

Epidemiological Characteristics and Clinical Approach of COVID-19 among Children under 18 Years in Iraq

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ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) is an emerging, rapidly evolving situation that leads to unprecedented demand for health care services.

Objectives: Underscoring the clinical manifestations of SARS-CoV-2 infection in children in Iraq by highlighting a new configuration of health care services without any boundaries in the future provided to pediatric patients via telemedicine.

Patients and methods: An ongoing prospective cross-sectional telemedicine-based study with data gathering and analysis of many variables of 62 patients in Iraq via remote consultations between July 2020 and May 2021.

Results: The male-to-female sex ratio was 0.8:1. The most frequently observed symptoms in infants less than 1 year of age have been coughing (66.6%) and fever (55.5%). In children aged 1-9 years, fever (61.1%) and rhinorrhea (55.5%) were the most commonly observed symptoms with additional clinical findings, including one case (2.7%) presented with bloody diarrhea and another case (2.7%) presented with chest pain. In children and Adolescents aged 10-<18 years, headache (64.7%) with a significant P-value (0.000) and fever (58.8%) were the most frequently observed symptoms. Only one patient (1.6%) requires hospital admission, and the vast majority of the patients are treated at home (98.4%). Hopefully, the case fatality rate was zero percent.

Conclusions: The COVID-19 trajectory in children has a good prognosis, even in cases with underlying chronic diseases, and most of the cases are treated at home using telemedicine-healthcare services.

Keywords: Epidemiology and clinical approach, Coronavirus; COVID-19, SARS-COV-2, telemedicine.

الخصائص الوبائية ، والنهج السريري ، و COVID-19 بين الأطفال دون سن ١٨ عامًا في العراق

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الخلاصة

الخلفية العلمية للبحث: يعد مرض فيروس كورونا ٢٠١٩ (COVID-19) حالة ناشئة سريعة التطور تؤدي إلى طلب غير مسبوق على خدمات الرعاية الصحية.

أهداف البحث: التأكيد على المظاهر السريرية لعدوى SARS-CoV-2 بين الأطفال في العراق من خلال تسليط الضوء على نوع جديد من انواع الخدمات الصحية-دون أي حدود في المستقبل-المقدمة لمرضى الأطفال عبر التطبيب عن بعد لتقليل مخاطر نقل العدوى إلى المرضى الآخرين و كادر المستشفى ، وخفض تكاليف الرعاية الصحية ، وإنشاء شبكة صحية عالمية أكثر قابلية للتكيف مع الأزمات الإنسانية في الأماكن التي تفتقر إلى الموارد.

المرضى وطرق العمل: دراسة مستعرضة مستمرة قائمة على الطب عن بعد مع جمع البيانات وتحليل العديد من المتغيرات لـ ٦٢ مريضاً في العراق من خلال الاستشارات عن بُعد بين تموز ٢٠٢٠ وأيار ٢٠٢١.

النتائج: كانت نسبة الذكور إلى الإناث ٠.٨ : ١. الأعراض الأكثر شيوعاً التي لوحظت عند الرضع الذين تقل أعمارهم عن سنة واحدة كانت السعال (٦٦.٦٪) والحمى (٥٥.٥٪). في الأطفال الذين تتراوح أعمارهم بين ١-٩ سنوات ، كانت الحمى (٦١.١٪) وسيلان الأنف (٥٥.٥٪) هي الأعراض الأكثر شيوعاً التي تمت ملاحظتها مع نتائج إكلينيكية إضافية ، بما في ذلك حالة واحدة (٢.٧٪) مصحوبة بإسهال دموي وحالة أخرى (٢.٧٪) مصحوبة بإسهال دموي. ألم صدر. في الأطفال والشباب الذين تتراوح أعمارهم بين ١٠ وأقل من ١٨ سنة ، كان الصداع (٦٤.٧٪) مع قيمة P كبيرة (٠.٠٠٠) والحمى (٥٨.٨٪) أكثر الأعراض التي لوحظت بشكل متكرر. احتاج مريض واحد فقط (١.٦٪) إلى دخول المستشفى ، وتم علاج بقية المرضى في المنزل (٩٨.٤٪). من الجيد أن يكون معدل الوفيات للحالات صفر بالمائة.

الاستنتاجات: إن مسار مرض كوفيد-١٩ عند الأطفال له تكهن جيد ، حتى في حالات الأمراض المزمنة الكامنة ، ويتم علاج معظم الحالات في المنزل باستخدام خدمات الرعاية الصحية عن بعد.

الكلمات المفتاحية: الخصائص الوبائية والنهج السريري، فيروس كورونا، كوفيد-١٩ السارس COV-2، التطبيب عن بعد.

INTRODUCTION

The ongoing *coronavirus* disease (COVID-19) pandemic resulted in severe acute respiratory syndrome affect people of all ages, genders, and cultures worldwide. COVID-19 was first identified in the city of Wuhan, China, the World Health Organization declared the outbreak a Public Health Emergency of International Concern on January 30, 2020, and a pandemic on March 11, 2020¹.

In contrast to other respiratory viruses, children appear to have a lower risk of infection than adults, and most of the reported cases in children are mild or asymptomatic. This is due to Angiotensin-converting enzyme receptors type2 (ACE2) which are important for viral entry, and these receptors appear to be less in children's lungs because these receptors increase with age², also children and young people have fewer ACE2 receptors in the nasal epithelium, the first point of contact for coronavirus, and the human body³, furthermore, the immune system of children responds to viruses differently than that of adults through a variety of mechanisms, including:

- Retention of T-cells in children, which are able to limit the inflammation.
- In children, the lung tissue naturally has a higher concentration of regulating T-cells.
- A high level of interleukin 10 (IL-10) is known as a human cytokine synthesis inhibitory factor, which is an anti-inflammatory cytokine that inhibits the inflammation of other components like interleukin 6 (IL-6) that are detrimental.
- The first line of defense against SARS-CoV-2 is innate immunity. This type of immunity in children

is well-trained not only by community-acquired viral infections but also by the use of vaccines.

e)In healthy children, endothelial damage is practically absent. This could help to avoid the spread of the inflammatory process.

The purpose of this study is to describe the epidemiological features, clinical manifestations, and treatment outlines of COVID-19 in children in Iraq via remote consultation under COVID-19 restrictions as a way of supporting non-severe COVID-19 patients and to highlight a new configuration of health care services provided to the patients via telemedicine healthcare services.

SUBJECTS AND METHODS

Ethical Considerations

The data was gathered from the child's parents after giving informed parental consent.

The Declaration of Helsinki's guiding principles were followed when conducting this study. The University of Mosul's Ethics Committee gave its approval.

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Study Design and Setting

Ongoing prospective cross-sectional telemedicine-based study with data gathering and analysis to specify the clinical manifestations, course, and treatment of sixty-two cases diagnosed with COVID-19 in most Iraqi governorates, including Baghdad, Nineveh, Basra, Erbil, Najaf, Karbala, Saladin, Babylon, and Dhi Qar, between July 2020 and May 2021.

Participants

The participants recruited in this study were based on inclusion and exclusion criteria.

Inclusion criteria include patients aged one month to 17 years, symptomatic children with a history of household contact with an adult patient confirmed as a patient of SARS-COV-2 infection by a positive nasopharyngeal swab antigen test.

Exclusion criteria include neonatal patients, asymptomatic children, symptomatic children with a history of contact with suspected infectious foci, and hospitalized patients with multisystem inflammatory syndrome (MIS-C).

Methods

The Iraq COVID-19 shutdown in July 2020 highlighted the importance of telemedicine healthcare services via digital communication and devices while limiting the risk of exposure to the virus.

Data were available for a proportion of children and young people on many important variables, including age, gender, clinical features, duration of symptoms, presence of underlying chronic diseases, source of infection, and response to treatment.

The author gathered the data by conducting a descriptive analysis of incoming teleconsultation calls and text messages under COVID-19 restrictions in order to collect symptoms and other information that led to diagnosis and treatment.

Early in the pandemic, most cases in the pediatric age group resulted from household exposure, with an adult as the index patient, and because the cases enrolled in this study were identified after implementation of strict physical distancing measures (e.g., school closure), limiting the exposure of children to close contact outside their household with the awareness of limited laboratory supplies like rapid test kits and TM for PCR swab, equipment, and personnel in governmental hospitals with intense viral transmission, the nasopharyngeal swab is not recommended in the case of children with symptoms that have a known infectious focus and who do not need hospitalization, and those patients were included in this study.

Limitations of the Study

Telemedicine healthcare services are not a complete substitute for in-patient visits; they are also not feasible for all patients because technology

does not always work smoothly, and these difficulties may interfere with the delivery of this type of healthcare.

Bias and Missing Data

Among the 62 patients enrolled in this study, four cases were lost in the follow-up of the study, so that the duration of symptoms could not be detected in those four cases.

Statistical Analyses

SPS program, version 27 and Minitab version 16
The P-value is considered significant if less than 0.05.

RESULTS

Epidemiological Characteristics

The epidemiological characteristics are summarized in (Table1).

The median age of cases included in this study was 6 years (range, from 1 month to 17 years).

Among the 62 cases included in this study, 34 were female (54.8%) and 28 were male (45.2%), for a male to a female sex ratio of 0.8:1. Clustering of families was the main way of transmission of SARS-CoV-2 into children.

The median incubation period (the time from exposure to the infected case to the appearance of the first symptom) was 4 days (ranging from 1-20 days).

Table1. The epidemiological characteristics of COVID-19 in children and adolescents.

Epidemiological parameter	No. &% (N=62)
Included patient number	62
Age range, (median)	1 mon-17 y (6 y)
Age interval (y)	
Less than 1 y	9 (14.5%)
1-9 y	36 (58%)
10-less than18 y	17 (27.5%)
Gender ratio	
Male/female (%)	28/34 (0.8:1)
Exposure to the source of transmission	
No. (%)	
Family members with COVID-19	58 (93.6)
Non-family members with COVID-19	2 (3.2)
Indefinite history of exposure	2 (3.2)
The incubation period (days)	1-20

The Clinical Findings

The symptoms of COVID-19 in children are close to those of adults, but appear to be milder in children than in adults, and they differ according to age group. The clinical findings of COVID-19 according to age group are summarized in (Table 2).

In children aged 1-9 years, additional clinical findings were noted, including one case (6 years of age) developing bloody diarrhea at 2.7%, and one case (4.5 years old) developing chest pain at 2.7%.

Table2.The clinical findings of COVID-19 in children and adolescents, according to the age group.

Presenting symptoms	Age group in years No. and %		
	Less than 1 y (N=9)	1-9 y (N=36)	10- <18y (N=17)
Fever (measured >38°C [100.4°F] or subjective)	5 (55.5)	22 (61.1)	10 (58.8)
Cough	6 (66.6)	14 (38.8)	8 (47)
Shortness of breath	2 (22.2)	2 (5.5)	1 (5.8)
Rhinorrhea / sneezing	4 (44.4)	20 (55.5)	6 (35.2)
Sore throat	0 (0.)	8 (22.2)	3 (17.6)
Nausea / vomiting	2 (22.2)	6 (16.6)	3 (17.6)
Poor feeding/poor appetite	4 (44.4)	8 (22.2)	2 (11.7)
Diarrhea	2 (22.2)	8 (22.2)	6 (35.2)
Bloody diarrhea	0 (0.0)	1 (2.7)	0 (0.0)
Abdominal pain	0 (0.0)	2 (5.5)	2 (11.7)
Loss of smell or taste	0 (0.0)	2 (5.5)	3 (17.6)
Headache	0 (0.0)	5 (13.8)	11 (64.7)
Lethargy/myalgia	3 (33.3)	12 (33.3)	8 (47)
Red eye (conjunctivitis)	2 (22.2)	1 (2.7)	0 (0.0)
Duration of symptoms range (d)	1-14	1-23	2-22

The Presence of Underlying Chronic Diseases

Only eight cases (12.9%) of the 62 COVID-19 cases had underlying chronic diseases, (five patient with asthma, one patient with cerebral palsy, one patient with factor 1 deficiency, and one patient with supraventricular tachycardia).

Treatment Outlines

The treatment outlines have been summarized in (Table 3).

Among the 62 patients, 61 (98.4%) were treated at home, with only one (1.6%) requiring hospitalization; all (62) required symptomatic treatment (100%), five (8%) required steroid therapy, and none (0%) required antibiotics such as Azithromycin or antiviral treatment. Hopefully, the case fatality rate was zero.

Table3. The treatment outlines.

Treatment outlines (n=62)	No. (%)
Treatment at home	61 (98.4)
Need for hospitalization	1 (1.6)
Symptomatic treatment	62 (100.0)
Steroid	5 (8)
Antibiotics (Azithromycin)	0 (0.0)
Antiviral treatment	0 (0.0)
Clinical outcome:	
Death (case fatality ratio)	0 (0.0)

DISCUSSION

This study describes the epidemiological features, clinical manifestations, and treatment outline of COVID-19 in children under 18 years of age in Iraq.

There was a female predominance, which is in contrast to a retrospective study from China ⁴.

The median age of cases enrolled in this study was 6 years, with a range from 1 month to 17 years, which is close to that of a study from five countries in China, Italy, United States, Iran, and Malaysia ⁵, in which the median age was 5 years.

93.6% of the patients were diagnosed as cases of COVID-19 when their family members were confirmed to be infected with SARS-CoV-2 by real-time reverse transcription-polymerase chain reaction (RT-PCR), which is comparable to studies in China ^{6,7}. Children and young people can easily acquire the infection from their families without having any exposure to the outside world.

3.2% of the cases acquired the infection from non-family members because they were unable to wear

face masks and had not taken additional preventive and control measures, and the source of infection could not be traced in 3.2% of the cases, so the recommendation is that children and young people actively participate in routine preventive actions to contain the spread of the SARS-CoV-2.

The youngsters exhibit certain properties in their immune response to SARS-CoV-2 and are unable to precisely identify their own symptoms or contact histories, as shown by the median incubation period of 4 days, with a range of 1–20 days⁸. Therefore, in order to prevent exposure to potential spreaders and infection, kids should make an effort to avoid interaction with complicated communities.

Cough and fever were the most frequently seen clinical signs of COVID-19 in infants younger than 1 year. Infants were more likely than older children to get a severe sickness from COVID-19, and the symptom duration ranged from 2–20 days⁹.

Their underdeveloped immune systems and smaller airways are probably to blame for this. The respiratory symptoms are similar to those of influenza and other coronaviruses¹⁰.

A red-puffed eye in infants was another clinical symptom that was noted. Pink eye is caused by SARS-CoV-2 infection of the conjunctiva. This infection is caused by either the lacrimal duct serving as one of the initial sites of SARS-CoV-2 transmission from the environment to the lungs or by SARS-CoV-2 traveling retrogradely from the airway passage to the eyes via the lacrimal duct, just like other respiratory viruses. The viral particle enters the cell through the cell membrane protein angiotensin-converting enzyme receptor 2 when it comes into touch with the conjunctival epithelial cells (ACE2). The only treatment for this kind of conjunctivitis is symptomatic relief¹¹.

In children aged 1-9 years, the most commonly observed clinical findings were fever, rhinorrhea, and/or sneezing, with the duration of symptoms ranging from 1 to 14 days. Those symptoms look like symptoms of other common illnesses, such as the common cold, allergies, and streptococcus throat¹². In this age group, there are additional observed clinical findings, including case (1), a 6-year-old child with no underlying chronic disease, who presented with high fever (measured temperature: 40° c), diarrhea, poor appetite, and abdominal pain without respiratory manifestations for 5 days, then started to develop bloody diarrhea (more than 3 times per day, small in amount, containing blood and mucus) for 2 days and improved with symptomatic treatment; the patient sibling, 11-year-old with no underlying chronic

disease, presented with diarrhea (watery diarrhea without blood in the stool), abdominal pain, headache, no fever, and no respiratory manifestations for 7 days, and improved with symptomatic treatment.

ACE2 receptors are highly expressed in the small intestinal enterocytes, and this expression on the surface cells of the small intestine may mediate the invasion and amplification of the SARS-CoV-2 and activation of gastrointestinal inflammation, according to a study¹³ to investigate the relationship between COVID-19 and gastrointestinal manifestation.

The result of the study¹⁴ reveal the duration time of positive results for SARS-CoV-2 RNA in stool ranged from 1 to 12 days and immunofluorescence data of biopsies taken by endoscope showed that ACE2 protein is abundantly expressed in the glandular cells of gastric, duodenal and rectal epithelia but ACE2 staining is rarely seen in esophageal mucosa because the esophageal epithelium is mainly composed of squamous epithelial cells, which express less ACE2 than glandular epithelial cells. Therefore, it is important to emphasize fecal-oral transmission prevention in order to stop the virus's spread among children.

Case (2), a 4.5-year-old with no underlying chronic diseases, presented with rhinorrhea, cough, and generalized body aches, including chest pain (intermittent and poorly described by the patient with normal oxygenation of the blood), no fever, and no shortness of breath for 6 days. The chest pain improved with supportive treatment and simple analgesics. This chest pain occurs in association with muscle or body aches in addition to other symptoms of COVID-19 in the pediatric age group¹⁵.

Among children and young people aged 10-18 years, the most commonly observed clinical findings were headache (with a significant P-value of 0.000), and fever, with the duration of symptoms ranging from 2-23 days in a similar pattern to adults.

While the majority of pediatric patients are minor, young adults appear to be more likely than younger children over the age of one to experience more severe COVID-19 symptoms¹⁶.

We found that (12.9%) of the cases had underlying medical diseases.

Compared to healthy children, children with underlying medical conditions may be more susceptible to serious sickness and may need hospitalization, as in Study

¹⁷ done in Sulaimaniyah Governorate in Iraq, in which preexisting diseases account for 12% of hospitalized children with COVID-19.

Of the patients treated at home, only one case (1.6%), a 13-year-old patient with chronic underlying disease (Factor 1 deficiency), required hospitalization because of repeated vomiting, diarrhea, and reduced urine output, admitted to the hospital only for one day, then discharged after correction of dehydration in order to complete the treatment at home.

Children with COVID-19 experience hospitalization rates that are significantly lower than those of adults ¹⁸.

Regarding the management of COVID-19 in the pediatric age group, it focuses on isolation in order to prevent the transmission of infection to others, supportive care, monitoring of clinical deterioration, and prevention of complications. In this study, all cases (100%) received supportive treatment.

Five patients (8%) with known cases of asthma experienced an increase in asthmatic attacks. Because of this, they received steroid treatment (oral Prednisolone 1-2 mg/kg/day for 5 days). Delaying therapy can increase the risk of a life-threatening asthma exacerbation, so it is important to follow the standard recommendations for prompt systemic glucocorticoid induction for asthma exacerbations ¹⁹.

None of the patients need antibiotics like azithromycin because COVID-19 is caused by a virus, therefore antibiotics should not be used for prevention or treatment. However, antibiotics can be used for hospitalized patients because bacterial coinfection is possible ²⁰, but the study ²¹ encourages early azithromycin administration at the first sign of a COVID-19 infection.

The case-fatality rate in this study was 0%; hopefully, COVID-19 is a rare cause of death in the pediatric age group ^{22,23}.

Even though COVID-19 has a good prognosis in children, a small number of patients may develop (MIS-C), a rare but serious condition in which the heart, lungs, kidneys, brain, skin, eyes, or gastrointestinal organs become inflamed.

It is unclear why some kids have developed MIS-C while others have not.

The majority of children who develop MIS-C may deteriorate rapidly, necessitating initial admission to a tertiary hospital. Some children may also require treatment in a pediatric intensive care unit.

During the height of the COVID-19 pandemic in Iraq, pediatric telemedicine healthcare services allowed for high-quality, effective medical care for

children. Telemedicine assisted in the quick identification of patients who needed immediate access to emergency care, even though the majority of children were managed conservatively at home.

CONCLUSION

1-Children have less severe clinical manifestations of COVID-19 than adults.

2-The frequency of symptoms has a distinct pattern from that of adult cases, respiratory symptoms shouldn't be regarded as a defining feature of COVID-19 in children.

3-The majority of the patients are treated at home by utilizing telemedicine healthcare services. This type of healthcare service can be seen as a powerful tool to improve patient outreach and health outcomes with many advantages for patients, including:

- Reduce healthcare costs.
- Improve weak public health systems and create a global health network more responsive to humanitarian crises in resource-poor settings.
- Reduce the long distance between remotely residing rural people and healthcare services.
- No transportation costs.
- Answering urgent patient concerns.
- Access to specialists.
- Less chance of catching a new illness.
- Less time in the waiting room.
- No need to take time off work and school.
- Eliminate child or eldercare issues.

So understanding of COVID-19 in children and young people will aid the treatment development.

RECOMMENDATIONS

This study recommends more clinical trials and studies in order to analyze the epidemiological and clinical characteristics of COVID-19 in the pediatric age group, so the children and young people could be saved from getting this infection and can be stopped from being as silent carriers and endangering the lives of other individuals, especially elderly and people with underlying chronic diseases, with this, pediatricians should have a high level of clinical suspicion to diagnose children and young people infected with SARS-CoV-2, because most of the pediatric cases are asymptomatic or mild, so the child's role in the contamination chain is precisely established and considered.

Also, the study recommends special attention needs to be paid to minimize the negative consequences for children by the measures taken

to control the COVID-19 pandemic, such as school closures and social distancing, in addition to that the study highly recommends a need for increased the use of telemedicine health care services in order to reduce the face to face appointments with patients to decrease the risk of transmitting the infection to other patients and medical staff and promise health care services without any boundary in the future, including consultations, diagnosis, nursing, treatment, rehabilitation, psychology, and some specialized services to reduce the long distance between remotely residing rural people and the health care services.

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Conflict of interest: "The author declares that there are no conflicts of interest regarding the publication of this manuscript".

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