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Original Article

Demographic Characteristics, Clinical Features, Laboratory, and Radiological Findings in Children Admitted to COVID19 Center in Amara City, Misan Province, Iraq

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ABSTRACT

Background:
Most pediatric patients with covid 19 had mild to moderate infection and some had severe challenging infection. Generally, they had variable signs and symptoms, laboratory, and radiological findings correlated with the patient age, the involved system, disease severity and probably any underlying disease.

Aim:
To identify the most common clinical features, the frequency of positive radiological findings, and laboratory results of the infected children hospitalized in Misan COVID-19 Center.

Materials and method:
A retrospective descriptive with some analytic study applied on 100 pediatric patients in the age range of (0-16) years, diagnosed with COVID-19 or were highly suspected cases, depending on clinical findings, laboratory tests, COVID-19 RT-PCR and/or chest (X-ray ± CT), whom were admitted to the Pediatric Covid -19 Center in Amara City, Iraq during the time period of (February-June, 2021). Their medical records were reviewed for demographic information, (gender, age, and residence), medical history, clinical examination, laboratory and imaging studies, (X-ray ± CT), O saturation, the duration of illness before admission of any underlying chronic diseases as well as the most common presenting signs and symptoms.

Results:
Children infected slightly more in the age range of (5-10 years), boys slightly more infected than girls as (54%) and (46%), respectively. The urban residents suffered more than the rural ones, 4% of all cases had low O_2 saturation. Fever and malaise were the most common presenting symptoms as (93%) and (68%), respectively. The illness duration before hospitalization commonly was (≤5days), (RT-PCR) was negative in 45% of patients, 54% had anemia with or without leukopenia and lymphopenia, CTs were positive in (62%) and CXR was positive in (53%), while the underlying chronic diseases were found in (23%) of the cases.

Conclusion:
Children of ages between (5-<10 years) were slightly more infected than others, fever, malaise, and cough were the most common manifestations, the urban predominance is high, and half of patients had anemia about one third and had lymphopenia. Likewise, one forth had thrombocytopenia, negative Covid-19 (RT-PCR), and/or CXR. The CT results did not exclude infection. Thus, we need further local studies to support our results.

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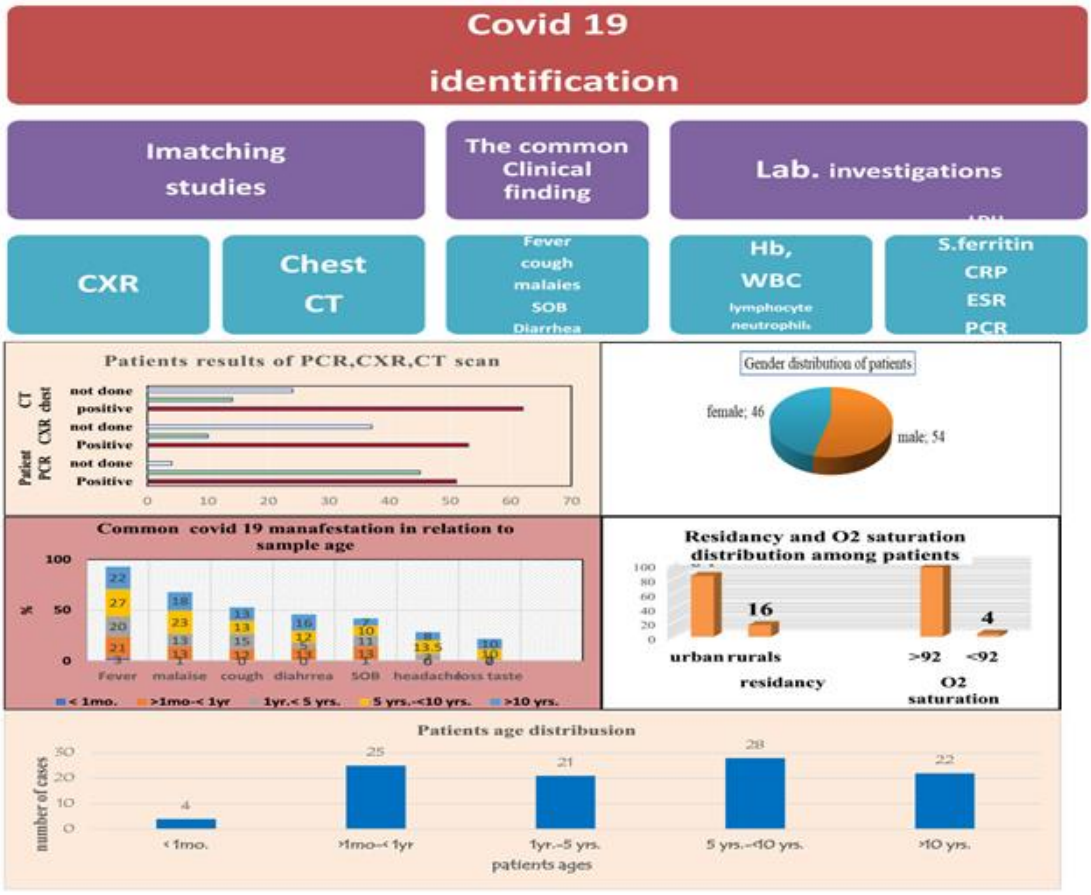
GRAPHICAL ABSTRACT



Introduction

COVID-19 is an acute respiratory syndrome caused by coronavirus 2 (SARS-CoV-2). It started in December 2019 in Wuhan, Hubei Province. WHO announced it as a global pandemic on March 11, 2020 [1]. It is mainly transmitted by respiratory droplets or by respiratory secretions, saliva, and aerosol particles [2] and by fecal-oral transmission several weeks after diagnosis [3]. Most infected children are recovered if had mild to moderate illness, while severely ill patients, mostly need hospitalization and ICU admission, or to be placed on a ventilator [4], mainly those whom born prematurely, or of age < 2 years, had obesity, DM, asthma, CHD, the genetic conditions or diseases of the nervous system or metabolism, sickle cell disease, immunosuppression, and down syndrome [5]. Most infected children reveal few symptoms or are completely asymptomatic, hence increases the risk of infection spread, while others presented with many possible symptoms, including fever, chills, shortness of breath, difficult breathing, cough, sore throat, fatigability, headache, nasal congestion, the runny nose, the muscle aches, body aches, abdominal pain, nausea, vomiting, diarrhea, poor feeding or poor appetite, and loss of taste or smell sensations [6]. Some children may experience multisystem inflammatory syndrome [7]. In April 2020, the reports from the U.K documented a presentation in children similar to the incomplete Kawasaki disease (KD) or toxic shock syndrome [8][9]. Thus, COVID-19 infection should be considered primarily in any child with new-onset fever and/or respiratory symptoms, especially if no identifiable cause can be detected [10]. The clinicians should have a high index of COVID-19 suspicion if the patient has traveled within the prior 2 weeks to a place where there is infection spread or has had close contact to the confirmed, the suspected case, or those present with COVID-19 complications like cardiac injury, ischemic stroke, and inflammatory complications [11,12]. NAAT (Nucleic acid amplification) test with RT-PCR assay is the preferred initial diagnostic tests [13]. Stool, ocular specimens, and blood specimens testing had a limited role in the diagnosis of COVID-19 [14, 15]. CT not routinely

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needed for the diagnosis of COVID-19 in children [16]. The elevated serum levels of Procalcitonin, interleukin- 6, D-dimer, LDH, CRP, and s. ferritin at admission or during hospitalization, hypoxia at admission and gastrointestinal symptoms on admission have been associated with the increased severity or worse outcomes [17- 22].

COVID era in Iraq marked with high exposure to the infected cases, a limited capacity to address the public health, and the second order effects of the pandemic. Coronavirus Cases: 2,321,874, Deaths: 25,185, and Recovered: 2,288,524 were registered until April 11, 2022. Data on pediatric COVID-19 cases are rare. The recently published data suggests that children constitute 1–5% of the diagnosed cases; however, the actual rate is underestimated in Iraq, probably due to the limited awareness among families and pediatricians' regarding the child milder symptoms comparing to the adults and the constrained laboratory testing capacity. Currently, because of the unsatisfying healthcare system in Iraq due to the decades of conflict, the risks of potential pediatric COVID-19 infection spread is accelerating especially among the refugees camps and internally displaced people. This study tried to fulfil a gap of the actual state of pediatric covid 19 in southern Iraq.

Materials and Methods

A retrograde descriptive study with some analyses applied in the period from (February – June) in 2021 on 100 randomly selected pediatric patients of both genders in the age range of 0-16 years admitted to Misan Maternity and Child Hospital/COVID-19 Center, for proper isolation and treatment. The center offered 20 beds equipped with CPAP machines in addition to a well-equipped ICU supplied with 10 ventilators for the critically ill children. We sub-divided the patients into five age groups: (<1 mo.), (1mo-<1 yr.), (1-<5 yrs.), (5-10 yrs.), and (>10 yrs.). The diagnosis was dependent on suggestive clinical findings supported by positive RT- PCR and/or positive chest x-rays or CT findings with or without a contact history to an infected person. Patients' data were collected from their hospital medical records after taking consents from the authorized personnel, the hospital's Medical Research Center, and the Ethics Committee. After reviewing the data, we obtained the demographic variables such as gender, residency, and ages as well as the medical information as history, clinical examination, and symptoms duration before hospitalization, the presenting signs and symptoms, any underlying chronic illnesses like cerebral palsies, hydrocephalus, diabetes mellitus, congenital heart diseases, and others in addition to the certain Laboratory tests as HB, total WBC and differential counts, platelets, C-reactive proteins (CRP), S. ferritin, and LDH. Identifying the normal and abnormal results values according to WHO referenced tables matched for the age and gender, we further checked the patients and relatives RT-PCR results when available and the possible chest -x ray findings of unilateral or bilateral infiltration as well as ground glass infiltrations. Furthermore, the chest CT results of patchy ground-glass opacities and other suggestive findings were examined. The results were arranged in tables and graphs for doing both analysis and comparison. The statistical analysis was carried out using the software packages SPSS version 17, and the statistical significance was accepted as $P<0.05$.

Results

Children in the age range of 5-10 years were slightly more infected than the other age groups, as being 28%, 25%, and 22%, respectively (Figure 1). There is no real gender difference (54% males and 46% females), the urban residents were represented more than the rural ones as 84% and 16%, respectively (Figure 2). 96% of the older patients had oxygen saturation (>92%), while 4% only had low saturation (<92%), mostly in both neonatal period and infancy (Figure 3).

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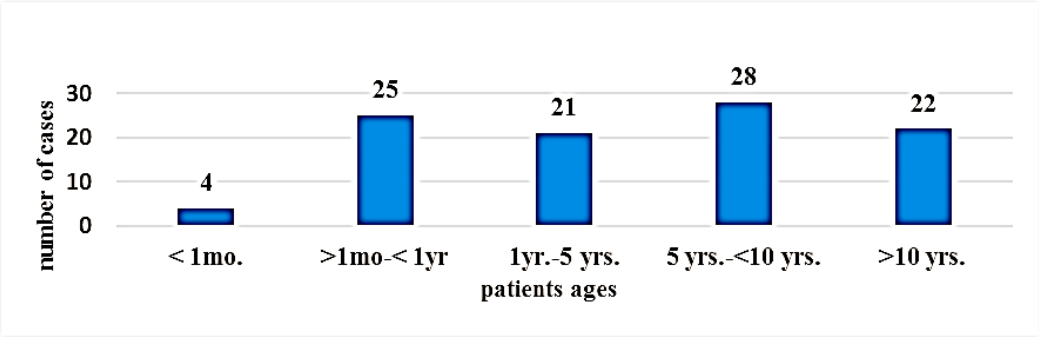

Figure 1: Age representation among COVID-19 patients

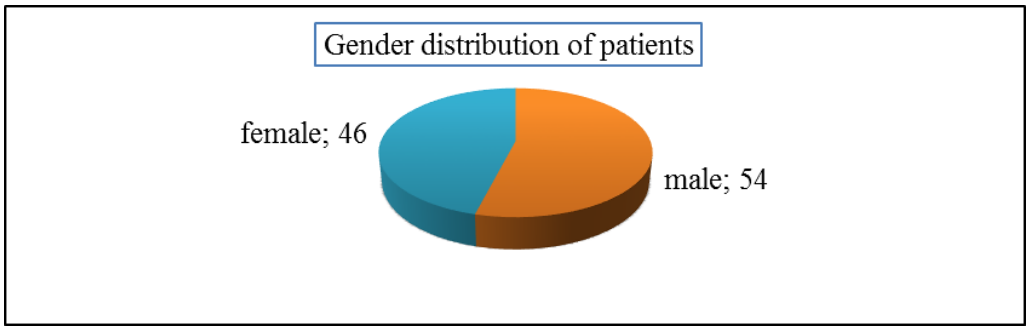

Figure 2: Gender distribution among COVID-19 sample patients

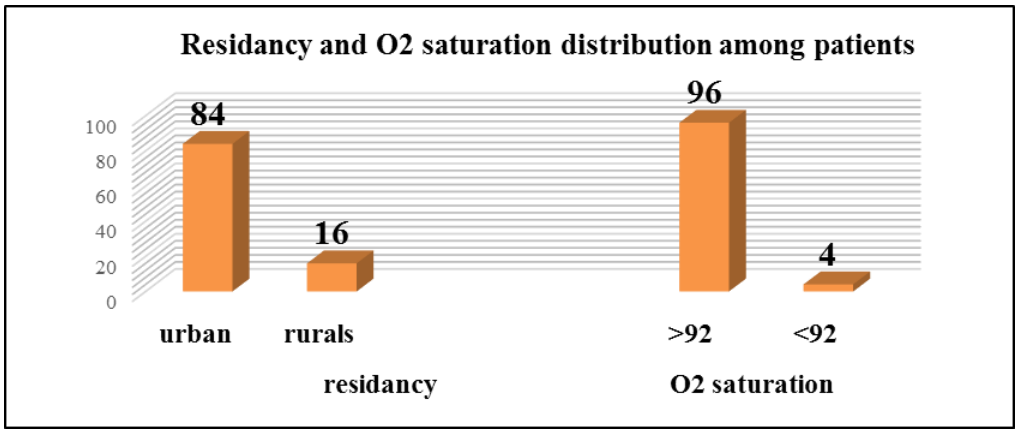

Figure 3: Residency and O2 saturation among COVID-19 patients

Table 1: Age correlation to illness duration before hospitalization

Age groups	< 5 days	>5days	TotalN=	P-value
<1mo G1 (Neonatal period)	3	1	4	0.008
1-<12mo G2 (Infancy)	19	6	25	
1y-<5 yrs. G3(toddlers& Preschoolers)	14	6	21	
5ys-<10yrs G4(school aged & preadolescents)	10	18	28	
10ys-16yrs G5 (Adolescence)	10	13	22	
Total	56%	44%	100%	

Illness duration from the appearance of signs and symptoms till hospitalization is variable and ranges from 1 day to 30 days. The most represented duration was (≤5 days) in (56%) of patients, mainly in younger patients. While the longer duration of (>5 days) was represented in (44%) of cases mainly in older groups, which means the illness duration before admission maximized by increasing ages with a significant statistical correlation (P-value= 0.008) (Table 1).

The most common representing signs and symptoms (Table 2):

Fever: It was represented in (93%) of cases, of near equal distribution in all groups, although the

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fever rate was a slightly higher in G4 group (5-<10 years).

Malaise: It was represented in (68%) of cases, mainly in older children G4 and G5.

Cough: It was represented in (53%) of patients, and alsocough rates were approximately equal at different ages except for the premature infants, who did not have a cough.

SOB: It was found in (42%) of children, the higher rates were among G2, G3, and G4 groups.

Diarrhea with or without vomiting: It was represented in (47%) of cases, the highest rate was in adolescents (16%), while none of them was observed in neonatal group.

Headache: It was represented in (22%), mostly among the older groups children G 3, G4, and G5 (i.e. toddlers, school children+ preadolescents, and adolescents) (7%), (6%), and (8%), respectively.

Taste loss: It was lost in (22%), and was mainly represented in older age groups, as indicated in Table 2.

Table 2: The distribution of the most common signs and symptoms among age groups

Sample Patient Age groups						
Clinical feature	***G1 <1 mo. Neonates***	***G2 1mo-< 1yr Infancy***	***G3. 1yr-<5 yrs. Post infancy, toddlers, and preschooler***	***G4. 5-<10 yrs. School children and pre-adolescents***	***G5. 10-16 yrs. Adolescence***	***Total%***
Fever	3	21	20	27	22	93%
Malaise	1	13	13	23	18	68%
Cough	0	12	15	13	13	53%
Diarrhea	0	13	5	12	16	46%
SOB	1	13	11	10	7	42%
Headache	0	0	7	13.5	8	28.5%
Loss taste	0	0	2	10	10	22%

- Patient PCR: It was positive in 51%, negative in 45%, and unknown in 4%.
- Relative **PCR:** It was positive in 46%, negative in 44%, and unknown in 10 %.
- Patient CXR: It was positive in 53%, negative in 10%, and unknown in 37%,
- Chest CT Scans: It was positive in 62%, negative in 14%, and unknown in 24%.

Table 3: Patient and relative RT-PCR, CXR, and CT scans' results

COVID-19 investigations	***Results type and numbers***		
	Positive	***Negative***	***Not done***
Patient RT- PCR	*51*	*45*	*4*
Relative RT- PCR	*46*	*44%*	*10*
Imaging studies			
Chest Xray	*53*	*10*	*37*
Chest CT	*62*	*14*	*24*

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Table 4: Percentages of blood indices results

Blood indices counts	Blood indices level		
	Low%	High%	Normal %
Total WBC	12	16	72
Neutrophils	8	36	56
lymphocyte	36	8	56
HB	56	1	43
Platelet	24	22	54
C- reactive protein	0	90	10
S. Ferritin	0	72	28
LDH	0	96	4

The total WBC count was normal in 72%, low in 12%, and high in 16%, of cases, while the neutrophil count was normal in 56%, high in 36%, and low in 8% of cases. Lymphocyte count was normal in 56%, high in 8%, and low in 36%. **(**56%) of patients were anemic, they had low Hb level between (7-9) gm/dl, the normal HB found in (43%), while high HB was found in 1%. Platelet counts were low in 24%, high in 22%, and normal in 54% of cases. C-reactive protein (CRP) was high in 90% of cases and normal in 10%, while S. ferritin level was high in 72% and normal in 28%. LDH level was normal in 4 % and high in 96% of cases, as presented in Table 4.

Table 5: Hepatomegaly, splenomegaly, and the underlying diseases correlation to patients' ages

Clinical abnormality	Group 2 1mo-<1 yr.	Group 3 1yr-<5yrs.	G.4(5yrs. - <10 yrs).	Group 5 ≥ 10 yrs.	Total	P-value
Hepatomegaly	1	0	6	3	10	0.02%
Splenomegaly	0	0	4	3	7	
Chronic disease	9	6	5	3	23	
Total	10	6	15	9	40	

Hepatomegaly and splenomegaly were positive significantly in older groups patients as (10%) and (7%), respectively (P-value= 0.02), while the underlying chronic diseases were significantly positive in 23% of cases mainly among younger ages (G2 and G3) from (1 month-<10 yrs.), (P-value=0.02).

Discussion

The characteristics of COVID-19 infection in Iraqi children have not been properly covered yet, regarding this issue, we conducted our study which identified that children of all age ranges obviously can be infected by COVID-19, agreeing with *Dong's* study [23] in which children in all age ranges could be infected. The proposed study identified a slightly higher COVID frequency among children aged between (5-<10 yrs.), this finding disagreeing two studies [24] and [25], in which the highest proportion was in older children (14-17 yrs.). This difference by the age-related infection rate among studies was related to the different social, environmental factors, and the altered health circumstances, the findings of our study demonstrate that higher frequency in the younger ages may be related to the overcrowding, poverty, the minimum health education programs, weak health care facilities, and the improper adherence to the personal protective equipment as wearing facial masks and keeping social distance between them which increases the risk of infection exposure.

We found no real gender differences, in spite of a slight male infection predominance mainly between (1year-10 yrs.), agreed with *Dong's* study [23] which is explained by gender-associated behavior expectations. Most male children in our society used to play outdoors with peers without using any personal protection measures. While the female predominance which is found in older

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group (>10 yrs.-16 yrs.) probably reflects their earlier puberty onset initiation due to the hormonal changes. The puberty and the associated psychological stresses play a role in depressing the immune system and facilitating COVID-19 infection. This finding requires more local studies to be confirmed.

The total (urban\rural) residency ratio is (4:1), the urban predominance was agreed in many studies as [26], [27], and [28], while it was disagreed to *Qian Huang's* study [29] in which the rural residents were more. In the present study, the urban predominance is probably related to the greater number of inhabitant people in urban areas than the rural ones where assumingly increases the possibility of COVID-19 virus replication and transmission commonly via different occasions as wedding parties, social gathering, and religious events superadded by weak adherence to the personal protective measures.

Low oxygen saturation was found in (4%) of cases that was disagreed with *Helen's* study [27] as only 1%. Hypoxia was mostly found among the neonates and infants that it was probably related to the structural immaturity of the respiratory system and the defective immune mechanisms.

Duration of patient illness before admission: ranged from (1 to 30 days), the present study found that the most common frequency of time limited symptoms duration before hospitalization was (≤5 days) that was agreed with *Leila's* study [30]. This finding was correlated positively and proportionally with patients ages (i.e. the younger patients had shorter intervals, while the older children had longer duration), and it was agreed with *Leadman's* study [24].

Fever and fatigability were the most common manifestations that were agreed with *Leila's* study [30], while was disagreed with *Derespina's* study [31], in which the most prevalent symptoms were primarily cough and malaise. These symptoms variability may be related to the potency of the host defensive mechanisms and immune responses to infection, reflecting the influences of racial, cultural, and environmental factors.

In the proposed study, diarrhea and/or vomiting and SOB frequencies (46%) and (42%) respectively, were higher than (32.2%) and (35.5%) rates, respectively, in *Onal's* study [30], the higher diarrheal manifestations may be explained by either host suppressed immunity, the superimposed other bacterial, or viral infections due to the surrounding unhealthy environment as non-purified water supply, poor sanitation, and poor food handling. The Stool examination is required to roll out other causes of diarrhea.

The high SOB frequency indicates COVID-19 severity, mostly in young infants due to their small airway size and poor tussive cough ability that increases the risk of severe chest infection, agreeing with *de Souza's* study [31].

Headache and taste loss frequencies in the present study were (28.5%) and (22%) respectively, disagreeing the lower frequencies of (20% and 2%), respectively, in *Kamil's* study [32], we found these subjective symptoms in older children only because we cannot measure them accurately in neonates and infants.

The Total WBC count was normal in (70%), while being low in (30%) agreed with *Kamil's* and *Fan's* studies [32] and [33]. In addition, neutrophil was high in (36%) probably due to superimposed bacterial infections agreed *Huang's* study [34]. We found low neutrophil count in (8%) of cases mostly in the immunocompromised; we need further studies of the larger number of patients in order to obtain more accurate results.

Lymphocyte count was low in (36%) of cases, agreeing *Guan's* study [35], while disagreeing the higher percentage of (45.9%) in *Onal's* study [25]. Platelet was low in (24%) of cases agreeing with the nearly close percentage of (20%) in *Fan's* study [32], but disagreeing *Guan's* study [35] result in (12%). (CRP), (LDH), and (ferritin) levels were high and indicates severity especially in (infancy) and between (5-16 years) age groups, agreed many studies [36], [37], and [38].

Patients RT PCR were negative in (45%) of cases whom diagnosed by positive CXR in (19%) or positive CT in (26%), which indicates a negative result of RT-PCR does not exclude COVID-19 infection. this in agreement with *Nina's* study [39] that may be explained either by the inaccurate

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technique of taking samples, or late testing, which decreases the yield of positive tests.

The relative (household) RT-PCR were positive in (45%) of cases which correlates with *Helen's* study [27] indicating that not all close household contacts were infected and it was agreed with *Nina's* study [39].

CT were positive in (62%) of patients, especially those with SOB which indicates severity that was disagreed with the (30%) in *Fang's* study [40]. Our higher positive results reflect the accuracy of CT in diagnosis of COVID-19 patients especially for rapid identification of the suspected cases that agreed *Sharon's* study [41], while disagreeing with *Xu's* study [42] which doubts the utility of CT in COVID-19 diagnoses and management of pediatric patients.

CXR findings were positive in 50% of cases, especially when associated dyspnea, that was disagreed with *Lundin's* study [43], in which it is higher (80%).

The underlying chronic diseases, is found in 23% of patients mostly in younger groups. It is significantly positive (p.value <0.02) with high severity and mortality rates, they necessitate urgent and aggressive treatment in ICU that is agreed *Companies'* study from the USA [44].

Combined hepatosplenomegaly found in (7%) of cases during their illness is significantly correlated with increasing ages (P-value <0.02), organomegaly indicates poor prognosis; agreeing with *Whittaker's* study [45], in which (6) of them had high (ferritin and LDH) and lymphopenia which indicates probably multisystemic inflammatory progression (MSI).

Recommendation

During COVID-19 outbreak, any child with (fever, cough, malaise, SOB, and diarrhea) with or without a history of contact with an infected person, should be regarded as infectious till proven otherwise. The evaluation of (blood indices, serum ferritin, CRP, LDH, chest CT and/or CXR, and RT-PCR testing) are needed to confirm the diagnosis, although negative results of imatching studies or RT- PCR test does not exclude COVID-19 infection.

Conclusion

The Covid 19 infection rate was highest (28%) among children aged between (5-<10 years). The most common clinical manifestations were Fever, malaise, and cough. Covid infection were more in children of urban predominance. 50% of patients had anemia, 36% had lymphopenia, 24% had thrombocytopenia, negative Covid-19 (RT-PCR), and/or CXR. The CT results did not exclude infection. Thus, we need further local studies to support our results.

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Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to responsible for all the aspects of this work.

Conflict of Interest

There are no conflicts of interest in this study.

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