Clinical Characteristics and Outcome of Pediatric COVID-19 in a Tertiary Care Children's Hospital in Detroit

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Background

- Our understanding on the epidemiology and outcome of COVID-19 in children are still limited.

- Differences in the prevalence and clinical presentation in children can vary based on the region of the country/world.

- Among communities of underrepresented racial and ethnic groups, long-standing health issues and social inequities have resulted in increased risk for infection, severe illness, and death from COVID-19.

Objective

To describe the clinical presentation, medical intervention and outcome of pediatric patients with confirmed COVID-19 treated at Children's Hospital of Michigan (CHM) during the current SARS-CoV-2 pandemic.

Methods

- We conducted a retrospective chart review of children ≤ 18 years of age with confirmed COVID-19 by polymerase chain reaction (PCR) testing on nasopharyngeal (NP) swab or antibody testing for SARS CoV-2 performed at our institution from March 1st 2020 to June 30th, 2020.

- The following variables were collected: Date of test, patient demographics, presence of comorbidities, presenting symptoms, laboratory investigations including respiratory viral panel (RVP) results if performed , radiographic results, disposition from the ED, escalation of care (PICU or NICU transfer), medications administered, interventions performed during hospitalization and outcome .

- For those patients who had serial laboratory testing and/or multiple radiographic studies, only the initial results were included.

Results

- ~1500 children underwent testing for SARS Cov-2 of whom 78 (5.2%) tested positive.

- Clinical characteristics are shown in Table 1:
- Majority were <1 year of age (23; 29.5%), female (42; 53.8%) and African American (50; 86.2 %).
- Asthma and obesity were the most common comorbidities (34; 43.6%).
- Fever, cough and vomiting were the most common presenting complaints.
- Majority of patients were admitted to hospital (82%).
- High rate of admission to the ICU- (37% of hospitalized patients).

- Significant proportion had severe (37%) or critical illness (22%); mild to moderate disease occurred in 57%; 23% had asymptomatic infection (Figure 1).

- Children with Multisystem Inflammatory Syndrome in Children (MIS-C) associated with COVID-19 (N=21) had a significantly lower absolute lymphocyte count, serum sodium and higher serum creatinine, CRP, ferritin, fibrinogen, PT , PTT , D- dimer and troponin levels compared to children with acute COVID 19 illness (Table 2).

- Respiratory viral PCR panel was performed in 30 (38.5%) patients. Viral co- infection was documented in 1 patient (RSV).

- Chest x-ray was the most common radiographic study performed; most common abnormalities noted were focal consolidation/opacity (11/53; 20.8%) and pleural effusion(3/53; 5.7%).
- Ultrasound abdomen was performed in 7 with MIS-C and 2 with acute COVID infection. Splenomegaly, hepatomegaly and mesenteric lymphadenopathy were noted in one patient each (Table 3).

- Ten patients required positive pressure ventilation and 11 required endotracheal intubation.
- Two patients required extracorporeal membrane oxygenation support (Table 4) .

- No death was associated with COVID-19

Table 1. Characteristics of 78 Study Patients

Characteristics	
Age (Median, IQR)	7.5 (14.3)
Age Range	47 days -18 years
Age Group	
<1 year	23 (29.5%)
1 – 4 years	13 (16.7%)
5- 9 years	15 (19.2%)
10 -14 years	19 (24.4%)
15 -18 years	8 (10.3%)
Gender	
Male	36 (46.2%)
Female	42 (53.8%)
Race*	
Black or African American	50 (86.2%)
White	8 (13.7%)
Ethnicity**	
Hispanic	9 (19.6%)
Not Hispanic	37 (80.4%)
Co- Morbidity	34(43.6%)
Obesity	21 (61.8%)
Asthma	16 (47.1%)
Sickle Cell Disease	5 (14.7%)
Congenital Heart Disease	1 (2.9%)
Diabetes mellitus	1 (2.9%)
Cancer	1 (2.9%)
Neurologic Abnormality	5 (14.7%)
Arthritis/Vasculitis	2 (5.8%)
Presenting symptoms	
Fever	50 (64.1%)
Cough	27 (34.6%)
Sore Throat	9 (11.5%)
Chest Pain	6 (7.7%)
DIB/Wheezing	15 (19.2%)
Vomiting	22 (28.2%)
Diarrhea	18 (23.1%)
PED Disposition	
Discharged home	14 (17.9%)
General floor admission	41 (52.5%)
PICU admission	21 (26.9%)
NICU admission	2 (2.6%)

Table 3: Radiographic Imaging of COVID-19 Patients

	Acute COVID Non- ICU	Acute COVID ICU	MIS-C
Chest X-ray performed %	(23) 79.3%	(10) 90.9%	(20) 95.2%
Chest X-ray abnormal %	(6) 20.7	(4) 13.8%	(1) 4.8%
Effusion	(1) 3.4%	(1) 9.1%	(1) 4.8%
Opacity	(5) 17.2%	(3) 27.2%	-
Focal Consolidation	(1) 3.4%	(1) 9.1%	
US Abdomen performed %	(2) 6.9%	-	(7) 33.3%
US Abdomen abnormal %	(1) 3.4%	-	(3) 14.3%
Splenomegaly	(1) 3.4%	-	-
Hepatomegaly	-	-	(1) 4.8%
Mesentric lymphadenoopathy	-	-	(1) 4.8%
Bilateral pleural effusions	-	-	(1) 4.8%
CT Abdomen performed %	-	(1) 9.1%	(2) 9.5%
CT Abdomen abnormal %	-	-	(1) 4.8%
Bilateral Pleural Effusions	-	-	(1) 4.8%
Ground Glass Opacity	-	-	(1) 4.8%

Table 2: Laboratory Tests of 78 Study Patients

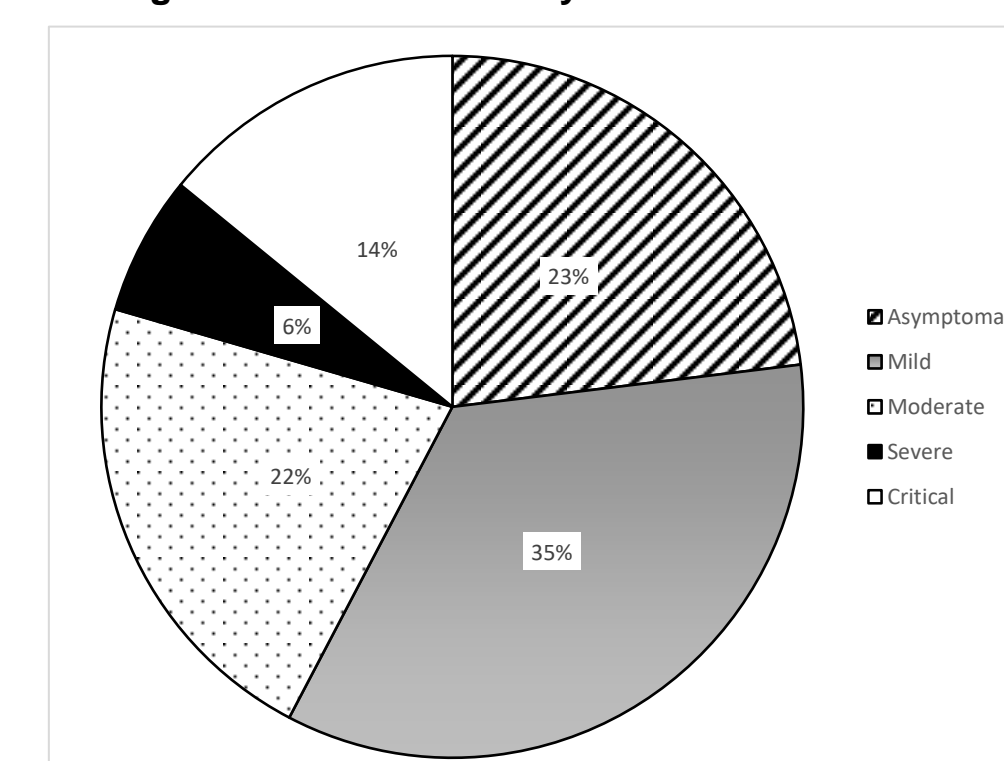|	Acute COVID Hospital	Acute COVID ICU	Acute COVID MIS-C	Reference Value
WBC performed	(25) 86.2%	(11) 100%	(21) 100%	
WBC (K/CUMM) median (IQ)	10 (8.4)	8 (1.75)	10 (8.7)	4.11-11.3
ALC performed	(24) 82.8%	(11) 100%	(21) 100%	
ALC (k/CUMM) median (IQ)	2.10 (2.87)	2.80 (2.4)	0.9 (1.4)	800-7900
PT performed	(14) 48.3%	(5) 45.5%	(21) 100%	
PT (sec) median (IQ)	10.75 (1.2)	11.5 (1.6)	11.9 (1.5)	<11.7
PTT performed	(14) 48.3%	(5) 45.5%	(21) 100%	
PTT (sec) median (IQ)	28.75 (2.88)	27.9 (1.7)	32.5 (4.5)	<33.1
Fibrinogen performed	(9) 31%	(5) 45.5%	(21) 100%	
Fibrinogen (mg/dL) median (IQ)	378 (194)	379 (204)	595 (238)	<466
D-dimer performed	(14) 48.3%	(5) 45.5%	(21) 100%	
D-dimer median (IQ)	0.97 (3.26)	0.63 (0.54)	2.19 (2.18)	<0.5
Sodium performed	(26) 89.7%	(11) 100%	(21) 100%	
Sodium (mMol/L) median (IQ)	136 (3.75)	135 (4)	131 (5)	136-145
Creatinine performed	(25) 86.2%	(11) 100%	(21) 100%	
Creatinine (mg/dL) median (IQ)	0.46 (0.41)	0.43(0.51)	0.67 (0.42)	<0.6
ALT performed	(22) 75.9%	(11) 100%	(21) 100%	
ALT (U/L) median (IQ)	20.5 (22.25)	25 (21)	22 (11)	<52
AST performed	(21) 72.4%	(11) 100%	(21) 100%	
AST (U/L) median (IQ)	31 (20)	36 (8.5)	34 (8)	<39
Albumin performed	(20) 69%	(10) 90.9%	(21) 100%	
Albumin (g/dL) median (IQ)	4.20 (0.25)	3.70 (0.55)	3.8 (0.5)	<4.7
BNP performed	(8) 27.6%	(1) 9.1%	(15) 71.4%	
BNP (pg/mL) median (IQ)	55 (89.75)	128 (0)	182 (1193.5)	<101
Troponin performed	(10) 34.5%	(4) 36.4%	(21) 100%	
Troponin (ng/L) median (IQ)	6.50 (5.00)	9.50 (29.75)	46 (156)	<17
CRP performed	(20) 69%	(6) 54.5%	(21) 100%	
CRP (mg/L) median (IQ)	14.10 (48.2)	21.1 (15.87)	143.5 (132.9)	<5
Ferritin performed	(13) 44.8%	(5) 45.5%	(21) 100%	
Ferritin (ng/mL) median (IQ)	132.5 (99.3)	111.9 (58.8)	364.6 (376.4)	<336
LDH performed	(11) 37.9%	(4) 36.4%	(21) 100%	
LDH (U/L) median (IQ)	292 (371.5)	333 (110)	362 (124)	<271
CK performed	(11) 37.9%	(4) 36.4%	(20) 95.2%	
CK (U/L) median (IQ)	76 (67.5)	416 (584)	107 (121.5)	<233
ESR performed	(8) 27.6%	(2) 18.2%	(19) 90.5%	
ESR (mm/Hr) median (IQ)	29 (33.5)	5.50 (1.5)	47 (22.5)	<13

Table 4: Interventions performed and length of stay in study cohort

Interventions	Acute COVID Non-ICU n=29	Acute COVID ICU n=11	MIS-C n=21
Respiratory n (%)	2 (6.9%)	7 (63.6%)	8 (38.1%)
O2 Therapy n (%)	2 (6.9%)	3 (27.2%)	3 (14.2%)
High flow Oxygen n (%)	1 (3.4%)	4 (36.3%)	2 (9.5%)
CPAP n (%)	-	2 (18.2%)	-
BiPAP n (%)	-	1 (9.1%)	-
Endotracheal Intubation n (%)	-	5 (45.5%)	6 (28.6%)
Cardiovascular n (%)	0 (0%)	3 (27.2%)	12 (57.1%)
Vasopressor/Inotrope Therapy n (%)	-	3 (27.2%)	12 (57.1%)
CPR n (%)	-	1 (9.1%)	1 (4.8%)
ECMO n (%)	-	-	2 (9.5%)
Hematologic n (%)	1 (3.4%)	2 (18.2%)	17 (81%)
Administration of Blood n (%)	1 (3.4%)	2 (18.2%)	3 (14.2%)
Anticoagulants n (%)	-	2 (18.2%)	3 (14.2%)
Aspirin n (%)	-	-	15 (71.4%)
Medications n (%)	17 (60.7%)	7 (63.6%)	17 (81%)
Antibiotics n (%)	17 (60.7%)	7 (63.6%)	17 (81%)
Steroids n (%)	1 (3.4%)	2 (18.2%)	2 (9.5%)
COVID specific:			
Azithromycin n (%)	2 (6.9%)	-	-
hydroxychloroquine n (%)	1 (3.4%)	1 (9.1%)	-
Remdesivir n (%)	-	2 (18.2%)	2 (9.5%)
Immunomodulators n (%)	-	-	19 (90.5%)
Intravenous Immunoglobulin n (%)	-	-	19 (90.5%)
Infliximab n (%)	-	-	8 (38.1%)
Length of ICU Stay (days) Median (IQR)	-	2.5 (5.62)	3 (5)
Length of Hospital Stay (days) Median (IQR)	2 (2)	3 (5.5)	7 (6)

Figure 1: Disease Severity of 78 COVID-19 Cases

Figure 1: Disease Severity of 78 COVID-19 Cases
(Asymptomatic, Mild, Moderate, Severe, Critical) — 13%, 35%, 22%, 6%, 14%

Conclusions

- Our cohort consisted predominantly of underrepresented racial and ethnic groups of children from a region of national COVID hotspot and highlights the potential for severe disease.
- Majority of our children with COVID-19 had a mild disease however a significant proportion had severe/critical illness and required hospitalization (82%).
- There was no COVID-19 related mortality.
- More studies of COVID-19 in children are needed in racial and ethnic minorities to better understand the disproportionately severe impact on these communities.
- Working with leaders in our community to develop targeted interventions within the underrepresented minorities may impact and reduce disparities in COVID-19 incidence.