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Original Research

Effect Of Chronic Renal Disease On Pulmonary Function Tests

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ABSTRACT

Backround: Renal failure could affect the mechanical and ventilatory function of the lungs either directly or indirectly. Chronic diseases have become a major cause of global morbidity and mortality even in developing countries. It is a study to showing the effect of chronic renal failure on pulmonary function tests. **Material and Method:** This study was conducted on 100 patients which were divided into two groups (Study group and Control group) of 50 patients each; age range between 18-55 years by using the simple random sampling technique. The pulmonary function test was carried out by using the Computerized spirometer (RMS-Helios 401 Transducer no 400-666 in both study as well as control groups**.Result:** The Mean values of pulmonary function test parameters that is FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$ and PEFR were higher than in study group as compared to control group. Analysis was performed by using SPSS version 17.0 computer software. The difference in the mean value of PFT parameters were found statistically highly significant ($p<0.001$ in all).**Conclusion:**This study shows that pulmonary function significantly deteriorates in Chronic Renal Failure patients.

Keywords:- Chronic Renal Failure, Pulmonary Function tests.

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INTRODUCTION

Chronic diseases have become a major cause of global morbidity and mortality even in developing countries[1]. Regardless of the etiology, patients with end-stage renal disease (ESRD) would usually experience decreased quality of life[2,3]. Renal failure affects every organ of the body and mainly the lungs. Respiratory disorders are among the most prevalent complications in the end-stage renal disease (ESRD) patients. On the other hand, renal failure could affect the mechanical and ventilatory function of the lungs either directly or indirectly[4]. The major direct impacts of renal failure are as follows: 1) intra- and extravascular volume overload and subsequent interstitial lung tissue edema; 2) increased permeability of capillary walls due to the toxic effects of uremia on the endothelial lining of pulmonary capillaries and subsequent small airways and alveoli edema; 3) increased airway resistance; 4) anemia and decreased blood flow in soft tissues including lungs, vascular walls and the subcutaneous tissues.

The hypoxia caused by the partial obstruction of capillary blood flow in the lungs due to leukocyte sequestration is a well-known complication in dialysis patients. Possible complications in peritoneal dialysis (PD) patients include fluid accumulation in the pleura, atelectasis, pneumonia and bacterial bronchitis[5]. Regarding the observations in animal studies, it has been confirmed that dialysis with incompatible cellulosic membranes could increase the release of elastase from activated neutrophils and decline the function of inhibitory proteins. This might lead to the breakdown of elastin fibrils while increasing the susceptibility to emphysema[6]. That fluid overload is a common and serious problem that leads to severe complications in hemodialysis patients. Fluid overload, increase in pulmonary capillary permeability, can result in pulmonary edema and pleural effusion, abnormalities that could explain, at least in part, the decrease in pulmonary function[7,8,9]. Since hemodialysis removes excess body fluid reducing water content of the lungs.

The aim of this study was to study Pulmonary Functions in Chronic Renal Failure Patients.

MATERIAL AND METHOD

Present study was conducted in the Department of Physiology & Department of Nephrology, S.P. Medical College & Associated Group of Hospitals, Bikaner to evaluate the pulmonary functions. This study was conducted on 100 patients which were divided into two groups (Study group and Control group) of 50 patients each; age range between 18-55 years.

Type of Study : Case Control Study.

Method : 100 subjects were divided into two groups.

Group I : 50 CRF patients (Study group)

Group II : 50 normal healthy subjects (control group).

Methodology : simple random sampling technique. In this method every third patient coming to OPD at Department of Nephrology, S.P. Medical College & Associated Group of Hospitals, Bikaner were choose.

Ethical clearance: Ethical clearance was taken from departmental research committee, Department of Physiology, S.P. Medical College, Bikaner as well as Institutional Ethics and Research Board of S.P. Medical College, Bikaner.

Inclusion criteria

1. Chronic Renal Failure Patients
2. Diabetic patients
3. Hypertensive patients

Exclusion Criteria

1. Pregnancy
2. Smoking
3. Severe anaemia due to some other causes such as iron deficiency or hemolytic anaemia.

Equipments:

Computerized spirometer (RMS-Helios 401 Transducer no 400-666)
Weighing machine

Pulmonary Function Test

Pulmonary function tests were assessed by using computerized spirometer.

Computerized Spirometer

This is solid state electronic equipment. The subject has to respire in to a sophisticated transducer, which is connected to the instrument by means of a cable.

Analysis of Observation

Standard statistical methods were applied for analysis of the observation. The mean values of various parameters were calculated separately in various groups of the subjects.

Statistical analysis

The data were expressed as Mean±SD. Statistical analysis were performed according to an intension to treat strategy. Quantitative data were presented as mean±SD and the student's unpaired 't' test was sued to compare the differences. All p values were 2 tailed, p value <0.05 was considered significant. Analysis was performed by using SPSS version 17.0 computer software.

OBSERVATIONS

Table 1: Showing distribution of the subjects according to their age group

Age Group (Years)	Study Group		Control Group		Total	
	No.	%	No.	%	No.	%
Young Age (18-35)	25	50.0	40	80.0	65	65.0
Middle Age (36-55)	25	50.0	10	20.0	35	35.0
Total	50	100	50	100	100	100

This table showing age wise distribution of 100 subjects which were divided into two groups of 50 cases each. In study group, equal number of subjects were selected in control group 40 cases in young age group (18-35 years) and 10 subjects in middle age group (36-55 years).

Table 2: Showing the mean value of pulmonary function tests between study and control groups

Pulmonary Function Test	Study Group		Control Group		t	p
	Mean	SD	Mean	SD		
FVC	63.20	22.19	102.80	11.77	11.147	<0.001
FEV_1	52.08	21.25	100.98	25.21	10.486	<0.001
FEV_1/FVC	80.94	25.01	101.40	9.60	5.400	<0.001
$FEF_{25-75\%}$	33.30	18.67	79.22	19.85	11.915	<0.001
PEFR	48.00	21.63	84.84	12.85	10.355	<0.001

Above table shows mean values of pulmonary function test parameters that is FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$ and PEFR. The mean values of these parameters were higher than in study group as compared to control group. The difference in the mean value of PFT parameters were found statistically highly significant (p<0.001 in all).

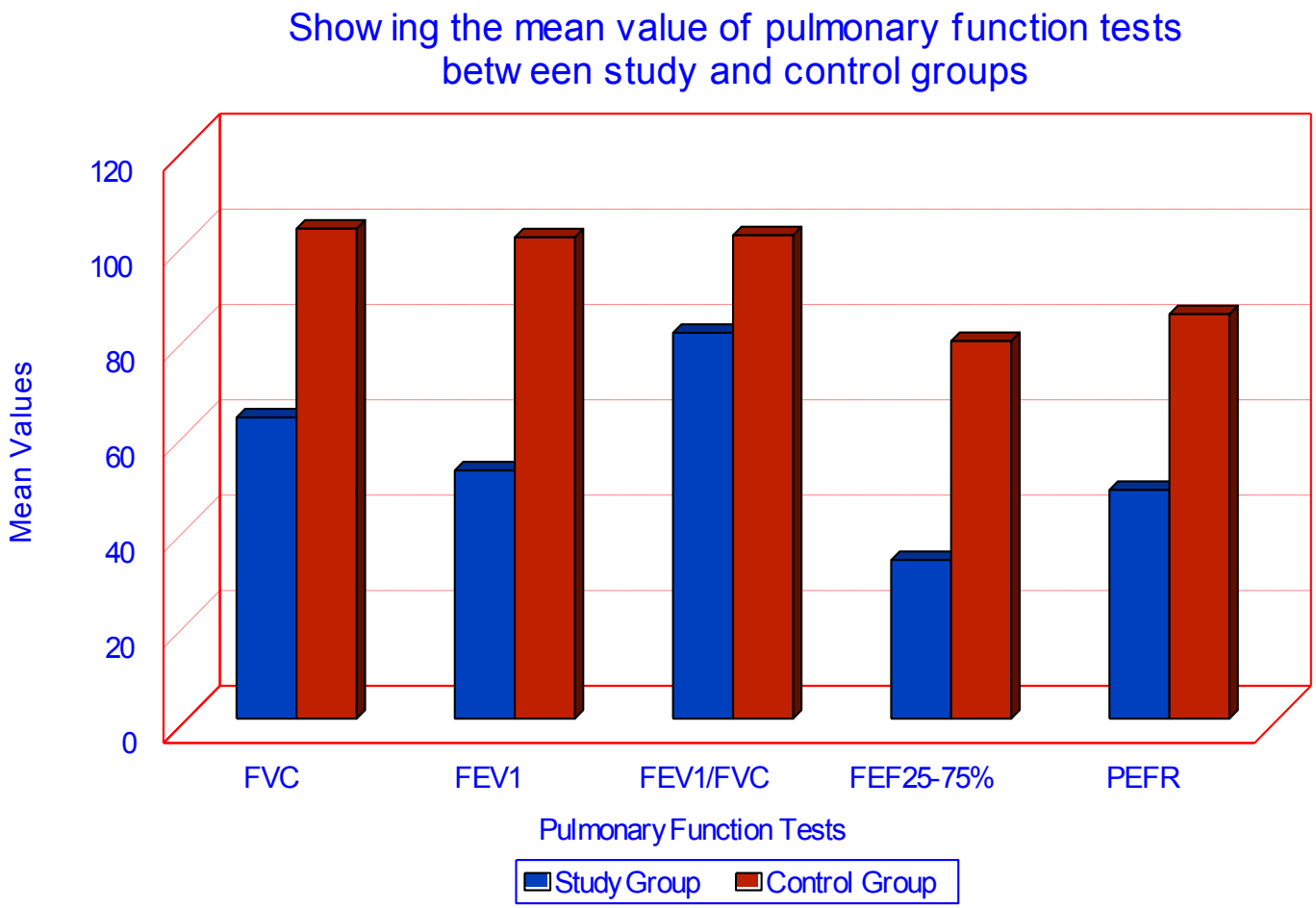


Table 3 Showing the mean value of pulmonary function tests between study and control groups in young age group

Pulmonary Function Test		Study Group		Control Group		t	p	
		Mean	SD	Mean	SD			
FVC		68.36	18.08	103.18	12.40	9.211	<0.001	
FEV_1	55.84	15.26			100.93	27.44	7.508	<0.001
FEV_1/FVC		81.12	21.16		101.62	9.24	5.380	<0.001
$FEF_{25-75\%}$			33.12	15.69	80.38	19.67	10.152	<0.001
PEFR			48.52	18.22	85.13	13.31	9.344	<0.001

Above table shows mean values of FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$ and PEFR among study group in young age group as compared to control group of young age. The difference in the mean value of PFT parameters were found statistically highly significant when it was compared between study and control groups ($p<0.001$ in all).

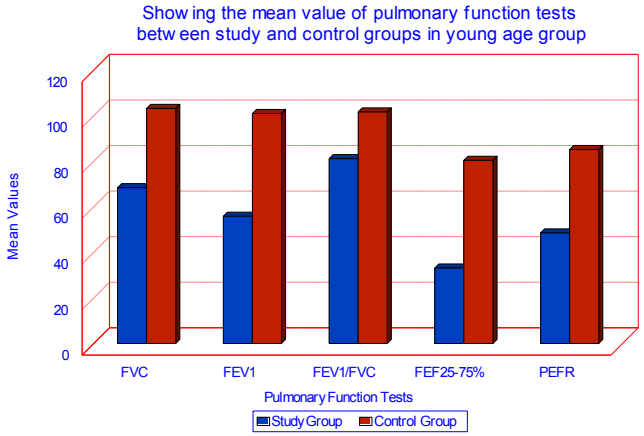
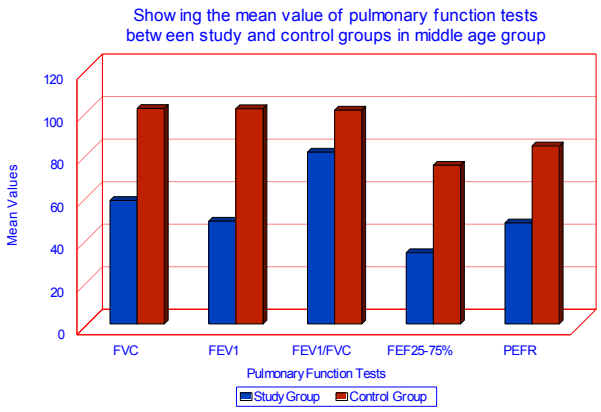


Table 4: Showing the mean value of pulmonary function tests between study and control groups in middle age group

Pulmonary Function Test	Study Group		Control Group		t	p
	Mean	SD	Mean	SD		
FVC	58.04	24.96	101.30	9.19	5.298	<0.001
FEV_1	48.32	25.69	101.20	14.07	6.117	<0.001
FEV_1/FVC	80.76	28.80	100.50	11.43	2.087	0.045
$FEF_{25-75\%}$	33.48	21.58	74.60	20.93	5.134	<0.001
PEFR	47.48	24.94	83.70	11.39	4.382	<0.001

Above table shows mean values of FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$ and PEFR among study group in middle age group as compared to control group of middle age. The difference in the mean value of PFT parameters were found statistically highly significant when it was compared between study and control groups (p<0.001 in all).



DISCUSSION

This cross sectional study was conducted in the department of Physiology Sardar Patel Medical College Bikaner. The study was carried out on 100 subjects between the age group 18-55 years. They were divided into two group: study group and control group. In study group 50 Chronic Renal Failure patients were taken from the department of Nephrology, PBM Hospital while in control group 50 healthy subjects were taken. After this, anthropometric parameters, pulmonary function test of subjects of the study were compared with the control group. The comparison was done considering the age group to which the subjects belonged. Table no. 1 shows age wise distribution of both study and control group subjects. The evaluation of pulmonary functions was done with help of five non-invasive parameters which included Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV_1), FEV_1/FVC Ratio, Forced Expiratory Flow ($FEF_{25-75\%}$), Peak Expiratory Flow Rate (PEFR).

The present study showed that :

1. PULMONARY FUNCTION TEST

a. Mean FVC in study and control groups were 63.20±22.19 and 102.80±11.77 respectively and the difference was found statistically highly significant (p<0.001).

b. Mean FEV_1 in study and control groups were 52.08±21.25 and 100.98±25.21 respectively and the difference was found statistically highly significant (p<0.001).

c. Mean FEV_1/FVC ratio in study and control groups were 80.94±25.01 and 101.40±9.60 respectively and the difference was found statistically highly significant (p<0.001).

d. Mean $FEF_{25-75\%}$ in study and control groups were 33.30±18.67 and 79.22±19.85 respectively and the difference was found statistically highly significant (p<0.001).

e. Mean PEFR in study and control groups were 48.00±21.63 and 84.84±12.85 respectively and the difference was found statistically highly significant (p<0.001).

Our present study showed that Forced Vital Capacity (FVC), Peak Expiratory volume in 1 second (FEV_1), FEV_1/FVC ratio, Forced Expiratory Flow ($FEF_{25-75\%}$) and Peak Expiratory Flow rate (PEFR) values were significantly higher in control group as compared to study group.Pulmonary function profile was analyzed and compared among the study group by Peter et al. Their study showed the control group was having higher predicted percentage of mean value of FVC, FEV_1, FEV_3, PEFR and MVV as compared to study group[10]. Ferrer et al[11] 1990, To assess lung function disturbances in hemodialysis patients, mean results of conventional lung function tests were within the Normal range:

1. Forced expiratory volume; (89±12.9%)
2. Forced mid-expiratory flow (FEF_{25-75}), (81±36.7%)
3. Total lung capacity (TLC), (94±14.6%)

In the year 1990, Ferrer et al[11] hypothesized that patients with chronic renal failure may present nonspecific bronchial hyperreactivity due to subclinical interstitial lung oedema. The result of the present study showed that those who did regular exercise or other physical activities had higher values of pulmonary function test as compared to those who did not any type of activity or smoking cigarettes and bidi. Significantly higher values were observed for FVC, FEV_1, $FEF_{25-75\%}$ and PEFR.

The possible explanation for this could be that regular forceful inspiration and expiration for prolonged periods during running may leads to the strengthening of the respiratory muscles, both voluntary and involuntary. This helps the lungs to inflate and deflate maximally. This maximum inflation and deflation is an important physiological stimulus for the release of lung surfactant and prostaglandin into the alveolar spaces thereby increasing the lung compliance and decreasing the bronchial smooth muscle tone respectively[12-14]. Ringqvist suggested that changes in airway resistance serves as a major stimulus for respiratory muscle hypertrophy. Since airway resistance is related inversely and curvilinear to lung volumes, then airway resistance will be reduced when subjects breathe at high lung volumes[15].

CONCLUSION

Our present study showed that Forced Vital Capacity (FVC), Peak Expiratory volume in 1 second (FEV_1), FEV_1/FVC ratio, Forced Expiratory Flow ($FEF_{25-75\%}$) and Peak Expiratory Flow rate (PEFR) values were significantly higher in control group as compared to study group.

Hence pulmonary function significantly deteriorates in Chronic Renal Failure patients.

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