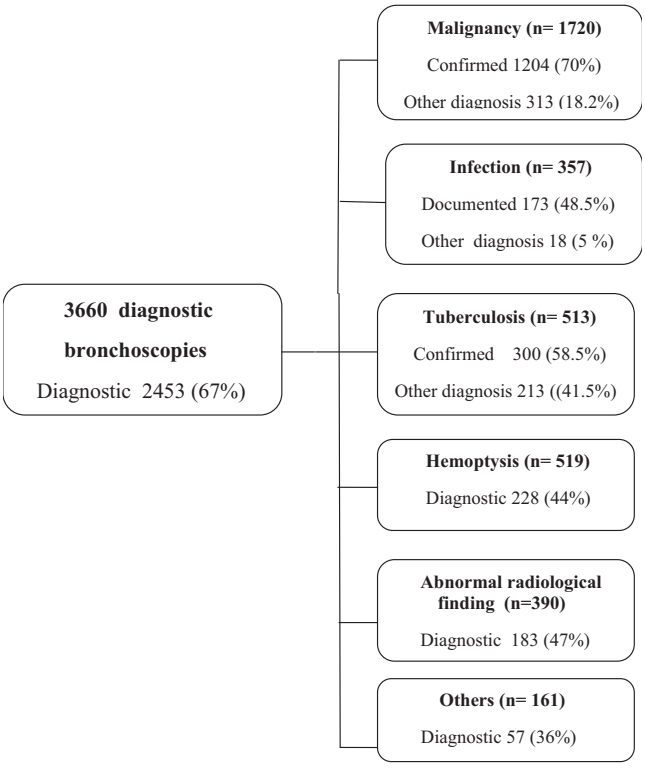

Figure 1 Diagnostic yield of flexible fiberoptic bronchoscopy.

Table 2 Complications of diagnostic bronchoscopy.

Complication	No. of patient	(%)
Minor		
Bronchospasm	22	0.6
Epistaxis	4	0.11
Laryngospasm	9	0.24
Total	35	0.95
Major		
Pulmonary hemorrhage*	4	0.11
Pneumothorax	8	0.22
Respiratory failure	12	0.33
Total	24	0.66
Death	2	0.05

* Pulmonary hemorrhage; more than 50 ml.

ported for patients with UIP, non specific interstitial pneumonitis, bronchiolitis obliterans organizing pneumonia (BOOP), hypersensitivity pneumonitis, sarcoidosis and eosinophilic pneumonia, respectively.

For those 96 patients with atelectasis, 70 (73%) were confirmed to have existing pathology; 48 with malignancy, 11 with mucus plugs or impacted secretions, 7 with nonspecific inflammation, and 4 with granulomatous disease. A summary of the diagnostic yield of FFB is given in Fig. 1. Complications of bronchoscopy are shown in Table 2.

Discussion

In this study, a retrospective analysis of 3660 consecutive diagnostic bronchoscopies was performed at a tertiary care University hospital in Upper Egypt over a period of 7 years. To the best of our knowledge, this work represents the largest ever study evaluating the diagnostic yield and complications of FFB in a developing or Middle East country through a 7-year period.

Although the indications for diagnostic bronchoscopy remained the same, different regions may have different priorities. Our findings are in agreement with those reports from Western countries [8], where malignancy was the most common indication for bronchoscopy. On the contrary, our results disagree with those of neighboring countries [2,9] where infection was the most common indication for bronchoscopy, followed by malignancy. Suspected malignancy, being the most common indication for FFB in our records, can be explained by the observations that 68% and 66% of our cohorts were males, and cigarette smokers, respectively. The current study confirms the importance of FFB in the diagnosis of different pulmonary diseases. Our results revealed an overall diagnostic yield of 67% and a yield of 70% for detecting malignancy.

Several authors had reported the diagnostic yield of FFB, with controversial results. Joos et al. [1] and Alzeer et al. [2] reported yields of 57% and 58%, among 430 and 592 patients, respectively. Whereas, Bhadke et al. [5] and Fein et al. [4] reported yields of 75% and 86%, among 120 and 14 patients, respectively. These discrepancies might be explained by differences in patients' numbers and demographics, methods of laboratory and pathologic diagnoses, and statistical analysis. The relatively higher yield of FFB in the present study could be explained by the fact that our Department caters to millions of population all over Upper Egypt, hence the resulting pressure on the facility leads to the use of FFB in patients who are more likely to have an underlying pathology.

Our results showed an overall 70% diagnostic yield of FFB for detecting malignancy, which increased to 94.7% for macroscopically visible tumors. Positive rates of 66.4%, 54%, and 42.6% were reported for BB, brushing, and BAL, respectively. These data are in concordance with those published by Schreiber et al. who conducted a systematic analysis of 30 studies of patients with central cancer lesions. Endobronchial biopsies provided the highest sensitivity (0.74; 20 studies), followed by brushings (0.59; 18 studies) and washings (0.48; 12 studies). The overall sensitivity for all bronchoscopic modalities combined, was 0.88 for centrally located endobronchial disease (14 studies) [10].

Our data revealed that bacterial pneumonia was diagnosed in 48.5% of patients bronchoscoped for suspected infection. Other studies reported similar results [1,2,5], yet with smaller numbers of enrolled patients. The infection due to Candida species has become more frequent in immunocompromised patients like those with HIV, diabetes mellitus, and those on immunosuppressive drug and corticosteroids. We reported fungal infection due to Candida species in 28 (7.8%) patients. These patients were diabetic and had cavitary lesion(s) on chest radiography.

Many studies [1,2,11,12] had established the utility of FFB in the diagnosis of pulmonary TB. FFB can be particularly useful in patients with smear-negative or absent sputum, and in those with endobronchial TB [11–13]. Shin and coworkers [14] reported sensitivity, specificity, positive predictive value, and negative predictive value for FFB of 75.9%, 97.2%, 95.3%, and 84.3%, respectively, for the rapid diagnosis of active pulmonary TB (PTB). Recently, Quaiser et al. [15], concluded that FFB is a useful tool in diagnosing sputum smear-negative PTB, and identifies individuals at a higher risk of disease progression at an early stage, despite not meeting routine bacteriological criteria for confirmation of PTB. Our data support the usefulness of FFB in the diagnosis of pulmonary TB. We found an overall diagnostic yield of 58.5%. BAL samples were positive with AFB stain and culture in 42% and 46.2% patients, respectively. Notably 30% of positive samples for AFB stain were for patients with smear-negative sputum.

With regard to patients with ILD, diagnostic yields of 33%, 47%, and 55%, were reported for patients with UIP, BOOP, and sarcoidosis, respectively. Our data are in agreement with those reported by several authors [2,9,16], and confirm the importance of transbronchial biopsy in diagnosing ILD. In patients with suspected ILD, more invasive diagnostic procedures such as thoracoscopic or open lung biopsies could be avoided and therefore, limiting the costs and morbidity.

Bronchoscopy-related complications were rare in the current study. We reported rates of 0.95%, 0.66%, and 0.05% for minor, major complications, and mortality, respectively. Notably, pneumothorax occurred in 0.22%, and was associated exclusively with TBB. Previous reports had shown that the rate of pneumothorax varied between 0.08% and 5% [17]. This low rate of pneumothorax is better than that reported by other studies [2] and supports those studies which

concluded that TBB without fluoroscopy is a safe procedure particularly in sarcoidosis and diffuse neoplasm [18].

Recently, a survey was conducted by the Japan Society for Respiratory Endoscopy [19] for the safety of endoscopy. The total number of diagnostic FFB procedures performed was 103978, and 4 patients died (0.004%). The complication rate according to lesion ranged from 0.51% to 2.06%, with the highest rate being observed in patients with diffuse lesions. The complication rate according to the procedure ranged from 0.17% to 1.93%, with the highest rate being observed in patients who underwent forceps biopsy. Overall, our reported rates of complications and mortality are more favorable than those reported in the literature [2,20] and confirm the safety of FFB and its routine procedures.

The last decades have seen introduction of several diagnostic innovations in the bronchoscopy suite, such as endobronchial ultrasound bronchoscopes, EBUS [21], navigation systems [22], hot biopsy forceps, and cryobiopsy [23]. These modalities were introduced with the aim to increase the diagnostic yield of bronchoscopy. However, such innovations are mainly limited to specialized centers and do not reflect the application of this technique in routine clinical practice [1].

Overall, findings of the current study confirm our belief that the diagnostic yield of FFB and its routine techniques are high, particularly in lung cancer patients and hence they should be continued to be optimally applied in patient management, particularly in developing countries. Although cost analysis was not carried out in the current study, our results could have important implications with regard to bronchoscopic management of patients with various respiratory diseases. The optimum use of conventional bronchoscopy and its techniques in the hands of experienced bronchoscopiests, with the adherence to the international guidelines for performing these techniques [7,24] will improve diagnostic outcomes of those patients with the least morbidity and mortality, employing better therapeutic strategies, and thus improving the overall management of those patients.

Possible limitations of this study such as data maybe biased selection, is related to its retrospective nature. Further prospective studies in the future may be needed to highlight the new diagnostic bronchoscopic interventions.

Conclusions

To conclude, results of this study confirm that flexible fiberoptic bronchoscopy is a valuable diagnostic tool, with a low rate of complications, particularly in patients with lung cancer. The diagnostic yield in our institution is almost similar to that reported in other series.

Competing interests

The authors declared no conflicts of interest.

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