

Indications and Outcome of Flexible Bronchoscopy at Muhimbili National Hospital in Dar es Salaam, Tanzania

Tito Lyimo^a, Victor Meza Kyaruzi^{a*}, Moses Byomuganyizi^a, Ramadhani Hassan Khamisi^a

^aDepartment of General Surgery, Muhimbili University of Health and Allied Science, Dar es Salaam, Tanzania.

Correspondence to Dr. Victor Meza Kyaruzi (dr.kyaruzi@gmail.com)

ABSTRACT

Background: A flexible bronchoscopy is an essential tool that is globally used for the diagnosis and treatment of Bronchopulmonary diseases. However the indication and outcome of flexible bronchoscopy has not been widely documented in majority of low resource settings.

Objective: To determine the indications and outcome of flexible bronchoscopy (FB) at Muhimbili National Hospital (MNH).

Methodology: A cross sectional analytical study was conducted for a period of 12 months. Details involving indications and outcome of flexible bronchoscopy includes; bronchoscopy findings, therapeutic value, diagnostic yield, and early procedural related complications together with their demographic data were documented after each procedure followed by analysis using SPSS version 25.

Results: Among 151 patients underwent flexible bronchoscopy 76(50.30%) were male and 75(49.70%) were female. The median age of 58 years with IQR (43, 65). Among the indications of flexible bronchoscopy, Cough and hemoptysis were the leading by 124(82.10%) and 38(25.20%) respectively. On the other hand hyperemic mucosa 47(31.10%) and endobronchial mass 32(21.20%) constituted the majority of the bronchoscopy findings. The overall diagnostic yield was 34.3% and procedural related complications was 18.54%. Among the indications for flexible bronchoscopy, the hemoptysis was associated with procedure related complications by 48(31.6%) OR (95%CI), 2.779 (2.339-3.219) $p < .020$. Among sampling technique of flexible bronchoscopy, the endobronchial biopsy and bronchi alveolar lavage (BAL) sampling technique were associated with procedure related complications by 60(39.5%), OR (95%CI), 4.393 (3.957-4.829) $p < .001$ and 22(14.70%), OR (95%CI) 1.870 (1.656-2.084) $p < .005$ respectively.

Conclusion: We have demonstrated that flexible bronchoscopy is a safe and reliable procedure in diagnosis of respiratory maladies including Mycobacterium tuberculosis (MTB) at Muhimbili National Hospital.

BACKGROUND

Bronchoscopy is an endoscopic technique that allows visualization of the airway of a patient with respiratory maladies.¹ In Tanzania bronchoscopy started in 1991 at Muhimbili National Hospital (MNH) in Dar es Salaam though it was done on small scale. Over the past five years, there is a three-fold increase in bronchoscopy at Muhimbili National Hospital.² Despite this increase, there are few documented indications and outcomes of bronchoscopy in Tanzania.

There are two types of bronchoscopes which are rigid and flexible. The flexible bronchoscope is an endoscopic instrument of choice for visualizing the tracheobronchial mucosa, down to the bronchioles.³ This study focused only on flexible bronchoscopy as it is a new emerging endoscopic technique of choice globally for visualizing the airway down to the bronchioles levels. Flexible bronchoscopy is usually

performed under local anesthesia.⁴

Flexible bronchoscopy is useful both for diagnostic and therapeutic purposes.³ The therapeutic values include endobronchial laser ablation, electrocautery, foreign body removal, tumor debulking, balloon dilatation, photodynamic therapy, and stent placement.⁵ The diagnostic values include; transbronchial biopsy, bronchial washing or brushing, bronchi alveolar lavage (BAL) sampling, and transbronchial needle aspiration.^{6,7} The indications for flexible bronchoscopy include symptoms or radiological anomalies that cannot be explained by non-invasive methods or to obtain samples from the lower airways.⁸

The outcome of flexible bronchoscopy includes; findings, diagnosis yield from samples, therapeutics, and complications.⁸

The flexible bronchoscopy is a very effective and safe procedure, the safety and effectiveness depend on the accuracy of the patient's selection and the experience

of the bronchoscopist.⁸

METHODOLOGY

Study setting

The study was conducted at Muhimbili National Hospital, located in Dar es Salaam -Ilala region in Upanga along United Nation road. Muhimbili National Hospital is the national referral hospital receiving patients from the district and regional referral hospitals within the country, and it serves as a city hospital by receiving more patient from the three designated regional referral hospital in the city (Amana, Temeke and Mwananyamala) and nearby district hospitals of coast region due to its geographical location. The hospital has a 1,500 bed capacity, attending 2,000 outpatients per day and admitting 1,000 to 1,200 inpatient per week. Muhimbili National Hospital hospital is a teaching hospital for Muhimbili University of Health and Allied Sciences (MUHAS) students and other affiliated universities like St Joseph University, Hubert Kairuki Memorial University (HKMU), and Aga Khan University. The endoscopy is under the department of internal medicine and provides care to a patient who requires an endoscopic procedure for diagnosis and therapeutic purposes. The unit is located within the pediatric complex building third floor which operates from Monday to Saturday. Bronchoscopies are usually done on Mondays and are performed by both physicians and cardiothoracic surgeons. Both inpatients and outpatients are attended, and after the procedures, the findings are entered on the Jeeva system, whereas the hard copy is given to the patient to return to the doctor who attended him/her. The findings for each patient are also documented on the patient's registry book. The data collection check list was used to extract data from the patient report, jeeva electronic system and registry book.

Study Design and Sampling

A prospective cross-sectional hospital-based study was conducted and a convenience non-probability sampling technique was used, whereby all flexible bronchoscopies done during the study period were included. All patient who underwent flexible bronchoscopy for emergency or elective purpose at MNH bronchoscopy units were recruited whilst all patients who repeated bronchoscopy for the same indications were excluded.

Sample Size Estimation

The sample size was estimated using the Cochran formula below;

$$n = (Z^2 P (1-P)) / \epsilon^2$$

Where:

n= Estimated sample size

Z= is the percentage point of the normal distribution corresponding to the level of significance (95% of C.I=1.96)

P= proportional of patients with bronchoscopy complications among patients who underwent bronchoscopy. (P=15% from the previous study).⁸

ϵ - Standard error of 5%

$$n = (1.96)^2 \times 15 \times (1-15) / (0.05)^2 = 196$$

Data Collection and Laboratory Analysis

The structured checklist was used to document data of all patients undergoing flexible bronchoscopy at MNH. The checklist was administered to the bronchoscopist for data collection soon after performing flexible bronchoscopy. The Olympus EVIS XI CV-1500 bronchoscope was used samples collected after bronchoalveolar lavage was analysed for gene expert, cytology, culture and sensitivity, microbiology and bronchial biopsy.

The laboratory results for the sample collected during the procedure were followed up in the laboratory after two weeks. The following variables were documented; patient demographic data (age and sex), indications of bronchoscopy, sampling technique, bronchoscopy findings, complications, histology, cytology and microbiology results, and therapeutic value.

Data Analysis

Data collected in a checklist was codified then entered in the Statistical Package of Social Science (SPSS) program version 25 where the analysis was done. Proportions were calculated for all categorical data like age and sex. Histograms, pie charts, and bar charts were used to summarize the data. Chi-square and T-tests were used for both categorical variables and one sample test for the significance level.

Ethical Considerations

Ethical clearance was sought from Muhimbili University of Health and Allied Science (MUHAS), Ethics and Research Committee. Permission was sought from MNH ethical clearance committee before the study was carried out, REF.DA.282/298/01.C/MUHAS-REC-06-2021-685.

All methods were performed according to the provisions of relevant guideline and regulations.

The participants signed to consent for their participation in this study and declared their approval for their information to be used for the purpose of this research only.

RESULTS

A total of 151 patients underwent flexible bronchoscopy: There were 76 male patients representing 50.3% and 75 female patients representing 49.7%. The median age of the study participant was 58 years with interquartile range (IQR) of (43-65). The age range was between 16 to 96 years. Majority of participant their ages were above sixty years 56(37.10%). Overall 143(94.70%) of the procedures were for diagnostic purposes, and 8(5.30%) of the procedures was for therapeutic purposes, where by the foreign body removal was 1(12.50%) and mucous clearance was 7(87.50%). None of the procedure were aborted due to complications. Table 1 shows the demographic characteristics of the participants.

The most leading indication for flexible bronchoscopy was cough in 124(82.10%) of cases, followed by hemoptysis in 38(25.20%) of the cases. Lung mass cases were 18(11.9%), dyspnea cases were 15(9.90%), and lung collapse 2(1.30%) and 1(0.70%) were for cases with other indications such as foreign body, wheezing, post PTB squal, cancer of the esophagus and nodule from the chest X-ray film. Figure 1 summarizes the indications for

The most frequent bronchoscopy findings was hyperemic mucosa by 41(31.1%) followed by endobronchial mass by 32(21.2%) , there was no abnormality found in 31(20.5%) bronchoscopic procedures , the rest of the findings the frequency was less than 12(7.90%). The therapeutic value of flexible bronchoscopy was mucous clearance 7(87.5%) and foreign body removal 1(12.50%), however stenting and tumor debulking were not performed at all. The most diagnostic yield was nonspecific inflammatory 102(67.50%), carcinoma and MTB were reported by 42(27.80%) and 7(4.70%) respectively. The most frequent histological type for carcinoma was adenocarcinoma by 30(71.43%) followed by squamous cell carcinoma by 11(26.19%) and lymphoma by 1(2.38%). The overall procedural related complications was 28(18.54%), the most frequent complication was desaturation by 14(9.3%) followed by hemorrhage by 12(7.90%) and pneumothorax and bronchospasm both occurred by 1(0.60%). Table 2 summarizes the flexible bronchoscopy outcomes at MNH.

Among the indications for flexible bronchoscopy, the hemoptysis was associated with procedure related complications by 48(31.60%), OR (95%CI),2.779 (2.339-3.219), $p < .020$. There was no significant association between procedures related complications and other indications. The endobronchial biopsy and BAL sampling technique were associated with procedure related complications by 60(39.5%), OR (95%CI), 4.393 (3.957-4.829) $p < .001$ and 22(14.70%), OR (95%CI) 1.870 (1.656-2.084) $p < .005$ respectively while the bronchial brushing and transbronchial biopsy were not associated with procedure related complications. Expertise level of education was not associated with procedure related complications, p -value $> .220$ across all levels.

TABLE 1: Demographic characteristics of the patients who underwent flexible bronchoscopy

Variable	Frequency (n)	Percentage (%)
Age group (years)		
≤ 35	21	13.90
36 - 45	23	15.20
46 - 60	51	33.80
>60	56	37.10
Median age in years (IQR) 58 (43,65)		
Sex		
Male	76	50.30
Female	75	49.70
TOTAL	151	100%

FIGURE 1: Indications of Flexible Bronchoscopy at MNH

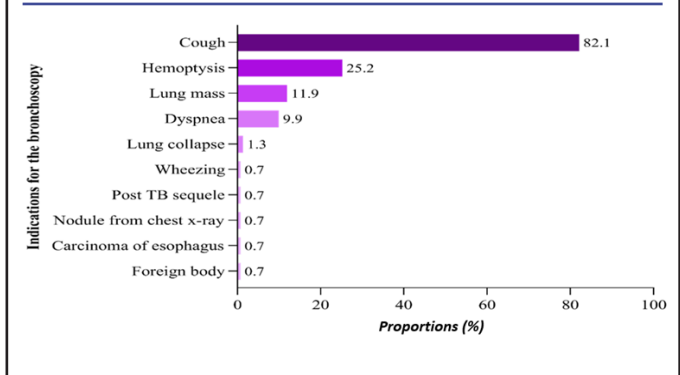


TABLE 2: The Outcomes of Flexible Bronchoscopy at MNH

Outcome	Variable	Frequency (n)	Percentage (%)
Findings	Hyperemic mucosa	47	31.20
	Endobronchial mass	32	21.20
	Thick mucus	10	6.60
	Pus trickling	9	6.00
	Extrinsic compression	6	4.00
	Concentric narrowing	4	2.60
	Others	12	7.90
	No abnormality	31	20.50
	TOTAL	151	100
Therapeutic value	NO	143	94.70
	YES	8	5.30
	Foreign body removal	1	0.70
	Mucous clearance	7	4.60
	TOTAL	151	100
Diagnostic yield	Non specific inflammatory	102	67.5
	Carcinoma	42	27.8
	MTB	7	4.70
	TOTAL	151	100

Continue

TABLE 2: Continued

Outcome	Variable	Frequency (n)	Percentage (%)
Procedure related complications	NO	123	81.50
	YES	28	18.50
	Desaturation	14	9.30
	Haemorrhage	12	7.90
	Pneumothorax	1	0.70
	Bronchospasm	1	0.60
	TOTAL	151	100

TABLE 3: Complications of Flexible Bronchoscopy and Factors Associated

Variable		YES (%)	Procedure related complication NO (%)	<i>p-value</i>	OR
Indications	Hemoptysis				
	YES	12 (31.6)	26(68.4)	.025	
	NO	17 (15.0)	96(85.0)		2.779
	Cough			.020	
	YES	20 (16.1)	104(83.9)	.040	
	NO	9 (33.3)	18(69.7)	.108	0.457
Sampling technique	Lung mass				
	YES	4(22.2)	14(77.8)	.752	
	NO	25(18.8)	108(81.2)		
	Lung collapse			.348	
	YES	1(50.0)	1(50.1)		
	NO	28(18.8)	121(81.2)		
	Dyspnea			.490	
	YES	4(26.7)	11(73.3)		
	NO	25(18.4)	111(81.6)		
	Others			.348	
YES	1(25.00)	3(75.0)	.578		
NO	28(19.0)	119(81.0)			
Expertise Level	Endobronchial biopsy	14 (35.9)	25(64.1)	.017	4.393
	BAL	15(14.7)	87(85.3)	.017	
	Transbronchial biopsy	0(0.0)	2 (100)	.005	1.870
	Bronchial brushing	0(0.0)	8(100)	.998	
Expertise Level	Super specialist	21(20.4)	82(79.9)		
	Specialist	6(13.0)	40(87.5)	.220	
	MSc resident	1(50.1)	1(51.1)		

DISCUSSION

Flexible bronchoscopy is the gold standard procedure in pulmonary medicine used to assist in diagnosis, staging and treatment of lung cancer, management of variety of pulmonary diseases. It provides a visual access to air passage and take biopsy of tissue or fluid if necessary. Flexible bronchoscopy is performed under local anesthesia or sedation. This study was conducted to state the indications and outcome of flexible bronchoscopy at bronchoscopy unit, Muhimbili National Hospital in the period of March 2021 and February 2022. Flexible bronchoscopy procedure related complication being the primary outcome.

The frequency ratio of male to female presentation for flexible bronchoscopy in Africa ranges from 1:1 to 1:2^{1,9,10}, in our study there was no remarkable predilection, the frequency of presentation for male and female was 76 (50.3%) and 75 (49.70%) respectively deriving to a ratio of 1:1.

The average age of patients who undergo flexible bronchoscopy procedure present frequently in their fifth decade with evident from multiple studies.¹¹⁻¹³ Our study revealed the median age of patients of 58 years with interquartile range of 43-65, this accounts a significance relationship for advanced age with high risk of respiratory morbidity.

In practical setting the flexible bronchoscopy is broadly used for diagnostic purpose and infrequently used for therapeutic interventions including foreign body removal and airway clearance for intensive care patients.¹³⁻¹⁵ Our study found that flexible bronchoscopy was frequently done for diagnostic purpose resulting to 94.70% diagnostic procedures and 5.30% therapeutic interventions.

In Africa the flexible bronchoscopy is mostly indicated for suspected lung cancer, pulmonary TB and hemoptysis^{1,3,10,11,16}, however in our study we observed that the most common indications were cough and hemoptysis by 82.10% and 25.20% respectively. These findings accorded with the studies done in Egypt, Saudi Arabia, Greece USA and Tanzania.^{3,8,9}

The overall diagnostic yield in this study was 34.80%, with the highest yield in patients with endobronchial mass. In this study it was found that the most two common findings during the flexible bronchoscopy were hyperemic mucosa and endobronchial mass by 31.10% and 21.2% respectively. This data partially match the study done in Egypt and Nigeria.⁸

The respiratory infection, MTB was diagnosed by 4.70% while the non-specific inflammatory was reported by 67.50%. These findings are contrary from the study done at King Abdul- Aziz Medical City in Saudi Arabia where the most common diagnosis reported was found to be respiratory infections mainly the MTB with the overall diagnostic yield of 46.00% with high prevalence among patients with HIV.¹ This variation might be influenced by difference in study sample size, as well as the efficiency of the bronchoscopic specimen handling, such as use of appropriate transport media and efficiency of cytological and microbiological evaluation. In our study 30 cases were diagnosed to have adenocarcinoma by 71.43% followed by 11 cases of squamous cell carcinoma by 26.19%

and 1 case of lymphoma by 2.38%. The predominance of adenocarcinoma in this study elaborates the similar results as reported in other previous studies from Tanzania and Saudi Arabia.¹⁷ This variation could be attributed by a large sample size included in this study compare to the previous studies.

Regarding the therapeutic value of flexible bronchoscopy we found that overall therapeutic value was 8(5.30%), the most patients underwent mucous clearance 7(4.6%) and 1(12.5%) underwent foreign body removal, whereby the procedure such as stenting and tumor debulking were not performed at all. This data differs with the study done in Egypt where it was found that 50% of cases underwent foreign body remove and interventional procedure such as stent placement, debulking by shaft of bronchoscope were performed by 1% and 5% respectively. This mismatch could be contributed by the lack of proper infrastructure to perform such an interventional flexible bronchoscopy.

In the present study, there were no mortality or procedure aborted due to complications. The complication of flexible bronchoscopy were uncommon, the study found that 81.50% of cases had no procedure related complications. 14(9.30%) case suffered desaturation during the procedure, though were not hypoxic before the beginning of the procedure and 12(7.90%) cases had hemorrhage during biopsy, which was controlled by local hemostatic measures. This result corresponds with the findings reported from the Nigerian tertiary center and Saud Arabia^{9,17} who found that 74% of the cases had no complications during the procedure. Similarly, Qanash¹, in their study had found minimal complications and concluded that the flexible bronchoscopy is the safe procedure, similar results were reported from Aim Shams Hospital in Egypt⁸, where 85% of cases had no complications, and the complications were bleeding 4%, desaturation 8% and surgical emphysema 1%. In this study we found among the indications of bronchoscopy, the hemoptysis was associated with procedure related complications. Patients presenting with hemoptysis had four times higher risk of developing complications during flexible bronchoscopy. We also found that among the sampling technique, the endobronchial biopsy and BAL were associated with procedure related complications while expertise level of education was not associated with procedure related complications.

Study Strength and Limitations

The strength of this study is pivoted on the fact that the practice of flexible bronchoscopy in our setting with appropriate indication and sampling technique elaborated the satisfactory diagnostic yield. However our study is restrained because the microbiology analysis for non-specific inflammatory cytological results was not established since the samples were not sent to microbiology laboratory for diagnostic evaluations such as culture and gram stain.

CONCLUSION

The flexible bronchoscopy is a very effective and safe procedure associated with low rate of complications and factors associated with complications are hemoptysis as indication of bronchoscopy, endobronchial biopsy and BAL sampling techniques. In this study, it was found that

the most prevalent diagnostic yield was carcinoma, the complication risk during flexible bronchoscopy was four times higher among patients who presented with hemoptysis.

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