International Journal of Contemporary Pediatrics
Kaur R et al. Int J Contemp Pediatr. 2021 Jun;8(6):1096-1101
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20212055

Original Research Article

Clinico-etiological profile of hospitalized paediatric patients: COVID-19 and non-COVID-19 in a district hospital of Northern India during lockdown period

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Received: 06 April 2021
Revised: 09 May 2021
Accepted: 10 May 2021

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ABSTRACT

Background: With the sudden outbreak of coronavirus pandemic in 2020, there is a paucity of data on the clinical and epidemiological profile of COVID positive paediatric patients. Objective of the study was a retrospective analysis of both COVID-19 and non-COVID-19 cases admitted to a district Hospital of Northern India.
Methods: A retrospective cross-sectional study was conducted in the Pediatric Emergency Department of Government Multi-speciality Hospital, Chandigarh from 22 March 2020 till 30 November 2020.
Results: A total of 842 children were enrolled. Among neonates, 33% had sepsis as the major admitting diagnosis and SARI in children less than 1 year (excluding neonates) (33.5%) and in the 1-5 years age group (37.3%). In children more than 5 years, acute febrile illnesses were the main admitting diagnosis (50.4%). 204 patients (24.2%) were tested for COVID-19. 62 children (30.4%) were found to be positive. Asymptomatic children (74.2%) dominated the COVID-19 positive group. The most common symptom included fever (87.5%) with no reported mortality. Atypical symptoms (56.1%) were more common than respiratory symptoms. The majority of children had mild COVID-19 symptoms (62.6%). The unusual presentation of COVID-19 was in the form of acute appendicitis (6.2%) and renal vein thrombosis (6.2%) in the symptomatic group.
Conclusions: For children with COVID-19, most of them were infected via family clustering, were asymptomatic, and had mild symptoms with an overall good prognosis. However, for atypical cases, a high suspicion of COVID-19 associated multisystem inflammatory syndrome should be kept in mind for early diagnosis.

Keywords: Paediatric, COVID-19, SARS-CoV-2, Risk factors, Severity, Clinico-etiological profile

INTRODUCTION

End of 2019 witnessed a sudden outbreak of novel coronavirus pneumonia in Wuhan, China, which brought the whole world to a stand-still, presented an unprecedented challenge to public health and economic sector, thereby causing a devastating impact globally.[1] The International Committee on Taxonomy of Viruses (ICTV) named the new coronavirus as severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2).[2] The WHO declared coronavirus disease 2019 (COVID-19), the disease caused by SARS-CoV-2, a pandemic health emergency on 11 March 2020. On 22 March 2020, the Government of India ordered a nationwide lockdown for 21 days, limiting movement of the entire 1.3 billion population of India as a preventive measure against the COVID-19 pandemic in India, which was extended later, followed by uplifting of the restrictions in a phased manner. Person-to-person transmission of SARS-CoV-2 occurs primarily through close contact with an infected person, mainly via respiratory droplets and after touching contaminated objects. Additional routes of

transmission are currently under investigation, including faecal viral shedding.[3] Although COVID-19, severe acute respiratory syndrome (SARS), and middle east respiratory syndrome (MERS) are all caused by coronavirus and can be manifested with severe respiratory distress, COVID-19 has its own epidemiological and clinical features.[4] Because of the similar etiology, children were initially thought to be more susceptible than adults for contacting the virus. However, less than 5% of total coronavirus disease (COVID-19) cases belonged to the paediatric age group, and the severity has been milder as compared to adults.[5] Due to huge burden of cases in adult population, the information regarding the disease epidemiology and clinical outcomes is widely available, but robust data is missing in the paediatric population as clinical, epidemiological characteristics and prognosis of COVID-19 is limited.[6] The need for our retrospective cross sectional study was based on identifying any variation in the clinical spectrum of hospitalized patients presenting in the paediatric emergency department of the district Hospital in Northern India during the COVID-19 pandemic lockdown period in India, evaluating the presentation of COVID-19 positive paediatric patients and studying their clinic-etiological profile, from a dedicated COVID-19 health centre, designated by the Government of India for testing and admitting the mild to moderate COVID-19 cases. Our observations may help the frontline health care providers to prepare for effective handling of a possible respiratory pandemic attack in the near future by gathering data from resource limited clinical setup.

Aim and objective

Aim and objective of the study was to evaluate clinico-etiological profile of hospitalized paediatric cases, including both COVID-19 and non-COVID-19 patients, admitted in the paediatric emergency department of a district Hospital in Northern India from 22 March 2020 (COVID-19 lockdown beginning) till 30 November 2020.

METHODS

This was a retrospective cross-sectional study, conducted in the paediatric emergency department of Government Multi-speciality Hospital, Chandigarh (District hospital of Indian Union Territory) during the lockdown period from 22 March 2020 till 30 November 2020. The sample size was selected based on the total admissions that took place in the Pediatric Emergency department during the study period. Medical records of 842 paediatric participants, who were admitted in the hospital during this time period were reviewed and those who met the following inclusion criteria were enrolled in the study: Children in the age group upto 12 years, presenting in the paediatric emergency, admitted and hospitalized for minimum of 24 hours, suspected COVID-19 hospitalized paediatric patients, cases who were referred to higher centers, those who left hospital against the medical advice. After admission, initial assessment of patients was done based on their appearance, breathing and circulation, and were subsequently categorised as stable, unstable and not life threatening, and unstable with life threatening conditions. Similarly, for patients with confirmed COVID-19, categorisation into mild, moderate and severe illness was done, based on the severity of their admitting complaints.[7] Temperature, documentation, oxygen saturation and other vitals were recorded at admission. After taking focussed history and detailed examination, the baseline investigations were done. Throat and nasal swabs for COVID-19 RT-PCR were done in patients with severe acute respiratory infections (SARI). SARI is defined, as per the WHO guidelines as, fever (>38 °C), cough, and increased work of breathing and requiring hospitalization. Eligible candidates for COVID-19 testing were selected as per the timely guidelines issued by the Indian Council of Medical Research (ICMR), Department of Health, Government of India, which were updated time to time, in accordance with the changing COVID-19 situation in India and hospital testing policy. Admitted patients were managed as per the standard guidelines. Clinico-etiological profile and outcome of the patients were documented.

Statistical analysis

For the study period, the variables of interest were extracted manually by the study authors. Relevant data was entered into Microsoft excel (version 2013) spreadsheet for building up the initial dataset. Subsequently, standardized response codes were defined for all variables to arrive at the final data-set used for statistical analysis using SPSS version 23.0 (IBM, USA). Patient confidentiality was maintained by using anonymized data with unique identifiers and by password protected dataset with restricted access.

RESULTS

A total of 842 children, that were admitted in the paediatric emergency department of our hospital, during this time period were enrolled in the study. The demographic profile of the hospitalized paediatric patients during the study period is mentioned in Table 1.

As compared to 2019, from April till November (1676 paediatric emergency admissions during 2019), the hospitalization rate dropped to around 50% in lockdown period. Majority of admitted children had unstable and not life-threatening medical condition at the time of admission (64.6%). For the paediatric hospitalization rate, 21.2% (179) children were admitted in our hospital, from 22 March 2020 till 31 May 2020. The hospitalization rate was lowest in this time, which gradually picked up to 262 children (31.1%) from beginning of June till August 31, 2020 and consequently to, 401 children (47.7%) from September 1, 2020 till November 30, 2020.

Among neonates, majority of them (33%) had Sepsis as the major presenting diagnosis, as shown in Table 2. For children's of all other age-group (excluding the neonates),

the clinical characteristics is represented in Table 3. SARI was the predominant diagnosis at the time of admission, in children both less than 1 year (excluding neonates) and among 1-5 years age group, which was, 33.5% and 37.3% respectively. At discharge, majority of admitted SARI cases in children less than 1 year (56%) and more than 5 years (46.6%) had pneumonia (both bacterial and viral), however in children of age group between 1-5 years, reactive airway disease was the main diagnosis with which SARI children were hospitalized (60.2%). In children more than 5 years, acute febrile illnesses, were the main presenting diagnosis (50.4%), among which dengue fever was predominantly seen during the study period (80.9%).

Table 1: Demographic profile of hospitalized paediatric patients.

Characteristic	Value (%)
Sex distribution	
Male	502 (59.6)
Female	340 (40.3)
Age group distribution (years)	
Neonates	218 (25.8)
Less than 1 (excluding neonates)	197 (23.4)
1-5	209 (24.9)
More than 5	218 (25.9)
Traiging at admission	
Stable	144 (17.1)
Unstable and not life threatening	544 (64.6)
Unstable and life threatening	154 (18.3)
Admitted cases distribution (month wise)	
22 March till 31 May	179 (21.2)
01 June till 31 August	262 (31.1)
01 September till 30 November	401 (47.6)

With respect to COVID-19 testing, initially all suspected cases were evaluated by the RT-PCR method and then with the introduction of rapid test from August 2020 in our hospital, a total of 204 paediatric suspects (24.2%) were tested during the study period. Among the tested children, 62(30.4%) were found to be positive. The clinical characteristics of COVID-19 positive hospitalized paediatric patients is shown in Table 4. Almost two-third (74.2%) of the tested children were asymptomatic, had normal chest X-ray and were home quarantined with close supervision of any danger signs. Among the 16 symptomatic patients (25.8%), the most common symptoms included fever with body temperature ranging from 37.3 to 40˚C (87.5%). Atypical symptoms (56.1%) were more common than the respiratory symptoms, such as acute diarrhoea, altered sensorium, blood in urine and stools, and abdominal pain. Overall, majority of hospitalized COVID-19 positive children (62.6%) had mild symptoms with a benign course and a decent recovery. As far as the treatment was concerned, all symptomatic children with normal chest X-ray were given supportive therapy and atypical cases given the established evidence-based care with no antiviral therapy or steroids given to any of them.

Table 2: Clinical characteristics of the admitted neonates.

Diagnosis	N=218 (25.8%)
Neonatal sepsis	72 (33)
Neonatal respiratory distress	49 (22.5)
Birth asphyxia	42 (19.3)
Congenital heart defects	10 (4.6)
Others*	45 (20.6)

*Environmental hyperthermia, hyperbilirubinemia, prematurity, congenital anomalies.

Table 3: Etiological diagnosis of hospitalized children (excluding neonates).

Diagnosis	Less than 1 year (N=197) (%)	1-5 years (N=209) (%)	More than 5 years (N=218) (%)	Total (N=624) (%)	P value
SARI	66 (33.5)	78 (37.3)	30 (13.7)	174 (27.8)	0.0001
Pneumonia	37	23	14	74	
Reactive airway disease	29	47	6	82	
Pulmonary tuberculosis	0	8	10	18	
Severe anaemia	27 (13.7)	15 (7.1)	4 (1.8)	46 (7.3)	0.0001
Diarrhoeal illness	40 (20.3)	46 (22)	20 (9.1)	106 (16.9)	0.001
Intestinal obstruction	2 (1)	1 (0.4)	0	3 (0.4)	0.328
Enteric fever	2 (1)	8 (3.8)	14 (6.4)	24 (3.8)	0.001
Dengue fever	3 (1.5)	6 (2.8)	89 (40.8)	98 (15.7)	
Scrub typhus	0	1 (0.4)	5 (2.3)	6 (0.9)	
Malaria	1 (0.5)	0	2 (0.9)	3 (0.4)	
Seizure disorder	29 (14.7)	31 (14.8)	27 (12.3)	87 (13.9)	0.456
Meningitis	9 (4.5)	12 (5.7)	5 (2.3)	26 (4.1)	
Cerebral edema, impending herniation	2 (1)	3 (1.4)	5 (2.3)	10 (1.6)	
Severe acute malnutritior	6 (3)	3 (1.4)	0	9 (1.4)	0.034
Others*	10 (5)	5 (2.3)	17 (7.8)	32 (5.1)	0.041

*Foreign body in airways, nephrotic syndrome, diabetes type 1, haemato-oncological disorders, and neurometabolic disorders

Only 2 COVID-19 positive children had co-existent infections (tubercular meningitis and enteric fever). Severe respiratory complications were rare in the paediatric COVID-19 positive patients. Only one child, aged 11 years, developed respiratory failure due to ruptured bacterial liver abscess with empyema. The affected child had per-se no severe respiratory complications due to COVID and got critically ill due to worsening of underlying primary illness. Two COVID positive children had unusual symptoms, one presented as 11-year-old with acute appendicitis and another as 3-year-old with haematuria and acute kidney failure. Both of these children were referred to a dedicated COVID-19 hospital (designated by Government of India for treating severe COVID cases). Child with acute kidney failure was eventually diagnosed as fungal and bacterial peritonitis and right renal vein thrombosis at the referral hospital and was referred back to our hospital for completion of intravenous antifungals and antibiotics. In neonatal age-group, a preterm baby, delivered at 32 weeks of gestation to COVID-19 positive mother with meconium stained liquor was admitted with neonatal respiratory distress (distress got settled within 48 hours of admission), had positive COVID-19 RT-PCR. The neonate recovered with minimal oxygen support, intravenous antibiotics, and was managed conservatively in view of negative septic work and normal chest X-ray.

Table 4: Clinical characteristics of symptomatic SARS-CoV-2 paediatric patients.

Characteristic	Value (%)
Asymptomatic cases	46 (74.2)
Symptomatic cases	
Fever	14 (87.5)
Sore throat	8 (50)
Generalised myalgia	7 (43.7)
Dry cough	4 (25)
Diarrhoea with no dysentery	2 (12.5)
Altered sensorium	1 (6.2)
Haematuria	1 (6.2)
Dysentery	1 (6.2)
Pain in abdomen	4 (25)
Profile of symptomatic cases	
Mild symptoms	10 (62.6)
Moderate symptoms	3 (18.7)
Severe symptoms	3 (18.7)
Concomitant infections	
Tubercular meningitis	1 (6.2)
Enteric fever	1 (6.2)
Ruptured liver abscess with right empyema	1 (6.2)

As far as the outcome of the admitted children was concerned, Table 5 shows that, out of 842 children, a substantial proportion got discharged (80.6%), with 124 (14.7%) cases that got referred, 3.5% children who took DAMA (discharge against medical advice), and only 1% mortality in non-COVID-19 cases that was reported in this timeframe. There was no mortality among the COVID-19 positive patients.

Table 5: Outcome of the hospitalized paediatric patients.

Final outcome	N=842 (%)
Discharged	679 (80.6)
Referred	124 (14.7)
DAMA	30 (3.5)
Mortality	9 (1)
Referred non-COVID-19 cases	N=124 (14.7)
Respiratory failure	42 (33.9)
Compensated shock	31 (25)
Pediatric surgery requirement	3 (2.4)
Others*	48 (38.7)
Referred COVID-19 cases	N=3 (4.8)
Ruptured liver abscess with empyema	1 (6.2)
Renal vein thrombosis with AKI and peritonitis	1 (6.2)
Acute appendicitis	1 (6.2)

*Raised intracranial tension, refractory status epilepticus, cyanotic congenital heart defects, end stage renal disease, and haemato-oncological disorders

DISCUSSION

There is ample knowledge available for adult patients with COVID-19, our information and interpretation of the clinical characteristics and epidemiology of paediatric COVID-19 is quite limited. With respect to this, we conducted a retrospective analysis of hospitalized children under 12 years age group in our District Hospital to assess the impact of the nation-wide lockdown on the paediatric hospitalization pattern and evaluating the clinico-epidemiological profile of the hospitalized paediatric patients with COVID-19. The lockdown restrictions led to significant decline (50%) in our pediatric emergency hospitalization. The burden on the health care system gradually picked up as the restrictions on lockdown were uplifted by the Government of India. Noticeably, less than 1-year-age group is still the most vulnerable and predominant hospitalized age-group and therefore, requiring maximum attention of the healthcare providers during the COVID-19 pandemic. Sepsis was the main diagnosis with which neonates were admitted. For children less than 5 years, as shown in Table 2, respiratory illnesses and diarrhoea are the major diagnosis with which paediatric patients are hospitalized in a district hospital, while for those more than 5 years, acute febrile illnesses are the major reason for hospitalization. For children with COVID-19, most of them were infected via family clustering and had no symptoms (74.2%), which was more than the study by Wu et al on adult patients and resembled the findings of study done by Zimmermann et al.[8,9] The lower risk of symptomatic infection among children

appears to be due to age-dependent expressions of ACE2 which is lower in younger children and increases with age. Lower ACE2 expression in children relative to adults may help explain why COVID-19 is less symptomatic in children.[10] The most common clinical symptom resembled the adult patients, that was, fever with rare comorbid conditions and few severe complications in paediatric population, as reported by Guan et al.[11] The unusual presentation of renal vein thrombosis in a COVID-19 positive paediatric patient depicted hypercoagulable state, the underlying cause still remained unclear for us. Whether COVID-19 associated multisystem inflammatory syndrome ended in such type of presentation, as reported by Kosmeri et al, or the child had some pre-existing hypercoagulable disorder is a matter of discussion and needs further studies in future.[12] Nevertheless, in severe presentation of COVID-19, a high suspicion of COVID-19 associated multisystem inflammatory syndrome need to be kept in mind for intensive monitoring, to prevent severe complications in the affected children. In particular, no advanced chest imaging studies such as HRCT chest was done in COVID-19 positive symptomatic paediatric group as majority of them had mild illness. Also, one neonate being infected with SARS-CoV-2, after the mother being tested with COVID-19 showing that irrespective of insufficient evidence of vertical transmission, there is definitely a high neonatal risk of SARS-CoV-2 infection if a mother contracted this virus during the pregnancy. A study reported by Zeng et al, also found that 3 of 33 newborns born to pregnant women infected with SARS-CoV-2 were diagnosed with COVID-19.[13] The severe presentation was seen in children more than 5 years of age, unlike the study reported by Dong et al that assessed the severity of illness by age and reported that the young children, particularly infants are more vulnerable to SARS-CoV-2 infection and had more severe disease.[14] The overall good prognosis of COVID-19 positive children with no mortality resembled the findings reported by Wu et al.[8]

As per the guidelines issued by ICMR, Ministry of Health and Family Welfare, India, only the SARI cases were selected for COVID-19 testing which could possibly explain testing only symptomatic patients or patients in contact with COVID-19 positive close family member during the study period. Ideally, COVID-19 testing should be done in all cases presenting with fever, diarrhoea and other systemic features as COVID-19 has variable and atypical presentation in paediatric population. Also, since no inflammatory markers such as serum ferritin, LDH and d-Dimer levels were available due to limitation of such testing in our hospital, we could not categorise the COVID-19 cases into mild, moderate and severe presentation based on the levels of inflammatory markers.

CONCLUSION

The lockdown period witnessed 50% reduction in paediatric emergency hospitalization of our district hospital (dedicated COVID-19 health centre). For non-COVID-19 patients, less than 1-year-age group deserves the maximum ongoing attention during this pandemic. Majority of COVID-19 positive paediatric patients were asymptomatic at the time of testing with fever as the major presenting symptom in the symptomatic group. Like the rest of world, our hospital had mild COVID-19 paediatric cases predominantly. Whether COVID-19 is associated with hypercoagulable state in paediatric population is a matter of discussion that needs further studies in near future. However, early suspicion, intensive monitoring of COVID-19 associated multisystem inflammatory syndrome is required to prevent devastating consequences of this entity in paediatric population. With that being said, it is obvious that we still cannot relax the stringent close monitoring of the hospitalized paediatric patients in this pandemic, given the majority of mild presentation of COVID-19 in the children.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Kaur R, Pandit S, Dhawan N. Clinico-etiological profile of hospitalized paediatric patients: COVID-19 and non-COVID-19 in a district hospital of Northern India during lockdown period. Int J Contemp Pediatr 2021;8:1096-101.