

Study of Pulmonary Function Test in a Stage 1 and Stage 2 in Covid-19 Patients

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ABSTRACT

Purpose here in this manuscript is to study the pulmonary function test in stage 1 and stage 2 in COVID-19 patients. With regard to **Materials and Methods** our case study consists of 89 patients, with single centred Hospital based comparative cross-sectional study. Results in the present paper Overall patients enrolled in the study were aged more than 40 years almost exclusively male 66 patients (74.2%), 23 females (25.4 %). All the patients were asked detailed history about smoking and pre-existing comorbidities of lung which decreases chances of false positive result of the study. The patient with higher HRCT score were found to have decreased in the Forced expiratory volume and other parameters of spirometry. In **Conclusion** we can state that COVID 19 pneumonia may result in clinically relevant alteration in pulmonary function test with mainly restrictive pattern.

Keywords: COVID-19, SARS, Pulmonary function, HRCT score, pneumonia

INTRODUCTION

Recognized as a recent respiratory disease with highly serious conditions and alarming hospitalization to the intensive care units. With registered 10,3 million cases and with almost 1,50,000 world-wide deaths, the outbreak of COVID-19 assumed a pandemic magnitude [1]-[3]. Fever, weakness, cough and sputum are the most common signs, including muscle tightness, anorexia, depression, diarrhea, dyspnea, vibration, pain, and repeated cooccurrence [4]. In most COVID-19 pneumonia cases there were bilateral pulmonary lesions including respiratory collapse or acute respiratory distress syndrome (ARDS) [5], [6]. It is important for researchers to understand the clinical features of COVID-19 which could help to better treat their sequelae in the post-acute period. It should be noted that there is now only trial proof of a pulmonary function test in COVID-19 patients, showing that respiratory rehabilitation of the older patients for 6 weeks can enhance oxygen intake, pulmonary functions, standard of living and anxiousness. We thus intended to evaluate breathing capacity in patients

surviving in COVID19 pneumonia during the therapeutic rehabilitation and two weeks after being discharged.[7]-[7].

The pandemic nature of COVID-19 has brought in improvements in safety practices involved in health care management and calls for changes in the implementing policy aimed at ensuring the security of users as well as health workers[10]. We therefore intended to evaluate breathing capacity in patients surviving in COVID19 pneumonia during the therapeutic rehabilitation and two weeks following their discharge. We are deeply concerned about the limitations of this pandemic's PFT laboratory activity, which can lead to a high risk of advancement of the disease and diagnostic deuteriation in the chronic obstructive pulmonary disorder patients.

Moreover, we are now constantly faced with the increase in new groups of individuals which will need to be thoroughly tested, assessed and/or monitored in the post-COVID-19 recovery process.

METHODS AND MATERIALS

Data

In the present study 89 patients with post COVID-19 status included during study period of 18 months. Patients with laboratory-confirmed COVID-19 who recovered and were discharged were consecutively included. Written informed consent was obtained from all participants before inclusion.

Method

The pulmonary ventilation function test was performed in accordance with the operating instructions for the American Thoracic Association pulmonary function test via an automatic pulmonary function testing system (Germany)[11].

Test

Test parameters included forced-back volumes (IVC), forced-back expiratory volumes (FEV1), forced-back volumes (FEV1/IVC) in the first second, the maximum expiration flow rate 25 percent (MEF25), the max. expiratory flow rate 50% of the vital volume (MEF50), the maximal expiratory volume of 75 percent (MBV) and the max. Expiratory volume (MEF75). The most common waveform has been applied 3 times to each measure. The expected value FEV1/FVC <70 percent of the VCD or IVC suggested as a restricted ventilation dysfunction, FVC or IVC, and a value of <70% of the predicted value defined impaired MEF 25–75% values[12].

RESULTS

Demographic profile and frequency distribution of age of study population

Frequency Distribution of age group:

In the present study, 8 cases (9%) study participants (COVID-19) were from the age group more than 70 years .17 cases (19.1%) study participants were from age group 61-70 years .23 cases (25.8%) study participants were from 51-60 years. 22 cases(24.7%) study participants were from 41-50 years

age group. Of all, 14 cases (15.7%) of the study participants were from 31-40 years age group. Whereas, five cases (5.6 %) of the study participants were from the age group of 21-30 years.

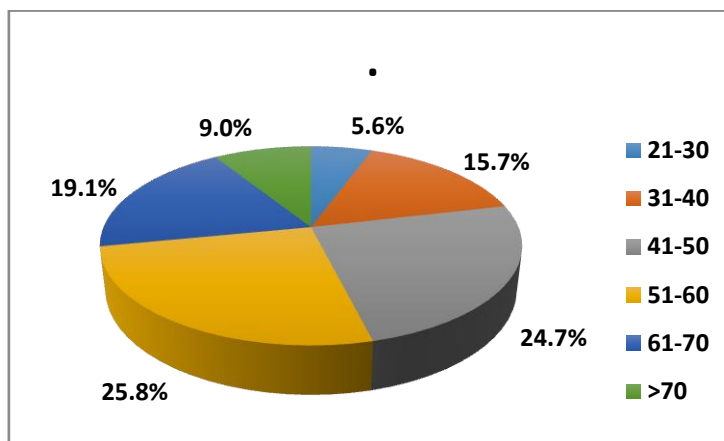


Figure 1: Distribution of Cases according to Age

GENDER

Present study included 23 females (25.8 percent) and 66 males (74.2 percent) and with male to female ratio being 2.86:1

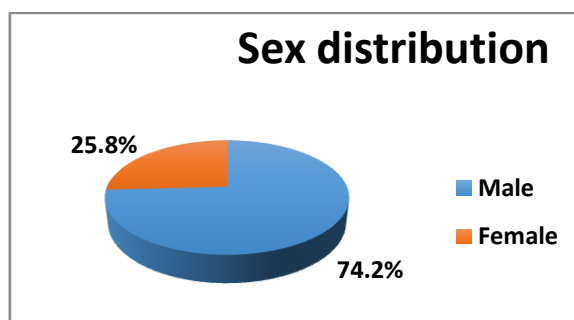


Figure 2: Distribution of Cases according to Sex

Distribution of cases according to PFT

In the table 1, out of 89 patients 34cases (38.2%) are found to have mild restrictive and mild obstructive disease. 26 cases (29.2%) are found to have moderate restrictive and obstructive disease. 9 cases (10.1 %) are found to have mixed disorder. Around 20 cases(22.5%) were found to have normal pulmonary function test.

Table 1: Distribution of Cases according to PFT

PFT	Number of cases	Percent
MILD RESTRICTIVE + OBSTRUCTIVE DISEASE	34	38.2
MODERATE RESTRICTIVE +OBSTRUCTIVE	26	29.2
MIXED DISORDER	9	10.1
WITH IN NORMAL LIMITS	20	22.5
Total	89	100

Distribution of cases according to HRCT

Out of all the 89 study cases, 16 cases (18%) were found to have 5-10% lung involvement. About 24 cases (27%) were found to have 10-15% lung involvement. 17 cases (19.1%) were found to have 15-25% lung involvement. About 13 cases (14.6%) were found to have 25-35% lung involvement. 16 cases (18%) were found to have 35-50% lung involvement. However, 3 cases (3.4%) were found to have more than 50% lung involvement.

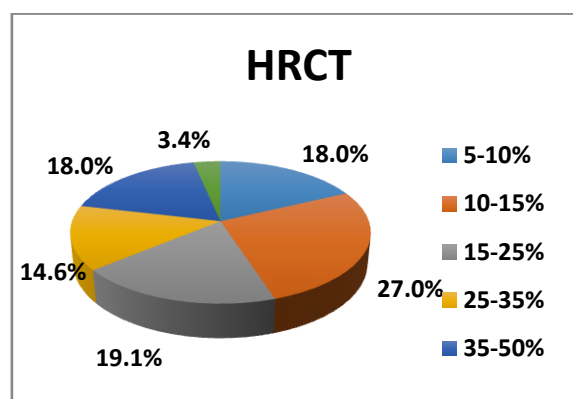


Figure 3: Distribution of Cases according to HRCT

Distribution of HRCT according to PFT

In table 2, Out of 89 patients 16 cases are in category of 5-10 % lung involvement shows 8 cases (50%) in mild restrictive and obstructive, 2 cases(12.5%) moderate restrictive and obstructive, 1(6.3%) in mixed, 5 cases (31.3%) are within normal limits. 24 cases are in category of 10-15% lung involvement, Out of which 15 cases(62.5%) are in mild restrictive and obstructive, 3 cases (12.5%)were in moderate restrictive and obstructive, 1(4.2%) in mixed, 5 cases (20.8%)were within normal limits 17 cases are in category of 15-25 % lung involvement, 5 cases(29.4%)are in mild restrictive and obstructive category , 3 cases (17.6%) were in moderate restrictive and obstructive

category, 1 case (5.9%) was in mixed diseases category, 8 cases (47.1 %) were in within normal limits. Out of 89 patients 13 patients were in category of 25-35% lung involvement out of which 4 cases (30.8%) were in mild restrictive and obstructive 7 cases (53.8 %) are in moderate restrictive and obstructive and 1 case (7.7%) is in mixed disease category.

1 case (7.7%) out of 89 cases was in within normal limits. 16 cases are in category of 35-50% lung involvement out of which 2 cases (12.5%) are in mild restrictive and obstructive, 9 cases (56.3%) are in moderate restrictive and obstructive, whereas, 4 cases (25 percent) were in mixed disease category, 1 case (6.3 percent) is within normal limits. 3 cases are in category 50-100 percent lung involvement.

2 cases (66.7%) out of the total 89 cases were in moderate restrictive and obstructive, 1 case (33.3 percent) was in mixed disease category.

Table: 2 Distribution of HRCT according to PFT

HRCT	Number of cases	PFT								Chi-Sq value	p value
		Mild res+ obs		Mod res+ obs		Mixed		WNL			
		N	%	N	%	N	%	N	%		
5-10%	16	8	50.0%	2	12.5%	1	6.3%	5	31.3%	35.18	0.002 (sig)
10-15%	24	15	62.5%	3	12.5%	1	4.2%	5	20.8%		
15-25%	17	5	29.4%	3	17.6%	1	5.9%	8	47.1%		
25-35%	13	4	30.8%	7	53.8%	1	7.7%	1	7.7%		
35-50%	16	2	12.5%	9	56.3%	4	25.0%	1	6.3%		
50-100%	3	0	0.0%	2	66.7%	1	33.3%	0	0.0%		
Total	89	34	38.2%	26	29.2%	9	10.1%	20	22.5%		

Note: * at 5% significance level (p<0.05)

DISCUSSION

COVID-19 pneumonia is emerging condition nowadays across whole world. Results of present case series revealed COVID-19 causes Atypical pneumonia. Depending upon severity of COVID-19 pneumonia shows lung involvement in HRCT findings.

We have divided according every patient percentage of lung involvement in correlation with its pulmonary function test after discharge of the patient .It shows severe group of patient whose lung involvement shows more than 40% are found to have moderate restrictive as well as obstructive lung disease due to pulmonary fibrosis as complication of COVID-19 positive patient .patient with less involvement in HRCT are found to have mild restrictive and mild obstructive lung disease or within normal limits .

Our data suggest that pulmonary function test needs to be carefully investigated in post COVID-19 patient. Additionally, study conducted by Alessia Fumagilli, shows restrictive disease in COVID-19 positive patient with higher HRCT findings. According European respiratory journal impaired diffuse lung capacity was most common abnormality ranging from 15.5 % to 43.6 , followed by defected total lung capacity , ranging from 5.2% to 10.9% .WAN et.al showed that 37% Middle east respiratory survivors have impairments in diffuse lung capacity with normal total lung capacity at 12 months of age .A study conducted in TAIZHOU hospital china 137 patient were examined for PFT after discharge and found to be restrictive pattern in patient higher HRCT score and proved inspiratory vital capacity impairment is greater than forced vital capacity so it proves alveoli damaged more in COVID-19 infection rather than airway.

In conclusion COVID-19 pneumonia may result in significant alteration in lung function with mainly restrictive pattern partly persisting at 6 weeks after recovery further studies are needed to confirm the observation on wider population and with more detailed diagnostic work up however potential implication of spirometric restrictive pattern in terms of quality of life and independency of patient it will be necessary to prevent the tsunami of post COVID-19 patients from catching health care system unprepared again after pandemic.

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