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COMPARISONS OF CHEST EXPANSION BETWEEN POST-COVID ADULTS AND NON-COVID HEALTHY INDIVIDUALS

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ABSTRACT:

Background: Post Covid -19 fibrosis is one of the emerging complications of COVID -19 pneumonia and ARDS. Reduced chest expansions may be secondary to fibrosis, consolidation, effusion, collapse or pneumothorax. Restrictive lung disease makes it difficult for the lungs to expand completely so making it harder for someone to inhale fully. Chest expansion measurement is important assessment in physical examination of post covid adults.

Aim: To compare chest expansion between non-covid healthy individuals and post covid adults.

Method: Total 120 participants were selected as per inclusion criteria for the study. The participants were allocated purposively into group A which consisted of non-covid adults and group B which consisted of post covid adults, 60 in each group. Group B was further divided into three groups according to HRCT score (mild, moderate, severe). Chest expansion was measured in both the groups at 2nd intercostal space, 4th intercostal space and xiphoid process by non-stretchable inch tape.

Results: The results showed that chest expansion reduces in post covid participant when compared to non-covid participant, P-value <0.0001 which was highly significant. It interprets that as the severity of HRCT increases, chest expansion reduces.

Conclusion: This study concluded that the chest expansion reduces in post covid patient compare to non-covid patient.

Keywords: Chest expansion, Inch tape, Non-Covid Adults, Post Covid Adults.

Introduction:

Coronavirus disease 2019 (COVID 19) was first detected in Wuhan, China in December 2019 and declared as pandemic by the world health organization (who) on march 11, 2020.in India the first case of covid-19 infection was reported in Kerala on January 27,2020.[1]

The coronavirus is a single stranded RNA virus with great capacity for fast mutations and recombination causing respiratory infections. The SARS-Cov -2 infection generally occurs through the coupling of s –protein located on the surface of virus with angiotensin–converting enzyme 2 (ACE2) which acts as a receptor for the virus. ACE2 is mostly present in the lungs and seems to be the main gateway for the virus. It is also present in large amounts in the heart which may lead to cardiovascular (CV) complications.[2]

The virus is transmitted via respiratory droplets and aerosols from one person to another person. The SARS-CoV -2 which is received via respiratory aerosols binds to nasal epithelial cells in upper respiratory tract. Due to involvement of upper airways, the disease manifests with symptoms of fever, malaise and dry cough. About one fifth of all infected patients progress to later stage of disease and develop severe symptoms which involves lower respiratory tract infection. This may lead to diffuse alveolar damage with resulting acute respiratory distress syndrome ARDS this damage to the lungs because of coronavirus infection can restrict the thoracic movement.[3]

Computed tomography findings are important in both diagnosis and follow up. With high resolution computed tomography (HRCT) severity can be assessed using the scoring system i.e. mild, moderate, severe which depends on the visual assessment of each lobe involved.[4]

After recovering from COVID-19 some survivors often persist lung trouble for several months because of their weak immune system. Some survivors may response more aggressively to COVID-19 resulting in cellular damage to other organs leading to ARDS. In severe cases, there is sudden and massive release of cytokines called cytokine storms leading to tissue inflammation and organ damage. These immune responses may further cause fibrotic changes making the lung harder and difficult to expand. Therefore, expansion of lungs in patients recovered from COVID-19 is necessary.

Post COVID-19 sequel can include activity related breathlessness, cough, weakness, fatigue, palpitations, decreased exercise tolerance which affects health related quality of life and daily activities. Therefore, respiratory rate and heart rate is of pivotal importance to evaluate lung function and exercise tolerance in post COVID adults.

Therefore, respiratory evaluation is an integral part to evaluate lung function in post COVID patients. Normal chest wall mobility is important for effective lung expansion and subsequent ventilation. Examination of chest movement is also an important tool for respiratory system evaluation of patient. thoracic movement can be check by observatory, palpatory and by using inch tape.[5]

Procedure:

An observational comparative study design was chosen for the study. Approval was taken from the institutional ethical committee and head of the department before conducting the study. Total 120 participants were selected as per inclusion criteria for the study. Participants aged 20 to 60 years, non-covid adults and post covid (mild, moderate, severe) adults up to 2 months of

quarantine period were included for the study. Non-covid adults with history of trauma, injury or any other surgical conditions of chest and restrictive lung conditions like tuberculosis, occupational disease was excluded. The participants were explained about the procedure of the evaluation and purpose of study and written informed consent was obtained. The participants were allocated purposively into group A which consisted of non-covid adults and group B which consisted of post covid adults, 60 in each group. Group B was further divided into three groups according to HRCT score (mild, moderate, severe).

Severity was assessed using the following scoring system which depends on the visual assessment of each lobe involved.

Percentage of lobar involvement	**score**
5% or less	1
5%to 25%	2
26% to 49%	3
50%to 75%	4
>75%	5

Assessment of chest expansion: Chest expansion was measured with study participants in sitting position, elbow slightly flexed so that the hands rested on hips. With the help of non-stretchable inch tape, the chest expansion was measured in centimetres at three levels that were 2nd intercostal space, 4th intercostal space and xiphoid process. Participants were asked to exhale the air as much as possible and then take a maximal deep inspiration. The difference between the full expiration & full inspiration was noted.

Statistical analysis:

Descriptive statistical data was presented in the form of mean +/- standard deviation and mean difference were calculated and presented. An unpaired T-test was performed to assess the statistically significant difference between the groups.

Table no 1: Comparison of difference of chest expansion at full inspiration and expiration in non covid and post covid participants.

Difference of chest expansion at full inspiration & expiration	**Non covid**		**Post covid**		**t- Value**	**P-Value**
	MEAN	**SD**	**MEAN**	**SD**		
At 2nd ICS	6.35	0.99	4.63	0.75	10.7021	<0.0001
At 4th ICS	6.23	0.91	4.65	0.85	9.8081	<0.0001
At xiphoid process	7.01	0.95	4.26	0.66	18.4961	<0.0001

Interpretation: Table no 1 shows in non-covid adults mean difference of chest expansion at 2nd ICS were 6.35 cm, at 4th ICS were 6.23cm, at xiphoid process is 7.01cm. In post covid adults mean difference of chest expansion at 2nd ICS were 4.63cm, at 4th ICS were 4.65cm and at xiphoid process were 4.26cm. P-value were <0.0001, which were highly significant.

Table no 2: Age wise comparison of difference in chest expansion at full inspiration and expiration in non-covid and post covid participants.

	Age Group	Non covid		Post COVID		t-Value	P=Value
		Mean	SD	Mean	SD		
At 2nd ICS in cms	21 30	6.64	0.80	5015	0.78	5.5560	<0.0001
	31 40	6.43	0.75	4.83	0.71	5.7034	<0.0001
	41 50	5.97	1.03	4.66	0.65	4.2302	0.0002
	51 60	5.53	0.50	4.0	0.81	4.4302	0.0002
F-Value		6.22		6.70			
P-Value		0.0010		0.0006			
At 4th ICS	21-30	7.35	0.97	4.66	0.54	9.9476	<0.0001
	31-40	7.18	0.77	4.16	0.72	10.5547	<0.0001
	41-50	6.89	0.94	4.15	0.62	9.4727	<0.0001
	51-60	6.11	0.60	4.03	0.64	7.9256	<0.0001
	F-Value	4.61		3.06			
	P-Value	0.0059		0.0355			
At xiph-oid process	21-30	6.86	0.84	4.99	0.54	7.7320	<0.0001
	31-40	6.68	0.71	4.61	0.56	8.0520	<0.0001
	41-50	6.37	0.98	4.38	0.54	7.0008	<0.0001
	51-60	5.62	0.61	4.08	0.64	5.8411	<0.0001
	F-Value	5.09		4.16			
	P-Value	0.0035		0.0004			

Interpretation: Table no 2 interpreted that in both non covid and post covid adults, as the age increases the chest expansion decreases. The P-value for both the groups were <.0001 which were highly significant.

Table no 3: Comparison of chest expansion at 2nd ICS, 4th ICS and xiphoid process in relation to severity of HRCT

	Mild	Moderate	Severe	Non COVID	F-Value	P-Value
Chest expansion at 2nd ICS	5.25+-0.41	4.60+-0.50	4.05+-0.76	6.35+-0.99	51.88	<0.0001
Chest expansion at 4th ICS	505+-0.56	4.55+-0.51	3.90+-0.55	6.23+-0.91	58.84	<0.0001
Chest expansion at xiphoid ICS	4.87+-0.36	4.15+-0.48	3.75+-0.55	7.01+-0.66	141.94	<0.0001

Interpretation: Table no 3 showed that as the severity of HRCT increases, chest expansion reduces. P-values at each level for both the groups were <0.0001, which were highly significant.

Results:

The results showed that chest expansion was reduced in post covid patient compare to non-covid patient. The P-value <0.0001 which was highly significant. It interprets that as the severity of HRCT increases, chest expansion reduces.

DISCUSSION:

The present study showed comparison of chest expansion between non covid and post covid adults which included 60 non covid and 60 post covid participants. In this study total 120 participants were present ,60 in each group. In non covid group there are 35% adults in age group of 20-30,26.67%adults in age group of 30-40,23-33% adults in age group of 40-50 and 15%adults in age group of 50-60.in post covid group there are 26% adults in age group of 40-50and 26.67% adults in age group of 50-60.

In non-covid group,51.67% were male and 48.33% were female. In post covid group 40% were male and 60% were female, in non covid adults mean difference of chest expansion at 2nd ICS were 6.35cm, at 4th ICS were 6.23cm. In post covid, mean difference of chest expansion at 2nd ICS were4.63cm, at 4th ICS were 4.65cm, at xiphoid process were 4.26cm

Study of Mouna Asly and Asma[1] hazing on ‘’rehabilitation of post covid -19 patients’’. Post covid-19 ARDS can progress to restrictive respiratory failure due to respiratory muscle weakness and secondary pulmonary fibrosis with impaired diffusion associated with physical deconditioning. Both of ARDS and the prolonged hospital stay due to covid-19 including time spent in an intensive care units lead respiratory, physical and psychological dysfunction. This puts them at greater risk for developing post intensive care syndrome (PICS). PICS is defined as new or worsening impairment in physical ,cognitive or mental health status arising after critical illness and persisting beyond discharge from the acute care setting.

Study of Ganesh Raghu and Kevin c Wilson[5] supported that COVID-19 interstitial pneumonia: monitoring the clinical course in survivors early evidence supports the hypothesis that some survivors might develop long term respiratory sequelae. Fibrotic abnormalities of the lung have been detected as early as 3 weeks after the onset of symptoms regardless of whether the acute illness was mild, moderate, severe.[7,8] It is very early to determine which COVID-19 patients are at greater risk for developing long term pulmonary abnormalities, if such sequelae will resolve, improve or become permanent and how the pulmonary abnormalities might be affected by therapeutics such as remdesivir, dexamethasone and others under investigations. It is hypothesized that most covid-19 survivors will manifest early pulmonary abnormalities which could range from being asymptomatic to mild to severe and debilitating.[9,10]

Study of Mohammadreza Tabary[6] on support that ‘’pathologic features of covid-19: Concise review oxygen requirements increase with the increasing CT severity. The progressive increase in oxygen requirements can be due to the direct damage of the lung by the virus causing inflammatory changes in alveolar wall that limit oxygen exchange, leading to acute respiratory distress, pulmonary fibrosis and eventually death. Moreover, significant pulmonary thromboembolic effects were also found on autopsies from patients who died from covid-19 disease.[11,12] A study showed that thoracic expansion measurements were significantly lower in post-COVID individuals with an increased BMI.[13]

Our study interprets that as the severity of HRCT increases, chest expansion reduces, statistical analysis showed that there is reduce in chest expansion in post covid patients compare to non-covid patients.

Conclusion:

This study concluded that the chest expansion reduces in post covid patient compare to non-covid patient. It interprets that as the severity of HRCT increases, chest expansion reduces.

Limitations:

Age group 20 to 60 were included as per availability and post covid duration 2 month of quarantine period. Occupation of the participant was not considered.

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