Fiberoptic bronchoscopy (FOB) is one of the commonest diagnostic procedures carried out in respiratory medicine. Although it is associated with minimal morbidity and mortality, transient changes in normal circulatory and pulmonary physiology are common.\(^1\)\(^2\) The occurrence of tachycardia, increased blood pressure, and decline in oxygen saturation and pulmonary functions, especially in patients with chronic airflow obstruction has been shown following FOB.\(^3\)\(^4\) We attempted to document various physiological cardiopulmonary variations that occur during flexible bronchoscopy among a spectrum of clinical indications.

We studied 88 patients referred for FOB by measuring the supine blood pressure, heart rate, oxygen saturation, and respiratory rate at 0 min, 5 min, and 10 min counted from scope insertion. Spirometry was carried out 30 min before and after the procedure using FLOWHANDY Zan 100 USB (ZAN Messgerate GmbH Oberthulba, Germany). Forced vital capacity (FVC), forced expired volume in 1 second (FEV1), peak expiratory flow rate (PEFR), and forced expiratory flow rate (FEF\(_{25-75}\)) measurement were recorded. Bronchoscopy was carried out using the OLYMPUS- BF 180 (OLYMPUS MEDICAL SYSTEM CORP Tokyo, Japan) videoscope through the nasal route, after obtaining written informed consent, under topical anesthesia with 2% lignocaine spray and solution. No intravenous midazolam and anticholinergics were used in any patient. Nasal oxygen (100%) was administrated to all patients at 2-3 L/min.

For analysis of data, paired \(t\)-test, Wilcoxon signed-rank test, and repeated measure analysis of variance (ANOVA) tests were used. Statistical analysis was carried out using SPSS 16 (IBM SPSS version 20 Armonk, NY, IBMCORP) and a significance level of the test (p) value less than 0.05 was considered to be statistically significant.

In total, 88 patients were studied (61 males (69%), mean [standard deviation (SD)] age 46.85 (15.69) years). The mean (SD) body mass index (BMI) was 20.86 (3.67) and the majority (68.18%) were nonsmokers. Most patients were being evaluated for suspected carcinoma lung (38.64%), bronchiectasis with superadded infection (19.3%), pneumonia (10.2%), carcinoma esophagus (7.9%), interstitial lung disease (6.8%), undiagnosed mediastinal lymphadenopathy (6.8%), and pleural effusion (4.5%). The mean (SD) duration of FOB was 15.4 (4.3) min. Most patients underwent bronchoalveolar lavage as the primary procedure (45.45%) followed by bronchial washings (35.2%) and endobronchial biopsies (19.4%).

FVC, FEV1, PEFR, and FEF\(_{25-75}\) all demonstrated a significant decline following the procedure [Table 1]. On the other hand, the heart rate, systolic blood pressure, and diastolic blood pressure significantly increased while oxygen saturation declined [Figure 1]. No clinically significant bleeding was observed that necessitated termination of procedure or any other intervention.

The effect of age on these parameters was examined by dividing all patients into two groups, i.e., less than and older than 45 years based on the mean age of the entire group. No significant difference was observed between these two groups except a higher systolic blood pressure (SBP) and diastolic blood pressure (DBP) at 0 min and 5 min of FOB in subjects older than 45 years.

This observational study evaluating cardiorespiratory physiological changes during flexible bronchoscopy showed an increase in blood pressure and heart rate during the procedure while oxygen saturation declined. The spirometry parameters (FVC, FEV1, PEFR, and FEF\(_{25-75}\)) decreased significantly after the bronchoscopy procedure. Changes in the pulmonary and circulatory statuses are expected during bronchoscopy and may be associated with an adverse outcome. Several factors contribute to the occurrence of intraprocedure hypoxia such as ventilation-perfusion mismatch, excessive sedative use, patient posture, and baseline FEV1.\(^2\)\(^3\)\(^5\)\(^-\)\(^7\) It has been observed that bronchial lavage with relatively small quantities of saline solution in the range of 30-40 mL to each lung for up to 3 min may cause significant hypoxemia that may persist for at least 10 min following termination of the procedure.\(^6\)

The mean duration of FOB in our study was similar to that reported by Harrel et al.,\(^9\) but less than that documented by Salisbury et al.\(^1\) Airflow disturbance in the large and small airways by whole FOB procedure produces significant changes in lung function parameters.\(^1\)\(^2\) A fall in saturation of peripheral oxygen (SpO2) occurs due to the presence of excessive tracheobronchial secretions and also depends on the scope position, with greater hypoxia when the scope is in the larger airways. Respiratory depression due to excessive sedation is
well-documented. For example, aerosolized atropine or isoproterenol accentuates FVC and FEV1 while topical lidocaine produces the opposite effects. The marked reduction in spirometric parameters in our patients implies that this procedure may have led to clinically overt bronchoconstriction. Whether the administration of preprocedure inhaled short acting bronchodilators will have a protective effect is unknown and merits further study. No significant major complication or bleeding episode was observed among our patients that might have necessitated termination of the procedure or emergency intervention.

Our study had some limitations. We could not enroll patients undergoing transbronchial lung biopsy due to risk of pneumothorax on post procedure spirometry. Only short-term post FOB measurements could be taken because patients were discharged from the hospital within 2-3 h after the procedure. We did not measure the total volume of topical lignocaine given to all patients. These could have affected the degree of bronchoconstriction during FOB.

To conclude, flexible FOB is associated with significant acute hemodynamic and respiratory alterations, notably hypoxia and a decline in lung function. Appropriate measures must be taken to prevent or minimize these to ensure an uncomplicated and comfortable FOB.

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**Conflicts of interest**
There are no conflicts of interest.

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