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## Children with COVID-19 at a specialist centre: initial experience and outcome

The 2019 novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes COVID-19, characterised by potentially severe respiratory and gastrointestinal symptoms, in humans.[1] As of late May, 2020, there were around 5 million confirmed cases of COVID-19 and more than 300 000 associated deaths globally.[1] COVID-19 can affect children, but it appears to be associated with fewer symptoms and less severe disease compared with adults, with correspondingly lower case-fatality rates.[2] In the UK, Public Health England has outlined a shielding strategy designed to protect those extremely vulnerable to SARS-CoV-2 infection,[3,4] such as individuals who are immunocompromised. We examined a cohort of paediatric patients, presenting to Great Ormond Street Hospital, London, UK (a specialist children's hospital), with suspected COVID-19 to document their clinical characteristics and outcomes with regard to the presence of underlying medical conditions associated with vulnerability.

We retrospectively used routinely collected deidentified hospital data within a secure digital research environment (REC approval 17/LO/0008) from children presenting to Great Ormond Street Hospital, with suspected COVID-19 between March 1 and May 15, 2020. COVID-19 positive cases were those with clinical features of COVID-19 and a positive PCR-test for SARS-CoV-2 (either directly or positive familial SARS-CoV-2 testing). Patients were classified regarding vulnerability group using NHS Digital methodology.[4]

There were 65 COVID-19 postive cases (median age 9 years [IQR 0·9–14]) during the study (appendix), of whom 31 (48%) were classed as vulnerable. The most common provisional diagnosis codes for the group were sepsis, fever, and pneumonia. Only one patient who tested positive for SARS-CoV-2 died because of an underlying medical condition and another infection not thought to be related to SARS-CoV-2.

29 (45%) patients required admission to the intensive care unit. Of whom, 14 (48%) were classed as vulnerable. The length of stay in the intensive care unit for all patients was 4 days (2·4–10·6). Compared with patients classed as non-vulnerable, those classed as vulnerable had a significantly longer stay of 11 days (3·7–15·1; Mann-Whitney *U* test p<0·001). Of the 29 patients admitted to the intensive care unit, 18 (62%) required mechanical ventilation, of whom ten (56%) were classed as vulnerable (p=0·53). Overall hospital stay was also significantly shorter in the non-vulnerable group (3·9 days [2·5–15·7]) than in the vulnerable group (16·2 days [3·8–20·8]; p<0·001). As of May 15, 2020, nine patients (14%) remained in hospital, three of whom (33%) were classed as vulnerable (p=0·35). During the study, with a daily average of 326 inpatients, on average ten were positive for SARS-CoV-2 at any time, representing around 3% of the hospital inpatient population, much lower than the estimated 25% COVID-19-positive population reported across adult London trusts.[5]

These data show the characteristics and outcomes of children presenting to a specialist children's hospital with clinical features of COVID-19 disease and positive testing, and confirm that some children with SARS-CoV-2 might have severe disease with requirement for intensive care admission. Of note, the reported cohort of patients are highly preselected, both for children with severe disease and for those with underlying medical conditions, and therefore the findings are not applicable to the general paediatric population. Stewart and colleagues[6] recently reported specific renal features in a case series of 52 children with COVID-19 referred to our centre, 35 of whom are also included in the present overall cohort. Previous data from general centres suggest that less than 1% of COVID-19 admissions are children younger than 18 years and data from multiple North American hospitals reported few paediatric patients with COVID-19 per intensive care unit.[7,8] As such, the present cohort disproportionately represents those with complex underlying medical conditions, consistent with the fact that around three quarters of inpatients registered with the hospital in 2019 would be considered as vulnerable according to COVID-19 guidance.[4] This is not unexpected because the hospital represents a centre for paediatric transplantation, genetic diseases (such as congenital immunodeficiency), and paediatric malignancy.

Furthermore, in children with confirmed COVID-19, the proportion of patients with underlying vulnerable conditions requiring admission to an intensive care unit for mechanical ventilation were not significantly different to those classed as non-vulnerable. Although the possible effects of lockdown and shielding remain undetermined, given that this series includes cases from before and during lockdown (since March 23, 2020), these data raise the possibility that underlying medical conditions that place children at increased risk of COVID-19 disease or complications might differ from adults. This is consistent with a study reporting no mortality in a multicentre cohort of patients with cystic fibrosis affected by COVID-19,[9] and another using a renal registry, suggesting that children receiving immunosuppressive treatment appear to have a mild COVID-19 clinical course.[10] Susceptibility for COVID-19 in vulnerable groups might therefore be both disease-specific and related to patient age.

In addition to the typical features of COVID-19 disease described in

Published Online June 22, 2020 https://doi.org/10.1016/S2352-4642(20)30204-2

See Online for appendix

adults, although most children who are infected appear to have mild disease,[2] some might have an unusual associated systemic inflammatory condition: paediatric inflammatory multisystem syndrome temporally related to SARS-CoV-2 infection (PIMS-TS).[11] The criteria for the definitive diagnosis of PIMS-TS are evolving, and it remains uncertain whether any of the current patients with COVID could represent such cases, and studies are underway examining the PIMS-TS phenomenon.

Limitations of these data include the retrospective nature of using routine data, absence of a matched control group, and the highly preselected population from a specialist children's hospital, which is not representative of the paediatric population as a whole, although these data do provide information regarding this potentially high-risk group. It should also be noted that since vulnerable children might be shielded, the pattern of presentation reported might not be representative of a non-shielded situation, and additional epidemiological studies are required.

We declare no competing interests.

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