

# Correlation of mRALE Severity Scoring System and NLR Values in COVID-19 Patients Accompanied by Fungal Infection at Dr Soetomo Hospital Surabaya

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## Abstract

**Objectives :** COVID-19 accompanied by a fungal infection can exacerbate the severity and complicate patient treatment. Assessment of the severity of plain chest radiographs using the *mRALE* scoring system can assist radiologists in identifying the patient's degree of severity. In addition, NLR can also be used as a parameter of the severity of a disease or a worse prognosis so that it can provide an objective basis for early identification and management of patients. This study aims to assess the severity of plain chest X-rays of COVID-19 patients accompanied by fungal infection using *mRALE* and its correlation with NLR values, as well as to determine the radiological appearance and distribution of lesions in COVID-19 patients accompanied by fungal infection.

**Material and Methods :** An analytical observational study with a retrospective design was conducted with 140 confirmed COVID-19 patients accompanied by fungal infections compare with 140 confirmed COVID-19 without fungal infections who are hospitalized at Dr. Soetomo and has chest radiography results at RSUD Dr. Soetomo, NLR value and sputum culture. The scoring system uses the RSUD *mRALE*. We evaluated the severity of lung disease based on the *mRALE* which is assessed by two observers.

**Result :** The relationship between the *mRALE* severity rating system and the NLR score was statistically significant and also between radiological infiltrates and consolidation with the presence of COVID-19 accompanied with fungal infection was statistically significant ( $p < 0.05$ ),

**Keywords:** Type your keywords here, separated by semicolons ; **Keywords :** COVID-19; fungal; *mRALE*; NLR

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## Introduction

The coronavirus disease 2019 (COVID-19), which started as a pneumonia epidemic in Wuhan, China in the end 2019, has become a global issue due to its high prevalence and rapid transmission (1). Until Mei 2022, globally more than six millions of death has been reported (2). In addition to the harmful effect of the virus, such as dysregulation of immune response and direct damage to pulmonary and extra-pulmonary tissues, COVID-19 can be accompanied by infection caused by other microorganism (1). Fungal, bacterial, and viral co-infections and super-infections have been detected in patients infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), leading to more difficult management and increased morbidity and mortality (3).

## Methods

An analytical observational study with a retrospective design was conducted with 140 confirmed COVID-19 patients accompanied by fungal infections compare with 140 confirmed COVID-19 without fungal infections. All patients with COVID-19 confirmed by a PCR test who were admitted to Dr. Soetomo General Academic Hospital during 2019 until 2020 were included in the study. All participants underwent chest radiography using a Carestream DRX Revolution Mobile X-ray type K5807-8357, NLR value, and sputum culture. The scoring system uses the RSUD *mRALE*. We evaluated the severity of lung disease based on the *mRALE* which is assessed by two observers. Data scores obtained from two observers were assessed for reliability and consistency using Kappa test was 0.000, the agreement between observers was assessed as very strong. The accumulated *mRALE* scores were divided into the following groups: 0 (normal), 1-20 (mild), 21-32 (moderate), and  $\geq 32$  (severe) (4,5). Evaluation of the chest radiographs was subsequently carried out, and included the radiographic features of pneumonia and lung-disease severity based on the *mRALE* score and the correlation assessment between NLR and each variable. Observers would inscribe the report on the worksheets provided and then analyze and present them as research results. Data obtained in the form of nominal data (i.e. gender, age, radiographic spectrum) and ordinal data were processed using SPSS 26 software, with an error rate of 5%. The nominal and ordinal data were evaluated using Chi-square, Mann-Whitney, and Spearman tests. A p-value  $< 0.05$  was considered significant, with a confidence interval of 95%.

## Result

A total of 280 subjects were included in this retrospective study. 140 Of these, 172 were males and 108 were females (table 1), aged between 3 months and 80 years, with an average age of 50,22 years (table 2).

Table 1. Characteristics of the sample by sex

Characteristics	n = 280
Gender	
Man	172 (61,45%)
Woman	108 (38,5%)

Table 2. Characteristics of the sample by age

Age (year)	n = 280
< 10	2 (0,7%)
11 – 20	5 (1,8%)
21 – 30	15 (5,4%)
31 – 40	47 (16,8%)
41 – 50	55 (19,6%)
51 – 60	93 (33,2%)
61 – 70	52 (18,6%)
71 – 80	11 (3,9%)

Table 3. Characteristics of the sample by age

Radiography Imaging	n = 280
Infiltrate	100 (71,4%)
Consolidation	94 (67,1%)
Interstitial pattern	22,1 (31%)
Fibrosis	10 (7,1%)
Cavitas	8 (5,7%)
Pleural effusion	5 (3,6%)
Bronchiectasis	3 (2,1%)
Calcification	2 (1,4%)
Nodul	1 (0,7%)
Bronchopneumonia	1 (0,7%)
Milier	1 (0,7%)
Pleural thickening	1 (0,7%)
Pneumothorax	1 (0,7%)

Table 4. Characteristics of the sample by severity score

Severity Index	COVID-19 + fungal	COVID-19
Normal	1 (0,7%)	8 (5,7%)
Mild	101 (72,1%)	118 (84,3%)
Moderate	29 (20,7%)	12 (8,6%)
Severe	9 (6,4%)	2 (1,4%)

Table 5. Correlation between laboratorium finding and severity score

Laboratorium finding	Severity Index	
Neutrophyl	p = 0,000	r = 0,220
Lymphosit	p = 0,002	r = -188
NLR	p = 0,000	r = 0,259

## Discussion

There is a significant correlation between the appearance of consolidation and infiltrates with the finding of COVID-19 accompanied by fungal infection compared to COVID-19 pneumonia COVID-19 without fungal infection (table 3). This consolidation is believed to be formed by the spread of inflammation through the pores of Kohn or Lambert's canals at the periphery of the lung. Thus, it usually appears in nonsegmental consolidation in the early stages of the disease (6).

Statistically there is a significant correlation with the increasing severity of COVID-19 patients accompanied by fungal infection, compared to COVID-19 patients without fungal infection, with a mild degree of 101 (46,1%), followed by a moderate degree of 29 (20,7%), and the severity degree was 9 (6,4%) and the thoracic appearance was normal in 1 patient (0,7%) (table 4). Patients with severe degrees of COVID-19 have tendency to be accompanied by other infection. This is thought to be due to the use of corticosteroids which increases the immunological risk of COVID-19 patients getting fungal infection (7).

Based on the results of the correlation assessment between mRALE and NLR value, using the Spearman's, all had a significant p-values were  $< 0.05$ , suggesting there was significant relationship between the mRALE severity score with NLR (table 5).

## Conclusion

In patients with confirmed COVID-19 associated fungal infection, a significant association was observed between mRALE severity score and NLR value.

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## Conflict of Interest

NIL

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mRALE : modified radiographic assessment of lung edema; NLR : Neutrophil lymphosit ratio; PCR: polymerase chain reaction

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