



(RESEARCH ARTICLE)



## Correlation of mortality levels of COVID-19 comorbid Type 2 diabetes mellitus patients with severity level of thoracic radiography in RSUD Dr. Moewardi

Multazam Siddiq<sup>1</sup>, Widiastuti Soewondo<sup>2,\*</sup>, Wachid Putranto<sup>3</sup> and Agus Joko Susanto<sup>3</sup>

<sup>1</sup> Medical Student of Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia.

<sup>2</sup> Department of Radiology, Dr. Moewardi Hospital/ Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia.

<sup>3</sup> Department of Interna, Dr. Moewardi Hospital/ Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia.

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### Abstract

COVID-19 has become a global health hazard and its high infectivity is worrying. This virus can infect anyone and can be more severe in people who have comorbid illnesses. One of the most common comorbidities in COVID-19 patients is type 2 diabetes mellitus. Chest radiography can be used to predict prognosis and mortality in COVID-19 patients. One of the scoring used is the Brixia score which serves to assess the severity of the lung based on certain indicators. There are not many studies that discuss the mortality rate of COVID-19 patients with comorbid diabetes mellitus based on the radiographic profile as measured by the Brixia score assessment. Therefore, this study aims to determine the correlation between the mortality rate of comorbid COVID-19 patients with type 2 diabetes mellitus with the severity of chest radiography using the Brixia score. This study used an analytic observational study with a cross-sectional approach. The subjects were 60 COVID-19 patients with type 2 diabetes mellitus who met the inclusion and exclusion criteria. Sampling was done by purposive sampling technique and the data obtained were analyzed using the contingency coefficient test. There was a significant relationship between the mortality rate of patients with COVID-19 comorbid type 2 diabetes mellitus and the severity of chest radiography using the Brixia score ( $p < 0.001$ ;  $p < 0.05$ ). There was a relationship between the mortality rate of COVID-19 patients with type 2 diabetes mellitus and the severity of chest radiography treated in the ICU of RSUD Dr. Moewardi, Surakarta

**Keywords:** COVID-19; Type 2 diabetes mellitus; Mortality; Chest radiography; Brixia score

### 1. Introduction

COVID-19 has become a global health hazard and its high infectivity is quite worrying. Indonesia is also inseparable from the impact of the COVID-19 pandemic. As of February 13, 2022, the total number of COVID-19 cases has reached 4,807,778 cases with a death rate of 145,176 people. The transmission rate of this virus is very high. This virus can be transmitted between humans through splashes of sputum or saliva when a COVID-19 sufferer coughs or sneezes (1). This virus can infect everyone and can manifest more severely in people who have comorbid illnesses.

The literature reports that older age, the presence of underlying comorbidities (such as hypertension, diabetes, and cardiovascular disease), and severity of pulmonary abnormalities are associated with an increased risk of death in patients with SARS-CoV-2 infection (2). Recent studies have found an increase in the severity of COVID-19 disease caused by SARS-CoV-2 infection in patients with diabetes mellitus.

In a study conducted by Sumanta Saha et al. It was found that the mortality rate of COVID-19 patients with comorbid diabetes mellitus was higher than patients without diabetes mellitus (3). In Indonesia itself, there is no definitive data

\* Corresponding author: Widiastuti Soewondo

Department of Radiology, Dr. Moewardi Hospital/ Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia.

regarding the mortality rate of COVID-19 patients with comorbid diabetes mellitus. However, diabetes mellitus is the most common co-morbidity of COVID-19 patients in Indonesia after hypertension (4).

To assess the mortality rate of COVID-19 patients with comorbid diabetes mellitus, an assessment called Brixia score based on the results of chest X-rays of patients. Chest X-ray is an important modality that can be used to treat COVID-19 patients (5). The Brixia score was specially designed for semi-quantitative studies of lung disease in COVID-19, ranking pulmonary involvement on a specific severity scale (18 severity points in total) according to the extent and characteristics of the lung disorder (6). The Brixia score divides the lung into six zones on the frontal chest projection (7). So far, not many studies have linked the mortality rate of comorbid diabetes mellitus COVID-19 patients with the severity of chest radiography using the Brixia score. Therefore, researchers are interested in examining this with the hypothesis that there is a correlation between the mortality rate of COVID-19 ICU patients comorbid type 2 diabetes mellitus with the severity of chest radiographs at RSUD Dr. Moewardi Surakarta.

## 2. Material and methods

This study is included in the analytic observational study with a cross-sectional approach. The research was conducted at RSUD Dr. Moewardi Surakarta using medical record data and chest X-ray results. The research subjects were COVID-19 patients with comorbid diabetes mellitus type 2 who were treated in the ICU of RSUD Dr. Moewardi Surakarta. The research sample is 60 samples with purposive sampling technique. The independent variable of this study is the severity of chest radiography. In this study, the severity of chest radiographs was measured by Brixia with an ordinal measurement scale. The dependent variable of this study is the mortality rate of COVID-19 patients. The population used was COVID-19 patients with type 2 DM comorbidities in the ICU of RSUD Dr. Moewardi and in the period between March - December 2021. Mortality was measured by medical record data at RSUD Dr. Moewardi with a nominal measurement scale. The data analysis technique in this study used the contingency coefficient test. If the results of  $p < 0.05$ , it means that statistically there is a significant correlation between the research variables. Data analysis using SPSS software.

## 3. Results

### 3.1. Sample Characteristics

A total of 60 patients with comorbid COVID-19 diabetes mellitus type 2 who were treated in ICU Dr. Moewardi Surakarta was involved in this research. The data used is secondary data taken from the patient's history.

**Table 1** Sample characteristic in categorical data

Gender	Frequency	%
<b>Gender</b>		
Male	36	60.0
Female	24	40.0
<b>Age</b>		
31-40 years	2	3.3
41-50 years	5	8.3
51-60 years	34	56.7
61-65 years	19	31.7
<b>Brixia score</b>		
Mild	10	16.7
Moderate	11	18.3
Severe	39	65.0
<b>Mortality</b>		
Died	45	75.0
Alive	15	25.0

Table 1 shows data consisting of gender, age, brixia score, and mortality. The data shows that the sample of men is more than women. The age distribution of the sample is more in the age range of 51-60 years (56.7%), followed by the age group of 61-65 years (31.7%). From the brixia score data, most patients had a severe category of brixia scores (65%). The majority of the samples had a higher death outcome (75%) than a living outcome

### 3.2. Data Analysis

Analysis in this study used the contingency coefficient correlation test.

**Table 2** Data analysis (an analysis by contingency coefficient correlation test)

Variable	Died	Alive	$r_k$ (Contingency Coefficient)	$p$ -value
<b>Gender</b>				
Male	26 (72.2%)	10 (27.8%)	0.078	0.543
Female	19 (79.2%)	5 (20.8%)		
<b>Age</b>				
31-40 years	1 (50.0%)	1 (50.0%)	0.177	0.584
41-50 years	4 (80.0%)	1 (20.0%)		
51-60 years	24 (70.6%)	10 (29.4%)		
61-65 years	16 (84.2%)	3 (15.8%)		
<b>Brixia score</b>				
Mild	1 (10.0%)	9 (90.0%)	0.569	<0.001*
Moderate	8 (72.7%)	3 (27.3%)		
Severe	36 (92.3%)	3 (7.7%)		

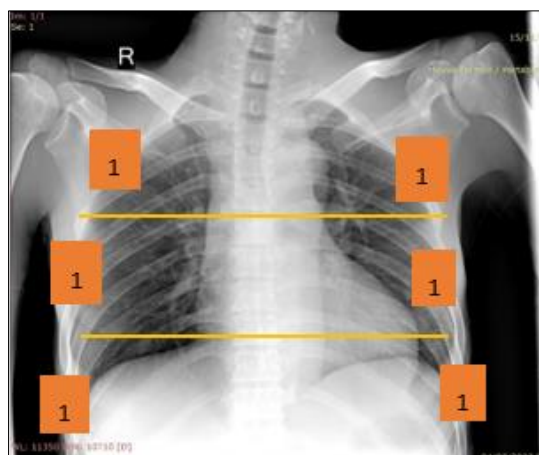
From the results of the contingency coefficient analysis ( $r_k$ ) between the gender and the mortality rate, the value of  $r = 0.078$  is obtained, which means that the level of gender relationship with mortality is low and statistically the value of  $p = 0.543$  ( $p > 0.05$ ) which shows no significant relationship.

Based on age, the value of  $r = 0.177$  was obtained, which means that the level of association between age and mortality was low and it was obtained that the value was  $p = 0.584$  ( $p > 0.05$ ) which showed an insignificant relationship.

Based on Brixia score, patients with a low Brixia score have a greater percentage alive outcomes than death, which is equal to 90%. Patients with moderate Brixia score scores had a greater percentage died outcomes than alive, which was 72.7%, and patients with severe Brixia score had a greater percentage died outcomes of 92.3%. Thus, it can be concluded that the greater the results of the Brixia score, the greater the risk that the patient will have a outcome death. The results of the contingency coefficient test ( $r_k$ ) obtained a ratio of  $r = 0.569$  which means that the level of mortality relationship with the Brixia score is included in the moderate category and a significant relationship is obtained with a value of  $p = <0.001$  ( $p < 0.05$ ).

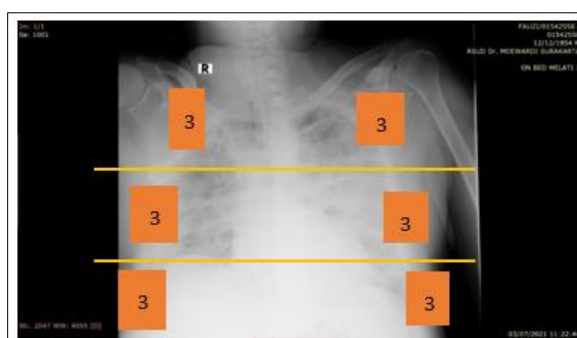
### 3.3. Brixia score Results

The number of patients who fall into the mild category and have alive outcomes is 9 patients out of a total of 10 patients.



**Figure 1** Alive patients with mild category Brixia score results

The number of patients who fall into the severe category and have dead outcome total of 56 patients out of a total of 60 patients.



**Figure 2** Dead patients with severe category Brixia score results

#### 4. Discussion

This study was conducted to know the correlation between the mortality rate of COVID-19 patients with comorbid diabetes mellitus type 2 who were treated at ICU Dr. Moewardi Surakarta with chest radiography based on the Brixia score assessment. This study's total number of samples was 60 patients.

This study's results indicate no relationship between gender and the mortality rate in comorbid COVID-19 patients with type 2 diabetes mellitus. Gender is not a risk factor that can cause fatal conditions in COVID-19 patients (6). In other research it is mentioned that although men and women are equally likely to be infected with COVID-19, men with COVID-19 are more at risk for worse outcomes and death, regardless of age (8).

In addition, this study also found no relationship between age and the mortality rate of comorbid COVID-19 patients with type 2 diabetes mellitus because there was no significant difference in the average number of COVID-19 patients with the outcome dying in each age group. COVID-19 can infect all age groups, from young children to adults, with different clinical manifestations according to their age group (9).

##### 4.1. Correlation of Mortality of COVID-19 Comorbid Type 2 Diabetes Mellitus Patients with Chest Radiography

Several scoring methods can be used to assess a chest X-ray of a COVID-19 patient, one of which is by using the Brixia score. The Brixia score is a semiquantitative scoring method used to assess the severity of COVID-19 patients by reading chest X-ray results. The Brixia score assesses lung abnormalities due to COVID-19 in 18 levels of severity (6). Brixia score divides the lung into six zones on the frontal chest projection (projection posteroanterior or anteroposterior according to the patient's position) (7). Each zone is scored 1-3 depending on the lung pathology involved found in this zone.

**Table 3** Brixia score assessment

Score	Pulmonary disorders
0	No lung abnormalities
1	Interstitial
2	Interstitial and alveolar infiltrates (interstitial predominance)
3	Interstitial and alveolar infiltrates (alveolar predominance)

**Table 4** Brixia score interpretation

Total Score	Severity Classification
0	Normal
1 -6	Mild
7-12	Moderate
13-18	Severe

From the study results, it was found that patients with a mild Brixia score category numbered 10 people with an average score of 4. The number of patients with a moderate Brixia score category numbered 11 with an average value of 11. The number of patients with a heavy/severe Brixia score category totaled 39, with an average score of 16. The higher the Brixia score obtained, the higher the probability that the patient will have the outcome of death (6).

From the results of data analysis, a significant relationship was found between the mortality rate and the results of chest radiographs that had been scored using the Brixia score with a  $p < 0.001$  ( $p < 0.05$ ). This is in line with research conducted in Bandung in 2021, which stated that the Brixia score could predict death but could not predict how long COVID-19 patients were hospitalized (10). In this study, the average Brixia score was obtained for patients with a died outcome was higher than the mean patient score with a survival outcome. This indicates that the Brixia score describes the severity of lung disorders that have the potential to increase mortality (10). Based on a study conducted by Borghesi et al. it was found that the cutoff value of the Brixia score was at number 8, which was included in the moderate category (6). This study is in line with that statement where there were 13 patients who were included in the moderate category, 10 of whom had an died outcome (76.9% ). Whereas for patients who were included in the severe/severe category (Brixia score 13-18) there were 60 patients with 56 of them having died (93.3%). In a study conducted by Balbi et al. It was also found that the higher the Brixia score, the higher the probability that the patient would have a death outcome, and vice versa (11).

The limitation of this study was that not all patients had measurement values for blood sugar levels or HbA1C in medical records, so researchers could not link high or low blood sugar levels with the severity of chest radiography which could affect mortality rates.

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## 5. Conclusion

From the results of this study, conclusions were obtained that were in accordance with the research hypothesis, namely that there was a correlation between the mortality rate of ICU COVID-19 patients comorbid with type 2 diabetes mellitus with the severity of chest radiography at RSUD Dr. Moewardi.

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## Compliance with ethical standards

### *Acknowledgments*

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*Disclosure of conflict of interest*

This study has no conflicts of interest

*Statement of ethical approval*

This research has been declared ethically feasible by the Health Research Ethics Commission of RSUD Dr. Moewardi with number 601 / IV / HREC / 2022.

*Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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