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Large thrombus in transit in a COVID-19 patient

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Abstract

The course of COVID-19 patients may be complicated by thromboembolic events. We report on a 48-year-old female COVID-19 patient who underwent surgical removal of a large intracardiac thrombus. As per our centre protocol, critically ill COVID-19 patients are anticoagulated by the direct thrombin inhibitor Argatroban with close monitoring of anti-IIa activity. An intra-atrial thrombus formation fixed in a patent foramen ovale but also large mobile portions in both atria was diagnosed 4 days after weaning and removal of the jugular and femoral extracorporeal membrane oxygenation cannulas. The thrombus was removed surgically via median sternotomy and on cardiopulmonary bypass. The thrombus had a bizarre appearance with several finger-like appendices, and histological analysis revealed a mixed picture of acute and chronic thrombus portions. This case highlights the risk of life-threatening thrombus formation in COVID-19 patients despite therapeutic thrombin inhibition.

Keywords: COVID-19 • Cardiac thrombus • Thromboembolic event

INTRODUCTION

The pro-coagulant state of COVID-19 patients is associated with a high incidence of thromboembolic complications of up to 16% in hospitalized patients. Accordingly, there is a vast consensus to conduct thromboprophylaxis in hospitalized and intensive care patients [1]. Thrombin inhibition with Argatroban appears a promising alternative anticoagulant strategy for COVID-19 patients through antithrombotic, anti-inflammatory and antiviral effects [2].

CASE REPORT

A 48-year-old obese female patient (body mass index 52 kg/m²) diagnosed with SARS-CoV-2 associated pneumonia was admitted to our tertiary centre with progressive acute respiratory distress syndrome. Under invasive mechanical ventilation and prone positioning, oxygenation was impaired with pO₂ of 40 mmHg. Venovenous extracorporeal membrane oxygenation (ECMO) was initiated. As per our centre protocol, therapeutic thrombin inhibition with Argatroban was administered continuously. Anticoagulation was monitored by daily measurement of the Argatroban and aPTT levels. The patient could be weaned from ECMO after 22 days, and the femoral and jugular cannulae were

removed while mechanical ventilation was continued. Four days later, transoesophageal echocardiography was performed after an episode with hypoxaemia and haemodynamic deterioration. A large echogenic structure with fixation in a patent foramen ovale (PFO) and 2–3 cm large mobile portions in both atria (see Figure 1A and 1B and Video 1) was shown. The not ECG-triggered cross-sections of a computed tomography angiography demonstrated non-contrasted areas in the left and the right atrium suspicious of intra-atrial thrombi as well. Pulmonary embolism was excluded. With a high risk for pulmonary or systemic embolization, there was an indication for mechanical removal of the thrombus. The procedure was performed surgically via median sternotomy and on cardiopulmonary bypass. After systemic heparinization, the aorta and both caval veins were cannulated and the heart was arrested. The right atrium was incised and the thrombus was exposed in the fossa ovalis. The thrombus had a bizarre appearance with several finger-like appendices. In order not to fragment the thrombus, the PFO was enlarged, and the thrombus was retrieved in toto (see Figure 1C and Figure 2 and Video 2). Histological analysis revealed a mixed acute and chronic thrombus. The left atrium was inspected for any residual thrombi, and the inter-atrial septum was closed with a continuous suture. The patient could be weaned uneventfully from cardiopulmonary bypass. Her chest had to be left open because probatory chest closure resulted in increased catecholamine

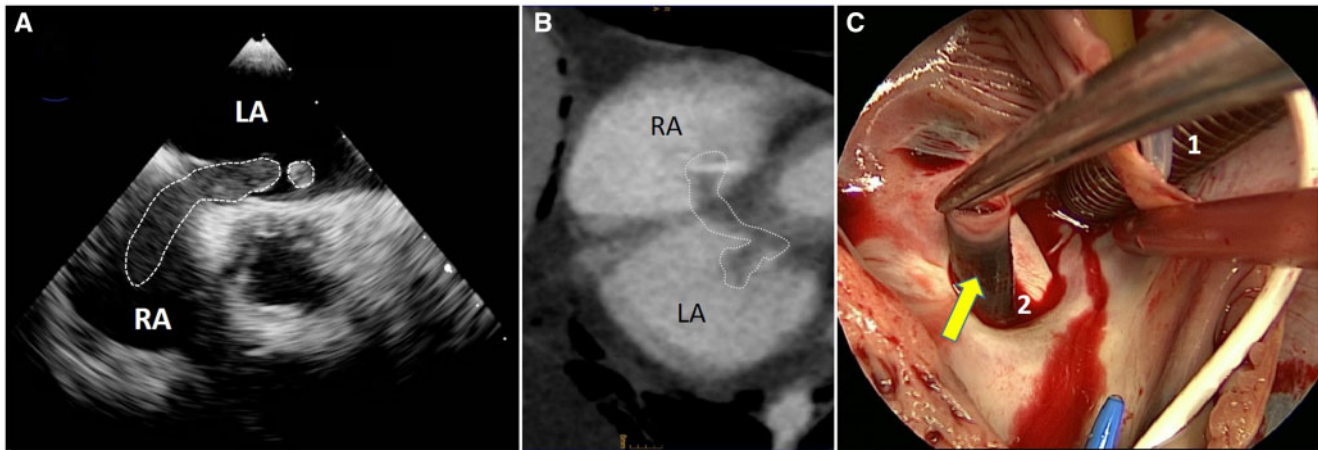
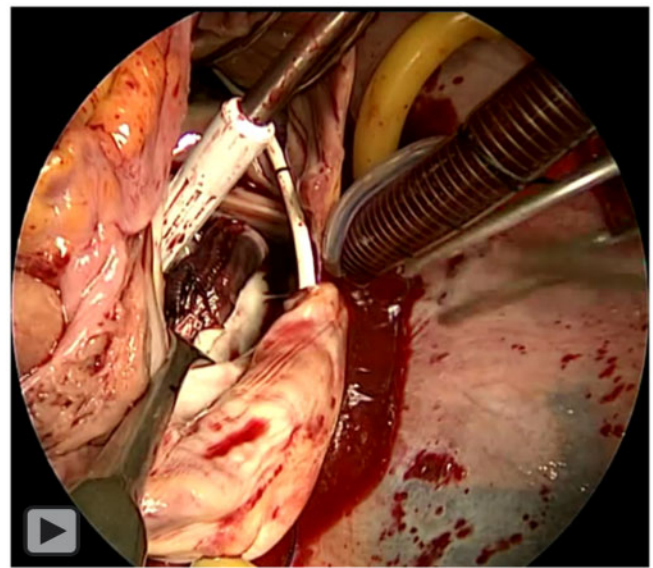


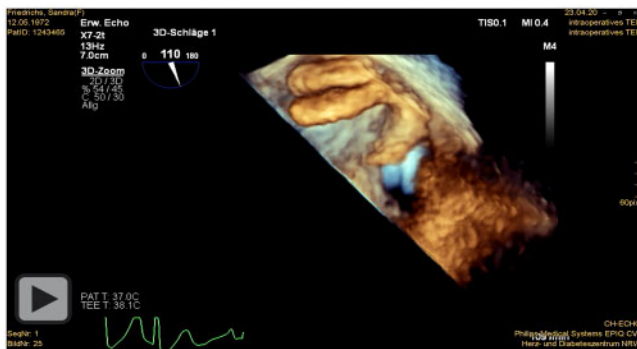
Figure 1: This figure shows the extend of the thrombus in (A) transoesophageal echocardiography, (B) computed tomography scan with adjacent beam hardening artefacts due to the atrial probe, and (C) in the right atrium intraoperatively. LA: left atrium; RA: right atrium, arrow point to the thrombus; 1: inferior caval vein cannula; 2: fossa ovalis and patent foramen ovale.



Figure 2: Extracted thrombus in toto.



Video 2: Extraction of the thrombus in transit after enlargement of the patent foramen ovale.



Video 1: Three-dimensional transoesophageal loop of the left atrial portion of the thrombus with several mobile portions.

requirements. The chest was closed 3 days later. Unfortunately, after initial good recovery from the surgical intervention, the patient died 2 weeks later from respiratory failure after transferral to a peripheral centre.

DISCUSSION

SARS-CoV-2 can cause significant morbidity and mortality, not only through pneumonia and irreversible lung injury but also due to COVID-19-associated coagulopathy that can lead to intravascular clot formation, thromboembolic complications, organ failure and death. A recent comparative study reported a much higher frequency of thromboembolic complications in COVID-19 patients on ECMO than in patients with similar viral pneumonia on ECMO [3]. Our case highlights the increased risk of thrombus formation despite monitored therapeutic thrombin inhibition in COVID-19 patients. The balance between anticoagulation strategy and thrombotic and bleeding complications in patients with COVID-19 seems complex. Results of ongoing antithrombotic COVID-19 studies are awaited to guide clinicians further in different disease stages [1]. Argatroban is being studied in a Phase 4

trial of anticoagulation in critically ill patients with COVID-19 (NCT04406389). The Argatroban monitoring should be complemented by the measurement of anti-IIa activity, as the aPTT measurement is prone to interactions, especially in critically ill patients. Also other agents, such as factor Xa inhibitors are studied in COVID-19 patients [4]. The presence of a PFO might have contributed to the serious complication in our patient. Although usually asymptomatic, an acute right-to-left inter-atrial shunt through the PFO could have been triggered by an increase of the right atrial pressure caused by the COVID-19 pneumonia [5]. A case with PFO and inter-atrial clot formation has been previously described in a SARS-CoV-2 positive patient with severe pulmonary embolism [6]. The development of an intracardiac thrombus may be multifactorial, and we cannot exclude also other causes such as a thrombus that has been shaved off an ECMO cannula, although a Fogarty catheter has been inserted during ECMO explantation.

In conclusion, critically ill SARS-CoV-2 patients are at risk for developing large intravascular clots despite effective anticoagulation. Patients with PFO might be at even increased risk for systemic thromboembolic events and may benefit from closer monitoring and increased intensity thromboprophylaxis.

Conflict of interest: none declared.

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