Major complications encountered during 9979 flexible bronchoscopies performed under local anesthesia over 8 years

Flexible bronchoscopy (FB) is a frequently employed diagnostic procedure for evaluating respiratory disorders.[1,2] Studies in the previous decades suggest a complication rate of 1% with FB.[3,4] The complication rates in the contemporary era are unknown. The indications for FB have considerably widened to include sicker patients (immunocompromised patients and others) who are at risk of higher complications. We reviewed our bronchoscopy database to assess the frequency of major complications among subjects undergoing FB procedures without sedation.

We performed a retrospective analysis of the data collected over 8 years (February 1, 2013–January 1, 2021). The Institute Ethics Committee approved the study protocol. We were granted a consent waiver as the study was retrospective and involved anonymized patient data. We have previously published details of some of the subjects included in the study.[5-7] We included all participants undergoing FB during the study period. We excluded FB procedures (radial and convex probe endobronchial ultrasound, argon plasma coagulation, electrocautery, balloon dilatation, or foreign-body retrieval) where conscious sedation was used.[8,9] We retrieved the following information from our database: (1) age and sex; (2) indication for the procedure; (3) type of procedure (bronchoalveolar lavage [BAL], endobronchial biopsy [EBB], and transbronchial biopsy [TBB]); (3) the number of procedures (none [airway inspection], one [either BAL, EBB, or TBB], or ≥2 procedures); and (4) the specific complications encountered.
Table 1: Baseline characteristics, indications, and procedural details of the study population undergoing bronchoscopy

| Characteristics                        | No major complications (n=9886) | Major complications (n=93) | Total (n=9979) | P  |
|----------------------------------------|---------------------------------|---------------------------|---------------|----|
| Demography                             |                                 |                           |               |    |
| Age (years), mean (SD)                 | 48.0 (16.7)                     | 50.4 (17.6)               | 48.0 (16.8)   | 0.17|
| Male sex                               | 6540 (66.2)                     | 57 (61.3)                 | 6597 (66.1)   | 0.32|
| Indications for bronchoscopy           |                                 |                           |               |    |
| Airway inspection                      |                                 |                           |               |    |
| Bronchogenic carcinoma                 | 1276 (12.9)                     | 6 (6.5)                   | 1282 (12.8)   | 0.0001|
| Tuberculosis                           | 2676 (27.1)                     | 26 (28.0)                 | 2702 (27.1)   |    |
| Sarcoidosis                            | 1630 (16.5)                     | 23 (24.7)                 | 1653 (16.6)   |    |
| Nonresolving pneumonia                 | 609 (6.2)                       | 12 (12.9)                 | 621 (6.2)     |    |
| Intestinal lung disease                | 452 (4.6)                       | 6 (6.5)                   | 458 (4.6)     |    |
| Others                                 | 2893 (29.3)                     | 17 (18.3)                 | 2910 (29.2)   |    |
| Procedure details                      |                                 |                           |               |    |
| BAL                                    | 4010 (40.6)                     | 37 (39.8)                 | 4047 (40.6)   | 0.99|
| EBB                                    | 2474 (25.0)                     | 31 (33.3)                 | 2745 (27.4)   | 0.07|
| TBB                                    | 1364 (13.8)                     | 47 (50.5)                 | 1411 (14.1)   | 0.0001|

*Airway inspection included stridor, hemoptysis, perioperative evaluation, and others. Values are expressed as numbers (%) unless otherwise mentioned. BAL: Bronchoalveolar lavage, EBB: Endobronchial biopsy, SD: Standard deviation, TBB: Transbronchial biopsy.

Table 2: Details of complications encountered during bronchoscopy

| Complication details | Number of patients |
|----------------------|--------------------|
| Any major complication | 93 (0.95)         |
| Complication details |                     |
| Pneumothorax         | 44 (0.44)          |
| Severe bleeding      | 27 (0.27)          |
| Endotracheal intubation | 23 (0.23)      |
| Cardiac arrest       | 2 (0.02)           |
| Death                | 5 (0.08)           |
| Number of procedures |                    |
| Airway inspection    | 10/3568 (0.3)      |
| Single procedure (BAL, EBB or TBB) | 51/4952 (1.0) |
| Two procedures       | 32/1366 (2.3)      |
| Operator             |                     |
| Consultant           | 26/93 (28.0)       |
| Fellow               | 67/93 (72.0)       |
| Duration of procedure (min), mean (SD) | 11.8 (8.3) |
| ICU stay after complication | 12/93 (12.9) |

An individual patient may have experienced one or more complications hence the individual numbers do not add up to 93. Eleven of these 44 (25%) pneumothoraces required chest drain insertion. Among those subjects with complications (n=93), The values are presented as numbers (%) for the entire study population unless mentioned as BAL: Bronchoalveolar lavage, EBB: Endobronchial biopsy, ICU: Intensive care unit, SD: Standard deviation, TBB: Transbronchial biopsy.

The study’s primary objective was to analyze the prevalence of major complications during nonsedation bronchoscopy. The indications of bronchoscopy and the procedures resulting in major complications were compared with uncomplicated procedures. We categorized the complications as major if the patient had any of the following: (1) hypoxemia requiring supplemental oxygen or mechanical ventilation (invasive or noninvasive); (2) severe bleeding (requiring instillation of ice-cold saline, local adrenaline, or tamponade to control the bleeding or blood transfusion); (3) life-threatening bleeding (requiring endotracheal intubation); (4) pneumothorax (with or without the need for drainage); and (5) death.

We performed all the bronchoscopy procedures after written procedural consent. FB was performed after clinical and radiological assessment by consultants or fellows under the direct supervision of the consultants. At our bronchoscopy suite, we administer local anesthesia using lignocaine spray (10 puffs) for the oropharynx, 2% lignocaine gel instillation into the nasal cavity, and 1% lignocaine spray sprayed on the vocal cords, the trachea, and major bronchi during the procedure. Coagulation profile and complete blood count were performed in all the subjects undergoing transbronchial lung biopsy (TBB) and those with risk factors for increased bleeding (anticoagulant and antiplatelet therapy, chronic liver disease, and history of bleeding diathesis). We performed TBB using alligator forceps without fluoroscopy guidance and obtained at least four moderate-to-large tissues. In general, 4–6 biopsies were obtained during EBB. A chest radiograph was performed 2–4 h (or earlier if indicated) after TBB. We monitored heart rate and oxygen saturation using a pulse oximeter before, during, and at least 15 min after the procedure. We prolonged the monitoring or admitted the patient to the hospital if a complication occurred.

In the event of bleeding during FB, the bronchoscopy table was tilted, and the patient was positioned with the affected side dependent. We instilled ice-cold saline or adrenaline (1:10000 dilution) if bleeding continued. We managed pneumothorax as per the standard recommendations depending on the size of the pneumothorax, the status of the underlying lung, and the patient’s clinical status.

We analyzed data using the commercial statistical package SPSS version 22.0 (IBM SPSS Inc., Armonk NY, US). Data are presented as numbers (percentage) or mean (standard deviation). As applicable, differences between groups were compared using the Chi-square test or Student’s t-test. We also performed a binary logistic regression analysis to ascertain factors associated with major complications during FB. For our analysis, we grouped the procedures as airway inspection, endobronchial procedures (BAL or EBB), and transbronchial procedures (TBB or without
During the study period, 12,450 subjects underwent a procedure in our bronchoscopy suite. We finally included 9,979 subjects (66.1% of subjects were men) with a mean age of 48.0 years. The most frequent indications for bronchoscopy were suspected malignancy, tuberculosis, or sarcoidosis [Table 1]. Ninety-three (0.93%) subjects experienced a major complication [Table 2]. Of those experiencing a complication, 72% were performed by fellows, the remainder by the consultants.

Pneumothorax (n = 44) and severe bleeding (n = 27) were the most common complications. Eleven of the 44 (25%) pneumothoraces required intercostal tube drainage.

Twenty-three (0.2%) subjects required endotracheal intubation for respiratory failure (n = 15), life-threatening bleed (n = 6), or cardiac arrest (n = 2). We recorded eight deaths (severe bleeding, n = 4; respiratory failure, n = 3; and cardiac arrest, n = 1) among the 9,979 procedures (0.08%). Twelve (12.9) of the 93 subjects were transferred to the intensive care unit (ICU) for management. We encountered complications more frequently in subjects who underwent two or more procedures versus a single procedure (2.3% vs. 1%) or airway inspection (0.3%). On binary logistic regression analysis, the performance of any procedure (TBB had a greater risk than EBB or BAL) was an independent risk factor for the occurrence of complications after adjusting for age and the clinical indication [Table 3].

We report the incidence of major complications encountered during FB at our institute over 8 years. Major complications (0.93%) including death (0.08%) were uncommon following outpatient FB. Nearly 13% of the subjects experiencing a major complication required ICU admission. The incidence and pattern of complications during bronchoscopy depend on the patient profile (age, comorbid illness), setting (emergency vs. elective), the indication (diagnostic vs. therapeutic), and the experience of the operator. Common complications requiring further intervention are severe bleeding, pneumothorax, and bronchospasm. At centers using sedation for outpatient bronchoscopy, oversedation contributes to a significant proportion. In a study published in 2006, the complication rates for bronchoscopy among fellows undergoing training was 2.06% of 3,538 procedures, and the most common was pneumothorax; mortality was (1/3528; 0.03%). Complication rates were highest for the fellows in their first 4 months of training than more experienced fellows (later part of the 1st-year training and 2nd-3rd years).

The rate and type of complication at our center may not be generalizable. Our study’s marginally higher death rate (8/10,000 bronchoscopies) might be due to the sicker patients referred to a tertiary center. Further, we performed FB without conscious sedation, and the complications may differ in centers routinely employing intravenous sedation or general anesthesia. Finally, our study is limited by the lack of details of minor complications occurring after bronchoscopy.

In conclusion, major complications such as pneumothorax, severe bleeding, and others occur uncommonly after FB, even without sedation. Diagnostic bronchoscopy performed on an outpatient basis is a safe procedure.

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Conflicts of interest

There are no conflicts of interest.

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