

BRIEF REPORT

Persistent symptoms in Swedish children after hospitalisation due to COVID-19

COVID-19 is generally mild in children,¹ and post-acute inflammatory conditions that are temporally associated with the virus are rare, but potentially severe. However, some children and adults experience persistent symptoms after COVID-19.² Long COVID has not been precisely defined, but one study reported symptoms approximately 60 days after the primary diagnosis.³ Although adult long COVID is increasingly being studied, the magnitude of persistent symptoms in children remains unclear.

This Swedish study assessed the extent, and type, of persistent symptoms in children aged 0–18 years who were admitted to one of the two paediatric hospitals in the Stockholm Region from 13 March to 31 August 2020 due to COVID-19. The inclusion criteria were the presence of a nasopharyngeal sample RT-PCR positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Children that tested positive, but were hospitalised for other reasons, were not included. Information on any persisting health issues following hospitalisation, their perceived severity and their impact on daily activities was collected during structured telephone interviews with the children and/or their guardians (Appendix S1). The children were followed up in December 2020 and January 2021, at least four months after being admitted (median 219 days, range 123–324 days). Three paediatricians reviewed the reported symptoms, in relation to the patient's age, and objective findings in their medical records. Symptoms were classified as mild, moderate or severe and by their uncertain or possible association with COVID-19. The Swedish Central Ethical Research Board approved the study (number 2020-02061), and guardians provided informed consent before data collection.

There were 147 SARS-CoV-2-positive children hospitalised during the study period, and 60 were primarily admitted due to COVID-19. Of these 60 children, nine fulfilled the criteria of multi-system inflammatory syndrome in children (MIS-C) and two of these required intensive care. Other reasons for admissions included dehydration (38%), infection observation (35%) and need for inhalations (23%). A total of 55 were interviewed and analysed (Table 1), as two were lost to follow-up and three declined to participate. We found that 12/55 (22%) had persistent symptoms and 8/12 had fatigue, which was the most common symptom. There were 6/12 with mild persistent symptoms with an uncertain relationship with COVID-19, including vague symptoms, such as parental reports of poor appetite despite good growth, an infant with a congested nose

and intermittent increases in body temperature. A third (4/12), aged 4, 14, 15 and 16 years, had multiple severe symptoms that were possibly related to COVID-19. All four reported fatigue and headache or myalgia, and three reported cognitive difficulties. Their median admission was seven days, compared with four days for the overall group: three had a C-reactive protein value of more than 200mg/l during their initial illness, and two were diagnosed with MIS-C. All the severe cases had symptoms that had a major impact on their daily activities, including reduced school attendance and leisure activities.

The groups were too small to determine statistically significant differences, but persistent symptoms seemed higher among children diagnosed with MIS-C.

A tenth of the 55 children who were hospitalised due to COVID-19 reported persistent symptoms that were assessed to have a possible association with the SARS-CoV-2 infection more than four months after their acute illness. This was lower than the 27% of Italian children with symptoms 120 days or more after diagnosis.⁴ However, shorter follow-up time and different patient categories may explain this difference, as symptoms may resolve over time. Australian researchers followed 171 children, with SARS-CoV-2 verified infections three and six months after their acute illness.⁵ Most children had a mild or asymptomatic disease, and only 14 required hospital care. Although 12/151 (8%) reported initial persistent symptoms up to eight weeks after symptom onset, these had all resolved after six months. Notably, all the children were under 13 years of age, but in our study, teenagers accounted for three of the four children with the most pronounced severe symptoms and the greatest impact on daily life.

Our conclusions were limited by the small sample and only included children admitted to the paediatric hospitals. This limits the generalisability to hospitalised children even though most children will have mild COVID-19. Children who tested positive for SARS-CoV-2 antibodies but had negative polymerase chain reaction results for SARS-CoV-2 were not included, and further assessment of persistent symptoms in children with MIS-C is warranted. Furthermore, self-reported symptoms may, to some extent, be difficult to validate and this makes it challenging to develop criteria for follow-up procedures. It is well known that viral infections may cause long-term symptoms. Further assessment with laboratory or radiological testing to identify organ damage or immunological reactions is

TABLE 1 Characteristics of 55 children following COVID-19 hospitalisation and reported problems in those with persistent symptoms

| | Persistent symptoms: severity/relationship to COVID-19 (n = 12) | | | Fully recovered after COVID-19 (n = 43) | Total (n = 55) n (%) |
|---------------------------------|---|----------------------------|--------------------------|---|----------------------|
| | Mild / uncertain (n = 6) | Moderate /possible (n = 2) | Severe/ possible (n = 4) | | |
| Age group | | | | | |
| <1 year | 3 | 0 | 0 | 18 | 21 (38%) |
| 1-5 years | 1 | 0 | 1 | 12 | 14 (25%) |
| 6-12 years | 1 | 0 | 0 | 6 | 14 (25%) |
| 13-18 years | 1 | 2 | 3 | 7 | 6 (11%) |
| Gender, male | 2 | 1 | 2 | 27 | 32 (58%) |
| Symptoms at onset | | | | | |
| Fever | 6 | 2 | 4 | 40 | 52 (95%) |
| Respiratory | 4 | 2 | 2 | 26 | 35 (64%) |
| Gastrointestinal | 1 | 0 | 4 | 17 | 22 (40%) |
| Hyperinflammation | 1 | 0 | 2 | 6 | 9 (16%) |
| Treatment received | | | | | |
| Oxygen | 0 | 1 | 1 | 6 | 8 (14%) |
| Intensive care | 0 | 1 | 1 | 1 | 3 (5%) |
| Hospitalisation, days | 7 (3-18) | 2.5 (2-3) | 7 (2-19) | 4 (1-23) | 4 (1-23%) |
| CRP, mg/L | 15 (4-210) | 47 (43-51) | 274,5 (9-320) | 38 (<1-330) | 39 (<1-330) |
| Days since discharge | 197 (172-242) | 262 (261-263) | 174 (139-210) | 237 (123-324) | 219 (123-324) |
| Chronic illness ^a | 1(17) | 2(100) | 2 (50) | 14(33) | 19 (35%) |
| Remaining symptoms ^b | | | | | |
| Fatigue | 2 | 2 | 4 | NA | NA |
| Gastrointestinal | 1 | 1 | 1 | | |
| Cognitive difficulties | 0 | 0 | 3 | | |
| Reduced smell/taste | 0 | 0 | 2 | | |
| Myalgia/headache | 0 | 0 | 4 | | |
| Depression/dysphoria | 0 | 1 | 2 | | |
| Respiratory | 1 | 1 | 1 | | |
| Other ^c | 2 | 0 | 0 | | |

Note: Data expressed as number of patients (with percentages for totals) or median and range values.

^aIncluding asthma, haematological/oncological, neurological/multiple.

^bSeveral symptoms per person reported.

^cIntermittent heart palpitations and increased body temperature.

warranted to better understand children with persisting symptoms related to the SARS-CoV-2 infection.

We found that a subset of children hospitalised for COVID-19 experienced long-term health issues, based on reports from them or their guardians. Early recognition and support for paediatric long COVID patients is needed to reduce potential consequences related to learning and social development.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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