

# Flexible fiberoptic bronchoscopy

## Diagnostic yield

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### ABSTRACT

**Objective:** Fiberoptic bronchoscopy is a minimally invasive procedure with a high diagnostic yield. The aim of this study was to document the usefulness of the procedure in the diagnosis of various respiratory disorders in a Middle East country.

**Methods:** Data on all bronchoscopies carried out in Chest Diseases Hospital, Kuwait from January 1996 to December 1998 were retrospectively collected.

**Results:** Out of 968 cases, only 620 (64%) patients had a full follow up. Suspected pulmonary tuberculosis (TB) (51.6%), unresolving pneumonia (16.1%), hemoptysis with a normal chest radiograph (8.4%), lung mass (7.7%) and hilar lymphadenopathy (3.2%) were the most common indications. Eleven percent of patients who underwent bronchoscopy had a normal chest radiograph, the reason being hemoptysis in 75.4%, inhalation injury in 21.8% and suspected upper airway obstruction in 2.9%. In smear negative suspected TB cases, 22.5%

proved to have active disease. Acid fast bacillus was identified in bronchoalveolar lavage, either by smear or culture, in 44 (73.3%) patients with suspected pulmonary TB and in 6 (54.5%) patients with miliary shadows. An underlying cause was identified in 28 (28%) patients with unresolving pneumonia. Ninety-four percent of cases with clinical impression of bronchogenic carcinoma could be diagnosed. Transbronchial biopsy was diagnostic in 79% patients with diffuse parenchymal lung disease. No complications other than transient hypoxemia and controllable bleeding were noticed.

**Conclusion:** Generally, the indications for flexible fiberoptic bronchoscopy remained similar to elsewhere. Unlike western series, the majority of the cases were for the diagnosis of pulmonary infections especially TB.

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Since the development of bronchoscopy a century earlier and the introduction of flexible fiberoptic instrument nearly 4 decades back, a lot of progress has been made in the field of bronchology. We have come a long way in imaging methods, energy transfer, navigation instruments, interventional technology and communication aspects.<sup>1</sup> Flexible fiberoptic bronchoscopy (FFB), an invasive

procedure with a high diagnostic yield and a low complication rate in experienced hands, is a commonly performed procedure in Respiratory Medicine these days and has become an essential, sophisticated and popular tool in this specialty. Moreover, it is considered as a fundamental diagnostic and therapeutic tool in the care of patients admitted in the intensive care units.<sup>2</sup> The

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safety and acceptance of FFB performed in hospitalized and ambulatory patients have been well established by many prospective and retrospective studies.<sup>3-5</sup> Generally, the indications and practice of bronchoscopy remain more or less the same worldwide, but regional differences may be seen in the most common causes for which it is performed.

**Methods.** The Respiratory Unit of the Chest Diseases Hospital is a tertiary referral center in Kuwait. Patients from other hospitals including some of the major regional hospitals are referred here for advanced evaluation of their pulmonary problems including bronchoscopy. All persons seeking entry to Kuwait for a long residency require to get a chest radiograph as a part of the screening process and those with abnormal findings needed further investigations including bronchoscopy.

This study was carried out as a retrospective analysis of patients who underwent bronchoscopy in Chest Diseases Hospital, Kuwait during a 3-year period (January 1996 to December 1998). All these patients were being investigated for a chest related problem. As a prerequisite, all patients had a chest radiograph, complete blood count, and a coagulation profile. In suspected tuberculosis (TB) cases, sputum was examined for acid fast bacilli (AFB) by direct smear. Oxygen saturation was measured before the procedure. Pulmonary function tests, computerized tomography scan of the chest or specific blood tests were carried out depending on the clinical situation. Arterial blood gases were carried out in high risk cases. A written consent was obtained from the patient or relatives. The procedure was properly explained to the patients and continuous monitoring of electrocardiogram (ECG), pulse rate, blood pressure and oxygen saturation was carried out. Pre-medications included atropine in selected cases and sedation with intravenous Midazolam, Alfentanil or a combination in most of the cases. Topical lignocaine was administered as a spray to the oro-pharynx initially and then instilled through the bronchoscope as advanced. Oxygen was given continuously through nasal prongs sufficient to maintain adequate saturation as measured by pulse oximetry. Trans-nasal route was preferred for the introduction of the scope. All procedures were carried out as per international recommendations and the updated version was reviewed subsequently.<sup>6,7</sup> The Olympus fiberoptic bronchoscopes initially and later the Olympus videoscope were used. Findings on visualization of the tracheobronchial tree were reported. Bronchoalveolar lavage (BAL), bronchial brushings and endobronchial or transbronchial biopsies (TBLB) were carried out depending on the clinical situation. These samples were then processed in the microbiology and pathology laboratories. All recorded cases were collected and

checked for the diagnosis, results of examinations and the conclusions drawn. These data were then tabulated and analyzed. Case records of those in-patients from other hospitals referred for bronchoscopy alone were not easy to trace and were not checked. Follow up data of foreign nationals who had this procedure for residency clearance in Kuwait were also not available.

**Results.** A total of 968 cases were carried out in this 3-year period, of which 34% were Kuwaitis and 66% non-Kuwaitis. Full follow up data were available only for 620 (64%) patients, partly due to the reasons mentioned above. There were 471 (76%) males and 149 (24%) females giving a female to male ratio of 1:3.2. Age and gender distribution is given in **Table 1**. Males were common in all age groups. Both males and females were more in  $\geq 41$ -50 year age group. The distribution of males and females in each group was roughly following the whole male to female ratio except with a slight increase in female patients in the 21-30 year group. One hundred and thirty-four (21.6%) patients were  $>60$  years and 423 (68.2%) in 31-60 year age group. A suspicion of active pulmonary TB (51.6%), unresolved pneumonia (16.1%), hemoptysis with a normal chest radiograph (8.4%), lung mass (7.7%) and hilar lymphadenopathy (3.2%) were the most common indications (**Table 2**). Eleven percent of the patients who underwent bronchoscopy had a normal chest radiograph, the reason being hemoptysis in 75%, inhalation injury in 21.8% and suspected upper airway obstruction in 2.9% (**Table 2**). In smear negative suspected TB cases, 22.5% proved to have active disease (**Table 2**). Bronchoalveolar lavage was positive for AFB either by smear or culture in

Table 1 - Age and gender distribution of patients who underwent bronchoscopy.

Age	Male N=471		Female N=149		Total N=620	
	n	(%)	n	%	n	%
<20	9	(1.9)	4	(2.7)	13	(2.1)
21 - 30	40	(8.5)	10	(6.7)	50	(8.1)
31 - 40	98	(20.8)	28	(18.8)	126	(20.3)
41 - 50	114	(24.2)	41	(27.5)	155	(25)
51 - 60	106	(22.5)	36	(24.2)	142	(22.9)
61 - 70	87	(18.5)	24	(16.1)	111	(17.9)
>70	17	(3.6)	6	(4)	23	(3.7)

Table 2 - Radiological presentation and final diagnosis of patients underwent bronchoscopy between January 1996 to December 1998 (N=640).

Radiological presentation and diagnosis	n	(%)
<b>Infiltrates? tuberculosis</b>	320	(51.6)
Active tuberculosis	60	(18.8)
Old tuberculosis	248	(77.5)
Miliary tuberculosis	11	(3.4)
Tuberculosis laryngitis	1	(0.3)
<b>Unresolving pneumonia</b>	100	(16.1)
Pneumonia	72	(72)
Tuberculosis	17	(17)
Bronchiectasis	8	(8)
Carcinoma	2	(2)
Tracheopathic osteoplastica	1	(1)
<b>Lung Mass/ Collapse</b>	48	(7.7)
Lung Cancer	45	(93.8)
Carcinoid	1	(2.1)
Tuberculosis	2	(4.2)
<b>Thoracic lymph nodes</b>	20	(3.2)
Sarcoid	8	(40)
Tuberculosis	6	(30)
Granulomatous disease	3	(15)
Malignancy	3	(15)
<b>Reticulonodular shadows</b>	19	(3.1)
IIP	7	(36.8)
Allergic alveolitis	5	(26.3)
BOOP	3	(15.8)
Normal	4	(21.1)
<b>Pleural effusion</b>	19	(3.1)
Pneumonia	13	(68.4)
Tuberculosis	4	(21.1)
Empyema	2	(10.5)
<b>Normal x-ray</b>	69	(11.1)
Hemoptysis	52	(75.4)
Burns/Inhalational injury	15	(21.8)
Upper airway obstruction	2	(2.9)
<b>Lung abscess</b>	19	(3.1)
<b>Raised diaphragm</b>	3	(0.5)
<b>Fungus ball</b>	1	(0.2)
<b>Peripheral infiltrates</b>		
Pulmonary eosinophilia	2	(0.3)

Table 3 - Positive yield of bronchoscopic procedures in patients with suspected pulmonary and miliary tuberculosis (TB).

Procedure	Pulmonary TB		Miliary TB	
	n	(%)	n	(%)
<b>Positive BAL</b>	44	(73.3)	6	(54.5)
Positive BAL Smear and culture	12	(20)	3	(27.3)
Positive sputum and BAL culture	17	(28.3)	1	(9.1)
Positive BAL culture only	15	(25)	2	(18.2)
<b>Negative BAL</b>	16	(26.7)	5	(45.5)
Positive therapeutic trial	8	(13.3)	1	(9.1)
Positive TBLB*	5	(8.3)	4	(36.4)
Positive FNAC*	3	(5)	-	-

BAL - bronchoalveolar lavage, TBLB - transbronchial biopsies, FNAC - Fine needle aspiration cytology

44 (73.3%) patients with suspected pulmonary TB and in 6 (54.5%) patients with miliary shadows, **Table 3.** Transbronchial biopsy was diagnostic in 36.4% of cases with miliary shadows. Fine needle aspiration cytology (FNAC) under CT scan guidance was a useful additional diagnostic investigation as it yielded a diagnosis in 3 (5%) more cases. In 17 patients, the sputum grew *Mycobacterium tuberculosis*. Therefore, in 27 out of these 44 cases (61.4%) BAL alone contributed to the diagnosis.

In unresolving pneumonia, an underlying cause was identified in 28 (28%) cases (**Table 2**). Forty-five (93.8%) cases with clinical or radiological diagnosis of bronchogenic carcinoma proved to have the same, while 3 cases had another diagnosis (**Table 2**). Transbronchial biopsy in patients with bilateral reticulonodular shadows gave a diagnosis in nearly 79% of cases, majority being IPF. Sarcoidosis, allergic alveolitis, bronchiolitis obliterans organizing pneumonia and eosinophilic infiltrates were the other diagnosis obtained with a similar or different radiological picture (**Table 2**). In 15 patients who underwent bronchoscopy for inhalational injury positive findings were documented only in 13% of the cases. No complications other than hypoxemia and controllable bleeding after biopsies were noticed in these patients.

**Discussion.** The indications for bronchoscopy remain more or less the same since its introduction in 1967. Even though the indications remain the same all over the world, regional differences are evident in the primary concerns. In a survey in the United Kingdom, the preparation and practice of FFB was found to vary among physicians in that country itself.<sup>8,9</sup> In majority of our cases FFB was carried out for the diagnosis of pulmonary infections especially TB, which correlates with the findings from other developing countries but differs from those reports from Western countries.

In an analysis of 300 FFB's in Brompton hospital, bronchogenic carcinoma was the most common diagnosis.<sup>10</sup> Later studies also attest the usefulness of FFB in suspected lung malignancies.<sup>11-13</sup> More recently Seshadri et al<sup>14</sup> from Cleveland Clinic reports on 5448 procedures that were carried out during a 4-year period. Lung cancer, metastatic cancer and granulomatous diseases were the primary diagnosis in the elderly while pneumonia or opportunistic infections were the concerns in the young.

Yaccob et al<sup>15</sup> from Malaysia comments on the high percentage of bronchoscopies carried out for infective respiratory disorders and on the younger age of their patients when compared to the western series. In a report from Ceylon, usefulness of FFB in

the diagnosis of smear negative pulmonary TB was highlighted.<sup>16</sup> Reports from the neighboring countries such as Kingdom of Saudi Arabia and Iraq reaffirms the safety of the procedure.<sup>17,18</sup> Pulmonary TB (31%), lung mass (15%) and hemoptysis (18%) were the most common indications in the Saudi series while 72% of the patients underwent FFB for a neoplastic lesion in the Iraq study.<sup>17,18</sup> Smear negative pulmonary TB (51.6%), unresolving pneumonia (16.1%) and hemoptysis with a normal chest radiograph (8.4%) were the most common indications in our series. Surprisingly, bronchogenic carcinoma was seen in a relatively few patients only.

Fiberoptic bronchoscopy is the most commonly used procedure to diagnose and stage bronchogenic carcinoma.<sup>11,12,19</sup> The approach and yield differ depending on the site, size and nature of the tumor. The yield being highest, between 55 and 85%, for central endobronchial lesions.<sup>19</sup> Though 94% of our cases with a suspected malignancy could be diagnosed for certain by bronchoscopy, the overall presentation was surprisingly low when compared with western series or even with that of our neighbors. Fiberoptic bronchoscopy is useful in the diagnosis and staging of diffuse parenchymal lung diseases (DPLD). The diagnostic yield of TBLB in DPLD varies from center to center. Figures such as 37.7%,<sup>20</sup> 79%<sup>21</sup> and 85%<sup>22</sup> have been reported. In a group of patients with interstitial pattern in chest radiograph and a non-specific diagnosis on TBLB, 75% had a benign course on long term follow up.<sup>23</sup> Milman et al<sup>3</sup> reports that 31% of their patients who had TBLB had DPLD with a diagnostic yield of 66.7%. Only 3% of our patients who underwent bronchoscopy had DPLD. Twenty-one percent of them had a normal lung tissue reported on TBLB while idiopathic pulmonary fibrosis was diagnosed in 36%.

It is relatively easy to collect specimens from the lower respiratory tract through a flexible bronchoscope for microbiologic analysis, especially in immunocompromised patients. The indication for FFB in community acquired pneumonias is quite vague,<sup>24</sup> but has proven its merit in nosocomial infections and ventilator associated pneumonia. In *Pneumocystis carini* infections, with BAL and TBLB, the diagnostic yield approaches 100%.<sup>25</sup> Fein et al<sup>26</sup> reported that over a one year period, 15% of consultations and 8% of bronchoscopies were carried out for unresolving pneumonias. Sixteen percent of our patients had bronchoscopy for unresolving pneumonia and it was a useful investigation to rule out other causes as in nearly three fourth of the cases an underlying cause could not be found. Bronchoalveolar lavage alone was diagnostic in a significant number of our patients with suspected pulmonary and miliary TB. Bronchoalveolar lavage combined with TBLB was

very fruitful in miliary TB. Flexible fiberoptic bronchoscopy is needed for the diagnosis of cases in which tubercle bacilli are not detected in sputum and in some instances for an earlier diagnosis of smear-negative/culture-positive patients.<sup>27-31</sup> Chan et al<sup>32</sup> documents a high diagnostic yield of 93% when combined with all bronchoscopic specimens. Yield of transbronchial biopsy was 17.5% in another study.<sup>33</sup> The yield from brush smears were found to be significantly better when compared to bronchial aspirate and post bronchoscopic sputum smears.<sup>34</sup> In 60% of patients with miliary TB bronchial brushings were positive on direct smear.<sup>35</sup>

In hemoptysis, bronchoscopy is used to localize the bleeding and for minor procedures to control the same. Controversy exists on the timing, whether to perform it while the patient is having hemoptysis or when it subsides a little. As in the former blood obscures vision and a detailed examination may not be possible. In our patients, bronchoscopy was performed as an emergency procedure as soon as the patient gets admitted if the bleeding is moderate to massive. Once the site is localized procedures such as bronchial artery embolization and surgical interventions can be carried out easily if the patients develops life threatening hemoptysis subsequently. Weaver et al<sup>36</sup> reports that localization of bleeding was accomplished in 80% of those with cancer and in 62% with non-malignant cause of hemoptysis. The role of FOB in patients with hemoptysis and a normal or non-localizing chest radiograph is not very clear. Many advice routine bronchoscopy is not necessary in these setting.<sup>37,38</sup> some advocate the same in view of the yield and relative easiness of the procedure<sup>39-41</sup> while others recommend to screen for associated risk factors to reduce the number of scopes at the same time increasing the yield.<sup>42,43</sup> In nearly two thirds of our patients with a normal chest radiograph and hemoptysis a diagnosis of bronchiectasis was made by other means and in 31% of cases a diagnosis could not be reached.

Inhalation of smoke can involve the upper airways, the lower airways or the lung parenchyma. Fiberoptic bronchoscopy is a useful, simple, safe and accurate method in the diagnosis of inhalation injury, determining the type, the site and the extent of damage sustained.<sup>44,45</sup> In our patients who underwent bronchoscopy for inhalational injury, positive findings were documented only in 13% of the cases. Flexible fiberoptic bronchoscopy is a safe procedure and is a valuable tool in the diagnosis and evaluation of different lung problems such as unexplained pulmonary infiltrates, smear negative TB, reticulonodular shadows in chest radiographs, hemoptysis and lung cancer. Unlike western series the majority of the cases were for the diagnosis of pulmonary infections especially TB.

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