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Abdominal pain in children with COVID-19

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Abstract

Objective. To analyze clinical features, diagnosis and treatment of pediatric patients referred to our pediatric surgery center with abdominal pain as a main manifestation of COVID-19.

Material and methods. We retrospectively reviewed 56 patients with abdominal pain associated with SARS-CoV-2 infection at the Basrah Children Specialty Hospital between June 2020 and December 2021. We collected data including demographic data, symptoms, imaging data, laboratory findings, treatments, and clinical outcomes.

Results. Fifty-six patients (48 male and 8 female) with a median age of 9 years were analyzed. All patients had abdominal pain. Fifty-two patients complained of vomiting, 48 patients with fever, 36 patients with cough, and 20 patients with shortness of breath. Twenty patients were diagnosed with acute appendicitis, two of them had appendicular abscess. Mesenteric lymphadenitis was found in 12 patients, obstructed inguinal hernia in 4 patients, and epididymo-orchitis in two patients. Ten patients required surgical intervention.

Conclusion. COVID-19 should be suspected in any child presenting with acute abdominal pain. In the era of COVID-19, all cases of abdominal pain in children including those with acute appendicitis are better to be treated conservatively.

Keywords: *abdominal pain, COVID-19, pediatric surgery, acute appendicitis, children.*

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Introduction

Coronavirus disease 2019 (COVID-19) was first described in Wuhan, China in January 2020. The disease is caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Because of the rapid worldwide spread, the disease was declared a global health emergency and pandemic [1, 2]. As of January 25, 2022, over 346 million cases and 5.5 million deaths have been reported globally [3]. The clinical course of the disease has relatively milder in children than in adults [4, 5]. However, Severe infections in children have been reported [6]. Apparently, the respiratory tract is the main part of the body affected by SARS-CoV-2 infection [7], and the spectrum of the symptoms range from fever and cough to pneumonia and acute respiratory distress syndrome. Many studies reported gastrointestinal manifestations such as nausea, vomiting, diarrhea, and abdominal pain with the description of acute abdomen presentation in some studies [8, 9]. It has been supposed that abdominal organs such as the ileum, kidneys, and bladder have high concentrations of ACE2 expression making them vulnerable to SARS-CoV-2 infection. About 10% of patients presented with gastrointestinal manifestations without respiratory features [11]. Despite the prevailing belief that COVID-19 in children is less virulent, however, reports from different areas in the world reported severe attacks describing a condition named multisystem inflammatory syndrome in children [12]. During the COVID-19 pandemic, the diagnostic difficulty for abdominal pain in children has increased [13]. In the literature, the cause of abdominal pain in children with COVID-19 was perforated Meckel's diverticulum [14], acute pancreatitis [15, 16], ileocolitis [17], mesenteric adenopathy [18], and intussusception [19].

In this study, we report the characteristics of fifty-six children presenting with abdominal pain in association with COVID-19. Therapeutic measures have also been recorded.

Patients and methods

The study involved patients who were admitted to our center for surgical conditions and had COVID-19 between June 2020 and December 2021. The confirmation of COVID-19 was by positive results RT-PCR of nasal or pharyngeal swab specimens.

Data collection was from the hospital medical records. The data included sex, age, symptoms, signs, vital signs at

Table1. **Epidemiological and clinical characteristics of children with COVID-19**

Parameter	Total (*n*=56)
Close contact	32 (57.1%)
Gender	
Male	48 (85.7%)
Female	8 (14.3%)
Age (years), median (range)	9 (0.1-13.7)
Bodyweight (kilograms), median (range)	23 (4-40)
Signs and symptoms	
Abdominal pain	56 (100%)
Vomiting	52 (92.9%)
Diarrhea	16 (28.6%)
Constipation	12 (21.4%)
Fever	48 (85.7%)
Cough	36 (64.3%)
Shortness of breath	20 (35.7%)
Temperature (C°), median (range)	38.35 (36.8-40)
Heart rate (beats per minute), median (range)	106.5 (80-135)
Oxygen saturation (%), median (range)	95.50 (89-99)

admission, and family history of COVID-19. Laboratory data collected included white blood cell (WBC), platelet count, hemoglobin, ferritin, lactate dehydrogenase (LDH), C-reactive protein (CRP), aspartate aminotransferase (AST), alanine aminotransferase (ALT), erythrocyte sedimentation rate (ESR), bilirubin, urea, creatinine, blood glucose, and albumin results. Data were obtained for chest CT scan and abdominal ultrasound results, Information regarding treatment options and hospitalization was also collected. Continuous variables were described as medians and simple ranges. Categorical variables were presented as frequency (number) and percentage.

Results

In this study, the median age was 9 years (range 1.1 to 13.7 years). Forty-eight (85.7%) were boys, 8 (14.3%) were girls so the male-to-female ratio was 6:1. The median body weight was 23 kg (range 4-40). Four patients were under 1 year (7.1%), 20 (35.7%) patients were above 10 years. Forty-eight (85%) patients came from poor or crowded neighborhoods.

All of the fifty-six (100%) patients had abdominal pain and 52 (92.9%) had vomiting. Fever was present in 48 (85.7%) patients. Cough and shortness of breath were present in 36 (64.3%) and 20 (35.7%) patients, respectively. Sixteen (28.6%) patients had diarrhea and there was constipation in 12 (21.4%) patients. At the time of admission, the median (range) of Oxygen saturation (SPO_2) was 95.50% (89-99), Temperature 38.35 Celsius (36.8-40), and heart rate 106.5 BPM (80-135). A History of close contact (suspected or confirmed) was present in 32 (57.1%) patients **(table 1)**.

Regarding laboratory results **(table 2)**, twenty-four (42.9%) patients had a white blood cell count of more than ($11 \cdot 10^9$/L), leukopenia was not found in any of our patients. Lymphocyte count was less than ($1 \cdot 10^9$/L) in eight (14.2%) patients and less than ($1.5 \cdot 10^9$/L) in sixteen (28.6%) patients. Four (7.1%) patients had a platelet count less than ($100 \cdot 10^9$/L). Hemoglobin levels were less than (10 g/L) in sixteen (28.6%) patients. LDH levels were elevated in 28 (58.3%) of 48 patients, serum ferritin levels were increased in 12 (27.3%) out of 44 patients. CRP tests were done for 52 patients and the results were abnormal in 24 (46.1%) patients. ESR results were more than (20 mm/hr) in 28 (63.6%) of 44 patients. Serum albumin results were low in 12 (27.2%) of 44 patients. High levels of urea and creatinine were recorded in eight (14.3%) patients. Blood glucose levels were mildly elevated in eight (14.3%) patients. AST and ALT levels were elevated in twenty (35.7%) patients. Of 48 patients, 10 (20.8%) had elevated bilirubin levels. Computed tomography (CT) revealed ground-glass opacities in 37.5% of the examined patients (12/32).

The findings by ultrasound examination were as follow: Normal studies in twelve (21.4%) patients, acute appendicitis in twenty (35.7%) patients, two of them had an appendicular abscess, mesenteric adenitis in 12 (21.4%) patients, unilateral epididymo-orchitis in two (3.5%) patients. Increase in the thickness of the ileal wall and free peritoneal fluid in six (10.7%) patients. The obstructed inguinal hernia was found in four patients **(table 3)**.

All patients were admitted in negative isolation rooms in the COVID-19 word, receiving intravenous fluid, intravenous cephalosporin (Ceftriaxone or Cefotaxime), Azithromycin (in patients with respiratory symptoms), intravenous paracetamol, intravenous metronidazole (in patients having acute appendicitis and appendicular abscess), intravenous ondansetron (in patients with vomiting), and intravenous omeprazole has been added in some patients, in addition to oxygen on need. Antiviral (Remdesivir) was used in twelve (21.4%) patients and systemic steroid (Dexamethasone) in twelve (21.4%) patients. The Management of patients was in collaboration between pediatric surgeons and pediatricians.

The diagnosis of acute appendicitis has been confirmed in twenty patients, eight of them treated conservatively, ten appendectomies performed, and aspiration of the appendicular abscess under ultrasound guide has been the treatment of two patients. Inguinal herniotomy, as an emergency surgical operation, has been done for one patient and manual reduction of the obstructed inguinal hernia in three patients.

Twelve patients (eight with epigastric pain and four with right lower abdominal pain with negative ultrasound studies) were discharged after the clearance of symptoms. All patients in this study were discharged well with no major complications with the hospital stay range (2-11) days, and median of [5].

Discussion

In this study, we reviewed the data of 56 children confirmed to have COVID-19 and having abdominal pain at

Table 2. **Laboratory data of children with COVID-19**

Laboratory results	Median	Range
White blood cell count (·10⁹/L)	10.19	4.77-18.98
Neutrophil count (·10⁹/L)	7.16	2.25-15.81
Lymphocyte count (·10⁹/L)	1.86	0.70-4.26
Hemoglobin (g/dL)	10.50	8.20-13.60
Platelet count (·10⁹/L)	272.50	93-589
Glucose (mmol/L)	5.00	3.3-6.9
Urea (mmol/L)	3.00	2.1-14.2
Creatinine (μmol/L)	38.50	26-132
ALT Alanine aminotransferase (U/L)	18.50	6-800
AST Aspartate aminotransferase (U/L)	22.50	10-900
Bilirubin (μmol/L) (*n*=48)	15.50	10-94
C-reactive protein (mg/L) (*n*=52)	7.40	6-168.0
Erythrocyte sedimentation rate (mm/hr) (*n*=44)	26.00	3-64
Lactate dehydrogenase (U/L) (*n*=48)	291.50	162-700
Albumin (g/L) (*n*=44)	36.00	29-48
Ferritin (ng/mL) (*n*=44)	87.40	37.20-538.70

Table 3. **Ultrasound data**

Finding	No. (%)
Normal	12 (21.4)
Uncomplicated acute appendicitis	18 (32.1)
Appendicular abscess	2 (3.5)
Mesenteric lymphadenitis	12 (21.4)
Epididymo-orchitis	2 (3.5)
Ileitis	6 (10.7)
Obstructed inguinal hernia	4 (7.1)
Total	56 (100)

the same time. The confirmation of the disease was by positive result polymerase chain reaction (PCR). Children were referred to our center from governmental medical institutions and private clinics. Out of the 56 patients study population, 32 (57.1%) patients had household COVID-19 contact, this means the intrafamily transmission of the disease was the major route of getting the infection. This result was consistent with other studies [20]. Forty-eight (85%) patients came from poor or crowded neighborhoods in which there is little or no application of the COVID-19 prevention instructions. This reflects the importance of adherence to the infection prevention instructions.

It was reported that about 10% of the children with SARS-CoV-2 infection had gastrointestinal symptoms [21]. A meta-analysis by Kai Qi, et al. declared the prevalence of abdominal pain in infected children was 3.6% [22]. Another study reported 17/291 (5.8%) had abdominal pain [23]. COVID-19 increases the difficulties of the management of children with abdominal pain and becomes an important differential diagnosis needed to be excluded particularly in the presence of household contact.

Fourteen children with abdominal pain and COVID-19 have been reported in Spain, four patients had positive PCR results, another four patients regarded confirmed cases depending on the positive SARS-CoV-2 immunoglobulin G (IgG) results. Nine patients were male; the median age was (9.5) years. Three patients had confirmed household contact. The associated symptoms were fever in 11, vomiting in 9, diarrhea in 7, cough in 3, and fewer other symptoms [24]. In this study the median age was [9] years. four patients presented with a right-sided obstructed inguinal hernia. All cases were confirmed by positive PCR results which were required inclusion criterion. The predominant gender of the 56 patients was male (48), thirty-two patients had confirmed or suspected contact. Fifty-two had vomiting. Fever was present in 48 patients, cough in 36 patients, and shortness of breath was in 20 patients, respectively. Sixteen patients had diarrhea and there was constipation in 12 patients.

One of our patients (male) had acute myeloblastic leukemia (AML) treated by chemotherapy for six months before COVID-19 infection, transferred from leukemia word to COVID-19 word after confirmation of the infection by PCR result, pediatric surgery consultation has been done for epigastric pain, cough, shortness of breath, high-grade fever. Abdominal examination revealed epigastric tenderness with normal ultrasound results. CT scan revealed a ground-glass appearance. This patient had the lowest oxygen saturation in this series measured by pulse-oximetry (89%), and the longest hospital stay (11) days. The discharging was according to his father's request to complete the treatment in his province. It is reported that even in children on chemotherapy, SARS-CoV-2 infection may be asymptomatic or mild disease [25].

A study involving 81 children in Turkey reported abnormal laboratory findings as follows: increased lactate dehydrogenase (17.2%), C-reactive protein (16%), D-dimer (12.3%), and decreased lymphocytes (2.5%), leucopenia (5%). CT revealed consolidation in three (4%) patients and ground-glass opacities in three (4%) patients [26]. In this study the results were nearly similar, Lymphocyte less than (1·10⁹/L) in eight (14.2%) patients LDH levels were elevated in 28 (58.3%) of 48 patients, serum ferritin levels

were increased in 12 (27.3%) of 44 patients. CRP results for 52 patients were abnormal in 24 (46.1%) patients. It is clear that the percentage of patients having abnormal LDH and CRP is higher in our study which involves the infected children with surgical diseases. The percentage of lymphopenia and the radiological chest findings were nearly similar in a study carried out in Taiwan [27]. We found that 37.5% of the CT scan reports revealed ground-glass opacities. Xiaoxia Lu et al. reported ground-glass opacities in 32.7% of 171 children with COVID-19 [28]. Abdominal CT scans have been done for two patients which confirms the diagnosis of an appendicular abscess.

The management of the twenty acute appendicitis cases was appendectomy in ten cases, ultrasound-guided aspiration of the two appendicular abscess cases, and conservative management of the eight remaining cases with good response to treatment. Seven of the ten appendectomies have been done before the confirmation of COVID-19 infection by the PCR. We encourage the conservative management of acute appendicitis in the era of the COVID-19 particularly patients with confirmed infection, the benefits of conservative management are to avoid the complications of the surgery and to decrease the risk of COVID 19 infection of the surgical team. C. Rico Espiñeira et al. recommend conservative management of acute appendicitis in children with COVID-19 infection if there is a poor general condition or the patients hemodynamically unstable [24].

The initial treatment was by empirical antibiotics and other supportive treatment, Antiviral (Remdesivir) used in twelve (21.4%) patients only. The Mortality rate was zero.

Conclusions

COVID-19 needed to be excluded in every child with abdominal pain particularly in the presence of household contact. Gastrointestinal symptoms may be the only presentation of COVID-19. Laboratory findings were similar to other studies with no specific findings for COVID-19. Lymphopenia and elevated LDH seem to be correlated with the disease and more investigation is required to confirm the infection. Ultrasound examination has an important role in the diagnosis of several surgical diseases, particularly acute appendicitis. Conservative management of acute appendicitis may be the option of choice in the COVID-19 era. COVID-19 in children with gastrointestinal symptoms had a good prognosis. A good medical history record and a comprehensive physical examination, as well as relevant laboratory and imaging tests, are required to achieve an accurate diagnosis of COVID-19.

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