

CLINICAL OVERVIEW

Characteristics of COVID-19 patients up to 6 months of age admitted to a paediatric emergency department

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Abstract

Very young age could be a potential risk factor for community-acquired severe acute respiratory syndrome coronavirus 2, due to immature immune systems. We retrospectively enrolled 39 infants up to 6 months of age who had presented to our tertiary Italian children's hospital emergency room between 9 March 2020 and 8 March 2021 and tested positive for the virus. Of those, 38 had a non-specific mild or asymptomatic clinical course and only one patient was admitted to intensive care with severe symptoms. We concluded that very young infants with COVID-19 had a generally favourable disease course.

KEYWORDS

asymptomatic, disease course, emergency room, infants, pandemic

Italy was the first western country to be overwhelmed by COVID-19, which was declared a pandemic by the World Health Organization on 11 March 2020.¹ Many papers have been published since then, and they have provided valuable information on the pathophysiology, prognosis and treatment strategies for COVID-19. However, data on paediatric patients are still lacking and the material that is available tends to be confusing.^{2,3} Children under 10 years of age represent less than 1% of all COVID-19 cases and appear to be affected more mildly than adults and show a more favourable clinical course. Children under 5 years of age, particularly those under 1 year of age and those with pre-existing comorbidities, could be more vulnerable to having moderate-to-severe COVID-19 disease, as reported by recent papers.⁴⁻⁸ Furthermore, it has been suggested that very young age could be a potential risk factor for community-acquired COVID-19, due to immature immune systems.⁸⁻¹² Conflicting conclusions have arisen due to the limited data available.^{5,6,10,12,13}

The main limitations of COVID-19 paediatric studies have been that they have covered patients from 0 to 18 years of age.^{5,6,14} Only a few papers have split patients into different age groups, such as less than 1 year of age, 1-9 years and 9-18 years.¹³⁻¹⁵

The aim of this paper was to report data on infants up to 6 months of age who were admitted to the emergency department (ED) of the Giannina Gaslini Children, in Genoa, Italy, with a confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. We wanted to assess whether this age group represented a risk factor for moderate-to-severe COVID-19 disease.

This 1-year study took place from 9 March 2020, which was the first day of the Italian lockdown, to 8 March 2021. Nasopharyngeal swabs and real-time polymerase chain reaction tests were used to detect SARS-CoV-2. A flow chart of the inclusion and exclusion criteria is presented in Figure 1.

Abbreviations: ED, emergency department; SARS-CoV-2, Severe acute respiratory syndrome coronavirus 2.

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If the patients tested positive for the virus, we recorded their age and perinatal and family history. The clinical data that were recorded were their symptoms, blood examination result on admission and after 36–48 h of hospitalisation, radiological tests and any therapies administered.

We found that 20,091 patients presented to our ED during the 1-year study period. Of the 205 who tested positive for the SARS-CoV-2 virus, 39 (19%) were up to 6 months of age, with a median age of 79 days (range 9–210), and 64% of those were male. More than half, 23/39 (59%), were less than 3 months old, including three (8%) under 28 days of age, and 16 (41%) who were at least 3 months old. None had been born preterm. We noted that 15 (38%) had an older sibling and 36 (92%) had at least one parent who also has been tested positive when they accompanied their child to the ED.

There were five patients (13%) with a pathological perinatal history: four had hypoxic ischaemic encephalopathy and one had intrauterine growth retardation. Comorbidities were recorded in four (10%) patients, and these were: a non-haemodynamically significant ventricular septal defect, a symptomatic Chiari I malformation with apnoea, an asymptomatic cystic fibrosis diagnosis during neonatal screening and a pancytopenia, with a suspected diagnosis of congenital cytomegalovirus versus congenital immunodeficiency.

On admission, 34/39 (87%) infants had a fever and their median body temperature in the ED was 37.8°C (interquartile range 37.5–38.1). There were also 15 (38%) patients who presented with mild respiratory symptoms, namely a cough and, or, rhinitis, and nine patients (20%) presented with mild gastrointestinal symptoms, such as vomiting and, or, diarrhoea and, or, feeding difficulties. In addition, two patients (5%) presented with a rash, 12 patients (30%) presented with no symptoms other than fever and three patients (8%) were totally asymptomatic. Two patients presented with several different symptoms. Only the patient with pancytopenia, a 4-month-old boy, presented to the ED with sepsis-like syndrome. He was hypotonic and pale, with prolonged capillary refill, moderately tachypneic with an oxygen saturation of 94%, and he had diastolic hypotension (91/45 mmHg). The patient required mechanical

ventilation for 13 days, parenteral nutrition and broad-spectrum antibiotics. A summary of the symptoms and clinical presentations of the patients is shown in Figure 2.

All patients presenting with gastrointestinal symptoms were tested for coprocultures, which were negative. Abdominal ultrasounds were performed on three patients, without any pathological findings. Chest X-rays were performed on four infants, and diffuse interstitial infiltration was detected in one of them. No other diagnostic assessments were deemed necessary.

We gave six (15%) patients antibiotic therapy, due to suspected bacterial co-infection, and there were three (8%) who required supportive intravenous fluids. Most of the patients, 32/39 (82%), received symptomatic therapy or did not require any care.

Laboratory tests revealed neutropenia in three patients, and in two cases their absolute neutrophil count normalised after 36–48 h. Conversely, three patients who had normal levels when they presented to the ED had developed neutropenia at 36–48 h. Slight lymphopenia was detected in two infants during their ED evaluation, but they did not include the infant with the history of pancytopenia.

With the exception of the patient with sepsis-like syndrome, none of the patients who were tested for biomarkers, namely C-reactive protein and procalcitonin, presented with elevated inflammation.

A total of 28 patients (72%) were hospitalised for a median of 5 days (range 2–60), including all three neonates. None of the patients were rehospitalised within 72 h of being discharged or developed childhood multisystem inflammatory syndrome associated with COVID-19 when they were followed up for at least 2 months.¹⁶

We believe that this was the biggest study to focus on infants under the age of 6 months who presented to an ED and tested positive for the SARS-CoV-2 virus over a 1-year period. Previous studies looked at smaller samples of patients with the virus or limited their studies to patients under 60 days of age.^{13,15}

The lack of information on COVID-19 characteristics in vulnerable patients up to 6 months of age continues to challenge ED physicians, but our data suggest that these infants experienced non-specific milder or asymptomatic forms of COVID-19. In addition, the normal values of C-reactive protein, procalcitonin and absolute neutrophil count were consistent with a mild inflammatory response. Virtually, all of our patients presented with mild or no symptoms, including those with comorbidities and those with a remarkable perinatal history.

As stated above, only one child became severely ill after developing COVID-19. He needed to be admitted to the intensive care unit and was treated with mechanical ventilation, probably due to the fact that he had pancytopenia and suspected immunodeficiency. He then developed central venous catheter-related sepsis caused by *Methicillin-susceptible staphylococcus aureus*.

With the exception of that 4-month-old boy, none of our other patients presented with the severe underlying conditions that have been associated with a higher risk of severe COVID-19. These include severe congenital heart disease, genetic, metabolic and, or, neurological diseases, which have been associated with a higher risk of severe COVID-19.

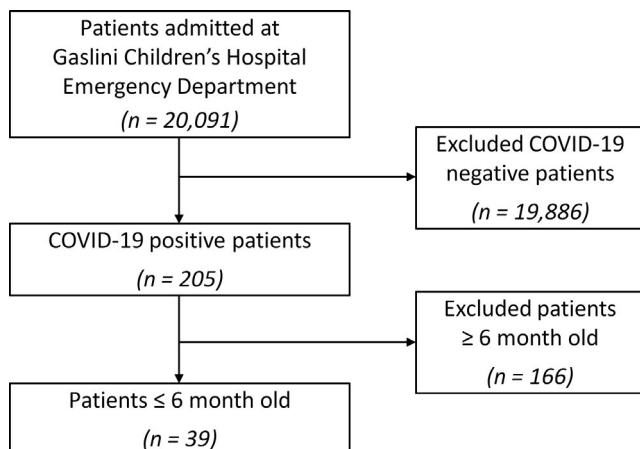


FIGURE 1 Inclusion and exclusion flow chart for the patients who tested positive for SARS-CoV-2

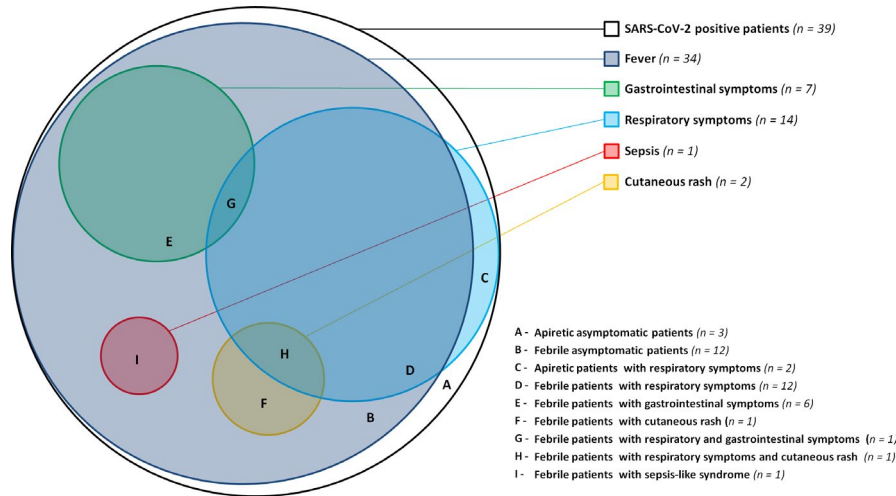


FIGURE 2 Distribution and clinical presentations of symptoms in the patients who tested positive for SARS-CoV-2. The various coloured circles show the distribution and overlap of the symptoms, and the letters identify the resulting clinical presentations

Other clinical conditions known to increase the risk of severe COVID-19, such as asthma, diabetes, obesity and hypertension, are uncommon in very young patients and were absent in this cohort.

Our study had some limitations, including the fact that retrospective designs can introduce bias. Although this study was one of the largest COVID-19 series to be carried out on patients under the age of 6 months, we are still confident that children of that age are a fairly small percentage of those affected by the disease.^{8,10,11,15}

We believe that our study provides valuable insights into the clinical and biochemical characteristics of infants under the age of 6 months who are infected with SARS-CoV-2. Our findings suggest that this age group was relatively spared from moderate-to-severe COVID-19 and presented with a favourable course. The experiences of young infants who develop COVID-19 are still evolving, and most of the knowledge that is available comes from anecdotal reports. That is why more prospective studies are needed. As shown in Figure 2, our experience demonstrated that infants with COVID-19 did not present with a specific clinical picture, but the clinical course was generally favourable.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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