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Clinical Severity of COVID-19 among Pediatric in Tertiary Level Hospital, West Sumatra

Finny Fitry Yani[1,2*], Amirah Zatil Izzah[1,2], Riki Alkamdani[1,2], Ratno Widoyo[3]

[1]Department of Pediatric, Dr. M. Djamil General Hospital, West Sumatera, Padang, Indonesia

[2]Department of Child Health, Faculty of Medicine, Universitas Andalas, Padang, Indonesia

[3]Department of Epidemiology and Biostatistics, Faculty of Public Health, Universitas Andalas, Padang, Indonesia

* Corresponding author.
E-mail address: finny_fy@yahoo.com

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Abstract

Background: COVID-19 clinical signs can be different for each pediatric patient. This study aims to systematically evaluate the clinical, laboratory examination, severity of COVID-19 infection of pediatric patients in RSUP Dr. M. Djamil General Hospital.
Methods: This is a cohort retrospective study. Data were extracted from the medical records of pediatric patient who received COVID-19 medical treatment between September 2020 to June 2021. The data were presented as frequency, percentage and adjusted odd ratio (aOR). Bivariate and multivariate analysis was done to identify the association.
Results: The results showed that from a total sample of 93 patients, the majority of these patients were male (60,2%) and fell within the age groups of 1-5 years (30,1%) and 11-15 years (31,2%). Most pediatric patients presented with a mild severity level of COVID-19. Clinical characteristics, such as consciousness (p=0.014), neurologic deficits (p=0.035), and thoracic abnormalities (p=0.040), showed a significant association with the severity level of COVID-19. There are no significant association between laboratory results and the severity level of COVID-19. Admission to PICU was identified as a protective factor against the mortality of COVID-19 (aOR=0.02) and abdominal abnormalities were identified as a contributing factor to mortality among pediatric COVID-19 cases (aOR=14.44).
Conclusions: Clinical characteristics including consciousness, neurologic deficits, and thoracic abnormalities were associated with the severity level of COVID-19. PICU admission and abdominal abnormalities were associated with mortality among pediatric COVID-19 patients.

Keywords: COVID-19, pediatric, clinical symptoms, laboratory test, severity

Introduction

Commencing in December 2019 in Wuhan, the coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has led to high morbidity and mortality worldwide including in pediatric patients Agrawal, et al (2023), Ali et al (2023) Whether, in the early stage of COVID-19 pandemic the proportion of pediatric cases was relatively small, its might be due to low testing rate in children.[1] Even though COVID-19 in pediatric cases of the general population are mostly asymptomatic or pre-symptomatic and have better clinical outcomes compared with adult cases.[2] However, COVID-19 in pediatric cases in the general hospital was mostly symptomatic and potentially led to severe and critical conditions.

Patients were categorized into five distinct clinical severity classifications: asymptomatic, mild, moderate, severe, and critical.[3] When classified as severe, the potential for organ dysfunction becomes a critical concern, encompassing conditions such as shock, acute respiratory distress syndrome (ARDS), acute cardiac injury, and

acute kidney injury, all of which can lead to fatal outcomes.[4] Critical cases often exhibit a combination of clinical and laboratory indicators of inflammation. These include elevated fevers, thrombocytopenia, high levels of ferritin, D-dimer, and C-reactive protein, as well as increased interleukin-6 levels).[5] This comprehensive assessment of both clinical and laboratory signs underscores the severity and complexity of critical cases, highlighting the importance of a nuanced and integrated approach to the management of severe manifestations of the illness.

Studies on clinical presentation and laboratory examination are still limited in Indonesia. More studies are needed to determine the disease burden and intervention strategies for the Indonesian pediatric population. It will help pediatricians and public health specialists to formulate policies on controlling and managing COVID-19 among pediatric cases. For these reasons, this study aims to systematically evaluate the clinical presentation and laboratory result and its association with the severity of COVID-19 infection of pediatric patients in RSUP Dr. M. Djamil Padang, West Sumatra.

Methods

This is a cohort retrospective study among 114 cases of pediatric patients (0-18 years old) who received COVID-19 medical treatment. The study was conducted from September 2020 to June 2021 in RSUP Dr. M. Djamil. Demographic information included sex age, patient residence, living in disease area, travel to the disease area, and history of contact with COVID-19 cases. The clinical presentation was information on consciousness and abnormality in vital signs, fever, acute respiratory infection, gastrointestinal disorders, and neurologic deficit. Laboratory information was from the laboratory result on the swab test of covid 19, abnormality on a blood test, D-dimer, and procalcitonin.

Patients were classified according to their clinical presentation upon admission as (1) asymptomatic (absence of signs and symptoms associated with COVID-19, normal clinical imaging, but positive ribonucleic acid SARS-CoV-2 test); (2) mild [presence of symptoms limited to the upper respiratory tract (including fever, fatigue, myalgia, cough, sore throat, runny nose or nasal congestion) or gastrointestinal symptoms (including nausea, vomiting, and abdominal pain, with normal lung auscultation)]; (3) moderate (presence of symptoms mentioned in the mild category together with clinical signs and symptoms of pneumonia but without hypoxemia); (4) severe (presence of signs and symptoms mentioned above together with dyspnea, central cyanosis and oxygen saturation of <92%); and (5) critical (presence of acute respiratory distress syndrome, respiratory failure, encephalopathy, myocardial injury, coagulation dysfunction, and acute kidney injury).[6] For the analysis reason, we grouped into two groups mild/moderate and severe/critical.

Statistical analysis was conducted using R software, version 4.3.1, on the Windows operating system, employing the "epicalc" package. Data descriptions were presented through frequency distributions and percentages in tables. Bivariate analysis was performed to examine the relationship between clinical presentation and laboratory examination with disease severity, utilizing the chi-square test or Fisher's exact test. Logistic regression was employed to ascertain the robust impact of independent variables on patient mortality. Those bivariate analyses with p-values < 0.25 were included in the analysis model. The effects of independent variables are reported as adjusted odds ratios (aOR)along with 95% confidence intervals (CI). Independent variables with odds ratios below 1 are defined as protective factors against patient mortality, while those with odds ratios above 1 are considered risk factors for COVID-19-related mortality in pediatric patients.

Results

We conducted a retrospective study on 114 cases of pediatric COVID-19 for this investigation. Out of these cases, 21 were excluded from our analysis, as illustrated in Figure 1.

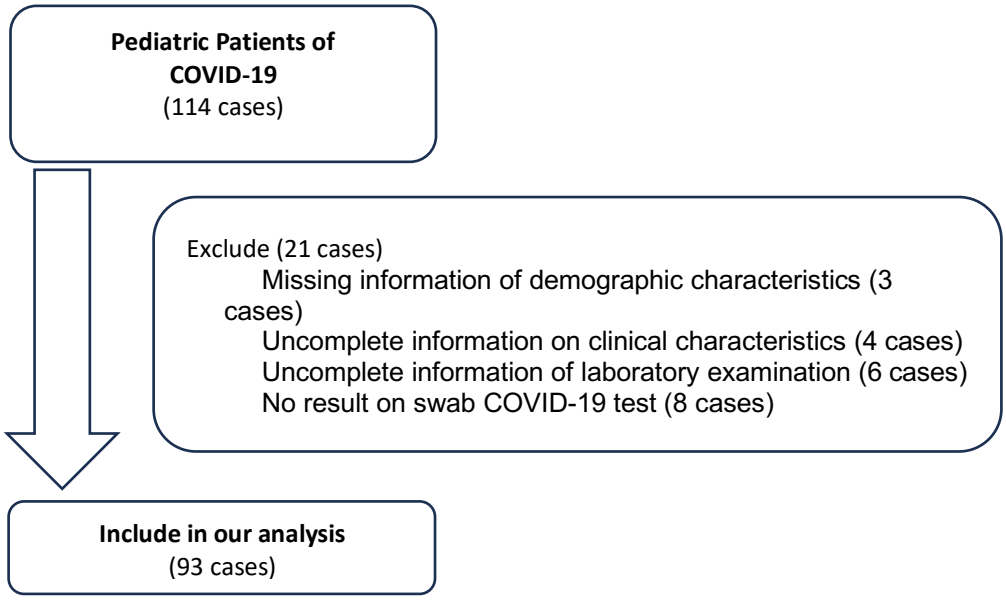

Figure 1. Sample criteria

Figure 1 showed the exclusion criteria encompassed cases where pediatric patients lacked essential demographic information, presented incomplete data on clinical manifestations and laboratory examinations or did not yield results from the COVID-19 swab test. Consequently, our analysis focused on a total of 93 pediatric cases included in the study.

Demographic characteristics, severity and death of COVID-19 pediatric patients in RSUP Dr. M. Djamil Padang (Table 1).

Table 1. Demographic characteristics, severity and death of COVID-19 pediatric patients (n=93)

Characteristics		n	(%)
Sex	Male	56	60.2
	Female	37	39.8
Age	0 Year	11	11.8
	1-5 Year	28	30.1
	6-10 Year	15	16.1
	11-15 Year	29	31.2
	> 15 Year	10	10.8
Patient residence	Rural	49	52.7
	Urban	44	47.3
Live in the disease area	No	22	23.7
	Yes	71	76.3
Travel to disease area	No	56	60.2
	Yes	37	39.8
Contact with case	No	85	91.4
	Yes	8	8.6
PICU Used	No	47	50.5
	Yes	46	49.5
COVID-19 severity	Mild	60	64.5
	Moderate	14	15.1
	Severe	13	14.0
	Critical	6	6.5
Death	No	72	77.4
	Yes	21	22.6

Table 1 presents the demographic characteristics, severity, and mortality data of pediatric COVID-19 patients at Dr. M Djamil Padang. The majority of these patients were male and fell within the age groups of 1-5 years and 11-15 years. A significant proportion of patients resided in areas affected by COVID-19; however, information regarding their contact with confirmed cases revealed no direct exposure. Upon admission to the hospital, more than 60% of pediatric COVID-19 cases exhibited mild conditions, and over 70% eventually recovered from the disease by the conclusion of the treatment period.

Clinical characteristics of pediatric patients in RSUP Dr. M. Djamil Padang based on Severity of COVID-19 (Table 2).

Table 2. Clinical characteristics of pediatric patients in RSUP Dr. M. Djamil Padang based on Severity of COVID-19 (n=93)

Clinical characteristics		Severity of COVID-19		P value
		Mild/Moderate	Severe/Critical	
		n (%)	n (%)	
Level of consciousness	GCS 15	68 (84)	13 (16)	0.014#
	GCS <15	6 (50)	6 (50)	
Vital sign	Normal	48 (82.8)	10 (17.2)	0.474*
	abnormal	26 (74.3)	9 (25.7)	
Fever	No	51 (82.3)	11 (17.7)	0.524*
	Yes	23 (74.2)	8 (25.8)	
Acute respiratory infection disorders	No	59 (83.1)	12 (16.9)	0.141#
	Yes	15 (68.2)	7 (31.8)	
Gastrointestinal disorders	No	56 (82.4)	12 (17.6)	0.419*
	Yes	18 (72)	7 (28)	
Neurologic deficit	No	66 (83.5)	13 (16.5)	0.035#
	Yes	8 (57.1)	6 (42.9)	
Head examination	Normal	71 (80.7)	17 (19.3)	0.269#
	Abnormal	3 (60)	2 (40)	
Abdominal examination	Normal	36 (83.7)	7 (16.3)	0.507*
	Abnormal	38 (76)	12 (24)	
Thorax examination	Normal	64 (84.2)	12 (15.8)	0.040#
	Abnormal	10 (58.8)	7 (41.2)	
Extremity examination	Normal	62 (77.5)	18 (22.5)	0.291#
	Abnormal	12 (92.3)	1 (7.7)	

Fisher's exact test
* Chi-square test

Table 2 displays the distribution of clinical characteristics based on the severity level of COVID-19 at admission to RSUP Dr. M Djamil Padang. We categorized severity into two groups: mild/moderate and severe/critical. Clinical characteristics, including consciousness, neurologic deficit, and thoracic abnormalities, exhibited significant associations with the severity level of COVID-19. Individuals admitted with severe/critical conditions were observed to be unconscious, displaying abnormalities in neurologic deficits, and exhibiting abnormalities in the thorax.

Laboratory examination results of pediatric patients in RSUP Dr. M. Djamil Padang Padang based on Severity of COVID-19 (Table 3).

Table 3. Laboratory examination results of pediatric patients in RSUP Dr. M. Djamil Padang Padang based on Severity of COVID-19 (n=93)

Laboratory examination		Severity of COVID-19		P value
		Mild/Moderate	Severe/Critical	
		n (%)	n (%)	
Swab test of COVID-19	Negative	42 (79.2)	11 (20.8)	1.000*
	Positive	32 (80)	8 (20)	
Platelets	Normal	27 (81.8)	6 (18.2)	0.897*
	Abnormal	47 (78.3)	13 (21.7)	
Leukocytes	Normal	39 (78)	11 (22)	0.883*
	Abnormal	35 (81.4)	8 (18.6)	
Haemoglobin	Normal	14 (82.4)	3 (17.6)	1.000#
	Abnormal	60 (78.9)	16 (21.1)	
D-dimer	Normal	3 (100)	0 (0)	1.000#
	Abnormal	5 (83.3)	1 (16.7)	
	No information	66 (78.6)	18 (21.4)	
Procalcitonin	Normal	3 (100)	0 (0)	1.000#
	Abnormal	3 (100)	0 (0)	
	No information	68 (78.2)	19 (21.8)	

Fisher's exact test
* Chi-square test

Table 3 displays the distribution of laboratory examination results based on the severity levels of COVID-19 at admission in RSUP Dr. M Djamil Padang. No significant association was found between laboratory results and the severity levels of COVID-19.

Clinical characteristics, PICU used, and levels of severity of COVID-19 among pediatric patients in RSUP Dr. M. Djamil Padang based on death of COVID-19

Table 4. Clinical characteristics, PICU used, and levels of severity of COVID-19 among pediatric patients in RSUP Dr. M. Djamil Padang based on death of COVID-19 (n=93)

Clinical characteristics		Death on COVID-19		P value
		No	Yes	
		n (%)	n (%)	
Level of Consciousness	GCS 15	67 (82.7)	14 (17.3)	0.004#
	GCS <15	5 (41.7)	7 (58.3)	
Vital sign	Normal	50 (86.2)	8 (13.8)	0.019*
	Abnormal	22 (62.9)	13 (37.1)	
Fever	No	52 (83.9)	10 (16.1)	0.066*
	Yes	20 (64.5)	11 (35.5)	
Acute respiratory infection disorders	No	55 (77.5)	16 (22.5)	1.000#
	Yes	17 (77.3)	5 (22.7)	
Gastrointestinal disorders	No	57 (83.8)	11 (16.2)	0.031*
	Yes	15 (60)	10 (40)	
Neurologic deficit	No	65 (82.3)	14 (17.7)	0.014#
	Yes	7 (50)	7 (50)	
Head examination	Normal	69 (78.4)	19 (21.6)	0.315#

	Abnormal	3 (60)	2 (40)	
Abdominal examination	Normal	40 (93)	3 (7)	0.002*
	Abnormal	32 (64)	18 (36)	
Thorax examination	Normal	62 (81.6)	14 (18.4)	0.056#
	Abnormal	10 (58.8)	7 (41.2)	
Extremity examination	Normal	62 (77.5)	18 (22.5)	1.000#
	Abnormal	10 (76.9)	3 (23.1)	
PICU used	No	30 (63.8)	17 (36.2)	0.003*
	Yes	42 (91.3)	4 (8.7)	
Severity of COVID-19	Mild/Moderate	63 (85.1)	11 (14.9)	0.001#
	Severe/Critical	9 (47.4)	10 (52.6)	

Fisher's exact test
* Chi-square test

Table 4 presents the consciousness, vital signs, gastrointestinal disorders, neurologic deficits, abdominal issues, PICU utilization, and the severity of COVID-19, all of which were found to be significantly linked to the fatality of COVID-19 outcomes. We found that deaths from COVID-19 were more prevalent among non-compos mentis individuals, those exhibiting abnormalities in vital signs, individuals with abnormalities in gastrointestinal disorders, individuals with abnormalities in neurologic deficits, individuals with abnormalities in the abdominal region, and those experiencing severe/critical levels of COVID-19. However, patients utilizing the PICU facility demonstrated a protective effect on pediatric patients, reducing the risk of fatality of COVID-19 outcomes.

Laboratory examination results of pediatric patients in RSUP Dr. M. Djamil Padang Padang based on Severity of COVID-19 (Table 5).

Table 5. Laboratory examination results of pediatric patients in RSUP Dr. M. Djamil Padang Padang based on Severity of COVID-19 (n=93)

Laboratory examination		**Death on COVID-19**		**P value**
		No	**Yes**	
		n (%)	**n (%)**	
Swab test of COVID-19	Negative	37 (69.8)	16 (30.2)	0.077*
	Positive	35 (87.5)	5 (12.5)	
Platelets	Normal	27 (81.8)	6 (18.2)	0.622*
	Abnormal	45 (75)	15 (25)	
Leukocytes	Normal	39 (78)	11 (22)	0.883*
	Abnormal	35 (81.4)	8 (18.6)	
Hemoglobin	Normal	12 (70.6)	5 (29.4)	0.524#
	Abnormal	60 (78.9)	16 (21.1)	
D-dimer	Normal	3 (100)	0 (0)	1.000#
	Abnormal	5 (83.3)	1 (16.7)	
	No information	64 (76.2)	20 (23.8)	
Procalcitonin	Normal	3 (100)	0 (0)	1.000#
	Abnormal	3 (100)	0 (0)	
	No information	66 (75.9)	21 (24.1)	

Table 5 displays the distribution of laboratory examination results based on the fatality of COVID-19 outcomes at RSUP Dr. M Djamil Padang. No significant association was found between laboratory results and the fatality of COVID-19 outcomes.

Factor associated with Death of COVID-19 pediatrics patients in RSUP Dr. M. Djamil Padang (Table 6).

Table 6. Factor associated with Death of COVID-19 pediatrics patients in RSUP Dr. M. Djamil Padang (n=93)

Characteristics		Death on COVID-19 pediatrics patients	
		Crude OR (95%CI)	**aOR (95%CI)**
Severity of COVID-19	Mild/Moderate	1	1
	Severe/Critical	6.36 (2.11-19.21)	3.41 (0.59-19.69)
PICU used	No	1	1
	Yes	0.17 (0.05-0.55)	**0.02 (0-0.21)**
Vital sign	Normal	1	1
	Abnormal	3.69 (1.34-10.18)	1.25 (0.25-6.16)
Fever	No	1	1
	Yes	2.86 (1.05-7.77)	3.8 (0.82-17.6)
Gastrointestinal disorders	No	1	1
	Yes	3.45 (1.24-9.66)	0.8 (0.12-5.28)
Abdominal examination	Normal	1	1
	Abnormal	7.5 (2.03-27.73)	**14.44 (2-15,97)**
Thorax examination	Normal	1	1
	Abnormal	3.1 (1-9.56)	1.67 (0.24-11.51)
Swab test of COVID-19	Negative	1	1
	Positive	0.33 (0.11-1)	0.12 (0.01-1.06)

Logistic regression was employed to obtain robust results regarding the effects of clinical characteristics and laboratory examination results on the fatality of COVID-19 outcomes (table 6). There was no association between the severity of COVID-19 during admission and the fatality of COVID-19. The presence of abdominal abnormalities was found to have a significant association with the fatality of COVID-19. Patients with such abnormalities had a 14.44 times higher risk of COVID-19 mortality among pediatric patients at RSUP Dr. M. Djamil Padang. At another site, the utilization of the PICU during COVID-19 medical treatment was identified as a protective factor against the fatality of the disease. This condition was able to save the pediatric patient from mortality.

Discussion

Most pediatric patients presented with a mild severity level of COVID-19 upon admission to RSUP Dr. M. Djamil Padang. Agrawal et al. study also found that most pediatric patients had a mild severity (41,55%).[7] In contrast to our findings, a recent study by Lei Wu et al. revealed that 42% of pediatric patients reported experiencing moderate.[8]

The majority of these patients resided in areas affected by the disease, yet most were identified as having no history of contact with confirmed COVID-19 cases. Chaudhuri also found that more than half of children patient positive COVID-19 resided in epidemic areas (68%).[9] Research by Hashemian found that most of the patients had no history of contact with positive COVID-19 cases (85,7%).[10] The difference result with a study by Hsieh et al. was that most of the patients had contact with confirmed patients (31%).[11]

Clinical characteristics, including consciousness, neurologic deficits, and thoracic abnormalities, showed a significant association with the severity level of COVID-19. Our findings were also consistent with the findings of Huang et al, Heba Ali, and Gundeslioglu et al, that there are association between neurologic disease and abnormal thorax CT with the severity of COVID-19.[12,13,14]

However, no significant association was found between laboratory results and the severity level of COVID-19. Our results are consistent with a recent study that found there is no significant association between platelet and D-dimer in the laboratory with severity level.[12,14] A cross-sectional study conducted by Xie et al. showed that low platelet count dan elevated D-dimer levels have a significant association with the severity of COVID-19 among pediatric patients.[15]

Utilizing PICU was identified as a protective factor against the mortality of COVID-19. Weldetsadik et al. study shows that there are significant association between ICU admission with mortality from COVID-19, however, ICU admission was a predictor factor of mortality among COVID-19 children and adolescent patients (COR=8,25).[16] Contrast to research by Shamsi et al. that PICU admission was not related to mortality of COVID-19.[17] On the other hand, abdominal abnormalities were identified as a contributing factor to mortality among pediatric COVID-19 cases. A previous study also found that in multivariable analysis, children with abdominal pain at admission were associated with mortality from COVID-19 (aHR=2,75).[18]

Conclusions

The primary data source in this study emanated from the medical records of pediatric patients undergoing treatment for COVID-19. Our approach involved meticulously extracting all accessible information from these records, aiming to construct a comprehensive overview of the clinical severity among these pediatric patients. However, there is limited information on laboratory examination results especially on biomarkers information. This deficiency specifically impacts our ability to comprehensively analyze the characteristics of D-dimer and procalcitonin and their potential association with the clinical severity of COVID-19 among pediatric cases.

This study showed that clinical characteristics including consciousness, neurologic deficits, and thoracic abnormalities were associated with the severity level of COVID-19. PICU admission and abdominal abnormalities were associated with mortality among pediatric COVID-19 patients.

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Declarations of competing interest

No potential competing interest was reported by the authors.

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