Cardiology in the Young

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Impact of COVID-19 on patients with congenital heart disease

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Letter to the Editor

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The Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-Cov-2) virus pandemic has infected 25.1 million people worldwide with 844,000 deaths (31 August, 2020) with numbers rising rapidly. In the adult population, coronary artery disease, heart failure, and arrhythmias have been found to be associated with a more severe disease course with COVID-19 as well as higher mortality.[1] With respect to CHD, both paediatric and adult, there is a paucity of data. Many professional groups have issued guidelines for patients and parents/carers based on judgement and physiological principles rather than hard data.

We conducted a PubMed search using the terms "congenital heart disease" and "COVID 19" and "congenital heart disease" and "SARS-CoV-2" up until 4 August, 2020. We excluded articles, which involved Paediatric Inflammatory Multisystem Syndrome Temporally Associated with SARS-CoV-2 (PIMS-TS) or Multisystem Inflammatory Syndrome in Children (MIS-C), as these patients are a different disease entity. We identified 19 papers of which 12 were guidelines, commentary, or opinion and 7 included patient data (Table 1). We included the 7 papers,[2–8] which contained actual patient data and this included a variety of case reports, case series, and retrospective reviews. We excluded the 12 papers[9–20] that did not include any patient data and were deemed guidelines, opinion pieces, or a commentary.

A total of 94 suspected or confirmed cases have been reported in 7 papers.[2–8] By far, the biggest published series is from Italy[2] with 76 patients included. Amongst the 94 reported cases of CHD and COVID-19 infection, 79 patients (84%) were adults and 15 (16%) were children. Only one death was reported from all papers. Simpson *et al*[3] described a 19- year-old male patient with hypertrophic cardiomyopathy, obesity, diabetes, and metabolic syndrome, who was supported with ECMO for COVID-19 infection but died. With respect to critical care, of all 94 patients, 3 patients required ECMO (3.2%), 6 received inotropes (6.4%), 6 received positive pressure ventilation (6.4%), and 3 were supported with non-invasive ventilation (3.2%). With regard to specific CHD groups, reported cases are heterogeneous with no obvious predilection for a particular form of CHD (Tables 2 and 3).

In April, 2020, the Center for Disease Control (CDC) in the United States of America released its data on the number of patients affected by COVID-19.[21] Of their cohort, 2572 (1.7%) were children. Of these 2572 children, information on underlying medical conditions was only available for 345 patients (13%), and of these 25 had pre-existing cardiovascular disease (1% of overall numbers, 7.3% of those in whom there was the information of underlying conditions). Overall three deaths were reported, but no data was given on the background of these patients and whether they had cardiovascular disease or not. Data on the outcome of adult patients with CHD could not be extracted because acquired and CHD were not differentiated.

From the relatively small amount of data available up until the time of our literature search and analysis (31 August, 2020), some tentative conclusions can be drawn. The mortality of patients with CHD affected by COVID-19 appears low, and the disease does not appear to impact a specific form of CHD. Data on adult outcomes will remain difficult to extract until CHD is coded separately from acquired cardiac disease. In children, the mortality from COVID-19 appears low from North American data.[4,21] Data sources may, however, be impacted by ascertainment bias to report more severe cases. Conversely, a lack of rigorous testing may underestimate the number of patients affected. The extent to which shielding measures have impacted CHD patients also remains unknown.

Since we conducted our literature review and analysis, an additional paper has been published by Lewis *et al*,[22] looking at the effect of COVID-19 on patients with CHD. (The data from this additional paper by Lewis and colleagues is not included in our analysis and our Tables 1–3). In the manuscript by Lewis and colleagues, from a population of >7000 adults and children under follow-up, 53 CHD patients presented with COVID-19-related symptoms over a 4-month period. Nineteen percent of the patients were <18 years and 43 (81%) had mild symptoms. Nine patients (seven adults and two children) had moderate/severe symptoms. The cohort included a broad range of CHD including tetralogy of Fallot/pulmonary valvar stenosis (n = 16, 30%), functionally univentricular physiology status post-Fontan palliation (n = 10, 19%), shunting defects (n = 6,11%), congenital valve abnormality (n = 7, 13%),

Table 1. Demographic data of patients with CHD and COVID-19 infection in seven published papers.

	Number of patients	% of patients
Total number of patients	94	
Number of deaths	1	1.1%
Patient category		
Adults	79	84%
Paediatrics	15	16%
Type of CHD		
Known	91	97%
Unknown	3	3%
Treatment		
NIV	3	3.2%
Intubation	6	6.4%
Inotrope	6	6.4%
ECMO	3	3.2%

ECMO=extra corporeal membrane oxygenation; NIV=non-invasive ventilation

Table 2. Specific CHD lesions reported in an Italian paper.[2]

Italian paper (n = 76)[2]	
CHD diagnosis	% of people with diagnosis
ASD	9%
VSD	13%
PS	5%
AS/BAV	9%
CoA	12%
Ebstein	5%
DORV	4%
TOF	12%
Pulmonary atresia	10%
TGA	8%
ccTGA	3%
AVSD	7%
TCPC	10%

AS=Aortic stenosis; ASD=Atrial septal defect; AVSD=Atrioventricular septal defect; BAV=Bicuspid aortic valve; ccTGA=Congenitally corrected transposition of the great arteries; DORV=Double outlet right ventricle; PS=Pulmonary stenosis; TCPC=Total cavopulmonary connection; TGA=Transposition of the great arteries; TOF=Teralogy of Fallot; VSD=Ventricular septal defect

atrioventricular canal defects (n = 7, 13%), and other diagnoses (n = 7, 13%). Fifty patients survived but there were three deaths (6%), at the age of 34, 65, and 69 years. Moderate/severe disease was significantly associated with the genetic syndrome and adult CHD physiological stages C and D.[23]

In the United Kingdom, the British Congenital Cardiac Association is conducting a nationwide, multicentre survey to gauge the impact of COVID-19 on CHD more comprehensively. This, we hope, will permit a better understanding of groups at risk which will impact preventative strategies.

Table 3. Specific CHD lesions reported in all other papers.[3–8]

All other papers combined (n = 18)[3–8]		
CHD diagnosis	Number of patients with diagnosis	% of patients with diagnosis
Unknown	3	17%
TGA	3	17%
TCPC	1	6%
Heart transplant	1	6%
AVSD	5	28%
TOF/AVSD	1	6%
Cardiomyopathy	3	17%
TOF	1	6%

AVSD=Atrioventricular septal defect; TCPC=Total cavopulmonary connection; TGA=Transposition of the great arteries; TOF=Tetralogy of Fallot

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