Echocardiographic Clues in Diagnosis of Takayasu Arteritis in a Child with Severe Acute Respiratory Syndrome Coronavirus 2–Related Multisystem Inflammatory Syndrome

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INTRODUCTION

Takayasu arteritis is a rare idiopathic arteritis that is infrequently diagnosed in children. The nonspecific clinical presentation in children (hypertension, headaches, fever, and weight loss) can often lead to misdiagnosis. Timely diagnosis and therapy are crucial in preventing irreversible vessel damage with resultant ischemia of vital organs.[1] Multisystem inflammatory syndrome in children (MIS-C) is a new childhood illness that is temporally associated with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection.[2] In the current pandemic, a workup of MIS-C is typically included in the evaluation of pediatric patients presenting with fever and nonspecific signs of inflammation. We present the case of a 13-year-old female patient who had immigrated from Liberia a year ago and presented to our emergency department with acute onset fatigue and severe hypertension. Laboratory testing was concerning for MIS-C. Echocardiogram revealed severely depressed ventricular function and thrombosis of the abdominal aorta that was later attributed to Takayasu arteritis.

CASE PRESENTATION

A previously healthy 13-year-old female patient who had recently immigrated to the United States from Liberia presented with 3 days of fatigue, nausea, and emesis. On physical exam, she had low-grade fever, severe hypertension (181 mm Hg/121 mm Hg) with a 20 mm Hg systolic blood pressure gradient between upper and lower extremities, and tachycardia with a gallop rhythm. Initial laboratory tests were notable for elevated cardiac markers (B-type natriuretic peptide 1,600 pg/mL [normal $<$ 100 pg/mL], troponin I 0.23 ng/mL [normal $<$ 0.03 ng/mL]), elevated inflammatory markers (C-reactive protein 5.1 mg/dL [normal $<$ 1.0 mg/dL), ferritin 72 ng/mL [normal 10-70 ng/mL]), elevated D-dimer 2.1 μg/mL [normal $\leq$ 0.40 μg/mL], and normal white cell count. Given the ongoing pandemic, testing for SARS-CoV-2 was obtained and was consistent with prior infection: nasopharyngeal quantitative polymerase chain reaction negative, serum IgM negative, serum IgG positive. Due to elevated cardiac markers and significant blood pressure gradient, transthoracic echocardiogram was obtained within an hour of admission to the cardiac intensive care unit and showed severely depressed left ventricular systolic function, severe mitral regurgitation, mild aortic regurgitation, and a patent aortic arch (Figure 1A and Video 1). Interrogation of the abdominal aorta showed a thickened aortic wall; irregular, echobright material partially occluding the lumen; and antegrade diastolic flow (Figure 1B–D, Video 2). These findings prompted emergent computed tomography angiography, which revealed diffuse thickening of the wall of the descending thoracic and abdominal aorta, intraluminal soft tissue densities suspicious for chronic intraluminal thrombus, multiple extensive pseudoaneurysms, and absence of contrast in the proximal left renal artery (Figure 2). In order to evaluate for additional vascular involvement and determine the chronicity of the observed findings, additional imaging was obtained. Magnetic resonance angiography of the chest, abdomen, and pelvis identified subacute to chronic thrombus within the thoracoabdominal aorta and near thrombotic occlusion of the left renal artery (Figure 3). Magnetic resonance angiography of the brain demonstrated normal arterial vessel configuration and size. Based on the patient's presentation and imaging findings, the differential diagnosis included inflammatory etiology (Takayasu arteritis, SARS-CoV-2-related MIS-C) versus infectious arteritis (extrapulmonary tuberculosis [TB], *S. Aureus*, or syphilis). Microbiology studies were significant for positive QuantiFERON and T-spot assays, as well as negative blood culture and rapid plasma reagin. Given the concern for latent TB infection, the patient was initiated on rifampin, isoniazid, pyrazinamide, and ethambutol. In addition, intravenous methylprednisone and intravenous immunoglobulin were initiated to mitigate the inflammatory process. No directed immunomodulatory therapy was started given ongoing infectious concerns. The acute critical care management included judicious afterload reduction (using nipride and nicardipine), diuresis, and anticoagulation with heparin. Ultimately, the patient underwent thoracoabdominal aortic aneurysm repair a week after admission with placement of a tetrafurcated graft from 5 cm below the aortic isthmus to below the level of the renal artery with anastomosis to the celiac, superior mesenteric, and bilateral renal arteries. Intraoperative examination demonstrated thoracoabdominal aortic aneurysms with multiple saccules containing clot and debris, total occlusion of the left renal artery, and adhesions surrounding the aorta (Figure 4). Histopathology of the surgical specimen revealed noninfectious aortitis consistent with Takayasu arteritis with transmural loss of

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VIDEO HIGHLIGHTS

Video 1: Two-dimensional grayscale and color Doppler echocardiographic imaging. Apical five-chamber view showing, dilated left atrium, severely depressed left ventricular systolic function, and severe mitral regurgitation.

Video 2: Two-dimensional grayscale and color Doppler echocardiographic imaging of the abdominal aorta showing the diffusely thickened aortic wall and intraluminal irregular, echobright material causing severe obstruction to aortic blood flow.

View the video content online at www.cvcasejournal.com.

elastic lamellae, laminar necrosis, and predominant lymphocytic vasculitis with rare neutrophils and marked reactive fibrosis. No acid fast bacilli were identified. After surgery, the patient was started on tocilizumab (IL-6 inhibitor) for directed immunomodulatory treatment for Takayasu arteritis and was continued on treatment for latent TB infection.

DISCUSSION

Takayasu arteritis is an idiopathic chronic granulomatous panarteritis that predominantly affects the aorta and its main branches. While the exact etiology of Takayasu arteritis is not known, infections including TB and viruses have been considered to play a role in the pathogenesis of the arteritis. Initial symptoms of Takayasu arteritis include fever, headache, arthralgias, and weight loss. Patients may have nonspecific symptoms for months to years until they develop progressive arterial fibrosis, stenosis, and thrombosis with signs of impaired tissue perfusion, usually in the second or third decade of life.[1,3] Presentation of Takayasu arteritis in childhood is rare. A study of 55 children with Takayasu arteritis in South Africa found that hypertension and ventricular dysfunction were the most common findings at presentation (71% and 67% of children, respectively). Stenoses of the abdominal aorta and renal arteries were common, with incidences of 64% and 62%, respectively. Aneurysms were only identified in 25% of the children. A positive purified protein derivative test for TB was documented in 73% of the children, although this is in the context of endemic TB in South Africa.[4] Our patient presented with classic late findings of childhood Takayasu arteritis with hypertension and heart failure secondary to obstruction of the abdominal aorta and renal arteries. However, her symptoms also resembled SARs-CoV2-related MIS-C, which include fever, vomiting, abdominal pain, elevated inflammatory and prothombotic markers, and impaired left ventricular function.[5,6] Although conclusions cannot be drawn from a single case, we wonder whether the inflammatory milieu associated with MIS-C had a role in exacerbating our patient's underlying arteritis, leading to the severe thrombosis of her abdominal aorta and subsequent acute heart failure. SARs-COV-2 infection has been reported to cause thrombotic and microangiopathic changes in blood vessels.[2,7] A detailed evaluation of the abdominal aorta on the initial echocardiogram played a key role in the timely diagnosis of this patient. This case highlights the importance of echocardiographic assessment of the abdominal aorta, particularly in patients who present with hypertension, extremity blood pressure gradients, and depressed ventricular systolic function. Cross-sectional imaging was crucial to determine the extent of the vascular disease. Computed tomography angiography provided clear anatomic delineation of the vascular

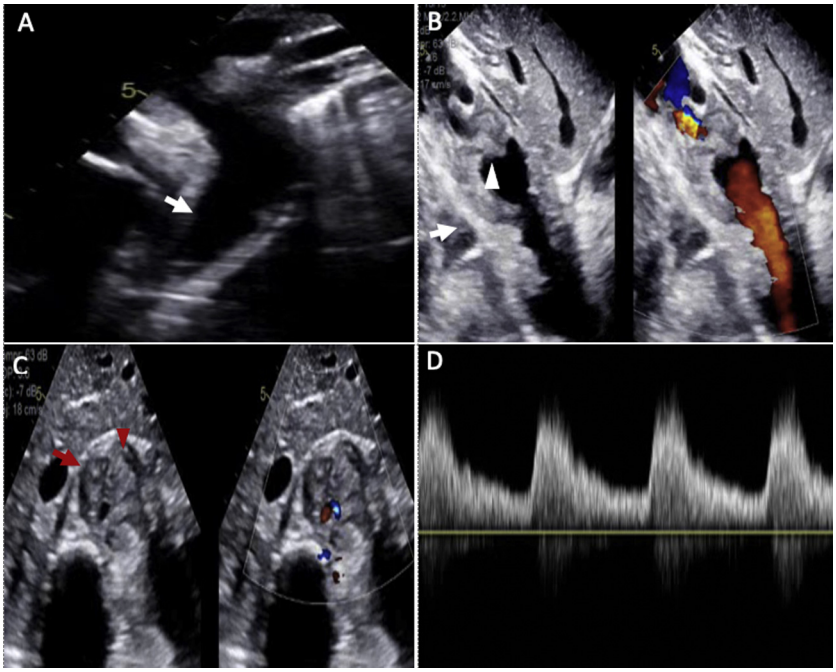

Figure 1 Echocardiographic findings. **(A)** Two-dimensional transthoracic echocardiography grayscale suprasternal notch view showing a patent aortic arch and proximal descending aorta with thickened walls (*arrow*). Longitudinal **(B)** and cross-sectional **(C)** grayscale and color Doppler imaging of the abdominal aorta demonstrate thickened aortic wall (*arrows*) and echobright, irregular intraluminal material (*arrow heads*). **(D)** Spectral Doppler signal of abdominal aorta with continuous antegrade flow in diastole.

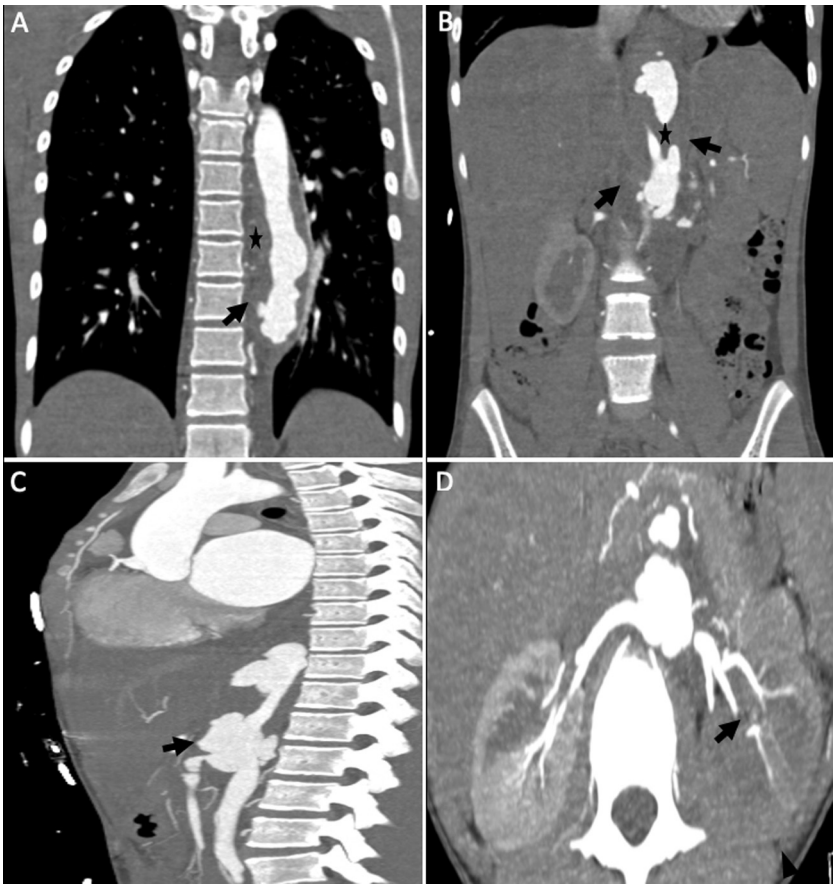

Figure 2 Computed tomographic angiography. Coronal views of chest **(A)** and abdomen **(B)** show diffuse thickening of aortic wall (*arrows*) and intraluminal irregularities (*stars*). **(C)** Sagittal view demonstrates aneurysmal outpouchings (*arrow*) of abdominal aorta. **(D)** Axial view shows proximal left renal artery stenosis (*arrow*) with delayed enhancement of left kidney.

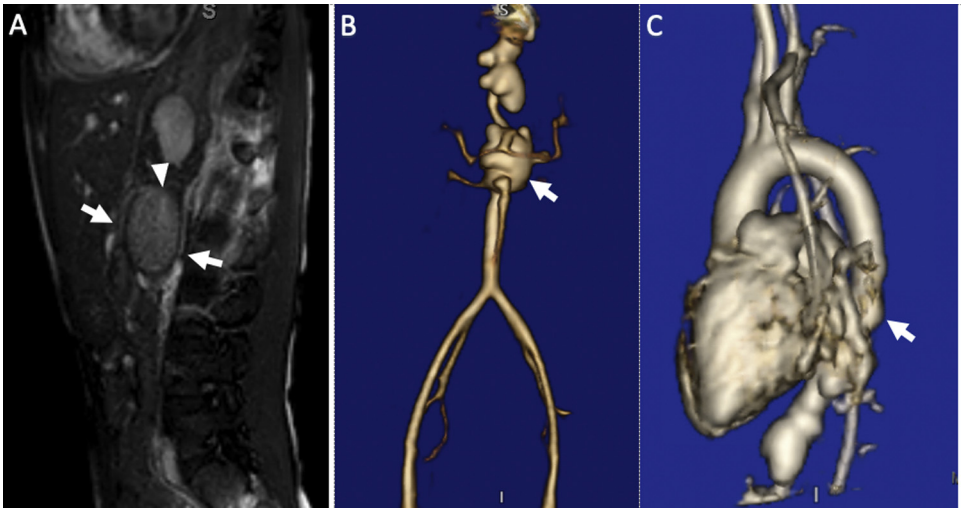

Figure 3 Magnetic resonance angiography **(A)** postcontrast fat-suppressed T1 sequence sagittal plane showing exuberant soft tissue thickening along the descending aorta (*wall marked by arrows*) with no significant delayed enhancement (*triangle*), suggestive of thrombus. **(B)** Three-dimenstional reconstruction of descending and abdominal aorta showing aneurysmal outpouchings (*arrow*). **(C)** Three-dimensional reconstruction of the heart, aortic arch, and descending thoracic aorta demonstrates aortic wall irregularity and outpouchings of descending aorta (*arrow*).

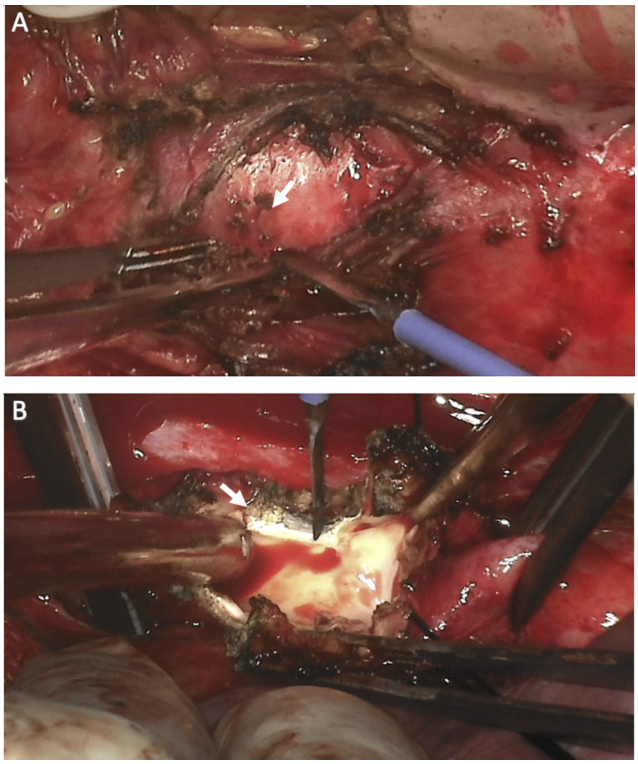

Figure 4 Intraoperative findings. **(A)** Image from the operating room during external examination of the aorta showing diffuse inflammation and adhesions surrounding the aorta (*arrows*). **(B)** Dissection of the aorta with internal examination showing the diffusely thickened walls of aorta (*arrow*).

lesions. Magnetic resonance angiography provided information about the chronicity of the thrombosis and the perfusion of abdominal organs.

CONCLUSION

Takayasu arteritis in children can present with severe hypertension and heart failure. Our patient had hemodynamic decompensation secondary to abdominal aorta thrombosis in the setting of significant inflammation related to SARs-CoV2 MIS-C. Echocardiographic imaging in patients with hypertension and blood pressure gradient between upper and lower extremities must include interrogation of the aortic arch and abdominal aorta. Cross-sectional imaging is useful to delineate the nature and extension of abdominal aorta lesions and to plan therapeutic interventions.

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.case.2021.03.005.

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