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| RESEARCH ARTICLE

Study of Indications and Early Complications of Bronchoscopy at TUH- Lattakia During 2020 – 2021

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| ABSTRACT
Flexible bronchoscopy is a major diagnostic and therapeutic tool employed largely in respiratory medicine. This study was designed to determine the indications and outcome of a bronchoscopic workup at Tishreen University Hospital during the period from March 2020 to March 2021. All patients undergoing flexible bronchoscopy were subjected to full history and clinical examination, and data about patient's demographic details, indications for bronchoscopy, sedation given, specimen obtained and results of the investigation, and complications encountered were recorded. The study results revealed that of 176 bronchoscopies, 171 (97.2%) were diagnostic, and the remaining five (2.8%) were therapeutic. The mean age of patients was 54.3 ± 11.8 years, with males constituting the majority, 71.6%. Malignancy and hemoptysis were the two main indications for bronchoscopy (34.1% and 27.8%, respectively). The overall complication rate was 5.7%. The complications included bleeding in five cases, hypoxemia in three cases, laryngeal spasm in two cases, and hypertension in one case. There were no deaths related to the procedures. The overall diagnostic yield was 61.4%. Malignancy was confirmed in 70% of suspected cases; endobronchial malignancies were diagnosed in 30 patients (93.7%) out of 32 who had a macroscopically visible tumor. Tuberculosis was diagnosed in 69.2% of suspected cases, whereas bacterial pneumonia was diagnosed in 62.5%. Bronchoscopy diagnosed 81.8% of patients with lobar atelectasis. The diagnostic yield was 47% for hemoptysis. Our results confirm that flexible bronchoscopy is a valuable diagnostic tool, with a low rate of complications, particularly in patients with lung cancer. The diagnostic yield in our locality is almost similar to that reported in other series.

| KEYWORDS

Bronchoscopy, indications, diagnosis utility, complications, Tishreen University Hospital

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1. Introduction

Flexible bronchoscopy (FB) is an important medical procedure that involves the direct visualization of the tracheobronchial tree using a fibreoptic scope and is pivotal in diagnosing a variety of respiratory diseases, particularly lung cancer (Daniels, 2017). In 1897, Gustav Killian, a German laryngologist and 'the father of bronchoscopy', viewed the trachea and main bronchi through the larynx via a rigid oesophagoscope and removed a foreign body (Becker, 2009). In 1904, Chevalier Jackson added an electric light source at the distal end and a suction channel. In the 1960s, Shigeto Ikeda, a Japanese physician, introduced the first fibreoptic bronchoscope. By the end of the 1980s, Asahi Pentax Company integrated a charge-coupled device, permitting video monitoring of the airway and heightening its educational and clinical benefits (Kabadayi and Bellamy, 2017). Over time, various sizes and lengths have been introduced for use across different patient populations.

The flexible bronchoscope (FB) has a mechanism to flex or extend its distal end, which allows access to otherwise inaccessible areas. There are several variants of traditional FB such as endobronchial ultrasound (EBUS), facilitating transbronchial needle aspiration of enlarged lymph nodes or masses, and ultrathin bronchoscopy (external diameter 2.8 mm), allowing examination beyond the third generation of airways (Kabadayi and Bellamy, 2017).

Although most patients well tolerate bronchoscopy, a brief period of observation is required after the procedure (Kirkpatrick, 1992). Most complications occur early and are readily apparent at the time of the procedure (Rozman, 2009). The patient should be assessed for respiratory difficulty (stridor and dyspnea). The patient will be hospitalized if there occurs any bleeding, air leakage (pneumothorax), or respiratory distress (Kirkpatrick, 1992). The complications, although rare, are important and should be prevented to improve the quality of the procedure.

Several medical centers all over the world have discussed their experience with the diagnostic yield of FB, with controversial results (Alzeer, 2008) (Kaparianos, 2008). However, in developing countries, there have been few reports (Bhadke, 2010) (El-Khushmam, 2006) of using bronchoscopy as a diagnostic procedure. Moreover, these reports are either descriptive or have a relatively small number of patients. Therefore, the aim of this study is to report our experience with the diagnostic yield and complications of FB at Tishreen University Hospital, a tertiary University Hospital in Lattakia, Syria.

2. Patient and Methods

2.1 Study Design and Settings

We conducted a prospective descriptive cross-sectional study of all patients who underwent a flexible bronchoscopy at the department of Chest Diseases, Tishreen University Hospital, during the period between March 2020 and March 2021. The hospital's ethics committee approved the study, and written consent was obtained from each patient prior to the procedure.

2.2 participants

Adult patients older than 15 years, who underwent bronchoscopy with the same method and same device and had no underlying disease, were consecutively enrolled. Patients included outpatients as well as inpatients from our department as well as different departments of the hospital.

2.3 Variables

Age, sex, smoking history, indication for the procedure, pre-medication, radiographic findings, suspected diagnosis, bronchoscopy findings, final diagnosis, and complications of bronchoscopy were included in this study as variables. The suspected diagnosis was based on clinical and radiographic findings, whereas the final diagnosis was based on the microbiological and histopathological diagnosis. Data collection was performed by a checklist, and data were extracted from medical documents. Documents with missing data were excluded.

2.4 Bronchoscopy procedure

Patients were maintained without oral intake for at least 6 hours prior to the procedure. Platelet count > 60,000/uL was ensured, along with normal prothrombin time (PT) and activated partial thromboplastin time (aPTT), which were required if transbronchial biopsy, endobronchial biopsy, or brushings were performed.

The procedure was performed using a flexible fiberoptic bronchoscopy (Storz، Germany) under local anesthesia, via nasal or oral route with the patient lying in the supine position. In the situation of unstable or intubated patients, the procedure was performed in the intensive care unit (ICU).

Just before insertion of the bronchoscope, 2–3 ml of 2% viscous lidocaine was applied to the nose. Midazolam (0.07 mg/kg) was administered intravenously in incremental doses to achieve conscious sedation before and after the insertion of the bronchoscope in some patients.

All patients were supplemented with oxygen through a nasal cannula and were continuously monitored with electro-cardiogram and pulse oximetry. Liquid lidocaine 2% was administered through the bronchoscope directly to the vocal cords and the bronchial tree as needed.

During the bronchoscopic procedure, diagnostic materials were obtained by bronchial washings, transbronchial needle aspiration (TBNA; lymph nodes or lung), bronchial brushings, endobronchial biopsy or transbronchial biopsy (TBB), as decided by the bronchoscopist on a case-by-case basis.

Transbronchial bronchial biopsy (TBB) was performed blindly and as per the international recommendations (British Thoracic Society, 2001). Biopsy specimens were fixed in formaldehyde solution, embedded in paraffin, and sectioned. Post-bronchoscopy chest X-ray was performed routinely 4 hours after TBB.

2.5 Statistical Analysis

After gathering the required data, a statistical analysis was performed. We used SPSS (version 20) software [Statistical Procedures for Social Sciences; IBM Corporation, Armonk, New York, USA]. Differences were tested by independent-sample-t and chi-square tests and were considered statistically significant at P values less than 0.05. Age was presented as mean ± standard deviation. Due to the descriptive nature of this study, all other data were presented as percentages (%). Calculations and graphs were done using Excel.

3. Result

A total of 200 patients underwent FB procedures. Twenty-four patients were excluded due to incomplete follow up data. The remaining 176 patients were studied. Their mean (±standard deviation) was 54.3±11.8 years; 126 patients (71.6%) were males, and 142 (80.7%) were smokers. Of 176 bronchoscopies, 171 (97.2%) were diagnostic and 5 (2.8%) were therapeutic.

3.1 Indications for bronchoscopy:

The most prevalent indication for bronchoscopy was suspected malignancy (34.1%), followed by hemoptysis (27.8%), suspected pneumonia (9.1%) and suspected tuberculosis (7.4%). Indications for bronchoscopy are shown in Table 1.

Table (1). Indications for bronchoscopy.

Indication	No. of patients	Percent (%)
Suspected malignancy	60	34.1%
Hemoptysis	49	27.8%
Suspected pneumonia	16	9.1%
Suspected tuberculosis	13	7.4%
Suspected interstitial lung disease (ILD)	12	6.8%
Atelectasis	11	6.3%
Pleural effusion	10	5.7%
Mucus suction (therapeutic FB)	5	2.8%
Total	176	100%

3.2 Pre-procedure sedation:

Fifty-two patients (29.5%) had pre-medication via the intravenous route and received only Midazolam. The remaining 124 patients (70.5%) had a bronchoscopy under local anesthesia.

3.3 Bronchoscopy findings and specimen taken:

Fifty-one patients (28.9%) had endoscopy visible endobronchial tumors, 38 (21.6%) had erythematous or indurated mucosa, 25(14.2%) had external compression, and 62(35.2%) had normal bronchoscopy findings. Of 176 bronchoscopies, a total of 89 bronchial biopsy, 95 transbronchial biopsy (TBB), and 143 bronchial wash were performed.

Bronchoscopies Characteristics are shown in Table 2.

Table (2). Characteristics of bronchoscopies

Characteristics	No. of patients	Percent (%)
Pre-procedure sedation		
Venous Midazolam	52	29.5%
Local Anesthesia	124	70.5%
Bronchoscopy findings		
Endobronchial Tumor	51	28.9%
Indurated/Erythematous Mucosa	38	21.6%
External compression	25	14.2%
Normal bronchoscopy findings	62	35.2%
Specimen taken		

Bronchial biopsy	89	50.5%
Transbronchial biopsy (TBB)	95	54%
Bronchial wash	143	81.3%

3.4 Complications

Of the 176 patients who underwent flexible bronchoscopy, 11 complications occurred in 10 patients (Table 3). Five patients had bleeding, one of whom developed hypoxemia. Hypoxemia alone occurred in two patients, laryngospasm in two patients, and hypertension in one patient. No deaths occurred during or 2 hours after bronchoscopy. The overall complication rate of FB encountered was 5.7%.

Table (3). Complications of bronchoscopies

Complications	No. of patients	Percent (%)
Bleeding	5	2.8%
Hypoxemia	3	1.7%
Laryngospasm	2	1.13%
Hypertension	1	0.56%

The mean age of patients who had complications during flexible bronchoscopy was significantly greater. There was no association between complications and the patient's gender, the indication for bronchoscopy, or the method of anesthesia, as shown in Table 4.

Table (4). Association between complications of bronchoscopies and other variables

Variables	Complications	NO complications	Test	P-value
Age (mean ± SD), years	58.4 ± 10	50 ± 12	2.16	0.031
Gender				
Male	6 (4.8%)	120 (95.2%)		
Female	4 (8%)	46 (92%)	0.7	0.4
Indication				
Suspected malignancy	4 (6.7%)	56 (93.3%)	0.165	0.684
Hemoptysis	2 (4.1%)	47 (95.9%)	0.234	0.569
Suspected pneumonia	0 (0%)	16 (100%)	1.06	0.303
Suspected tuberculosis	2 (15.4%)	11 (84.6%)	2.46	0.116
Suspected ILD	1 (8.3%)	11 (91.7%)	0.169	0.681
Atelectasis	1 (9.1%)	10 (90.9%)	0.254	0.614
Pleural effusion	0 (0%)	10 (100%)	0.639	0.424
Mucus suction	0 (0%)	5 (100%)	0.31	0.577
Pre-procedure sedation				
Venous Midazolam	5 (9.6%)	47 (90.4%)		
Local Anesthesia	5 (4.1%)	119 (95.9%)	2.13	0.144

3.5 Diagnostic yield of bronchoscopy:

The overall diagnostic yield was 61.4% (108/176), Table 5.

Of 60 patients suspected to have malignancy, 42 (70%) patients were confirmed. Endobronchial malignancies were diagnosed in 30 patients (93.7%) out of 32 who had a macroscopically visible tumor. For suspected malignancies not seen during bronchoscopy, malignancy was diagnosed bronchoscopicaly in 12 patients (42.8%).

For patients bronchoscoped due to hemoptysis, 23 (47%) patients were confirmed to have existing pathology; 12 with malignancy, 5 with pneumonia, 4 with chronic bronchitis, and 2 with tuberculosis.

Pneumonia was suspected in 16 patients, 10 (62.5%) patients were confirmed to have existing pathology; bacterial pneumonia was diagnosed microbiologically in five (31.3%), tuberculosis (TB) in three (18.7%) and ILD (cryptogenic interstitial pneumonia) in two (12.5%). Of 13 patients suspected to have tuberculosis, 9 (69.2%) patients were confirmed to have existing pathology; TB was diagnosed in 7 (53.8%), and bacterial pneumonia in 2 (15.5%).

FB confirmed the diagnosis of ILD in 5 (41.7%) patients out of 12 who were suspected via the use of TBB. Reported ILD were usual interstitial pneumonitis (UIP) in 2 patients, bronchiolitis obliterans organizing pneumonia (BOOP) in 2 patients, and sarcoidosis in 1 patient.

For those 11 patients with atelectasis, 9 (81.8%) were confirmed to have existing pathology; 4 with malignancy, 3 with mucus plugs or impacted secretions, 1 with nonspecific inflammation, and 1 with granulomatous disease.
For patients bronchoscoped due to pleural effusion, 5 (50%) patients were confirmed to have existing pathology; 3 had malignancy, and 2 had pneumonia.

Table (5). Diagnostic yield by indication

Indication	No. of patients	No. of cases diagnosed by bronchoscopy	Diagnostic yield
Suspected malignancy	60	42	70%
Hemoptysis	49	23	47%
Suspected pneumonia	16	10	60.5%
Suspected tuberculosis	13	9	69.2%
Suspected ILD	12	5	41.7%
Atelectasis	11	9	81.8%
Pleural effusion	10	5	50%
Mucus suction	5	5	100%
Total	**176**	**108**	**61.4%**

4. Discussion

The introduction of flexible bronchoscopy (FB) has revolutionized the care and management of patients with pulmonary diseases. It provides 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. This study aimed to determine the indications, complications, and diagnostic yield of flexible bronchoscopy at the department of Chest Diseases, Tishreen University Hospital, during the period between March 2020 and March 2021.

The study included 176 patients (71.6% males, 28.4% females) with a mean age of 54.3 years, and 80.7% of the patients were smokers. Suspected malignancy was the most common indication for flexible bronchoscopy (34.1%), followed by hemoptysis (27.8%) and suspected pulmonary infection (16.5%).

Although the indications for diagnostic bronchoscopy remained, the same, different regions may have different priorities. While suspected malignancy was the most common indication in most studies, suspected lung infection was the most common indication in others. Jin et al. (2008) in China reported that the most common indication for bronchoscopy was suspected malignancy (60%), followed by pulmonary infection (16.9%) and cough (14.7%). Mohamed et al. (2013), in a retrospective study of 3980 bronchoscopy, reported that the most common indication for bronchoscopy was suspected malignancy (47%), followed by pulmonary infection (23.8%) and hemoptysis (14%). In the study of Mensah et al. (2021) in Ghana, the most common indication for bronchoscopy was suspected malignancy (55.3%), followed by pulmonary infection (21.2%).

Alzeer et al. (2008) conducted a retrospective study in Saudi Arabia that included 720 bronchoscopy, the most common indication for bronchoscopy was pulmonary infection (35.9%), followed by suspected malignancy (25.9%), suspected interstitial lung disease (12.2%), and hemoptysis (9.8%). Another study from Saudi Arabia conducted by Qanash et al. (2020) showed that the most common indication for bronchoscopy was pulmonary infection (47.5%), followed by suspected malignancy (17.2%), immunodeficiency associated infiltrates (14.6%), and hemoptysis (11.1%). Suspected malignancy, being the most common indication for FB in our records, can be explained by the observations that 71.6% and 80.7% of our cohorts were males, and cigarette smokers, respectively.

Leiten et al. (2016) conducted a meta-analysis of 45 studies. They concluded that the rate of mortality and severe complications is very rare; pneumothorax-requiring intervention was reported in 0-2.1% of patients who had undergone TBB. The rate of bleeding ranged between 2.5 - 89.9% and the rate of hypoxemia between 0.7 - 76.3%. Authors attributed this considerable variability in complication rates to a lack of consensus on defining and measuring complications and that many of the presented studies have a modest sample size.

The mortality in our study was nil, and the complication rate was 5.7%. We reported rates of 2.8% for bleeding, 1.7% for hypoxemia, 1.13% for laryngospasm, and 0.56% for hypertension. The mean age of patients who had complications was significantly greater than that of patients without complications (58.4 ± 10 V.S. 50 ± 12 years, P=0.031). We found no significant differences in the complication rates across patients, regardless of their gender, underlying respiratory disease, or sedation method. These data are important because of the need to improve patient safety by preventing or reducing risks, especially in a teaching hospital setting. In addition, it is important to know the risks of the procedure in order to develop informed consent forms that clearly explain to patients and their families the expected complication rate.

Jin et al. (2008) defined severe complications of FB as: death, massive hemoptysis (> 200 ml) during or 1 h after bronchoscopy, laryngospasm or bronchospasm, which made it necessary to suspend the procedure, cardiac arrhythmias, pneumothorax and/or subcutaneous emphysema occurred during or after the procedure and required suction or drainage, tracheal perforation, or airway obstruction. The rate of severe complications of bronchoscopy was 0.739%; mortality was 0.013%. Bleeding was the most common complication. Mohamed et al. (2013) reported a complication rate of 1.48% and death of 0.05%. The most common complications were bronchospasm (0.6%), hypoxemia (0.33%), and bleeding (0.11%). Mensah et al. (2021) reported no deaths and a complication rate of 5.9%. Hemorrhage occurred in 3.5% and hypoxia in 2.4%. In Alzeer et al. (2008) study, no deaths occurred, and the complication rate was 5%. Hypoxemia occurred in 2%, hemorrhage in 1.7%, pneumothorax in 0.6%, and bronchospasm in 0.4%. Qanash et al. (2020) showed no deaths, and the complication rate was 1.5%.

Jacomelli et al. (2020) in Brazil reported no deaths, and the rate of complications was 5.3%. Bleeding occurred in 2.2%, pneumothorax in 0.7%, and bronchospasm in 0.8%. Consistent with our results, the mean age of patients who had complications during FB was significantly greater than that of patients without complications, with no significant differences in the complication rates across patients, regardless of their gender, underlying respiratory disease, or sedation method.

The complication rate was low in our study because FB is performed in accordance with international standards at our institution. In addition, all FB procedures are performed by qualified professionals trained and with technical experience in performing FB and diagnosing and managing complications; adequate preparation of the patient prior to the endoscopy is essential to minimize and prevent complications.

The diagnostic yield of bronchoscopy in our study was 61.4%; bronchoscopy was able to confirm the presence of pathological events in 81.8% of cases of atelectasis, 70% of suspected malignancies (this percentage increased to 93.7% in endobronchial tumors), and 69.2% of suspected tuberculosis.

Several authors had reported the diagnostic yield of FB, with controversial results. Mohamed et al. (2013) showed that the diagnostic yield of bronchoscopy was 67%, and 70% for the diagnosis of malignancy.

Alzeer et al. (2008) reported a yield of 58%. The greatest yield was for tuberculosis (67%), followed by malignancy (61.2%, this percentage increased to 94.2% for endobronchial neoplasms), interstitial lung disease (43%), infection (40.5%), hemoptysis (37.7%).

Qanash et al. (2020) reported a yield of 46%. The greatest yield was for pulmonary infiltrates associated with immunodeficiency (85.7%), hemoptysis (63.6%), suspected interstitial lung disease (58.3%), pulmonary infections (53.7%), and malignancy (44.1%).

In the study of Werpachowska et al. (2014) in the UK, bronchoscopy was performed in 149 patients (55% of males) with a mean age of 65 years. The most common indication for bronchoscopy was suspected malignancy (52.3%), followed by hemoptysis (22.8%). The diagnostic yield of bronchoscopy was 76.9%; bronchoscopy was able to confirm the presence of pathological events in 52.6% of cases suspected of malignancy; this percentage increased to 80% in endobronchial tumors.

5. Conclusion

In general, the results of our study confirm that flexible bronchoscopy is a safe procedure and provides a high diagnostic yield; the complication rates and diagnostic yield in our study are similar to those mentioned in the medical literature.

6. Recommendations

Based on the diagnostic and therapeutic role of flexible bronchoscopy and its safety in terms of complications, we recommend continuing to adopt this procedure in the hospital and conducting more studies in the future on the latest diagnostic techniques related to bronchoscopy.

Authors contributions: LH, MA, LA: designed the study. LH collected the data, analyzed and interpretation of the result, and drafted the manuscript. MA, LA revised the manuscript. All authors read and approved the final manuscript.

Conflicts interests: The authors have no conflict of interest associated with this article.

Ethical approval: Ethical approval to conduct the study was obtained before the commencement of the study. Informed consent was sought from each patient before being enrolled on the study.

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