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Catheter-directed thrombolysis for the treatment of acute pulmonary embolism refractory to systemic fibrinolysis

Short title: Catheter-directed thrombolysis for PE refractory to systemic fibrinolysis

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The management of acute pulmonary embolism (PE) has been defined in recent guidelines, however, a variety of clinical scenarios still remain a diagnostic and therapeutic challenge [1,2]. Failure of systemic thrombolysis (ST) for acute PE is defined as persistence of hemodynamic instability and right ventricular (RV) dysfunction observed within 36 hours [1]. In some patients, however, symptoms and RV dysfunction persist beyond that time, despite hemodynamic stabilization after ST and continuous anticoagulation. As the treatment of such patients is less well established, we share our experience on the use of CDL in such clinical scenario.

A 36-year-old man with a recent history of lower limb fracture, was admitted to a district hospital due to acute dyspnea. An urgent computed tomography angiography (CTPA) revealed a saddle thrombus in the pulmonary trunk with extensive clots in the right and left pulmonary arteries (PA). Shortly after he deteriorated, requiring pharmacological support with dobutamine and norepinephrine. Anticoagulation and ST were initiated immediately. A total dose of 100 mg of alteplase was administered within 2 hours resulting in gradual hemodynamic improvement allowing for discontinuation of catecholamine infusion. In the following days his clinical status remained stable. He was treated with parenteral heparins followed by a direct oral anticoagulant. Despite the treatment, he complained of shortness of breath on minimal exertion, had persistent tachycardia and hypoxemia. His echocardiography at 7th post-ST day displayed permanent RV dysfunction and increased RV systolic pressure of 86 mmHg. Biochemical analysis revealed elevated level of troponin T of 20.43 ng/l - lower than at baseline (122.2 ng/l), continuously increased NT-proBNP of 7062 pg/ml (4422 pg/ml at baseline), and no signs of other significant abnormalities. The CTPA showed persistence of clots in both PAs with only a little improvement in arterial patency as compared to initial CTPA. No signs of recurrent PE or features of pre-existing chronic thromboembolic pulmonary disease were found. Therefore Pulmonary Embolism Response Team was
requested for advice [3]. Due to the presence of clinical, imaging and laboratory signs of significant RV dysfunction, and incomplete resolution of clots after ST, reperfusion treatment was recommended. Percutaneous, ultrasound-assisted, low-dose thrombolysis (USAT) with the use of two catheters installed within clots and a total tPA dose of 10 mg during 5-hour infusion, as described previously, was safely performed [4,5]. Advantage of local delivery of tPA directly into obstructing clots dictated the use of USAT over ST. The therapy resulted in a rapid improvement of symptoms and RV function, decrease in thrombi burden and systolic PA pressure, and reduction of the NT-proBNP to 216 pg/mL. The patient was discharged home at 6th postoperative day with only mild exercise dyspnea. He was seen at 6-month follow-up visit reporting no exercise limitation. Echocardiography showed no signs of pulmonary hypertension and the NT-proBNP level was 19 pg/ml.

We showed in this report, that CDL may bring benefit to patients with persistent symptoms after incomplete ST. Vigilance to such clinical situations and awareness of potential therapies is warranted as no routine management has been established yet.
References:


Figure 1. Computed tomography pulmonary angiography (CTPA) in a patient with high-risk acute pulmonary embolism showing saddle thrombus (*) overriding pulmonary trunk bifurcation with extensive clots in the right and left pulmonary arteries (PA) (#) (A) and dilatation of the right ventricle (RV) with the RV/LV ratio of 2.2 (B), who was initially treated with systemic thrombolysis (ST) resulting in hemodynamic improvement, but persistence of dyspnea, RV dilatation (RV/LV ratio of 1.5) (D) and occlusive clots in proximal left and right PAs (#) with sole resolution of the saddle thrombus (*) (C), and who eventually underwent percutaneous, ultrasound-assisted, low-dose, local thrombolysis with the use of two catheters installed within clots, what led to withdrawal of symptoms, restoration of both PAs’s patency (#) (E) and reduction of the RV dilatation (RV/LV ratio of 0.9) (F).