

The Spectrum of Complications in Patients Undergoing Fiberoptic Bronchoscopy

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ABSTRACT

Background: Flexible fiberoptic bronchoscopy is a basic and essential procedure in the field of interventional Pulmonology. It is among the bronchoscopic procedures performed most commonly. Although it is a relatively safe, effective and well-tolerated procedure, there are still several complications that can occur which are important and steps should be taken to prevent them to improve the quality of the procedure.

Aim: The purpose of the study was to determine the spectrum of complications in patients undergoing fiberoptic bronchoscopy at Sher I Kashmir Institute of Medical Sciences (SKIMS-Srinagar, Kashmir), a tertiary care hospital in the valley of Kashmir.

Materials and Methods: This prospective descriptive study included 70 consecutive adult patients between 18-82 years (mean 55.221), who underwent fiberoptic bronchoscopy in the Pulmonary lab, carried out by four experienced bronchoscopists (>10 years of experience) from the Department of Internal and Pulmonary Medicine. Bronchoscopic findings and complications were recorded in the preformed proforma at the time of enrolment in the study.

Results: the most common indications for the procedure were, lung mass (34.3%), hemoptysis (20%), non-resolving consolidation (14.3%), and chronic cough (12.9%). Bronchoscopic complications were seen in 22 patients (31.4%), including bleeding (9 cases), arrhythmia (8 cases), hypoxemia (4 cases), and others like epistaxis and vomiting in 2 cases. Multiple complications occurred in 2 cases. These complications were managed conservatively and all patients recovered without any serious consequences or mortality. There was no association between complications and age however; the correlation between bronchoscopic findings or bronchoscopic interventions with bronchoscopic complications was significant ($P < 0.001$).

Conclusion: According to the results obtained, the majority of the complications that occurred were minor with only major complications that had severe bleeding and that too was managed conservatively. Thus, it can be concluded that flexible fiberoptic bronchoscopy is safe and should be performed wherever indicated with the entire backup needed to tackle the complications.

Keywords: Fiberoptic Bronchoscopy, Bronchoscopic indications, Lung mass, Bronchoscopic interventions, bleeding

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INTRODUCTION

The field of pulmonary medicine has been greatly transformed by flexible fiberoptic bronchoscopy, and since its introduction in 1966, it has become an essential procedure in the field of pulmonary medicine¹. Bronchoscopy is an endoscopic technique used for visualizing the inside of the respiratory tract for diagnostic and therapeutic purposes^{2,4}. Rigid, flexible, and virtual bronchoscopy are the three types of bronchoscopy. The most common type of bronchoscopy performed is the flexible fiberoptic bronchoscopy (FOB). Today, FOB has become the procedure of choice for the diagnosis of many pulmonary disorders⁵. It has become the mainstay of

medical management as it allows the direct visualization of normal and pathological variations of the upper and lower airways including the upper lobes and the apical segments and sub-segmental bronchi directly which are otherwise difficult to assess through other means⁶. It is a safe procedure that causes less discomfort to the patients, which can be performed under local anaesthesia and allows the visualization of the tracheobronchial tree maximally in a short period. It also enables sampling techniques such as bronchial brushings (BB), bronchial washings (BW), bronchoalveolar lavage (BAL), endobronchial biopsies

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(EBB), transbronchial biopsies (TBB), and transbronchial needle aspiration (TBNA)⁷. FOB has also become an important tool for the removal of secretions, clots, mucous plugs, and foreign bodies. The more recent advancements in the field of bronchoscopy include stent placement for relieving airway compression⁸. Indications for FOB can be either diagnostic or therapeutic. The diagnostic indications include suspected endobronchial diseases or lesions with or without radiological evidence, which may present as chronic cough, hemoptysis, atelectasis, post-obstructive pneumonia, localized wheeze, stridor or lung mass⁹. Sometimes, FOB is used as a screening tool to look for the site or segment of bleed in a case of hemoptysis or take BAL or transbronchial lung biopsy in a case of diffuse parenchymal lung disease or non-resolving pneumonia. FOB may also be carried in a case of mediastinal adenopathy, lobar collapse, interstitial lung disease, and chest trauma. The therapeutic indications include foreign body aspiration or removal, drainage of lung abscesses, stent placement, balloon dilation and endotracheal intubation¹⁰. Despite being an effective, relatively safe and well-tolerated procedure, it still holds several potential complications that can occur⁹, which can be labelled as minor, major/severe or fatal. These may vary across individuals and institutes. Although rare immediate complications can be caused by the procedure or the diagnostic sampling, such as bronchospasm, laryngospasm, pneumothorax, bleeding, infection, arrhythmia, hypoxemia, and respiratory depression⁸⁻⁹. The complication rates from fiberoptic bronchoscopy range from <0.1 to 11%, with mortality generally reported between 0 and 0.1%⁸.

MATERIAL AND METHODS

Study design and place: This study was a prospective observational and descriptive study that was conducted over 6 months (March 2021 – August 2021), at Sher-I-Kashmir Institute of Medical Sciences (SKIMS) Soura, a 1200 bedded tertiary healthcare institute in north India.

Study Population and Protocol

A total of 75 consecutive adult patients were screened for the study. Among these, 70 patients were enrolled in the study irrespective of age, sex, and occupation. Five patients were excluded from the study because three patients tested positive for AFB and two patients tested positive for COVID-19 during the pre-procedure workup resulting in

deferral of their procedures. All 70 fiberoptic bronchoscopies performed were diagnostic. Detailed demographic data including age, gender, occupation, smoking history (non-smoker, smoker, and ex-smoker)¹¹, clinical and radiographic findings (based on CT-Scan), and bronchoscopic indications were noted. Blood tests performed 48 hours before the procedure, including coagulation studies, complete blood count, kidney function test, triple serology status (HCV, HbsAg, HIV), and sputum for acid fast bacilli (AFB) were also entered in the preformed proforma at the time of enrolment in the study. As the study was conducted during the COVID-19 pandemic, every patient would be screened by a questionnaire to find out their COVID-19 status and to find out if there's any history suggestive of past or present infection. Each patient needed to undergo an RT-PCR (Reverse Transcriptase Polymerase Chain Reaction) test for COVID-19 before the procedure as a step to contain the spread of infection. Data collection was performed by proforma and data was extracted from medical documents. Patients would come for the procedure with an overnight or at least 6 hours fast. After obtaining consent, the patient's blood pressure, heart rate and oxygen saturation were checked before the procedure and these parameters were monitored throughout and up to 6 hours after the procedure. Trans-nasal route with supine position was the most preferred way for performing bronchoscopy using Olympus BF-IT180 bronchoscope with 6.0mm external diameter and 3.0mm working channel and Fujinon EB-530T with 5.9mm external diameter and 2.8mm working channel. The severity of bleeding was categorised into minimal, mild, moderate and severe bleeding as described ahead. The blood loss during the bronchoscopy was measured from aspirated secretions, but we did not use a haemoglobin detector as used by Carr et.al¹². During the bronchoscopy, any visible endobronchial bleeding would be actively suctioned into a suction apparatus collection jar via the bronchoscope. Here the volume of the blood is mixed with lavage fluid measured in millilitres and recorded for each patient. The intensity of bleeding was also assessed as per the intervention needed to control the bleeding like ice-cold saline, tranexamic acid, local adrenaline spray, IV fluids, blood transfusion or abandoning the procedure because of excessive bleeding. The amount of blood lost was determined immediately after the procedure and graded 1 to

10 with the use of a visual analogue scale with mild (1 to 3), moderate (4 to 6), and severe bleeding (> 7). The accurate quantification of the amount of bleeding that occurs during bronchoscopy is often difficult for several reasons which include the insensate bleeding into the bronchial tree that cannot be suctioned out and the imprecise estimation of the volume of blood aspirated as it gets mixed with lavage fluid and other bronchial secretions.

Ice-cold saline 0.9%, tranexamic acid (T-Stat) and diluted adrenaline (1:10,000) solution were kept ready during the procedure. After bronchoscopy, all the patients were kept under constant close observation to assess any post-bronchoscopy complication with the advice of “nil per oral” for 2 hours post-procedure. The bronchoscopic interventions performed, findings observed, and the complications faced during the procedure were recorded in the performed proforma.

During the procedure a decline in oxygen saturation below 90% was considered clinically significant¹³, systolic blood pressure (SBP) of >180/90mmhg was considered clinically significant hypertension for the procedure¹⁴, and SBP of < 90mmhg as hypotension¹⁵, and heart rate of > 130 beats per minute (BPM) as tachycardia¹⁶, and heart rate of < 60 BPM as bradycardia¹⁵.

Ethics and consent

The study was approved by the Institutional Ethics Committee at Sher-I-Kashmir Institute of Medical Sciences. A proper informed consent written in English and Urdu was taken from all the participants of the study. Our study does not include a paediatric group, as there is a separate bronchoscopy unit for children at our institute.

Statistical analysis

After collecting the required data, the statistical analysis was performed. Continuous variables were represented by descriptive statistics and the categorical variables in terms of frequency, percentage, mean $\pm$ SD, and range. All the comparisons were done by using the Chi-Square test, a P value < 0.05 was considered statistically significant. Statistical analysis was performed using SPSS (version 23.0) software [Statistical Procedures for Social Sciences; Chicago, Illinois, USA].

RESULTS

A total of 70 patients were included in the study. Out of 70

patients, 49 (70%) were males and 21 (30%) were females (figure 1). The majority of the patients, 30 (42.8%) were above 60 years of age and 29 (41.4%) between 30-60 years of age, with a mean age of $\pm$ 55.22 years (range 18-82 years, figure 2). Among 70 patients 61 (87.1%) were from rural areas and 9 (12.9%) were from urban areas. 31.4% were non-smokers, 32.9% were smokers, and 35.7% were ex-smokers.

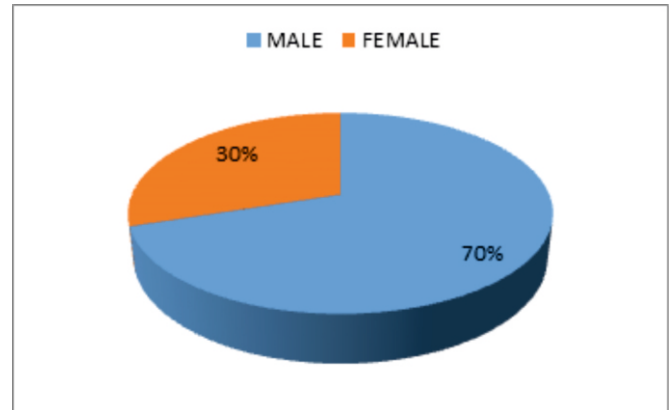


Fig. 1

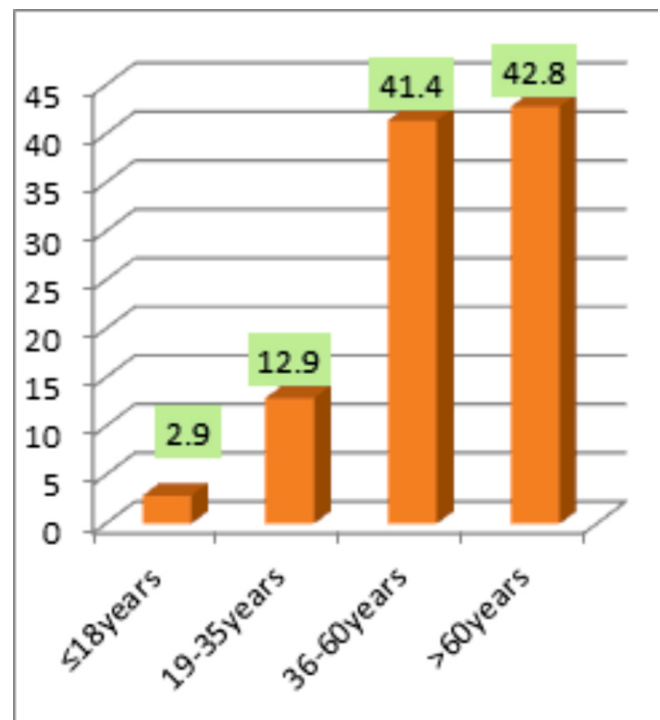


Fig. 2

Lung mass (34.3%), haemoptysis (20%), non-resolving consolidation (14.3%), and chronic cough (12.9%) were the most common indications, table 1. When these patients were asked about their history regarding COVID-19 infection, 46 (65.7%) patients had undergone COVID-19 RT-PCR testing for some other reasons in the past. Among these, two (2.9%) patients had tested positive and recovered from COVID-19 infection and 44 (62.8%) patients were COVID-19 negative (Naïve). Mass lesion (44.3%) in the lung and collapse/consolidation (31.4%) were the most common radiological findings. Other CT scan findings included mediastinal lymphadenopathy, hilar lymphadenopathy, calcified nodules, pleural effusion and infective bronchiolitis, table 2. BAL (45.7%) and lung biopsy (40%) were the most common bronchoscopic interventions performed, table 3. Screening FOB was performed in 12.9% and transbronchial needle aspiration (TBNA) was done in 2.9% of patients. In 16 (22.8%) patients, bronchoscopic study was unremarkable. FOB was suggestive of endobronchial growth/mass in 32.9%, Bronchial Anthracofibrosis/Anthracosis in 15.7%, extrinsic compression in 11.4%, hyperemic mucosa and other findings in 8.6%, table 4. The frequency of radiographic mass lesions was more common in smokers (ex or current) 52% (25/48), than in non-smokers 27.3% (6/22) and the bronchoscopically mass lesion was found in 39.6% (19/48) smokers and 27.3% (6/22) non-smokers.

Table 1: Indications for FOB

Bronchoscopic indications	Frequency	Percent
Lung mass	24	34.3
Haemoptysis	14	20.0
Non resolving consolidation	10	14.3
Chronic cough	09	12.9
CA lung on treatment	06	8.5
Mediastinal lymphadenopathy	02	2.9
Miscellaneous	05	7.1

Table 2: Radiological findings of patients undergoing FOB

CT Findings	Frequency	Percent
Mass lesion	31	44.3
Collapse /consolidation	22	31.4
Infiltrates and GGOs	6	8.6
Bronchiectasis	6	8.6
Multiple findings	6	8.6
Normal	1	1.4

Table 3: Bronchoscopic interventions done in patients who underwent FOB

Bronchoscopic Intervention	Frequency	Percent
BAL	32	45.7
Endobronchial biopsy	28	40
Screening	9	12.9
TBNA	2	2.9
Multiple interventions	2	2.9

Table 4: Finding on fiberoptic bronchoscopy

Bronchoscopic Findings	Frequency	Percent
Endobronchial growth/mass	23	32.9
Normal Study	16	22.8
Anthracosis/BAF	11	15.7
Extrinsic compression	8	11.4
Hyperemic mucosa	6	8.6
Nodular elevations	3	4.3
Collapse	2	2.9
Multiple findings	6	8.6

Bronchoscopic complications occurred in 22 (31.4%) patients including bleeding (9 cases), arrhythmia (8 cases), hypoxemia (4 cases), and other complications like epistaxis and vomiting in 2 cases, table 5. Multiple complications occurred in 2 cases, which included one case with bleeding plus arrhythmia (tachycardia) and one case with bleeding plus hypoxemia and arrhythmia (tachycardia). Out of a total of 11 cases of bleeding, 1 case was of minimal bleeding, 2 cases were mild, 7 cases were moderate and only one case was of severe bleeding, table 6. These complications were managed bronchoscopically and all patients recovered without any serious consequences or need for any further intervention. No major complication occurred and there was no mortality in our study. Out of 70 procedures, a total of 3 procedures were abandoned because of excessive bleeding. There was no association between complications and age of the patient ($P>0.05$), but there was a significant positive association between bronchoscopic complications with bronchoscopic findings (like endobronchial lesions, anatomical distortions and BAF) and bronchoscopic complications with interventions (like endobronchial biopsies and TBNA) with $P<0.001$.

Table 5: Complications in the study patients

Complications	Frequency	Percent
Bleeding	09	12.9
Arrhythmias (tachycardia)	08	11.4
Hypoxemia	04	5.7
Others	02	2.9
Multiple complications*	02	2.9

Table 6: Severity of bleeding in the study patients

Severity of Bleeding	Frequency	Percent
Minimal	01	1.4
Mild	02	2.9
Moderate	07	10
Severe	01	1.4

DISCUSSION

In our study, the majority of the patients, 49 (70%) were males 21 (30%) were females (Fig 1) and 30 (42.8%) patients belonged to the age group of > 60 years followed by 29 (41.4%) patients belonged to the age group of 36-60 years, with a mean age of 55.22 (Fig 2). This was consistent with other studies¹⁷⁻¹⁸. We found that the most common indication for flexible fiberoptic bronchoscopy was lung mass (34.3%), followed by haemoptysis (20%), non-resolving consolidation (14.3%), chronic cough (12.9%), CA lung on treatment (8.5%), miscellaneous (7.1%), and lymph nodes 2 (2.9%), table 1. As with other studies conducted by Hassan G et al in Kashmir, he also observed mass shadows (21 patients, 37.5%) as the main indication for FOB followed by haemoptysis (13 patients, 23.2%), pleural effusion (11 patients, 19.7%), lung collapse (8 patients, 14.3%), and solitary pulmonary nodule (3 patients, 5.4%) [19]. Lymph nodes share only (2.9%) as an indication for bronchoscopy, as conventional TBNA has now given way to EBUS which is a preferred intervention for these patients.

We observed that the frequency of radiographic mass lesions was more common in smokers 52%(25/48), than in non-smokers 27.3% (6/22) and the bronchoscopically mass lesion was found in 39.6% (19/48) smokers and 27.3% (6/22) non-smokers. Mass lesions found on bronchoscopy were 39.6% (19/48), which was less than the frequency of mass lesions found on radiography 52% (25/48). This can be easily explained by the fact that peripheral mass lesions might not be accessible and hence not visible on Fiberoptic bronchoscopy.

In this study, the common CT findings were; mass lesions 31 (44.3%), followed by collapse/consolidation 22 (31.4%). Bronchiectasis, GGOs & infiltrates, were present in 6 patients each (8.6%), table 2. This was consistent with the study by Shrestha B K et al. They observed that the most common radiological indication for bronchoscopy was mass 111 (78.7%), followed by collapse/consolidation 35 (24.8 %), and nodules 16 (11.3 %)²⁰.

The most common bronchoscopic intervention in our study was bronchoalveolar lavage (BAL) in 45.7%, followed by lung biopsy in 40%, screening in 12.9% and TBNA in 2.9%. Two (2.9%) patients underwent multiple interventions, endobronchial biopsy and BAL were taken from both of

them, table 3. A study was conducted by Grendelmeier et al in Switzerland and demonstrated that bronchoalveolar lavage was the most commonly performed diagnostic procedure in 253 cases (31.5%), followed by bronchial washing in 174 cases (21.7%)²¹. Endobronchial lung biopsy was the second most common intervention in our study. It could be because endobronchial growth was the most common bronchoscopic finding which required a biopsy. Since the advent of endobronchial ultrasound EBUS, the number of patients undergoing conventional TBNA has gone down significantly, same is reflected in our study as well.

Complications during bronchoscopy occurred in 22 (31.4%) patients with no mortality. Most of the complications were in the form of only bleeding in 9 (12.9%), tachycardia in 8 (11.4%) and hypoxaemia in 4 (5.7%) patients. 2 patients had complications like mild epistaxis and vomiting and 2 patients had more than one complications which included one patient with bleeding and tachycardia and another patient with bleeding, hypoxemia and tachycardia. The majority of the complications were minor and self-limiting, and a few of them were managed bronchoscopically without any serious consequences. Three procedures were abandoned because of complications. One patient had a relatively serious complication in the form of severe bleeding that too was managed conservatively and the patient was discharged after 6 hours. Complications like pneumothorax, cardiac arrest, respiratory depression, severe bronchospasm or seizures were not experienced during this study. Also, no episodes of hypotension or hypertension were recorded, table 5. The study conducted by Jacomelli M et al in Brazil analysed 3,473 fiberoptic bronchoscopies and reported that the overall complication rate was 5.3%¹⁸. No mortality was observed in their study similar to ours but the percentage of complications was higher in our study, the reason could be a relatively small sample size which may be inadequate to compare these findings in general.

A study conducted by Ibrahim et al, in Qatar, reviewed 1006 records of adult flexible fiberoptic bronchoscopies and also reported that the main complication in their study was bleeding 23.9% and pneumothorax 9.8%²². In our study, the overall incidence of bleeding as a complication was relatively high mainly because our study had a small sample size. The other reason for this probably could be that a good

number of our patients underwent lung biopsy (40%). Lung biopsy and TBNA are usually associated with incidences of bleeding²³.

The total incidences of bleeding were 11 (15.7%). 9 patients had only bleeding as a complication and the other two had bleeding as a part of multiple complications. One patient had minimal bleeding, two patients had mild bleeding in which one case of bleeding was accompanied by tachycardia, seven patients had moderate bleeding, and one had severe bleeding accompanied by hypoxemia and tachycardia, table 6. One case of severe bleeding was associated with TBNA and all other cases of bleeding occurred post endobronchial biopsy.

Haemostasis was achieved by local cold saline spray and by continued suctioning of blood from the airways in 3 cases of bleeding (1 minimal and 2 mild cases), by local cold saline and tranexamic acid in 6 moderate cases of bleeding. Two (2.9%) cases of bleeding were managed by local cold saline, tranexamic acid (endobronchial/intravenous), and local adrenaline (1:10,000) spray. Among these 2 patients, 1 patient had moderate bleeding and the other had severe bleeding this patient also had hypoxemia and arrhythmia (tachycardia) due to which his procedure was abandoned. Fortunately, this patient didn't develop any serious consequences and was later stabilized without the need for any further intervention. Korraa et al, in Egypt in their study concluded that Endobronchial installation of tranexamic acid is an effective and safe modality of treatment for controlling non-life-threatening bronchopulmonary bleeding²⁴.

The incidence of arrhythmia in our study was 11.4% (8 patients). Shrader and Lakshminarayan, in their study, found that 11.4% (8/70) of the patients developed major arrhythmias because of the fiberoptic bronchoscopic procedure [25], which corresponds to our findings. In our study, 2.9% (2 patients) developed arrhythmia (tachycardia) along with other complications like bleeding and hypoxaemia (one in each patient). All arrhythmias were minor, self-limiting and none required treatment. 1 case had a resistant tachycardia of 170 bpm, which led to the early termination of the procedure. (2.9%) 2 patients had transient bradycardia (< 60 bpm) with heart rates of 42 bpm and 59 bpm respectively.

In our study hypoxemia during bronchoscopy was the third

main complication after bleeding and arrhythmia. We recorded four (5.7%) cases of hypoxemia, in which one patient (1.4%) had severe bleeding and arrhythmia (tachycardia) as well. This was consistent with a study by Suleman A et al¹⁷. No cases of hypoxemia before or after bronchoscopy were reported. Continuous oxygen supplementation from the time of sedation to the end of the procedure maintained spo2 >90% with a mean oxygen saturation of 94% during the procedure. However, mean saturation before and after the procedure was 97% and 96% respectively.

In our study, the most common bronchoscopic finding was endobronchial growth/lesion/mass in 23 patients (32.9%), a normal study in 16 patients (22.8%), Bronchial arthrofibrosis/anthracosis in 11 patients (15.7%), and extrinsic compression in 8 patients (11.4%). Hyperemic mucosa and other findings each with 6 (8.6%). Edematous mucosal nodular elevations 3 (4.3%) and collapse 2 (2.9%) were also found. 8.6% of patients present with multiple findings, table 4. This was consistent with the study by Sinha S, et.al²⁶.

In our study, we studied the correlation of bronchoscopic complications with age, and bronchoscopic findings, and found no association between complications and age by a study by Fazlalizadeh et al²⁷. They also found no association between complications and age. However, we found a significant association of complications with bronchoscopic findings ($P<0.001$) which was unlike their findings as they found no association between these two. We also found a significant association between complications and bronchoscopic interventions ($P<0.001$). We found that the association of complications with bronchoscopic findings and interventions were directly related to each other, as when bronchoscopic findings like endobronchial growth or extrinsic compression are present interventions like lung biopsy are more likely required accordingly and due to which the chances of complications like bleeding do increase.

LIMITATIONS

The main limitation of our prospective descriptive study was the considerably small sample size which may be inadequate to confirm the observed findings in general. Bleeding quantification may be over or underestimated as it was assessed based on clinical intervention or

bronchoscopic measures necessary to stop the bleeding and stabilize the patient.

CONCLUSION

According to the results obtained, the complications that occurred were minor with only one case of severe bleeding and that too was managed bronchoscopically without any need for further intervention, but it resulted in the termination of the procedure. No major adverse complications were recorded. Thus, it may be concluded that flexible fiberoptic bronchoscopy is a safe procedure and can be performed whenever indicated. Appropriate preparation, proper screening, close observation and adherence to the protocol are vital for a successful and safe procedure. Considerable training of staff and skilled personnel ensures patient safety and best outcomes. It needs further large studies with a good number of patients to support our findings.

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REFERENCES

- Ikeda S, Yanai N, Ishikawa S. Flexible bronchofiberscope. *Keio J Med*. 1968 Mar;17(1):1-16. doi: 10.2302/kjm.17.1. PMID: 5674435
- Balfour-Lynn I M, Spencer H. Bronchoscopy--how and when? *PaediatrRespirRev*. 2002 Sep;3(3):255-64.
- deBlic J, Scheinmann P. Fibreoptic bronchoscopy in infants. *Arch Dis Child*. 1992 Feb;67(2):159-61.
- Adwan H, Wigfield C H, Clark S, Barnard S. Interventional bronchoscopy for benign tracheobronchial diseases under cardiopulmonary bypass support: case reports and literature review. *J Cardiothorac Surg*. 2008; 3: 27.
- Joos L, Patuto N, chhajed P N, Tamm M. Diagnostic yield of flexible bronchoscopy in current clinical practice. *Swiss Med Wkly*. 2006 Mar 4;136(9-10):155-9.
- Kumaran R, Sung A, & Ernst A (2017). Airway Anatomy For TheBronchoscopist in A. Ernst &F.Herth (eds) Introduction to bronchoscopy (p 38-45) cambridge. Cambridge University of press.
- Suratt P M, Smiddy J F, Gruber B. Deaths and complications associated with fiberoptic bronchoscopy. *Chest*. 1976 Jun;69(6):747-51.
- Stahl D L, Richard K M, Papadimos T J. Complications of bronchoscopy: A concise synopsis. *Int J critilln sci*. 2015jul-sep;5(3):189-95.
- Waxman AB. Flexible bronchoscopy: indications, contraindications, and consent. *Introduction to bronchoscopy*. 2009 Jan 12:78.
- Browning R F, Turner J F, Wang K P. Indications and contraindications in flexible bronchoscopy. In flexible bronchoscopy 2012 Jan 5 (pp.70-91). Wiley-Blackwell.ch7.
- La Caille L, Patino Fernandez A M, Monaco J, Ding D, Upchurch Sweeney C R, Butler C D, Turner J R (2013). Exsmoker. *Encyclopedia of Behavioral Medicine*. 741-42.
- Carr I M, Koegelenberg C F, Von Groote-Bidlingmaier F, Mowlana A, Silos K, Haverman T, et, al. Blood loss during Flexible Bronchoscopy: A Prospective Observational Study. *Respiration*. 2012;84(4):312-8.
- Van Zwam J P, Kapteijns E F, Lahey S, Smit H J. Flexible bronchoscopy in supine or sitting position: a randomized prospective analysis of safety and patient comfort. *J BronchologyIntervPulmonol*. 2010 Jan;17(1):29-32.
- Ni Y L, Lo Y L, Lin T Y, Fang Y F, Kuo H P. Conscious sedation reduces patient discomfort and improves satisfaction in flexible bronchoscopy. *Chang Gung Med J*. 2010 Jul-Aug;33(4)443-52.
- Ryu J H, Lee S W, Lee J H, Lee E H, Do S H, Kim C S. Randomized double-blind study of remifentanyl and dexmedetomidine for flexible bronchoscopy. *Br J Anaesth*. 2012 Mar; 108(3):503-11.
- Williams T, Brooks T, Ward C. The role of atropine premedication in fiberoptic bronchoscopy using intravenous midazolam sedation. *Chest*. 1998 May;113(5):1394-8.
- Suleman A, Ikramullah Q, Ahmad F, Mohammad Y. K. 'Indications and complications of bronchoscopy: An experience of 100 cases in a tertiary care hospital'. *J Postgrad Med Inst*. 2008 Jul;22(3):210-14.
- Jacomelli M, Margotto S S, Demarzo S E, Scordanmaglio P R, Cardoso P F G, Palomino A L M,

- et, al. Early complications in flexible bronchoscopy at a university hospital'. *J Bras Pneumol*. 2020;46(4):e20180125.
19. Hassan G, Khan G Q, Yaseen M, Masood T. Cardiac arrhythmias during fiberoptic bronchoscopy and relation with oxygen saturation. *Lung India*. 2005;2(22):54-9.
20. Shrestha B K, Adhikari S, Kumar B T, Kadaria D. Complications and predictors of diagnostic yield of endobronchial forceps biopsy in visible lesions. *JAIM*. 2019 Jul-Dec;8(2):21-5.
21. Grendelmeier P, Kurer G, Pflimlin E, Tamm M, Stolz D. Feasibility and safety of propofol sedation in flexible bronchoscopy. *Swiss Med Wkly*. 2011 Aug 26;141:w13248.
22. Ibrahim A S, Allangawi M H, Sattar H A, Mobyed H S, Almohammed A A. Indications, diagnostic yields and complications of transbronchial biopsy over 5 years in the State of Qatar. *Saudi Med J*. 2005 Apr;26(4):641-5.
23. Bo L, Shi L, Jin F, Li C. The hemorrhage risk of patients undergoing bronchoscopic examinations or treatments. *Am J Transl Res*. 2021 Aug 15;13(8):9175-9181. PMID: 34540033; PMCID: PMC8430161.
24. Korraaa E E, Madkoura A M, Galal I H, El-Saidy I M. Bronchoscopic instillation of tranexamic acid to control bronchopulmonary bleeding. *Egypt. J. Bronchol*. 2017 Jul-Sep;11(3):244-9.
25. Shrader D L, Lakshminarayan S. The Effect of Fiberoptic Bronchoscopy on Cardiac Rhythm. *Chest*. 1978 Jun;73(6):821-4.
26. Sinha S, Guleria R, Pande J N, Pandey R M. 'Bronchoscopy in adults at a tertiary care centre: indications and complications'. *J Indian Med Assoc*. 2004 Mar;102(3):152-4.
27. Fazlalizadeh H, Adimi P, Kiani A, Malekmohammad M, Jabardarjani H R, Soltaninejad F, et, al. Evaluation of bronchoscopy complications in a tertiary health care center. *Tanaffos*. 2014;13(4):48-50.