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Analytical Study of COVID 19 in Pediatrics

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Abstract

Background: The current corona virus disease 2019 (COVID-19) pneumonia pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has become a major global health threat. Since its first identification in Wuhan, China, in December 2019, COVID-19 has spread globally at an accelerated rate with rapid increases in cases and mortality.

Aim of Study: Study and analyze the COVID-19-positive and suspected children regarding the patient's clinical, laboratory, diagnostic, course and treatment outcome data.

Material and Methods: Combined retrospective and prospective study was conducted at, Minia General Hospital, Mallawy isolation hospital, Mallawy Chest Hospital and Assiut Al-Azhar University Hospital and Minia University Hospital from April 2020 until October 2021. A total of 117 admitted or outpatient COVID-19 confirmed or suspected pediatric children were enrolled.

Results: Age ranged from 0.05 to 18 years with a mean of 9.05±6.06 years, and the age groups from (0-6) years were 42 (35.89%), from (7-12) years were 27 (23.1%) and more than 12 years 48 (41.01). There were 72 (61.54%) males and 45 (38.46%) females. 110 (94%) patients had fever. 109 (93.2%) had running nose. 82 (70%) had sore throat, 111 (95.9%) had cough 33 (28.2%) had diarrhea. 66 (56.4%) of the studied patients were moderate cases, 20 (17.1%) were mild, 24 (20.5%) were Severe and 7 (5.98%) were critical. 2 (1.7%) of the studied patients were asthmatic. Regarding cardiac complications, 1 (0.9) had impending heart failure, 2 (1.7%) arrested while 1 (0.9%) had cardiac thrombosis. Regarding chest CT, 12 (10.3%) had CO-RAD 1 (normal) CT, 1 (0.9%) had CO-RAD 2 (low suspicious) s, 3 (2.6%) had CO-RAD 4 (highly suspicious), 11 (9.4%) had CO-RAD 5 (very high suspicious), 40 (34.2) had CORAD 6 (PCR positive) while chest CT wasn't done on 50 (42.7%) of the studied patients. 113 (96.6%) had antipyretics (Paracetamol). Regarding anticoagulants, 15 (12.8%) had Clexane, 1 (0.85%) had Heparin and 3 (2.6%) had Aspirin.

Conclusions: Finally we could conclude that, COVID-19 infection is not uncommon in pediatric patients and most of them are moderate and it presents as either primary, MIS-C, and Kawasaki disease like symptoms, CT chest is highly sensitive in diagnosis of COVID-19 in comparison with X-ray. Most common symptom are fever and cough, Sore throat, runny nose and anosmia. D-dimer high level associated with long stay at hospital. We found that most of the deaths and ICU outcomes related to MIS-C presentation and associated comorbidities. Decreased mortality rate in our study 1.7%, and this is an evidence of the success of the Egyptian protocol in management of COVID-19 cases. Many cases the first presentation is not related to the respiratory system as DKA, seizures, jaundice, so during disease outbreak any symptom is consider COVID-19 until proven otherwise.

Key Words: *COVID 19 – Paediatrics.*

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Introduction

THE current corona virus disease 2019 (COVID-19) pneumonia pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has become a major global health threat. Since its first identification in Wuhan, China, in December 2019, COVID-19 has spread globally at an accelerated rate with rapid increases in cases and mortality **[1]**.

In less than three months, the global number of confirmed COVID-19 cases increases more than seventy times. That infection rate, scary as it sounds, hides just how much the out-of-control virus has spread, especially in the hardest-hit **[2]**.

The first COVID-19 confirmed case in Egypt was announced by the Ministry of Health and Population (MoHP) on February 14, 2020 **[3]**.

In children, the first positive COVID-19 case was reported on January 20, 2020, in China **[4]**.

Infection with SARS-CoV-2 in children is less common than in adults, and often they have a mild form of the disease and a lower mortality rate; children account for an estimated 1 to 5% of patients diagnosed with COVID-19 **[5]**.

Studies conducted on the Chinese population helped confirm that the most common source for the infection in children was the exposure to an infected household family member [6].

The clinical manifestations of COVID-19 in children are similar to other viral respiratory tract infections, namely, fever, cough, shortness of breath, sore throat, diarrhea, nausea, vomiting, anorexia, and myalgia [7].

Some studies also reported that many confirmed COVID-19 children are asymptomatic at presentation [8].

Severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) infections may result in the multisystem inflammatory syndrome in children (MIS-C). The clinical presentation of MIS-C includes fever, severe illness, and the involvement of two or more organ systems, in combination with laboratory evidence of inflammation and laboratory or epidemiologic evidence of SARS-CoV-2 infection. Some features of MIS-C resemble Kawasaki Disease, toxic shock syndrome, and secondary hemophagocytic lymphohistiocytosis/macrophage activation syndrome [9].

About one-fifth of all infected patients progress to this stage of disease and develop severe symptoms. The virus invades and enters the type 2 alveolar epithelial cells via the host receptor ACE-2 and starts to undergo replication to produce more viral Nucleocapsids. The virus-laden pneumocytes now release many different cytokines and inflammatory markers such as interleukins (IL-1, IL-6, IL-8, IL-120 and IL-12), tumour necrosis factor-α (TNF-α), IFN-γ and IFN-β, CXCL-10, monocyte chemoattractant protein-1 (MCP-1) and macrophage inflammatory protein-1 α (MIP-1 α). This 'cytokine storm' acts as a chemoattractant for neutrophils, CD4 helper T cells and CD8 cytotoxic T cells, which then begin to get sequestered in the lung tissue. These cells are responsible for fighting off the virus, but in doing so are responsible for the subsequent inflammation and lung injury. The host cell undergoes apoptosis with the release of new viral particles, which then infect the adjacent type 2 alveolar epithelial cells in the same manner. Due to the persistent injury caused by the sequestered inflammatory cells and viral replication leading to loss of both type 1 and type 2 pneumocytes, there is diffuse alveolar damage eventually culminating in an acute respiratory distress syndrome [10,11].

Diagnosis can be confirmed by Reverse transcriptase-Polymerase chain reaction (RT-PCR) on respiratory specimen (commonly nasopharyngeal and oropharyngeal swab). In mechanically ventilated children, bronchoalveolar lavage (BAL) or endotracheal aspirate would be the preferred specimen [11].

CT changes observed in children infected with SARS-CoV-2 include bilateral multiple patchy, nodular ground-glass opacities, speckled ground-glass opacities and/or infiltrating shadows in the middle and outer zone of the lung or under the pleura. These findings are unspecific and milder compared with those in adults [12].

Management is mainly supportive care including sufficient fluid and calories intake, and additional oxygen supplementation. Many drugs still under trial; Hydroxychloroquine, ivermectin, remdesivir proved to be effective as anti-viral drugs, Corticosteroids may reduce mortality for patients with COVID-19 and ARDS. For patients with severe COVID-19 but without ARDS, evidence regarding benefit from different bodies of evidence is inconsistent and of very low quality, Leukotrienes and their receptors they are lipid mediators of inflammation and tissue damage, thus, use of specific drugs should be under medical and regulatory supervision to establish safety and efficacy [13].

The Pfizer vaccine can be safely administered to children from 5 years of age. Both Moderna and Pfizer vaccines are licensed for use in children from 12 years of age. Vaccine trials for the use of other COVID-19 vaccines in children and adolescents are ongoing and WHO will update its recommendations when the evidence or epidemiological situation justifies a change in policy. Children and adolescents above 5 years of age with comorbidities that put them at significantly higher risk of serious COVID-19 may be offered vaccination alongside other high priority groups. However, WHO recommends that countries should vaccinate healthy children only when high vaccine coverage with two doses has been achieved in higher priority-use groups, as identified in the WHO Prioritization Roadmap [14].

Patients and Methods

A Combined retrospective and prospective study Summed all COVID-19 confirmed or suspected pediatric cases at Minia General Hospital, Mallawy isolation hospital, Mallawy Chest Hospital and Assiut Al-Azhar University Hospital and Minia University Hospital and outpatient from April 2020 until October 2021.

Inclusion criteria:

Children aged 1 day-18 years with laboratory-confirmed COVID-19 by reverse transcription polymerase chain reaction (RT-PCR) or Computerized tomography of the chest (CT) or suspected by complete blood picture or c-reactive protein or D-dimer or Ferritin were admitted to those hospitals and outpatient clinics in the period between April 2020, and October 2021.

Exclusion criteria:

Children aged > 18 years old with respiratory, metabolic, endocrine or blood diseases diseases.

Methods:

The following patient characteristics were evaluated: Demographic data, medical history, clinical manifestations, laboratory data, radiological characteristics, drugs that were given during the illness, and the outcome of the disease. These data were obtained from the patient's medical record. For the epidemiological history, we focused on travel and vaccination history, residence in epidemic areas or areas with clusters and outbreak, and history of contact with confirmed COVID-19 patients within the past 14 days. According to the Egyptian protocol for the treatment of COVID-19 and its updated versions thereof was declared by the supreme scientific committee for management of COVID-19 (affiliated to Ministry of health and population), nasopharyngeal swab samples were collected by a trained laboratory technician from patients with suspected SARS-CoV-2 infection; the samples then were processed for RNA extraction and those who tested positive for COVID-19 were admitted and started treatment. On day 5 of admission, repetition of the PCR samples was done to check for viral clearance. Patients were considered cured if they became clinically cured after testing negative for the infection after two consecutive PCR tests. Laboratory tests included complete blood count, serum biochemical tests, liver and kidney functions and coagulation profile. Radiological investigations included chest X-ray and chest computed tomography (CT) scans. Treatment of the patients was performed according to Egyptian treatment protocol for children. For the clinical outcomes, the patient was declared cured when the symptoms of the infection were absent for at least 3 consecutive days without taking antipyretics and fulfilling two consecutive negative results of RT-PCR with a 48-hour interval. On the other hand, negative outcomes were referred to as disease progression to critical illness or, at worse, death. Only patients who achieved cured outcomes were discharged from the hospital.

Results

Table (1): Demographic data of the studied patients.

		N=117
Age (years)	Mean ± SD	9.05±6.06
	Range	0.05-18
Age groups	From (0-6) years	42 (35.89%)
	From (7-12) years	27 (23.1%)
	More than 12 years	48 (41.01%)
Sex	Male	72 (61.54%)
	Female	45 (38.46%)
Residence	Urban	61 (52.1%)
	Rural	56 (47.9%)

Table (2): Clinical signs of the studied patients.

	N=117
Fever	110 (94%)
Running nose	109 (93.2%)
Cough:	
Dry cough	19 (16.2%)
Productive cough	92 (78.6%)
Total	111 (95.9%)
Shortness of breath	99 (84.6%)
Anorexia	116 (99.1%)
Vomiting	35 (29.9%)
Diarrhea	33 (28.2%)
Level of consciousness:	
Alert	115 (98.3%)
DCL	1 (0.9%)
Drowsiness	1 (0.9%)
Rash:	
Face and trunk	1 (0.9%)
All over the body	1 (0.9%)
Total	2 (1.7%)
Anosmia	67 (57.3%)
Sore throat	82 (70%)
Conjunctivitis	10 (8.5%)
Neck lymphadenopathy	10 (8.5%)

Table (3): Oxygen saturation, respiratory rate and MAP of the studied patients.

		N=117
Oxygen saturation (%):		
- Children not received O2 (86 case 73%)	Mean ± SD	96±1.1
	Range	94±99
- Children need O2 therapy (24 case)- (17%) (Sat before O2)	Mean ± SD	86.4±1.4
	Range	85-90
- Children need O2 therapy (24 case)- (17%) (Sat after O2)	Mean ± SD	95.7±1.2
	Range	94-99
- Ventilated children saturation 7 case 6% (before vent)	Mean ± SD	61.3±14.6
	Range	40-80
- Ventilated children saturation 7 case (after vent)	Mean ± SD	90.8±6.8
	Range	75-95

Table (4): Severity of the studied patients.

	N=117
Severity:	
Moderate	66 (56.4%)
Mild	20 (17.1%)
Severe	24 (20.5%)
Critical	7 (5.98%)

Table (5): Complications of the studied patients.

	N=117
Asthma exacerbation	2 (1.7%)
Cardiac complications:	
Impending heart failure	1 (0.9)
Arrested	2 (1.7%)
Atrial Thrombosis	1 (0.9%)
Mitral regurge	1 (0.9%)
Total	5 (4.3%)
Neurological complications:	
Headache	54 (47.9%)
Drowsiness	1 (0.9%)
DCL	1 (0.9%)
Total	56 (47%)
Diabetic ketoacidosis (first presentation)	8 (6.8%)
Hepatic complications:	
Jaundice	2 (1.7%)
Hepatosplenomegaly	2 (1.7%)
Hepatic encephalopathy	1 (0.9%)
Hematological complications:	
Mild thrombocytopenia	1 (0.9%)
Pancytopenia	1 (0.9%)
Total	2 (1.7%)
Lymphadenopathy:	
Cervical	10 (8.5%)
Generalized	6 (5.1%)
Total	16 (13.7%)

Table (6): Laboratory investigation of the studied patients.

	N=117
Hb (gm/dL):	
Mean ± SD	11.67±1.78
Range	6.5-16
*Lymphocytes (*10 ^{3} cells/ml):*	
Mean ± SD	19.91±11.93
Range	5-69
*Neutrophil (*10^3 cells/ml):*	
Mean ± SD	55.56±9.50
Range	23-83
*Total leukocyte count (*10 ^{3} cells/ml):*	
Mean ± SD	3.86±1.81
Range	1.8-11

Table (6): Count.

	N=117
*PLT (*10^3 cells/ml):*	
Mean ± SD	259.03±69.75
Range	63-445
CRP (mg/L):	
Mean ± SD	54.97±37.67
Range	3-190
D-dimer:	
Mean ± SD	0.48±0.40
Range	0.3-4
PCR:	
Not done	77 (65.8%)
Positive	40 (34.2%)
Serum ferritin (mg/L):	
Mean ± SD	165.10±33.70
Range	58.6-250
Urea (mmol/L):	
Mean ± SD	30.09±22.54
Range	20-150
Creatinine (mg/dL):	
Mean ± SD	0.91±0.90
Range	0.5-7

Table (7): Other laboratory findings of the studied patients.

	N=117
Monocyte count of 30%	1 (0.9%)
Elevated SGOT, SGPT and bilirubin	1 (0.9%)
Elevated SGOT, SGPT, bilirubin and ammonia	1 (0.9%)
Elevated Rbs then became normal	1 (0.9%)

Table (8): Chest CT and ECHO of the studied patients.

	N=117
Chest CT:	
Not done	50 (42.7%)
CO-RAD 1 (normal)	12 (10.3%)
CO-RAD 2 (low suspicious)	1 (0.9%)
CO-RAD 4 (highly suspicious) Abnormalities suspicious for COVID-19	3 (2.6%)
CO-RAD 5 (very high suspicious) Typical COVID 19 finding	11(9.4%)
CO-RAD 6 (PCR positive)	40 (34.2)
X-ray:	
Not done	112 (95.7%)
Consolidation opacities	4 (3.4%)
Consolidation opacities with pneumothorax	1 (.9%)
ECHO:	
Not done	110 (94%)
Mitral regurgitation	1 (0.9%)
Thrombosis	1 (0.9%)
CHD	3 (2.6%)
ASD- PFO	2 (1.7%)

Table (9): Abdominal ultrasound of the studied patients.

	N=117
Abdominal ultrasound:	
Not done	41 (35%)
Normal	66 (56.4%)
Chronic kidney disease	8 (6.8%)
Hepatosplenomegaly	2 (1.7%)

Table (10): Chest examination of the studied patient.

		N=117
Inspection:		
Shape	Normal shape	114 (97.4%)
	Barrel shaped (known asthmatic)	2 (1.7%)
	Unilateral bulge (complicated pneumothorax ventilated case)	1 (0.9%)
Respiratory movement	Limited unilateral	1 (0.9%)
	Limited bilateral (asthma)	2 (1.7%)
Retraction	Intercostal retraction	20 (17%)
Palpation:		
Position of mediastinum	Shifted to opposite site (pneumothorax)	1 (0.9%)
Respiratory movement	Limited unilateral	1 (0.9%)
	Limited bilateral	2 (1.7%)
Palpabl rhonchi		19 (16.2%)
Chest wall tenderness		15 (12.8)
Percussion:		
Hyperresonant (pneumothorax)		1 (0.9 %)
Resonant		81 (69%)
Dull (patchy)		35 (29.9%)
Auscultation:		
Air entry	Decreased (pneumonia)	78 (67.9%)
	Normal air entry (sinusitis, bronchitis)	39 (33%)
Type of breathing	Bronchial	87 (74.35%)
	Vesicular	28 (23.9%)
	Harsh vesiclar	2 (1.7%)
Adventious sound	Wheezes	19 (16.2%)
	Crepitation	85 (72.6%)

Table (11): Antipyretics, anticoagulants and steroids of the studied patients.

Antipyretics (Paracetamol)	113 (96.6%)
Anticoagulants:	
Clexane	15 (12.8%)
Heparin	1 (0.85%)
Aspirin	3 (2.6%)
Total	19 (16.2%)
Steroids:	
Inhalation	10 (8.5%)
Oral	19 (16.2%)
Oral and inhalation	9 (7.7%)
Hydrocortisone	5 (4.3%)
Methylprednisolone	7 (6%)
Dexamethasone	22 (18.8%)
Total	72 (61.5%)

Table (12): Antivirals and antibiotics of the studied patients.

Antiviral Acyclovir, Ivermectin:	
Oseltamivir	1 (0.9%)
Remdesivir	23 (19.7%)
Acyclovir	6 (5.1%)
Antibiotics:	
Azithromycin	3 (2.6%)
2nd generation cephalosporin	114 (97.4%)
3rd generation cephalosporin	1 (0.9%)
4th generation cephalosporin	30 (25.6%)
Vanc, 3rd gen cephalosporin (Combination in PICU)	5 (4.3%)
Vanc, Meropenem (Combination in PICU)	16 (13.7%)
Vanc, Gentamicin (Combination in PICU)	1 (0.9%)
Amikacin, 3rd gen cephalosporin (Combination in PICU)	1 (0.9%) 2 (1.7%)
Ampicillin, 3rd gen cephalosporin (Combination in PICU)	3 (2.6%)

Table (13): Other drugs of the studied patients.

	N=117
Ondansetron	35 (29.9%)
Bronchodilator	25 (21.4%)
Lactoferrin	23 (19.7%)
Ursofalk	1 (0.9%)
Diuretics	2 (1.7%)
IV fluids	35 (29.9%)
IV IG	1 (0.9%)
Insulin	8 (6.8%)
Mg sulphate	6 (5.1%)
Dopamine	1 (0.9%)
Dobutamine	1 (0.9%)

Table (14): Vitamins of the studied patients.

	N=117
Zinc	92 (78.6%)
Vitamin C	92 (78.6%)
Vitamin D	92 (78.6%)

Table (15): Respiratory support of the studied patients.

Respiratory support:	
Oxygen therapy	24 (20.51%)
Mechanical ventilation	7 (6 %)
Total	31 (26.5%)

Table (16): Finding of the studied patients.

	N=117
Pneumonia	70 (59.8%)
Bronchitis as 1 st then pneumona	27 (23.1%)
Cardiac presentation (in form of intra atrial thrombosis)	1 (0.9%)
GIT manifestation (vomiting and diarrhea 30 case (25.6%) (vomiting only 5 case 4.2%) (Diarrhea only 3 case 2.6%)	38 (32.5%)
MIS-C:	
GIT and pulmonary	38 (32.5%)
Pulmonary, hepatic and cardiac	1 (0.9%)

Table (17): Hospital duration, PICU admission and mortality incidence of the studied patients.

	N=117
Longest duration at hospital (days)	45
PICU admission	25 (21.4%)
Hospital isolation department	28 (23.9%)
Out patient	64 (54.7%)
Mortality	2 (1.7%)

Table (18): Course of disease and outcome of the studied patients.

	N=117
Longest duration at hospital (days)	45
PICU admission	25 (21.4%)
Hospital isolation department	28 (23.9%)
Out patient	64 (54.7%)
Mortality	2 (1.7%)

Discussion

In the current study we found, regarding demographic data of the studied patients, age ranged from 0.05 to 18 years with a mean of 9.05 6.06 years, and the age group from (0-6) years was (35.89%), from (7-12) years was (23.1%) decreased number in this group may be due to mild symptoms and so didn't seek medical advice and more than 12 years (41.01 %). There were 72 (61.54%) males and 45 (38.46%) females. Regarding address, 61 (52.1%) lived in urban areas and 56 (47.9%) lived in rural areas.

In comparison with Bai et al., **[16]** stated that among the 25 cases, 14 were males and 11 were females. The median age was 11.0 (6.3-14.5) years (range 0.6-17.0 years). All children were related to a family cluster outbreak, and 7 children (28%) with a travel or residence history in Hubei Province **[16]**.

In comparison with Shekerdemian et al., **[17]** stated that of the 48 children with COVID-19 admitted to participating PICUs, 25 (52%) were male, and the median (range) age was 13 (4.2-16.6) years.

In disagreement with our study Ahmed et al., **[22]** stated that included 27 children with COVID-19 infection. The median age of our patients was 9 months (2 m-12 years).

In the current study we found, regarding clinical signs of the studied patients, most common symptoms 110 (94%) patients had fever. 109 (93.2%) had running nose. Regarding cough, 19 (16.2%) had dry cough while 92 (78.6%) had productive cough. 99 (84.6%) had shortness of breath. 116 (99.1%) had anorexia. 35 (29.9%) had vomiting. 33 (28.2%) had diarrhea. Regarding level of consciousness, 115 (98.3%) were alert, 1 (0.9%) had DCL while 1 (0.9%) had drowsiness. 1 (0.9%) had rash in face and trunk while 1 (0.9%) had rash all over the body. 15 (12.8%) had anosmia. 82 (70%) had sore throat. 10 (8.5%) had conjunctivitis. 10 (8.5%) had neck lymphadenopathy.

In agreement with our result Bai et al., **[16]** study show, The most common symptoms were cough (13 cases, 52%) and fever (6 cases, 24%).

Ahmed et al., **[16]** also agree with our result as showed Fever, respiratory, and gastrointestinal (GIT) symptoms were predominant presenting symptoms in our patients. Comorbidity was reported in 59.3.

Saleh et al., **[21]** also agree with our result, twenty-nine (67.4%) were symptomatic at presentation, with fever being the most common symptom (n=23, 53.5%), followed by respiratory (n=5, 11.6%) and gastrointestinal symptoms (n=3, 7%) **[21]**.

Also, Wang et al., **[18]** agree with our results that among the children with severe symptoms that reported symptom clearly, 9 children have comorbidity, 10 children have gastrointestinal symptoms and 4 children have concurrent infection. Only two children were dead that has been reported in our included studies (46,65). The main symptoms were fever [48% (95% CI: 39%, 56%)], cough [39% (95% CI: 30%, 48%)]. Thirty percent (95% CI: 18%, 42%) of children had both cough and fever. Seven percent (95% CI: 5%, 9%) and 6% (95% CI: 4%, 9%) of cases had diarrhea and nausea/vomiting. The proportion of children with more than one symptom was 35% (95% CI: 21%, 48%), and 19% (95% CI: 14%, 23%) of all children were asymptomatic.

In comparison with Qi et al., study conclude that among fever (48.5%, 95% CI: 41.4-55.6%) and cough (40.6%, 95% CI: 33.9%-47.5%) were the most common symptoms this in agree with our study, almost all studies have counted these 2 symptoms. Runny nose (11.0%, 95% CI: 6.9%-15.8%), headache (9.2%, 95% CI: 4.1%-15.7%), sore throat (6.8%, 95% CI: 2.8%-12.0%) were reported in 16, 13, and 23 studies, respectively. Other symptoms are relatively rare and few studies have been reported.

In the current study we found, respiratory rate ranged from 25 to 88 breaths per minute with a mean of 41.14± 17.4 breaths per minute at age group from (0-6) years, respiratory rate ranged from 25 to 50 breaths per minute with a mean of 32.4±6.7 breaths per minute at age group from (7-12) years, respiratory rate ranged from 23 to 86 breaths per minute with a mean of 29.79 ±9.6 breaths per minute at age group from 7-12) years. Regarding MAP ranged from 50 to 100 (mmHg) with a mean of 84.26±7.38 (mmHg).

Regarding chest examination, 115 (98%) had normal shape, 2 (1.7%) had barrel shaped, 1 (0.9%) had unilateral bulge, 1 (0.9%) had limited movement unilateral, 2 (1.7%) had limited movement bilateral, 25 (21.4%) had retraction, 24 (20.51%) had cyanosis, 1 (0.9%) had shifted mediastinum to opposite side, 19 (16.2%) had palpable rhonchi, 15 (12.8) had chest wall tenderness, 81 (69%) had resonant chest in percussion, 1 (0.9 %) had hyper resonant chest in percussion, 35 (29.9%) had dull in percussion, 78 (67.9%) had decreased air entry, 39 (33%) had normal air entry, 19 (16.2%) had wheezy chest auscultation, 85 (72.6%) had crepitation.

In the current study we found that regarding respiratory support, 24 (20.5%) of the studied patients had oxygen therapy and 7 (6%) had mechanical ventilation. Regarding different finding 70 (59.8%) of the studied patients had Pneumonia, 27 (23.1 %) had bronchitis as 1st then pneumonia, 1 (0.9%) had cardiac presentation (in form of thrombosis) and, 38 (32.5%) had GIT manifestation. 39 (33.3%) had MIS-C presentations as follow, 38 (32.5%) had both GIT and pulmonary signs while 1 (0.9%) had Pulmonary, hepatic and cardiac signs, regarding comorbidities 10 (8.6%) have comorbidities as follow, 2 (1.7%) had bronchial asthma, 3 (2.6%) had congenital heart, 8 (6.8%) had chronic renal failure, 1 (0.9%) had osteogenesis imperfecta.

In comparsion with our study Shekerdemian et al., **[17]** stated that Forty patients (83%) had significant preexisting comorbidities; 35 (73%) presented with respiratory symptoms and 18 (38%) required invasive ventilation. Eleven patients (23%) had failure of 2 or more organ systems. Extracorporeal membrane oxygenation was required for 1 patient (2%).

Also Wang et al., **[16]** stated that concluded that among the children with severe symptoms that reported symptom clearly, 9 children have comorbidity, 10 children have gastrointestinal symptoms and 4 children have concurrent infection.

In the current study we found that regarding severity of disease, 66 (56.4%) of the studied patients were moderate cases, 20 (17.1%) were mild, 24 (20.5%) were Severe and 7 (5.98%) were critical.

In disagreement with our results Bai et al., **[16]** showed that according to the results 8 (32%) asymptomatic, 4 (16%) very mild cases and 13 (52%) common cases. No severe or critical cases were identified.

In comparison with our study Wang et al., **[18]** show ninety-four percent (95% CI: 90%, 98%) of children were mild cases and 3% (95% CI: 2%, 4%) were severe case.

Also Qi et al., **[19]** stated that Asymptomatic infection and severe cases, respectively, accounted for 27.7% (95% CI: 19.7%-36.4%) and 1.1% (95% CI: 0%-2.9%) of patients.

In the currret study we found that complication were, 2 (1.7) of the studied patients had asthma exacerbation. Regarding complications, 2 (1.7%) of the studied patients were asthma exacerbation. Regarding cardiac complications, 1 (0.9%) had impending heart failure, 2 (1.7%) arrested, 1 (0.9) had mitral regurg-itation while 1 (0.9%) had atrial thrombosis. Regarding neurological complications, 54 (46.2%) had headache, 1 (0.9%) had drowsiness and 1 (0.9%) had DCL. 8 (6.8%) had diabetic ketoacidosis (first presentation). 2 (1.7%) had jaundice, 2 (1.7%) had hepatosplenomegaly and 1 (0.9%) had hepatic encephalopathy. Regarding hematological complications, had mild thrombocytopenia while 1 (0.9%) had pancytopenia. 10 (8.5%) had cervical lymphadenopathy while 6 (5.1%) had generalized lymphad-enopathy.

In agreement with our study Ahmed et al., showed that The multisystem inflammatory syndrome was reported in 33% of patients with GIT symptoms were the most frequent presenting symptoms. Myocarditis was reported in 22% of patients.

The mortality rate in this cohort was 14.8%. On multivariate analysis, the only predictor of mortality was the development of MIS-C.

In comparison with our study Saleh et al., In this cohort of patients with age <14 years, hypertension, respiratory symptoms and ABO group-A were significantly associated with pediatric intensive care unit (PICU) admission during the course of treatment. Patients with elevated FVIII and fibrinogen levels at presentation were more likely to have an extended length of hospital stay (LOS) (*p*-value =0.036 and 0.032 respectively). No thrombotic event was observed in our cohort.

In the current study we found that Hb ranged from 6.5 to 16 (gm/dL) with a mean of 11.67 ± 1.78 (gm/dL). Lymphocytes ranged from 5 to 69 (* 10^3 cells/ml) with a mean of 19.91 ± 11.93 (* 10^3 cells/ml) (86%) of cases had lymphopeina, while 6% of cases had lymphocytosis. Neutrophil ranged from 23 to 83 (*10^3 cells/ml) with a mean of 55.56±9.50 (*10^3 cells/ml), Total leukocyte count ranged from 2.6 to 16 (* 10^3 cells/ml) with a mean of 7.45±2.7 (*10^3 cells/ml) 0.03% cases had decreased level of leukocyte and (1 1%) of cases had elevated leukocytic count . PLT ranged from 63 to 445 (* 10^3 cells/ml) with a mean of 259.03±69.75 (* 10^3 cells/ml). CRP ranged from 3 to 190 (mg/L) with a mean of 54.97±37.67 (mg/L). D-dimer ranged from 0.3 to 4 with a mean of 0.48±0.40. PCR was positive in 40 (34.2%) of the studied patients while PCR wasn't done in 77 (65.8%). Serum ferritin ranged from 58.6 to 250 (mg/L) with a mean of 165.10±33.70 (mg/L). Urea ranged from 20 to 150 (mmol/L) with a mean of 30.09 ± 22.54 (mmol/L). Creatinine ranged from 0.5 to 7 (mg/dL) with a mean of 0.91 ±0.90 (mg/dL). 1 (0.9%) of the studied patients had monocyte count of 30%. 2 (1.7%) had elevated SGOT, SGPT and bilirubin. 1 (0.9%) had elevated SGOT, SGPT, bilirubin and ammonia. 1 (0.9%) had elevated random blood sugar then became normal.

In consistent to our result Bai et al., **[16]** showed In the 25 cases, on admission, 21 cases (84%) had normal white blood cell counts, while only 2 cases (8%) more than 10 x 10^9/L and 2 cases (8%) less than 4 x 10^9/L, respectively; 22 cases(88%) had normal CD4+ T lymphocyte counts, while in the remaining 3 cases (8%) this increased mildly; 23 cases had normal CD8+ T lymphocyte counts, while in the remaining 2 cases (8%) CD8+ T lymphocyte counts were mildly increased as well. All Lymphocyte counts were normal.

In consistent to our result Wang et al., **[18]** reported that seventeen case series reported the results of routine blood tests. The mean leucocyte count in children was 6.25_109/L (95% CI: 5.97, 6.54). Fifteen percent (95% CI: 4%, 26%) of cases had leucocyte count above the normal range and 28% (95% CI: 17%, 38%) of cases below the normal range. The mean lymphocyte count in children was 2.84x10^9/L (95% CI: 2.55, 3.13). Lymphocyte count was elevated in 41% (95% CI: 2%, 80%) and below normal in 15% (95% CI: 8%, 22%) of children. Eighteen case series reported the results of blood biochemistry tests. The mean value of ALT was 20.46U/L (95% CI: 14.51, 26.41), and 11% (95% CI: 8%, 14%) of cases had elevated ALT values. The mean value of aspartate aminotransferase (AST) was 32.04 U/L (95% CI: 30.25, 33.83), and 15% (95% CI: 9%, 21%) of cases had elevated AST values. The mean value of C-reactive protein (CRP) was 5.05mg/L (95% CI: 1.86, 8.24), and CRP was elevated in 22% (95% CI: 15%, 28%) of the children. Nine case series reported coagulation function test, the mean value of D-dimer was 0.33mg/L (95% CI: 0.17, 0.49) in studies of children with COVID-19. Fifteen percent (95% CI: 7%, 22%) of cases above the normal range of D-dimer value.

In consistent to our result Ma et al., showed eight (16%) patients had lymphopenia, seven (14%) with thrombocytopenia, four (8%) with lymphocytosis, two (4%) with thrombocytosis, ten (20%) with elevated C-reactive protein, four (8%) with hemoglobin above, and six (12%) with below standard reference values.

In disagreement with our study Qi et al., **[19]** stated that among only 5.5% (95% CI: 2.8%-8.9%) of children with COVID-19 showed lymphopenia in laboratory tests, which is very common in adult COVID-19. The pooled prevalence of leukopenia in pediatric COVID-19 patients was estimated to be 7.3% (95%CI: 3.4-12.2%), while the corresponding values for high C-reactive protein level, high LDH level, high creatine kinase MB level, high AST level, and high erythrocyte sedimentation rate were 14.0% (95% CI: 6.8%-22.8%), 17.4% (95% CI: 7.8%-29.3%), 43% (95% CI: 25.4%-61.5%), 12.3% (95% CI: 7.5%-17.8%), and 29.7% (95% CI: 10.0%-53.3%), respectively. Abnormal results in laboratory tests for COVID-19 in children were not as common as those in adults.

In current study we found that chest CT, 12 (10.3%) had CO-RAD 1 (normal) CT, 1 (0.9%) had CO-RAD 2 (low suspicious) s, 3 (2.6%) had CO-RAD 4 (highly suspicious), 11 (9.4%) had CO-RAD 5 (very high suspicious), 40 (34.2) had CORAD 6 (PCR positive)while chest CT wasn't

done on 50 (42.7%) of the studied patients. Regarding chest X-ray, 50 (42.7%) had different types of opacities, 1 (.9%) had consolidation opacity with pneumo-thorax, 59 (50.4%) had normal x-ray, 3 (2.6%) show cardiomegally, while chest X-ray wasn't done on 7 (6%).Regarding ECHO, 1 (0.9%) had mitral regurgitation, 1 (0.9%) had atrial thrombosis, 3 (2.6%) had CHD, 2 (1.7%) had ASD-PFO while ECHO wasn't done on 110 (94%) of the studied patients. abdominal ultrasound, 66 (56.4%) had normal ultrasound, 8 (6.8%) had chronic kidney disease, 2 (1.7%) had hepatosplenomegaly while abdominal ultrasound wasn't done on 41 (35%) of the studied patients.

In comparison with Ma et al., **[20]** reported that there were a few differences between COVID-19 children and COVID-19 adults in terms of laboratory findings and CT characteristics. CT is a powerful tool to detect and characterize COVID-19 pneumonia but has little utility in evaluating clinical recovery for children. These results oppose current COVID-19 hospital discharge criteria in China, as one requirement is that pulmonary imaging must show significant lesion absorption prior to discharge. These differences between pediatric and adult cases of COVID-19 may necessitate pediatric-specific discharge criteria, Seven (14%) of the 50 had no radiologic evidence of disease on chest CT. For the 43 patients who had abnormal CT findings, in addition to previously reported patterns of ground-glass opacity (67%), local patchy shadowing (37%), local bilateral patchy shadowing (21 %), and lesion location of lower lobes (65%), other CT features include that an overwhelming number of pediatric patients had lesions in the subpleural area (95%) and 22 of the 28 lower lobe lesions were in the posterior segment (78%). Lesions in most of the 15 patients (67%) who received chest CT at discharge were not completely absorbed, and 26% of these pediatric patients had CT lesions that were either unchanged or worse Ma et al., **[20]**.

In agreement with our study Wang et al., **[18]** reported that Forty-two studies reported the imaging features of children with COVID-19, including 19 case series and 23 case reports. Sixty-six percent (95% CI: 55%, 77%) had abnormal imaging. Thirty-five percent (95% CI: 26%, 44%) of children had ground-glass opacity.

In comparison with our study Qi et al., **[19]** stated that about 36.0% (95% CI: 27.7-44.7%) of the pediatric COVID-19 patients did not show abnormal imaging findings. Among patients with abnormal imaging findings, unilateral lesions, bilateral lesions, and ground-glass opacity accounted for 29.4% (95% CI: 24.8%-34.3%), 24.7% (95% CI: 18.2%- 31.6%) and 32.9% (95% CI: 25.3%-40.9%), of the cases.

In agreement with our study Ahmed et al., **[22]** stated the most frequent radiological findings were ground glass opacities in 100% of patients and bilateral findings in 96%, while cardiomegaly was found in 44% of patients.

In the current study we found that 113 (96.6%) had antipyretics (Paracetamol). Regarding anticoagulants, 15 (12.8%) had Clexane, 1 (0.85%) had Heparin and 3 (2.6%) had Aspirin. Regarding Steroids, 10 (8.5%) had inhalation steroids, 19 (16.2%) had oral, 9 (7.7%) had both oral and inhalation, 5 (4.3%) had Hydrocortisone, 7 (6%) had Methylprednisolone and 22 (18.8%) had Dexamethasone. Regarding Antivirals, 1 (0.9%) had Acyclovir and Ivermectin, 23 (19.7%) had Oseltamivir, 6 (5.1%) had Remdesivir and 3 (2.6%) had Acyclovir. Regarding Antibiotics, 114 (97.4%) had Azithromycin, 1 (0.9%) had 2n generation cephalosporin, 30 (25.6%) had 3 rd generation cephalosporin, 5 (4.3%) had 4 th generation cephalosporin, 16 (13.7%) had Vanc and 3 rd gen cephalosporin, 1 (0.9%) had Vanc and Meropenem, 1 (0.9%) had Vanc and Gentamicin, 2 (1.7%) had Amikacin and 3rd gen cephalosporin and 3 (2.6%) had Ampicillin and 3rd gen cephalosporin. 35 (29.9%) of the studied patients had Ondansetron, 25 (21.4%) had bronchodilator, 23 (19.7%) had Lactoferrin, 1 (0.9%) had Ursofalk, 2 (1.7%) had diuretics, 35 (29.9%) had IV fluids, 1 (0.9%) had IV IG, 8 (6.8%) had Insulin, 6 (5.1%) had Mg sulphate, 1 (0.9%) had Dopamine and 1 (0.9%) had Dobutamine. 92 (78.6%) of the studied patients had zinc, 92 (78.6%) had vitamin C and 92 (78.6%) had vitamin D.

In comparison with our study Bai et al., **[16]** stated that all patients were treated with interferon, 6 cases combined with Ribavirin, and 12 cases combined with lopinavir or ritonavir. The days from onset to RNA turning negative were 15.20 ± 6.54 days. There was no significant difference of RNA turning negative between the groups of interferon, interferon plus ribavirin and interferon plus lopinavir or ritonavir treatment. All the cases recovered and were discharged from hospital Bai et al., **[16]**.

In comparison with our study Shekerdemian et al., **[17]** stated targeted therapies were used in 28 patients (61%), with hydroxychloroquine being the most commonly used agent either alone (11 patients) or in combination (10 patients).

In the current study we found that regarding course of disease, 109 (92.31%) of the studied patients had Regressive caurse early with supportive treatment, 2 (1.71%) had progressive caurse end by death, 2 (1.7%) had progressive course for 15 day then had regress, 1 (0.9%) had progressive course for 27 then had regress, 1 (0.9%) had progressive course for 30 day then had regress, 2 (1.7%) had progressive course for 33 day then regress. Outcome, 107 (93.16%) of the studied patients were cured, 8 (6.84%) became diabetic while 2 (1.71%) died. Longest duration at hospital was 45 days this case complicated with cardiac thrombosis and elevated D-dimer, 25 (21.4%) cases were admitted to PICU, 28 (23.9%) were admitted hospital isolation department, 64 (54.7%) were out patient clinic and 2 (1.7%) cases died.

In agreement with our study Shekerdemian et al., [17] stated at the completion of the follow-up period, 2 patients (4%) had died and 15 (31%) were still hospitalized, with 3 still requiring ventilatory support and 1 receiving extracorporeal membrane oxygenation. The median (range) PICU and hospital lengths of stay for those who had been discharged were 5 (3-9) days and 7 (4-13) days, respectively.

In agreement with our study Saleh et al., [21] stated that Patients with elevated FVIII and fibrinogen levels at presentation were more likely to have an extended length of hospital stay (LOS) (*p*-value=0.036 and 0.032 respectively). No thrombotic event was observed in our cohort. D-dimer values were higher (above 0.5 g g/mL) in 24 (55.8%) patients at admission. We found an association between high D-dimer and PICU admission and LOS.

In agreement with the current study Ahmed et al., [22] stated that The mortality rate in this cohort was 14.8%. On multivariate analysis, the only predictor of mortality was the development of MIS-C Ahmed et al., [22].

The strengths of current study were due to every effort was made to ascertain that all data were documented, and only complete information was included in data analysis. Assessment of study outcomes was done by the same team.

The limitations of current study were due to COVID 19 pandemic, relatively small sample size regarding accuracy of study outcomes and the study was retrospective trial so patient's data were liable to be lost or missed.

Conclusions:

Finally we could conclude that, COVID-19 infection is not uncommon in pediatric patients and most of them are moderate and it presents as either primary, MIS-C, and Kawasaki disease like symptoms, CT chest is highly sensitive in diagnosis of COVID-19 in comparison with X-ray. Most common symptom are fever and cough, Sore throat, runny nose and anosmia. D-dimer high level associated with long stay at hospital. We found that most of the deaths and ICU outcomes related to MIS-C presentation and associated comorbidities. Decreased mortality rate in our study 1.7%, and this is an evidence of the success of the Egyptian protocol in management of COVID-19 cases. Many cases the first presentation is not related to the respiratory system as DKA, seizures, jaundice,so during disease outbreak any symptom is consider COVID-19 until proven otherwise.

Statistical analysis:

- Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) version 28 (IBM Inc., Armonk, NY, USA).
- Shapiro-Wilks normality test and histograms were used to test the distribution of quantitative variables to select accordingly the type of statistical testing: Parametric or nonparametric.
- Quantitative parametric variables (e.g., age) were expressed as mean, standard deviation (SD) and range.
- Categorial variables (e.g., sex) were expressed as frequency and percentage (%).

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Ethical approval: The study was approved by the Institutional Ethics Committee.

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دراسة تحليلية لمرض كوفيد ١٩ فى الأطفال

كانت جائحة الالتهاب الرئوى الناتج عن فيروس كورونا الحالى كوفيد ١٩، الناجم عن متلازمة الجهاز التنفسى الحادة الوخيمة، فيروس كورونا، الذى شكل تهديداً صحياً، عالمياً كبيراً. منذ تحديده لأول مرة فى ووهان، الصين، فى ديسمبر ٢٠١٩. انتشر كوفيد ١٩ على مستوى العالم بمعدل متسارع مع زيادات سريعة فى الحالات والوفيات إجرينا هذه الدراسة فى مستشفيات عزل ملوى، ومستشفى صدر ملوى ومستشفى المنيا العام ومستشفيات جامعة أزهر أسيوط ومستشفى جامعة المنيا من أبريل ٢٠٢٠ حتى أكتوبر ٢٠٢١، وهى دراسة تحليلية للأطفال المصابين بفيروس كوفيد ١٩ فيما يتعلق بالبيانات السريرية والمختبرية والتشخيصية والعلاجية للمريض، تراوحت الأعمار من ٠.٠٥ إلى ١٨ سنة بمتوسط ٩.٠٥±٦.٠٦ سنة، كان هناك ٧٢ (٦١.٥٤٪) ذكور و ٤٥ (٣٨.٤٦٪) إناث. ١١٠ (٩٤٪) مرضى يعانون من الحمى. ١٠٩ (٩٣.٢٪) لديهم رشح بالأنف، ٨٢ (٧٠٪) لديهم التهاب فى الحق، ١١١ (٩٥.٩٪) يعانون من السعال، ٣٣ (٢٨.٢٪) يعانون من الإسهال. ٦٦ (٥٦.٤٪) من المرضى الذين خضعوا للدراسة كانوا حالات متوسطة، ٢٠ (١٧.١٪) كانت خفيفة، ٢٤ (٢٠.٥٪) شديدة و ٧ (٥.٩٨٪) كانت حرجة. كان ٢ (١.٧٪) من المرضى الخاضعين للدراسة مصابين بالربو. فيما يتعلق بمضاعفات القلب، ١ (٠.٩٪) كان لديه فشل بوظائف القلب، ٢ (١.٧٪) توقف عضلة القلب ١ (٠.٩٪) كان لديه جلطة بالقلب.