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Case Report

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Catheter-directed thrombolysis in a COVID-19 patient complicated with pulmonary embolism

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Abstract:

Since December 2019, the novel coronavirus (COVID-19) outbreak has become an important public health problem and one of the most common causes of morbidity and mortality worldwide. COVID-19 is highly associated with thromboembolic events, like deep venous thrombosis and pulmonary embolism (PE). Catheter-directed thrombolysis (CDT) provides effective reperfusion for the treatment of PE. We report a patient who was presented with intermediate-risk PE and had a saccular aneurysm of the anterior cerebral artery. The patient was suffered from recent COVID-19 infection and ischemic stroke. As the patient had high bleeding risk for full-dose systemic thrombolytic therapy, CDT was the preferred method for reperfusion. Finally, the patient was discharged from the hospital uneventfully 4 days later. In the setting of high bleeding risk, CDT seems to be an effective and safe approach in patients with intermediate-risk PE.

Keywords:

Catheter-directed thrombolysis, COVID-19, pulmonary embolism

Introduction

COVID-19 is a recently identified disease that is highly associated with thromboembolic events, such as deep venous thrombosis and pulmonary embolism (PE).[1,2] Catheter-directed thrombolysis (CDT) is an effective and safe method used for reperfusion, especially in intermediate- and high-risk PE patients with absolute or relative contraindications for full-dose thrombolytic therapy. Herein, we report a case of PE in a patient with COVID-19, successfully treated with CDT.

Case Report

We present a case of a 52-year-old, morbid obese female patient with a history of hypertension and recent ischemic stroke. A saccular aneurysm of the anterior cerebral artery was incidentally detected in cranial imaging at the time of hospitalization for stroke 2 months before [Figure 1]. Shortly afterwards, the patient was hospitalized with COVID-19, which was confirmed by both viral polymerase chain reaction and thorax computed tomography (CT). The patient stated that she had not used low-molecular-weight heparin (LMWH) therapy after hospital discharge for the last week. She was admitted to our emergency department with the complaint of shortness of breath. On physical examination, blood pressure was 90/70 mmHg, heart rate was 110 per minute, and oxygen saturation was 88%. Electrocardiogram revealed sinus tachycardia with right axis deviation [Figure 2a]. Serum levels of D-dimer and troponin-T were elevated. Bedside transthoracic echocardiography (TTE) examination showed enlargement of the

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right heart chambers, decrease in right ventricular systolic function and increase in systolic pulmonary artery pressure (PAP) (65 mmHg). In pulmonary CT angiography, filling defects of massive PE causing significant obstruction in both pulmonary artery bifurcation and main branches were observed [Figure 2b]. CDT method was preferred for reperfusion as our patient had an intracranial aneurysm and a recent history of ischemic stroke. Therapeutic dose of LMWH was administered before the procedure in the emergency department. As the right common femoral vein has a relatively straight course to the right heart, interventional cardiologists mostly prefer it for access. Therefore, we performed the procedure via the right common femoral vein route and general protection equipment against COVID-19 were used during the procedure. Following pulmonary artery cannulation, thrombus aspiration and 10 mg bolus tissue plasminogen activator (tPA), alteplase, was administered to both pulmonary arteries [Figure 3a]. As occlusion continued at the left lower pulmonary artery level, consecutive dilatations were performed with a 5.0 mm × 15 mm noncompliant balloon [Figure 3b]. Distal pulmonary artery flow was restored in control images [Figure 3c]. A catheter was left at the main pulmonary artery and a 24-h tPA infusion was given at a rate of 1 mg per hour. The patient's clinical condition improved rapidly within 24 h. Control TTE showed improvement in right ventricular systolic function and decrease in systolic PAP (30 mmHg). In lower extremity venous Doppler ultrasonography, intraluminal thrombus was observed at the level of the popliteal vein. Thrombus was thought to be persistent due to the lack of full-dose systemic fibrinolytic therapy. Inferior vena cava filter application was not considered as the level of thrombus was not above the popliteal vein. LMWH was administered during hospitalization. The patient was discharged from the hospital uneventfully on therapeutic dose of rivaroxaban. Written informed consent was obtained from the patient for publication of this case report, including the results of imaging methods.

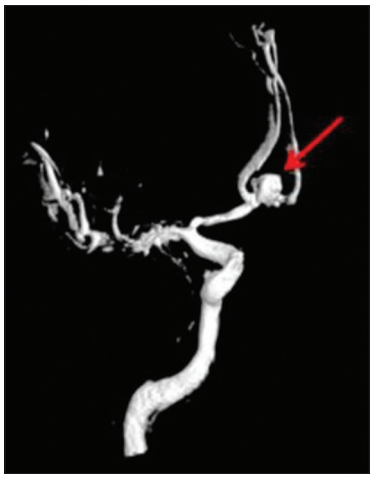

Figure 1: Three-dimensional computed tomographic angiographic view of intracranial aneurysm of the anterior cerebral artery

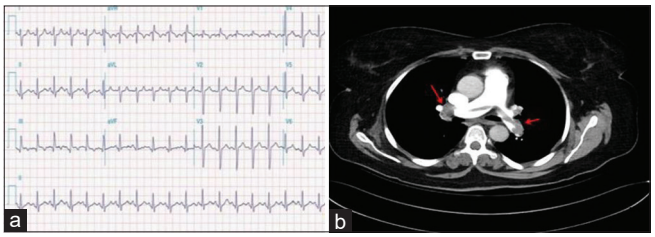

Figure 2: (a) Patient's admission electrocardiogram. (b) Computed tomographic pulmonary angiogram of the chest, large filling defects in the main, bilateral main branches of pulmonary arteries

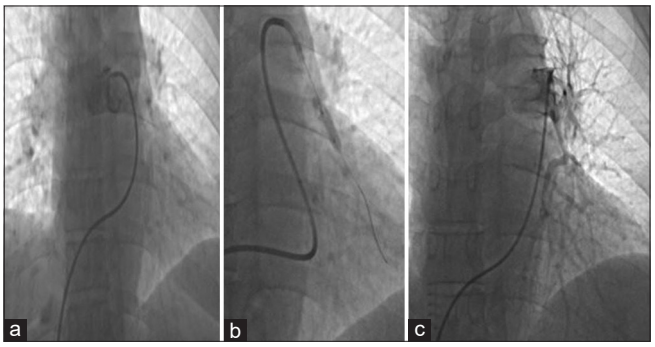

Figure 3: (a) Pulmonary angiographic view of the left pulmonary artery following thrombus aspiration and alteplase administration. (b) View of the balloon dilatation to the left pulmonary artery. (c) Maintaining the normal left pulmonary artery distal flow

Discussion

This case highlights the efficacy and safety of CDT in patients with COVID-19 related PE who had high bleeding risk for thrombolytic therapy. Mechanisms such as acute lung injury, cytokine storm, hematopoietic stem cells and/or bone marrow stroma invasion, and hypoxia developing during the course of COVID-19 trigger prothrombotic events and increase the incidence of acute PE.[3] As in our case, rapid diagnosis and effective intervention are vital in high-risk PE patients.

In CDT, direct placement of a multi-side-hole catheter enables a high thrombolytic drug concentration in the thrombus. Furthermore, direct fibrinolytic drug infusion increases intra-thrombal pressure, which provides a rapid and effective lysis of the clot.[4] After catheter engagement, a bolus of 2–10 mg of thrombolytic may be given before initiation of the infusion. With an infusion rate of 1–2 mg/h, a total dose of 15–30 mg of tPA is used in CDT, whereas a standard dose of 100 mg tPA given in systemic full-dose thrombolysis.[5] CDT is efficient and has lower risk of major hemorrhage compared to systemic full-dose thrombolysis.[5] Besides, it is a less invasive method than surgical embolectomy and has

lower incidence of periprocedural morbidity. Hence, it seems reasonable to use CDT in an increasingly manner to restore right ventricle (RV) function earlier in intermediate and high-risk PE patients.

The current literature on CDT is mostly limited to case series and few randomized controlled studies designed with a small number of patients. CDT was compared with anticoagulation therapy in many of these studies, and no significant difference was found in terms of mortality and bleeding complications.[6-8] However, CDT provided an earlier reduction in RV/left ventricle ratio and PAP in intermediate-risk PE patients compared to anticoagulation therapy.[6-8] Other limitations regarding these trials may be the enrollment of a relatively small number of intermediate- and high-risk PE patients, like our case, and lack of head-to-head comparison of CDT with full-dose systemic thrombolytic therapy.

Systemic fibrinolytic therapy was accepted as the traditional reperfusion therapy in massive PE. According to current guidelines,[9] high-risk PE patients (patients with shock status or deep hypotension) are recommended to be treated by emergency surgical embolectomy in case of a contraindication for fibrinolytic therapy. Unfortunately, this option was not suitable for our patient because she had severe comorbidities for surgical treatment and a lack of adequate experience for surgical embolectomy in our center. Theoretically, it is known that there is a risk of pulmonary hemorrhage with systemic thrombolytic therapy in the damaged lung parenchyme due to COVID-19.[10] Besides COVID-19 infection, our patient had an intracranial aneurysm and a recent history of ischemic stroke. Therefore, CDT was preferred for reperfusion therapy. CDT may be an additional reliable therapeutic option in patients with COVID-19 and PE who had comorbidities facilitating bleeding.

Arterial and venous thromboembolic events had been frequently reported during the course of COVID-19.[11,12] To note, these prothrombotic complications were not rarely seen following hospital discharge. In this context, PE should be considered in patients presenting with acute shortness of breath or deoxygenation following COVID-19 infection.[13] Besides, patient education and medical advice for the continuation of the anticoagulation therapy after hospital discharge is of extreme importance; especially in patients with high risk for thromboembolism.

Conclusion

PE should be considered in the differential diagnosis of acute-onset dyspnea and extended thromboprophylaxis should be considered in COVID-19 patients with high risk for thromboembolic events following hospital discharge. CDT may be an effective and reliable therapeutic option in patients with COVID-19-related PE who had high bleeding risk for full-dose systemic thrombolytic therapy.

Authorship contributions
Concept - B.B.K.; Design -B.B.K., K.K.; Supervision - K.K.; Materials –B.B.K., K.K.; Data collection and/or processing – B.B.K., K.K.; Analysis and/or interpretation – B.B.K., Literature search – B.B.K., K.K.; Writing - B.B.K.; Critical revision -K.K.

Conflicts of interest
None Declared.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understand that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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