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Spirometry assessment of pulmonary function in patients with ischemic heart disease in Patna medical college and hospital

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Abstract

Introduction: spirometric assessment of pulmonary function in patients with ischemic heart disease. There is evidence for greater recurrence of adverse cardiovascular events in those patients with ischemic heart disease who have impaired lung function, in comparison with those with normal pulmonary function.

The mortality rate was observed to be higher among people with ischemic heart disease who also had poor lung function. Spirometry can easily and precisely evaluate pulmonary function in an outpatient context. The loss of lung function and the onset of coronary artery disease have both been linked to systemic inflammation, according to certain theories. This may also explain the frequent co-existence and striking association between the two disorders. So significant is this association that forced expiratory volume in one second (fev1) as assessed by spirometry has been termed not just a lung function test but a marker of premature death from ischemic heart disease. A high incidence of pulmonary functional abnormalities in patients with coronary artery disease who previously had no pulmonary disease will be noted in previous studies. Thus, it has been suggested that ischemic heart disease, itself may be responsible for impaired lung function.

Since impaired lung function is a risk factor for future adverse cardiovascular events, there may be a case for the institution of respiratory rehabilitation in the elderly with ischemic heart disease. Thereby, a new strategy to reduce morbidity and mortality among the elderly with ischemic heart disease may emerge. But first it is necessary to identify such patients with impaired lung

function. Hence, the need for this study will be felt. There is also evidence for greater recurrence of adverse cardiovascular events in those patients with ischemic heart disease who have impaired lung function, in comparison with those with normal pulmonary function.

It has been discovered that those with ischemic heart disease who had poor lung function died more frequently.

"Recent research seems to indicate that a systemic inflammation may be the mechanism underlying the impairment of lung function and the development of coronary artery disease"

Spirometry-measured forced expiratory volume in one second (fev1) has been described as a marker of early death from ischemic heart disease in addition to a lung function test.

In several investigations, patients with coronary artery disease who had no prior pulmonary disease showed a significant frequency of pulmonary functional abnormalities.

Ischemic heart disease alone may be to blame for decreased lung function. This decreased lung function may also shorten survival time in patients with ischemic heart disease.

At the end of the study if they will observe that there is significant decline in lung function in some elderly patients with ischemic heart disease. The institution of pulmonary rehabilitation can be considered as a therapeutic option in these individuals.

Objective: to assess pulmonary function in the elderly patients with ischemic heart disease visiting Patna medical college hospital, Patna.

To detect impaired lung function, if present.

Materials and methods: the senior patients with ischemic heart disease who visited the Patna medical college and hospital in Patna between April 2021 and October 2022 were the subjects of the prospective study

Sample size: 82

Result: among the 82 patients under study, 48 (58.5%) were male and 34 (41.5%) were female patients. Most of the subjects of this study were aged between 51 – 60 years (51.2%) mean age 51.22 ± 4.05 years. There was a mean forced vital capacity (fvc) of 2.41 ± 1. 091.forced expiratory volume in one second (fev1) was on average 1.832 ± 1. 006.mean fev1/fvc was 74.374 ± 13.063. 26 out of 82 subjects (68.3%) had an abnormal lung function (fev1/fvc less than 70%). Rest of the 56 subjects (31.7%) had a normal lung function (fev1/fvc more than 70%).

Conclusion: in this study subnormal pulmonary function was detected in elderly individuals with ischemic heart disease, as evidenced by fev1, and fvc values which were significantly lower than that predicted for normal subjects. The pattern of the pulmonary function defect was of restrictive type in the majority. In this study, fev1, and fvc values as a percentage of predicted tended to decline as the number of coronary arteries involved increased.

Keywords: Ishemic heart disease, pulmonary function test, spirometry, coronary artery disease.

Introduction

"The Association Between Impaired Lung Function and Ischemic Heart Disease Have Been Established by Many Studies". Many Researchers Have Noted the Increased Incidence of Cardiovascular Disease In Individuals Who Had Been Earlier Detected To Have Subnormal Pulmonary Function By Spirometry.

There Is Also Evidence for Greater Recurrence of Adverse Cardiovascular Events in Those Patients With Ischemic Heart Disease Who Have Impaired Lung

Function, In Comparison With Those With Normal Pulmonary Function.

The Mortality Rate Was Observed to Be Higher Among People with Ischemic Heart Disease Who Also Had Poor Lung Function. Spirometry Can Easily and Precisely Evaluate Pulmonary Function in An Outpatient Context.

The Loss of Lung Function and The Onset of Coronary Artery Disease Have Both Been Linked to Systemic Inflammation, According to Certain Theories.

"This May Also Explain the Frequent Co-Existence and Striking Association Between the Two Disorders. So Significant Is This Association That Forced Expiratory Volume in One Second (Fev1) As Assessed by Spirometry Has Been Termed Not Just a Lung Function Test but A Marker of Premature Death from Ischemic Heart Disease".

"A High Incidence of Pulmonary Functional Abnormalities in Patients with Coronary Artery Disease Who Previously Had No Pulmonary Disease Will Be Noted in Previous Studies".

Thus, It Has Been Suggested That Ischemic Heart Disease, Itself May Be Responsible for Impaired Lung Function.

Since Impaired Lung Function Is a Risk Factor for Future Adverse Cardiovascular Events, There May Be a Case for The Institution of Respiratory Rehabilitation in The Elderly with Ischemic Heart Disease. Thereby, A New Strategy to Reduce Morbidity and Mortality Among the Elderly with Ischemic Heart Disease May Emerge. But First It Is Necessary to Identify Such Patients with Impaired Lung Function. Hence, The Need for This Study Will Be Felt.

Numerous Studies Have Found a Link Between Poor Lung Health and Cardiovascular Disease.

There Is Also Evidence for Greater Recurrence of Adverse Cardiovascular Events in Those Patients with Ischemic Heart Disease Who Have Impaired Lung Function, In Comparison with Those with Normal Pulmonary Function.

It Has Been Discovered That Those with Ischemic Heart Disease Who Had Poor Lung Function Died More Frequently.

"Recent Research Seems to Indicate That a Systemic Inflammation May Be the Mechanism Underlying the Impairment of Lung Function and The Development of Coronary Artery Disease".

Spirometry-Measured Forced Expiratory Volume in One Second (Fev1) Has Been Described as A Marker of Early Death from Ischemic Heart Disease in Addition to A Lung Function Test.

In Several Investigations, Patients with Coronary Artery Disease Who Had No Prior Pulmonary Disease Showed a Significant Frequency of Pulmonary Functional Abnormalities.

Accordingly, It Has Been Proposed That Ischemic Heart Disease Alone May Be to Blame for Decreased Lung Function. This Decreased Lung Function May Also Shorten Survival Time in Patients with Ischemic Heart Disease.

"Impaired Pulmonary Function Is Common in Cardiac Patients (Shnkman Et Al., 1997). Respiratory Muscle Wasting Has Been Well Documented in Mitral Stenosis (Saxena Et Al., 2007). Furthermore, It Was Found That Pulmonary Impairment Is More Frequent After Cardiac Surgery Than After Other Major Surgical Procedures (Bund Et Al., 1998). Deterioration In Pulmonary Function Is A Common Complication Following Cabg Surgery And There Is Still Speculation To The Precise

Causative Factors Thereof[16]. (Kleinloog And Mcfarlane, 2007)".

"The Current Study Aimed to Assess the PFTS Of Cardiac Patient; With Ischemic or Rheumatic Heart Diseases as Well as Patients Who Underwent CABG Or Valvular Procedures".

"At The End of The Study If They Will Observe That There Is Significant Decline in Lung Function in Some Elderly Patients with Ischemic Heart Disease. The Institution of Pulmonary Rehabilitation Can Be Considered as A Therapeutic Option in These Individuals".

Aims And Objectives

To Assess Pulmonary Function in The Elderly Patients with Ischemic Heart Disease Visiting Patna Medical College Hospital, Patna.

- To Detect Impaired Lung Function, If Present.

Materials and Methods:

Study Design:

The Senior Patients with Ischemic Heart Disease Who Visited the Patna Medical College and Hospital in Patna Between April 2021 and October 2022 Were the Subjects of The Prospective Study.

Sample Size: 82

Inclusion Criteria

- The Presence of Coronary Artery Disease, As Determined by Coronary Angiography: Patients Having a History of Myocardial Infarction or Acute Coronary Syndrome Were Included in The Study Regardless of Whether Angiograms Had Been Performed.

Exclusion Criteria

- Patients Will Have a History of Pulmonary Chronic Illness.
- Acute Coronary Syndrome, Myocardial Infarction, Or CABG Within the Four Weeks Prior To The Pulmonary Function Test.
- Patients Who Suffered from Congestive Heart Failure.
- People With Spinal Malformations.
- Patients Will Have Severe Obesity.

Investigations

Routine Tests

Testing Of Pulmonary Function By Spirometry Was Done.

- Complete Blood Count
- Serum Creatinine
- Random Blood Sugar
- Pulmonary Function Test
- Doppler Echocardiography
- Chest X Ray
- ECG

Assessment of pulmonary function was then based on the standard accepted values of the pulmonary function variables for the Indian population.

Statistical analysis

Descriptive statistical analysis was carried out in my study. The software namely MS excel was used for the analysis of the data.

Results

Table 1: Gender wise distribution of study population

Gender	Frequency	Percent
Male	48	58.5
Female	34	41.5
Total	82	100.0

Among The 82 Patients Under Study, 48(58.5%) Were Male And 34 (41.5%) Were Female Patients

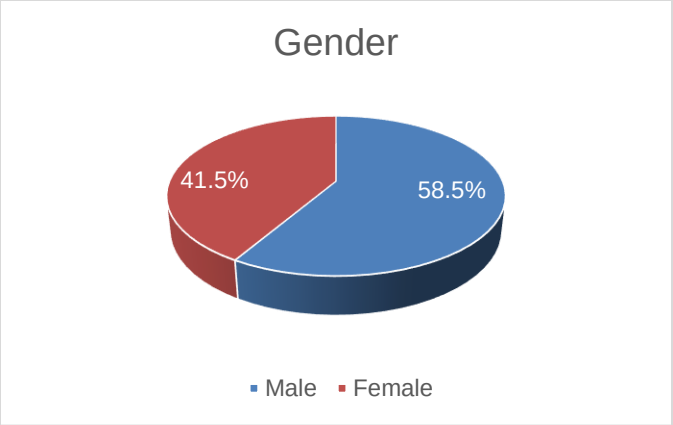

Figure 1: gender wise distribution

Table 2: age wise distribution of study population

Age (Group)	Frequency	Percent
40 - 50	39	47.6
51 - 60	42	51.2
Above 60	1	1.2
Total	82	100.0
Mean ± Sd	51.22 ± 4.05	

Most of the subjects of this study were aged between 51-60 years (51.2%) Mean Age 51.22±4.05 years.

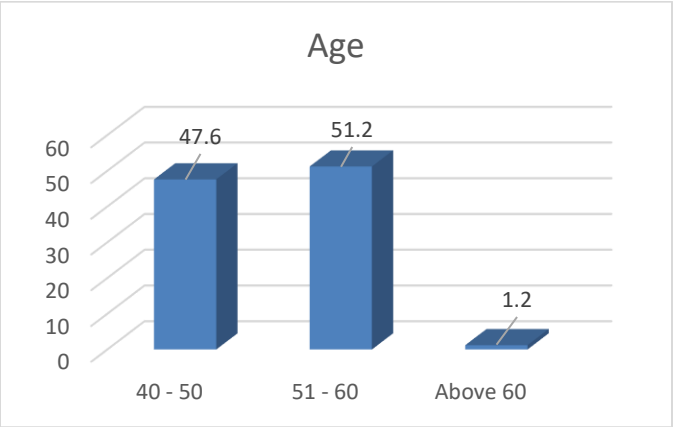

Figure 2: age wise distribution

Table 3: mean FVC, fev1 and fev1/FVC

Parameters	Minimum	Maximum	Mean	Std. Deviation
FVC	0.50	5.08	2.411	1.091
FEV1	0.42	5.00	1.832	1.006
FEV1/FVC	42.7	100.0	74.374	13.063

The mean forced vital capacity (FVC) in the current Study Was 2.41 ±1.091. FEV1 Was 1.832 ± 1.006, The Mean Forced Expiratory Volume in One Second. FEV1/FVC Ratio Averaged 74.374 ± 13.063.

Table 4: lung function

Lung Function	Frequency	Percent
Normal	56	68.3
Abnormal	26	31.7
Total	82	100.0

26 out of 82 subjects (68.3%) had an abnormal lung function (fev1/FVC less than 70%). Rest of the 56 subjects (31.7%) had a normal lung function (fev1/fvc more than 70%).

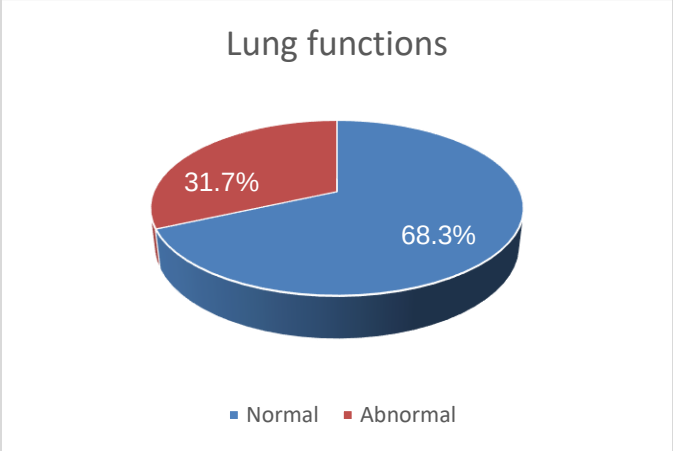

Figure 4: lung function

Table 5: Mean FVC, fev1 and fev1/FVC between male and female

Parameters	Male	Female	P-Value
	Mean ± Sd	Mean ± Sd	
FVC	2.96 ± 1.00	1.63 ± 0.65	<0.001
FEV1	2.26 ± 1.03	1.22 ± 0.56	<0.001
FEV1/FVC	73.52 ± 13.37	75.58 ± 12.72	0.485

In the current study, Males had considerably higher mean forced vital Capacity (FVC) Than Females (P 0.001). The Mean Forced Expiratory Volume in One Second (FEV1) Was Also Substantially Greater in Men Than In Women (P 0.001). Again, There Was No Significant Mean Differences of FEV1/FVC Between Male and Female (P=0.485).

Figure 5: Mean FVC, And FEV1 Between Male and Female

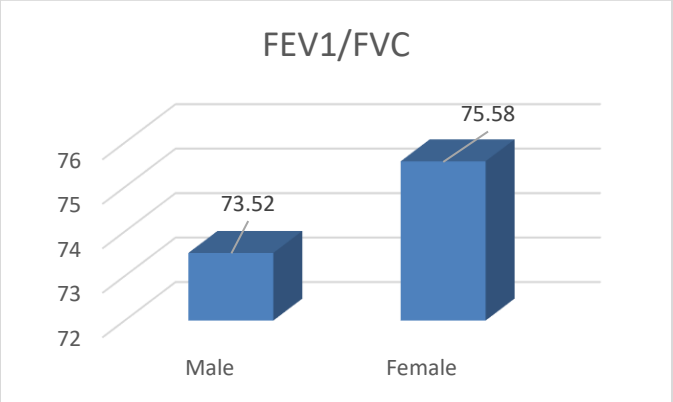

Figure 6: Mean FEV1/FVC Between Male and Female

Table 6: Lung Function and Age

		Age			Total
		40 - 50	51 - 60	>60	
Normal (Fev1/Fvc Above 70%)	No	29	26	1	56
	%	74.4%	61.9%	100.0%	68.3%
Abnormal (Fev1/Fvc Below 70%)	No	10	16	0	26
	%	25.6%	38.1%	0.0%	31.7%
Total	No	39	42	1	82
	%	100.0%	100.0%	100.0%	100.0%

Table 7: Lung Function and Smoking

			Lung Function		Total
			Normal	Abnormal	
Smoking	Yes	No	12	7	19
		%	21.4%	26.9%	23.2%
	No	No	44	19	63
		%	78.6%	73.1%	76.8%
Total		No	56	26	82
		%	100.0%	100.0%	100.0%

Out of the 82 patients under study, 19 (23.2%) were smokers and 63 (76.8%) Were Non-Smokers. There Was No Significant Difference Association Between Lung Functions and Smoking (P-Value =0.568).

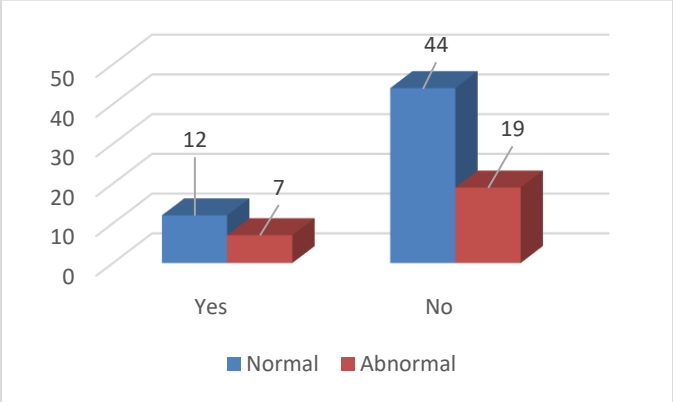

Figure 7: lung function and smoking

Table 8: lung function and hemoglobin

Haemoglobin (Hb)	Lung Function	
	Normal	Abnormal
Mean	11.28	12.10
Sd	1.28	1.83
P-Value	0.021	

There was significant association between lung functions and hemoglobin (p-value =0.021).

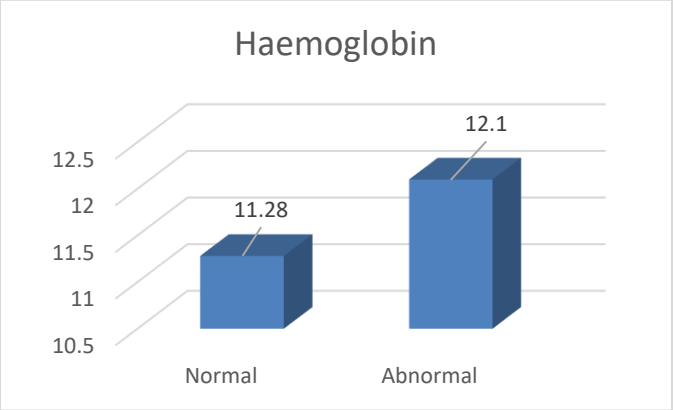

Figure 8: lung function and hemoglobin

Table 9: lung function and Esr

Esr	Lung Function	
	Normal	Abnormal
Mean	20.86	18.19
Sd	24.82	29.40
P-Value	0.671	

There was no significant association between Lung functions and Esr (P- Value= 0.671)

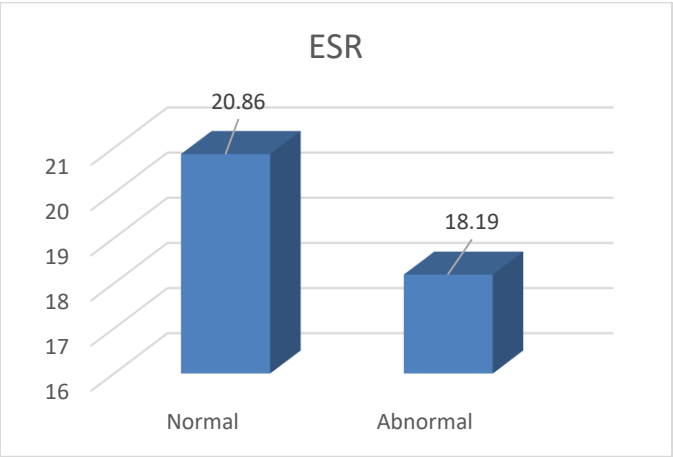

Figure 9: lung function and ESR

Table 10: Lung function and RBS

Rbs	Lung Function	
	Normal	Abnormal
Mean	109.48	110.23
Sd	26.13	30.06
P-Value	0.909	

There was No Significant Association Between Lung Functions and RBS (P-Value =0.909).

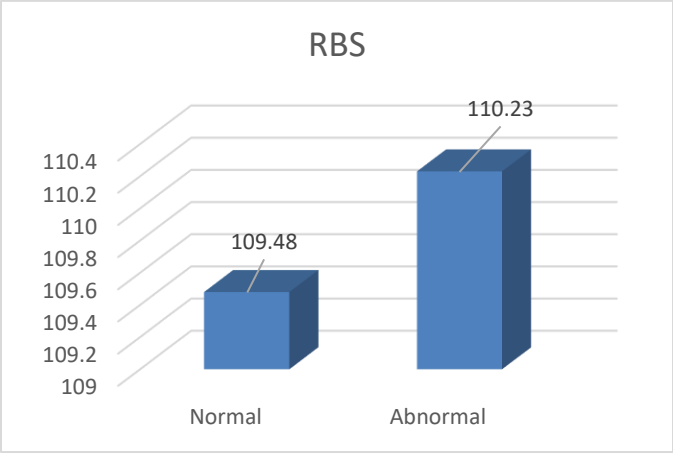

Figure10: lung function and RBS

Table 11: lung function and b. Urea

B. Urea	Lung Function	
	Normal	Abnormal
Mean	38.73	40.15
Sd	9.51	7.30
P-Value	0.502	

There was No Significant Association Between Lung Functions and B. Urea (P-Value =0.502).

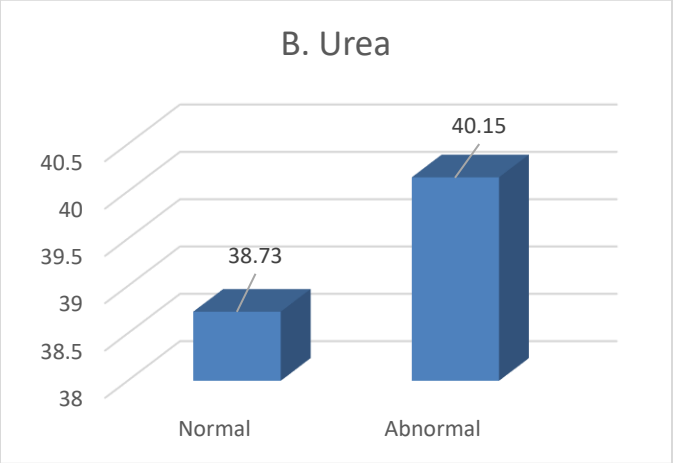

Figure 11: lung function and b. Urea

Table 12: lung function and s. Creatinine

S. Creatinine	Lung Function	
	Normal	Abnormal
Mean	0.97	1.00
Sd	0.29	0.26
P-Value	0.568	

There was No Significant Association Between Lung Functions and S. Creatinine (P-Value =0.568).

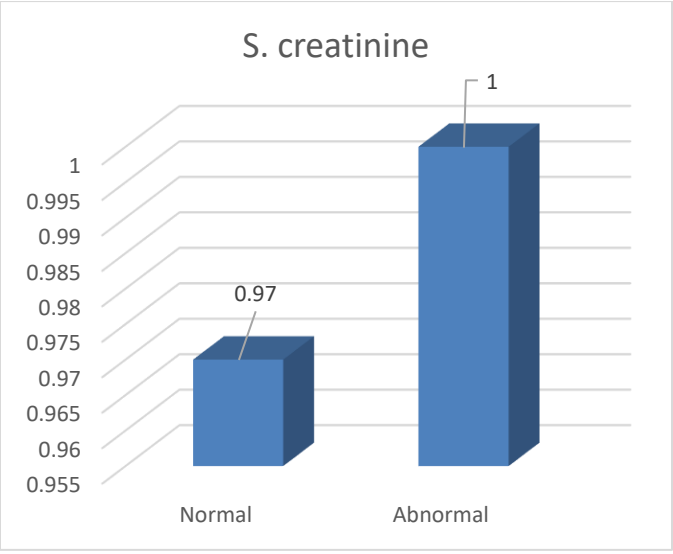

Figure 12: lung function and b. Urea

Table 13: lung function and s. Cholesterol

S. Cholesterol	Lung Function	
	Normal	Abnormal
Mean	183.16	191.69
Sd	52.77	45.19
P-Value	0.479	

There was No Significant Association Between Lung Functions and S. Cholesterol (P-Value =0.479).

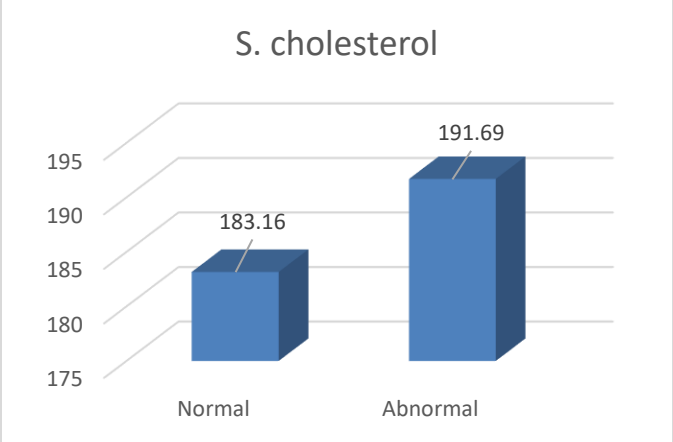

Figure 13: lung function and s. Cholesterol

Table 14: lung function and s. Triglyceride

S.Triglyceride	Lung Function	
	Normal	Abnormal
Mean	190.64	227.50
Sd	90.09	83.22
P-Value	0.081	

There was No Significant Association Between Lung Functions and S. Triglyceride (P-Value =0.081).

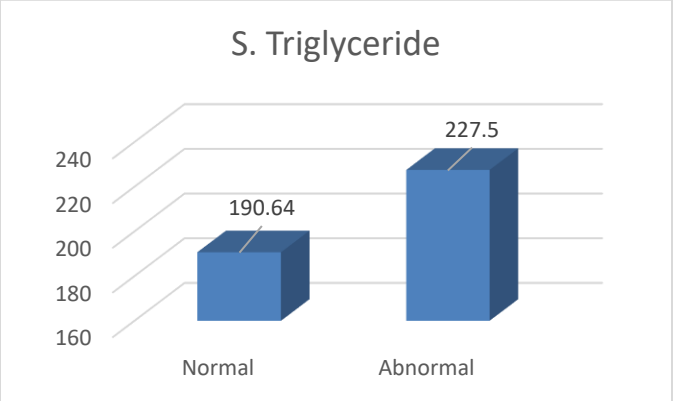

Figure 14: Lung Function and S. Triglyceride

Discussion

Lung function begins to decline slowly and steadily from middle age into old age. The deterioration may accelerate in old age. It is thought that a loss of elastic tissue may lead to mild subclinical emphysema even in healthy non-smokers. fev1 declines at a rate of 30 – 35 ml per year. Vital capacity decreases while the residual volume increases. Functional residual capacity also increases with age. This may leave the diaphragm at a mechanical disadvantage, particularly if there is associated loss in height of the thorax due to osteoporotic collapse of thoracic vertebrae etc. The diffusing capacity declines linearly with age [1].

This loss is compounded by decline of pulmonary function associated with ischemic heart disease in the elderly. Much evidence has been gathered in recent times indicating a decline in lung function consequent to coronary artery disease. Enright et al [2] found that coronary artery disease, on an average was associated with 40– 100 ml decrements in fev1and 50-150 ml decrements in FVC in the elderly, even in non-smokers, and in the absence of heart failure [3].

Low fev1 has been shown to be a significant risk factor for cardiac and all-cause mortality. Thus, the elderly patients with ischemic heart disease and sub optimal lung function represents a group at very high risk for cardiac and all-cause mortality, including fatal arrhythmias. Enright et al [4] studied a cohort of elderly (over age 64 years) subjects who were somewhat healthier than average for that population. They excluded subjects who were current smokers or had smoked more than 20 pack-years. They also eliminated subjects with asthma, chronic bronchitis, and emphysema. The measurements were made at least 3 months after cardiac surgery or myocardial infarction. In this heal their than average cohort, the authors found slightly decreased values of fev1 and fvc in subjects with coronary heart disease. They found that coronary artery disease, on an average was associated with 40 – 100 ml decrements in fev1 and 50-150ml decrements in fvc in the elderly, even in non-smokers, and in the absence of heart failure.

Out of 42 subjects aged between 51 and 60 years, 16 (38.1%) had a fev1/fvc ratio less than 70% and 10 cases (25.6%) had a ratio less than 70%. This indicated that with the increase of age abnormal lung function increases. Scanlon has speculated that ischemic heart disease can cause pulmonary restriction [11].

In the current study, the mean forced vital capacity (fvc) of men was substantially larger than that of women (p 0.001). Similarly, mean forced expiratory volume in one second (fev1) was significantly higher in male as compared to female ($p<0.001$). Again, there was no significant mean differences of fev1/fvc between male and female ($p=0.485$).

It has been speculated that a systemic inflammatory process may be contribute towards the impairment of lung function and the development of coronary artery disease. This may also explain the frequent co-existence and striking association between the two disorders. Mannino et al found that at a population level, individuals with the lowest fev1 have the highest levels

of crp, fibrinogen, and other systemic inflammatory markers, while those with the highest fvc1 have the lowest values.24 Engstrom, concluded that although associations with increased inflammatory sensitive proteins levels contributed to the increased cardiovascular risk among men with low FVC [7]. Levels and other cardiovascular risk factors could not completely account for the increased risk for men with low fvc. The full explanation for this relationship remains to be explored [7]. Goswami has recently noted high levels of tumor necrosis factor-α and other inflammatory markers in Indian patients with coronary artery disease [25]. The average ejection fraction among the study subjects was 51.752%. The Spiro metrically assessed variables fev1 as a percentage of predicted (p = 0.015), fvc as a percentage of predicted (p =0.004) and pef as a percentage of predicted (p = 0. 0.009) increase significantly with increases in cardiac ejection fraction. However cardiac ejection fraction did not have any significant influence on the fev1/fvc ratio as a percentage of predicted (p = 0.692), the overall pattern being predominantly restrictive.

Conclusion

In this study subnormal pulmonary function was detected in elderly individuals with ischaemic heart disease, as evidenced by fev1, and fvc values which were significantly lower than that predicted for normal subjects. The pattern of the pulmonary function defect was of restrictive type in the majority. In this study, fev1, and FVC values as a percentage of predicted tended to Decline as The Number of Coronary Arteries Involved Increased.

Summary

- Among the 82 patients under study, 48 (58.5%) were male and 34 (41.5%) were female patients.
- Most of the subjects of this study were aged between 51 – 60 years (51.2%) mean age 51.22 ± 4.05 years.
- There was a mean forced vital capacity (fvc) of 2.41 ± 1.091.
- Forced expiratory volume in one second (fev1) was on average 1.832 ± 1.006.
- Mean fev1/fvc was 74.374 ± 13.063.
- 26 out of 82 subjects (68.3%) had an abnormal lung function (fev1/fvc less than 70%).
- Rest of the 56 subjects (31.7%) had a normal lung function (fev1/fvc more than 70%).
- There was a mean forced vital capacity (fvc) of significantly higher in male as compared to female (p<0.001).
- Mean forced expiratory volume in one second (fev1) was significantly higher in male as compared to female (p<0.001).
- There were no significant mean differences of fev1/fvc between male and female (p=0.485).
- Out of the 82 patients under study, 19 (23.2%) were smokers and 63 (76.8%) were non-smokers.
- There was no significant difference association between lung functions and smoking (p-value =0.568).

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