MINI REVIEW

Cardiovascular Consequences of Fiberoptic Bronchoscopy

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Introduction

The flexible fiberoptic bronchoscope introduced by Killian in 1897 has become a versatile tool in pulmonary medicine, and has gained wide acceptance over the recent years because of its advantage of superior visualization, ease of application and better tolerance by the patients compared to rigid bronchoscop (1,2). Besides its role in the diagnosis of various lung lesions, the use of lasers in conditions like bronchogenic carcinoma and bleeding cavitatory lesions, and the application of endobronchial radiation therapy, have revolutionized the pulmonary medicine. Despite this, the complications, although less, are known to occur, which may arise from the administration of premedication and topical anesthetics, mechanical presence of the bronchoscope in the bronchial tree or the application of newer modalities like lasers and endobronchial radiations (3-5). Cardiovascular complications are well known to occur as a result of premedications, topical anesthetics and the hypoxemia engenderd during the procedures (3,6-8). Well awareness of the physicians and bronchoscopists can prevent or minimize the occurrence of such adverse consequences.

Heart Rate

Pulse rate increases tremendously during the bronchoscopic procedures, can be regular or irregular. Sinus tachycardia can occur as a result of catecholamine reponse to the anxiety state of the patients, premedication with atropine or even as a result of hypoxemia both due to central nervous system stimulation and release of catecholamines (3,7-10). Atropine can cause increase in heart rate at a dose of above 1mg and below this cardiac slowing can occur. Low doses of atropine when given subcutaneously or intramuscularly, can exert an initial parasympahomimetic effect, possibly via central action. Sinus bradycardia is also known to occur during bronchoscopy, attributed to low dose of atropine used, vagal stimulation or severe hypoxemia occurring during the procedures (11).

Hypoxemia

The occurrence of hypoxemia during fiberoptic bronchoscopy is attributed to a spectrum of factors. It can be reflex in nature due to stimulation of subepithelial receptors by bronchoscope resulting in bronchoconstriction with a consequent mismatch of ventilation and perfusion, large doses of local anesthetic agents may further ameliorate this bronchoconstriction. Hypoxemia can even occur in patients with pneumonia due to mechanical occlusion of the orifice of the involved lobe and critical impairment of gas flow. In the absence of pneumonia, collateral ventilation probably prevents this mechanism of hypoxemia (12-15). Other possible factors responsible for occurrence of hypoxemia, include the mechanical presence of bronchoscope in the bronchial tree, prolonged suctioning, and hemorrhage from the biopsy sites, lavage fluids and oversedation with drugs especially opiates (13,16,17). Thus the combination of reflex stimulation and ventilation -perfusion mismatching due to airway obstruction appears to be the most likely cause of hypoxemia during fiberoptic bronchoscopy (10,13,18).

Cardiac Arrhythmias

Several studies so far, including our study of 1542 procedures, have well documented the development of cardiac arrhythmias, most often related to the occurrence of hypoxemia during the procedures (3,8,16,19,20). Various disturbances of cardiac rhythm during FOB which have been observed and well documented so far include multifocal atrial tachycardias, atrial flutter and fibrillation, paroxysmal supra-ventricular tachycardias, atrial and ventricular premature complexes, right and left bundle branch blocks, AV nodal blocks of Wenckebach type and complete AV blocks. Majority of these disturbances of cardiac rhythm have been attributed to hypoxemia engendered during the procedures, as a result of complex cellular dysfunction resulting from the metabolic effects of severe acute hypoxia (3,7,10,18,19,21).

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Arrhythmogenicity due to hypoxia may also be as a result of pH related alterations in calcium or magnesium levels, or the levels of circulating catecholamines(22).

Myocardial Ischemia and Infarction

Significant hemodynamic alterations including heart rate, mean arterial pressure and cardiac index, occur during fiberoptic bronchoscopy. These changes are of little consequence in patients with normal cardiovascular function; in patients with pre-existing hypertension, coronary artery disease, or in elderly patients with accompanying lung disease, these may be of particular importance. Significant myocardial ischemia and occurrence of myocardial infarction during fiberoptic bronchoscopy are well known(7,21,23).

Cardiac Arrest and Deaths

Mortality due to cardiac arrest following the occurrence of arrthymias and respiratory arrest, has been 0.01 to 0.25% till date. In a study of Credle WF(21) and associates, including 2452 bronchoscopic procedures, 3 deaths (0.01%) took place, and in another study of 48000 procedures conducted by Suratt PM and co-workers 12 deaths were encountered indicating mortality of 0.02% (24). In our recent study involving 1542 procedures one death took place still indicating a very low (0.08%) mortality (10).

In brief, the aim of being pessimist about fiberoptic bronchoscopy despite its excellent role in the diagnostic and therapeutic aspects of pulmonary medicine, is to make physicians and bronchoscopists well aware of the adverse effects. It is thus recommended that supplemented oxygenation should be made mandatory during the procedures with facilities of well equipped intensive care units, to minimize the risk of such complications.

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