Research Article

COVID-19 IN Children

Marwa ibrahem Abdelrazic[1], Walid Abdelwahab Eid[1], Eman Fathi Abdelrazik[2] and Alshimaa Mohammed Rateeb[1]

[1] Department of Pediatrics , Faculty of Medicine, Minia University, El-Minia, Egypt.
[2] Department of Public Health Medicine , Faculty of Medicine, Minia University, El-Minia, Egypt.

Abstract

Objective: Coronavirus disease (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), became a pandemic in March 2020, affecting millions of people worldwide. However, COVID-19 in pediatric patients represents 1–5% of all cases, and the risk for developing severe disease and critical illness is much lower in children with COVID-19 than in adults. The clinical severity of the infection varies from a simple cold to severe acute respiratory syndrome (ARDS) or even death. Multisystem inflammatory syndrome in children (MIS-C), a possible complication of COVID-19, has been described as a hyperinflammatory condition with multiorgan involvement similar to that in Kawasaki disease or toxic shock syndrome in children with evidence of SARS-CoV-2 infection. **Methods:** 148 children were selected for our study. The demographic data, clinical manifestation, and laboratory measurements were also collected. **Results**: There was a statistically significant difference between positive covid-19 cases and negative cases as regarding inflammatory markers (CRP , LDH, D.Dimer and ferritin)

Keywords   COVID-19 , pediatric , SARS-CoV-2 , inflammatory markers.

Introduction

Coronavirus disease 2019 (COVID-19) is a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The first known case was identified in Wuhan, China, in December 2019. The disease has since spread worldwide, leading to an ongoing pandemic.[1-3]. The clinical severity of the infection varies from a simple cold to severe acute respiratory syndrome (ARDS) or even death[2]. The infection is reported to be rarely seen in childhood and commonly affects ≥15 years old; however, the number of pediatric COVID- 19 cases has increased rapidly with the global spread of the infection[4].

Unlike most other viral pneumonitis, SARS-CoV-2 often causes hyperferritinemia, eleva-tions in D-dimer, lactate dehydrogenase (LDH), transaminases, troponin, CRP, and other inflammatory markers[5]

Patients and Methods

This study is a cross sectional study which carried out among 148 pediatric cases of clinical manifestation or chest CT suspected covid-19 aged between 1 Month and 18 years, who attended to the Pediatric Intensive care unit of Maternity and Children's Hospital, Minia University, Minia Governorate.

 1- **History:**
• **Socio demographic data**: age, sex, and residence,
• **Personal medical history**: the duration of disease, the received therapy and the response to therapy.
2- Physical examination

Including general examination, chest examination Glascow coma scale (GCS), and Grade of Respiratory distress.

3- Laboratory investigation:
- Complete blood picture
- C-reactive protein (CRP)
- Covid-19 inflammatory markers (D. dimer – serum ferritin – LDH)
- Renal function test
- Liver function test
- Nasopharyngeal swab (PCR)

Data collection:
Clinical data, laboratory, and imaging (chest X-ray and computed tomography) findings on admission were recorded retrospectively. According to SARS-CoV-2 polymerase chain reaction (PCR) analysis, **patients were divided into two groups**:
(1) positive covid-19 cases group: patients whose SARS-CoV-2 polymerase chain reaction (PCR) analysis was positive

(2)) negative covid-19 cases group: patients whose SARS-CoV-2 polymerase chain reaction (PCR) analysis was negative.

statistical analysis:
The analysis of the data was carried out using the IBM SPSS 26.0 statistical package software (IBM; Armonk, New York, USA). Normality of the data was tested using the Kolmogorov-Smirnov tests. Data were expressed as median, interquartile ranges (IQR) for quantitative measures, in addition to both number and percentage for categorized data. Mann-Whitney U test for non-parametric data were used for comparison between two independent group, The *Chi-square test or Fisher's exact test* were used to compare categorical variables. A p-value less than 0.05 was considered significant.

Result
Clinical and laboratory data of the studies groups were tabulated and statistically analyzed Result of the study are shown in the present tables as following:

Table (1): basic demographic data of children at intensive care unit

Demographic data	PCR negative (n = 92)	PCR positive (n = 56)	p value
Age (months) Median (IQR)	6 (3 - 22.5)	6 (2.13 - 17.25)	0.953
Sex • Male N (%) • Female N (%)	67 (72.8%) 25 (27.2%)	32 (57.1%) 24 (42.9%)	**0.049***
Duration of illness (days) Median (IQR)	5 (3 – 7)	5 (3 – 7)	0.486

Analyzed by Mann-Whitney Test and chi square test
*: Significant difference at P value < 0.05

Table (1) show significant difference between positive and negative cases as regarding sex with p value 0.048 .and also show that there was non-significant difference between PCR positive and PCR negative cases as regarding demographic data age or onset of illness with p value > 0.05 .
MV = mechanical ventilation

Table (2): clinical finding of children at intensive care unit

Clinical manifestations	PCR negative (n = 92)	PCR positive (n = 56)	p value
	N (%)	N (%)	
Fever	85 (92.4%)	55 (98.2%)	0.129
Cough	62 (67.4%)	42 (75%)	0.326
Shortness of breath	64 (69.6%)	39 (69.6%)	0.992
Vomiting	27 (29.3%)	14 (25.0%)	0.567
Diarrhea	32 (34.8%)	13 (23.2%)	0.138
Convulsion	26 (28.3%)	13 (23.2%)	0.499
MV	52 (56.5%)	31 (55.4%)	0.89

Analyzed by Chi-square test or Fisher's exact test
*: Significant difference at P value < 0.05

Table (2) show that there was non-significant difference between PCR positive and PCR negative cases as regarding clinical manifestation (fever , cough , diarrhea, cough , shortness of breath , convulsion and MV) with all p value > 0.05.

Table (3): Frequency distribution of children at intensive care unit in relation to laboratory parameters

Laboratory investigations	PCR negative (n = 92)	PCR positive (n = 56)	p value
	Median (IQR)	Median (IQR)	
Hemoglobin	10.95 (9.3 - 12.1)	10.25 (9.52 - 11.7)	0.645
Leucocyte count*	10.55 (7.05 - 15.5)	7 (5 - 11.9)	0.001*
Platelet	290 (200 - 421.)	232 (114. - 376.)	0.095
Lymphocyte	22 (15 - 31.5)	20 (13.2 - 29.5)	0.264
Neutrophil	75(60-80)	74(64-83)	0.875
CRP	24 (22.5 - 48)	48 (36 - 96)	0.006*
Urea	30 (24 - 42.2)	30.5 (25 - 42.5)	0.589
Creatinine	0.6 (0.5 - 1)	0.7 (0.5 - 0.97)	0.271
ALT	43 (20 - 77)	43.5 (22.5 - 79.5)	0.418
AST	50.5 (29 - 78.7)	56 (33.2 - 137.)	0.320
D.DIMER*	1.75 (1 - 3.17)	2.75 (1.5 - 4.17)	0.014*
Ferritin*	245 (139 - 341.)	313.5 (214 - 465.)	0.004*
LDH*	472.5 (346. - 685.)	935.5 (650 - 1179)	0.0001*

ALT =alanine transaminase ,AST = aspartate transaminase ,LDH =lactate dehydrogenase enzyme, CRP = C- reactive protein
Analyzed by Mann-Whitney Test
*: Significant difference at P value < 0.05

Table (3) show that there was significantly decrease in leucocyte count in PCR positive cases in compared to PCR negative cases with p value 0.001, also there were significantly difference in PCR positive cases in compared to PCR negative cases as regarding inflammatory markers (LDH, ferritin, D. Dimer, CRP) with p value (0.0001, 0.004, 0.014, 0.006) respectively.

Discussion

Coronavirus disease 2019 (COVID-19), which is caused by severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) first appeared in Wuhan, China, and was announced as a pandemic in March 2020[6]. The clinical severity of the infection varies from a simple cold to severe acute respiratory syndrome (ARDS) or even death[2].

According to demographic data of our cases, ages of our children ranged from 1month to 18 years with median age 6 month (2.13 – 17.3).

This finding suggests that all ages of childhood were susceptible to covid-19 with non significant difference between positive and negative PCR cases or clinical severity as in **table (1)** and this agreed with Dong, Mo et al.,[7] who show that Children of all ages were susceptible to COVID-19 .

Median time from the onset of symptoms prior to hospitalization was 5 days without significant difference between positive or negative pediatric covid-19 cases and that was similar to previous reports Cheung, Zachariah et al.,[8].

Our study demonstrate in table (1) that there is a significant difference between positive and negative pediatric covid19 cases as regarding sex with p value 0.049 and 57% of positive cases are male while 43% are female , agree with Lu, Zhang et al.,[9] who reported that majority of the infected children in China were reported to be males . The cause of male predominance is unclear but partly it may be due to outdoor playing activities of male children as compared to girls leading to increased risk of exposure.

Our study show variation in clinical presentation of cases as fever 98.2% ,cough 75% ,shortness of breath 69.6% ,vomiting 25% , diarrhea 23.2% ,convulsion 23.2% as in table (2) this agree with Dong, Mo et al.,[10] and 55.4% need mechanical ventilation and respiratory support without significant difference between positive and negative cases and this agree with Fan, Beitler et al.,[11]

In our study Table (3) show significant increase in inflammatory markers LDH ,Ferritin and D. Dimer in covid-19 cases with p value 0.0001 , 0.004, 0.014 respectively and this agree with Hernández, Nan et al.,[12], who report increase in inflammatory markers with covid-19. also table (3) show significant leucopenia in pediatric covid-19 cases with significant p value .001 and this agree with Rahimzadeh, Ekrami Noghabi et al.,[13] who present 9 pediatric cases of COVID-19 … Three cases had leukopenia . and also agree with Carlotti, Carvalho et al.,[14] who report a leukopenia in 26.3% of patients among a series of 171 pediatric cases of COVID-19. as table (3). but disagree with Bari, Ch et al.,[15] who found that there was no significant leukopenia in pediatric cases of COVID-19.

Table (3) show that there is no significant lymphopenia in pediatric covid-19 cases and This is consistent with a study in Wuhan, China where lymphopenia was not found in pediatric patients[16]

Conclusion
our study show marked increase in inflammatory markers (CRP, LDH, D. Dimer, Ferritin) in positive pediatric covid-19 cases

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