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Percutaneous transcatheter aspiration of pulmonary embolism leading to diagnosis of hepatocellular carcinoma tumor embolus and change in systemic chemotherapy

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Abstract

The management of metastatic hepatocellular carcinoma (HCC) is complex, particularly when complicated by pulmonary embolism. In these cases, atezolizumab-bevacizumab therapy is contraindicated due to an elevated risk of thromboembolic events. Differentiating pulmonary tumor embolism from thromboembolic disease is diagnostically challenging. This report outlines the benefit of transcatheter aspiration to obtain pathological evidence of pulmonary artery tumor embolus in an HCC patient. The intervention enabled a significant shift in the management strategy, leading to an escalation of systemic HCC therapy. This case underscores the importance of precise diagnostic techniques such as transcatheter aspiration in guiding treatment decisions, particularly in cases where pulmonary embolism may signify an underlying malignancy-driven process.

Keywords

Pulmonary embolism, tumor thrombus, hepatocellular carcinoma, INARI

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Introduction

Atezolizumab-bevacizumab is recommended as first-line therapy for patients with unresectable hepatocellular carcinoma (HCC), but it is not indicated in patients with pulmonary embolism due to an elevated risk of thromboembolic events. Pulmonary embolism might be caused by thrombotic disease and a tumor embolus. Differentiation between tumor and thromboembolic disease is challenging, but definitive histopathologic diagnosis is paramount for adequate HCC therapy in this scenario.

This report describes a transcatheter aspiration and pathological examination of the specimens that led to the diagnosis of tumor emboli and, consequently, to a change in systemic therapy.

Case report

A 57 year-old male presented with a large 17.5 x 15.5 x 12.5 cm HCC involving the entire right hepatic lobe and subsequent compression of the liver veins. The inferior vena cava (IVC) and the central liver veins showed thrombosis.

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The patient underwent extended right hemihepatectomy (S IV–VIII), simultaneous IVC replacement (Gore-Tex graft, 20 mm diameter), and partial diaphragmatic resection with direct sutures. Postoperatively, the patient developed a pulmonary embolism that was managed conservatively with anticoagulation. Follow-up computed tomography 10 months post liver resection showed an increase in lung metastases and enlargement of pulmonary embolism involving the bilateral main pulmonary arteries with complete occlusion of the lower right pulmonary artery, partial occlusion of the lower left pulmonary artery, and extension of thrombus into both upper pulmonary arteries. The right ventricle was not dilated (the right-to-left ventricular ratio was 0.75), and the patient denied any symptoms of dyspnea and could walk without limitations.

Our multidisciplinary tumor board reviewed the case, and the decision was made to start sorafenib and perform interventional aspiration of the pulmonary embolism to diagnose or rule out tumor embolism. Elective aspiration with the FlowTriever System (Inari Medical, Irvine, CA) was scheduled during local anesthesia. A 20-F Gore Dry-Seal sheath was placed in the right common femoral vein, and the 20-F and 16-F Triever catheters were used for aspiration of the embolus (Figure 1); additionally, FlowTriever catheters with nitinol disks for mechanical disruption were utilized to maximize therapy and to address wall-adherent components of the embolus. The procedure was completed without any complications, and the patient was sent to the regular ward afterward. After the third post-interventional day, the patient was discharged on rivaroxaban 15 mg twice daily.

Histopathology of the extracted specimens (Figure 2) revealed 20% tumorous infiltration of the embolus, immunohistochemically concordant with the known HCC (Figure 3). Immunohistochemically, the tumor cells expressed cytokeratin and HepPar-1, confirming the hepatocellular differentiation. Following another review by our multidisciplinary tumor board, the recommendation was made that sorafenib should be switched to atezolizumab/bevacizumab as a simple thromboembolic event was ruled out, and tumor embolization was diagnosed histopathologically.

A follow-up scan, 3 months after the therapeutic adjustment to atezolizumab/bevacizumab, showed a regression of pulmonary metastasis. The pulmonary emboli were reduced after thrombectomy, compared to the initial CT, and the wall-adherent part remained stable but showed calcification (Figure 4). Notably, the patient did not develop any respiratory symptoms during subsequent follow-up.

Discussion

HCC has a well-established association with hypercoagulable states due to the tumor's expression of procoagulant proteins and has a broad spectrum of clinical presentations, from acute hypoxia to more latent symptoms like pulmonary hypertension.[1] In our case, the patient was diagnosed with a pulmonary embolism that affected both main pulmonary arteries and enlarged during conservative therapy. The patient did not present with typical symptoms of pulmonary embolism, such as dyspnea. This presentation and the embolism's enlarging progression prompted the question of whether tumor cells were present within the embolism.

The incidence of pulmonary thromboembolism in cancer patients varies from 0.13% to 8.65%.[2] However, autopsy studies indicate that 3% to 26% of solid tumor patients have pulmonary tumor embolism,[3] yet only 8% show morbidity or mortality directly linked to the tumor emboli.[3,4] Most cases are related to breast, lung, or gastric cancer, while liver tumors causing pulmonary embolism are rare.[4,5] Pulmonary tumor embolism often has a poor prognosis, particularly in advanced neoplastic stages, and cancer progression is one of the leading causes of death in these patients.[6]

Several interventions are available for consideration for the management of pulmonary thrombi: therapeutic anticoagulation, systemic thrombolysis, catheter-directed thrombolysis, aspiration thrombectomy, and surgical excision.[7] The presence of neoplastic cells within the embolism constricts the range of effective therapeutic strategies for extensive pulmonary embolism, as mere anticoagulation or thrombolysis is often insufficient.[8] Percutaneous aspiration is gaining traction as a viable alternative for managing pulmonary thrombi and has been used in tumor embolism cases, but no HCC pulmonary tumor emboli cases have been reported.[9]

The FlowTriever system typically requires only a single venous access point and does not require venovenous extracorporeal membrane oxygenation (ECMO) and general anesthesia like other systems.[8] The aspirated blood is filtered and transfused to the patient during the procedure, resulting in minimal blood loss. Due to the FlowTriever system's minimally invasive nature, the system is particularly advantageous. It is a viable option not only for the treatment of acute pulmonary embolism but also for safely alleviating thrombus or embolus load in the pulmonary arteries and obtaining a necessary pathological diagnosis, which was of particular interest in our case.

The initiation of cancer treatment in patients with additional pulmonary emboli must take into account the potential risks of serious adverse events associated with the treatment regimens. During treatment with bevacizumab, the incidence of arterial thromboembolism is increased. These findings suggest a dual-edged sword; while bevacizumab might be beneficial for cancer treatment, it could simultaneously predispose to thromboembolic complications.[10] The decision by our multidisciplinary tumor board to transition from sorafenib to a combination of atezolizumab and bevacizumab reflects a tailored approach to a

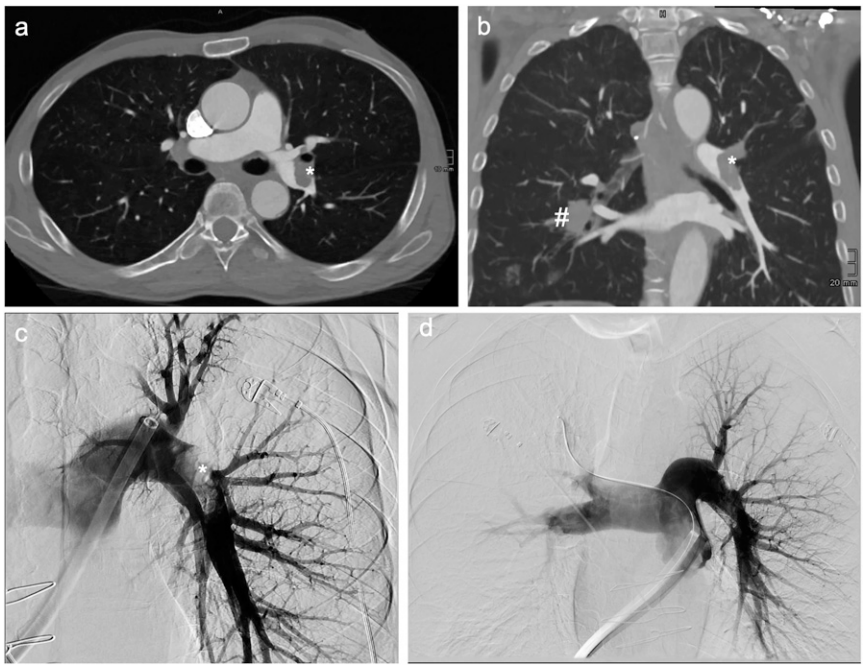

Figure 1. Mechanical aspiration of the left pulmonary artery (a), (b) Computed tomography angiography revealed pulmonary artery emboli in the left main pulmonary artery (*) and pulmonary metastasis (#). The smaller thrombus in the right segmental upper lobe artery is not shown. (c) Digital subtraction angiogram (DSA) before the intervention with a clear visualization of the embolus in the left main pulmonary artery (*). (d) DSA of the pulmonary arteries shows the near-complete embolus removal with only wall-adherent residual embolus remaining without any flow impairment.

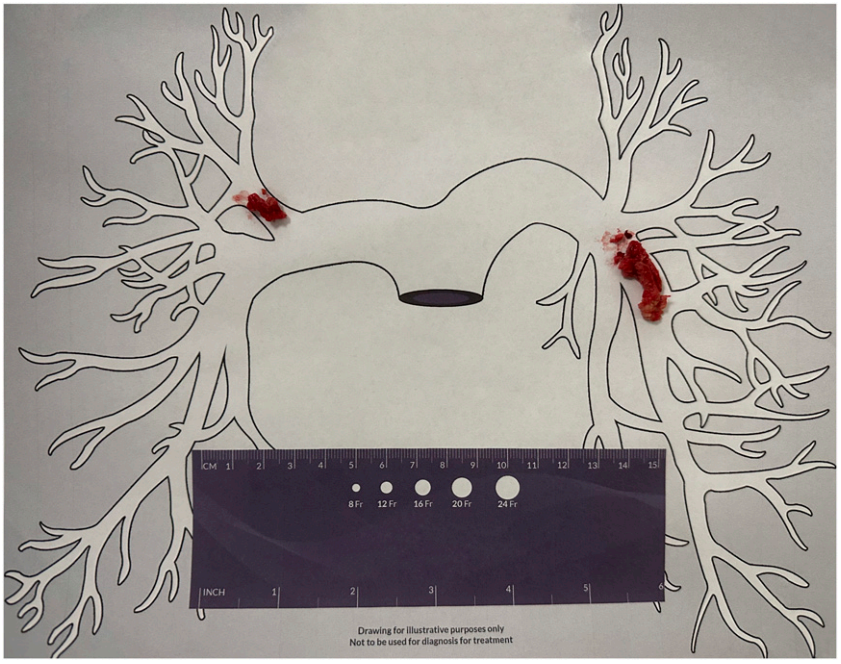

Figure 2. Extracted pulmonary emboli Anatomical sketch of the pulmonary arteries showing an extensive HCC tumor embolus extracted from the left main pulmonary artery and a small thrombus from the right segmental upper lobe artery.

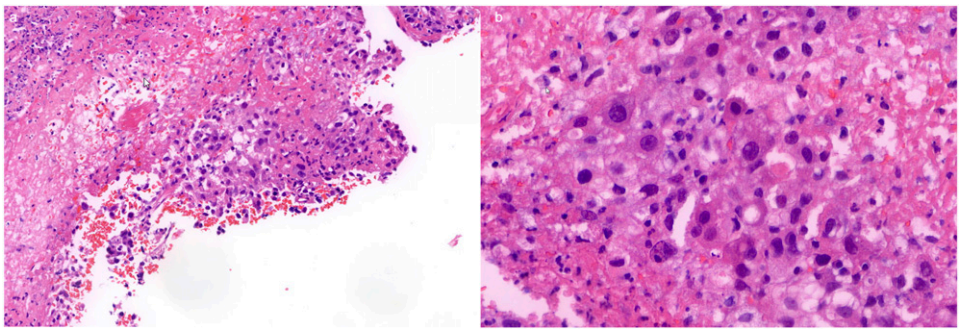

Figure 3. Histopathologic examination Microscopic examination of a specimen extracted from the pulmonary artery revealed cellular clusters of an epithelioid tumor with focal necrosis intermingled with adherent microthrombi. The neoplastic population consisted of polygonal cells with enlarged round nuclei and abundant eosinophilic cytoplasm with signs of vacuolation. The chromatin texture was slightly condensed, forming occasionally prominent nucleoli. (a) Lesion at scanning magnification (hematoxylin-eosin stain, x100); (b) Morphological features under power magnification (hematoxylin-eosin stain, x400).

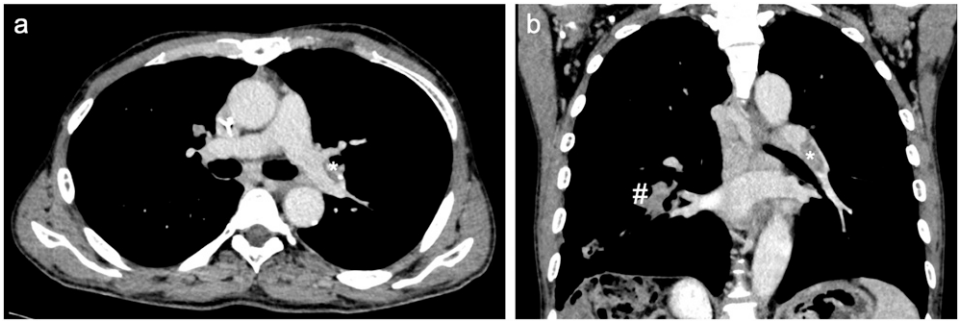

Figure 4. (a), (b) Follow-up Computed tomography angiography (3 months after chemotherapy change) revealed stable wall-adherent pulmonary artery emboli in the left main pulmonary artery with calcification (*) and regressive pulmonary metastasis (#).

complex clinical scenario, representing a more advanced therapeutic strategy. This shift in management was based on the careful exclusion of a thromboembolic event and the histopathological confirmation of tumor embolism. With thrombectomy, a sample of the pulmonary embolus was taken, and the thrombus was reduced with a remaining wall-adherent part. Calcification of the remaining thrombus indicated a transition to a chronic embolus in the follow-up CT scan. No thromboembolic event was observed under the new chemotherapy regimen.

In conclusion transcatheter aspiration successfully extracted pulmonary artery emboli and enabled definitive diagnosis of tumor embolism, leading to an escalation of systemic HCC therapy.

Declaration of conflicting interests

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Ethical statement

Ethical approval

For this type of study, formal consent is not required.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Consent for publication

Consent for publication was obtained for every individual person's data included in the study.

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