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CASE REPORT

BEGINNER

CLINICAL CASE

Acute Coronary and Cerebral Emboli From a Pedunculated Ascending Aorta Thrombus

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ABSTRACT

Hyperprolactinemia is a risk factor for thrombus formation. We present a rare case of a mobile ascending aorta thrombus leading to acute myocardial infarction and cerebral infarction in a patient with idiopathic hyperprolactinemia. (**Level of Difficulty: Beginner.**) (J Am Coll Cardiol Case Rep 2021;3:1194–9) © 2021 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/).

HISTORY OF PRESENTATION

A 54-year-old man was referred to our institution with persistent chest discomfort radiating to his left shoulder. He was hemodynamically stable with a blood pressure of 139/92 mm Hg and a heart rate of 85 beats/min. Physical examination findings revealed no abnormality except for gynecomastia. Laboratory results showed a significant elevation in troponin T level (0.877 ng/ml; normal range ≤0.014 ng/ml). Electrocardiography showed ST-segment elevation and inverted T waves in the precordial and inferior leads (**Figure 1A**). Transthoracic echocardiography revealed reduced anterior-apical wall motion with no obvious apical intracardiac thrombus. The patient was diagnosed with acute ST-segment elevation myocardial infarction and underwent emergent coronary angiography. There were no apparent atherosclerotic lesions in the coronary arteries; a small thrombus was observed in the distal left anterior descending artery, suggesting a coronary artery embolism (CAE) (**Figures 1B and 1C,** Video 1).

LEARNING OBJECTIVES

- To describe the pathophysiology of a mobile ascending aorta thrombus leading to CAE.
- To describe the investigation of CAE etiology and discuss optimal management for preventing embolic events.

PAST MEDICAL HISTORY

The patient had a history of multiple cerebral infarctions 3 years ago for which he was taking

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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 Author Center.

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edoxaban (60 mg/day) as a direct oral anticoagulant. Carotid ultrasonography and ambulatory electrocardiographic monitoring at the time revealed no atherosclerotic lesions in the internal carotid artery and no atrial fibrillation; therefore, the cause of cerebral infarction was unclear. His medication history also included lansoprazole (15 mg/day) and mosapride (5 mg/day) for chronic gastritis and bezafibrate (400 mg/day) for dyslipidemia. There was no obvious cause for his gynecomastia.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis for CAE included cardiogenic thrombus, such as intracardiac thrombus of the left atrial appendage and ventricle, infective endocarditis, and paradoxical embolism through intracardiac shunts.

INVESTIGATION

In addition to edoxaban, the patient was started on dual-antiplatelet therapy with aspirin (100 mg/day after a loading dose of 200 mg) and prasugrel (3.75 mg/day after a loading dose of 20 mg). Transesophageal echocardiography (TEE) to investigate the cause of the CAE was not possible because the patient developed sudden-onset dysphasia and hemiplegia within 24 h after admission. Emergent magnetic resonance imaging and angiography confirmed multiple acute cerebral infarctions in both hemispheres and concomitant left middle cerebral arterial occlusion (**Figure 2**). Transcatheter retrieval of cerebral thrombus was immediately performed, and neurological abnormalities dramatically improved. TEE and contrast-enhanced computed tomography imaging subsequently showed no evidence of intracardiac thrombus, valvular disease, or intracardiac shunt; however, a large mobile pedunculated thrombus attached to the ascending aorta was observed (**Figure 3,** Video 2). Laboratory investigations for thrombophilia, including protein C, protein S, antinuclear antibodies, and lupus anticoagulant, indicated no abnormal findings; nonetheless, notable laboratory results revealed hyperprolactinemia, with a prolactin level on admission of 34.3 ng/ml (normal range: 3.5 to 12.7 ng/ml) (**Table 1**). The patient was diagnosed with chronic hyperprolactinemia based on examination findings of gynecomastia and hyperprolactinemia. Hyperprolactinemia is a known risk factor for thrombus formation, and this was believed to have contributed to chronic thrombus formation, resulting in multiple systemic embolization.

MANAGEMENT

The patient underwent successful semi-emergent ascending aorta replacement to prevent future

ABBREVIATIONS AND ACRONYMS

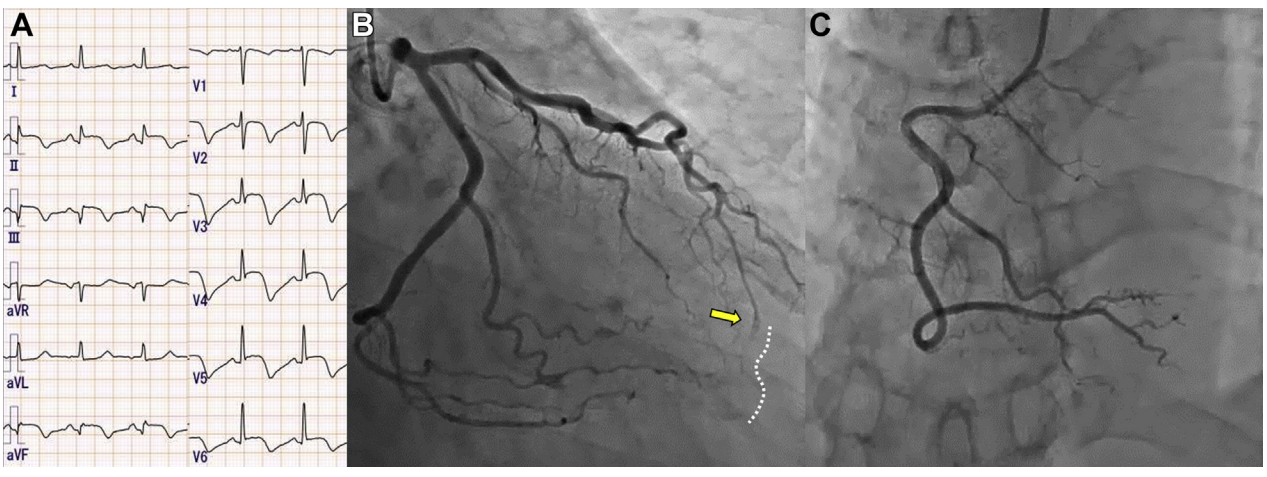
AMI = acute myocardial infarction

CAE = coronary artery embolism

LAD = left anterior descending artery

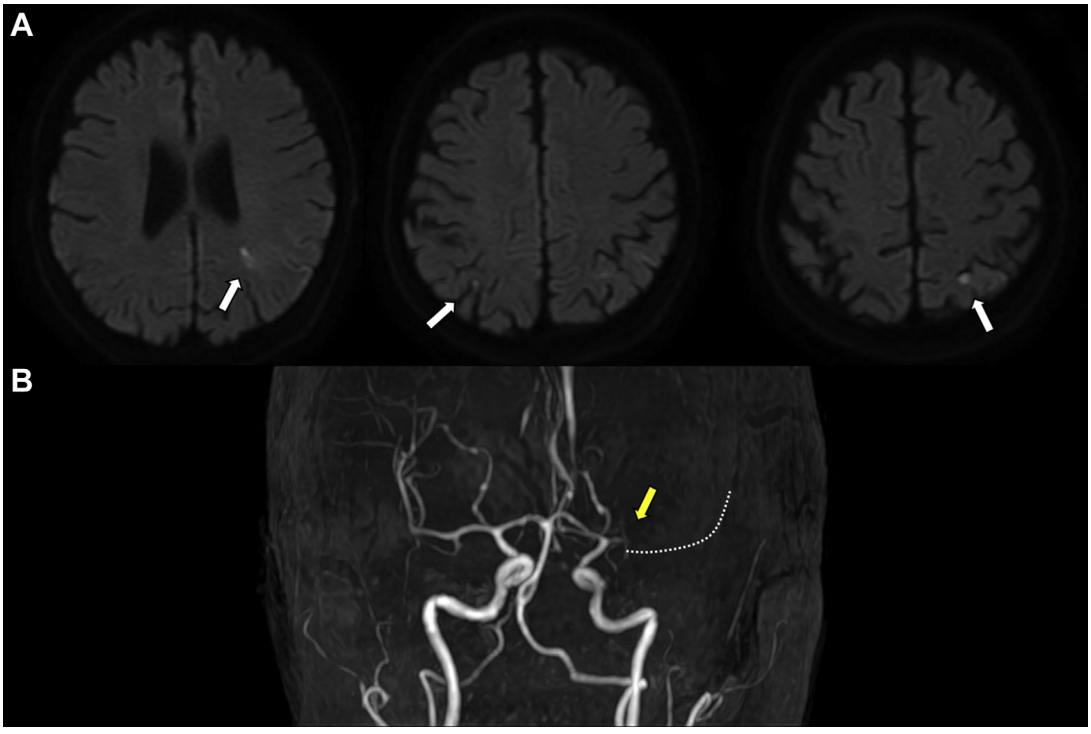
TEE = transesophageal echocardiography

FIGURE 1 Electrocardiography and Coronary Angiography



(A) Electrocardiography. **(B, C)** Coronary angiography showing a small thrombus in the distal left anterior descending artery (**yellow arrow and dotted line** indicate the thrombus and delayed flow of the distal left anterior descending artery, respectively).

FIGURE 2 Brain Magnetic Resonance Imaging and Angiography



(A) Brain magnetic resonance imaging showing multiple acute cerebral infarctions **(white arrows)**. **(B)** Brain magnetic resonance angiography showing left middle cerebral artery occlusion (**yellow arrow and dotted line** indicate left middle cerebral artery occlusion).

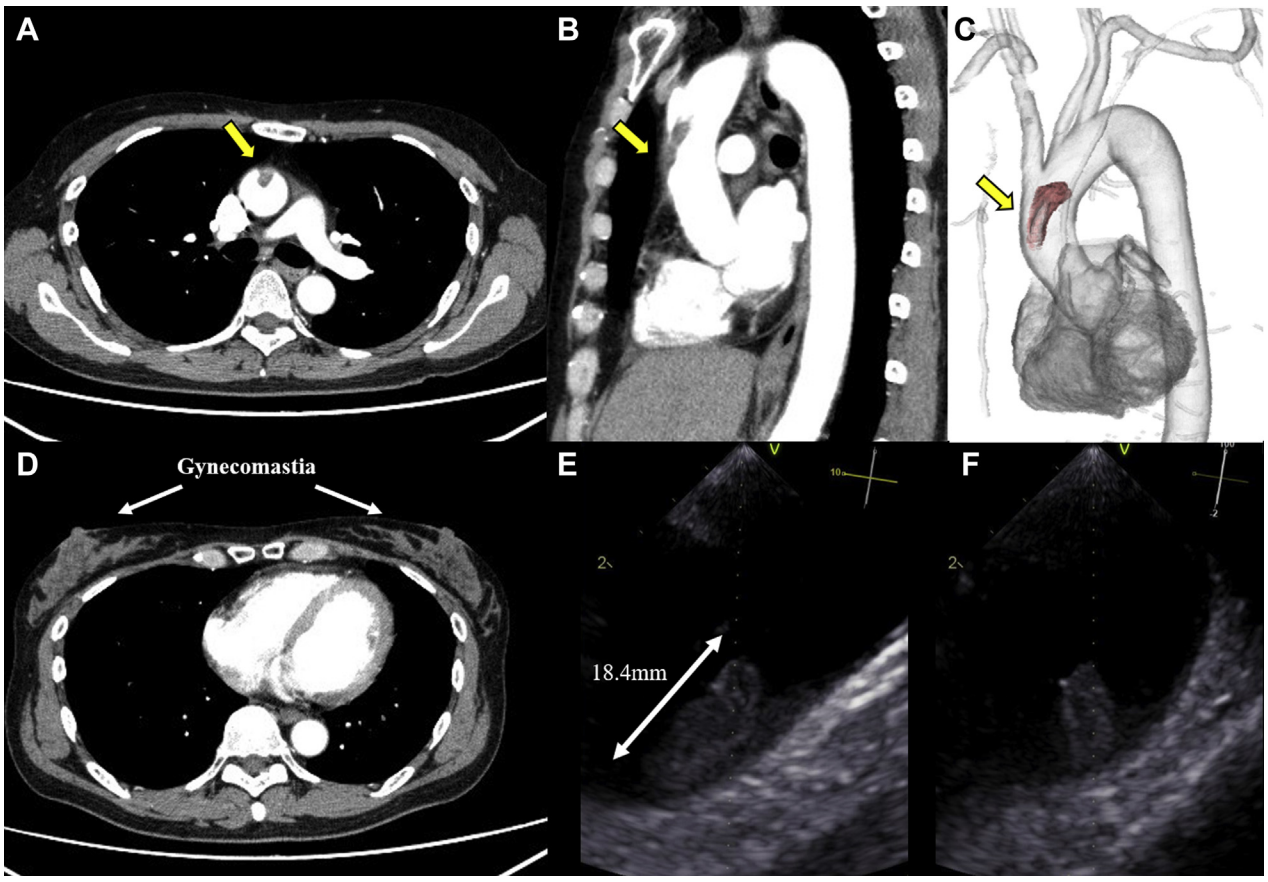
embolic events. Intraoperatively, there was an organized white thrombus with a fresh red thrombus (~20 mm in length) attached to the anterior wall of the ascending aorta, located 30 mm distal to the sinotubular junction. Histopathological findings including immunostaining showed chronic thrombus formation, with an organized area with many CD34-positive capillaries close to the attachment site at the aortic wall without accumulation of CD68-positive macrophages, suggesting aortic erosion with chronic thrombus (**Figure 4**).

DISCUSSION

We present a rare case of a mobile ascending aorta thrombus leading to acute myocardial infarction (AMI) and acute cerebral infarction. Although plaque rupture and erosion are the main causes of AMI, CAE has been recognized as a nonatherosclerotic cause of AMI (1,2). An ascending aorta thrombus is a rare cause of CAE (3). Antithrombotic medications, including aspirin and warfarin, are the most common treatments for aortic mural thrombus; however, surgical thrombectomy is recommended for patients with large (>10 mm) or highly mobile thrombi and those with a history of recurrent embolic events (3,4). Because the patient had a history of cerebral infarction and a large and mobile thrombus, surgical resection with thrombectomy was chosen to minimize the risk of further vascular events. The mechanism of ascending aorta thrombus has not been fully elucidated; however, endothelial erosion or plaque rupture in the ascending aorta might lead to thrombus formation even in aortas with abundant blood flow (5). Pathological findings in this case revealed that the organized thrombus with neovascularization on the ascending aorta was derived from aortic erosion of a non-atheroma without plaque rupture.

Moreover, coexistent hypercoagulable disorders, such as protein C deficiency or antiphospholipid antibody syndrome, are reportedly associated with

FIGURE 3 **Mobile Ascending Aorta Thrombus**



(A, B) Contrast-enhanced computed tomography (CT) imaging of an ascending aorta thrombus. **(C)** CT angiography; **red structure** indicates thrombus. **Yellow arrows** highlight thrombus in the pedunculated ascending aorta. **(D)** CT imaging showing gynecomastia. **(E, F)** Transesophageal echocardiography confirmed a highly mobile thrombus attached to the anterior aortic wall.

thrombus formation in 17% of ascending aorta thrombi (6). In this case, the existence of gynecomastia suggested a state of chronic hyperprolactinemia, which is a known cause of a hypercoagulable state (7). The incidence of venous thromboembolism was reported to be significantly higher in patients with hyperprolactinemia than in the general population (8). Several mechanisms of thrombus formation in hyperprolactinemia have been proposed, including platelet aggregation via adenosine diphosphate up-regulation caused by higher prolactin levels and reduction in tissue factor pathway inhibitors (9,10). Hyperprolactinemia is mainly caused by primary prolactin-secreting pituitary tumors, drugs, and renal or hepatic disorders; however, no specific cause was detected in the current case.

Finally, we considered that idiopathic hyperprolactinemia induced chronic thrombus formation on the atherosclerotic-degenerated ascending aorta, leading to multiple systemic embolisms. Further large-scale studies investigating the association between hyperprolactinemia and aorta thrombus formation are warranted.

FOLLOW-UP

The patient was discharged on aspirin and warfarin without any disabilities, and no further embolic events had occurred by the 1-year follow-up.

CONCLUSIONS

We report a rare case of a mobile ascending aorta thrombus leading to AMI and cerebral infarction in

TABLE 1 Laboratory Results

	Results	Normal Range
Platelet number, $\times 10^4/\mu l$	84	15–35
PT (INR)	1.12	0.84–1.14
APTT, s	31.6	26.0–38.0
D-dimer, μg/ml	1.5	0–1.0
Protein S, %	84	74–132
Protein C, %	150	64–135
Antithrombin III, %	89	<70
Anti-nuclear antibody	<40	<40
C-ANCA, IU/ml	0.5	<2
P-ANCA, IU/ml	0.5	<2
Lupus anticoagulant	0.8	<1.3
Anti-cardiolipin antibodies, U/ml		
Immunoglobulin M	1.1	<20
Immunoglobulin G	14.0	<20
Anti-β_2-GPI, U/ml	<0.7	<3.5
Homocysteine, nmol/ml	10.7	5–15
Prolactin, ng/ml	34.3	3.6–12.8

Anti-β_2-GPI = anti-beta$_2$-glycoprotein I complex antibody; APTT = activated partial thromboplastin time; C-ANCA = cytoplasmic anti-neutrophil cytoplasmic antibody; P-ANCA = perinuclear anti-neutrophil cytoplasmic antibody; PT (INR) = prothrombin time (international normalized ratio).

a patient with idiopathic hyperprolactinemia. Early investigation of CAE (including ascending aorta thrombus) and of concomitant hypercoagulability (including hyperprolactinemia) might be effective for preventing further embolic events in such cases.

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The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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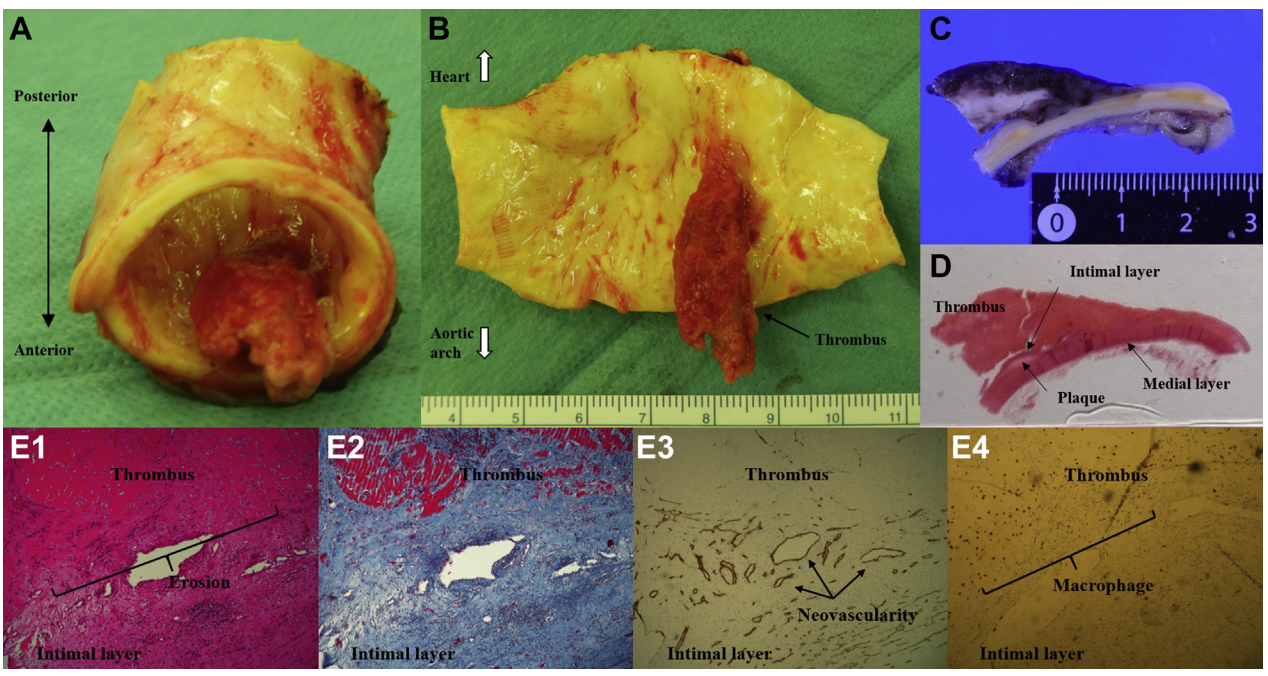
FIGURE 4 Surgical and Pathological Findings of the Aorta Thrombus



Surgical findings **(A, B)** and macroscopic specimens **(C, D)** showing the mobile thrombus attached to the ascending aorta. There are no obvious findings of plaque rupture at the thrombus attachment site (i.e., aortic plaque erosion). **(E1)** Hematoxylin-eosin staining showing the thrombus attached to the erosion site at the aortic intima. **(E2)** Masson's trichrome staining showing that collagen fibers are produced from the vascular endothelial injury site. **(E3)** CD34 immunostaining showing the thrombus with many CD34-positive capillaries close to the attachment site at the aortic wall. **(E4)** CD68 immunostaining showing no accumulation of CD68-positive macrophages at the aortic intima attached with a thrombus.

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KEY WORDS acute myocardial infarction, coronary artery embolism, hyperprolactinemia, mobile ascending aorta thrombus, systemic embolization

APPENDIX For supplemental videos, please see the online version of this article.