Bronchoscopy, indications, safety and complications

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ABSTRACT

Objectives: To review the safety, indications, complications of flexible fiberoptic bronchoscopies performed at university teaching hospital, and to correlate the bronchoscopic findings with radiology, histology, and history of smoking.

Methods: A total of 124 consecutive flexible fiberoptic bronchoscopies were reviewed in the last 3 years. A special form that contains personal data, indications, premedications, route of insertion, bronchoscopic findings, and complications in subjects-undergone bronchoscopy was completed.

Results: A suspicion of pulmonary tuberculosis (31%), lung mass (19%) and hemoptysis (18%) were the most common indications. Hypoxemia (14%) during procedure and pneumothorax post procedure were the most common complications. Mortality rate was 0%. For 57% of subjects who had histology, lung cancer (44%), and tuberculosis (15.5%) were commonly found. Lung cancer (72%) and tuberculosis granuloma (18%) were mainly responsible for narrow segments during bronchoscopy. A radiological tumor like mass was found histopathologically to be as lung cancer in 86% and as tuberculous granuloma in 5%. About 84% of lung cancer patients were either smokers (57%) or ex-smokers (27%) as compared to only 35% in smokers and 13% in ex-smokers in patients without lung cancer, P-value<0.01.

Conclusions: Flexible fiberoptic bronchoscopy can be performed safely whenever indicated. Complications occurred were minor and self limiting. Appropriate preparation, and close supervision and adherence to the protocol were essential for a successful and safe procedure.

Keywords: Bronchoscopy, indication, complication, safety.

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Flexible fiber optic bronchoscopy (FFB) was introduced by S. Ikeda in 1964. Since then bronchoscopy has become an important diagnostic and therapeutic tool for management of chest disease. The indications of bronchoscopy are numerous and usually based on the presence of respiratory symptoms and abnormal chest radiograph or both.[1] Common indications include peripheral pulmonary nodule, hemoptysis, chronic cough, pleural effusion, recent or unresolved pneumonia, pulmonary tuberculosis, and lung collapse.[2-9] Bronchoscopy can be used in the intensive care units as an aid for intubation, positioning of double lumen tubes for surgery, and in the diagnosis of ventilation-assistance.[7-10] In areas with high prevalence of pulmonary tuberculosis, bronchoscopy and bronchoscopic lung biopsy (BLB) (transbronchial lung biopsy) was found to be very useful for diagnosis of pulmonary tuberculosis especially in the presence of radiological infiltration and negative sputum smears for acid fast bacilli.[8]

Several studies have shown that bronchoscopy is a safe procedure that carries very low mortality rate that ranges from 0% to 0.1%.[11,12] Recently, bronchoscopy was found to be performed safely following a recent myocardial infarction as long as the patient doesn't have active ischemia during procedure.[13] However, complications may occur

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either during the procedure or post bronchoscopy. Among the complications that have been reported were hypoxemia, bronchospasm, seizure, laryngeal spasm, pneumothorax, septicemia, airway obstruction, respiratory arrest, hemorrhage, arrhythmia and cardiovascular collapse.[14-18]

In our institution we usually perform about 50 to 60 FFB's per year. We believe this is the first in western Saudi Arabia to evaluate the use of FFB. The objectives of this study were to assess the safety or otherwise, indications and complications of FFB at our university hospital and to correlate the bronchoscopic findings with the radiological and histological data and with history of smoking.

Methods. ***Data collection.*** In this study we documented a total of 160 consecutive bronchoscopies that were performed in the last 3 years (January 1997 to January 2000) at the King Abdulaziz University Hospital (KAUH) Jeddah, Saudi Arabia. Thirty-six patients undergoing FFB were excluded from the study because of insufficient data. The FFBs were performed by two attending physicians (OA & MK) from KAUH. Each FFB report, completed by attending physicians and a resident in training contained, the age, sex, indications, history of smoking, route of insertion, premedications used, anesthesia, types of procedure carried out (brushings, washings, bronchoalveolar lavage, endobronchial biopsy and bronchoscopic lung biopsy), bronchoscopic findings, associated disease and complications. There was a standard protocol for filling out each bronchoscopy report and for observing the patients for post bronchoscopy complications. All patients were observed for possible complications including death until discharge.

Procedure protocol. All subjects undergoing bronchoscopy should sign an informed consent. They were maintained without oral intake for almost 6 hours. All subjects should have normal prothrombin time, partial thromboplastin time and platelets count > 60,000/**µ**l particularly if the patient will have BLB, endobronchial biopsy or brushing. Arterial blood gases analysis was also performed.

Atropine at dose 0.6 mg, and pethidine at dose of 30 mg to 75 mg were both given intramuscularly to each patient 30 to 60 minutes before procedure. During the bronchoscopy oxygen saturation was maintained through continuos pulse oximeter and supplemental oxygen through nasal canula at 2-6L/ minute was provide to each subject to maintain oxygen saturation >90%. Blood pressure was measured by dinamap pre and post bronchoscopy or as necessary if indicated. All subjects were continuously monitored with 12 leads electrocardiogram tracing. Rippon soaked with Lidocaine 10mg/ml was placed and packed into nostrils for 10 minutes before procedure. Lidocaine with spray 10mg/ml for pharynx and hpopharynx with injection of 20 mg/ml transorally for the larynx. Midazolam (2-5mg) or diazepam (5-10 mg) was administered intravenously and titrated as needed to achieve good sedation. Bronchoscopy was performed in the supine position and in most cases through transnasal route, with exception in the presence of nasal airway obstruction due to (narrow nostrils, gross adenoids) when a guard was used. During bronchoscopy, additional anesthesia for the bronchial tree was administered through the bronchoscope by directly spraying 1 ml, aliquots of 2% lidocaine on the bronchial tree up to maximum dose of 20 ml.

Brushing was performed by wedging the bronchoscope in the desire segments. The brush forceps was passed into the bronchus to reach the affected segments. The brush was drawn to and from several times, removed and run over glass plates from material to be examined pathologically and bacteriological. Bronchial wash or the small lavage was performed by wedging the bronchoscope in the desired lung segments and performing serial wash and suctioning of 20-ml aliquots of sterile saline solution. Transbronchial biopsy was performed blindly without fluoroscopy guide, as it was not available in our institution. The bronchoscope was wedged in the desire segments with abnormal radiological finding. The biopsy forceps was then passed into the bronchus to reach the lung periphery. The forceps were withdrawn for 2-3 cm and opened. The opened forceps was advanced quickly and carefully for 1 to 2 cm during expiration, closed and then removed from the bronchoscope to obtain the specimen. This procedure was repeated 3 to 5 times to obtain adequate samples.

Data management and statistical analysis. Data was entered on computer using database and verified for coding errors. Statistical analysis was carried out using SPSS package. Descriptive statistics (ie. mean, median, standard deviation, range, standard error, and frequencies) were performed to describe the studied variables. Chi-square test was used as appropriate. Level of significance was set to be <0.05 throughout analysis.

Results. A total of 124 bronchoscopies were studied and their characteristics were described. Male patients comprised 69%, and the overall mean age was 49.9 years $\pm$ 17.7. About 45% were Saudis. Over 50% of patients were either current smokers (14%) or ex-smokers (17%). About 57% of cases had no associated illnesses, while 29% of them had either Chronic Obstruction Airway Disease (COPD) (18.5%), Diabetes Mellitus (10.5%). The vast priorities (98%) of bronchoscopies were carried out for diagnostic purposes and only few (2%) were carried out for therapeutic purposes. Table 1 shows the most frequent indications for bronchoscopy in our

Table 1 - The most frequent indications for bronchoscopy based on clinical and radiological presentations.

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Indication	No (%)
Diagnostic	
Pulmonary infiltration (suspected TB or other infection)	38 (31)
Lung mass	24 (19)
Hemoptysis	22 (18)
Pulmonary fibrosis	10 (8)
Atelectasis	7 (6)
Pneumonia	6 (5)
Cough	3 (2)
Sarcoidosis	2 (2)
Aspergillosis	2 (2)
Lung abscess	2 (2)
Therapeutic	
Retained secretions	3 (2)

Table 2 - Frequency distribution of cases for bronchoscopic findings.

Findings*	No (%)
Inflammatory changes	79 (64)
Narrow segment	38 (31)
Tumor like mass	23 (18.5)
Normal	17 (14)

*More than 1 type of finding can be seen in the same patient.

Table 3 - Percentages and range of abnormal findings of investigations before the procedure.

Investigation	Abnormal %	Range of abnormality
Platelets	9	91-149
PT	16	1.2-1.4
PO2	13	6.2-7.9
PCO2	12	6.17-7.93

PT=Prothrombin time, PO2-Arterial oxygen pressure, PCO2-Carbon dioxide pressure

Table 4 - Percentage of complications during bronchoscopy.

Complication	No (%)	Outcome
Hypoxemia	17 (14)	Transient and improved with O2 supply during and post procedure
Sinus tachycardia	6 (5)	Subsided with sedation
Bronchospasm	4 (3)	All inhaled B2 agonists
Bradycardia	2 (2)	Transient, no therapy was given
Apnea	2 (2)	Transient, improved with stimulating the patients to breath
Fits	1 (1)	Subsided with IV diazepam, FFB terminated
None	92 (74)	
Total	**124**	

Table 5 - Percentage of complications post-procedure.

Complication	No (%)	Outcome
Pneumothorax	5 (4)	3 required tube thoracostomy
Sepsis	1 (1)	Treated with anitbiotics
Death	0 (0)	
None	118 (95)	

Table 6 - Frequency distribution of post bronchoscopy +ve histopathology cases.

Bronchoscopy findings	No. (%)
Lung cancer	31 (44)
TB granuloma	12 (17)
Chronic non specific inflammation	9 (13)
Squamous metaplasia	5 (7)
Usual interstitial pneumonia	5 (7)
Chronic bronchitis	4 (6)
Desquamative interstitial pneumonia	2 (3)
Lupus pneumonitis	1 (1)
Sarcoidosis	1 (1)
Pneumonia	1 (1)
Total	**71 (100)**

patients.

Brushing and bronchial washing were carried out in about 90% of patients and 82% had biopsy. Only 19 (15%) patients had BLB. Table 2 shows the bronchoscopic finding. Table 3 shows the percentage of abnormal findings of investigations carried out before the procedure. Table 4 shows the complications during procedure. About 80% of cases had no complications during procedure. In addition, the vast majority (95%) had no complications post-procedure. Five patients (4%) had pneumothorax post procedure, all of them had BLB as shown in Table 5. Histology was carried out for 71 (57%) patients. Table 6 shows the frequency distribution of post bronchoscopy +ve histopathology cases.

Cytology was carried out for 23 (18.5%) patients with lung cancer. Squamous cell carcinoma was found in 61%, small cell in 22% adenocarcinoma in (13%), and alveolar cell in 4%. Smoking history was compared among patients with histopathology positive for lung cancer versus those with a negative one. About 84% of lung cancer patients were either current smokers (57%) or ex-smokers (27%) as compared to only 35% and 13%, among patients without cancer, P-value<0.01. On the 19 patients who had BLB, 4 (21%) had hypoxemia during procedure. Another 5 patients (26%) had pneumothorax post procedure. No other complications were encountered in this group. A bronchoscopic finding of narrow segments was associated with a histopathology of lung cancer in 72%, TB. Granuloma in 14%, and chronic nonspecific in 7%.

Inflammatory changes finding on bronchoscopy were associated with a histopathology of lung cancer in 41%, TB. Granuloma in 18%, and other histopathologic findings in the rest.

A radiological finding of tumor like mass was confirmed by histopathology as lung cancer in 86%, as tuberculosis granuloma in 5% and as chronic nonspecific inflammations in 5% of such cases following FFBs. While 5 out of 10 patients who had abnormal Arterial Oxygen Pressure (PO2) and 5 out of 9 patients who had abnormal Carbon Dioxide Pressure (PCO2) experienced significant hypoxemia during procedure, none of those with either or both abnormalities had any complications post-bronchoscopy. Seven out of 23 cases with existing COPD (30%) experienced hypoxemia and 2 cases experienced sinus tachycardia during procedure. None of the 13 diabetics had hypoglycemic attacks during or post-procedure. None of those patients with low platelet count (lowest 91 thousand) or prolonged PT (highest 1.4) had experienced any bleeding tendency during or post procedure. The male patient who had fits during the procedure recovered completely.

Discussion. The safety of FFB has been documented from different parts of the world.[15,16] The mortality rate due to the procedure is exceedingly low (from 0-0.01%). Although Dreisen et al[17] reported a higher mortality rate among their 205 FFBs of 0.5%. The mortality obviously depends on the scrutiny of selection of patients for the procedure and the experience of the bronchoscopist and the facilities available. Our rate of major complications compares favorably with those from other studies.[16,18,19] Our pneumothorax rate (4%) compares with their pneumothorax rates of 0.16%, 2% and 30% (with hemorrhage). We had no pulmonary hemorrhage or respiratory failure compared with a rate of 0.32% of these two major complications[16] and a 5% rate of major complications by Dreisen et al.[17] Our pneumothorax rate is due in part of the lack of fluoroscopy during BLB, and that we had in our series a higher percentage of BLB (15.5%) compared with 4% in another study.[16] Minor complications in our study included hypoxemia and sinus techycardia as the most common followed by bronchospasm. Our rate of hypoxemia (14%) and techycardia (5%) compared with (42%) and (15.5%) by Davies et al.[20] Furthermore, hypoxia has been a recognized complication both of transoral and transnasal FFB for at least 25 years.[21,22] Dysrrhythmias have also frequently been described,[23] we had none. Bronchospasm may be prevented by the inhalation of four puffs of 0.02-mg ipratropium bromide 15 minutes before FFB.[24] Our mortality rate was 0%; but a more realistic figure of 0.01% was quoted by Credle et al[15] after reviewing 24,521 FFBs performed by 250 physicians. This although absolute contraindications to bronchoscopy are limited to life-threatening arrhythmia or refractory hypoxemia with relative contraindications of increase risk of bleeding during biopsy.[25]

Our top four indications for FFB were pulmonary infiltration in the chest x-ray, lung mass, hemoptysis and interstitial fibrosis in that order, which constituted 75% of the total. This compares with 52% Fibs performed for suspected infection in another study.[16] Of the 124 patients in our series, about one third (38 patients=31%) had FFB for suspected TB. The diagnosis was confirmed in 28 patients either by TB granuloma in the histology of transbronchial or endobronchial biopsy (12 patients) and/or positive AFB smear or culture in the lavage fluid (16 patients). This compares with 32.5% bronchoscopic diagnostic yield for tuberculosis in another study.[26] The diagnostic role of FFB in pulmonary tuberculosis has been established especially in countries where the prevalence of tuberculosis is moderately high such as Thailand and Saudi Arabia.[26,27]

The yield of FFB in our series was fairly high and the correlation with radiologically findings and histology was good. This was shown by the fact that of the 38 patients suspected of having TB or other infections, on radiological or clinical grounds, 28 had proven TB by bronchoscopic techniques ie. biopsy or acid fast bacilli (AFB) in the lavage fluid. Furthermore, of the 46 patients who had a lung mass radiologically or hemoptysis, 31 had bronchial carcinoma following FFB. None of our patients underwent an open lung biopsy, as the great majority of them were diagnosed by mean short of open lung biopsy. The well-established link between smoking and lung cancer has been highlighted again, as 84% of lung cancer patients in this series were either smokers or ex-smokers.

All our patients were asked about their fears and concerns before the procedure, and their comments afterwards. Their concern before FFB centered on how the procedure was performed and the type of anesthesia, while their main concern afterwards knew the findings in the table and the results of histology and microbiology or both. Some (about one third) found it unpleasant but none found it very unpleasant. This shows the need to explain to our patients not only why they need FFB, but also how it is performed, and to give them and their relatives the result as soon as possible.[28]

In conclusion, this study shows that FFB is a safe and a useful procedure in diagnosing many chest disease when performed under appropriate conditions, and that it has a high yield and a low rate of complications.

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