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Case Report

Suction thrombectomy for management of pulmonary tumor embolism in the setting of hepatocellular carcinoma with macrovascular invasion [☆]

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ABSTRACT

Pulmonary tumor thrombi are rare but challenging to treat given the generally poor health of the patients in whom they occur and the low likelihood of the embolism to respond to anticoagulation. Management options include therapeutic anticoagulation and surgery, but the mortality rate is high in either case. Thus, in patients who are symptomatic, the decision about whether to intervene may be challenging. Here the authors present an alternative minimally invasive approach, illustrated in the case of a patient with hepatocellular carcinoma who developed intermediate-risk pulmonary tumor embolism that was successfully managed via suction embolectomy. Such treatment should be considered not just as a life-saving intervention but as a palliative one as well.

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Introduction

Nonthrombotic pulmonary embolism (NTPE) is rare compared to pulmonary thromboembolism (PTE) but can be a source of significant morbidity and mortality when it occurs [1]. Possible etiologies may be endogenous, such as tumor, fat, and amniotic fluid, or exogenous, such as catheter and filter fragments, coils, polymethyl methacrylate, and n-butyl cyanoacrylate. Treatment is challenging due

to the distinct clinical scenarios, relative rarity, and general lack of response to therapeutic anticoagulation. In asymptomatic patients, anticoagulation can be administered until the material epithelializes and is thus no longer thrombogenic, whereas those with significant symptoms may require surgery [2]. Minimally invasive endovascular techniques are increasing in availability, but applicability and efficacy remain unproven.

Suction thromboembolectomy has been shown to be safe and effective for intermediate risk PTE and is increasingly

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being utilized in cases of high-risk PTE as well [3,4]. Unlike therapeutic anticoagulation and systemic thrombolysis, it rapidly relieves right heart strain with a significantly lower risk of clinically significant hemorrhage. Importantly, it remains effective in cases where the embolic material is organized and resistant to chemical methods of treatment. Because of this, suction thromboembolectomy is potentially useful in the treatment of some cases of NTPE.

Here the authors present a case of a patient with hepatocellular carcinoma who developed intermediate-risk pulmonary tumor embolism that was successfully managed via suction embolectomy.

Case presentation

An 83-year-old man presented to the emergency department (ED) with one hour of chest pain and shortness of breath. His medical history was notable for dementia, coronary artery disease, nonviral cirrhosis, and multifocal HCC for which he had undergone 2 rounds of locoregional therapy, most recently 1 year prior. A month before the current presentation, he was found to have tumor thrombus in the intrahepatic IVC extending to the cavoatrial junction, for which he was started on apixaban.

On presentation, the patient was at his baseline mental status, mildly hypotensive (blood pressure 90s/60s mmHg), in normal sinus rhythm (heart rate 70s), mildly tachypneic, and saturating 94% on room air. Laboratory data was notable for high-sensitivity cardiac troponin 123 ng/L, B-type natriuretic peptide (BNP) 785 pg/mL, lactate 6.2 mmol/L, and platelets 25×10^3 /mL. Bedside echocardiography showed right ventricular dilatation with McConnell's sign, and computed tomography angiography (CTA) demonstrated occlusive thrombus in the right main pulmonary artery and subocclusive thrombus in the left upper lobar artery (Fig. 1); no filling defects were apparent in the visualized portion of the IVC. Given these



Fig. 1 – Contrast-enhanced coronal CT image demonstrating a large occlusive thrombus in the right main pulmonary artery extending into lobar branches (arrow).

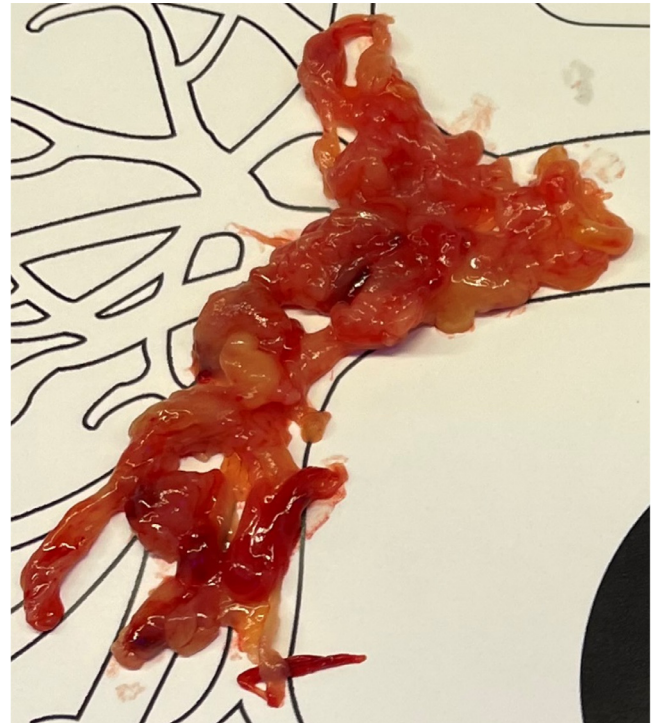


Fig. 2 – Photograph of material removed from right lung.

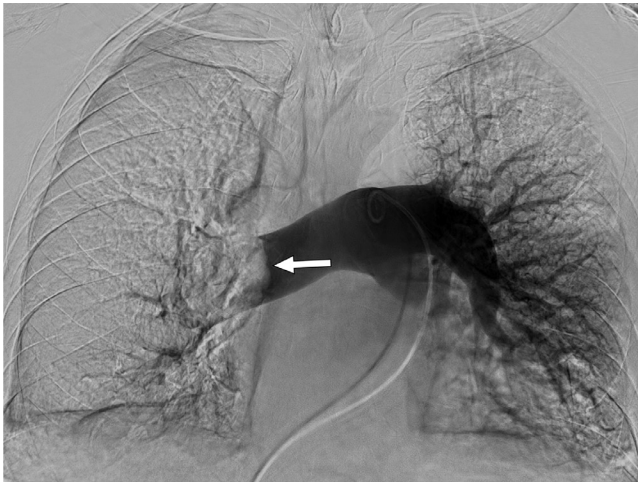
findings, he was diagnosed with intermediate-high risk pulmonary embolism and mechanical thrombectomy performed [5].

The procedure was performed under moderate sedation. A 24 French Intri sheath (Inari Medical, Irvine, CA) was introduced into the right common femoral vein and the main pulmonary artery selected with a 6 French pigtail catheter. Suction embolectomy performed in the right main pulmonary artery using a Trierer24 catheter (Inari Medical) yielded a large amount of organized material (Fig. 2); given its atypical appearance, it was sent for pathologic analysis. Angiography showed complete resolution of filling defects (Fig. 3) and mean pulmonary artery pressure decreased from 18 to 10 mmHg. Consequently, the procedure was concluded. A postprocedural duplex study showed no deep venous thrombosis, and a CT abdomen/pelvis confirmed the presence of a large right hepatic HCC invading into the IVC to the level of the cavoatrial junction (Fig. 4).

The patient was continued on therapeutic-dose anti-coagulation after the procedure but developed a subdural hematoma causing midline shift, so it was discontinued. He subsequently developed respiratory failure, was transitioned to home hospice care, and discharged 17 days after the procedure. Pathology showed poorly differentiated metastatic carcinoma compatible with HCC.

Discussion

The incidence of tumor thrombi varies widely but may be as high as 26% when evaluated at autopsy; because it tends to



A



B

Fig. 3 – (A) Frontal digital subtraction angiogram demonstrating occlusive thrombus in the right main pulmonary artery (arrow), consistent with prior CT. (B) Pulmonary angiography after right pulmonary artery thrombectomy shows significant improvement of the right lung blood flow.

accompany advanced disease, it is a poor prognostic indicator [6]. Thrombi are classified as microvascular or macrovascular depending on the size of the embolic material. The former occurs most commonly in the setting of mucin-secreting adenocarcinomas and manifests as nonspecific tree-in-bud opacities [7]. It results either from accumulation of tumor foci within the artery or from thrombotic microangiopathy, in which fibrocellular intimal hyperplasia, necrosis, and connective tissue proliferation occur [8,9]. Macrovascular emboli, by contrast, can be directly visualized in the lumen of the pulmonary artery. The most common causes are hepatocellular, renal cell, and breast carcinoma, although a variety of other etiologies have also been reported [10,11]. Differentiation from bland thrombus can be challenging as the lack of vascular connection may limit enhancement.

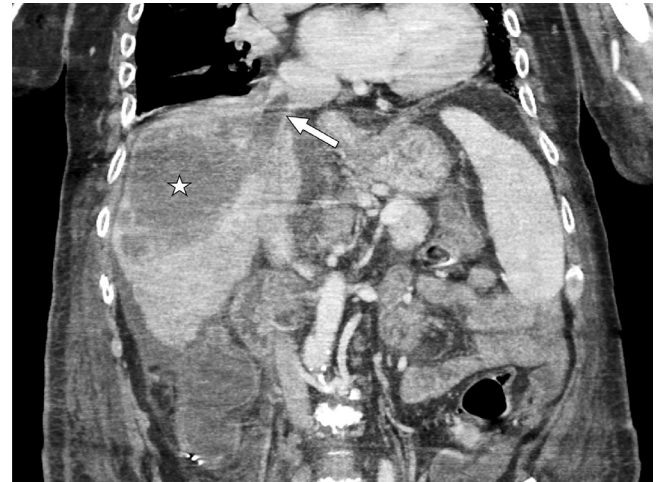


Fig. 4 – Contrast-enhanced coronal CT image demonstrating a large right hepatic tumor (star) extending into through the hepatic vein into the IVC to the level of the inferior cavoatrial junction (arrow).

Vascular invasion is a well-recognized negative prognostic indicator in patients with HCC, to the extent that the presence of portal invasion changes the recommended treatment [12]. Although detection varies by modality, studies suggest that IVC invasion occurs in 9%-26% of cases and to the level of the right atrium in 1%-4% [13–15]. Furthermore, the rate of vascular invasion increases with tumor size, rising to 65% in patients with tumors >5 cm (although this study included portal vein invasion as well) [16]. Surgical resection has high mortality but remains the treatment of choice, although percutaneous IVC thrombectomy has also been reported [17,18].

HCC-related pulmonary tumor embolism is extremely rare, being reported only as single cases. Consequently, both the frequency and optimal treatment remain unknown. Options thus far have been limited to anticoagulation or surgery, with one limited analysis suggested that survival was improved with the latter [19]. However, surgery is accompanied by substantial morbidity, which may be particularly undesirable in these patients with short life expectancies who may thus experience limited benefit.

Suction embolectomy, here performed with the Inari FlowTriever system, presents an alternative approach. In addition to obviating much of the risk of surgery, the procedure can be performed minimally invasively, quickly, and under local anesthesia with or without moderate sedation. Therapeutic anticoagulation is necessary during the procedure but does not necessarily need to be continued afterwards, which is particularly useful in patients at increased bleeding risk. Given these differences, consideration should be given to offering suction embolectomy not only in patients undergoing or at risk of sudden decompensation, but in those with macroscopic tumor emboli who are hemodynamically stable but symptomatic. Thus, it may be considered not just as a life-saving intervention but as a palliative one as well. Importantly, the feasibility of the technique in patients with pulmonary tumor emboli resulting from other malignancies and using other aspiration devices, remains unknown.

Conclusion

This report demonstrates a novel approach to treatment of NTPE, illustrated in the case of a macroscopic tumor embolus resulting from HCC. Utilization of this technique to manage other causes of NTPE should also be considered, when feasible.

Patient consent

Authors declare that patient's informed consent was obtained.

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