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Diagnostic Utility of Flexible Bronchoscopy in Nigeria: The Lagos Experience

Oluwafemi Ojo

ojofemi911@yahoo.com

Lagos State University Teaching Hospital

Temitope Fapohunda-Ayanda

Lagos State University Teaching Hospital

Olaronke Folaranmi

Lagos State University Teaching Hospital

Abiola Omolayole

Lagos State University Teaching Hospital

Abiodun Tekobo

Lagos State University Teaching Hospital

Olufunke Adeyeye

Lagos State University Teaching Hospital

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DIAGNOSTIC UTILITY OF FLEXIBLE BRONCHOSCOPY IN NIGERIA: THE LAGOS EXPERIENCE

Authors:

Dr. Oluwafemi Ojo[1,2], Dr. Temitope Fapounda-Ayanda[1,2], Dr. Olaronke Folaranmi[1,2], Dr. Abiola Omolayole[1], Dr. Abiodun Tekobo[1], Prof. Olufunke Adeyeye[1,2].

Institution:

Department of Medicine, Lagos State University Teaching Hospital

Corresponding Author:

Department of Medicine, Lagos State University Teaching Hospital

Dr. Oluwafemi Ojo

Email: ojofemi911@yahoo.com

ABSTRACT

Background: Flexible bronchoscopy (FB) is an indispensable tool in respiratory medicine, but its availability in public tertiary healthcare centers across developing nations like Nigeria remains limited.

Objective: To evaluate the indications, diagnostic yield, and safety profile of flexible bronchoscopy at the Lagos State University Teaching Hospital (LASUTH) over a period of 3 years.

Methods: A retrospective review was conducted on 59 patients who underwent FB between May 2022 and October 2025 at the LASUTH bronchoscopy suite. Extracted data included demographic characteristics, procedural indications, sampling techniques, histopathological/microbiological findings, and complications.

Results: Of the 59 patients, 28 (47.5%) were male and 31 (52.5%) were female (ratio 1:1.1), with a mean age of 47.7 years. Diagnostic indications accounted for 96.6% (n=57) of cases, primarily for granulomatous lung diseases (57.6%) and suspected neoplasms (44%). The main sampling modalities used were bronchoalveolar lavage (84.7%) and endobronchial biopsy (72.8%). Malignancy was confirmed in 26.9% of suspected cases. Seven cases of pulmonary tuberculosis and three cases of non-tuberculous mycobacteria were confirmed. The overall diagnostic utility achieved was 60%. No major complications or mortality occurred; transient post-procedural fever was noted in three patients (5.1%).

Conclusion: Flexible bronchoscopy is a highly valuable, effective, and safe intervention for evaluating complex pulmonary pathologies in Nigeria. Expanding infrastructural capacity and training is vital to optimize respiratory disease management regionally.

Keywords: Flexible Bronchoscopy, Diagnostic Yield, Granulomatous Lung Disease, Lung Neoplasm, Nigeria.

INTRODUCTION

The global burden of respiratory diseases has escalated significantly over the past few decades, driven by intersecting epidemics of infectious diseases like tuberculosis (TB), emerging fungal infections, environmental pollutants, and a rising incidence of lung malignancies[1, 2]. Managing these conditions effectively hinges on achieving an early, accurate, and definitive tissue or microbiological diagnosis. Since its historic introduction into clinical practice by Shigeto Ikeda in 1966, the flexible bronchoscope has fundamentally transformed the landscape of respiratory medicine[3, 4]. By offering excellent visual access to the tracheobronchial tree, flexible bronchoscopy (FB) enables clinicians to directly inspect airway anatomy and sample deep parenchymal lesions through minimally invasive means[3, 5].

In modern clinical algorithms, the indications for flexible bronchoscopy are categorized into diagnostic and therapeutic frameworks[6]. Diagnostically, it is deployed to investigate unexplained radiological abnormalities (such as pulmonary nodules, masses, or interstitial infiltrates), persistent hemoptysis, chronic unexplained cough, and localized wheezing[4, 6]. It serves as a frontline modality to obtain specimens for histopathological, cytological, and microbiological evaluation via techniques like bronchoalveolar lavage (BAL), endobronchial brushing, endobronchial biopsy (EBB), and transbronchial needle aspiration (TBNA)[7]. Therapeutically, it is invaluable for clearing thick mucous plugs, managing massive hemoptysis, stenting stenosed airways, and removing aspirated foreign bodies[8].

Despite these clear clinical benefits, the deployment of bronchoscopy services in resource-limited settings, particularly within sub-Saharan Africa, faces extensive challenges[9]. Infrastructure deficits, prohibitive procurement and maintenance costs for equipment, lack of steady power supply, and a shortage of trained pulmonologists or technical staff mean that functional bronchoscopy suites are restricted to a few isolated public urban centers[9, 10]. Consequently, many patients with complex lung pathologies suffer from delayed diagnoses, empirical treatments (such as repeated, unindicated courses of anti-tuberculosis therapy), and poor clinical outcomes[11, 12].

In Nigeria, a few pioneering centers have documented their institutional profiles to demonstrate the utility of this service despite local constraints[13, 14]. Identifying unique regional variations in patient profiles and disease patterns is vital for adapting healthcare delivery. To address this diagnostic gap in Lagos State, the Respiratory Unit of the Lagos State University Teaching Hospital (LASUTH) officially launched its dedicated bronchoscopy suite in May 2022. This report reviews the initial three-year institutional experience at LASUTH, detailing the primary

clinical indications, diagnostic yield, and safety parameters achieved.

METHODS

Study Design and Setting

This study was a descriptive, retrospective clinical audit conducted at the Respiratory Unit of the Department of Medicine, Lagos State University Teaching Hospital (LASUTH), located in Ikeja, Lagos, Nigeria. LASUTH serves as a leading public tertiary referral center catering to the vast, densely populated urban and peri-urban demographics of Lagos State and neighboring regions. The dedicated bronchoscopy suite was established and officially launched in May 2022, equipped with a single functional flexible bronchoscope.

Study Population and Data Selection

The study population encompassed all consecutive patients who underwent flexible bronchoscopy at the facility over a three-year period extending from the suite's inception in May 2022 up to October 2025. The suite accommodated primary respiratory patients admitted or managed within LASUTH, as well as external referrals originating from other public and private healthcare facilities within and outside Lagos State. No eligible patients were excluded during this timeframe, culminating in a total sample size of 59 procedures.

Procedural Protocol

Prior to each procedure, patients underwent mandatory pre-bronchoscopy evaluations, including a comprehensive clinical history, physical examination, relevant chest imaging (chest X-rays and/or computed tomography scans), serum electrolytes, and a clotting profile. Written informed consent was routinely obtained.

Procedures were conducted by trained pulmonologists in the bronchoscopy suite under local

anesthesia utilizing 2% topical lidocaine spray to suppress the gag and cough reflexes, supplemented with conscious sedation (typically intravenous midazolam) where clinically indicated. Oxygen saturation, heart rate, and blood pressure were monitored continuously throughout the intervention. Airway sampling methods were selected based on the visual findings and suspected pathology, comprising:

Bronchoalveolar Lavage (BAL): Instillation and aspiration of sterile normal saline into a subsegmental bronchus to obtain cellular and microbiological specimens.

Endobronchial Biopsy (EBB): Forceps sampling of visible mucosal abnormalities or exophytic masses.

Endobronchial Brushing: Cytological brushing of visible lesions.

Transbronchial Needle Aspiration (TBNA): Needle aspiration of submucosal or extrinsic masses.

Recovered specimens were immediately processed and forwarded to the institutional laboratory services for histopathology, cytology, and detailed microbiological testing, which included Gram staining, aerobic cultures, fungal cultures, GeneXpert MTB/RIF assays, Line Probe Assays (LPA), and Mycobacterial cultures.

Data Extraction and Statistical Analysis

Data were retrieved from the standardized bronchoscopy register and corresponding patient clinical files. The extracted variables included: Sociodemographic characteristics (age, biological sex), clinical indications prompting the procedure, the specific sampling modalities executed, the laboratory, pathological, and microbiological results and lastly, the adverse events or complications recorded during or within 24 hours post-procedure.

The primary outcome measure was "diagnostic utility" (or diagnostic yield), defined as the percentage of procedures that provided a definitive microbiological, cytological, or

histopathological diagnosis that directly influenced clinical management or confirmed/ruled out the primary suspected differential diagnosis. Data were cleaned, compiled, and analyzed using descriptive statistics. Continuous variables (such as age) were summarized as means, while categorical parameters (such as sex, indications, and yields) were expressed as absolute frequencies and percentages.

RESULTS

Demographic and Procedural Characteristics

A total of 59 flexible bronchoscopy procedures were performed during the study period. All 59 patients successfully tolerated and completed their respective procedures. The study cohort comprised 28 males (47.5%) and 31 females (52.5%), representing a balanced male-to-female ratio of 1:1.1. The mean age of the patients was 47.7 years.

The vast majority of the interventions were performed for diagnostic indications (n=57, 96.6%), whereas therapeutic interventions accounted for a minor subset (n=2, 3.4%). Repeat procedures were necessary for two individual patients: one patient underwent a total of four serial sessions and another underwent two sessions, secondary to clinical requirements for progressive monitoring or clearance.

Clinical Indications

The clinical drivers for flexible bronchoscopy often overlapped, with several patients exhibiting more than one diagnostic indication as shown in Table 1. The evaluation of suspected granulomatous lung diseases (encompassing sarcoidosis and tuberculosis) stood out as the predominant indication, noted in 34 patients (57.6%). This was closely followed by suspected pulmonary or laryngeal neoplasms, which motivated 26 cases (44.4%). Other diagnostic requests

included the evaluation of fungal lung infections, non-tuberculous mycobacteria (NTM), interstitial lung diseases (ILD), hemoptysis, and unexplained hilar or mediastinal lymphadenopathy. The single indication for therapeutic bronchoscopy was foreign body retrieval, performed in 2 patients (3.4%).

Table 1: Distribution of Clinical Indications among the Study Cohort (N=59)

INDICATIONS	FREQUENCY (%)
Granulomatous lung disease - 34 Tuberculosis -23 Sarcoidosis – 29 Fungal lung disease - 14	57.6
Lung Neoplasm - 26	44.4
Interstitial lung disease - 7	11.7
Hilar and Mediastinal lymphadenopathy - 4	6.8
Foreign body removal - 2	3.4

Note: Percentages sum up to >100% due to overlapping clinical indications in individual patients.

Bronchoscopic Sampling Methods Utilized

To maximize diagnostic returns, multi-modal sampling was frequently performed during a single session. Bronchoalveolar lavage (BAL) was the most frequently deployed technique, utilized in 50 patients (84.7%). Endobronchial biopsy (EBB) was successfully executed in 43 patients (72.8%) where visible mucosal alterations or mass lesions were accessible. Endobronchial brushing and transbronchial needle aspiration (TBNA) were utilized less frequently, in 5 (8.47%) and 2 (3.4%) patients respectively.

Diagnostic Yield and Utility Analysis

The overall diagnostic utility achieved across the entire study cohort was 60%. However, the success rate varied when stratified by the primary clinical suspicion as shown in Table 2:

Granulomatous Lung Disease Evaluation

Among the cohort evaluated for granulomatous pathologies, histopathological examination revealed chronic inflammation in 28 patients (47.4%). This was further differentiated into chronic non-specific inflammation in 19 cases and chronic necrotizing inflammation in 9 cases. Significant lymphocytosis was identified via BAL fluid cytology in 13 patients. Sarcoidosis was definitively confirmed in 13 out of 29 suspected cases, yielding an indication-specific diagnostic utility of 44.8%.

For infectious granulomas, microbiological confirmation of Mycobacterium tuberculosis (MTB) was achieved through multiple parallel modalities: 3 samples (5.1%) were positive on automated TB cultures, 3 (5.1%) were positive via GeneXpert MTB/RIF assays, and 1 (1.7%) demonstrated positivity via Line Probe Assay (LPA). All 59 routine bronchial washings performed were entirely negative for acid-fast bacilli (AFB) via conventional smear microscopy.

Overall, pulmonary tuberculosis was confirmed in 7 cases; 5 of these occurred in patients initially suspected to have TB, while 2 were incidental diagnoses uncovered in patients undergoing evaluation for completely different clinical reasons. The diagnostic utility for MTB was calculated at 30.4%(7/23). Additionally, non-tuberculous mycobacteria (NTM) were isolated and confirmed in 3 patients, yielding a utility rate of 37.5% (3/8) among suspected cases.

Suspected Neoplasms

Out of the 26 patients investigated for suspected lung or laryngeal malignancies, a definitive tissue diagnosis of malignancy was established in 7 cases (26.9%). Within these confirmed malignancies, lung adenocarcinoma was the predominant histological subtype (n=4), followed by squamous cell carcinoma (n=3). Interestingly, in one patient whose initial clinical and radiological picture strongly suggested tuberculosis, flexible bronchoscopy successfully ruled out

TB and established a definitive diagnosis of lung adenocarcinoma.

Conversely, benign lesions were confirmed in 6 cases (23.1%), while 4 cases yielded inconclusive results due to insufficient specimen cellularity. The diagnostic utility for confirmed neoplastic pathology was established at 26.9%.

Table 2: Stratified Diagnostic Utility by Suspected Clinical Disease Category

Variable Pathological Category	Number Suspected (n)	Definitive Confirmations (n)	Diagnostic Utility Rate (%)
Sarcoidosis	29	13	44.8%
Tuberculosis (MTB)	23	7	30.4%
Non-Tuberculous Mycobacteria (NTM)	8	3	37.5%
Lung Neoplasm	26	7	26.9%

Fungal Lung Disease	14	5	35.7%
Foreign Body Retrieval	2	0	0.0%
OVERALL COHORT UTILITY	**59**	**35**	**60.0%**

Secondary Microscopic and Therapeutic Findings

General microbiological cultures from BAL fluids grew pathogenic bacteria in 18 instances (30.5%) and identified fungal isolates in 5 cases (8.5%). Among the 14 patients specifically suspected to have fungal lung disease, 5 were confirmed, providing a diagnostic utility of 35.7%. For the therapeutic cohort, although the foreign bodies were visualized and manipulated, immediate successful retrieval inside the suite was not achieved (0%).

Safety and Complications Profile

Flexible bronchoscopy proved to be safe and well-tolerated at our center. There were no recorded incidents of major procedural complications, such as severe respiratory depression,

massive un-controlled hemorrhage, pneumothorax, or cardiac arrhythmias. Furthermore, zero procedure-related mortalities occurred during the entire evaluation period. The only recorded adverse events were minor, consisting of transient post-bronchoalveolar lavage (post-BAL) low-grade pyrexia observed in 3 patients (5.1%), which resolved rapidly with simple antipyretic administration.

DISCUSSION

The initiation of the flexible bronchoscopy service at LASUTH in May 2022 represents a significant step forward in expanding public tertiary respiratory interventions within Lagos State. Over its first three years of operation, the facility completed 59 procedures, maintaining a well-distributed demographic split (male-to-female ratio of 1:1.1) and a relatively young to middle-aged patient distribution (mean age of 47.7 years). This demographic breakdown matches data published across several Nigerian centers, emphasizing that bronchoscopic services are heavily utilized by working-age adults who bear a high burden of chronic thoracic diseases[13-15]

A striking finding from our study is that the evaluation of granulomatous lung diseases (sarcoidosis and tuberculosis) stood out as the leading clinical indication for flexible bronchoscopy, representing 57.6% of the entire cohort. This finding contrasts with historical literature from alternative Nigerian bronchoscopy registries. For instance, landmark studies conducted by Adewole et al. in Ile-Ife[13] identified suspected bronchogenic carcinoma (lung neoplasm) as their most frequent procedural indication. This difference highlights how clinical patterns vary by region. Lagos is a dense metropolitan hub where environmental exposures and overcrowding can complicate the presentation of chronic infectious granulomas (like TB) and non-infectious inflammatory pathologies (like sarcoidosis), often mimicking malignancy on standard chest radiographs[16-18]. Consequently, clinicians in our environment increasingly rely

on flexible bronchoscopy to differentiate these overlapping clinical entities.

In terms of diagnostic performance, the overall diagnostic yield of 60% achieved in our center lines up closely with international standards and mirrors the 60.7% yield reported by Adewole et al.[13], as well as similar public hospital cohorts across developing economies. This consistency is encouraging given that our suite operated with only one functional flexible bronchoscope throughout this period, highlighting the value of targeted, multi-modal sampling.

By combining bronchoalveolar lavage (84.7%) with endobronchial biopsies (72.8%), our clinicians were able to confirm diagnoses for complex pathologies that would otherwise remain unresolved through non-invasive testing. The value of this approach is well illustrated by the case where a patient initially suspected of having refractory tuberculosis was definitively diagnosed with lung adenocarcinoma. This underscores how tissue confirmation via bronchoscopy helps prevent the mismanagement associated with empirical anti-TB treatment[13, 19].

Our microbiological yield for Mycobacterium tuberculosis highlighted the role of advanced diagnostic platforms. Traditional bronchial washing smears failed to detect acid-fast bacilli in all samples (0%), which is consistent with the known low sensitivity of smear microscopy in diluted washings. However, utilizing automated mycobacterial cultures, GeneXpert MTB/RIF, and Line Probe Assays (LPA) successfully confirmed 7 cases of pulmonary tuberculosis. This confirms that pairing flexible bronchoscopy with molecular diagnostic techniques substantially enhances diagnostic accuracy for paucibacillary and sputum-scarce tuberculosis[20-22]. Furthermore, isolating non-tuberculous mycobacteria (NTM) in 3 cases (37.5% utility) demonstrates that flexible bronchoscopy is effective at identifying alternative pathogens that mimic multi-drug resistant TB, allowing for more tailored therapeutic choices.

Regarding neoplastic investigations, our confirmed malignancy rate stood at 26.9%, with lung adenocarcinoma emerging as the primary histological subtype, followed by squamous cell carcinoma. This high proportion of adenocarcinoma matches recent global epidemiological shifts showing a rising incidence of non-small cell lung cancer among non-smokers and urban populations, likely driven by ambient air pollution and environmental factors[1, 2]. The 4 inconclusive biopsy results due to insufficient specimens highlight the technical challenges of working with small forceps tools, pointing to a clear opportunity for ongoing quality improvement and specialized cytopathology training.

Finally, our safety data strongly reinforce the established profile of flexible bronchoscopy as a highly secure, low-risk medical intervention. The complete absence of major complications or mortality in our series mirrors findings from Adewole et al.[13], who reported minimal morbidity profiles under local anesthesia and conscious sedation. The single minor complication identified which was transient post-BAL pyrexia in 3 patients (5.1%) is a well-documented physiological response to alveolar rinsing, caused by cytokine release rather than active infection, and resolves quickly with routine antipyretics[23, 24].

Study Limitations

This study is limited by its retrospective design, which constrained data collection to information available in historical medical records. It was also conducted at a single center with a relatively small sample size (N=59), reflecting the early development phase of the bronchoscopy suite. Additionally, the lack of specialized accessories limited our ability to perform advanced interventions, such as real-time endobronchial ultrasound-guided biopsies (EBUS) or successful therapeutic foreign body extractions inside the suite.

Conclusion and Recommendations

The initial experience at the Lagos State University Teaching Hospital proves that flexible bronchoscopy is a safe, reliable, and essential tool for diagnosing a wide range of infectious and neoplastic respiratory conditions. To build on these promising initial outcomes, we recommend investing in institutional infrastructure, procuring additional video-bronchoscopes, securing specialized biopsy accessories, and providing continuous training for medical and support staff. Expanding public sector bronchoscopy capacity across Nigeria will minimize diagnostic delays and significantly improve outcomes for patients with complex lung diseases.

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