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Successful percutaneous transluminal angioplasty to treat superior vena cava syndrome

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Superior vena cava syndrome (SVCS) is caused by reduced blood flow through SVC, leading to facial and neck swelling, upper limb swelling, dyspnea and cough [1]. The most prevalent cause of SVCS is malignancy. The non-malignant causes include infection, thrombosis and complications associated with the intravascular devices. For example, 25% of patients with pacemakers have central venous obstruction, although only 1% of these patients are symptomatic, likely due to the development of collateral circulation [2]. Depending on the cause, the treatment of SVC includes radiotherapy or chemotherapy, systemic anticoagulation or thrombolysis and endovascular techniques [2]. The latter include percutaneous transluminal angioplasty (PTA) and stenting [3] or thrombectomy [4]. Endovascular techniques have higher

efficacy for symptom relief (80%–95%), compared to radiotherapy (56%–96%) and chemotherapy (59%–77%) [2], with a relatively low complication rate (0%–19%) [3]. We present a patient with symptomatic SVCS, successfully treated with PTA.

A 34-year-old man with suspected arrhythmogenic cardiomyopathy, suspected Marfan syndrome, history of recurrent venous thromboembolism, history of triple sudden cardiac arrest, implantation of cardioverter-defibrillator (ICD) in secondary prevention, its triple removal and reimplantation due to infection, end of battery life and infective endocarditis, was admitted to the hospital due to stabbing chest pain and dyspnea. Upon physical examination, oedema of the upper body and distended veins were observed, with no signs of peripheral congestion. Echocardiography showed normal dimensions and contractility of the left ventricle with the ejection fraction of 50%, slightly dilated right ventricle and moderate tricuspid regurgitation. Computed tomography angiography revealed obstructed right brachiocephalic vein and subtotal occlusion of SVC with collateral circulation (Figure 1A; Supplementary material, *Video S1*). The symptomatic SVCS was diagnosed and the patient was qualified for endovascular treatment.

Following the puncture of right common femoral vein, digital subtraction angiography was performed from the left subclavian vein, confirming critical SVC stenosis (Figure 1B). Next, PTA was conducted using the EverCross Balloon Catheter (8 × 60 mm, 10 atm, Medtronic, Minneapolis, MN, US) and Atlas Dilatation Catheter (12 × 80 mm, 10 atm, Beckton Dickinson, Franklin Lakes, NJ, US) (Figure 1C). A control venography showed normal outflow of the SVC and no flow via the collateral circulation (Figure 1D; Supplementary material, *Video S2*). Following the procedure, SVC symptoms alleviated within a few days. The ICD check confirmed correct device functioning. Considering the suspicion of arrhythmogenic cardiomyopathy and Marfan syndrome, genetic tests were scheduled.

Although malignancy remains the most prevalent cause of SVCS, the non-malignancy causes are increasing, including thrombus or obstruction due to repeated implantable cardiac device implantation [3]. In case of thrombosis caused by COVID-19 infection, successful rheolytic thrombectomy with AngioJet (Boston Scientific, Marlborough, MA, US) has recently been reported, the device also used for endovascular treatment of acute pulmonary embolism [4, 5]. In case of intravascular devices, stent implantation, usually followed by oral anticoagulation, is the treatment of choice. Regarding the presence of the ICD wire in the SVC, history of infective endocarditis and complete SVC expansion following PTA, no stent was implanted in this case. Since our patient had recurrent venous thromboembolism, he was chronically treated with dabigatran, which was continued after hospital discharge.

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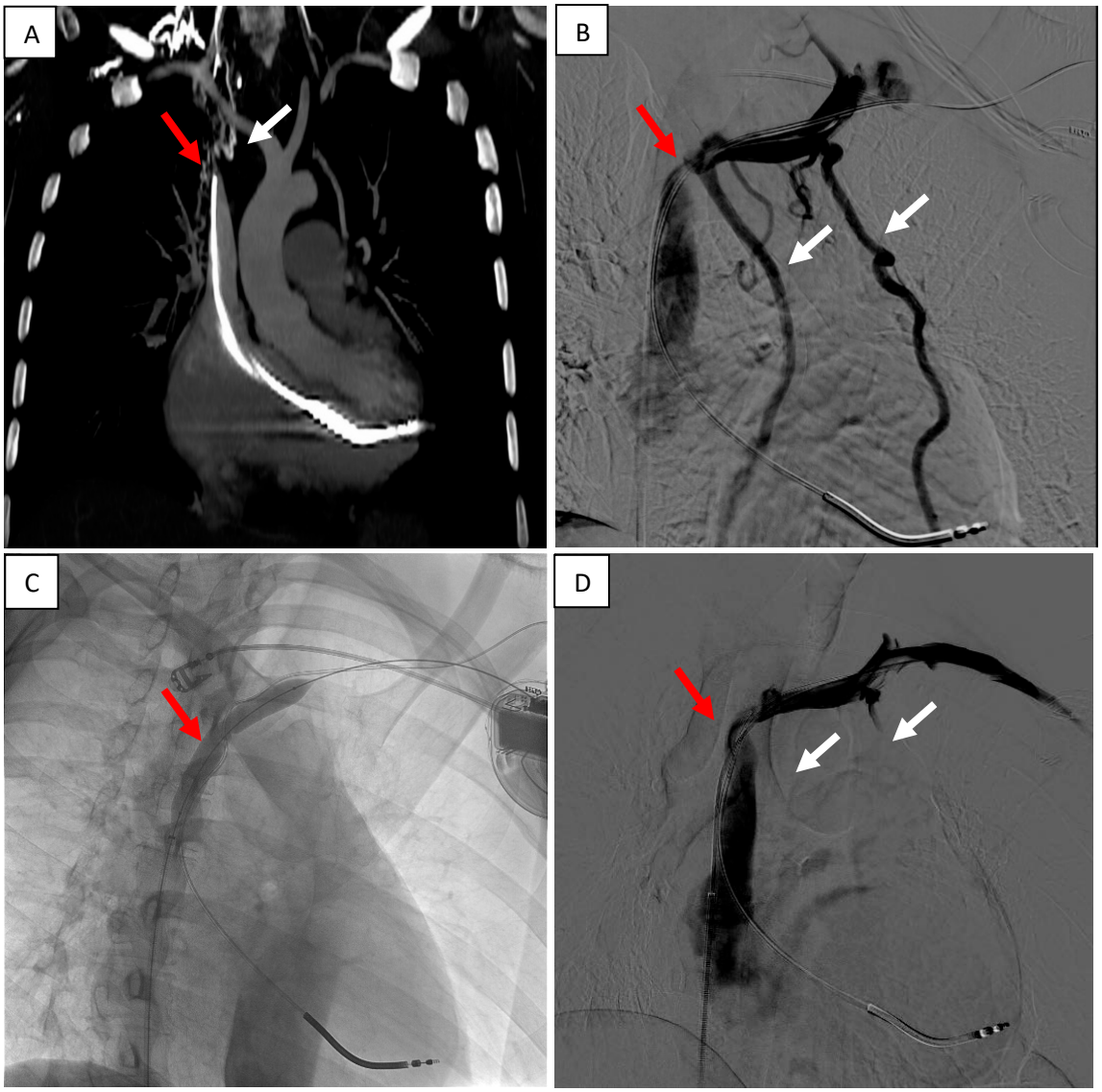

Figure 1. A. Computed tomography angiography showing obstructed right brachiocephalic vein and subtotal occlusion of superior vena cava (SVC; red arrow) with visible collateral circulation (white arrow); **B.** Digital subtraction angiography (DSA) showing critical stenosis of SVC (red arrow) with visible collateral circulation (white arrows); **C.** Percutaneous transluminal angioplasty using the EverCross Balloon Catheter (8 × 60 mm, 10 atm, Medtronic); **D.** Control DSA showing normal outflow from the SVC, with no flow *via* collateral circulation (white arrow)