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THROMBOEMBOLIC EVENTS

INTERMEDIATE

CASE REPORT: CLINICAL CASE SERIES

4 Cases of Aortic Thrombosis in Patients With COVID-19

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ABSTRACT

Since the outbreak of the COVID-19 pandemic, increasing evidence suggests that infected patients present a high incidence of thrombotic complications. This report describes 4 cases of aortic thrombosis in patients admitted for COVID-19 infection between March 26 and April 12, 2020, in Mulhouse, France. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2020;2:1397–401) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Since the outbreak of the coronavirus-2019 (COVID-19) pandemic, increasing evidence suggests that infected patients present a high incidence of thrombotic complications such as deep vein thrombosis (1), pulmonary embolism (2), or microvascular thrombosis (3). All these data suggest the existence of a hypercoagulable state in patients with COVID-19 disease (4). This hypercoagulability induced by COVID-19 seems to be responsible for venous thromboembolic events but can also cause arterial complications.

LEARNING OBJECTIVES

- To recognize vascular complications among COVID-19 patients.
- To demonstrate the presence of aortic thrombosis in patients with COVID-19 disease.

OBSERVATION

This paper describes 4 cases of aortic thrombosis in patients admitted for severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) infection in the authors' hospital in Mulhouse, France, between March 26 and April 12, 2020. Clinical characteristics and biological details are summarized in **Table 1**.

CASE 1. The first patient was a 64-year-old male with a history of Down syndrome (without congenital heart disease) admitted for hypoxemic pneumonia. COVID-19 disease was confirmed by reverse-transcriptase-polymerase-chain-reaction (RT-PCR) test. Computed tomography (CT) results showed bilateral ground glass opacities (20% lung injury) and a nonobstructive descending aortic thrombus formation (**Figure 1**). This patient was treated with therapeutic anticoagulation and presented no further complications. He was discharged home at day 6.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC: Case Reports* author instructions page.

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ABBREVIATIONS AND ACRONYMS

COVID-19 = coronavirus-2019

CT = computed tomography

RT-PCR = reverse-transcriptase polymerase chain reaction

SARS-CoV-2 = severe acute respiratory syndrome-coronavirus-2

CASE 2. The second patient was a 68-year-old male with history of smoking, hypertension, coronary artery disease, and deep vein thrombosis (Table 1) who was admitted for acute bilateral lower limb ischemia. COVID-19 disease was confirmed by RT-PCR results. CT showed bilateral ground glass opacities (25% to 50% lung injury) as well as an obstructive thrombosis of the abdominal aorta and bilateral common iliac artery thromboses (Figure 2). An axillobifemoral bypass was performed, followed by therapeutic anticoagulation with good initial results. The patient died 7 days after surgery from a major hemorrhage.

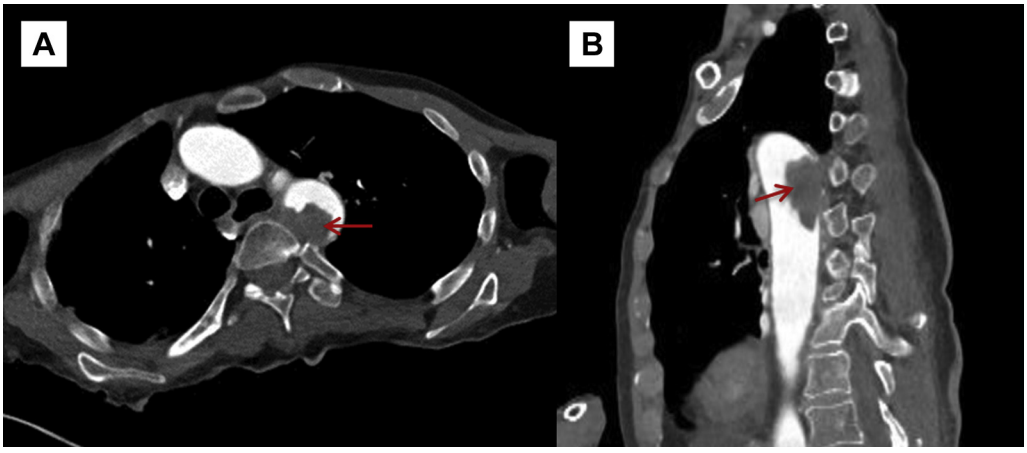
CASE 3. The third patient was a 72-year-old male with history of hypertension, diabetes, and coronary artery disease (Table 1) who was admitted for hypoxic

TABLE 1 Demographic, Clinical, Tomographic, and Biological Characteristics

	Patient #1	Patient #2	Patient #3	Patient #4
Demographic characteristics				
Age, yrs	64	68	72	78
Sex	M	M	M	M
BMI, kg/m^2	23	34	27	35
Clinical characteristics				
Cardiovascular risk factors	None	Hypertension, history of smoking, dyslipidemia	Hypertension, diabetes, dyslipidemia	Hypertension, history of smoking
Medical history	Down syndrome	Coronary artery disease, deep vein thrombosis	Coronary artery disease, pacemaker, hyperthyroidism, depression	Cardiac hypertrophy, pulmonary embolism, sleep apnea
Treatment at home	None	Aspirin, perindopril, bisoprolol, pravastatin	Aspirin, ramipril, simvastatin, ivabradine, metformin, valproic acid	Irbesartan, pravastatin, omeprazol
Symptoms at disease onset	Fever, cough, dyspnea	Fever, cough, diarrhea	Cough, diarrhea, anosmia	Fever, cough, diarrhea
Time from disease onset to thrombotic event, days	18	10	28	8
Manifestation of thrombotic event	None	Acute bilateral lower-limb ischemia	Acute ischemia of the right lower limb	Abdominal pain (right renal infarction)
Death	No	Yes	No	Yes
CT findings				
Degree of lung injury, %	20	25-50	25-50	25-50
Thrombotic localization	Nonobstructive descending aortic thrombus formation	Obstructive abdominal aortic and bilateral iliac common arteries thrombosis	Nonobstructive abdominal aortic thrombosis and right iliac common artery thrombosis	Nonobstructive abdominal aortic thrombus formation and right renal artery thrombosis
Biological characteristics at thrombosis diagnostic time				
RT-PCR SARS-CoV-2-positive, +	+	+	+	+
White-cell count, per mm^3 (RV 4,000 to 11,000)	15,490	9,150	6,060	14,170
Total neutrophils, per mm^3 (RV 2,100 to 8,900)	12,690	8,220	4,760	12,840
Total lymphocytes, per mm^3 (RV 1,260 to 3,350)	1,150	490	790	770
Total monocytes, per mm^3 (RV 250 to 840)	1,160	380	450	680
Platelet count, per mm^3 (RV 150,000 to 450,000)	172,000	248,000	115,000	134,000
Hemoglobin, per g/l (RV 130 to 160)	177	166	169	108
Prothrombin time, s (RV 10.2 to 12.9)	14.4	14.9	12.7	18.1
Fibrinogen, g/l (RV 2.13 to 4.22)	3.00	3.80	3.02	7.70
D-dimer, mg/l (RV <500)	2,160	1,696	1,825	4,169
High-sensitivity cardiac troponin I, pg/ml (RV <45)	540	9,000	ND	<45
Antiphospholipid antibodies	ND	ND	-	-
Antithrombin, % (RV 83 to 126)	ND	78%	104%	79%
eGFR, ml/min/1.73 m^2) (RV ≥90)	49	76	61	63
C-reactive protein, mg/l (RV 0 to 3)	16	35	7	132

BMI = body mass index; CT = computed tomography; eGFR = estimated glomerular filtration rate; ND = not determined; RT-PCR = reverse-transcriptase polymerase chain reaction; RV = reference values; SARS-CoV-2 = severe acute respiratory syndrome-coronavirus-2.

FIGURE 1 Computed Tomography Angiography of Patient #1

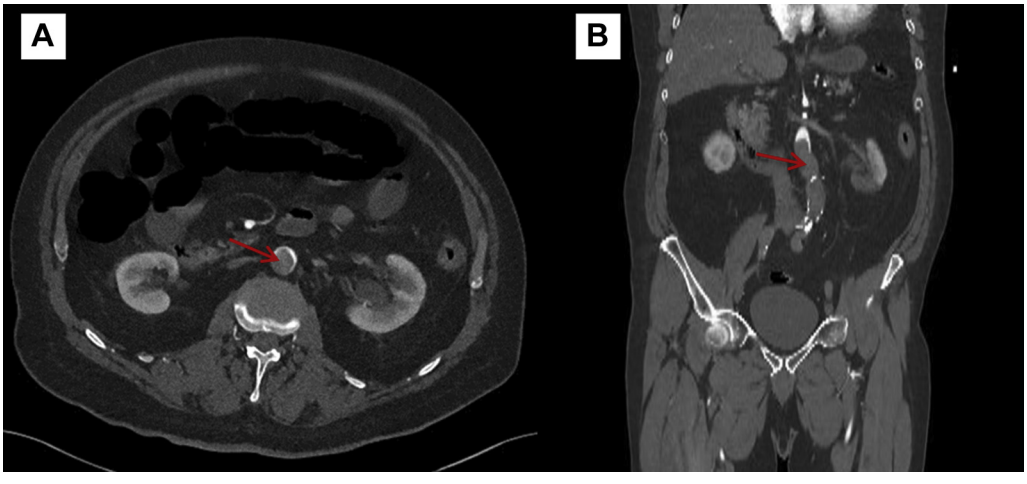


CT angiography of patient 1 shows a nonobstructive thrombus formation of descending aorta **(arrow)** in an axial view **(A)** and a sagittal view **(B).**

pneumonia. COVID-19 disease was confirmed by RT-PCR results, and CT showed bilateral ground glass opacities (25% to 50% lung injury). On day 14 after admission, the patient experienced acute ischemia of the right lower limb, and CT showed a nonobstructive abdominal aortic thrombosis as well as an obstructive right common iliac artery thrombosis (Figure 3). The patient was treated with therapeutic anticoagulation, and surgical thrombectomy was performed 7 days later with a good result.

CASE 4. The fourth patient was a 78-year-old male with a history of smoking, hypertension, cardiac hypertrophy, and pulmonary embolism (Table 1) who was admitted for hypoxic pneumonia. COVID-19 disease was confirmed by RT-PCR results, and CT showed bilateral ground glass opacities (25% to 50% lung injury). On day 7 after admission, the patient presented with abdominal pain. Abdominal CT showed a nonobstructive abdominal aortic thrombus formation and a right renal infarction consistent with a

FIGURE 2 Computed Tomography Angiography of Patient #2



CT angiography of patient 2 shows an obstructive thrombosis of the abdominal aorta **(arrow)** in an axial view **(A)** and a coronal view **(B)**.

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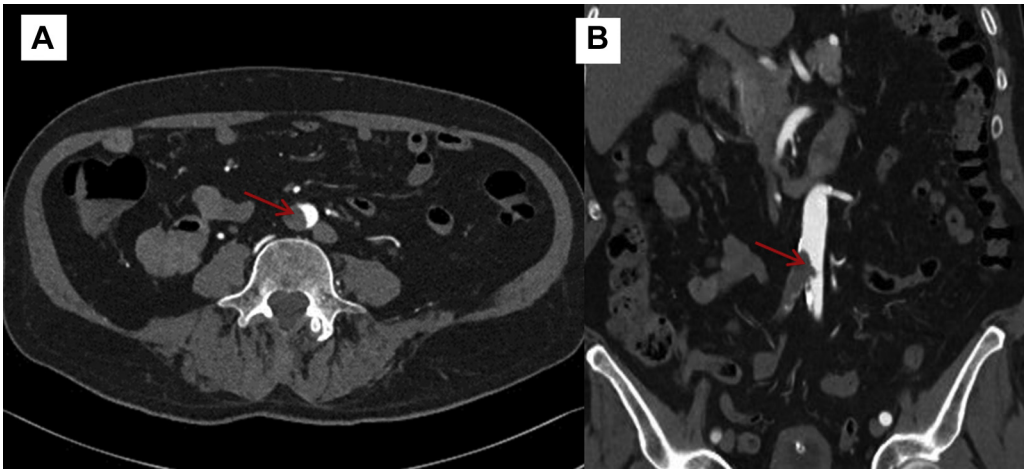
FIGURE 3 Computed Tomography Angiography of Patient #3



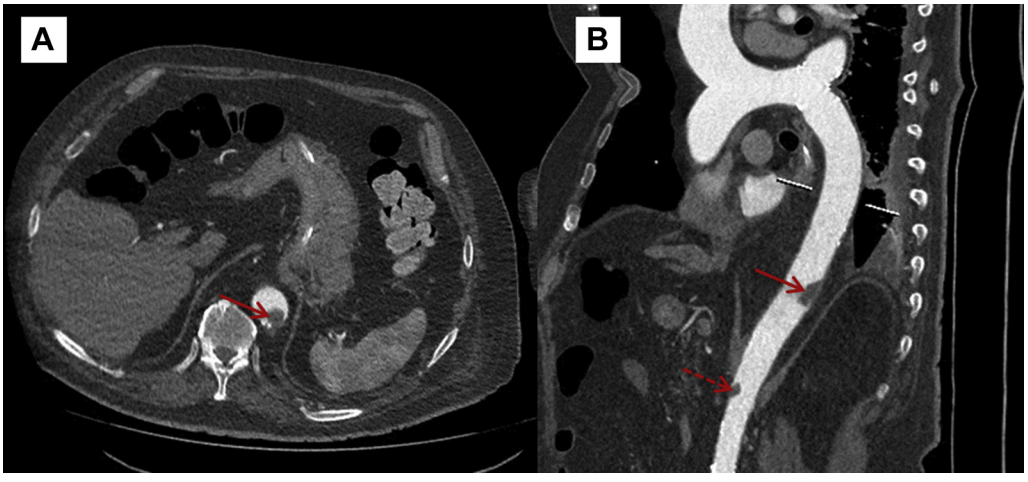
CT angiography of patient 3 shows a nonobstructive abdominal aortic thrombosis and an obstructive right common iliac artery thrombosis **(arrow)** in an axial view **(A)** and a coronal view **(B)**.

thrombosis of the right renal artery (Figure 4). Therapeutic anticoagulation was started. The patient presented with a cerebral infarction 2 days later and died.

DISCUSSION

To the authors' knowledge, this is the first series of aortic thrombosis cases in COVID-19 patients to be published. Prognosis of patients hospitalized with COVID-19 disease is often determined by the extent of pulmonary lesions. However, vascular complications can also greatly affect outcome, as illustrated here. Many authors have recently demonstrated a strong link between COVID-19 infection and thromboembolism. The physiopathology has not yet been fully elucidated, but current data suggest the existence of a

FIGURE 4 Computed Tomography Angiography of Patient #4



CT angiography of patient 4 shows a nonobstructive abdominal aortic thrombus formation **(arrow)** in an axial view **(A)** and a sagittal view **(B)** and a right renal artery thrombosis **(dashed arrow)** in sagittal view.

hypercoagulability state in patients with COVID-19 disease. A recent paper attributes this state "to excessive inflammation, platelet activation, endothelial dysfunction, and stasis" (5). Others have suggested that formation and polymerization of fibrin are responsible for this hypercoagulability (6). Therefore, recent recommendations insist on thromboprophylactic measures to prevent thromboembolism (4,7,8).

A recent publication found evidence of the presence of virus in endothelial cells (9). One explanation is that the angiotensin-converting enzyme 2 receptor that the virus uses to infect cells is widely expressed in endothelial cells. This causes endotheliitis, which could explain why COVID-19 patients seem prone to venous and arterial thrombosis. This paper (9) also underlines the fact that patients predisposed to endothelial lesions (hypertension, male sex, smoking, diabetes) could be more prone to infection of the endothelium induced by the virus. This was the case with the present series of patients who were all male, 75% had hypertension, 50% had a history of smoking, and 50% had a history of coronary artery disease. On the other hand, 2 of the 4 patients also had a history of pulmonary embolism or deep vein thrombosis, suggesting an individual predisposition. Finally, outcomes in COVID-19 patients affected by arterial thrombosis seem to be severe, as 50% of these patients died.

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