

Epidemiological and Clinical Characteristics of Pediatric COVID-19: A Tertiary Care Study in AlAhsa, Saudi Arabia

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Abstract

Background: The COVID-19 pandemic has raised significant concerns about its impact on children's health worldwide, with limited studies focusing on pediatric cases in Saudi Arabia. This descriptive cross-sectional study examines the epidemiological and clinical characteristics of pediatric COVID-19 cases admitted to a tertiary pediatric hospital in AlAhsa from 2nd of March 2020, until 31st of December 2020. Additionally, the study identifies risk factors associated with pediatric intensive care unit (PICU) admissions and mortality.

Method: This study included children with confirmed COVID-19 admitted to Maternity and Children Hospital in AlAhsa. Data on demographics, clinical presentations, comorbidities, and laboratory findings were collected and analyzed. Associations between these variables and outcomes such as PICU admission and mortality were assessed using IBM SPSS version 22.

Results: A total of 123 children with COVID-19 were included, with a mean age of 7.6 ± 4.9 years (range: 1 - 14 years). Males constituted 48.8% (n = 60) of cases, and 99.2% (n = 122) were Saudi nationals. Comorbidities were present in 32.2% (n = 37) of patients. Symptoms were reported in 84.6% (n = 104) of cases, with respiratory symptoms in 50.4% (n = 62) and gastrointestinal (GIT) symptoms in 45.5% (n = 56). Symptom duration ranged between 1-6 days in 61.5% (n = 64) and exceeded 15 days in 9.6% (n = 10). Fever was the most commonly reported symptom (61.8%). Additionally, 65% (n = 80) of patients tested positive for the G6PD assay. PICU admission occurred in 22.8% (n = 28) of cases. Children with GIT symptoms had a significantly higher PICU admission rate (37.5%) compared to those without GIT symptoms (10.4%, $P = .001$). Similarly, 75% of children with diabetes required PICU admission compared to 21.6% of others ($P = .013$). The overall mortality rate was 5.7% (n = 7). All mortalities occurred among PICU-admitted children, indicating a significant association between PICU admission and mortality.

Conclusion: Most pediatric COVID-19 cases presented with mild symptoms, with respiratory and gastrointestinal manifestations being the most common. Comorbidities, such as diabetes, significantly increased the likelihood of PICU admission. PICU admission emerged as a critical risk factor for mortality. Further research is needed to explore the relationship between comorbidities, disease severity, and mortality to enhance outcomes in pediatric COVID-19 cases.

Keywords: COVID-19; Pneumonia; Respiratory Distress Syndrome; Pandemic; Corona Virus

Abbreviations

COVID-19: Coronavirus Disease 2019; PICU: Pediatric Intensive Care Unit; GIT: Gastrointestinal Tract; G6PD: Glucose-6-Phosphate Dehydrogenase; IBM SPSS: International Business Machines Statistical Package for the Social Sciences

Introduction

Wuhan, a city in the Hubei Province of China, and 162 other countries identified the novel RNA coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as the cause of a cluster of pneumonia cases in December 2019. It was named coronavirus disease 2019 (COVID-19). In late January 2020, the number of cases led to the declaration of a public health emergency. In March 2020, COVID-19 emerged as a pandemic [2]. On 2nd March 2020, Saudi Arabia reported the first case of COVID-19 patients coming from abroad [3]. Although the pandemic is over, we still have clusters of outbreaks, particularly in winter. Over 1.1 million new cases were reported in just 28 days, leading to a 40% increase in hospitalization and a 13% increase in intensive care unit admissions [10]. Coronaviruses are a large family of RNA viruses that cause illnesses ranging from the common cold to more severe diseases such as Middle East respiratory syndrome. The coronavirus, MERS-COV, has an estimated incubation period of 2 to 14 days, with an average of 4 - 5 days post-exposure [1].

COVID-19 in children had a mild course and a better prognosis in comparison to the adult age group between 18 and 64 years in the United States of America, which accounted for up to 5 percent of positively diagnosed COVID-19 cases. Around 73% of pediatric patients had symptoms (fever, cough, or shortness of breath) compared to 93% of adults during a two-month period of a pandemic [5]. Most hospitalized children had a brief febrile illness and made a full recovery, but a minority had severe disease in Saudi Arabia [6].

Although there is limited information about COVID-19 infection in the pediatric age group, the age group in Saudi Arabia differs from other countries, leading to different clinical manifestations. Saudi Arabia has published few studies, and those that have explored the relationship between risk factors and pediatric intensive care unit admission or morbidity in the pediatric age group have only covered a brief period of time. To date, we have not found any long-term research on COVID-19 epidemiology and clinical manifestations, especially prior to the vaccination era.

Materials and Methods

Study design

It was a descriptive cross-sectional study in a single tertiary pediatrics hospital. We conducted the study at the Maternity and Children Hospital in the AlAhssa region of Saudi Arabia, which has a capacity of 450 beds. We reviewed the medical records of pediatric patients aged 14 years or younger to describe the epidemiological and clinical manifestations, their outcomes, and to confirm the COVID-19 results through HESN.

Study subjects

We include all patients aged 0 to 14 years with positive COVID-19 tests confirmed by RT-PCR, and they met the Saudi Ministry of Health case definition for the timeframe of the study and were admitted to maternity and children's hospitals either from the emergency department or referred from other facilities from March 2nd, 2020, until December 31st, 2020.

The definition of a confirmed COVID-19 case includes any hospitalized pediatric patient aged 0 - 14 years who has a positive confirmatory polymerase chain reaction (PCR) for the COVID-19 test, irrespective of their symptoms or signs. However, the Saudi Ministry of Health has made numerous changes to this definition throughout the study period.

Data collection

We collected data by accessing patients’ hard-copy medical records and using the Saudi Ministry of Health’s Health Electronic Surveillance Network (HESN) program to verify confirmed results and record information in a data collection sheet.

Patients’ demographics, underlying medical conditions, clinical manifestations, classification of COVID-19 disease severity, laboratory and radiological investigations conducted, interventions administered, and outcomes such as time to recovery, discharge from the hospital, admission to the pediatric or neonatal intensive care unit (PICU or NICU), the need for positive pressure ventilation (PPV), and mortality, which is defined as death after 30 days from the start of related symptoms, were all listed on the data collection sheet.

Results and Discussion

We included a total of 123 children with COVID-19. Children’s ages ranged from 1 to 14 years, with a mean age of 7.6 ± 4.9 years old. Exactly 60 (48.8%) children were males. A total of 122 (99.2%) of the children were from Saudi Arabia. Also, 3 (2.4%) cases came from endemic areas with symptoms. A total of 37 (32.2%) cases had comorbidities. The most commonly reported co-morbidities were sickle cell disease (9.6%), congenital cardiac disease (3.5%), diabetes mellitus (DM) (3.5%), renal disease (3.5%), bronchial asthma (2.6%), and immunocompromised (2.6%) (Table 1).

Bio-demographic data	No	%
Age in years		
1-5	53	43.1%
6-10	27	22.0%
11-14	43	35.0%
Gender		
Male	60	48.8%
Female	63	51.2%
Nationality		
Saudi	122	99.2%
Non-Saudi	1	.8%
Came from Endemic Area w/ Symptoms		
Yes	3	2.4%
No	120	97.6%
Comorbidity		
Yes	37	32.2%
No	78	67.8%
Diseases		
Congenital cardiac disease	4	3.5%
Bronchial asthma	3	2.6%
Laryngomalacia	2	1.7%
DM	4	3.5%
Renal Disease	4	3.5%
Hematology (SCD)	11	9.6%
Neurology	2	1.7%
Neurology (CP)	1	.9%
Immunocompromised	3	2.6%

Table 1: Bio-demographic data of study children with covid-19 in maternity and children hospital, AL-Ahssa, Saudi Arabia 2020.

A total of 104 (84.6%) children reported experiencing symptoms. 62 (50.4%) children reported respiratory symptoms, while 56 (45.5%) reported GIT symptoms. Symptoms lasted for 1-6 days among 64 (61.5%) children and for more than 15 days among 10 (9.6%). A total of 29 (23.6%) were on medications. We performed a chest X-ray on 59 (48%) children, and 35 (59.3%) showed pneumonia (Table 2).

Clinical presentation	No	%
Presence of Symptoms		
Yes	104	84.6%
No	19	15.4%
Respiratory Symptoms		
Yes	62	50.4%
No	61	49.6%
GIT Symptoms		
Yes	56	45.5%
No	67	54.5%
Duration of symptoms		
1-6 days	64	61.5%
7-14 days	30	28.8%
15 days/more	10	9.6%
On Medication		
Yes	29	23.6%
No	94	76.4%
Chest X-ray		
Yes	59	48.0%
No	64	52.0%
Finding		
Normal	24	40.7%
Pneumonia	35	59.3%

Table 2: Clinical presentation of children with covid-19 in maternity and children hospital, AL-Ahssa, Saudi Arabia 2020.

A total of 104 (84.6%) children reported experiencing symptoms. 62 (50.4%) children reported respiratory symptoms, while 56 (45.5%) reported GIT symptoms. Symptoms lasted for 1-6 days among 64 (61.5%) children and for more than 15 days among 10 (9.6%). A total of 29 (23.6%) were on medications. 59 (48%) children had a chest X-ray, and 35 (59.3%) showed pneumonia. The most reported symptoms included fever (61.8%), followed by vomiting (30.1%), cough (27.6%), diarrhea (26.8%), shortness of breath (14.6%), and runny nose (11.4%). Headache (4.9%) and sore throat (4.1%) were the least recorded symptoms.

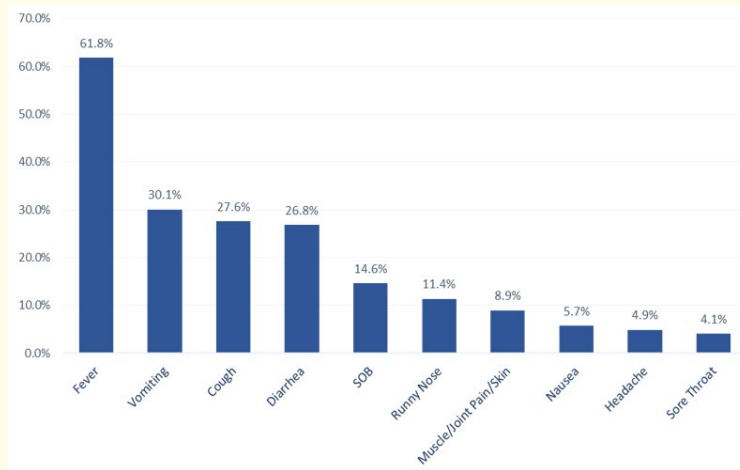


Figure 1: Clinical symptoms among children with covid-19 in maternity and children hospital, AL-Ahssa, Saudi Arabia 2020.

Only 3 children (2.4%) had a history of allergy. A total of 76 (61.8%) had a history of contact with positive COVID-19 cases, of which 91 (74%) had contacted one positive case, 15 had contacted two positive cases, and 15 (12.2%) had contacted 4 - 6 positive cases. A total of 80 individuals (65%) underwent the G6PD assay. Of the study children, 28 (22.8%) received an ICU admission, while 95 (77.2%) did not (Figure 2).

Other data	No	%
History of Allergy		
Not known	120	97.6%
Yes	3	2.4%
Contact with Positive Case		
Yes	76	61.8%
No	47	38.2%
No of positive		
One	91	74.0%
Two	15	12.2%
Three	2	1.6%
4/more	15	12.2%
G6PD Assay		
Yes	80	65.0%
No	43	35.0%

Table 3: Other clinical data among study children with covid-19.

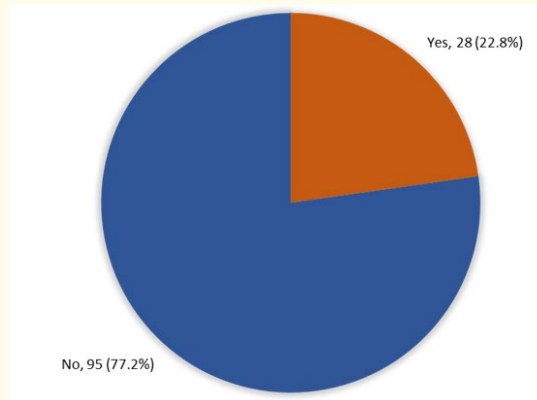


Figure 2: ICU admission among children with covid-19 in maternity and children hospital, AL-Ahssa, Saudi Arabia 2020.

The ICU admitted exactly 34.9% of children aged 11-14 years, compared to 11.3% of those aged 1-5 years, a statistically significant difference ($P = .021$). Additionally, the ICU admitted 75% of diabetic children, compared to 21.6% of other children ($P = .013$). 26.9% of symptomatic children received an ICU admission, while none of the asymptomatic children did ($P = .010$). Additionally, the ICU admitted 37.5% of children with GIT symptoms, compared to 10.4% of other children ($P = .001$) (Table 4).

Factors	ICU admission				p-value
	Yes		No		
	No	%	No	%	
Age in years					.021*
1-5	6	11.3%	47	88.7%	
6-10	7	25.9%	20	74.1%	
11-16	15	34.9%	28	65.1%	
Gender					.564
Male	15	25.0%	45	75.0%	
Female	13	20.6%	50	79.4%	
Comorbidity					.119
Yes	12	32.4%	25	67.6%	
No	15	19.2%	63	80.8%	
Bronchial asthma					.683 ^s
Yes	1	33.3%	2	66.7%	
No	26	23.2%	86	76.8%	
DM					.013* ^s
Yes	3	75.0%	1	25.0%	
No	24	21.6%	87	78.4%	

Immunocompromised					.683 ^{\$}
Yes	1	33.3%	2	66.7%	
No	26	23.2%	86	76.8%	
Presence of Symptoms					.010* ^{\$}
Yes	28	26.9%	76	73.1%	
No	0	0.0%	19	100.0%	
Respiratory Symptoms					.703
Yes	15	24.2%	47	75.8%	
No	13	21.3%	48	78.7%	
GIT Symptoms					.001*
Yes	21	37.5%	35	62.5%	
No	7	10.4%	60	89.6%	
Contact with Positive Case					.144
Yes	14	18.4%	62	81.6%	
No	14	29.8%	33	70.2%	

Table 4: Factors associated with ICU admission among children with covid-19 in maternity and children hospital, AL-Ahssa, Saudi Arabia 2020.

P: Pearson X^2 test; *\$*: Exact probability test.

* $P < 0.05$ (significant).

Only 7 (5.7%) of the study’s children with confirmed COVID-19 infections died (Figure 3).

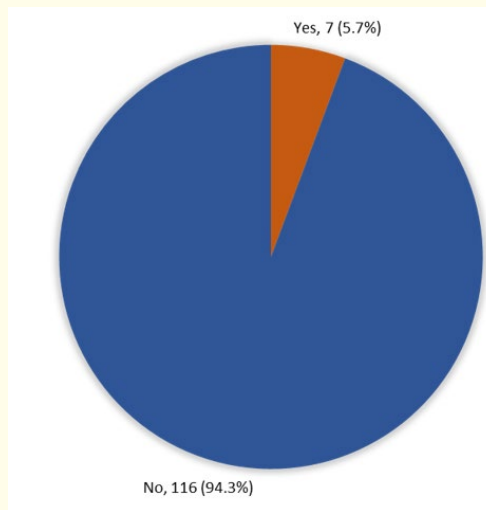


Figure 3: Shows the mortality rate among children with COVID-19 at the maternity and children hospital in AL-Ahssa, Saudi Arabia, in 2020.

Only ICU admission was significantly associated with mortality among the study children. Only 25% of children admitted to the ICU died, while none of the other children died ($P = .001$). All other factors showed an insignificant association with children's mortality.

Factors	ICU admission				p-value
	Yes		No		
	No	%	No	%	
Age in years					.108
1-5	1	1.9%	52	98.1%	
6-10	1	3.7%	26	96.3%	
11-16	5	11.6%	38	88.4%	
Gender					.271
Male	2	3.3%	58	96.7%	
Female	5	7.9%	58	92.1%	
Comorbidity					.833
Yes	2	5.4%	35	94.6%	
No	5	6.4%	73	93.6%	
Bronchial asthma					.655
Yes	0	0.0%	3	100.0%	
No	7	6.3%	105	93.8%	
DM					.604
Yes	0	0.0%	4	100.0%	
No	7	6.3%	104	93.7%	
Immunocompromised					.655
Yes	0	0.0%	3	100.0%	
No	7	6.3%	105	93.8%	
Presence of Symptoms					.244
Yes	7	6.7%	97	93.3%	
No	0	0.0%	19	100.0%	
Respiratory Symptoms					.252
Yes	5	8.1%	57	91.9%	
No	2	3.3%	59	96.7%	
GIT Symptoms					.525
Yes	4	7.1%	52	92.9%	
No	3	4.5%	64	95.5%	
Contact with Positive Case					.288
Yes	3	3.9%	73	96.1%	
No	4	8.5%	43	91.5%	
ICU admission					.001*
Yes	7	25.0%	21	75.0%	
No	0	0.0%	95	100.0%	

Table 5: Factors associated with mortality among children with covid-19 in maternity and children hospital, AL-Ahssa, Saudi Arabia 2020.

P: Pearson X^2 test; \$: Exact probability test.

* $P < 0.05$ (significant).

By comparing your study findings to those of other studies, we can observe similarities and differences in demographic characteristics, clinical presentation, comorbidity prevalence, and outcomes such as ICU admission and mortality. These comparisons help contextualize the results and contribute to the existing knowledge of COVID-19 in children.

Discussion

The study revealed that about one-third of the children had underlying comorbidities, with sickle cell disease being the most common. The majority of the children experienced mild symptoms, with fever, respiratory, and gastrointestinal symptoms being the most frequently reported. Approximately 23% of the children required ICU admission, and factors such as older age, diabetes, symptomatic presentation, and gastrointestinal symptoms were associated with a higher likelihood of ICU admission. The children in the study had an overall mortality rate of 5.7%, with a significant correlation between ICU admission and mortality. However, no other factors examined in the study showed a significant association with children's mortality.

Despite variations in categorizing age groups at the time of presentation across studies [3,5,6], our study found that the majority of hospital admissions, accounting for 43% of patients, are from the age group under five years. Different local and international studies, despite the variety of COVID-19 presentations in children, consistently report fever as the most common presentation symptom in pediatric wards or pediatric intensive care units [6-9]. Our study confirms this trend, with over 60% of patients presenting with fever. While some studies identify respiratory symptoms as the most common presentation symptoms [6,9], our findings, along with those of others, indicate that respiratory symptoms rank as the second most common presentation. This is likely due to the transmission of COVID-19 via respiratory droplets [7,8]. Nearly all previous studies observed comorbidities, ranging from 11.4% to 49% of cases, and our findings, which included 32.2% of cases, fell within this range [1-9]. Our study found that sickle cell disease was the most commonly observed comorbidity, accounting for 9.6% of cases, in contrast to other studies where different comorbidities, such as immune suppression, cardiac diseases, and chronic lung diseases, were predominant [2,7,8]. Consanguinity could explain the dominance of sickle cell disease in the region. Our study had a high PICU admission rate of 22.8%, compared to other studies in Saudi Arabia that ranged from 1.76% to 10.42% [2,6]. Early in the pandemic, unclear presentation and disease progression in symptomatic patients led to the admission of patients with morbidity to the PICU. Few studies in Saudi Arabia studied risk factors for PICU admission, primarily focusing on laboratory findings [3]. These studies concluded that the presence of dyspnea, leukocytosis, abnormal chest radiographic findings, and comorbidities at the time of presentation were associated with PICU admission. Our study found that the current symptoms, specifically GIT symptoms and DM as a comorbidity, were statistically significant risk factors for PICU admission. Previous studies, particularly on type-1 DM, also reported these findings [11,13]. Although bronchial asthma was associated with risk for PICU admission in some studies [12], our study didn't show statistically significant results.

Mortality during the period of study was 5.7%, which is considered high compared to other studies that report less than 5%, although other studies report higher mortality rates up to 13% [14,15]. Five of the seven cases that died had a diagnosis of multisystem inflammatory syndrome in children (MIS-C), one had a premature ARDS diagnosis, and the other had a complex neurological disorder with severe pneumonia.

Another study [11] observed that admission to PICU was a statistically significant risk factor for mortality. While each case carries its own mortality risk, we hypothesized that complications during PICU admission, such as ventilation or infection-related issues, could also contribute to this risk.

Limitation of the Study

Limitations in our study include restriction to clinical presentation and excluding laboratory findings that could potentially support the association between PICU admission and mortality. The global shortage of all types of supplies, including laboratory investigations,

was the cause of this limitation. Additionally, patient charts were only available in paper form, which hindered the availability of certain investigation results.

Conclusion

Our study provides a comprehensive overview of the epidemiological and clinical manifestations of COVID-19 among pediatric patients in tertiary pediatric hospitals in Saudi Arabia. Our findings indicate that while most children experienced mild symptoms and made a full recovery, a significant subset required PICU admission, particularly those with underlying comorbidities such as type-1 diabetes mellitus and gastrointestinal symptoms. The study highlights the importance of vigilant monitoring and tailored medical care for children with COVID-19, especially those with pre-existing conditions. Despite the overall low mortality rate, the association between PICU admission and increased risk of death underscores the need for early intervention and robust healthcare support for severe cases.

Conflict of Interest

There is no conflict of interest to be declared.

Bibliography

1. Jameela A Kari., *et al.* "Coronavirus disease in children: A multicenter study from the Kingdom of Saudi Arabia". *Journal of Infection and Public Health* 14.4 (2021): 543-549.
2. Ahmad ALGhamdi., *et al.* "Epidemiology, clinical characteristics and risk factors of COVID-19 among children in Saudi Arabia: a multicenter chart review study". *BMC Pediatrics* 22.1 (2022): 86.
3. Albuali WH., *et al.* "Clinical profile, risk factors and outcomes of pediatric COVID-19: a retrospective cohort multicenter study in Saudi Arabia". *BMJ Open* 12.3 (2022): e053722.
4. AbdulAziz AlMayouf., *et al.* "Clinical Characteristics, Laboratory Findings, Management, and Outcome of Severe Coronavirus Disease 2019 in Children at a Tertiary Care Center in Riyadh, Saudi Arabia: A Retrospective Study". *Frontiers in Pediatrics* 10 (2022).
5. Abeer A Alnajjar., *et al.* "Clinical characteristics and outcomes of children with COVID-19 in Saudi Arabia". *Saudi Medical Journal* 42.4 (2021): 391-398.
6. Ansel Hoang., *et al.* "COVID-19 in 7780 pediatric patients: A systematic review". *EClinicalMedicine* 24 (2020): 100433.
7. Yousef M Alsofayan., *et al.* "Clinical characteristics of COVID-19 in Saudi Arabia: A national retrospective study". *Journal of Infection and Public Health* 13.7 (2020): 920-925.
8. COVID-19 epidemiological update - 19 January 2024. WHO.
9. K Keller., *et al.* "Risk factors for intensive care admission in pediatric patients with COVID-19 - results of the German nationwide inpatient sample". *European Heart Journal* 13.1 (2022).
10. Stephanie P Ungar., *et al.* "Hospital and ICU admission risk associated with comorbidities among children with covid-19 ancestral strains". *Clinical Pediatrics* 62.9 (2023).
11. "Clinical characteristics of children and young people admitted to hospital with covid-19 in United Kingdom: prospective multicentre observational cohort study". *BMJ* 370 (2020): m3249.
12. Maroussia Roelens., *et al.* "Evolution of COVID-19 mortality over time: results from the Swiss hospital surveillance system (CH-SUR)". *Swiss Medical Weekly* 151.4748 (2021).

13. Eva Miranda Marwali, *et al.* "Paediatric COVID-19 mortality: a database analysis of the impact of health resource disparity". *BMJ Paediatrics Open* 6.1 (2022): e001657.
14. Jameela A Kari, *et al.* "Coronavirus disease in children: A multicenter study from the Kingdom of Saudi Arabia". *Journal of Infection and Public Health* 14.4 (2021): 543-549.
15. Stephanie P Ungar, *et al.* "Hospital and ICU admission risk associated with comorbidities among children with covid-19 ancestral strains". *Clinical Pediatrics* 62.9 (2023).

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