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by Reny Luhur Setyani

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Chest Radiography and CT scan as Predictor Factors for Long Covid

Reny Luhur Setyani [1], ***Srie Retno Endah*** [2], ***Ana Majdawati*** [3], ***Muhammad Hafiz*** [4], ***Farsida*** [5], ***Rahma Ayu Iarasati*** [6], ***Tutwuri Handayani*** [7], ***Khatarina Setyawati*** [8]

[1] *Radiology Departement of Jakarta Islamic Hospital, Faculty of Medicine University of Muhammadiyah Jakarta, Jakarta, Indonesia*
[2] *Radiology Departement of Budi Asih Hospital, Jakarta, Indonesia*
[3] *Radiology Departement of Yogyakarta Islamic Hospital, Yogyakarta, Indonesia*
[4] *Pulmonology Departement of Budi Asih Hospital, Jakarta, Indonesia*
[5,6,7,8] *Faculty of Medicine University of Muhammadiyah Jakarta, Jakarta, Indonesia*

Abstract

Background: *There are several criteria for Long Covid patients and clinicians need to treat and sort out COVID-19 patients based on the risk of worsening, and the severity of lung disease to prevent this condition.*

Objective: *This study is aimed to obtain the relationship between the condition of COVID-19 patients at the time of admission to the hospital based on a chest X-ray using the Brixia Score and the stage on the Chest CT using the Severity Score with symptoms at 6-8 weeks after treatment, which is used as a predictor of the occurrence of Long Covid.*

Method: *The design of this study was a retrospective cohort design to analysis of chest radiography images using the Brixia Score, and the chest CT scan image based on the Severity Score at the time of being diagnosed with COVID-19. The result is then compared with the onset of Long Covid.*

Result: *From 54 research samples, using frequency distribution analysis, the data obtained are 34 non-elderly people (63%) and 20 elderly people (37%); female 26 (48.1%), male 28 (51.9%); 14 people without Long Covid symptoms (25.9%), 40 people with Long Covid symptoms (74.1%); The Brixia Score based on chest radiography obtained 21 mild (38.9%), 20 moderate (37%), 13 severe (24.1%); Severity Score based on CT scan of the thorax found 18 mild (33.3%), 29 moderate (53.7%), 7 severe (13.0%). In the Kolmogorov-Smirnov test, the distribution of data is normal, and in the Pearson test, there is a strong relationship between Brixia Score and Long Covid symptoms (r = 0.553) and the relationship between Severity Score and Long Covid symptoms (r = 0.733) with p = 0.000.*

Conclusion: *There are significant relationships between the Brixia Score and Severity Score with Long Covid symptoms.*

Keywords: *COVID-19, Long Covid, Brixia, Severity Score*

Abstrak

Latar belakang: Banyaknya pasien dengan gejala *Long Covid* membuat dokter perlu merawat dan memilah pasien COVID-19 berdasarkan risiko perburukan, dan keparahan penyakit paru-paru untuk mencegah kondisi ini lebih banyak terjadi kedepannya.

Tujuan: Penelitian ini bertujuan untuk mendapatkan hubungan antara kondisi pasien COVID-19 saat masuk rumah sakit berdasarkan foto rontgen dada menggunakan *Brixia Score* dan stadium pada CT Dada menggunakan *Severity Score* dengan gejala pada 6 -8 minggu setelah pengobatan, yang digunakan sebagai prediktor terjadinya *Long Covid*.

Metode: Rancangan penelitian ini adalah desain kohort retrospektif untuk analisis citra radiografi dada menggunakan Skor Brixia, dan citra CT scan dada berdasarkan *Severity Score* pada saat diagnosis COVID-19. Hasilnya kemudian dibandingkan dengan timbulnya *Long Covid*.

Hasil: Dari 54 sampel penelitian dengan menggunakan analisis distribusi frekuensi diperoleh data 34 orang bukan lansia (63%) dan 20 orang lansia (37%); perempuan 26 (48,1%), laki-laki 28 (51,9%); 14 orang tanpa gejala covid lama (25,9%), 40 orang dengan gejala covid lama (74,1%); Skor Brixia berdasarkan foto toraks didapatkan 21 ringan (38,9%), 20 sedang (37%), berat 13 (24,1%); *Severity Score* berdasarkan CT scan thorax ditemukan 18 ringan (33,3%), 29 sedang (53,7%), 7 berat (13,0%). Pada uji Kolmogorov-Smirnov distribusi data normal, dan pada uji Pearson terdapat hubungan yang kuat antara Skor Brixia dengan gejala *Long Covid* (r = 0,553) dan hubungan antara *Severity Score* dengan gejala *Long Covid* (r =

Corresponding Author:
Reny Luhur Setyani | Radiology Departement Rumah Sakit Islam Jakarta, Faculty of Medicine University of Muhammadiyah Jakarta, Jakarta, Indonesia | -email

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0,733) dengan p = 0,000.

Kesimpulan: Terdapat hubungan yang signifikan antara *Brixia Score* dan *Severity Score* dengan lama gejala covid.

Kata kunci: COVID-19, *Long Covid*, Brixia, *Severity Score*

INTRODUCTION

Corona Virus Disease 2019 (COVID-19) is an infectious disease caused by the Novel Coronavirus, which since December 2019 has spread from China to the rest of the world and was declared a Global Pandemic by WHO on March 11th, 2020. This infection can cause severe pneumonia and even carrying fatal Acute Respiratory Syndrome (1). The spectrum of infection severity ranges from asymptomatic to mild, which is seen in a total of 81% of cases; moderate symptoms (14% of total cases) with shortness of breath, hypoxia, or involvement of more than half of the lung on chest radiograph; severe (5% of cases) with respiratory failure, shock, or multiorgan dysfunction(2). The mortality rate in the world is 2.38% of reported non-critical cases. Severe disease can occur in healthy people of all ages but is most commonly found in the elderly or patients with co-morbidities such as Cardiovascular Disease, Diabetes Mellitus, Hypertension, Chronic Pulmonary Disease, Lung Cancer, Malignancy, and Metastatic Diseases, Chronic Kidney Disease, Obesity and Tobacco-Related Diseases (2).

Laboratory findings related to severity include lymphopenia, thrombocytopenia, neutrophil-lymphocyte ratio >3.3; increases in aspartate transaminase (AST), base transaminase (ALT) (37%), lactate dehydrogenase (LDH), increases inflammatory markers, for example. Reactive protein C (CRP), ferritin, D dimer (>1 mcg/ml), prothrombin time, troponin, creatinine phosphokinase, and acute renal failure (2). Although Chest Radiography is considered insensitive for detecting lung involvement in its early stages, in emergency situations, standard or bedside chest radiography becomes an important diagnostic tool for monitoring the day-to-day development of unstable lung conditions in COVID-19, especially in critical conditions. ICU patient (3)

Long Covid is a condition where the patient does not recover after several weeks or months after getting the initial symptoms of COVID-19, regardless of whether being examined or not (4). Many COVID-19 patients who are hospitalized still experience further symptoms such as shortness of breath, coughing, fatigue, and mental disorders. In many cases, not only severe get old Covid cases, but also mild cases have recurring symptoms including constant fatigue, headaches, chest pains, myalgias, palpitations, and even develop cognitive impairments such as poor memory and concentration (4).

In the majority of patients recovering from severe COVID-19, significant Pulmonary Fibrosis is found. Chest radiography is used to diagnose and evaluate disease progression in the lungs. However, follow-up Chest Radiography did not correlate with Abnormal CT Findings and Permanent Functional Impairment. Chest Radiography is an independent risk factor for poorer prognosis in COVID-19 patients, where 86% have an abnormal Chest CT after 3 months. In this study, changes in Chest Radiography findings were correlated with recovery time, and abnormal findings were reported to be significantly correlated with COVID-19 severity (5).

METHODS

1. Patient population and sample

The study was conducted at RSUD Budhi Asih Hospital between December 2021 and May 2022, we enrolled 54 consecutive patients (28 males, 26 females) in a retrospectively designed study. The inclusion criteria were adults over 18 years old, with a history of hospitalization due to moderate to severe Covid 19, current PCR (-), and having a complete Chest X-Ray and Chest CT when admitted to the hospital. Patients with massive pleural effusion and pneumothorax were excluded.

All data from the study sample were identified and recorded including all symptoms for 6-8 weeks after hospitalization. Initial chest radiographs were

analyzed using the Brixia Score and initial chest CT was analyzed using the Severity Score.

This study was designed as a Retrospective Cohort to analyze Chest Radiography using the Brixia Score and Chest CT scan using the Severity Score from the initial findings. The result will be used as a predictor of Long Covid.

2. Chest Radiography and Chest CT

Chest radiography was performed on a mobile digital x-ray machine (Mobilett Elara Max, Siemens, Forchheim, Germany). The patient is positioned upright or supine, with the trachea centered and equidistant from the clavicular heads on either side, the spine visible as a transparent structure through the cardiac shadow and a full inspiratory effort if possible. Standard exposure parameters are 80 kVp and 2 mAs.

Chest CT was performed without contrast administration, on a 128-multislice detector CT system (Revolution Maxima, GE, Waukesha, Wisconsin). All patients were positioned supine (headfirst, arms above head) right at the isocenter of the gantry. The scanning range extends from the level of the tracheal bifurcation to the diaphragm. The following scan parameters were used: 2x64x0.625 mm detector collimation with resulting slice acquisition of 2x128x0.625 mm via a z-flying focal point, 280 msec gantry rotation time, and 3.4 pitch.

This study was approved by the local ethical committee, and informed consent was obtained from all patients.

RESULTS

Table 1 Frequency Distribution of Patient Characteristics

No	Characteristics		Total	
			n	%
1	Age	Non-elderly	34	63,00
		Elderly	20	37,00
2	Gender	Women	26	48,10
		Man	28	51,90
3	Comorbid	No	29	53,70
		Yes	25	46,30
4	Lab Result (PCR, NLR)	Normal	2	3,70
		Abnormal	52	96,30

Table 1 depicts an almost equal proportion of age, gender, and comorbid characteristics. However, the proportion of characteristics based on lab results shows a greater proportion of abnormal lab results.

Table 1 Frequency Distribution of Variable

No	Variable		Total N = 54	Percentage %
1.	Brixia Score	Mild	21	38,9
		Moderate	20	37,0
		Severe	13	24,1
2.	Severity Score	Mild	18	33,3
		Moderate	29	53,7
		Severe	7	13,0
3.	Long Covid sympthoms	No	16	29,6
		Yes	38	70,4

Whereas in Table 2, the information obtained was 21 people with a mild Brixia Score (38.9%), 20 people with a moderate Brixia Score (37%), 13 people with a severe Brixia Score (24.1%); 18 people with a mild Severity Score (33.3%), 29 people with a moderate Severity Score (53.7%), 7 people with a severe Severity Score (13.0%).

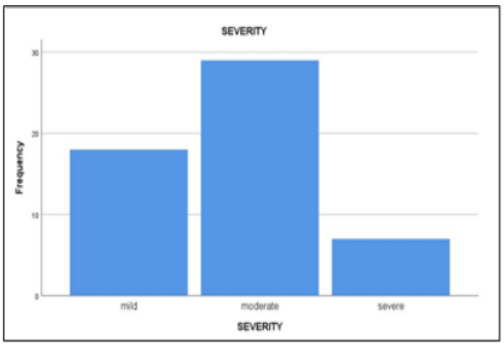

Figure 1 Severity Score

Figure 1 shows there are more moderate Severity Score than mild and severe.

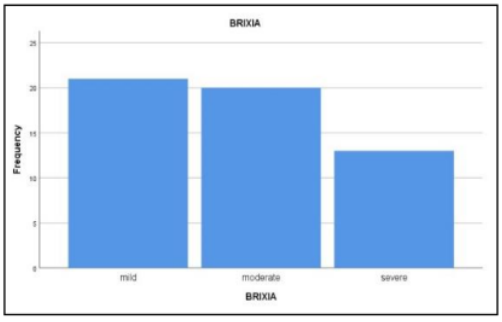

Figure 2 Brixia Score

Figure 2 shows there are mild Brixia Score more than

moderate and severe.

The most Brixia Score is mild category, the most Severity Score is the moderate category, and most of the patients have Long Covid symptoms.

Tabel 2 Brixia Score and Severity Score to Long Covid symptoms.

No	Variable		Long Covid symptoms		Total N = 54	r value	p Value
			No	Yes			
1.	Brixia Score	Mild	13	8	21	0.553	0,000
		Moderate	3	17	20		
		Severe	0	13	13		
2.	Severity Score	Mild	15	3	18	0.733	0.000
		Moderate	1	28	29		
		Severe	0	7	7		

Table 3 can be concluded that the correlation between the Brixia Score and Long Covid symptoms with a value of r = 0.553 with a strong relationship, with a value of p = 0.000 so that H_0 is rejected (<0.05), which means there is a relationship. Correlation between Severity Score and Long Covid symptoms with a value of r = 0.733 with a strong relationship, with a value of p = 0.000, so H_0 is rejected (<0.05), which means there is a relationship.

It can be concluded that the higher the results of the Brixia Score and Severity Score, the higher the Long Covid symptoms.

DISCUSSION

The correlation between Brixia Score and Severity Score for Long Covid symptoms shows a strong relationship (Table 3). The Brixia Score correlates strongly with disease severity and outcome and can support clinical decision-making (6). It can even determine the fatality of a disease that results in death if the score is more than 12(7). Although the Brixia Score can predict death, it cannot predict the length of stay of confirmed COVID-19 patients who are hospitalized (8)(9).

LIMITATION

Retrospective data is used so that the data obtained is less comprehensive, and there is a potential for bias in the data because the patient's symptoms are subjective, and there is the possibility of other co-morbidities outside those studied, thus disguising the symptoms of Long Covid itself.

CONCLUSION

Based on the analysis and discussion that has been done, it can be concluded that there is a significant relationship between Brixia Score based on chest radiography and Long Covid symptoms and there is a significant relationship between Severity Score based on chest CT scan and Long Covid symptoms. Researchers feel the need to dig deeper into the symptoms of Long Covid patients, supplemented by radiological images with chest CT scan modalities, chest radiography which can be used to predict Long Covid patients.

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Conflict of Interest

There is no conflict of interest.

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