CLINICAL VIGNETTE

SARS-CoV-2 Infection in a Patient with Congenital Heart Disease Related Pulmonary Hypertension

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Introduction

Pulmonary arterial hypertension (PAH) is defines by a resting mean pulmonary arterial pressures of 25 mm Hg or higher, on right heart catheterization.[1] Symptoms of PAH may include dyspnea, exertional syncope, and premature death from right ventricular failure.[2] Among the many etiologies of PAH, adult congenital heart disease related-PAH (ACHD-PAH) is increasing as adults with ACHD have improved outcomes with advances in surgeries and drug therapy. Some studies PAH prevalence of rates of six cases per 1000 adults.[3] Unfortunately, PAH mortality remains significantly higher than the general ACHD population, with median age of death at 48.8 years.[4,5]

Eisenmenger's syndrome (ES) is a dreaded complication of congenital heart diseases. It may result from non-repaired left-to-right cardiac shunts leading to high pulmonary vascular resistance (PVR), elevated right sided cardiac pressures, and reversal of the shunt as right-sided cardiac pressures become higher than left-sided pressures.[6] Historically, patients with PAH who develop ES only live to about 20-25 years and generally have worse outcomes compared to patients with PAH alone.[7]

Despite the high mortality associated with PAH, patients with concomitant COVID-19 pneumonia surprisingly have a less severe course than expected.[8,9] We present a 57-year-old man with PAH and ES who presented with COVID-19 pneumonia. He surpassed his expected survival with PAH and ES with on no medical therapy, and also did relatively well with COVID-19 pneumonia.

Case

A 57-year-old man presented to the emergency department, with worsening shortness of breath (SOB) for the past week. He has heart failure with chronic, intermittent dyspnea for 15 years. The patient appeared plethoric and was in respiratory distress. The patient appeared plethoric and in respiratory distress. Pulse oximetry was 83% on room air and he was placed on bilevel positive airway pressure (BiPAP). He had a systolic murmur at the right sternal border and a fixed split S2, bibasilar crackles, and clubbing of all fingers. Labs were significant for pH 7.46, pCO2 40, pO2 68 (arterial blood gas), and HCO3 28.6; white count 8.4; and hemoglobin 20.2. His SARS-CoV-2 RNA, transcription-mediated amplification based diagnostic assay was positive.

CT pulmonary angiography demonstrated aneurysmal dilatation with mural thrombus in the right pulmonary artery, ground-glass opacities in the upper lobes and a patent ductus arteriosus (PDA) (Figures A, B).

Transthoracic echocardiogram demonstrated a 2cm ventricular septal defect (VSD), an atrial septal defect (ASD), right ventricular pressure overload, and right to left shunting leading to a diagnosis of ES. (Figure C).

The patient was started on remdesivir, dexamethasone, and diuretics. Within one day oxygen decreased to nasal cannula. After a detailed risk-benefit discussion, warfarin was started for the mural thrombosis.

After discharge, right heart catheterization confirmed PAH.

Discussion

This remarkable patient survived into his sixth decade of life and continues to thrive. His short, relatively uncomplicated course with COVID-19 lends credence to the possibility of a protective effect PAH has against the SARS-CoV-2 virus. To our knowledge this is the first reported patient with PAH not on prior medications who fared well with concomitant SARS-CoV-2 pneumonia.

Our patient was born with a VSD, ASD, and PDA, which had persisted into adulthood. Congenital cardiac shunts may result in volume and pressure overload leading to vascular dysfunction and remodeling that cause increased pulmonary vascular resistance over time, leading to PAH and increased right heart pressures that can eventually reverse the shunt from left-to-right to right-to-left and thus the development of ES. (10, 11)

The prevalence of PAH amongst adults with congenital heart disease ranges between 4.2 to 28%.[12,13] The prevalence of ES is

unknown but about 8% of children with congenital cardiac disease and 11% of those with left-to-right heart shunts will develop ES.[12,14] The right-to-left shunt inherent to ES is associated with hypoxemia and cyanosis, causing increased erythropoietin levels that lead to erythrocytosis, increased blood viscosity, and endothelial dysfunction.[15] These patients are also at high risk of bleeding due to decreased levels of clotting factors and increased fibrinolytic activity.[16] This combination can be devastating as pulmonary embolisms can result in pulmonary infarctions and intrapulmonary hemorrhage, which are very difficult to treat. Anticoagulation is extremely high risk due to the bleeding tendencies.[17]

Given the dangerous comorbidities, low cardiac reserve, and high mortality in patients with PAH, raising high initial concern for this population of adults with COVID 19 pandemic. Further hypoxemia and the release of inflammatory cytokines was thought to put patients with PAH at risk of rapid right ventricular decompensation.[18]

Patients with PAH have fared better than expected with SARS-CoV2 infection.[19,20] Possible explanations include that the somewhat unique medications use to treat PAH may have a protective effect, other theories suggest that impaired endothelium in the lungs may lead to an impaired inflammatory response which protects against an uncontrolled systemic inflammatory state.[8] Our patient with severe PAH on no medications had a mild reaction to SARS-CoV2 suggesting that the paradoxical, protective association of PAH to SARS-CoV2 may not be due to medications, but rather to the pathophysiology of the disease. Future research is needed to assess relationship between PAH and SARS-CoV2 infection.

Figures

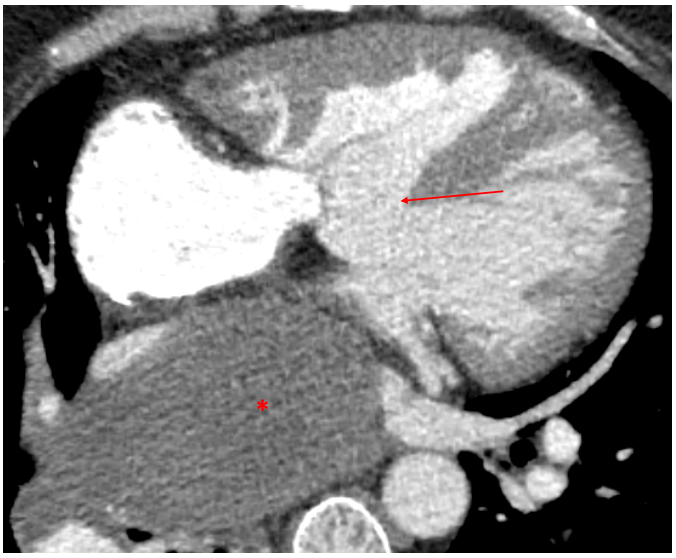

Figure A. Cardiac Computed tomography of large perimembranous ventricular septal defect (arrow). Evidence of large mass in pulmonary artery consistent with intramural thrombus (star).

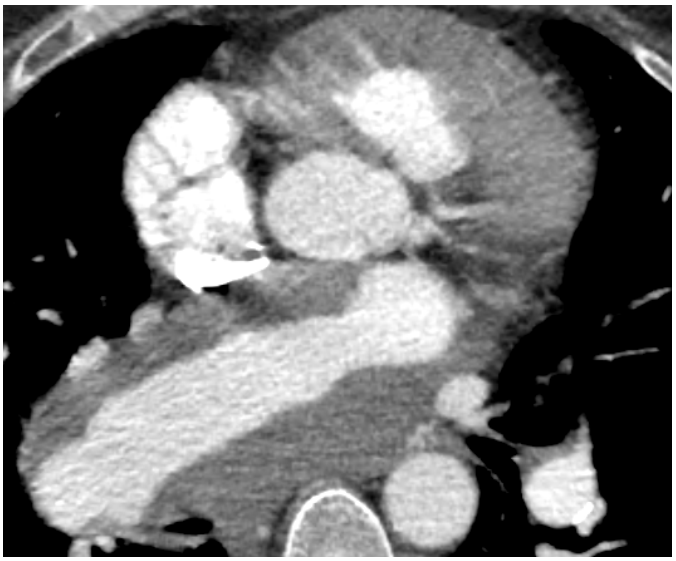

Figure B. Computed Tomography with right pulmonary artery intramural thrombus

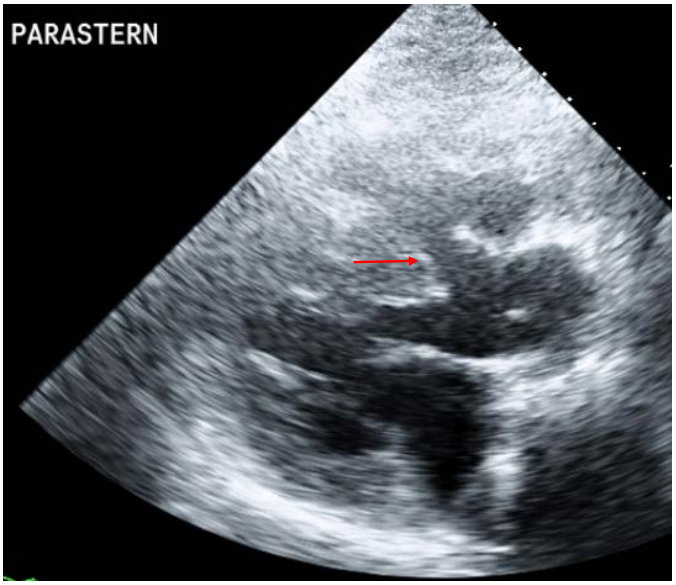

Figure C. Transthoracic parasternal long axis imaging showing a large perimembranous ventricular septal defect (arrow)

Disclosures: none.

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