ABSTRACT

Introduction: Coronavirus disease-19 (COVID-19) is a global health crisis. The clinical characteristics, disease progression, and outcome in children and young adults appear significantly milder compared to older individuals.

Case series: The aim is to study the epidemiological and clinical characteristics of paediatric COVID-19 patients. All children between one month and 15 years of age who tested positive for COVID-19 infection were included in the study. Detailed information including demographic data, travel and contact history, living conditions, symptoms, and presence of comorbid conditions was taken. Baseline laboratory parameters were evaluated and repeated as required.

A total of 56 children were included in the study. The majority of the study population was from the lower middle socioeconomic class. Only 12 subjects (21.42%) were symptomatic and all had mild symptoms. Neutrophil Lymphocyte-ratio (NLR) and CRP showed a significant correlation with the severity of the illness.

Conclusion: Present study shows that there is a higher disease burden in lower-socioeconomic groups with the majority of children having a positive household contact and milder disease

KEYWORDS COVID-19, demographic data, symptoms, children

Introduction

Coronavirus disease-19 (COVID-19) has emerged as a major global health problem over the last 18 months. It started in Wuhan, China, in December 2019 and has spread rapidly, affecting over 200 countries worldwide. Children account for 1-5% of diagnosed COVID-19 cases. However, most children with COVID-19 infection tend to be asymptomatic or mildly symptomatic compared with older individuals [1]. Since many children are asymptomatic, we cannot diagnose them without population screening. Though the disease has spread globally, clinical features and epidemiological characteristics of children with COVID-19 infection are poorly understood [2]. In general, the important clinical characteristics and their outcomes have often been missed by the data of national surveillance systems [3-5].

The data available from India on epidemiological features, clinical manifestations, and transmission patterns in children with COVID-19 is limited [6]. Hence, to study these variables in children with COVID-19 in a tertiary care hospital, we undertook this study. Moreover, some parts of the country are already experiencing high numbers of COVID-19 patients in the second wave of COVID-19 infections. As per the experts, there can be a third wave that may affect the children to a greater extent due to the lack of vaccination in this age group at present. In such a scenario, this information will be of immense importance to plan for better use of resources and healthcare workers in tackling the pandemic.

Currently, in India, as per the report of the Ministry of Health and Family Welfare (MOHFW), there were 28103997 virologically confirmed COVID-19 positive cases and 337989 deaths [7].
Aims and objectives
To study the clinical and epidemiological characteristics of Pediatric COVID19 patients.

Case series

Materials & Methods

Study design and setting
A retrospective study was conducted in the Pediatric department (Outpatient and inpatient) of a tertiary care teaching hospital of Western India from April 2020-September 2020. The study centre caters to heterogeneous populations representing both urban and rural patients. Clearance from the institutional ethics committee was obtained.

Methodology
Our study included patients aged from one month to 15 years who tested positive for COVID-19 infection by the reverse transcriptase-polymerase chain reaction technique for a nasopharyngeal swab. Factors that we studied were demographic data, travel, and contact history, living conditions and overcrowding, immunization status, symptoms and presence of comorbid conditions. Overcrowding was defined as per persons per room criterion in which the number of persons in the household is divided by the number of rooms in the house [8].

Standard criteria by the Government of India, Ministry of Health & Family Welfare (MoHFW), Directorate General of Health Services were used to classify children as per disease severity [9]. For all children, we captured the laboratory parameters, including complete blood count and C-reactive protein (CRP). Chest radiograph reports of all patients were noted. Toussie D et al. scoring system was used to decide how much lung involvement was considered when the total score was given a score of one, and a score of zero was given for no opacity. 50% involvement was considered when the total score was 3 [10].

All patients had been managed as per the hospital protocol. All children had been monitored daily to see the change in the disease severity. Children were discharged from the hospital as per the Revised Discharge Policy for COVID-19 by MoHFW, which states that children who completed 10 days from the test positive date and were either asymptomatic or free from any symptoms for 3 days could be discharged [11].

Statistical analyses
Statistical Package for Social Sciences (SPSS) software version 25.0 was used for data analysis. Spearman’s Rho correlation coefficient was used to determine the correlation with disease severity. A p-value <0.05 was considered significant.

Results
The study included a total number of 56 children who satisfied the inclusion criteria. Table I shows the demographic profile of the study population. The majority of children were aged between 0-5 years & 10-15 yrs. Females outnumbered males by a ratio of 1.33:1. Most (80%) of the children were from the containment zones made by the local Municipal Corporation. More than half the study population (55%) was from the lower middle socioeconomic class. Overcrowding at home was seen in 30 cases (53.57%). The majority of study subjects had a history of positive household contact. As per weight for age criteria, most children (85%) were well nourished. Thirty-five (62.5%) children had completed the immunization as per the Universal Immunization Program. All children had BCG scars.

The clinical profile of the subjects is shown in Table II. Only 12 subjects (21.42%) were symptomatic, and all had mild symptoms including fever, cough and abdominal pain except one child who had hypoxia on pulse oximetry and required oxygen.

Table III shows the investigation profile of the study subjects. The mean (SD) leukocyte count was 7378.4 (2584.5) X10^9/L (range, 3300-19300 X10^9/L). Anaemia was present in 30 (53.57%) children. Leucopenia was present in two (3.57%) children while leukocytosis was not seen in any child. CRP was positive in seven patients (12.5%). Neutrophil Lymphocyte-ratio (NLR) (r=0.34, p-value = 0.01) showed a significant correlation with the severity of the illness. Absolute Neutrophil Count (ANC) (r=0.23, P=0.096) did not show any correlation with the severity of the disease. Lymphocyte to CRP Ratio (LCR) (r= -0.24, P=0.066) did not show any correlation with the severity of the disease. CRP (r=0.32, p-value = 0.01) showed a significant correlation with the severity of the illness. Chest radiograph was done in all patients. Three patients had haziness in either the mid or lower zone. The disease category for almost all patients remained the same through the hospital stay except one (changed from cat 1 to cat 3). None of the patients required an extension of hospital stay.

Discussion
Almost all children in our study were from the local Municipal Corporation identified containment zones and had exposure to positive household contact 50. Also, nearly half of the children were from the age group between 0-5 yrs. Young children are in close contact with their parents or caregivers for most of their time spent at home. Also, the social distancing norms are not very easily understood or followed by children less than five years of age.

Lower socioeconomic status and overcrowding are common risk factors for getting the infection. In our study, most patients belonged to either lower or lower-middle socioeconomic class and a little more than half had overcrowding at home. A similar pattern was also seen in other countries [12]. In addition, malnutrition has been one of the important risk factors in adult COVID-19 infection [13]. Children with malnutrition are prone to infections; however, in this study, most of the children were well-nourished as per weight-for-age criteria.

In the present study, most children either had no symptoms or mild symptoms. In our study, fever was the commonest symptom. Similar observations have been reported in studies conducted by Ambike, D et al. in India & Qiu H- in China [14,15]. The majority of children in our study had an uneventful hospital stay and no mortality. A study by Meena J showed that most of the patients were suffering from a mild disease (96%), and very few children (1%) were critically ill [16]. As per the data summary published by NYC Health, the mortality rate of COVID-19 in children is less than 1% [17]. Despite the various hypotheses which have been proposed for the lesser disease severity in children [18], a definite answer to this is still under research.

There were three children with comorbidities; one child had gastric outlet obstruction and underwent exploratory laparotomy, another came in with diabetic ketoacidosis and was a...
### Table number I- Demographic profile of Pediatric COVID 19 patients (n=56)

| Factor                      | Number | Percentage (%) |
|-----------------------------|--------|----------------|
| **Age**                     |        |                |
| 0-5yrs                      | 25     | 44.64          |
| 5-10yrs                     | 10     | 17.85          |
| 10-15yrs                    | 21     | 37.5           |
| **Sex**                     |        |                |
| Male                        | 24     | 42.85          |
| Female                      | 32     | 57.14          |
| **Socio-economic status**   |        |                |
| Upper                       | 2      | 3.5%           |
| Upper Middle                | 5      | 8.9%           |
| Lower Middle                | 31     | 55%            |
| Lower                       | 18     | 32%            |
| **Overcrowding**            |        |                |
| Yes                         | 30     | 53.57          |
| No                          | 26     | 46.42          |
| **Contact with a family member** | | |
| Yes                         | 50     | 89.28          |
| No                          | 6      | 10.71          |
| **Immunization status as per UIP** | | |
| Complete                    | 35     | 62.5           |
| Incomplete                  | 21     | 37.5           |
| BCG scar                    | 56     | 100            |

### Table number II- Clinical profile of Pediatric COVID19 patients (n=56)

| Number          | Percentage (%) |
|-----------------|----------------|
| Asymptomatic    | 78.57          |
| Symptomatic     | 21.42          |

#### Predominant symptoms

| Symptom          | Percentage (%) |
|------------------|----------------|
| Fever            | 7.14           |
| Cough            | 7.14           |
| Abdominal Pain   | 5.35           |

### Table number III- Laboratory and radio diagnosis of Pediatric COVID 19 patients (n=56)

| Lab parameter    | Normal (%) | Abnormal (%) |
|------------------|------------|--------------|
| Hb               | 26(46.42%) | Anemia 30(53.57%) |
| TLC              | 54(96.42%) | Leucopenia 2(3.57%) |
| Thrombocytopenia | 0          | nil          |
| CRP              | 49(87.5%)  | 7(12.5%)     |
| X-ray            | 53         | 3            |

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known case of type-1 diabetes, while one child was diagnosed to have congenital heart disease. This child with congenital heart disease was found to have Tricuspid Atresia and, due to the presence of hypoxia with comorbidity, was classified as category 3. In the haematological profile of study patients, leukopenia was seen in only two (3.57%), and there was no evidence of lymphopenia, thrombocytopenia or eosinopenia. Similar observations were seen in a study by Sarangi B et al.[6]. NLR in our study showed a moderate positive correlation coefficient with the disease severity. In a similar study from Pune, Neutrophil -lymphocyte-ratio and lymphocyte- monocyte-ratio (LMR) showed a significant correlation with the severity of the illness[6]. A meta-analysis by Lagunas-Rangel FA showed that increased NLR levels and low LCR levels reflected an enhanced inflammatory process and may suggest a poor prognosis [19]. In our study, CRP showed a significant correlation with the severity of the illness. High CRP values have become synonymous with severe COVID-19 infection among adults, as seen in the majority of the studies [20].

Study limitation
The study’s major limitation is the smaller sample size. Further studies with a larger sample size will help understand the clinical and epidemiological characteristics of paediatric COVID-19 patients at different geographical locations.

Conclusion
The present study showed that lower socioeconomic status and overcrowding are common risk factors associated with COVID-19 infection in children. Most children with COVID-19 have mild or no symptoms at all.

Ethics/Institutional Review Board Approval of Research
Approval was obtained from the Institutional Ethics Committee of Smt Kashibai Navale Medical College and General Hospital, Narhe, Pune, Maharashtra.

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Conflict of interest
There are no conflicts of interest to declare by any of the authors of this study.

References
1. Ludvigsson J. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. Acta Paediatrica. 2020;109(6):1088-1095.
2. Castagnoli R, Votto M, Licari A, Brambilla I, Bruno R, Perlini S et al. Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection in Children and Adolescents. JAMA Pediatrics. 2020;174(9):882.
3. Bialek S, Gierke R, Hughes M, McNamara L, Pilishvili T, Skoff T. Coronavirus Disease 2019 in Children — United States, February 12–April 2, 2020. MMWR Morbidity and Mortality Weekly Report. 2020;69(14):422-426.
4. Bialek S, Boundy E, Bowen V, Chow N, Cohn A, Dowling N et al. Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19) — United States, February 12–March 16, 2020. MMWR Morbidity and Mortality Weekly Report. 2020;69(12):343-346.
5. Istituto superiore di Sanità. Epidemia COVID-19. Aggiornamentonazionale 23 marzo 2020. Available at https://www.epicentro.iss.it/coronavirus/bollettino/Bollettino-sorveglianza-integrata-COVID-19_23-marzo%202020.pdf(accessed March 30, 2020)
6. Sarangi B, Reddy V, Oswal J, Malshe N, Patil A, Chakraborty M et al. Epidemiological and Clinical Characteristics of COVID-19 in Indian Children in the Initial Phase of the Pandemic. Indian Pediatrics. 2020;57(10):914-917.
7. World Health organization. Coronavirus disease (COVID-19)situation reports 79. Available at (accessed on March 27, 2020) https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports
8. Park K. Environment and Health. In: Park K, ed. Park’s Textbook of Preventive and Social Medicine. 23rd ed. Jabalpur: Bhanot Publishers; 2015.p.758.
9. Guidelines On Clinical Management Of COVID – 19. Government of India Ministry of Health & Family Welfare Directorate General of Health Services (EMR Division), pp.3-5. Available at: https://www.mohfw.gov.in/pdf/GuidelinesonClinicalManagementofCOVID192020.pdf. Accessed July 27, 2020.
10. Toussie D, Voutsinas N, Finkelstein M, Cedillo M, Manna S, Maron S et al. Clinical and Chest Radiography Features Determine Patient Outcomes in Young and Middle-aged Adults with COVID-19. Radiology. 2020;297(1): E197-E206.
11. Revised Discharge Policy for COVID-19. Available from: https://www.mohfw.gov.in/pdf/ReviseddischargePolicyforCOVID19.pdf. Issued on 8th May 2020.
12. Coronavirus Disease 2019 (COVID-19). Centers for Disease Control and Prevention. 2020. Available from: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/racial-ethnicminorities.html. Accessed June 20, 2020.
13. Li T, Zhang Y, Gong C, Wang J, Liu B, Shi L, et al. Prevalence of malnutrition and analysis of related factors in elderly patients with COVID-19 in Wuhan, China. European Journal of Clinical Nutrition. 2020;74(6):871–5.
14. Ambike DA, Mundlod SS, Ahmed S, Byale A. Clinical and demographic profile of pediatric COVID-19 in a tertiary care teaching hospital. Medical Journal of Dr DY Patil Vidyapeeth. 2021;14(2):134.
15. Qiu H, Wu J, Hong L, Luo Y, Song Q, Chen D. Clinical and epidemiological features of 36 children with coronavirus disease 2019 (COVID-19) in Zhejiang, China: an observational cohort study. The Lancet Infectious Diseases. 2020;20(6):689–96.

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16. Meena J, Yadav J, Saini L, Yadav A, Kumar J. Clinical Features and Outcome of SARS-CoV-2 Infection in Children: A Systematic Review and Meta-analysis. Indian Pediatrics. 2020;57(9):820–6.

17. COVID-19: Data [Internet]. COVID-19: Latest Data - NYC Health. [cited 2021Jun16]. Available from: https://www1.nyc.gov/site/doh/covid/covid-19-data.page

18. Hoffmann M, Kleine-Weber H, Schroeder S, Krüger N, Hertler T, Schiergens TS, et al. SARS-CoV-2 Cell Entry Depends on ACE2 and TMPRSS2 and Is Blocked by a Clinically Proven Protease Inhibitor. Cell. 2020;181(2).

19. Lagunas-Rangel FA. Neutrophil-to-lymphocyte ratio and lymphocyte-to-C-reactive protein ratio in patients with severe coronavirus disease 2019 (COVID-19): A meta-analysis. Journal of Medical Virology. 2020;92(10):1733–4.

20. Wang L. C-reactive protein levels in the early stage of COVID-19. Médecine et Maladies Infectieuses. 2020;50(4):332–4.