ORIGINAL ARTICLE

Flexible fiberoptic bronchoscopy in respiratory care: Diagnostic yield, complications, and challenges in a Nigerian Tertiary Center

OO Adewole, UU Onakpoya[1], AB Ogunrombi[1], A Komolafe[2], AD Odeyemi, S Adeniran[2], G Erhabor

Department of Medicine, Pulmonary Division, Obafemi Awolowo University and Teaching Hospitals, [1]Department of Surgery, Cardiothoracic Division, Obafemi Awolowo University and Teaching Hospitals, [2]Department of Morbid Anatomy and Histopathology, Obafemi Awolowo University and Teaching Hospitals, Ile Ife, Nigeria

Abstract

Introduction: Flexible fiberoptic bronchoscopy (FOB) is a key diagnostic and therapeutic procedure in pulmonology. Experience with fiberoptic bronchoscopy is scanty in most developing countries.
Objectives: The goal of this study was to report our experience and clinical utility of fiberoptic bronchoscopy.
Methods: A review of bronchoscopy requests, services, and reports performed over a 5-year period was performed. Demographic characteristics were extracted. Indications for the procedures, type of bronchoscopic sampling done, final diagnosis, and complications were reported. Sensitivities, specificities, and overall diagnostic yield of the procedures were determined.
Results: About 163 diagnostic bronchoscopies were performed during the study. Ninety-nine patients with complete data were analyzed. Mean age was 54.8 ± 19.2 years, with males constituting the majority, 56.6%. Suspected bronchial cancer and pleural effusion were the main indications for bronchoscopy (33% and 19.1%, respectively). A total of 80, 39, and 99 bronchial washings, brushings, and bronchial biopsies were performed, respectively. Bronchial cancer was confirmed in 51.5% and was diagnostic in 57% of suspected pleural effusion. Pulmonary tuberculosis was confirmed in 50% of suspected cases and additional 8 cases were diagnosed. The overall diagnostic yield of bronchoscopy was 62%. Specificities of bronchial brushing and washing cytology for excluding bronchial cancer were 90.9 and 83%, respectively, and sensitivities of detecting bronchial cancer were 64.3% and 59%, respectively, $P < 0.05$ each. Serious complication occurred in about 1%. There was no mortality.
Conclusions: These results show that FOB is a useful and safe procedure with a low complication rate in our setting.

Key words: Bronchoscopy, challenges, complications, Nigeria yield

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Address for correspondence:
Dr. OO Adewole,
Department of Medicine, Pulmonary Division,
Obafemi Awolowo University Teaching and Teaching,
Hospitals, PMB 5538, Ile Ife, Nigeria.
E-mail: adewolef@yahoo.co.uk

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Introduction

The introduction of flexible fiberoptic bronchoscopy (FOB) has revolutionized the care and management of patients with

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pulmonary diseases. It provides an excellent visualization of the tracheobronchial tree, thereby allowing for both diagnostic and therapeutic procedures. The chief goal of diagnostic bronchoscopy is to obtain representative pulmonary specimens to diagnose different conditions. Since invented, FOB had undergone different revolutions and modifications so as to ensure that appropriate and adequate respiratory specimens are obtained for analysis.[1,2]

Many centers have reported their experiences with FOB under different conditions.[3-5] However, in most developing countries, there are very few reports on the use of FOB in the diagnosis of pulmonary patients. An earliest study done in Nigeria was over three decades ago and the most recent was close to two decades; also both are from only one center.[6,7] Since then, the use of FOB had gone into oblivion, until recently and our center is at the front runner in this in Nigeria. To the best of our knowledge, bronchoscopy service is only available and functional in very few centers.

In this study, we present our experience with FOB over a 5-year period, highlighting the yield of FOB, complications, and commonly encountered challenges including uptake.

Methods

Patients

The hospital is in the Southwestern part of the country with large referrals from different other sites. Bronchoscopy service commenced in the hospital in the late 2008 being done once in a week because of space, mostly done in a general endoscopy suite. The study covered the period from January 2009 until December 2013.

Patients for FOB were either from the ward, outpatients' clinics, or referrals from other hospitals. All patients signed an operation concept form in the presence of eyewitness before the procedure. Patients' demographic and clinical data such as indication for FOB, suspected diagnosis, comorbid states, and premeditation were retrieved from the bronchoscopy record and patients' case note. Other information obtained were bronchoscopic findings, final diagnosis, and complications of the procedure. Suspected diagnosis was based on clinical suspicion whereas the final diagnosis was definitive based on microbiological, cytological, and histopathological findings. The procedure was done by a pulmonary physician, thoracic surgeon, or a postgraduate doctor, usually a senior resident in training with a full complement of endoscopy nurses.

The study was approved by the hospital's Ethics Committee.

Bronchoscopy procedure

A description of our FOB procedure had previously been published.[8]

In summary, the procedure was performed using an FOB (Pentax FB 18X; Pentax, Japan) under local anesthesia, through nasal route with the patient lying in the supine position. Ten percent of xylocaine spray was applied to the nostril, nasopharynx, and oropharynx for topical anesthesia.

Patients were supplemented with oxygen if required through nasal cannula and were continuously monitored with electrocardiogram and pulse oximetry. Liquid xylocaine 2% was administered through the bronchoscope directly to the vocal cords and the bronchial tree as needed.

During the procedure, diagnostic materials were obtained by bronchial washings (BWs), bronchial brushings (BBs), and endobronchial biopsy (EB); other techniques such as transbronchial needle aspiration (TBNA) or transbronchial biopsy (TBB) were done as decided by the bronchoscopist on a case-by-case basis. BW was obtained by instilling at least 10 ml of sterile isotonic NaCl solution into the bronchus of interest followed by immediate aspiration into a collector. Specimens were sent to the laboratory for bacterial culture and cytological study. BB was done by applying the cytology brush in up and down stroke with an unprotected brush. About 3–5 brush samplings were done, smears were made on to a glass slide and transported to the laboratory for analysis. For EB, a re-useable biopsy forceps was used to perform biopsy on a mass or area with marked mucosa changes. TBB was performed blindly.

All the subjects were kept under constant supervision for postbronchoscopy complications for variable period usually for about 1 h following the procedure. Total numbers and severity of complications were noted. Cytological and histological specimens were prepared according to standard guidelines and were read and interpreted by a histopathologist.

Statistical analysis

Data were analyzed using SPSS for Windows, Version 18.0. Chicago, SPSS Inc. Age was presented as mean ± standard deviation. Data were expressed with frequency distribution and percentages. Sensitivities and specificities with 95% confidence interval (CI) were calculated to determine the performances of different cytological methods.

Results

A total of 163 bronchoscopies were done. All the FOBs done during this period were for diagnostic purpose. Sixty-four patients were excluded from the analysis due to incomplete data. Of the 99 patients with complete data, the mean age was 54.8 ± 19.0 years and the majority (56/99), i.e., 56.6% were males. Twenty eight (28.3%), 7 (7.1%), and 6 (6.1%) patients had hypertension, COPD, and diabetes mellitus,

respectively. About 18 (18.2%) patients had a history of cigarette smoking.

Indications for bronchoscopy

Table 1 shows the indications for bronchoscopy in the 99 patients.

The most common diagnostic indication for bronchoscopy was for suspected bronchogenic malignancy (33%), followed by the pleural effusion of undetermined origin (19.2%). Six (6.1%) patients were suspected to have pulmonary tuberculosis (PTB), but had sputum smears which were negative for acid-fast *Bacilli* (AFB).

Diagnostic yield

All the 99 procedures/patients had BW; EB was done in 72 and BB in 39 patients. In addition, 2 and 1 TBNA and TBB were done, respectively. More than one sampling was done per patient.

As shown in Figure 1, bronchial malignancy was confirmed in 17 of the 33 (51.5%) patients, whereas it was excluded in 12 (36.1%) patients whose diagnosis were PTB, suppurative lung diseases, and nonconclusive because of insufficient specimen in four patients.

Table 1: Indications for flexible bronchoscopy among the patients

Indication	Frequency (%)
Bronchogenic carcinoma	33 (33.0)
Pleural effusion	19 (19.2)
Chronic cough	13 (13.1)
Hemoptysis	10 (10.1)
Pulmonary tuberculosis	6 (6.1)
Suppurative lung disease	5 (5.1)
Lung collapse	4 (4)
Others	9 (9.1)

Others=Posterior mediastinal mass, pulmonary nodule, idiopathic pulmonary fibrosis, and tracheo-esophageal fistula

Table 2: Performance of cytological techniques in the diagnosis of bronchial cancer

Cytological technique	Histology (%)		Total
	Positive	Negative	
Bronchial brushing			
Positive	9 (64.2)	5 (35.8)	14*,†
Negative	1 (9.1)	10 (90.9)	11
Sensitivity	64.2		
Specificity	90.9		
Bronchial washing			
Positive	13 (59.0)	9 (41.0)	22*
Negative	4 (16.7)	20 (83.3)	24
Sensitivity	59.0		
Specificity	83.3		

*$P<0.05$; †Fisher's exact test used

Of the 19 patients with pleural effusion, bronchoscopy was diagnostic in 11 (57%) patients, of which malignancy was responsible for 6/11 (54.5%) and 4 (36.4%) additional PTB and 1 (9.1%) pneumonia were diagnosed in them.

Bronchoscopy was diagnostic of chronic cough in 11 (92%) patients, of which malignancy accounted for 36.3%. There were two cases due to sarcoidosis and 1 PTB. Two of the patients with sarcoidosis had typical cobblestone appearance of the bronchial mucosa and this was confirmed with the typical noncaseating granuloma on histology.

Pulmonary TB was confirmed in 50% of the patients with suspected TB. It was excluded in one patient where pneumonia was diagnosed. Diagnosis was made from cytological specimen revealing Langerhans cells with numerous lymphocytes and histology consistent with TB granuloma. Overall, a total of 11 PTBs were diagnosed; Three, in whom TB was the primary indication and eight in other cases. BW was negative for AFB in all the samples.

In 11 patients, EB tissues were said to be inadequate; therefore, diagnosis could not be confirmed in them and in the remaining 27 because EB was not done.

The overall diagnostic yield for bronchoscopy was 62% (61/99). We have a high rate of inconclusive result due to insufficient biopsy, 11.1%.

The most common complication was epistaxis 2/99 (2.1%), desaturation 2/99 (2.1%), and 1 cardiac arrest. There was no death.

Diagnostic performances of bronchial brushing and washing cytology in bronchial cancers

Table 2 shows the performances of BB and washing cytology in the diagnosis of bronchial malignancy.

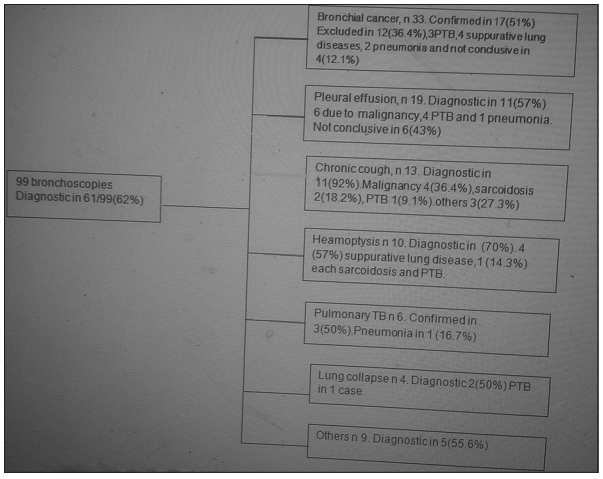

Figure 1: Diagnostic yield of bronchoscopy (PTB: Pulmonary tuberculosis)

As shown in the table, both techniques have significantly high specificity, 90.9% and 83.3% for BB and washing cytology, respectively, $P < 0.05$ each.

However, the sensitivity of detecting bronchial cancer was higher for BB than washing, 64.2% and 59%, respectively, with both tests having a strong agreement, $\kappa = 0.9$, 95% CI: 2.25–99.6, $P < 0.0001$.

Discussion

This work examined the diagnostic yield and clinical utility of FOB in a resource-poor setting and presents a major update and information after more than three decades when earliest work was done using a light bronchoscope.[7]

In this study, bronchial cancer was the most common indication for FOB. The yield for FOB diagnosis of lung cancer was 51% and 57% for diagnosing pleural effusion. The overall diagnostic yield of FOB was 62%. Cytological techniques for the diagnosis of malignancy were moderately sensitive, but highly specific for diagnosing malignancy. Complication rate was 5%.

Compared with an earliest study in Nigeria, this study presents an improvement in the 44% diagnostic yield reported more than three decades ago and showed similarity in the complication and mortality rate.[6] Uptake, growth, and the spectrum of bronchoscopic services available are still limited. As it was in the earliest study, the situation is the same with very few centers offering the service.

Bronchial cancer was responsible for the highest indication, this is consistent with studies in Nigeria and other parts of the world.[4,6,7,9-11] This could be a reflection of the perceived clinical utility of bronchoscopy. Lung cancer was the highest indication even in India with a similar and even higher TB prevalence than Nigeria.[12] For PTB, diagnosis with sputum smears is most commonly practiced and is diagnostic in larger number of patients.

The yield for lung cancer from FOB was lower than results from studies in Egypt, 70%,[10] and India, 75%,[3] but comparable with 57% reported from Switzerland.[9] This may reflect the prevalence of lung cancer and the risk factors in the different population and other factors. In addition, the gross endobronchial tumor was not common in our series. We found a higher frequency of tumor infiltrating the mucosa. This assertion is supported with the finding of more cases with adenocarcinomas in our study than in those studies where squamous cell cancers were the most common. The likelihood, therefore, of a different tumor biology in our lung cancer cases cannot be ruled out. The higher yield for lung cancer from FOB obtained in this study may be indicative of increasing incidence of lung cancer in Nigeria compared with 30–40 years ago.[6,7] Early and right diagnosis of lung cancer will reduce the risk of inappropriate anti-TB drugs use and cancer-related deaths. On the other hand, bronchoscopy was helpful in excluding lung cancer in 42.4% of patients, showing its value not only as a rule in, but also as to rule out the procedure for malignancy.

Similarly, lung cancer was responsible for the majority of cases of pleural effusion of undetermined origin. Although TB was the most common cause of pleural effusion in this locality followed by lung cancer,[13] a likelihood of changing pattern in the face of tobacco epidemic and air pollution is possible in this setting.[14,15] This should be addressed in a well-designed study. The utility of bronchoscopy in diagnosing pleural effusion has been well-studied.[16,17] It is generally believed that the presence of additional lesions in the lung parenchyma makes bronchoscopy imperative.[16,17] This explains our experience where FOB procedures were diagnostic in more than half of the cases.

In this study, we found a 50% diagnostic yield for TB. These were smear-negative cases where TB diagnosis will have been missed. Diagnosis was possible in them with a finding of TB granuloma on biopsy, although bronchial washout was negative for AFB. This yield is lower than 58.5% reported by Mohamed *et al.*,[10] which collected bronchoalveolar lavage for analysis and in addition to the inclusion of those who were smear-positive for AFB unlike in our study. Although the availability of GeneXpert has led to improved diagnosis of TB, this is still not widely available and it is expensive. From the above findings, it can be seen that bronchoscopy leads to an additional incremental yield of TB, still indicative that FOB is quite useful in sputum smear-negative PTB.

Diagnostic yield in interstitial lung diseases and solitary pulmonary nodule was quite low compared with our findings in malignancy and infective diseases. This might not be unconnected with the lower number of such cases and relatively few fine-needle aspiration cytology and TBB that were done. However, FOB was diagnostic of sarcoidosis in two patients and one patient with chronic cough and hemoptysis, respectively.

We were at the onset doing mainly BW and EB until the biopsy forceps spoilt, and due to delay in getting an appropriate replacement, we had to resort to BB in addition. This was responsible for the fewer number of BBs. Even for those cases where biopsies were done, the rate of inconclusive result due to insufficient tissue was high. This challenge of purchasing and replacing appropriate accessories and adequate tissue processing, in our opinion, were major challenges we encountered that bronchoscopy practice in low-income settings may need to continually overcome. Pulmonary histopathology is quite wide and highly variable; hence, the need for more pulmonary histopathologists is imperative and cannot be overemphasized. Availability of sustained immunohistochemistry panels for lung cancer will enable adequate and proper cancer typing.

A comparative analysis showed that BB had higher sensitivity and specificity compared with BW, both had high agreement. The yields of the two cytological methods should be interpreted with caution because of the small size. This is, however, consistent with other studies that reported a higher sensitivity for BB compared with BW.[9,18-20]

Cytological diagnosis was noted to be equally accurate and correlates well with the EB.[21] To increase bronchoscopic yield, however, combining different sampling techniques has been suggested.[18-20]

The incidence of major complication, cardiac arrest, was 1%, the procedure was stopped, patients had an emergency and successful cardioversion. Majority of the complications were minor, self-resolving epistaxis (because the nasal route was usually employed), and vasovagal reaction with transient hypoxemia. In total, we recorded an overall complication rate of 5% and no mortality. Large-scale study had reported mortality of about 0.004% and complication rate ranging from 0.5% to 2.06%.[22] The rate of serious adverse effects reported was lower than the reports of other smaller studies by Hehn *et al.*, 2.8%[23] and Bechara *et al.*, 8%,[24] and death rate of 1.4%.[24] This report still confirms the relative safety of FOB in trained hands in most clinical conditions in any setting, if appropriate guidelines are followed.

Due to the nature of the study, limitations such as the small size from one active single center, data collection and retrieval problems, inadequate specimen for histological study, limited scope of respiratory problems, and no cost–benefit analysis of the procedure among the study population must be acknowledged. More re-organization and enhanced capacity for bronchoscopy will be helpful in overcoming these challenges.

Overall, even though our findings confirm the belief that the diagnostic yield of FOB and its routine sampling techniques are high, particularly in malignancy and TB, and that the procedure is equally safe, uptake and availability are still low.

This will definitely impact the quality of respiratory service offered. Active and productive centers should be supported and empowered so that training with real hands on could be available to most physicians in the country. Similarly, universal access to health should be pursued.

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Conflicts of interest
There are no conflicts of interest.

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