

Indications for performing flexible bronchoscopy: Trends over 34 years at a tertiary care hospital

Ankit Amar Gupta, Inderpaul Singh Sehgal, Sahajal Dhooria, Navneet Singh, Ashutosh Nath Aggarwal, Dheeraj Gupta, Digambar Behera, Ritesh Agarwal

Department of Pulmonary Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh, Haryana and Punjab, India

ABSTRACT

Background and Aim: Due to its easy maneuverability, patient comfort and documented safety as an outpatient procedure, flexible bronchoscopy (FB) has replaced rigid bronchoscopy for routine diagnostic use. Herein, we report our 34-year experience with outpatient performance of FB. **Materials and Methods:** This was a retrospective analysis of all FB procedures performed between September 1979 and November 2013 (period I: 1979–1990; period II: 1991–2000; period III: 2001–2013) in a tertiary care hospital. Demographic profile of patients, indications for performing FB, and annual and seasonal trends were noted from the records. **Results:** A total of 24,814 bronchoscopies were performed during the study period. The mean (SD) age of patients (71.6% males) was 48.4 (15.5) years. The number of procedures performed per decade showed an absolute increase by 322%. The most common indication for FB was suspected bronchogenic carcinoma (32.2%) followed by pulmonary infections (18.6%) and interstitial lung diseases (13%). The proportion of annual cases due to interstitial lung diseases (3.9% in period I to 16.2% in period III) increased over the years, whereas disorders such as hemoptysis and pleural effusion showed a declining trend as an indication for FB. A seasonal trend was observed for diseases such as sarcoidosis, bronchogenic carcinoma and pulmonary infections. Six deaths were encountered during the study period in patients undergoing FB. **Conclusion:** FB is increasingly being performed in the diagnosis of respiratory disorders and is a safe outpatient procedure. Although bronchogenic carcinoma remains a common indication for performing FB, benign conditions such as pulmonary infections and sarcoidosis constitute important indications in the Indian scenario.

KEY WORDS: Bronchoscopy, hemoptysis, interstitial lung disease, lung cancer, pleural effusion, sarcoidosis, tuberculosis

Address for correspondence: Dr. Ritesh Agarwal, Department of Pulmonary Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh - 160 012, Haryana and Punjab, India. E-mail: agarwal.ritesh@live.com

INTRODUCTION

Since the advent of flexible bronchoscopy (FB) in 1966,^[1] the scope and indication of FB has seen an exponential surge. Apart from visualizing the airways, FB is used for performing various diagnostic (bronchoalveolar lavage, endobronchial and transbronchial biopsies) and therapeutic (extraction of foreign body, mucus plugs, blood clots, relieving central airway obstruction,

deployment of metallic stents and others) procedures. FB is an easy to perform and a safe procedure.^[2,3] Unlike its rigid counterpart, FB can be performed under conscious sedation and local anesthesia thereby avoiding the attendant complications of general anesthesia. Moreover, FB is an outpatient procedure, thus obviating the need for hospitalization. Furthermore, FB can be used to observe upper lobes and bronchial subsegments that are not easily visualized by a rigid bronchoscope.^[4-9] FB is now widely performed in India and is considered an essential requirement for a pulmonologist. Herein, we describe our experience of performing FB over the last three-and-a-half decades.

MATERIALS AND METHODS

This was a retrospective analysis of all FB procedures performed between September 1979 and November 2013.

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The study protocol was approved by the Ethics Review Committee. A written informed consent was obtained from all patients prior to the procedure. The following details were recorded: demographic profile, clinical indication, and month and year of bronchoscopy.

FB was performed in the bronchoscopy suite using bronchoscopes (BF P-20, BF 1T20, BF 1T150 or BF XT40 models; Olympus [Tokyo, Japan]) with outer diameters ranging from 4.9 to 6.2 mm. The procedure was performed either by a consultant or by a fellow under direct supervision of a consultant. FB was performed through the nasal route in supine posture, wherever possible. All patients received nebulized lignocaine (4% solution) immediately prior to the procedure. Topical 2% lignocaine spray was used just prior to the procedure augmented with “spray as you go” over the vocal cords and the airways. No sedation was used during or prior to the bronchoscopy. Monitoring of vital signs (pulse rate, respiratory rate, blood pressure, arterial oxygen saturation by pulse oximetry) was performed during the procedure.

To calculate the seasonal trends, the year was divided into four quarters (February–April, May–July, August–October, and November–January) in accordance with the Indian seasons, namely spring, summer, autumn, and winter. The number of bronchoscopy procedures done during each quarter was plotted as a percentage of the annual number of bronchoscopies performed in that year. The time period was divided into three periods: (a) Period I: 1979–1990; (b) period II: 1991–2000; (c) period III: 2001–2013.

RESULTS

A total of 24,814 bronchoscopic procedures were performed during the study period. Six (0.02%) deaths were encountered during the study. The number of bronchoscopies performed each year increased gradually from 120 in the year 1980 to 1476 in the year 2013 [Figure 1]. No consistent trend in the seasonal procedure frequency could be elicited over the 34 years period [Figure 2].

Demographic trends

The mean (standard deviation) age of patients undergoing FB was 48.4 (15.5) years, with men (49.6 years) being older than women (45.2 years). More procedures were performed in men ($n = 17,778$; 71.6%) compared with women ($n = 7,036$; 28.4%).

Clinical indications for bronchoscopy

The most common clinical indication for performing FB was malignancy ($n = 7,989$; 32.2%) followed by infections ($n = 4,611$; 18.6%) and interstitial lung disorders ($n = 3,244$; 13%). Other common indications were hemoptysis ($n = 2,734$; 11%), pleural effusion ($n = 901$; 3.6%), mediastinal lymphadenopathy and hoarseness of voice ($n = 4,984$; 20.1%), foreign body extraction ($n = 65$; 0.26%), preoperative and post-operative

assessment ($n = 317$; 1.3%).

Among infections, *Mycobacterium tuberculosis* was the most commonly encountered organism ($n = 2,349$; 9.5%), whereas *Pneumocystis jiroveci*, *Aspergillus*, *Mucormycetes*, *Nocardia*, *Cytomegalovirus*, and others were seen in 9.1% ($n = 2,262$) of the patients. Among the interstitial lung disorders, sarcoidosis ($n = 2,216$, 8.9%) formed the most common indication for FB and in 1028 (4.1%) cases, disorders such as nonspecific interstitial pulmonary fibrosis, idiopathic pulmonary fibrosis, hypersensitivity pneumonitis, eosinophilic lung disease, drug-induced interstitial lung disease, vasculitis, and others formed less common indications for FB [Table 1].

Disease trends

The mean age of patients undergoing FB with clinical diagnosis of malignancy, tuberculosis, sarcoidosis, interstitial lung diseases (ILD), and pleural effusions was 56.3, 41.4, 43.6, 48.8, and 50.4 years, respectively. Below 40 years of age, benign (sarcoidosis, pulmonary infections, and evaluation of hemoptysis) conditions were common indications for FB, whereas in patients above 60 years of age suspected bronchogenic carcinoma was the most common indication for FB. Between 40 and 60 years of age both benign (tuberculosis, interstitial lung disease including sarcoidosis, pleural effusion, and others), and malignant (bronchogenic carcinoma) disorders formed indication for performing FB [Table 2].

The number of females undergoing FB increased over the years from 23.9% in period I to 30.4% in period III [Table 3]. Bronchogenic carcinoma as an indication for FB in females increased over the years (124/929, 13.3% in period I; 316/1976, 15.9% in period II; 925/5084, 18.2% in period III). Benign diseases such as sarcoidosis, tuberculosis, and interstitial lung disease were more common among females, whereas bronchogenic carcinoma was more common in males [Table 4].

Periodic trends

There was an increase in the number of flexible bronchoscopies performed over three decades increasing from 3,528 in period I to 14,906 in period III, an absolute increase of 322%. Sarcoidosis (0.9% in period I to 11.9%

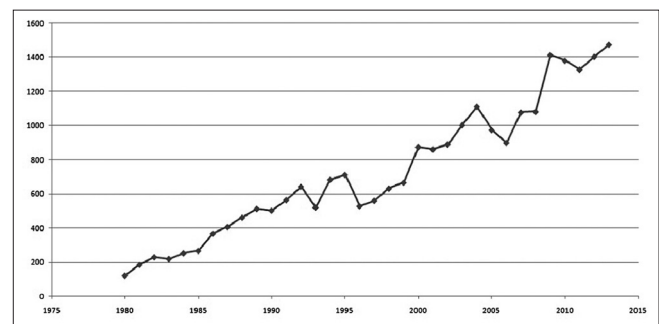


Figure 1: Line diagram depicting the number of flexible bronchoscopies performed during the study period

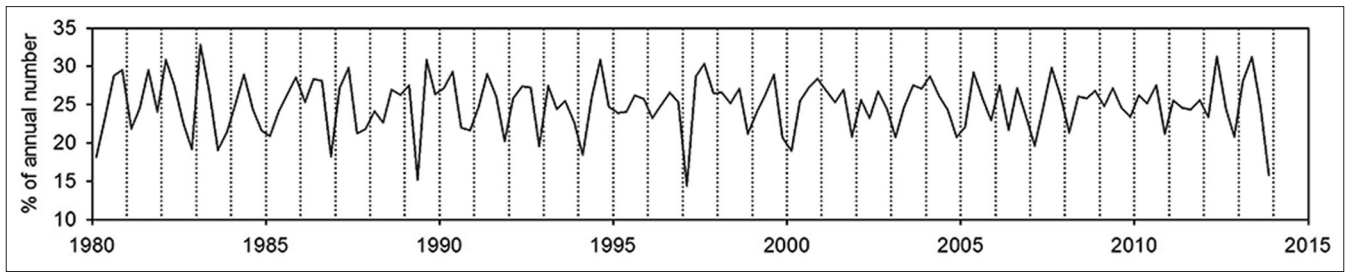


Figure 2: Seasonal trend of bronchoscopies performed during the study period. Each year has four points corresponding to the four quarters related to the four seasons in India (see Materials and Methods for details)

in period III), tuberculosis (5.8% from period I to 11.3% in period III) and bronchogenic carcinoma (26.3% in period I to 34.1% in period III) showed an increasing trend as an indication for performing FB. Hemoptysis and pleural effusions showed a declining trend as an indication for performing FB (13.3% in period I to 9.6% in period III and 5.4% in period I to 2.6% in period III, respectively; Table 5).

Seasonality

Certain diseases such as sarcoidosis, bronchogenic carcinoma, pleural effusion, and pneumonia showed a seasonal trend for doing FB [Table 6]. Diseases such as sarcoidosis and malignancy were more common during the summer season (May-July), whereas infections and pleural effusion were commonly seen during autumn (August-October).

DISCUSSION

The study spanning a period of over three decades highlights an increase in the usage and utility of FB to diagnose various respiratory ailments. FB was a safe outpatient procedure. Certain diseases such as sarcoidosis and infections showed a seasonal trend and have tremendously increased as an indication for performing FB.

The mean age of our patients undergoing FB was younger as compared with those in other studies.^[10,11] This is likely due to a higher proportion of patients undergoing FB for benign conditions, which is more commonly seen in younger individuals. FB was performed more commonly in males, consistent with previous studies.^[10,12,13] However, there was a gradual increase in the proportion of females undergoing flexible bronchoscopies over the past three decades (23.9% in period I to 30.4% in period III). This is likely due to an increasing awareness and literacy amongst women along with more equitable distribution of health care facilities.

The most common clinical indication for performing FB during the study period was bronchogenic carcinoma constituting almost one-third of all the bronchoscopies performed. This is also consistent with previous studies in which bronchogenic carcinoma formed the commonest indication for FB.^[10,12,13] In one study of 429 patients, bronchogenic carcinoma was an indication in about 45.5%

Table 1: Clinical indications for carrying out flexible bronchoscopy

Clinical indication	No. (%)
Hemoptysis	2734 (11)
ILD	1028 (4.1)
Infections	2262 (9.1)
Malignancy	7989 (32.2)
Miscellaneous	5335 (21.5)
Pleural effusion	901 (3.6)
Sarcoidosis	2216 (8.9)
Tuberculosis	2349 (9.5)
Total	24,814 (100)

ILD: Interstitial lung diseases

Table 2: Age distribution of the patients

Clinical indication	Age distribution (years)				Total
	≤20 (%)	21-40 (%)	41-60 (%)	>60 (%)	
Hemoptysis	185 (16.2)	1168 (17.8)	1052 (8.9)	329 (6.2)	2734 (11.0)
ILD	23 (2.0)	234 (3.6)	599 (5.1)	172 (3.2)	1028 (4.1)
Infections	135 (11.8)	768 (11.7)	957 (8.1)	402 (7.5)	2262 (9.1)
Malignancy	33 (2.9)	754 (11.5)	4474 (38.0)	2728 (51.2)	7989 (32.2)
Miscellaneous	450 (39.5)	1614 (24.5)	2294 (19.5)	977 (18.3)	5335 (21.5)
Pleural effusion	31 (2.7)	207 (3.1)	450 (3.8)	213 (4.1)	901 (3.6)
Sarcoidosis	48 (4.2)	880 (13.4)	1118 (9.5)	170 (3.2)	2216 (8.9)
Tuberculosis	235 (20.6)	954 (14.5)	823 (7.0)	337 (6.3)	2349 (9.5)
Total	1140 (100)	6579 (100)	11,767 (100)	5328 (100)	24,814 (100)

ILD: Interstitial lung diseases

Table 3: Gender distribution over the study period

Period	Gender distribution (%)		
	Female	Male	Total
1979-1990 (I)	843 (23.9)	2685 (76.1)	3528 (100.0)
1991-2000 (II)	1667 (26.1)	4713 (73.9)	6380 (100.0)
2001-2013 (III)	4526 (30.4)	10,380 (69.6)	14,906 (100.0)
Total	7036 (28.4)	17,778 (71.6)	24,814 (100.0)

of cases undergoing FB.^[12] There has been an increase in the incidence of lung cancer in India in the last few decades. In a sporadic review from various hospitals across the country, the incidence of lung cancer increased from 27.4 per million in 1950 to 78.6 per million in 1959. There are 47,000 men and 11,000 women diagnosed as having lung cancer every year according to the global burden of lung cancer data in India.^[14] In our study, the overall male to female ratio of cancer patients was 4.8 with a steady decline (6.5 in period I, 5.3 in period II and 4.5 in period

III) suggesting an increase in the number of female patients undergoing FB for the indication of lung cancer.

Among benign diseases, sarcoidosis, pulmonary infections, evaluation for hemoptysis, and pre- and postoperative assessment were common indications. Foreign body inhalation was a rare indication for performing FB. FB is widely employed to identify the etiology and localize the site of bleeding. In our series, hemoptysis as an indication for FB constituted 11% (n = 2734) of all the bronchoscopies performed. However, there was a declining trend in hemoptysis as an indication for FB constituting 13.3% in period I to 9.6% in period III. The likely decrease can be attributed to the early diagnosis of tuberculosis, and declining prevalence of severe forms of pulmonary tuberculosis;^[15] other reason is the advancement in radiological techniques for evaluating hemoptysis.^[10,12,13]

Table 4: Gender differences for clinical indications for flexible bronchoscopy

Clinical indication	Gender (%)		Total
	Female	Male	
Hemoptysis	775 (11.0)	1959 (11.0)	2734 (11.0)
ILD	513 (7.3)	515 (2.9)	1028 (4.1)
Infections	650 (9.2)	1612 (9.1)	2262 (9.1)
Malignancy	1367 (19.4)	6622 (37.2)	7989 (32.2)
Miscellaneous	1675 (23.8)	3660 (20.6)	5335 (21.5)
Pleural effusion	269 (3.8)	632 (3.6)	901 (3.6)
Sarcoidosis	978 (13.9)	1238 (7.0)	2216 (8.9)
Tuberculosis	809 (11.5)	1540 (8.7)	2349 (9.5)
Total	7036	17,778	24,814

ILD: Interstitial lung diseases

Table 5: Periodic trends of diseases

Clinical indication	1979-1990 (Period I)	1991-2000 (Period II)	2001-2013 (Period III)	Total
Hemoptysis	469 (13.3)	833 (13.1)	1432 (9.6)	2734 (11.0)
ILD	105 (3.0)	289 (4.5)	634 (4.3)	1028 (4.1)
Infections	364 (10.3)	619 (9.7)	1279 (8.6)	2262 (9.1)
Malignancy	929 (26.3)	1976 (31.0)	5084 (34.1)	7989 (32.2)
Miscellaneous	1235 (35.0)	1481 (23.2)	2619 (17.6)	5335 (21.5)
Pleural effusion	190 (5.4)	319 (5.0)	392 (2.6)	901 (3.6)
Sarcoidosis	33 (0.9)	402 (6.3)	1781 (11.9)	2216 (8.9)
Tuberculosis	203 (5.8)	461 (7.2)	1685 (11.3)	2349 (9.5)
Total	3528 (100)	6380 (100)	14,906 (100)	24,814 (100)

ILD: Interstitial lung diseases

Table 6: Seasonal distribution of clinical indications for flexible bronchoscopy

Clinical indication	Seasonal distribution N (%)				Total
	Feb-Apr (Spring)	May-Jul (Summer)	Aug-Oct (Autumn)	Nov-Jan (Winter)	
Hemoptysis	710 (26.0)	672 (24.6)	691 (25.3)	661 (24.2)	2734 (100.0)
ILD	275 (26.8)	242 (23.5)	279 (27.1)	232 (22.6)	1028 (100.0)
Infections	563 (24.9)	549 (24.3)	635 (28.1)	515 (22.8)	2262 (100.0)
Malignancy	1909 (23.9)	2089 (26.1)	2007 (25.1)	1984 (24.8)	7989 (100.0)
Miscellaneous	1243 (23.3)	1434 (26.9)	1429 (26.8)	1229 (23.0)	5335 (100.0)
Pleural effusion	203 (22.5)	216 (24.0)	251 (27.9)	231 (25.6)	901 (100.0)
Sarcoidosis	512 (23.1)	657 (29.6)	627 (28.3)	420 (19.0)	2216 (100.0)
Tuberculosis	617 (26.3)	632 (26.9)	621 (26.4)	478 (20.4)	2348 (100.0)
Total	6032 (24.3)	6491 (26.2)	6540 (26.4)	5751 (23.2)	24,814 (100.0)

ILD: Interstitial lung diseases

Non-resolving pneumonia as an indication was seen in approximately 20% of all bronchoscopies performed. This is similar to the experience reported from other centers in Asia.^[10,12,13] Pulmonary tuberculosis was the commonest indication for FB in patients presenting with suspected pneumonia, due to the high TB burden in India. We also performed bronchoscopy in patients of suspected infection with *Pneumocystis jirovecii*, *Aspergillus*, *Mucormycetes*, *Nocardia*, *Cytomegalovirus*, and others. This group (n = 2,262; 9.1%) comprised of patients who were immunocompromised (hematological malignancies, chronic renal failure, diabetes mellitus, human immunodeficiency virus infection, and others) or were on immunosuppressive drugs (post-transplant, connective tissue disorders, and others).

Interstitial lung disease was an indication in 13% (n = 3,244) of all bronchoscopic procedures performed. Sarcoidosis was the commonest disease, whereas others such as nonspecific interstitial pneumonia, idiopathic pulmonary fibrosis, hypersensitivity pneumonia, and eosinophilic lung diseases were an indication for FB in only a minority of cases. While sarcoidosis as an indication for bronchoscopy had increased over time, other interstitial lung diseases have remained fairly constant as an indication for diagnosis. The diagnosis of interstitial lung disorders such as idiopathic pulmonary fibrosis and nonspecific interstitial pneumonia is primarily clinicoradiological (or requires surgical lung biopsy), and generally obviates the need for FB. The number of patients with sarcoidosis undergoing bronchoscopic evaluation has increased (from period I, n = 33; 0.9% to period III, n = 1781; 11.9%) due to increased awareness of the disease among physicians and the need to exclude pulmonary tuberculosis in Indian settings before starting treatment.^[16-20]

Seasonal variation was observed with sarcoidosis, lung cancer, pulmonary infections, and pleural effusion. An association between the season of diagnosis of lung cancer, and survival has been previously reported. In most studies, lung cancer diagnosed in winter carried a poorer outcome.^[21-23] There was also a trend toward higher number of cases of sarcoidosis being diagnosed in summer (May–July). This is in agreement with previous studies studying seasonal variability of sarcoidosis.^[16,24-26]

The increased incidence of infections and pleural effusions can be explained by the impact of the rains in the Indian subcontinent.^[27-29] A higher incidence of tuberculosis was seen in spring and summer months in a review of several studies similar to our experience. Although the transmission of infection may be higher in the winter months due to overcrowding, the delayed hypersensitivity and the incubation period leads to disease manifestation in spring and summer.^[30]

We also observed an increase in the number of bronchoscopies being performed during each period spanning over almost three decades. The number of flexible bronchoscopies have risen gradually by over 300% between periods I and III. This is due to the ease of performing the procedure on an outpatient basis under local anesthesia. Moreover, it is a safe procedure with only six deaths encountered over the last three and half decade.

CONCLUSION

FB is increasingly being utilized in diagnosis of a wide array of respiratory disorders. It is fairly safe and can be performed as an outpatient procedure. Certain diseases such as sarcoidosis, pulmonary infections show a seasonal variation. Although bronchogenic carcinoma is the commonest indication for performing FB, in tropical country such as India, benign diseases such as pulmonary infections and sarcoidosis form an important indication for performing FB.

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