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ADVANCED

CASE REPORT: CLINICAL CASE

Interventional Removal of LV Thrombus in a Patient With Cardiogenic Shock and Transitory Ischemic Attack

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ABSTRACT

We discuss a 38-year-old bodybuilder who had cardiogenic shock and multiorgan failure. The patient developed significant speech disorders resulting from thromboembolism of a huge, volatile left ventricular thrombus. Because of inoperability and the threat of severe ischemic stroke, the thrombus was removed with a snare and application of a cerebral embolic protection device. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2023;15:101860)

A 38-year-old male bodybuilder with long-standing abuse of anabolic agents was admitted to our university hospital (University Hospital, Eberhard Karls University Tübingen, Tübingen, Germany) because of cardiogenic shock and progressive multiple organ failure.

PAST MEDICAL HISTORY

On admission, the patient reported chest pain, shortness of breath, and minor hemoptysis for 2 days. Physical examination revealed tachypnea (20 breaths/min), tachycardia (110 beats/min), and basal wet breathing sounds involving the basal lung fields. The initial electrocardiogram showed sinus tachycardia but no signs of acute myocardial ischemia. The patient was admitted to our intensive care unit for further monitoring and diagnostic testing.

LEARNING OBJECTIVES

- An interventional approach with steerable sheaths and snares to remove thrombotic masses is feasible with the concomitant use of a CEPD.
- Abuse of anabolic-androgenic steroids is associated with enhanced risk of complicated myocardial infarction.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis list of cardiogenic shock comprised coronary artery disease, cardiac toxicity of anabolic steroid agents, myocarditis, nonischemic cardiomyopathy, and valvular heart disease. Furthermore, an intracardiac mass was detected in the apex of the left ventricle by transthoracic echocardiography (TTE), thus indicating the differential diagnosis of a left ventricular (LV) thrombus vs infective endocarditis, myxoma, cardiac metastasis, primary cardiac tumors or malignomas, vasculitis, and thrombophilia.

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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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ABBREVIATIONS AND ACRONYMS

CEPD = cerebral embolic protection device

DAPT = dual antiplatelet therapy

LAD = left anterior descending artery

LV = left ventricular

RCA = right coronary artery

TTE = transthoracic echocardiography

INVESTIGATIONS

Coronary angiography revealed severe coronary artery disease with a subtotal flow-limiting occlusion of the right coronary artery (RCA) (TIMI flow grade 1-2) and a 75% coronary stenotic lesion within the proximal left circumflex and left anterior descending (LAD) coronary arteries. After revascularization with acute percutaneous coronary intervention and stenting of the RCA and LAD arteries, the hemodynamic situation stabilized, and multiorgan failure recovered. TTE revealed severely reduced systolic LV function with an ejection fraction of 20% and a large, anteroseptal, volatile LV thrombus (**Figure 1A**, Supplemental Figures 1A and 1B, Video 1). Therapeutic anticoagulation with low-molecular-weight heparin in combination with dual antiplatelet therapy (DAPT) was initiated. After 5 days, significant temporary incomprehensive speech disturbances, conjugate eye deviation, and acute disorientation developed in this patient. A cerebral computed tomography scan revealed no signs of an ischemic or hemorrhagic stroke. Repeated TTE showed a progressive and macerated LV thrombus (Videos 2 and 3). Clinical assessment revealed regredient neurologic deficits within 12 hours.

MANAGEMENT

Because of the hemodynamic instability, the progressive multiple organ failure, and the high thromboembolic risk, we abandoned thrombolytic or surgical treatment strategies in favor of an interventional approach to remove the thrombus. Previously, we successfully aspirated a left atrial thrombus through a transseptal steerable FlexCath Advance (Medtronic) sheath[1]; however, in this case, aspiration to extract thrombotic material from the ventricle was not possible.

Thus, we undertook the venture of an interventional "rescue" approach to remove the giant, volatile LV thrombus. Before accessing the LV through a transseptal approach, we placed a cerebral embolic protection device (CEPD) (Sentinel, Boston Scientific) (**Figure 1B**, Video 4). The 2 filters were placed into the brachiocephalic and left common carotid arteries through the right radial artery (**Figure 1B**, Video 4). After transseptal puncture, a steerable, flexible, 12-F inner-diameter sheath bidirectional 9-F guiding catheter (FlexCath Advance, Medtronic) was inserted into the left atrium and passed through the mitral valve toward the anteroseptal thrombus mass (**Figures 1C and 1D**, Video 5). We advanced a snare catheter through a bidirectional 8-F guiding catheter placed in the steerable sheath, and after several attempts we were able to entwine the LV thrombus at the apical base (Video 5). The thrombus was almost completely removed with the snare by retraction of the guiding catheter (**Figures 1E and 1F**). The intervention was assisted throughout the procedure by transesophageal echocardiography. Slight sedation was used during the whole procedure to enable continuous neurologic assessment of the patient in the setting of increased thromboembolic risk. After the procedure, the CEPD remained for a further 60 minutes and was removed thereafter. Only small thrombotic debris was captured in the protection filters.

Daily TTE control examinations revealed only a small residual floating thrombus, which completely disappeared 2 weeks after the procedure with the use of oral vitamin K antagonists (international normalized ratio: 2.5-3.5) (**Figure 1F**, Video 6). The patient's neurologic situation resolved quickly, without any remaining deficits.

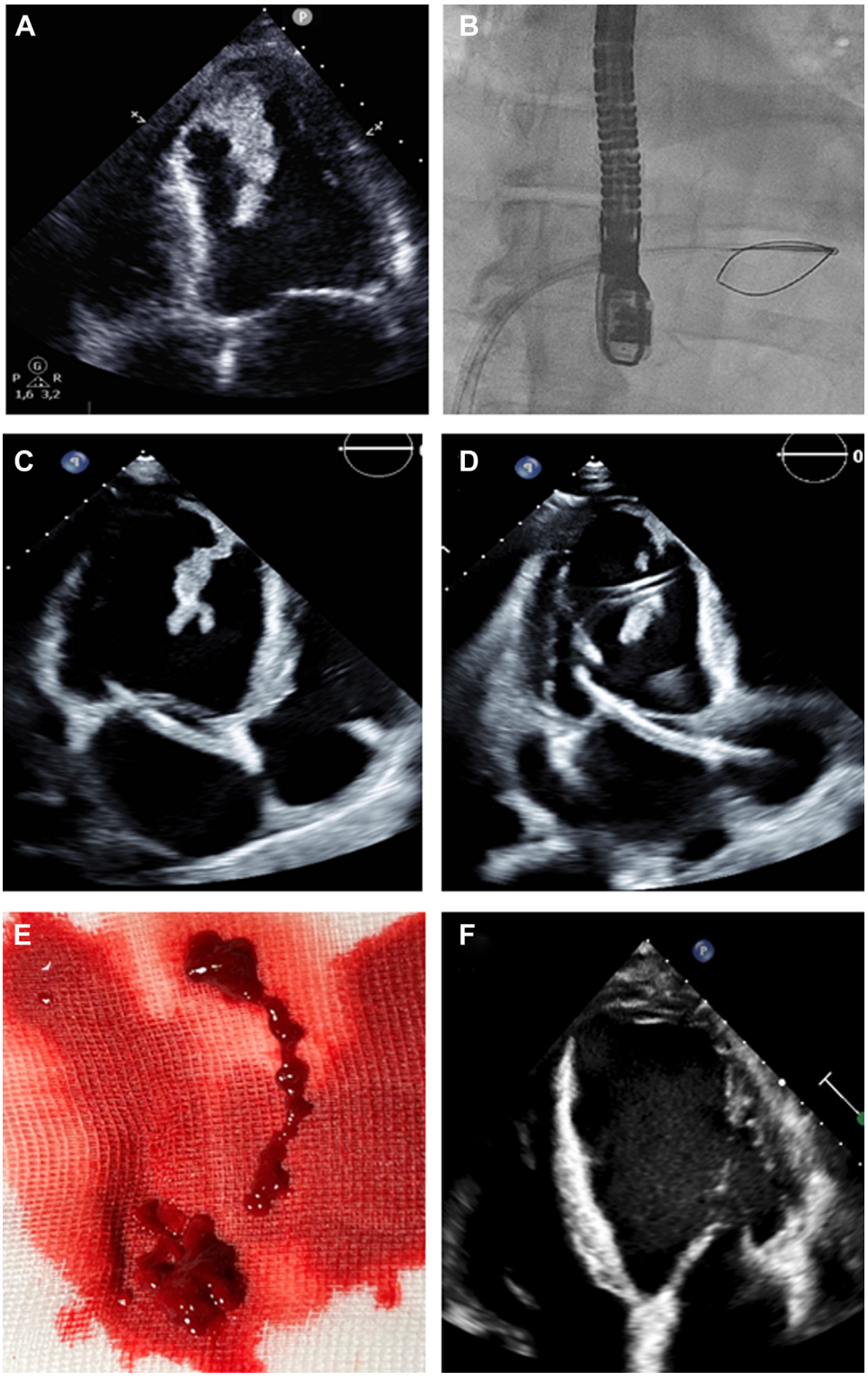
DISCUSSION

Strategies to remove intravascular or intracardiac masses such as LV thrombi revolve around antithrombotic protocols, thrombolysis, and surgical interventions. However, when thrombolysis or surgical approaches are contraindicated or are associated with high thromboembolic risk, innovative interventional procedures should be considered in these patients. Although snares have been described as useful tools to remove implanted, intracardiac devices,[2,3] to our knowledge our case of interventional removal of a large, macerated LV thrombus with a snare and with the simultaneous use of a CEPD, is the first to show that this strategy is feasible in patients with an immediate indication for removal of intracardiac thrombotic masses and with a reasonable risk of thromboembolic complications.[2,3] Other interventional strategies, such as catheter-based aspiration technologies or the use of retrieval devices, have also been described to offer minimally invasive alternatives to surgical thrombectomy with low procedure-associated risks.[2-5]

FOLLOW-UP

Repeated cardiologic assessment and TTE during follow-up proved the persistent absence of LV thrombus, substantially improved LV function (ejection fraction, 45%), and recovery of renal and liver function (Video 7). Currently and for time being, the

FIGURE 1 **Interventional Snare-Guided Removal of a Left Ventricular Thrombus**



(A) Transthoracic echocardiography showing the apical left ventricular thrombus. **(B to D)** Transesophageal echocardiographic guiding procedure of LV thrombus capture by snare enlacement. **(E)** Gross pathologic features of the extracted thrombus. **(F)** Transthoracic echocardiography after intervention.

patient is receiving treatment with vitamin K antagonists, DAPT, and intensified heart failure medications (sacubitril/valsartan, dapagliflozin, bisoprolol, and eplerenone). The patient has recovered physically, with no signs of clinically relevant heart failure. His recovery allowed him to resume controlled cardiovascular workouts after 6 months.

CONCLUSIONS

Our proposed approach, using a snare to extract the LV thrombus combined with the use of a protection device, may even decrease the number of complications in high-risk patients, as in the patient we describe here. Selected patients may benefit from interventional thrombus extraction with a snare, and that makes the clinical implication of this technique even more appealing for additional indications. The presumed origin of the thrombus may be multicausal, promoted by the acute ventricular dysfunction of the ischemic myocardium and the prothrombotic effects of long-standing anabolic steroid abuse.

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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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KEY WORDS cardiogenic shock, interventional therapy, left ventricular thrombus

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