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CARDIAC ARRHYTHMIA AND HEMODYNAMIC EFFECTS DURING FIBEROPTIC BRONCHOSCOPY

Respiratory Medicine

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ABSTRACT

Background: Arterial hypoxaemia is the commonest complication, since respiratory depressant drugs are used for premedication, and the airway is also partially occluded by the bronchoscope. The study is therefore designed to find out the changes in arterial oxygen tension during FOB along with effect on central hemodynamics, electrocardiographically.

Objectives:

· To find out the changes in arterial oxygen tension during FOB.

· To study the effects of fiberoptic bronchoscopy on central hemodynamics, electrocardiographically.

Methods: 100 patients aged 20 years and above undergoing FOB were evaluated for the arterial oxygen tension and cardiac rhythm changes at KNCH, Jodhpur.

Results: All patients developed a fall in PaO2 following FOB which was highly significant but hypoxaemia was noted only in 18 cases. There was a uniform rise in heart rate in all the patients after FOB which was statistically significant. There was slight sinus tachycardia in most of the cases although E.C.G. indicated no major arrhythmias. There was no significant change in pH level. Mean of SBP and mean of DBP was statistically significant.

Conclusion: All patients showed a decline in arterial PaO2 after FOB which was highly significant. There was slight sinus tachycardia in most of cases. FOB itself does not endanger the patients with any significant or serious complications.

KEYWORDS

hemodynamics, fiberopticbronchoscopy, electrocardiogram

INTRODUCTION:

Bronchoscopy was established by Jackson in 1907 early in this century for the investigation of pulmonary diseases. He used a rigid open tube bronchoscope and it rapidly became a routine procedure, especially in the diagnosis of malignant diseases. Flexible bronchoscope was introduced by Ikeda[1] in 1964 for the early diagnosis of bronchial carcinoma. Flexible bronchoscopy (FB) is a safe and frequently performed procedure for the assessment, diagnosis, and treatment of patients with respiratory diseases. FB is now established as an essential diagnostic and therapeutic tool in respiratory medicine. Fiberoptic bronchoscopy is the preferred initial approach in diagnosing a lung density. Fiberoptic instrument is superior to a rigid scope because of increased visual and biopsy range with minimal discomfort and negligible risk to the patient. With fiberoptic bronchoscope, complications were classified into major and minor. Major complications were observed as death, cardiopulmonary arrest, myocardial infarction, pneumonia, pneumothorax larger than 20%, pulmonary haemorrhage requiring transfusion, and neurologic events such as seizures or a cerebrovascular accident. Minor complications included hemoptysis, pneumothorax smaller than 20%, vasovagal reaction, mild obstruction of airways leading to hypoxia.

Primary Objective

To find out the changes in arterial oxygen tension during fiberoptic bronchoscopy.

Secondary Objective

To study the effects of fiberoptic bronchoscopy on central hemodynamics, electrocardiographically.

MATERIALS AND METHODS:

Type Of Study- observational study**.**

Study Place-This study was done in 100 adult patients above 20 years of age irrespective of their sex and occupation at KNCH, Jodhpur.

Inclusion Criteria: All adult patients, irrespective of their sex and occupation.

Exclusion Criteria:

1. Uncooperative patients,
2. Hemodynamically unstable patients,
3. Any severe acute illness and those who refused to undergo the procedure,

TOPICALANAESTHESIA:

Local anaesthetic effect of the pharynx, nasal mucosa, and larynx were achieved by 2-3 puffs of 10% xylocaine spray by the manual device. Anaesthetic effect was checked by gag reflex.

PROCEDURE:

A fiberoptic bronchoscope (OLYMPUS MODEL TH 190) was used in the study. ABG samples were taken before bronchoscopy procedure from femoral artery, and just after completion of the procedure. ECG recordings were taken just before the procedure and within 15 minutes after completion of the procedure. To obtain the ABG, 2 ml. disposable syringes with needle were required for each sample separately. Before collecting the samples,the syringes and needles were heparinised by pushing solution heparin (5000 I.U.) in syringe. Samples were immediately subjected on blood gas analyzer (SN 15643; COBAS b 121) for examination within half an hour after withdrawal. Patients after bronchoscopy were kept in the observation room for 2 hours.

Data Analysis

A database was created in SPSS statistical software, version 24.0 for Windows. Continuous data were summarized with means (M) and standard deviations (SD). Absolute numbers and percentages were used for categorical data. Comparison of quantitative variables among groups, when these followed a normal distribution, was done with the Student t test for independent samples; if distribution was not normal, the non-parametric Kruskal-Wallis/ Mann–Whitney U test was used. The non-parametric Pearson chi square test and where applicable Fischer exact test was used. For all statistical tests, a significance threshold of $p = 0.05$ was applied.

Statistical Analysis:

The changes in arterial oxygen tension during FOB were assessed and their effects on central hemodynamics, electrocardiographically were found. The results were considered statistically significant if p value was <0.05.

OBSERVATIONS AND RESULTS

The present study was undertaken in 100patients of various

pathologies. To evaluate its safety and complications like hypoxia, the following points were assessed:

1. To evaluate the decrease in oxygen tension in blood after the procedure if present
2. To evaluate the effects of hypoxaemia in patients by clinical examination and by E.C.G.

Table I: Age & Height Distribution

Age (in Years)	Minimum	Maximum	Mean	Std. Deviation
Age (in Year)	22.00	84.00	59.39	11.83
Height (in Inch)	60.00	69.00	65.05	2.67

Table 2: Age And Gender Distribution

Age Group	Gender		Total
	F	M	
20-30	0	2	2
30-40	2	3	5
40-50	2	12	14
50-60	3	27	30
60-70	4	33	37
>70	0	12	12
Total	11	89	100

Table 3: PaO_2(mmHg) Wise Distribution Of The Study

	Mean PaO_2 mmHg	Range of PaO_2	Mean fall in PaO	Range of fall in PaO
Before Bronchoscopy	80.73±11.37	61-100	10.96	7.82-14.09
After Bronchoscopy	69.77±11.07	50.9-99.4		

SE=0.94 T=1.1 P value=0.001 (s)

Table 4: Effect Of Bronchoscopy On pH

	Mean pH	Range of pH	Mean rise in pH	Range of rise in pH
Before bronchoscopy	7.33±.05	7.3-7.5	0.03	-0.02-0.09
After bronchoscopy	7.42±.32	7.4-7.6		

SE=0.03 T=1.57 P value=0.21

Table 5: Effect Of Bronchoscopy On Heart Rate

	Mean heart rate per minute	Range of heart rate	Mean rise in heart rate	Range of rise in heart rate
Before Bronchoscopy	85.55±8.924	71-116	10.55	8.1-13
After Bronchoscopy	96.10±8.64	84-122		

SE=0.89 T=1.05 P value=0.01

Table 6: Effect Of Bronchoscopy On SBP

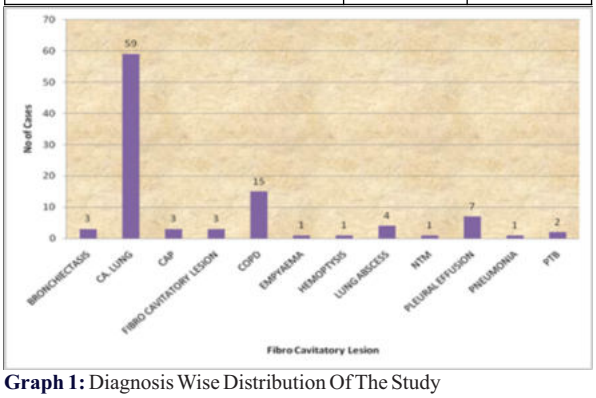
	Mean	Std. Deviation	P value
Before Bronchoscopy	119.84	13.032	0.001 (S)
After Bronchoscopy	122.96	12.291	

Table 7: Effect Of Bronchoscopy On DBP

	Mean	Std. Deviation	P value
Before Bronchoscopy	78.76	9.104	0.001 (S)
After Bronchoscopy	80.04	8.835	

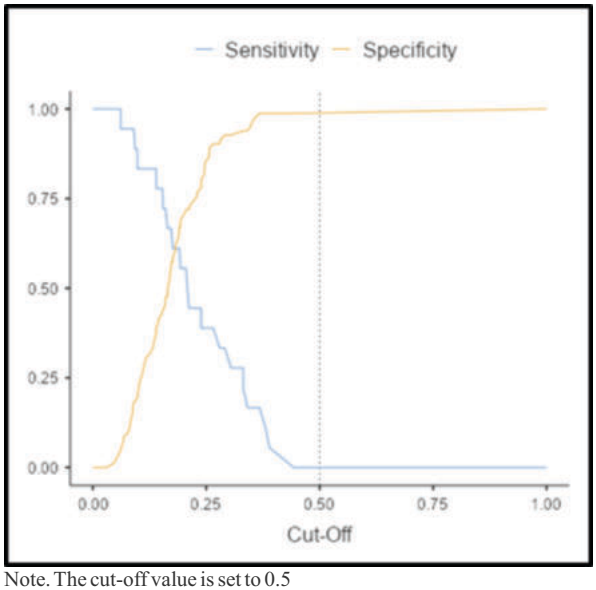
Table 8: Diagnosis Wise Distribution Of The Study

Diagnosis	Frequency	Percent
BRONCHIECTASIS	3	3.0
CA. LUNG	59	59.0
CAP	3	3.0
FIBRO CAVITATORY LESION	3	3.0
COPD	15	15.0
EMPYAEMA	1	1.0
HEMOPTYSIS	1	1.0
LUNG ABSCESS	4	4.0
NTM	1	1.0
PLEURAL EFFUSION	7	7
PNEUMONIA	1	1.0
PTB	2	2.0
Total	100	100.0



Graph 1: Diagnosis Wise Distribution Of The Study

Cut-Off Plot



Note. The cut-off value is set to 0.5

Graph2: Cut Off Plot For The Sensitivity And Specificity

DISCUSSION:

The patients included in the study were distributed mainly in the age group of 20 to above 70 years, out of which 89 were males and 11 were females. Bronchoscopic procedures like punch biopsy, bronchial washing and brush biopsy were performed. There was a uniform increase in the heart rate in patients undergoing fiberoptic bronchoscopy procedure. Before bronchoscopy the range of heart rate was 71-116 beats per minute with the mean heart rate being 85.39 while after the fiberoptic bronchoscopic procedure the range of heart rate was 70-99 beats per minute with the mean heart rate being 88.49. On statistical comparison between pre and post bronchoscopy procedure 'p' value was found to be <0.05 i.e.significant. Anxiety and catecholamine stimulation during the procedure may well contribute to ensuing tachycardia.Nearly uniform sinus tachycardia was also observed by **Credle et al[3] (1974), Luck et al[4](1978)** in their studies. **Sharma et al[5](1999),** observed that out of 50 patients, the increase in heart rate was observed in 97% of cases. The maximum increase in heart rate was observed during the procedure (27 beats/min) during which a significant fall in PaO_2 was also noted. Frequency of sinus tachycardia was 94%, bradycardia was 2% while no arrythmia and blocks. **Shrader & Laxminarayan[5](1973),** observed that ischaemic heart disease and COPD are the main risk factors which may influence the cardiac rhythm and oxygen status during fiberoptic bronchoscopic procedure. **Luck et al[4](1978)**, recorded most of the ectopic beats in patients of coronary heart disease. No hemodynamic changes were observed and the patients did not develop angina during the procedure.

Minor arrhythmias were frequent in cases with carcinoma lung in the form of sinus tachycardia which was reported only in 6 cases in present study. That can be explained by the degree of hypoxaemia because of the loss of lung volume due to malignancy. All the cases in present study were well selected and none had unstable angina or hypoxaemia at rest and this may well account for the no incidence of cardiac arrhythmias developing during the procedure of bronchoscopy as compared to the series of **Barrett, C.R.[6](1978).Lundgren et al [7](1982),** observed that when bronchoscopy passed through larynx, it induced marked increase in heart rate and cardiac index with significant decrease in PaO_2.

In our study all hundred patients showed a decline in arterial PaO_2 after fiberoptic bronchoscopy ranging from 7.82-14.09 mmHg, the decline in arterial PaO_2 from 80.73 (SD ± 11.37) to 69.77(SD ± 11.07) mm Hg was highly significant('p'<0.05). The mean fall in PaO_2 levels in this study was 10.96 mmHg. One case showed maximum fall of PaO_2 level i.e.26 mm Hg from 78.5 to 52.5 mm Hg. Similarly **G. Hassan et al[8](2005),** observed that during bronchoscopy done on 56 hospitalized patients, statistically highly significant ($p < 0.001$) fall of SaO2 was observed progressively while bronchial tree was being examined and various procedure like forceps biopsy, brush biopsy and bronchoalveolar lavage were performed. **Sharma et al[5](1999),** studied 50 patients in whom a significant fall in PaO2 was seen (mean fall 8 +/- 2.45 mm Hg). The lowest values were recorded at the completion of the procedure. In all patients studied during room air breathing, the decline in arterial PaO_2 from 63.69+/-6.43 to 56.65+/- 5.47 was highly significant ($p<0.05$) The mechanisms responsible for the arterial PaO_2 decline during fiberoptic bronchoscopy were not defined by this procedure but may be due to intrapulmonary shunt and zones of low ventilation-perfusion ratio, obstruction of the trachea and large bronchi, laryngospasm and bronchospasm.2**Jones and O'Driscoll June[9](2001)** studied 44 patients in whom oxygen saturation was monitored during the procedure with pulse oximetry (PO) and arterial blood gas levels were measured before and after FOB. No difference in saturation values was found between arterial blood gas levels and PO analysis both before and after FOB. Saturation values (mean +/- SD) were significantly decreased after FOB (from 96.5 +/- 1.0% to 91.6 +/- 3.6%, $p < 0.05$), and desaturation (arterial oxygen saturation <90%) was detected in 22 of the patients (50%) during the procedure.

Sharma et al(1993)[10], selected 21 patients for bronchoscopic study and arterial blood gas study were also done. They concluded that arterial hypoxaemia during fiberoptic bronchoscopy can be of substantial degree and persists for a variable period of time after completion of the procedure. Bronchoalveolar lavage has also been associated with hypoxaemia which can not only be distressing to the patient but may also precipitate cardiac arrhythmias and cardiac arrest. pH observed in one hundred patients selected for study also did not show any significant change. Before bronchoscopy mean pH was 7.33 (SD ± 0.03) with range of 7.33 to 7.57 and after bronchoscopy mean pH was 7.42 (SD ±with range of 7.42 to 7.60. On statistically comparison, it was found to be insignificant ($p>0.05$). **Albertini et al[11](1975)**, observed in 40 patients and concluded that alterations in pH associated with fiberoptic bronchoscopy were uncommon in these patients, no significant mean pH changes were noted. **Sharma et al[4](1999)** observed in 50 patients that there was not any significant change in pH.

In our study mean of SBP before bronchoscopy was 119.84 and after bronchoscopy the mean value was 122, p value (<0.05) was statistically significant and mean of DBP before bronchoscopy 78.76 and after bronchoscopy the mean value was 80.04, p value (<0.05) was statistically significant. **Lundgren et al[7](1982)** observed that when bronchoscopy passed through larynx, it induced marked increase in mean arterial pressure, mean pulmonary arteriolar occlusion pressure and cardiac index with significant decrease in PaO_2. **Anant Mohan et al[12](2016),** 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 and found that the heart rate, systolic blood pressure, and diastolic blood pressure significantly increased while oxygen saturation declined. **F. S. Xue et al[13](2006)** studied blood pressure and heart rate changes during nasotracheal intubation under general anaesthesia in 100 patients. These patients were randomly allocated to either the direct laryngoscopy group or the fibreoptic bronchoscope group. Blood pressure at intubation and the maximum values during the observation were significantly higher in the fibreoptic bronchoscope group than in the direct laryngoscopy group. Heart rate at intubation was also significantly greater in the fibreoptic bronchoscope group than in the direct laryngoscopy group.

LIMITATIONS:

Our study had some limitations. 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.

RESULTS:

All patients showed a decline in arterial PaO2 after FOB which was highly significant. There was slight sinus tachycardia in most of cases. FOB itself does not endanger the patients with any significant or serious complications. E.C.G. recorded before and after bronchoscopy indicated that there was no arrhythmia developed.

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Conflict Of Interest: None declared

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