Title
Critical Paediatric COVID-19: Varied presentations but good outcomes

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Dear Editor,

International reports of the COVID-19 pandemic have described the relative sparing of children, both in case frequency (1) and disease severity (2-4). The major presentation described in children is the paediatric inflammatory multi-system syndrome (PIMS-TS) – many of these children do not have evidence of PCR positive viral disease and therefore may represent a post-infectious phenomenon (5). We describe our single-centre paediatric intensive care unit (PICU) experience of children who tested positive for SARS-CoV-2 in the first 10 weeks of the pandemic in the UK, excluding those who met PIMS-TS criteria as these have been described elsewhere.

A total of 313 children were admitted to our ICUs from the 26th of March to the 31st of May 2020. Ninety-six children were suspected to have COVID-19 of which 24 (25%) children tested RT-PCR positive at admission with SARS-CoV-2 on nasopharyngeal aspirate. Thirteen children presented with a PIMS-TS phenotype; here, we describe the characteristics and course of the remaining 11.

The demographic and presenting characteristics are shown in Table 1. Co-morbidities were present in all but two children. Four (36%) children were from a black, Asian or minority ethnic background. The clinical characteristics are presented in Table 2. Inflammatory markers were raised, but the range of maximum values during admission were widely variable.

Four children had respiratory disease fulfilling the 2015 PALICC criteria for paediatric acute respiratory distress syndrome (pARDS). Hypoxaemic respiratory failure management included prone ventilation (n=4) and inhaled pulmonary vasodilators (n=3). Two infants were escalated to high frequency oscillation due to refractory hypoxia on conventional ventilation. Median duration of ventilation was 13 days (IQR 10-15.5 days).

The remaining 7 children required admission to PICU for reasons other than respiratory failure. Three children presented in status epilepticus (two with known seizure disorders and one with an acquired head injury). All tested negative for SARS-CoV-2 on CSF analysis. Three children presented with significant new diagnoses (congenital heart disease, leukaemia and diabetes mellitus) which would have required PICU admission regardless of their SARS-CoV-2 status. The other child was undergoing chemotherapy for a malignancy and was on established long term ventilation but did not require a significant escalation in their ventilator parameters. Two of the cohort were immunocompromised.

Amongst other therapies, 5 (45%) children received vaso-active drugs. None received renal replacement therapy or ECMO. Five children (45%) received compassionate use of Remdesivir following ethics review. Six children (55%) received prophylactic anticoagulation with LMWH as part of a modification of our usual practice. The two infants developed line associated thrombosis in the absence of prophylaxis requiring therapeutic anticoagulation.

All children survived to discharge from PICU.

While children can present to PICU with a pattern of illness similar to adult COVID-19 disease, this is rare and the majority of those affected have identifiable vulnerabilities. A larger number of children were found to be SARS-CoV-2 positive co-incidentally. Whilst a causal relationship between some presentations and SARS-CoV-2 infection cannot be ruled out, these cases will have implications for hospital infection control precautions in children with critical illness throughout the pandemic.

References:

1. International Severe Acute Respiratory and Emerging Infections Consortium (ISARIC) COVID-19 Report 19th May 2020. Last accessed from https://media.tghn.org/medialibrary/2020/05/ISARIC_Data_Platform_COVID-19_Report_19MAY20.pdf
2. Castagnoli R, Votto M, Licari A, et al. Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection in Children and Adolescents: A Systematic Review [published online ahead of print, 2020 Apr 22]. JAMA Pediatr. 2020;10.1001/jamapediatrics.2020.1467.
3. Parri N, Magistà AM, Marchetti F, et al. Characteristic of COVID-19 infection in pediatric patients: early findings from two Italian Pediatric Research Networks [published online ahead of print, 2020 Jun 3]. Eur J Pediatr. 2020;10.1007/s00431-020-03683-8.
4. Zachariah P, Johnson CL, Halabi KC, et al. Epidemiology, Clinical Features, and Disease Severity in Patients With Coronavirus Disease 2019 (COVID-19) in a Children's Hospital in New York City, New York [published online ahead of print, 2020 Jun 3]. JAMA Pediatr. 2020;e202430.
5. Toubiana J, Poirault C, Corsia A, et al. Kawasaki-like multisystem inflammatory syndrome in children during the covid-19 pandemic in Paris, France: prospective observational study. BMJ. 2020;369:m2094.