Original Article

Correlation of Chest Radiographic findings with Spirometry in Chronic Obstructive Pulmonary Disease (COPD)

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ABSTRACT:

Objective: *Diagnosis of COPD is confirmed on spirometry but diagnosis of emphysema remains problematic. Different modalities have been used in various ways to accurately assess the extent and severity of emphysema.* ***Methods and materials:*** *This cross sectional study was carried out in Radiology & Imaging Department of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic disorders (BIRDEM), Dhaka during July 2013 to June 2014,on a total of 73 patients with suspicion of COPD to establish diagnostic usefulness of chest X-ray in evaluation of Chronic Obstructive Pulmonary Disease (COPD) and to correlate the findings with spirometry.*

Result:

Majority (39.7%) of the Chronic Obstructive Pulmonary disease (COPD) patients were in 7th decade and the mean age was 62.14±10.59 years. Male to female ratio was almost 3:1.Almost one fourth (24.7%) patients were retired Govt. service, 20.5% were business man and female patients mostly (19.2%) housewives.

Almost all male patients were smoker and 47.2% patients belonged to smoking 16-20 pack years. The mean smoking (pack years) was found 17.06±3.47 varies from 11 to 24.

The mean forced vital capacity was found 53.42±16.44% and the mean forced expiratory volume in the first second was 31.18±12.06%.The mean FEV1/FVC was found 52.29± 9.82% with range from 39 to 77%. The mean peak expiratory flow was found 31.3±13.09% with range from 9 to 68%.The mean maximal expiration flow rate was found 21.15±11.24% with range from 5 to 49%.

More than half (50.7%) of the patients had 1-15 cm height of right dome of diaphragm. The mean height of right dome of diaphragm was found 1.08±0.35cm.The mean right lung length was found 25.15±1.59 cm with range from 22.1 to 27.9cm.Almost two third (65.8%) patients had right dome of diaphragm >7th rib-≤8th rib, 5.5% hand >6th rib - -≤7th rib and 28.8% had >8th rib. Mean than half (54.8%) of the patients had retrosternal space 3.1-3.5 cm and the mean retrosternal space was 3.01±0.52cm.

More than two third (68.5%) of the patients hand signs of vascular deficiency (DTRN-S) 2 score and the mean signs of vascular deficiency was found 1.88±0.9cm with range from 0-4 score.

Almost forty (39.7%) percent patients had CXR score 7 & the mean CXR score was 7.25±0.98.Forced expiratory volume in the first second and CXR score including FVC and CXR score were statistically significant (p<0.05) among the groups.

FEV_1/FVC and CXR score were not statistically significant (p>0.05) among the groups.

Peak expiratory flow (PEF) and CXR score were statistically significant (p<0.05) among the groups.

Maximal expiration flow rate and CXR score were statistically significant (p<0.05) among the groups.

A positive significant correlation was r=0.447; (p<0.001) between RSP score with PEF.

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Significant negative correlation was r=0.428; (p<0.001) between DTRN-S score with FVC, negative significant correlation r=0.304' (p<0.001) between DTRN-S score with FEV1, negative significant correlation, r=0.247; (p=0.005) between DTRN-S score with FEV1/FVC and negative significant correlation, r=-0.555; (<0.001) between DTRN-S score with PEF.

Conclusion: *It can be concluded that methodical interpretation of chest radiographs can assess the COPD cases and well correlate with spirometry.*

(The Insight 2020; 3(2): 44-55)

INTRODUCTION:

Chronic Obstructive Pulmonary Disease (COPD) is defined as a preventable and treatable lung disease with some significant extrapulmonary effects that may contribute to the severity in individual patients. The pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases. Related diagnosis include chronic bronchitis (cough and sputum on most days for at least 3 consecutive months for at least 2 successive years) and emphysema (abnormal permanent enlargement of the airspaces distal to the terminal bronchioles, accompanied by destruction of their walls and without obvious fibrosis)[14].

The prevalence of COPD is directly related to the prevalence of risk factors in the community, such as tobacco smoking coal dust exposure or the use of bio-mass fuels and to the age of the population being studied. Those with most severe disease bear the greatest personal impact of the condition and contribute to the significant social and economic consequences on society. It is predicted that by 2030, COPD will represent the 7th leading cause of disability and 4th most common cause of death worldwide [2].

Acute exacerbation of Chronic Obstructive Pulmonary Disease (COPD) represents a major burden for patients and health care systems. For patients, acute exacerbations are common reasons for lesion admission and severely affect health related quality of life (HRQL)[3] and prognosis[4]. Mortality rates during hospitalization are around 10% [5] and during the year following a hospitalization may be as high as 40% [6]

Prevalence of COPD in more than 40 years population is 21.24% with 95% Cl 20.77% to 21.67% in Bangladesh and the overall prevalence is 4.32% [7].

Diagnosis of COPD is confirmed on spirometry but diagnosis of emphysema remains problematic. Different modalities have been used in various ways to accurately assess the extent and severity of emphysema. Chest radiograph (CXR) showing signs of hyperinflation, such a increased lung volumes, low flat diaphragm, increased retrosternal space or signs of destruction such as decreased vascular markings, bullae etc, may be helpful in detecting emphysema about spirometry, along with measurements of static lung volumes and diffusion has been found to be a very sensitive indicator of emphysema. Severe emphysema typically causes airflow limitation, air trapping and diminished diffusion capacity [8]. Most series show a progressive decrease in forced expiratory volume in the first second (FEV1) forced vital capacity (FVC) ratio and diffusion capacity with worsening degrees of emphysema [9]. Diffusion capacity appears to be related best to the severity of emphysema [10].

Chest X-ray is low cost and widely available at most of the upazilla in our country. Due to ignorance of the patients, lack of sharp cut technology (like spirometry) in every level sometime people are misguided by various type of diagnostic procedures. Maximum people of our county lives below the standard level economical parameter. So we should be more sincere about the interpretation of chest radiograph to evaluate Chronic Obstructive Pulmonary Disease for the sake of the wellbeing of our people. This study will help people to save their hard earning as well as policy maker to take proper action in case of the patients with Chronic Obstructive Pulmonary Disease . Therefore, this study collected the X-ray data and analyzed the

diagnostic performance of this imaging procedure regarding patients with chronic performance of this imaging procedure regarding patients with Chronic Obstructive Pulmonary Disease (COPD) in our country. By using X-ray in COPD patients to find out the correlation co-Efficient with spirometry.

Therefore, this study evaluate the utility of chest radiograph (CXR) for the diagnosis of COPD particularly the emphysema and to correlate these findings with pulmonary function tests (Spirometry).

METHODS AND MATERIALS:

X-ray chest PA and left lateral view was performed. A standardized 2 meter focus to film distance was used. Exposure time was kept as short as possible to reduce motion un-sharpness and radiation dose. Kilovoltage (Kv) was adjusted to each patients' body build, X-ray chest variables were level of right dome of diaphragm, right lung length, height of right dome of diaphragm, retrosternal space and signs of deictically vascular according the variables. Chest X-ray score were calculated chest X-ray was analyzed by the investigator and subsequently confirmed by a radiologist in the department of radiology and imaging, BIRDEM, who did not know the subjects condition to eliminate biasness.

Spirometry test was performed by respiratory medicine department. Spirometry variables were forced vital capacity (FVC), forced expiratory volume in 1st second (FEV1), forced expiratory volume in 1st second/forced vital capacity, peak expiratory flow (PEF) and maximal expiratory flow rate (FEF Max). Two respiratory medicine specialists who did not know the subjects' condition and X-ray chest findings analyze CXR to eliminate biasness.

The numerical data obtained from this study were analyzed and calculated by standard statistical formula.

Observation and results: A total number of 73 patients of COPD were included in this study. The age range was 31 to 90 years. Mean age was (62.14±10.59) years. Both male and female patients were included in this study. Among 73 patients 54(74%) were male and 19 (26%) were female. Occupational status of the 73 patients were also observed. Almost one fourth (24.7%) patients were retired government service, 15 (20.5%) were businessman, 14 (19.2%) were housewife 10(13.5%) were farmer and others 5 (6.8%). According to smoking/ year it was observed that almost half (47.2%) patients belonged to smoking 16-20 pack/year (20 cigarettes in a pack). The mean smoking/year was found 17.06±3.47 pack/year with range from 11 to 24 pack years. This observation is shown in table-I. Lung function tests forced vital capacity (FVC), forced expiratory volume is 1st second (FEV_1) and FEV1/FVC was done in all 73 patients. In more than half (52.42±1%) patients FVC was >75%. Mean FVC was found 53.42±16.44% with range from 19 to 90% and shows in Taste-II. In majority 33(45.2%) patients hand FEV1 21-30%. The mean FEV1 was found 31.18±12.06% with range from 14 to 66% and show in Table-III. It was observed that majority 30(41.1%) patient had FEV1/FVC 41-50%. The mean FEV1/FVC was found 52.29±82% with range from 39 to 77% and shown in Table –IV. Peak expiratory flow (PEF) and maximal expiratory flow rate was also observed in all patients in this study. It was found that majority 32(43.8%) had PEF 21-30%. The mean PEC was 31.3±13.09%/ with range from 9 to 68% and shown in Table-V. It was also found that almost half (47.9%) patient hand maximum expiration flow rate ≤20%. The mean was 21.15±11.24% with range from 5 to 49% and shown in Table-IV.

All patients underwent chest radiographs postero-anterior (PA) and left lateral view (lateral view).

The height of right of diaphragm were measured in all 73 patient. Among them more than half (50.7% had 1-1.5cm. The mean height was 1.08±0.35 with range from.

Table-I: Distribution of the study patients according to smoking (pack years)(n=53)(20 cigarettes in a pack).

Smoking(Pack years	Number of patients	Percentage
11-15	16	30.2
16-20	25	47.2
21-24	12	22.6
Mean±SD	17.06±3.47	
Range (min-max	(11-24)	

Table-II : Distribution of the study patients according to capacity (FVC)(n=73).

Forced vital capacity (%)	Number of patients	Percentage
≤20	2	2.7
21-30	2	2.7
31-40	8	11.0
41.50	23	31.5
>50	38	52.1
Mean±SD	53.42±16.44	
Range (min-max	(19-90)	

Table-III: Distribution of the study patients according forced expiratory volume in the first second.

Forced expiratory volume in the first second (%)	Number of patients	Percentage
≤20	14	19.0
21-30	33	45.2
31-40	11	15.1
41.50	7	9.5
>50	8	11.0
Mean±SD	31.18±12.06	
Range (min-max)	(14-66)	

Table-IV : Distribution of the study patients according to FEV_1/FVC.

FEV1/FVC (%)	Number of patients	Percentage
≤40	8	11.0
41.50	30	41.1
51-60	20	27.4
61.70	13	17.8
>70	2	2.7
Mean±SD	52.29±9.82	
Range (min-max)	(39-77)	

Table-V : Distribution of the study patients according to peak expiratory flow (PEF) (n=73).

Peak expiratory flow (%)	Number of patients	Percentage
≤20	12	16.4
21-30	32	43.8
31-40	12	16.4
41.50	13	17.8
>50	4	5.5
Mean±SD	31.3±13.09	
Range (min-max)	(9.68)	

Table-VI: Distribution of the study patients according maximal expiration flow (n=73).

Maximal Expiration flow rate (%)	Number of patients	Percentage
≤20	35	47.9
21.30	23	31.5
31-40	10	13.7
41.50	10	13.7
41-50	5	6.8
Mean±SD	21.15±11.24	
Range (min-max)	(5-49)	

0.4 to 1.8 cm and shown in table-VII. The length of right lung was observed and found that 37(50.7) patients had right lung length >25cm. The mean right lung length was 25.15±1.59cm with range from 22.1

to 27.9 cm and shown in table-VIII. The level of right dome of diaphragm were evaluated in all patients. All most two third 48(65.8%) patients had >7th rib to ≤8th rib, 4(2.5%) had >6th rib ≤7th rib and 21(28.8%) had >8th rib and shown in table-IX. Retrosternal space measurement is an important parameter of COPD patient. In this study it was observed that more than half 40(54.8%) had 3.1-3.5cm. The mean retrosternal space was found 3.1±0.52 cm with range from 1.5 to 4.1 cm and shown in table-X. The signs of vascular deficiency of the study patients was observed. More than two third 50(68.5%) had 2 score. The mean was found 1.88±0.9 with range from 0 to 4 and shown in table-XI. Among the study patients, chest radiograph score was observed and found that majority 29(39.7%) had score 7. The mean score was 7.25±0.98 with range from 5 to 9 score and shows in table-XII and figure-II.

The association between the lung function tests and chest radiograph score (calculate by different parameters) was studied in all study patients. Association between FVC and CXR score was observed. A total 3 patients had 5 score among them 1(33.3%) patients had 31.50 FVC and 2(66.7%) had >70 FVC. A total 12 patients had 6 CXR score among then 5(41.7%) patients hand 31.50FVC, 6(50%) had 51.70 and 1(8.3%) had 51.79 and 6(20.7)% had >70 FVC. FVC and CXR four groups reached from chi square test. These results are shown in table-XIII.

Association between FEV1 and CXR score a total 3 patients had 5 CXR score, among then 1(33.3%) patients hand ≤30 FEV1 and 2(66.6%) had >50 FEV1. A total 12 patients had 6 CXR score, among then 9(75%) patients had ≤30 FEV1, 2(16.7%) hand 31-40 FEV1 and 1(8.3%) had 41-50FEV1. A total 29 patients had 7 CXR score, among then 14(48.3%) patients had ≤30 FEV1, 5(17.2%) had 31-40 FEV1, 6(20.7%) had 41-50 FEV1, and 4(13.8%) hand FEV1, FEV1 and CXR score were >50 FEV1. FEV1 and CXR score were statically significant (p<0.05%) between 4 groups. This results are depicted in table-XIV.

Association between FEV1/FVC with CXR score was studied. A total 3 parents had 5 CXR score, among them 1(33.3%) patients had 51-60 FEV1/FVC and 2(66.7%) had 61070 FEV1/FVX. A total 12 patients had CXR score, among them 6(50%) patients had 41-50 FEV1/FVC and 51-60 FEV1/FVX respectively. A total 29 patients had 7 CXR score among then 6(20.7%) had 41-50FEV1/FVC, 6(20.7%) patients had ≤40FEV1/FVC, and 2(6.9% had >70 FEV1/FVC. FEV1/FVC and CXR score were not statically significant (p>0.05) between four groups. These results are depicted in Table-XV. Evaluating association between peak expiratory from (PEF) with CXR score total 3 patients hand 5 CXR score, among then 1(33.3%) patients had 21030 PEF and 2(66.7%) had 41-55 PEF. A total 12 patients had 6 CXR score, among the (33.3%) patients had ≤PEV, 7(58.3%) had 21-30 PEF as (1(8.3% had 41050 PEF. A total 29 patients hand 7CXR score among then 2(6.9%) patients had ≤PEF, 12(41.4%) had 41050 PEF, (3(10.3%) had 31-40 PEF, *927.6%) had 41-50 PEF score were statically significant (p<0.05) reached from chi square test between four groups. These results are depicted in table-XVI.

In all patients in this study the correlation between chest radiographs findings with spirometry results in patients of COPD was evaluated. Significant positive correlation was found radiographic with spirometry parameter that express hyperinflation (RESVs PEF). Negative significant correlation was found DTRNSVs FVC, FEV1, FEV1,.FVC and PEF and shows in table-XIII.

Table-VII: Distribution of the study patients according height of right dome of diaphragm (n=73).

Height of right dome of diaphragm (cm)	Number of patients	Percentage
≤1cm	33	45.2
1cm-1.5cm	37	50.7
>1.5cm	3	4.1
Mean±SD	1.08±0.35	
Range (min-max)	(0.4-1.8)	

Table-VIII: Distribution of the study patients according to right lung length (n=73).

Right lung length (%)	Number of patients	Percentage
≤25	36	49.3
>25	37	50.7
Mean±SD	25.15±1.59	
Range (min-max)	(22.1-27.9)	

Table-IX: Distribution of the study patients according to level of right dome of diaphragm (n=73).

Level of right dome of diaphragm	Number of patients	Percentage
>6th rib-≤7th rib	7	5.5
>7th rib-≤8th rib	48	65.8
>8th rib	21	28.8

Table-X : Distribution of the study patients according to measurement of retrosternal space (n=73).

Retrosternal space (cm)	Number of patients	Percentage
<2.5cm	6	8.2
2.5-3.0 cm	15	20.5
3.1-3.5 cm	40	54.8
≥3.5 cm	12	16.4
Mean±SD	3.04±0.52	
Range (min-max)	(1.5-4.1)	

Table-XI : Distribution of the study patients according to sing of vascular deficiency (n=73).

Sings of vascular deficiency	Number of patients	Percentage
0	8	1.1
1	6	8.2
2	50	68.5
3	5	6.8
4	4	5.5
Mean±SD	1.88±0.9	
Range (min-max)	(0-4)	

Table-XII: Distribution of the study patients according to CXR score (n=73).

CXR score	Number of patients	Percentage
5	3	4.1
6	12	16.4
7	29	39.7
8	22	30.1
9	7	9.6
Mean±SD	7.25±0.98	
Range (min-max)	(5.9)	

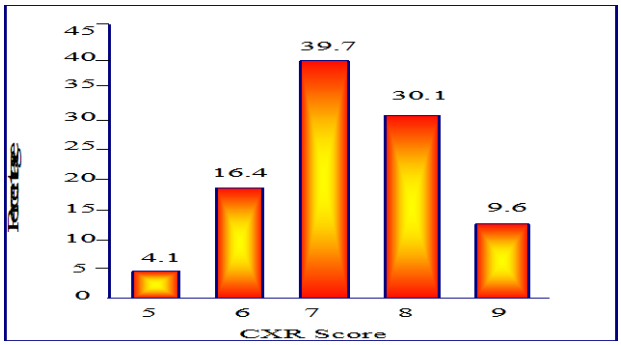

Figure-I: Bar diagram sowing CXR score of the patients.

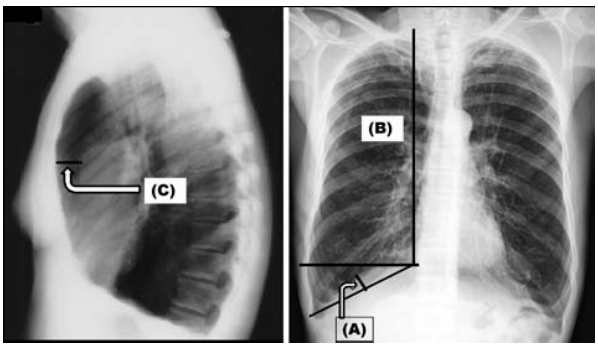

Figure II. X-ray test PA and lateral view. A- Height of right dome of Diaphragm. B- Right lung length.

C- Retrosternal space.

Table-XIII: Association between forced vital capacity with CXR score (n=73)

FVC(%)	5score		6score		7score		8scroe		9score		P
	N	%	N	%	N	%	N	%	N	%	Value
≤30	0	0.0	0	0.0	2	6.9	0	0.0	2	28.6	
31-50	1	33.3	5	41.7	8	27.6	14	3.6	3	42.9	0.015[5]
51-70	0	0.0	6	50.0	13	4.8	6	27.3	2	28.6	
>70	2	66.7	1	.83	6	20.7	2	9.1	0	0.0	

S=Significant

P Value reached from chi square test.

Table-XIV: Association between forced expiratory volume in the first second with CXR score (n=73)

FEV_1(%)	5score		6score		7score		8scroe		9score		P
	N	%	N	%	N	%	N	%	N	%	Value
≤30	1	33.3	9	75.0	14	48.3	16	72.7	7	100	
31-50	0	0.0	2	16.7	5	17.2	4	18.2	0	00	0.028[s]
41-50	0	0.0	1	8.3	6	20.7	0	0.00	0	0.00	
>50	2	66.7	0	0.0	4	13.8	2	9.1	0	0.0	

S=Significant

P Value reached from chi square test.

Table-XV: Association between FEV1/FVC with CXR score (n=73)

FEV_1(%)	5score		6score		7score		8scroe		9score		P
(%)	N	%	N	%	N	%	N	%	N	%	Value
≤40	0	0.0	0	0.0	6	20.7	2	9.1	0	0.0	
41-50	0	0.0	6	50.0	10	34.5	8	36.4	6	85.7	
51-60	1	33.3	6	50.0	6	20.7	6	27.3	1	14.3	0.069[s]
61-70	2	66.7	0	0.0	5	17.2	6	27.3	0	0.0	
>70	0	0.0	0	0.0	2	6.9	0	0.0	0	0.0	

S= not significant. P Value reached from chi square test.

Table-XVI: Association between peak expiratory flow with CXR score (n=73)

Peak	5score		6score		7score		8scroe		9score		P value
Expiratory flow (%)	N	%	N	%	N	%	N	%	N	%	Value
≤20	0	0.0	4	33.3	2	6.9	2	9.1	4	57.1	
21-30	1	33.3	7	58.3	12	41.4	10	45.5	2	28.6	
31-40	0	0.0	0	0.0	3	10.3	8	36.4	1	14.3	0.03[s]
41-50	2	66.7	1	8.3	8	27.6	2	9.1	0	0.0	
>50	0	0.0	0	0.0	4	13.8	0	0.0	0	0.0	

S=significant

P Value reached from chi square test.

Table-XVII: Association between FEV1/FVC with CXR score (n=73)

Maximal	5score		6score		7score		8scroe		9score		P
Expiration flow rate (%)	N	%	N	%	N	%	N	%	N	%	Value
≤10	0	0.0	4	33.3	6	20.7	0	0.0	2	28.6	
11-20	1	33.3	3	50.0	11	37.9	6	27.3	2	28.6	
21-30	0	0.0	3	25.0	10	34.5	8	36.4	2	28.6	0.047[5]
31-40	2	66.7	0	0.0	5	6.9	6	27.3	0	0.0	
>40	0	0.0	2	16.7	0	0.0	2	9.1	1	14.3	

S=significant

P Value reached from chi square test.

Table-XVIII: Correlation of chest radiographic findings with spirometry result in patient of Chronic Obstructive Pulmonary Disease (COPD).

Chest radiographic findings	FVC(%)	FEV1(%)	FEV1/FVC(%)	PEF (%)	FEF (%)
Spearman Correlation					
DMHT score	-0.226	-0.120	0.201	-0.026	0.216
DML score	0.079	0.033	-0.075	-0.004	-0.155
RSP Score	0.174	-0.304	-0.247'	-0.555"	0.100
DTRN-S score	-0.428"	-0.304"	-0.247'	-0.555"	-0.163
CXR score	-0.215	-0.229	-0.163	-0.062	0.134
Person Correlation					
LL (cm)	-0.118	0.012	0.093	-0.020	0.22

"P<0.05; **P<0.001. DMHT-Height of right dome of diaphragm. DML-Level of right dome of diaphragm.

RSP-Retrosternal space. DTRN-S-Signs of vascular deficiency. CXR-Chest radiographs.

DISCUSSION:

A total 73 patients out of 80 patients were selected with suspicion of COPD referred to Radiology and imaging department of Bangladesh institute of research and rehabilitation in Diabetes, endocrine and metabolic disorder (BIRDEM) Dhaka for chest X-ray during July 2013 to June 2014. 7 Patients were exclude from this study according to different exclusion criteria. Patients with cough with expectoration from most of the days for at least three mouths of the year for at least two successive years (COPD), history of exertional dyspnoea and having both chest radiograph and spirometry done were enrolled in this present study.

In this present study it was observed that majority (39.7%) patients with Chronic Obstructive Pulmonary Disease (COPD) were in 7th decade and the mean age was 62.14±9.8 years with range 31 to 90 years [11] and [12] showed the mean age were 61.5±9.8 years with range from 41 to 78 years and 60.0±9.7 years with range from 31 to 81 years respectively. Which is closely resembled with the patient study similarly [13] showed the group comprised mean age belonged to 22-96 years with mean age 59.1±11.8 years. On the other hand[3] has observed higher mean age of patients having COPD, which was 67.5±8.3 years, which is higher with the current study, this may be due to increased life expectancy in their study patients.

In this current study it was observed that almost three fourth (74.0%) patients were male and 26.0% were female and male to female ratio was almost 3:1. Similarly,[3] observed that 74.3% and 25.7% were male and female respectively, which indicates that COPD was predominant in male subjects.

In this series it was observed that almost one fourth (24.7% patients were retired Govt. severe, 20.5% business man. 19.2% housewives, 15.1% service holder, 13.7% farmer, 3.1% jobless and 2.7% contractor.

In this present study it was observed that almost had (47.2%) patients belonged to smoking 16-20 pack years. The mean smoking (pack years) was found 17.06±3.47 years with range from 11 to 24 years[11] found that the mean smoking (pack years) was found in 42.49±23.08 years with range from 14 to 125[3] obtained 22 patients were current smokers, with a mean of 46±35 pack years [12] showed that 59,0% patient were current or previous smokers, which are consistent with the current study.

In this current study it was observed that the man forced vital capacity (FVC) was found 53.42±16.44% with range from 19 to 90%. In another study[11] found the mean FVC was 77.68±14.55% with range from 56 to 116% which is a higher with the current study.

In this series it was observed that the mean forced expiratory volume in the first second (FEV1) was found 31.18±12.06% with range from 14 to 66%[11] found that the mean forced expiratory volume in the first second (FEV1) was found in 46.28±14.36% with range from 19 to 72% which is comparable with the current study.

In this present study it was observed that the mean FEV1/FVC was found 52.29±9.82% with range from 39 to 77%. Similarly,[11] obtained that the mean FEV1/FVC was 59.03±12.02% with range from 20 to 81% [3],[13] observed the mean FEV1/FVX 44±15% and FEV1/FVX (% predicted) 73.3±18.9 respectively.

In this current study it was observed that the mean peak expiratory flow (PEF) was found in 31.3±13.09% with range from 9 to 68[3] reported that dairy card PEER data were recorded for a mean of 307±49 or for 84±13% of the year study period.

In this series it was observed that the mean maximal expiration flow rate was found 21.15±11.24% with range from 5 to 49%[14] shoed the maximal expiratory flow at 75% of the expired vital capacity, which is higher with the current study.

In this present study it was observed that more than half (50.7%) had 11.5cm and the mean height of right dome of diaphragm (DMHT) was found 1.08±0.35cm with range from 0.4 to 1.8cm[11] found that the mean DMHT was 1.58±0.31cm with range from 0.90 to 2.20cm[15] obtained in their study that the position of diaphragm, the diaphragm was recorded as ‘low’ it the level of the right dome was at the anterior end of the seventh rib or lower. The diaphragm was recorded as 'that’ it the maximum curvature of the right dome was less than 1.5cm[16].

In this current study it was observed that the mean right lung length (LL) was found 25.15±1.59 cm with range from 22.1 to 27.9cm[11] found the mean right lung length was found in 24.78±1.94cm with range from 19.70 to 27.80cm.

In this series it was observed that almost two third (65.8% patients had height of right dome of diaphragm (DML)>7^{th} rib - ≤8^{th} rib. 4(5.5%) had >6^{th} rib - ≤7^{th} rib and 21(28.8%(had >8^{th} rib[11] mention in their study that the DML was calculated as the level of the apex of the right diaphragm in relation to anterior rib.

In this present study it was observed that more than half (54.8%) had 3.1-3.5cmand the mean retrosternal space was found 3.01±0.52cm with range from 1.5 to 4.1cm[11] showed maximal RSP measured 3.60cm and mean retrosternal space was found in 2.63±0.60cm with range from 1.20 to 3.60 cm[15] study 11 patients had a retrosternal space of 4.0 or 3.5cm. When the retrosternal space was 4.5cm or more there was a striking predominance of patients with severe airflow obstruction; but a normal retrosternal space did not exclude the presence of server airways obstruction. Conversely, a space in the range 3.0-4.0cm was present in some of the patients with relatively mild impairment of the FEV1. When TLC was above

140% of the predicted value the retrosternal space was usually at least 3cm.

In this current study it was observed that more than two third (68.5%) had sings of vascular deficiency (DTRN-S) 2 score and the mean was found 1.67±0.9 with range from 0 to 4 score[11] showed the mean sings of vascular deficiency (DRTN-S) was to be found 1.65±1.011 with range from 0.00 to 4.00 which is closely resembled with the present study.

In this series it was observed that majority (39.7%) had CXR score 7 and the mean CXR score was found 7.25±0.98 with range from 5 to 9 score[11] obtained in their study that the mean CXR score was found in 4.00±1.75 with range from 1.00 to 8.00.

In this current study it was observed that a total 3 patients had 5 CXR score, among them 1(33.3%) patients had 31-50 FVX and 2(66.7%) had >70 FVX. A total 12 patients had 6CXR score, among them 5(41.7%) patients had 31.50 FVX, 6(50.0%) had 51-70 and 1(8.3%) had >70 FVC. A total 29 patients had 7 CXR score, among them 2(6.9%) patients hand ≤30 FVC, 8(27.6%) had 31-50 FVX, 13(44.8%) had 51-70 and 6(20.7%) hand >FVX. FVX and CXR score were significant (p<0.05) differ among four groups.

In this present study it was observed that a total 3 patients had 5 CXR score, among them 1(33.3^) patients had ≤(30 FEV_1 and 2(66.7%) had >50 FEV_1. A total 12 patients had 5 CXR score, among them 1(33.3%) patients had 21-30 PEF and 2(66.7%) had 41-50 PEF. A total 12 patients had 6 CXR score, among them 4(3.3%) patients had ≤20PEF, 7(58.3%) had 21-30 PEF and 1(8.3%) had 41-50 PEF. A total 29 patients had 7 CXR score, among them 2(6.9%) patients had ≤20 PEF, 12(41.4%) had 21-30 PEG, 3(10.3%) had 31-40 PEF, 8(27.6%) had 41-50) PEF and 4(13.8%) had >50 PEF, PEF and CXR score were significantly (p<0.05) differ among the four groups.

In this study it was observed that a total 3 patients had 5 CXR score, among them 1(33.3%) patients had 11-20 patients had 11-20 FEF_{Max} and 2(66.7%) had 31-40 FEF_{Max}. A total 12 patients had 6 CXR score among them 4)33.3%) patients had ≤10 FEF_{Max}, 3(25.0%) had 11-20 FEF_{Max}, 3(25.0% had 21-00 FEF_{Max} and 2(16.7%) had >40 FEF_{Max}, a total 29 patients had 7 CXR score, among them 6(20.7%) patients had ≤10 FEF_{Max}, 11(37.9%) had 11.20 FEF $_{Max}$, 10(34.5%) had 21-30 FEF $_{Max}$ had 2(6.9%) had 31-40 FEF_{Max}, Maximal expiration flow rate and CXR score were significantly (p<0.05) differ among the four groups.

A variety of pulmonary function tests are available to measure airflow, airflow obstruction, functional capillary volume, alveolar volume, and air trapping, The most reliable of these tests in mild to moderate obstructive lung disease is FEV1 and the FEV1/FVC ratio reported by[17], [18]. Good correlation of these tests with radiologic findings had been demonstrated in advanced obstructive lung disease but not in mild or moderate disease reported by many investigator.[19],[20],[21],[22]

In this study it was observed that a positive significant correlation was r=0.447; (p<0.001) between RSP score with PEF. On the other hand a significant negative correlation was r=0.428; (p<0.001) found between DTRN-S score with FVC, negative significant correlation, r=0.304; (p<0.001) between DTRN-S score with FEV_1, negative significant correlation, r=0.247; (p=0.005) between DTRN-S score with FEV_1/FVC and negative significant correlation r=-0.555; (p<0.001) between DTRN-S score with PEF,[11] found that negative correlation, was between CXR score and functional parameters that express hyperinflation (FVC, FEV1, FEV_1/FVX and FEF). CXR score was not significantly associated with FVC, FEV_1, FEV_1/FVC and FEF).

In another study[12] obtained that there was a significant inverse correlation between CT scores and percentage predicted values of Dlco/VA (r=-0.650), FEV1 (r=-0.552), and FVF (r=-.0409), (p<0.001). A significant but smaller correlation, also was noted with the CXR scores and percentage predicted; Dlco/VA (r=-0.564), FEV_1 (r=-0.454), and FVX (r=-0.355), (p<0.005). When decreased diffusion capacity and airflow obstruction were used as functional criteria was as sensitive as PFT in detecting COPD. Significant correlation also was

noted with obstructive airways disease (FEV_1, FVC, FEV_1/FVC and to a lesser degree, air trapping as measured by RV[12].

CONCLUSION:

From this study it can be concluded that chest X-ray is useful in evaluation of patients of COPD and correlate with the findings with spirometry, Facility of X-ray of chest is present in every corner of the country but not the spirometry. So, in case of suspected COPD patients and for follow up both PA and lateral chest radiographs are recommended for evaluation, Methodical interpretation of chest radiographs can assess the COPD cases as good as spirometry.

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