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Case Report

Vegetation Formation and Aortitis as a Possible Sequela of COVID-19 in a Patient with an Aortic Stent: A Case Report

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Abstract

Bacteria, especially staphylococcal groups, cause aortic graft infection. Infection stems from synthetic materials that repair aneurysms or artery blockages. Aortic stent infection and vegetation formation are rare, and heterogeneous presentations and ambiguous findings in routine diagnostic modalities render the diagnosis challenging.

A 25-year-old man with a history of catheter-based aortic stenting for hypertension associated with severe aortic coarctation was referred to our tertiary care hospital. Five months before the presentation, the patient had been infected with COVID-19, but he recovered after mild symptoms. Nevertheless, 3 months later, he developed erythematous lesions, progressive anorexia, epigastric pain, fever, and weakness. The results of blood tests, blood cultures, transthoracic echocardiography, plain chest radiography, computed tomography angiography, and electrocardiography were unremarkable. We found severe infectious aortitis, crescent thickness surrounding the aorta, pseudoaneurysm development, and a mass with dimensions of 17 mm×8 mm within the aortic stent on transesophageal echocardiography (TEE). Broad-spectrum antibiotic therapy was initiated, and the patient was transferred to the operating room, where the infected stent and adhesive vegetation were removed. The patient recovered remarkably after the surgery and was discharged. At 6 months' follow-up, he was in good condition.

Our findings highlight the significance of maintaining vigilance and a high level of clinical suspicion for the possibility of vegetation formation and aortitis as the possible sequelae of COVID-19, particularly in patients with an implanted stent. Furthermore, we strongly suggest TEE in patients with implanted stents to detect vegetation and aortitis.

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Keywords: *Aortic stent; Vegetation; Aortitis; COVID-19; Endocarditis; Case report*

Introduction

Coarctation of the aorta (CoA) is a well-known congenital heart disease, with an incidence of approximately 3 cases per 10 000 births.[1] Because of its fatal consequences, the prognosis of patients without treatment is poor, with 75% mortality at 43 years of age.[2] On the other hand, the emergence of several surgical techniques has significantly diminished overall morbidity and mortality rates among patients undergoing interventions for CoA. With the advances

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in equipment and the continued refinement of catheter-based stenting, an endovascular approach for the treatment of aortic abnormalities, such as CoA, has gained traction over the past 2 decades.[3, 4] Despite the successful outcome of catheter-based stenting in patients with CoA, complications such as recoarctation, aneurysm formation, intimal tear, and dissection may occur.[3] Aortic stent infection, albeit rare, is a clinically challenging condition and life-threatening complication.[3] Aortic wall inflammation is more commonly caused by non-infectious and inflammatory causes, such as Takayasu's and giant cell arteritis. Infectious etiologies are syphilis, tuberculosis, salmonellosis, and other bacterial or viral pathogens.[5]

This case report presents infectious aortitis and large vegetation on the aortic stent of a patient who had recently recovered from COVID-19 infection.

This case is reported with permission granted by our institutional review board, and written informed consent was provided by the patient.

Case Report

A febrile 25-year-old Iranian man with a history of endovascular CoA repair for severe hypertension in childhood was referred to our tertiary care hospital. The patient had no family history of heart disease and was on treatment with captopril (50 mg/d) and triamterene/hydrochlorothiazide (50/25 mg/d). He had an infection with the COVID-19 delta variant (polymerase chain reaction test-confirmed COVID-19) 5 months before this presentation but recovered without hospitalization. Nonetheless, after 3 months, he developed erythema in the right ankle joint, which resolved in a few days. The distal phalanges of the right toe and the right thumb thereafter developed erythema and swelling over the next several days. The patient was also experiencing progressive anorexia, epigastric pain, fever, and weakness. He was, therefore, initially admitted to a rheumatology ward with a pre-diagnosis of acute rheumatic fever/endocarditis; and after echocardiography, he was transferred to our hospital on the third day of hospitalization. Routine lab tests, blood cultures, and rheumatologic blood tests had been performed in the rheumatology ward but were not mentioned separately since they were not fully prepared when the patient was transferred to our center. We had no information about antibiotic consumption during the 3 days of hospitalization in the rheumatology department.

On admission to our hospital, the patient had a blood pressure of 155/100 mmHg, a pulse rate of 150 bpm, a body temperature of 38 ℃, and a respiratory rate of 22 breaths per minute. Physical examination was unremarkable, and electrocardiography and plain chest radiography revealed no significant abnormalities (Figure 1 & Figure 2). Blood cultures were repeated 3 times, but all were negative. Rheumatologic blood tests, consisting of antinuclear antibodies, anti-double-stranded DNA, anti-cyclic citrullinated peptide, anti-neutrophil cytoplasmic antibodies, and rheumatoid factor, were normal except for

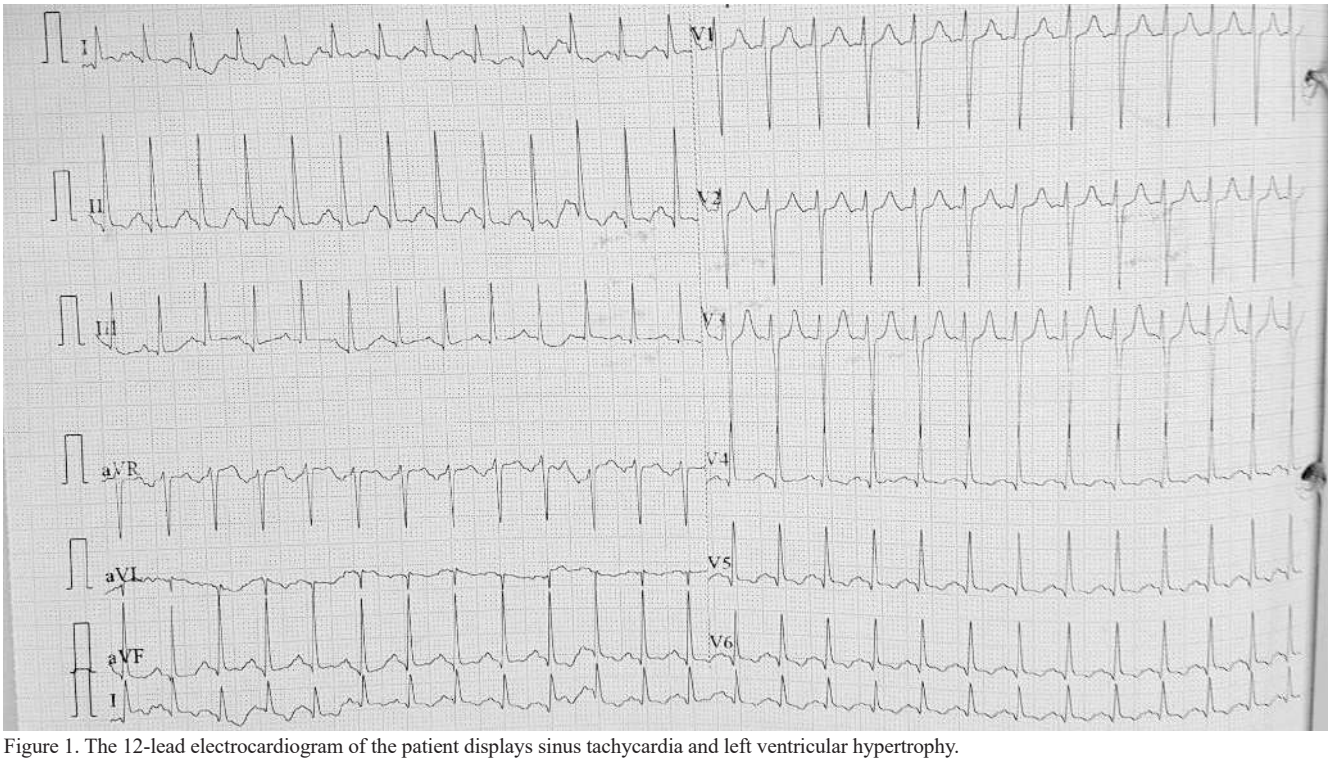

Figure 1. The 12-lead electrocardiogram of the patient displays sinus tachycardia and left ventricular hypertrophy.

an elevated level of erythrocyte sedimentation rate (123) and C-reactive protein (+3). HBsAg, anti-HCV, and anti-HIV were negative. Other laboratory tests revealed mild anemia (hemoglobin level =10.5) and relatively elevated white blood cell (10.5×10^3) and polymorphonuclear leukocyte (89%) counts (Table 1). Transthoracic echocardiography (TTE) illustrated moderate left ventricular hypertrophy, mild mitral regurgitation, mild aortic insufficiency, and mild narrowing of the sinotubular junction area; however, no vegetation was seen (left ventricular ejection fraction =55%). Next, the patient underwent transesophageal echocardiography (TEE) for a complete evaluation of the aortic stent in the descending aorta, which had been implanted at the typical site of the CoA. At the proximal and distal ends of the stent, complex aortitis with an approximate circumferential thickness of 8 mm and pseudoaneurysm development surrounding the aorta were visualized. The effective lumen of the CoA was 11 mm.

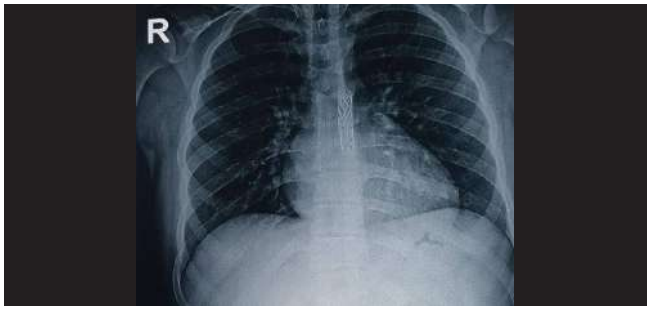

Figure 2. The patient's plain chest radiography (posterior-anterior projection) illustrates the stent in the descending aorta at the typical site of the coarctation of the aorta (stent length=6 cm).

Table 1. Results of the patient's blood tests

Test	Result
White blood cells (10^3/μL)	10.3 → 7.5
Hemoglobin (g/dL)	10.5 → 10.8
Platelet count (10^3/μL)	340 → 243
Blood urea nitrogen (mg/dL)	8.0
Serum creatinine (mg/dL)	1.0
Blood sugar (mg/dL)	108
Na (mmol/L)	140
K (mmol/L)	4.1
Cardiac troponin I (ng/mL)	0.1
Uric acid (mg/dL)	5.7
Serum iron (μg/dL)	40
Total iron-binding capacity (μg/dL)	290
Ferritin (ng/mL)	347
Erythrocyte sedimentation rate (mm/h)	123 → 105 → 119 → 80
C-reactive protein	3+ → 4+ → 2+
Blood culture	No growth × 3 times

At the distal portion of the stent, 17 mm long and 8 mm thick lesions, including a mobile mass compatible with vegetation with or without superimposed thrombosis, were observed (Figure 3 & Video 1). Computed tomography angiography showed an aortic stent with an open lumen, focal aneurysmal dilatation (diameter =15 mm) at the proximal section of the subclavian artery, and focal narrowing at the proximal section of the left common carotid artery (Figure 4). Broad-spectrum antibiotic therapy was initiated with vancomycin, gentamicin, ciprofloxacin, and ampicillin/sulbactam antibiotics. However, the patient had a hypersensitivity response to vancomycin, which included itchy and erythematous rashes on the neck, upper torso, arms, and legs, indicative of red man syndrome. The reaction was alleviated a few days after the medication was switched to linezolid. He was transferred to the operating room after 15 days of antibiotic therapy. Under general anesthesia, a thoracotomy was performed, and the aorta was inspected. There was widespread inflammation and swelling around the aorta. The infected stent and adhesive vegetation were removed, and the aorta was anastomosed end-to-end with a Dacron graft (diameter =22 mm). The antibiotic regimen was continued after surgery until day 40 since its initiation. The patient recovered remarkably after the surgery. The fever and migratory arthritis of the joints had immediate and complete resolution, and the weakness and anorexia gradually improved. He had an uneventful postoperative recovery, and his symptoms had resolved by the time of discharge. No significant complication was detected in the TTE examination at discharge. The patient was discharged with blood-pressure-lowering treatment. At 6 months' follow-up, no significant complication was detected in physical and TTE examinations.

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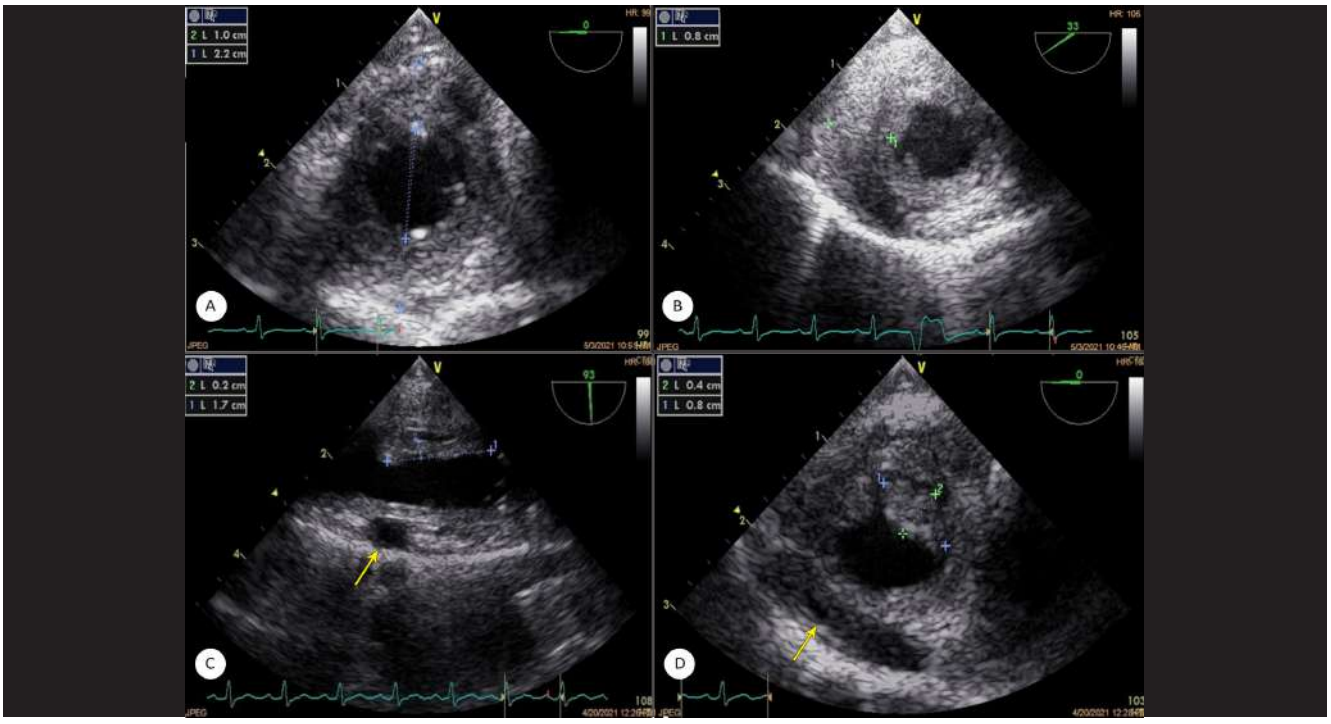

Figure 3. The patient's transesophageal echocardiography is presented herein.
A) The upper esophageal short-axis view of the descending aorta shows the stent at the typical site of the coarctation (effective lumen size of the aorta =11mm and outer to outer =22 mm). B) The upper esophageal short-axis view of the descending aorta illustrates very thick intima and media at the aortic wall (thickness =8 mm), compatible with infected aortitis. C) The upper esophageal long-axis view of the descending aorta illustrates a complicated lesion at the distal portion of the stent (length =17 mm and thickness =8 mm). D) The upper esophageal short-axis view of the descending aorta illustrates pseudoaneurysm formation in the aortic wall at the distal portion of the stent (arrow).

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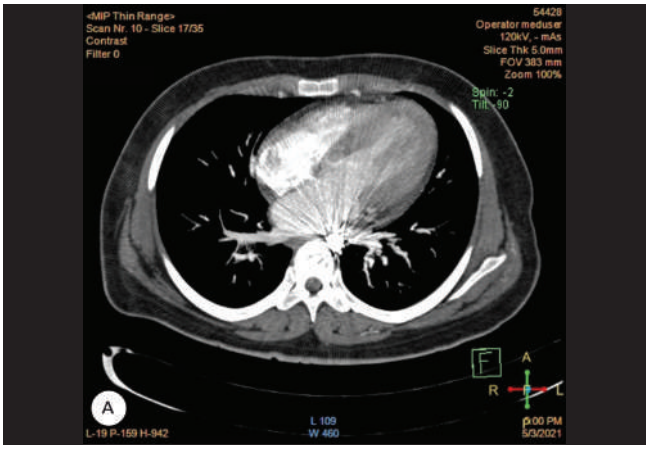

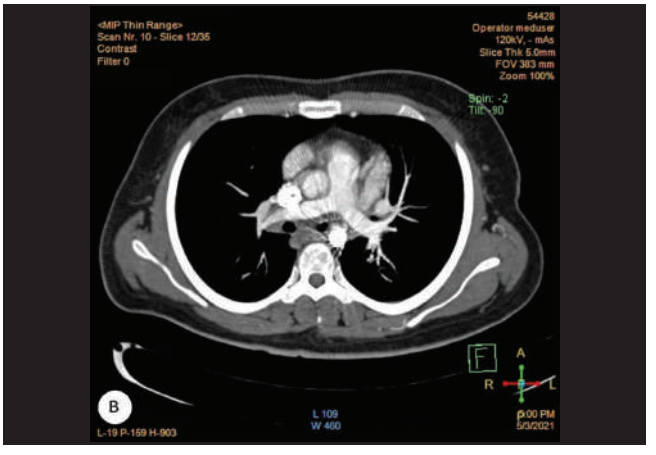

Figure 4. The image presents the computed tomographic angiography of the patient's aorta. The axial view shows the stent in the descending aorta. The filling defect of the mass inside the stent is not detectable possibly because of the streak artifact of the stent.

Discussion

Infectious aortitis following stent placement is a rare but life-threatening condition. We presented a case with a history

of endovascular stenting of CoA, referred to our hospital a few months after COVID-19 infection with some nonspecific symptoms. Nonetheless, TEE revealed aortitis and vegetation inside the stent. Several aspects of the presented case should be discussed.

Although the principal causes of aortitis are non-infectious and inflammatory etiologies, the reports of infectious aortitis are increasing concerning the increasing usage of the endovascular approach and endograft aneurysm repair.[2] Therefore, patients undergoing stent placement should be properly informed about the possibility of this complication.

Furthermore, considering the scarcity of cases of infectious aortitis following aortic stenting, the symptoms and signs of this phenomenon need elucidation.[6] Previously, some nonspecific symptoms were reported for similar cases, including fatigue, night sweats, chest pain, and shivers, which persisted for several weeks.[7, 8,9]

COVID-19 is reported to affect almost every organ in the body, leading to a variety of complications ranging from gastrointestinal to neurological and cardiovascular manifestations.[10] A few cases presentations have reported the occurrence of aortitis due to COVID-19.[11, 12] This phenomenon was first described in a 71-year-old man who presented with chest pain 2 months after recovery from COVID-19 infection.[11] Apoptosis and endotheliitis, which happen when neutrophils and mononuclear cells enter infected endothelial cells brought on by viral infection, are 2 potential pathogenic factors for aortitis. Leukocytoclastic vasculitis develops later in these arteries as a result of an accelerated karyolysis, a buildup of apoptotic bodies, caspase granules, and fibrinoid substances.[13] Type III hypersensitivity acute vasculitis, characterized by the deposition of polyclonal antigen-antibody immune complexes, results from this inflammatory response.[14]

Based on the cause and severity of the condition, anti-inflammatory medications, antibiotics, and occasionally surgical or endovascular therapy are suggested. Prednisone was used to treat the majority of COVID-19-induced aortitis patients, and therapy lasted around a month.[15] For either infectious or non-infectious aortitis, antibiotic susceptibility patterns, doses, and durations were not consistently provided.[12]

Gram-positive and Gram-negative bacteria should be generally treated with initial empiric antibiotic therapy for infectious aortitis, with risk factors for multidrug-resistant organisms and/or extended-spectrum beta-lactamase-resistant bacteria taken into account. These bacteria may need specific antibiotics, such as vancomycin, ceftaroline, daptomycin, linezolid, and carbapenem, or newer agents.[16, 17] Since some developing Salmonella strains, particularly in Asia, are becoming increasingly resistant to ciprofloxacin and other traditional antibiotic treatments, beta-lactam medicines (ceftriaxone, piperacillin-tazobactam, or other beta-lactams) are preferable when Salmonella aortitis is diagnosed.[18] If surgery is not urgently required, intravenous antibiotics should be administered 2 to 4 weeks prior to surgery to cure the local infection and avoid reinfection, particularly for in-situ graft placement (neither impending aortic rupture nor hemodynamic instability). Following surgery, intravenous antibiotics should be continued for another 6 to 12 weeks after sterile blood cultures.[19, 20]

The duration of antibiotic therapy is still debatable, with some specialists recommending lifetime suppressive oral antibiotic medication following intravenous antibiotics, particularly for hard-to-treat bacteria or in-situ graft implantation.[21, 22] Culture susceptibility determines the need for long-term suppressive antibiotic therapy with oral drugs, although little information is available on particular antibiotics, antibiotic doses, and the length of therapy.[23 24]

Moreover, in terms of the potential consequences and comorbid conditions, the choice of antibiotic treatment for patients with COVID-19 and culture-negative aortitis should be carefully examined.[25] Clinical response, a downtrend in inflammatory markers, and an improvement in radiological findings can all be drawn upon to monitor therapy response.[26]

In our study, the patient's blood culture was negative, and the entire period of his antibiotic treatment was 40 days: 15 days before surgery and 25 days after surgery. Additionally, the response to treatment was determined by improvement in the patient's general condition, clinical findings, and echocardiography.

The significant and scintillating aspect is that we established the diagnosis with the aid of TEE when no other imaging methods had recognized it. Therefore, it seems that scarce reports in this regard can be partly due to the non-use of this valuable imaging study. The accumulation of the reports of patients with this complication can provoke further research in this regard.

Conclusion

The occurrence of aortitis and the formation of septic vegetation on the aortic stent is rare but should be considered an important differential diagnosis in patients with previous endovascular stenting and febrile diseases, such as COVID-19 and probably superimposed bacterial infection. Furthermore, we wish to highlight the significance of maintaining vigilance and a high level of clinical suspicion for the possibility of infectious aortitis and vegetation inside the stent. We also strongly recommend TEE on patients with implanted stents to detect vegetation and aortitis.

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To watch the following video, please refer to the relevant URL:

https://jthc.tums.ac.ir/index.php/jthc/article/view/1831/1080

Video 1. The video presents transesophageal echocardiography illustrating the mobile mass on the implanted stent.