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Circumferential Fibrosis of the Ascending Aorta After COVID Infection



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After recovering from severe COVID-19 infection, 2 women presented with chest pain. Computed tomographic angiography suggested acute ascending aortic dissection. At operation in both patients, the ascending aorta was encased in dense fibrous tissue, within which were focal collections of mononuclear cells, including many plasma cells. There was no entry tear or dissection. Such findings we have not encountered previously, and PubMed search of “periaortic fibrosis and COVID-19” yielded no similar cases or possible relation. © 2022 Elsevier Inc. All rights reserved. (Am J Cardiol 2022;184:154–156)

Introduction

Two women were recently referred to Baylor University Medical Center (BUMC) from outside hospitals, a month apart, with diagnoses of probable acute Stanford type A aortic dissection. Each had contracted COVID-19 within 6 months of presentation. At operation, both patients had circumferential fibrosis of the ascending aorta, without an intimal-medial tear or medial dissection.

Patients Studied

Patient #1 was 56 years of age and Patient #2 was 36. Both were female. Both had had severe cases of COVID-19 infection associated with violent coughing. The COVID-19 screening test was negative on admission in Patient #1 and positive in Patient #2. Both were obese (body mass index 34.4 and 35.4 Kg/m², respectively). Both had normal left ventricular ejection fractions and normal aortic valves. The one major difference between the 2 patients was the recent diagnosis of cancer in the left breast (untreated) in patient #1. Both patients presented to emergency departments with chest pain. A diagnosis of ascending aortic dissection was made by radiologists in both cases.

Both patients underwent replacement of the ascending aorta, one in April and one in May 2021. Computed tomographic, gross and histologic findings of the ascending aorta in each patient are shown in [Figures 1](#) and [2](#). Numerous special stains of histologic sections of the ascending aorta in patient #1 were negative for cancer.

Discussion

Peri-aortic fibrosis in the abdominal portion of the aorta is commonly called idiopathic retroperitoneal fibrosis, or

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Ormond's disease,¹ a rare fibrotic inflammatory disease which may cause ureteral obstruction and renal failure.

No case of circumferential fibrosis of the ascending aorta associated with COVID-19 has been reported. The computer tomographic findings in both patients appeared much like a Stanford Type A aortic dissection, with true and false channels, limited to the ascending aorta (zone 0). The “thrombosed false channel”, however, was, in fact, circumferential fibrosis.

“Periadventitial aortic wall enhancement” by computed tomography associated with positive COVID-19 was reported by Terzi and colleagues^{2,3} in 2020. From the computed tomographic study these authors diagnosed “intramural hematoma” but unfortunately examination of the operatively excised aorta was not reported. We would argue that “intramural hematoma” cannot be diagnosed definitely by computed tomography. Mori and associates⁴ also in 2020, described 2 patients with acute aortic dissection, type A, also associated with COVID-19 infection. By computed tomography these authors also diagnosed “intramural hematoma” but both patients had an entry tear in the ascending aorta, thus excluding the diagnosis of “intramural hematoma.” In neither patient were the findings of the operatively excised specimen described. Again, we would argue that computed tomography cannot definitely diagnose “intramural hematoma.”

One condition that can be associated with circumferential fibrosis is IgG4-related disease.^{5,6} It is characterized by elevated serum levels of IgG4 and histopathological findings including fibrosis with infiltration of the fibrous tissue by lymphocytes and IgG4-positive plasma cells. IgG4 related disease results in lymphoplasmacytic aortitis which occurred in each of the 2 patients described herein.

The international consensus guidelines for the morphologic diagnosis of IgG4-related disease requires the presence of lymphoplasmacytic aortic / periaortitis with >50 IgG4 plasma cells per 400 x high-power field and a IgG4 / IgG ratio >50% when counting the 3 high-power fields with the greatest degree of IgG4 positivity, a criteria not achieved, however, in either patient in the present study. Thus, the circumferential fibrosis of the ascending aorta in our 2 patients may not be IgG4-related, but rather COVID-related, and can appear as aortic dissection by imaging studies.

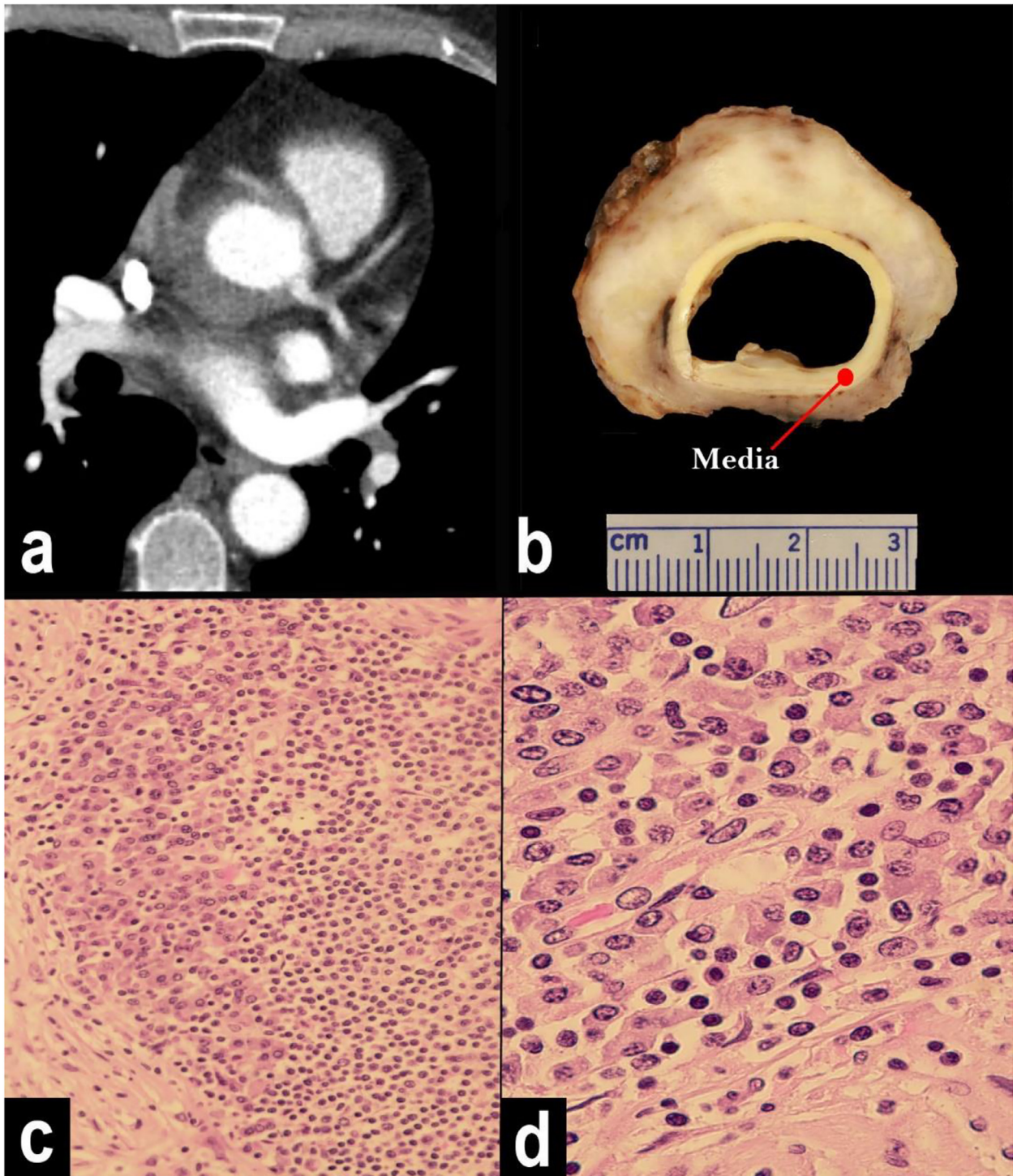


Figure 1. Case # 1. Shown here are figures of the aorta. a) computed tomographic image of the aorta. The peripheral portion of the ascending aorta is very thick and the aortic lumen is about the same size as that of the descending thoracic aorta. b) cross section of the excised aorta showing the media and the perivascular fibrosis. c) low power photomicrograph of the ascending aorta just outside the media. There are numerous plasma cells and lymphocytes present in the perivascular fibrous tissue. d) A close-up of an area of the cells in c showing numerous plasma cells. Hematoxylin / eosin (c & d); x 400 (c) x 1000 (d).

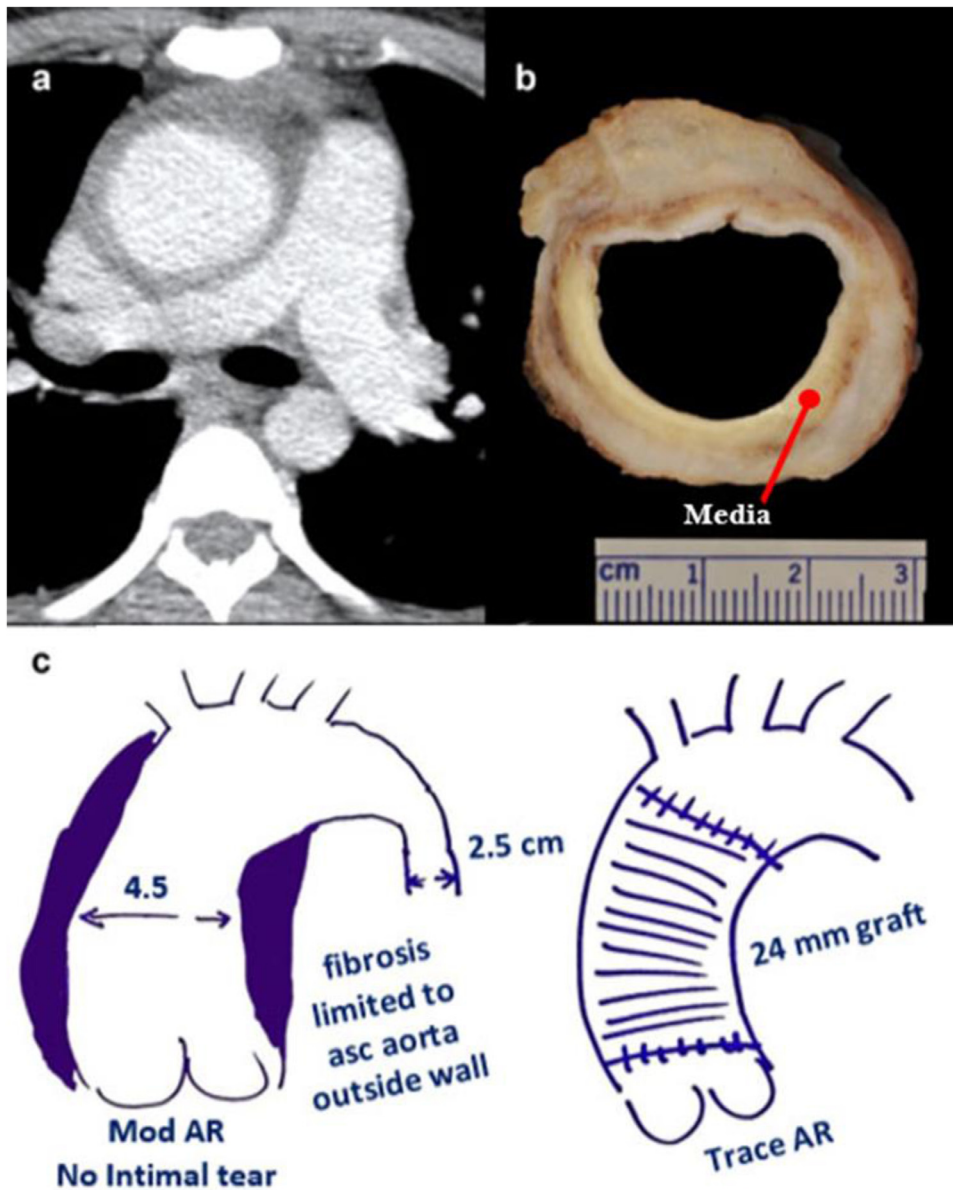


Figure 2. Case # 2. a) computed tomographic image showing the ascending aorta to be considerably larger than the descending thoracic aorta, and the ascending aorta is surrounded by very thickened adventitia. b) cross section of the operatively excised ascending aorta showing the media surrounded by dense white fibrous tissue. c) an illustration of the aortic finding at operation (left) and the surgical procedure performed. AR = aortic regurgitation.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

- Vaglia A, Martitani F. Idiopathic retroperitoneal fibrosis. *J Am Soc Nephrol* 2016;27:1880–1889.
- Terzi F, Cefarelli M, Fattori R, Di Eusanio M. Intramural hematoma as unexpected complication of COVID-19 infection. *Aorta (Stamford)* 2020;8(3):74–75.
- Terzi F, Fattori R, Di Eusanio M. COVID-19 and Acute aortic syndromes: understanding the dynamic interplay. *Aorta (Stamford)* 2021;9(3):124–125.
- Mori M, Geirsson A, Vallabhajosyula P, Assi R. Surgical management of thoracic aortic emergency with pre- and postoperative COVID-19 disease. *J Card Surg* 2020;35(10):2832–2834.
- Umehara H, Okazaki K, Masaki Y, Kawano M, Yamamoto M, Saeki T, Matsui S, Yoshino T, Nakamura S, Kawa S, Hamano H, Kamisawa T, Shimosegawa T, Shimatsu A, Nakamura S, Ito T, Notohara K, Sumida T, Tanaka Y, Mimori T, Chiba T, Mishima M, Hibi T, Tsubouchi H, Inui K, Ohara H. Comprehensive diagnostic criteria for IgG4-related disease (IgG4-RD), 2011. *Mod Rheumatol* 2012;22:21–30.
- Stone JR, Bruneval P, Angelini A, Bartoloni G, Basso C, Batoroeva L, Buja LM, Butany J, d'Amati G, Fallon JT, Gittenberger-de Groot AC, Gouveia RH, Halushka MK, Kelly KL, Kholova I, Leone O, Litovsky SH, Maleszewski JJ, Miller DV, Mitchell RN, Preston SD, Pucci A, Radio SJ, Rodriguez ER, Sheppard MN, Suvarna SK, Tan CD, Thiene G, van der Wal AC, Veinot JP. Consensus statement on surgical pathology of the aorta from the Society for Cardiovascular Pathology and the Association for European Cardiovascular Pathology: I. Inflammatory diseases. *Cardiovasc Pathol* 2015;24:267–278.