

SPIRO METRIC AND SOME SELECTIVE IMMUNOLOGICAL CHANGES AMONG 49 CASES OF DIFFERENT RESPIRATORY DISEASES

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Summary

Total 49 patients having different types of respiratory diseases were selected to evaluate their Spiro metric and IgG, IgE related blood changes. Out of these 49 respondents, 27 were females and 22 were males. 9 patients were more than 60+ years of age. Among the sufferers, 10 had bronchial asthma, 22 patients had bronchitis. Illness duration varied from <1 month to >30 years; 14 male respondents had smoking habit. 50% of the respondents had hereditary trend of present respiratory disease, 5 cases had drug addiction. Chest X-ray was performed for 48 cases, abnormality revealed in 13 cases. Out of 40 routine examination of blood, 13 had eosinophilia and raised ESR values. 15 respondents had eosinophil count 10-15%, 4 had >20%. Spirometry performed on 28 respondents. 07(25%) of the cases revealed abnormal feature-out of these, 02(29%) were obstructive and 5(71%) were restrictive¹. Mean FVC and FEV₁ of the restrictive cases were 59.42% and 52.68% respectively. Both are <80% of the predicted normal value, FEV₁/FVC was 0.88 (<90% of predicted normal). In case of 02 obstructive types, FEV₁/FVC was 0.86 (<90% of predicted normal). Immunological changes of blood were observed through serum IgG and serum IgE level estimations. Mean serum IgG level of 49 respondents was 16.27 g/L, SD ±4.33, t= 7.73 at P₄₈<0.001, showing notable variation with the reference value for serum IgG. Mean serum IgE level was 1051.72 iu/ml, SD±915.87iu/ml, t=7.37 which significantly differ from normal reference serum level of IgE at P₄₈<0.001 irrespective of age of the respondents.

Mean FVC, FEV₁ were highest in obstructive cases-156.4%, 135.9% and lowest in restrictive cases-59.42%, 61.9% respectively. The ratio of FEV₁ and FVC was observed in normal cases as 90.87%. Predicted FVC among smokers was 105.70% and in non-smokers, it was 117.19%. Significant differences of mean FVC was observed between smokers (3.77± 1.26) and non-smokers (3.94± 2.19); F=3.02,P.05. Gender discrimination of lung functions was significantly different in case of FVC, in males it was 4.25 ± 2.08 and in females, it was 3.18 ± 1.16; F=3.22, P>.10. Among the 49 individuals serum IgG and serum IgE values spread scattered, regression line passed through the intercept value 11.69 on Y-axis.

Key words

Spiro metry; immunological changes; respiratory diseases

Introduction

The forum of International Respiratory Societies (FIRS) convening at the 40th Union World Conference on Lung health in Cancun, Mexico on 9th December 2009 recognizes that hundreds of millions of people around the world suffer each year from treatable and preventable chronic respiratory disease. Chronic respiratory diseases cause approximately 7% of all deaths globally and represent 4% of the global burden of the diseases².

Respiratory diseases of putative disordered immune regulation include those caused by a hypersensitivity (allergy) to an exogenous antigen, autoantibody or immunodeficiency. Hypersensitivity responses to know antigens include hypersensitivity pneumonitis, allergic asthma (atopic and occupational), some examples of eosinophilic pneumonias (parasitic, drug induced and allergic bronchopulmonary aspergillosis) and other drug induced lung diseases^{3,4,5}. Autoimmune diseases include collagen vascular diseases, granulomatous diseases, vasculitis syndromes and idiopathic interstitial fibrosis. Infectious agents cause respiratory diseases in patients with primary or secondary immunodeficiency: viral, bacterial, fungal or parasitic. Sometimes drug induced hypersensitivity reactions may occur which may involve IgE auto antibodies (Type i), cellular cytotoxicity (Type ii), antigen-antibody complexes (Type iii) or T cell mediated hypersensitivity (Type iv)⁶.

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Immune system has developed into a remarkably efficient mechanism for protecting human life. The basic property of immune system is that it can distinguish non- self from self⁷.

Spirometry is the standard test for evaluating airway narrowing. The test is based on the fact that during exhalation, increasing effort does not continue to increase expiratory airflow, maximal flow occurs without great effort and airway narrowing due to a disease can be detected as a decrease in expiratory airflow⁸.

The pulmonary function tests permit an accurate and reproducible assessment of the functional state of the respiratory system and allow quantification of the severity of the disease, thereby enabling assessment of the natural history and the response to therapy⁹.

Large-scale research on immunological field with ultramodern investigations will help to control the top priority morbidity and mortality causing diseases of our country involving the respiratory system.

Materials and methods

The subjects, 49 in number were selected purposively, having problems with different respiratory diseases. In this cross-sectional type of study, data collection tenure was 03.02.2008 up to 08.05.2011. Before collecting data by face-to-face interview through a prepared questionnaire, which contains both structured and unstructured questions, verbal consent was taken from the respondent patients.

Respondent's disease background, treatment history, investigations with reports on Spiro metric and immunological findings were collected properly.

Cases were of different areas, different socio-economic status as well as different occupations. Those patients who had no Spiro metric findings or IgG, IgE level estimations were excluded from the study.

Findings were compared with reference values of serum IgG, serum IgE levels, and standard lung function test values. Statistical analysis with appropriate tests were performed to determine whether the changes are significant or not, calculated at 5% or other appropriate levels of confidence.

Results

Table I : Age of the respondents

Sl. No.	Age groups (years)	No	%	Remarks
1.	0-5	02	4.08	
2.	5-10	04	8.16	
3.	10-15	03	6.12	
4.	15-20	04	8.16	
5.	20-25	03	6.12	
6.	25-30	07	14.29	
7.	30-35	05	10.21	
8.	35-40	01	2.04	
9.	40-45	03	6.12	
10.	45-50	02	4.08	
11.	50-55	02	4.08	
12.	55-60	04	8.16	
13.	60+	09	18.38	
	Total	49	100.0	

Table II : Gender of the respondents

Sl No	Sex	No	%	Remarks
1.	Male	22	44.90	
2.	Female	27	55.10	
	Total	49	100.00	

Table III : Diagnosis of disease – ailments of the respondents

Sl. No	Socio-economic status	No	%	Remarks
1.	Bronchial asthma	10	20.41	
2.	Chronic bronchitis	21	42.86	
3.	Chronic bronchitis with Gall stone	01	2.04	
4.	Sinusitis	02	4.08	
5.	Allergic rhinitis	05	10.21	
6.	Ch. bronchitis with Pneumonitis	02	4.08	
7.	Pneumonia	02	4.08	
8.	RDS	01	2.04	
9.	Acute bronchitis	01	2.04	
10.	PTB	01	2.04	
11.	COPD	01	2.04	
12.	Chronic bronchitis DM hypertension	01	2.04	
13.	Rheumatoid arthritis t peptic ulcer DM	01	2.04	
	Total =	49	100.0	

Table IV : Circulating eosinophil count

Sl. No.	Test result (%)	No.	%	Remarks
1.	0-5	17	34.69	
2.	5-10	17	34.69	
3.	10-15	07	14.30	
4.	15-20	04	8.16	
5.	> 20	04	8.16	
	Total	49	100.0	

Table V : Spirometric findings of lung function

Findings	No	%	Remark
Restrictive	05	17.86	
Obstructive	02	7.14	
Normal	21	75.0	
Total	28	100.0	

Table VI : Different spirometric findings

A. FVC (Unit: L)

Sample ID No	Measured	Predicted	% Predicted	Remark
lmm/1	0.93	3.63	25.0	Restrictive
lmm/2	3.48	4.08	85.3	Normal
lmm/3	1.20	2.88	41.0	Normal
lmm/7	2.26	3.29	68.0	Restrictive
lmm/10	2.21/ 2.44	3.37/ 3.37	65.6/72.4	Mild Restrictive
lmm/11	1.97	2.31	85.3	Normal
lmm/12	2.81	3.11	90.4	Normal
lmm/15	4.87	2.78	175.2	Normal
lmm/18	1.78; 262	3.75; 3.75	47.5; 69.9	Moderate restrictive
lmm/19	4.93	3.98	123.9	Normal
lmm/22	4.40	3.48	126.4	Normal
lmm/24	3.51	2.91	120.6	Normal
lmm/27	3.69	4.03	91.0	Restrictive
lmm/29	2.82	3.49	80.8	Normal
lmm/32	3.21	3.00	107.0	Normal
lmm/33	3.52	4.29	82.1	Normal
lmm/34	3.51	2.91	120.6	Normal
lmm/36	3.61	4.18	86.4	Normal
lmm/40	4.49	3.54	126.8	Normal
lmm/41	4.09	2.54	161.0	Normal
lmm/42	6.39	3.88	164.7	Normal
lmm/44	4.11	2.80	146.8	Obstructive
lmm/45	9.26	4.26	217.4	Normal
lmm/46	3.62	3.17	114.2	Normal
lmm/47	3.50	2.86	122.4	Normal
lmm/48	6.24	3.76	166.0	Obstructive
lmm/49	4.03	3.36	119.9	Normal
lmm/50	7.95	4.10	193.9	Normal

B. FEV 1.0 (Unit: L)

Sample ID No	Measured	Predicted	% Predicted	Remark
lmm/1	0.93	3.03	30.0	
lmm/2	3.17	3.82	83.0	
lmm/3	0.88	2.73	32.0	
lmm/7	1.88	2.40	78.0	Smoker
lmm/10	1.69/ 1.90	2.59/2.59	65.3/73.4	Smoker
lmm/11	1.75	1.76	99.4	
lmm/12	2.70	2.09	129.2	Smoker
lmm/15	4.87	2.60	168.1	
lmm/18	1.48; 1.65	3.28; 3.28	45.1; 50.3	
lmm/19	4.60	3.62	127.1	Smoker
lmm/22	2.68	2.76	133.3	Smoker
lmm/24	3.35	2.84	118.0	
lmm/27	3.39	3.72	91.0	
lmm/29	2.73	2.76	98.9	Smoker
lmm/32	2.81	2.98	94.3	
lmm/33	3.38	4.10	82.4	Smoker
lmm/34	3.35	2.84	118.0	
lmm/36	3.41	3.96	86.1	
lmm/40	3.90	2.84	137.3	Smoker
lmm/41	3.82	3.17	120.5	
lmm/42	5.77	3.46	166.8	Smoker
lmm/44	2.98	2.60	114.6	
lmm/45	8.07	4.09	197.3	
lmm/46	3.19	2.22	143.7	Smoker
lmm/47	2.94	2.68	109.7	
lmm/48	5.25	3.34	157.2	
lmm/49	3.48	2.53	137.5	Smoker
lmm/50	7.44	3.79	196.3	

C. PEF- (L/S)

Sample ID No.	Measured	Predicted	% Predicted	Remark
lmm/1	1.55	8.37	18.0	Male
lmm/2	4.40	8.95	49.2	Male
lmm/3	0.97	6.15	15.0	Female
lmm/7	1.97	7.95	24.0	Male
lmm/10	4.00/ 3.45	7.83/ 7.83	51.1/ 44.4	Male
lmm/11	3.51	5.35	65.6	Female
lmm/12	10.84	7.44	145.7	Male
lmm/15	6.83	5.92	115.4	Female
lmm/18	4.77, 4.19	8.34, 8.34	57.2, 50.2	Female
lmm/19	11.31	8.90	127.11	Male
lmm/22	5.13	8.08	63.5	Male
lmm/24	6.47	6.10	106.1	Female
lmm/29	5.10	8.25	61.8	Male
lmm/32	3.46	6.22	55.6	Female
lmm/33	10.54	9.47	111.3	Male
lmm/34	7.37	6.01	122.6	Female
lmm/36	5.05	9.18	55.0	Male
lmm/40	7.83	8.52	91.9	Male
lmm/41	6.84	6.33	108.1	Female
lmm/42	7.04	8.72	80.7	Male
lmm/44	7.05	6.10	115.6	Female
lmm/45	11.42	9.30	122.8	Male
lmm/46	8.03	7.50	107.1	Male
lmm/47	6.44	6.24	103.2	Female
lmm/48	6.67	8.29	80.5	Male
lmm/49	5.69	8.01	71.0	Male
lmm/27	4.06	8.91	45.0	Male
lmm/50	13.38	9.15	146.2	Male

Original

Table VII : Serum Ig G level of the respondents

Sample ID No	Measured level g/l	Mean	Range	S.D	Reference value
Imm/1	20.75				
Imm/2	18.0				
Imm/3	20.6				
Imm/4	23.0				
Imm/5	14.2				
Imm/6	19.5				
Imm/7	21.2				
Imm/8	5.34				
Imm/9	23.1				
Imm/10	8.5				5.83 to 17.6 g/L
Imm/11	17.82				
Imm/12	14.97				
Imm/13	16.99				
Imm/14	17.72	16.27 g/L			
Imm/15	15.0				5.34 to 25.11 g/l
Imm/16	14.6				
Imm/17	16.99				
Imm/18	17.72				
Imm/19	15.0				±4.33
Imm/20	14.6				
Imm/21	14.3				
Imm/22	15.0				
Imm/23	10.5				
Imm/24	22.8				
Imm/25	16.47				
Imm/26	15.2				
Imm/27	20.0				
Imm/28	11.0				
Imm/29	1034				
Imm/30	11.0				
Imm/31	9.84				
Imm/32	14.0				
Imm/33	19.30				
Imm/34	11.05				
Imm/35	11.53				
Imm/36	15.1				
Imm/37	19.4				
Imm/38	23.0				
Imm/40	24.0				
Imm/41	15.63				
Imm/42	13.9				
Imm/43	18.52				
Imm/44	19.0				
Imm/45	17.0				
Imm/46	17.0				
Imm/47	25.11				
Imm/48	15.6				
Imm/49	14.0				
Imm/50	12.26				

Table VIII : Serum IgE level of the respondents

Sample ID No	Measured level iu/ml	Mean	Range	S.D	Reference value
Imm/1	123.0				
Imm/2	2000.0				
Imm/3	187.0				
Imm/4	2025.0				
Imm/5	2300.0				
Imm/6	2200.0				
Imm/7	2400.0				
Imm/8	607.0				
Imm/9	407.0				0-1 year: <29 iu/ml
Imm/10	300.0				
Imm/11	182.0				
Imm/12	555.0				
Imm/13	290.0	1051.72			
Imm/14	102.0	iu/ml			
Imm/15	402.0				1-2 year: <49 iu/ml
Imm/16	735.0				
Imm/17	2400.0				
Imm/18	2930.0				64.7 to 2930.0 iu/ml
Imm/19	2400.0				
Imm/20	293.0				3-9 year: <52 iu/ml
Imm/21	520.0				
Imm/22	2400.0				
Imm/23	1760.0				
Imm/24	312.0				Adult: < 87 iu/ml
Imm/25	64.7				
Imm/26	136.0				
Imm/27	2600.0				
Imm/28	890.0				
Imm/29	114.2				
Imm/30	880.0				
Imm/31	149.0				
Imm/32	2050.0				
Imm/33	539.0				
Imm/34	2100.0				
Imm/35	760.0				
Imm/36	539.0				
Imm/37	444.0				± 915.87
Imm/38	531.0				
Imm/40	2200.0				
Imm/41	711.0				
Imm/42	1240.0				
Imm/43	1100.0				
Imm/44	1430.0				
Imm/45	2300.0				
Imm/46	72.0				
Imm/47	217.0				
Imm/48	298.0				
Imm/49	2150.0				
Imm/50	89.20				

Table IX : Lung function parameters on gender basis

Gender	No	FVC	FEV	PEF
		Mean ± SD	Mean ± SD	Mean± SD
Male	18	4.25 ± 2.08	3.81 ± 1.85	6.58 ± 3.04
Female	10	3.18 ± 1.16	2.82 ± 1.18	5.37 ± 4.06
F ratio	--	3.22	2.03	1.78
d.f.	--	27	27	27
P value	--	P<10%	P>10%	P>10%
Remarks	---	Significant at P _{.01} Level	Not-Significant at P _{.10} level	Not-Significant at P _{.10} level

Table X: Comparison between smokers and non-smokers regarding spirometric measurements

Spirometric measurements	Group		F test value	P value (.05)	Remark
	Smoker Mean ±SD	Non-smoker Mean ±SD			
FVC	3.77 ± 1.26	3.94 ± 2.19	3.02	2.0	Significant
FEV1	3.05 ± 1.54	3.52 ± 1.98	1.65	2.70	N.S.
FEV1/FVC	0.80	0.89			
PEF	7.51 ± 3.17	5.90 ± 3.12	1.03	2.70	N.S.
	n=11	n=17			

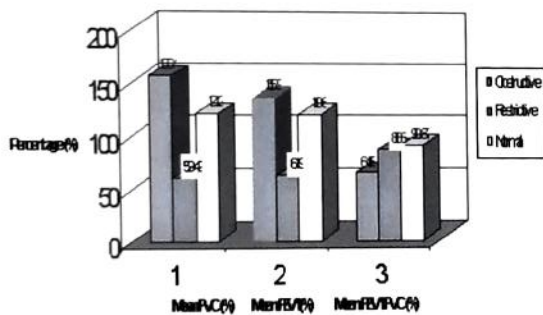


Fig 1 : Lung function parameters of normal, obstructive and restrictive cases

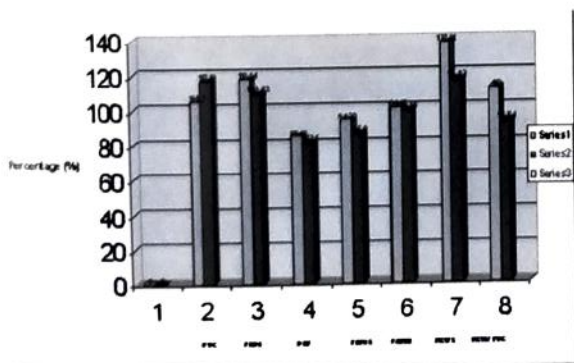


Fig 2 : Mean % prediction of respiratory parameters in non smokers and smokers group

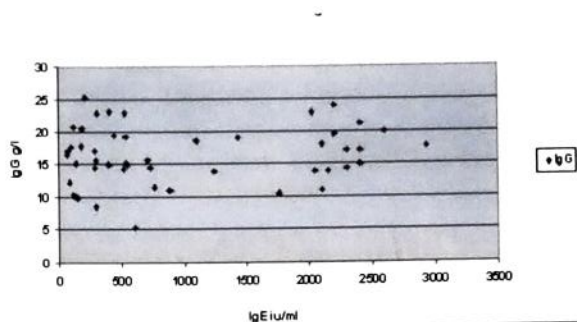


Fig 3 : Scatter diagram showing individual variations of Serum IgG and Serum IgE leves

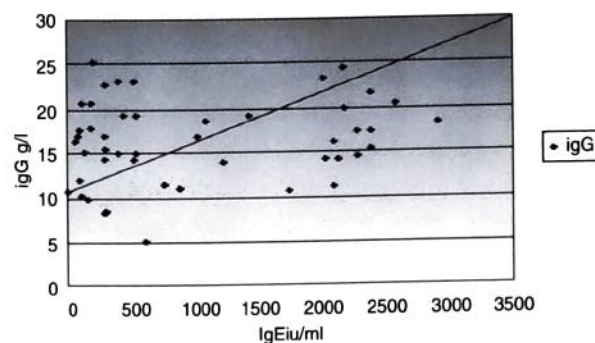


Fig 4 : Regressing line and individual variations of serum IgG and serum IgE levels

Discussion

Total selected cases of respiratory diseases were of following disease types: 10 were asthmatic, 20 were of chronic bronchitis, 05 were suffering from allergic rhinitis and chronic bronchitis with different complication manifestation found in 5 cases. The burden and costs of chronic bronchitis with emphysema are enormous. 1.5 million emergency department visits, 7,50,000 hospitalizations, 1,20,000 deaths and \$ 39 billion direct and indirect costs each year in USA alone. (www.cdc.gov/fastats/copd.htm). Chronic bronchitis usually occurs among the elderly. Revealed 34/1000 cases in 65+ years old. In this work, 9(19%) were of 60+ years old, 7(15%) were in 25-30 years age group, only 2(4%) were up to 05 years. Gender discrimination 27(55%) females and 22(45%) males were due to availability of cases¹⁰. Allergic rhinitis has become the most common allergic or immunological disorder in the USA population, caused by IgE mediated reactions to aeroallergens-estimated 01 in 07 persons. Out of 49 respondents, 33(67%) belonged to upper middle class, 9(19%) were of upper class. In their study on 51,804 patients revealed COPD among 1 in 32 people in most socio economically deprived parts of U.K. compared with 1/98 in most affluent society².

Original

Majority 45(92%) of the respondents were chronic sufferers, only 4(8%) had acute illness. 21(43%) had illness duration of (1-5) years. 50% of the respondents had hereditary trend of present disease condition.

14(29%) of the cases were smoker. Smoking directly causes more than 4,30,000 deaths each year. 25% of American adult smoke (50 million people): 15-20% of the smokers later on develop airflow obstruction. FEV₁/FVC decreasing less than 65% (V.Dimov, 2008). In this work, mean FEV₁/FVC in obstructive cases was 64.5%. Telling smokers about their spirometry report, lung age improves quit rates at 12 months from 6.4% to 13.6% according to a study of 561 UK smokers¹¹. In this work, mean FEV₁/FVC in obstructive cases was 64.5%.

For diagnostic purpose, different investigations were performed. These were Chest X- Ray (48cases), sputum for AFB (22 Cases), tuberculin tests (15 cases), R/E of blood (41cases) Urine R/E (25 cases), blood sugar estimations (23 Cases), Peripheral blood film study (16 cases) and circulating eosinophil count (49 cases), Platelet count (35 Cases), Liver functions tests (11), MP (3) and Widal tests (8) etc.

For lung function testing, spirometry was performed on 28 cases. On the basis of reports, 21 of this revealed normal feature of the lung function, 02(7%) were obstructive and 05(18%) were restrictive in nature. In British Journal of Industrial Medicine published study which was performed on 556 men aged 30-54 years for 12 years (1960-72). FEV₁ was measured. It helped to determine the differences in FEV₁ slopes by factory. It was found that 28.4% of all death in the year 2000 was due to lung cancer. Here, between smoker and non-smoker groups, mean FVC were 3.77 ± 1.26, 3.94 ± 2.19, mean FEV₁ were 3.05 ± 1.542, 3.52 ± 1.98, PEF 7.51 ± 3.17, 5.90 ± 3.12 respectively⁸.

Serum IgG and serum IgE level estimation was done for all of the 49 cases. Mean serum IgG of the respondents was 16.27 g/l, SD was ± 4.33, range was 5.34 to 25.11 g/l. The reference range for Ig G is 5.83 to 17.6 g/l. The change of serum IgG in comparison to normal range is significant. $t=5.57$, $P_{48}<0.001$.

For determining the consequence of various lung diseases on serum IgE level, estimation was done for all of the 49 cases. Mean was determined as 1051.72 iu/ml; it ranged from 64.7-2930 iu/ml. The SD was highly variable, ± 915.87. Comparing with the reference value for adults <87 iu/ml, $t=7.37$ at $P_{48}<0.001$, highly significant.

Evaluation of Immunotherapy induced changes in specific IgE, IgG and IgG sub classes in Birch pollen allergic patients by means of immunoblotting for 22-41 months. Among 10/18 (55.5%) patients, antibodies were found to decrease; no change was observed in 3/9 (33.3%) cases, decreased in 3/9 (33.3%) cases. In the case of minor allergies, 5/18 (27.7%) respondents and 8/9 (88.8%) non-respondents showed specific IgE before IT.

P. Gidikova, G. Prakova, G. Sandera in 2010 performed a study on workers exposed to asbestos dust in relation to BMI and duration of smoking. Spirometric tests were performed on 97 workers, the test revealed spirometric findings for comparing FEV₂₅₇₅, FEV₂₅ ($p=0.003$), FEV₅₀ ($p=0.004$) and FEV₁/FVC ($p=0.022$). Statistically significant differences were found between non-smokers and smokers with 10 and more pack years. M Abdul Gaafar, E. Mahmoud et. al. in 2009 in their study on 160 male workers of an Iron and Steel factory performed spirometric and audiometric investigations. With increasing years of employment, deterioration of Spiro metric measurements was observed.

Exposed group showed significant lower mean value of FVC%(81.09± 14), FEV₁% (79.85± 17.26) and FEV₁/FVC % (100.85± 18.3) than controls (89.75±8.13, 94±5.83442 and 106.05±5.8 respectively ($p<0.05$). In a research work on 134 ex-workers of a Quartz Stone Factory disclosed the spirometric findings. FVC decreases with age. FEV₁ also lower in elderly group. All the lung function parameters were found to be significantly lower in females than in males. For FVC, F ratio of respiratory disease was found to be significant after adjusting for age. ($F=5.96$; $df=3$, $p<0.01$), sex ($F=227.9$; $df=3$; $p<0.001$) and smoking habit ($F=10.54$, $df=3$, $p<0.01$). In this study, among 18 males, FVC was significantly lower than FVC of 10 females. 4.25 ± 2.08 in males and 3.18 ± 1.16 in females [F ratio=3.22, $p>.10$] It was concluded from the study that Quartz stone workers who were exposed to approximately 100% free silica have deteriorated lung function.

In their work Ig G subclass levels in epithelial lining fluid (ELF) in COPD expressed that deficiency of IgG may be responsible for recurrent infections in COPD. Study performed on 41 individuals. Total Ig levels did not differ between the groups.

All serum IgG scs except IgG₁ increased in-group 1 versus the control group. (Mean values mg/l): IgG₂=3734, IgG₃= 1119, IgG₄= 405; p<0.05). However, in the ELF, mean IgG₁ and IgG₂ levels significantly decreased (367.3 mg/l and 201.7 mg/l) respectively. (P = 0.05). Study concluded with the view that in COPD, immunologic response impaired. May be responsible for recurrent exacerbations of diseases¹². These research works clarify and ensure the role of spirometry and immunological knowledge on serum IgE and IgG levels to persuade the management and treatment of various pulmonary diseases.

Conclusion

Knowledge to treat and manage the respiratory diseases include ideas on body defense system and quantitative analysis of the lung functions. Research work was performed only on 49 patients as the investigations are costly (Requires nearly Tk.4000/- only for serum IgG, IgE level estimations and spirometry), criteria of the diseases were clear manifestations of pulmonary problems.

Respiratory diseases are the topmost morbidity and mortality problems in our country till now. Proportional morbidity of ARI diseases (cold and cough, asthma, influenza, pneumonia) is about 30%. Only asthma and TB constitute 17% of deaths in Bangladesh. (BBS/2010). Through this work, an attempt was made to assess the IgG, IgE level changes as well as Spiro metric findings of the respondent cases.

Disclosure

All the authors declared no competing interestes

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