Renal cell carcinoma as a cause of aortic tumor thrombus embolization and acute limb ischemia

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ABSTRACT

This article presents a unique case of acute limb ischemia resulting from arterial tumor embolism secondary to renal cell carcinoma involving an aortobi-iliac bypass graft. To the best of our knowledge, this instance is the first documented in the literature of such a complication. The patient, a man in his 70s with a complex medical history, underwent bilateral femoral embolectomy and subsequent endovascular intervention for the resolution of the tumor thrombus. The rarity of this phenomenon poses challenges in formulating a standardized management strategy. (J Vasc Surg Cases Innov Tech 2024;10:101594.)

Keywords: Aortic tumor thrombus; Aortic graft tumor thrombus; Renal cell carcinoma; Acute limb ischemia; Tumor thrombus embolization

Renal cell carcinoma (RCC) is a commonly encountered renal malignancy known for its insidious presentation and metastatic potential. With the patient's consent for publication, this case highlights arterial tumor embolism preseting with acute limb ischemia (ALI) in a patient with RCC. Although venous invasion is a well-documented feature of RCC,[1] arterial tumor embolism leading to ALI remains exceedingly rare.

CASE REPORT

In September 2023, a 76-year-old man patient presented with left lower limb Rutherford 1 ALI and worsening chronic right lower limb-threatening ischemia. In 2021, he was diagnosed with stage IV left RCC with vertebral metastasis. A 7-cm infrarenal aortic abdominal aneurysm was discovered incidentally. Because the patient was initially to undergo surgical resection, endovascular aneurysm repair (EVAR) was performed. Ultimately, surgical resection did not eventuate in favor of immunotherapy and radiation treatment. In March 2023, the repair was complicated by bilateral EVAR limb occlusion with right Rutherford 2a ALI on a background of recently progressive bilateral short distance claudication. After confirmation of stable disease and a favorable cancer prognosis by the patient's oncologist, explantation of the EVAR with in situ Dacron reconstruction and successful bilateral limb embolectomies and fasciotomies was performed. No histopathology was obtained.

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The patient's other medical history includes type 2 diabetes and ischemic heart disease, resulting in a cardiac arrest in 2022. His medications at presentation included clopidogrel 75 mg daily, apixaban 5 mg twice daily, and fenofibrate. He quit smoking 20 years prior with a 40 pack-year history. He is a retired public servant from Canberra, supported by his wife.

Upon admission, he was diagnosed with Rutherford 1 ALI. Computed tomography angiogram revealed extensive nonocclusive thrombus in the aortobi-iliac graft extending into both external iliac arteries, with near occlusion on the left (Figs 1 and 2). There was further occlusive embolus in the left superficial femoral artery.

Because the patient had developed thrombosis while anticoagulated, hematology was consulted for advice. Heparin infusion was initiated, and the patient underwent urgent bilateral femoral embolectomy without fasciotomies. The retrieved emboli from the aorta and the left lower limb had an unusual macroscopic appearance and were sent for histology. This revealed a mix of degenerate blood cells, fibrin, inflammatory cells, necrotic tissue, and malignant cells. Immunohistochemistry confirmed the presence of RCC, characterized by sheets of large atypical epithelioid cells, occasional prominent nucleoli, and abundant eosinophilic cytoplasm. Immunohistochemistry was positive for EMA, PAX-8, CD10, and vimentin, with AMACR, CK7, and SOX 10 exhibiting negativity (Fig 3).

A follow-up computed tomography angiogram and pyelogram at 72 hours after surgery showed persistent floating thrombus in the aortic graft but improved iliac perfusion. Left ureter thickening and a tissue conglomerate near the left common iliac artery were noted. Owing to concerns of further embolization, endovascular exclusion was achieved by deploying a 26 × 45-mm Gore Excluder Conformable cuff (W. L. Gor & Associates, Flagstaff, AZ) in the body of the Dacron graft extending with a 16 × 12-mm Gore Excluder aortic limbs into both external iliac arteries. The patient was discharged with perfusion intact to both limbs.

Upon close follow-up, further angioplasty was performed owing to progress of his infrainguinal vascular disease, which

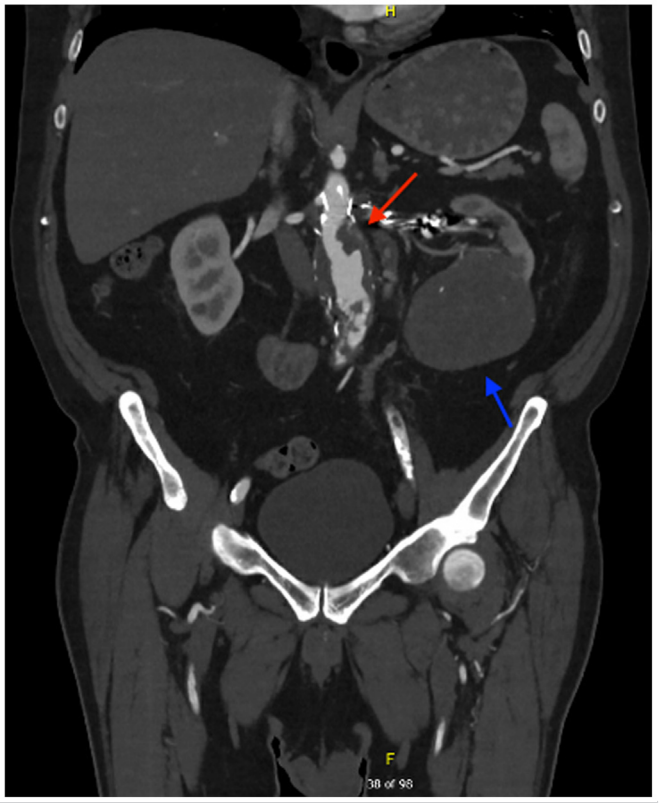

Fig 1. Coronal computed tomography images demonstrating aortic tumor thrombus within the aortic graft (red arrow) and the left renal cell carcinoma (RCC) (blue arrow).

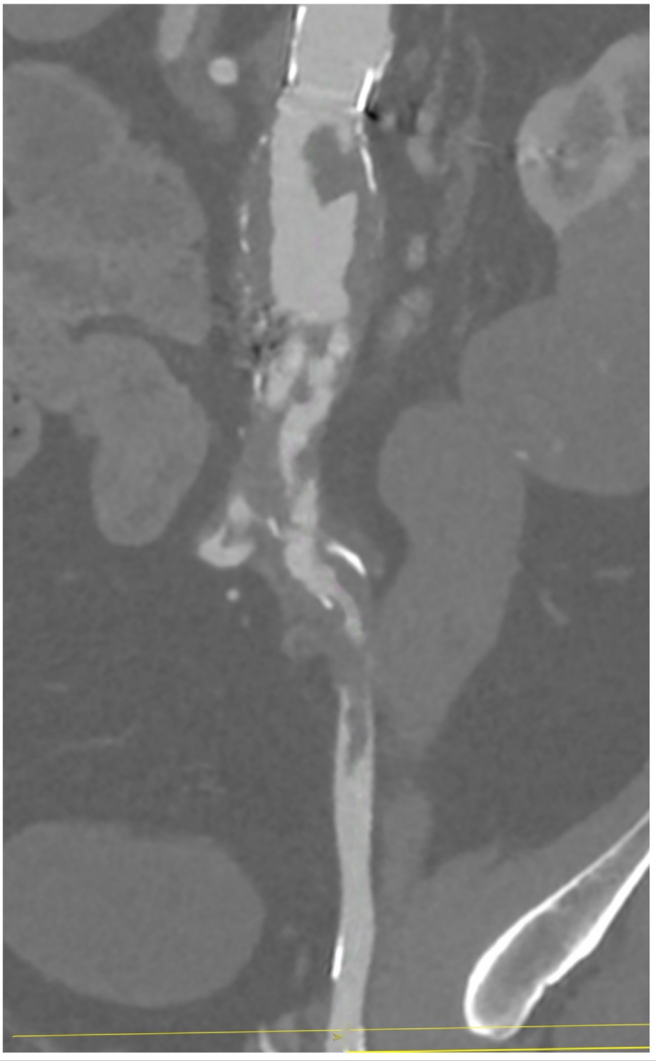

Fig 2. Reconstructed computed tomography angiography image showing extent of tumor in the aorta and left iliac limb.

was ultimately deemed nonreconstructable in February 2024, when a palliative option was discussed. At this time, owing to patient and family preference, bilateral above-knee amputations were performed for progressive ischemia and rest pain. Eventually the patient passed away in April 2024 after a brief period of full comfort measures.

DISCUSSION

This case report documents tumor emboli from RCC owing to tumor thrombus invading the lumen of an aortobi-iliac bypass graft.

The sole documented instance of tumor thrombus in an aortic Dacron bifurcated graft was reported in 1976, outlining a case involving primary aortic sarcoma at the proximal anastomotic site, resulting in tumor embolus and ALI.[1]

RCC, prevalent among individuals >60 years of age, often remains asymptomatic until reaching advanced stages. In 15% of cases, RCC invades the renal vein, potentially progressing to the heart or pulmonary circulation, worsening the prognosis.[2,3] Only one rare case in 2021 depicted a 33-year-old patient with RCC-induced aortic tumor thrombus in both renal arteries, leading to hypertensive emergency and anuric renal failure.[4]

Tumour embolism, defined as translocation of tumor cells from a primary neoplastic source to arterial sites resulting in occlusion and secondary complications of ischemia, necessitates careful differentiation from cancer-associated thromboembolism owing to the hypercoagulable state of malignancy. This distinction is important because the management strategies vary. This diagnosis can be complex, however, because it relies on histopathological confirmation, which is often determined post mortem, and the presentation of the two occlusive events can be very similar.[5]

Determining the process that led to formation of tumor thrombus in this patient's aortic graft poses challenges and is ultimately not possible with certainty. The most common process for tumor embolism is directly from disruption of an atrial myxoma, likely related to the proximity to the heart and its cyclic pump action, releasing fragments into the systemic circulation. Invasion of a primary lung neoplasm into the left atrium or pulmonary veins with eventual embolization downstream is also

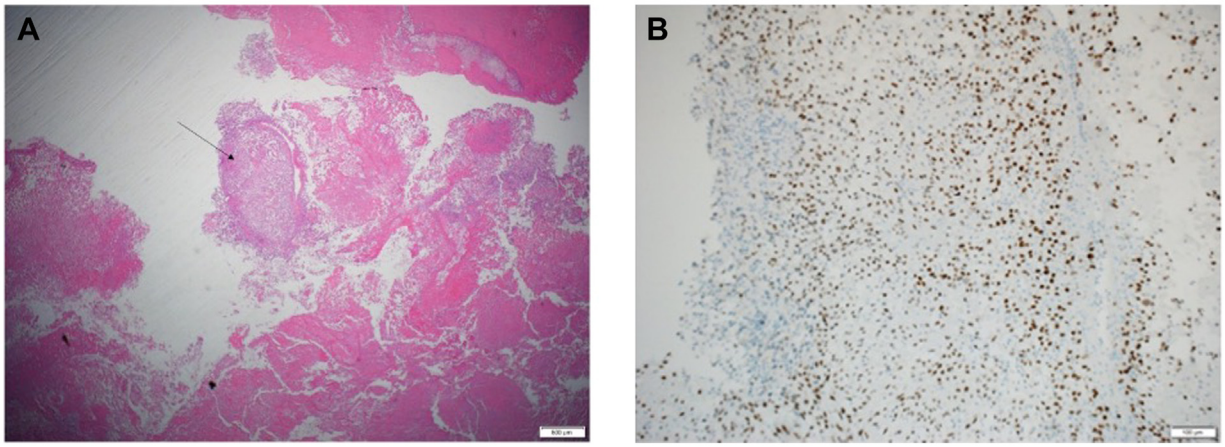

Fig 3. (A) Low magnification photomicrograph showing aortic thrombus with malignant tumor (black arrow showing tumor). **(B)** Photomicrograph showing positive PAX 8 staining, confirming tumor embolus of renal cell carcinoma (RCC).

reported to be a common cause.[6] The computed tomography angiogram obtained at admission and 72 hours after the intervention did not demonstrate direct invasion of the primary tumor into the graft or aorta clearly.

A possible etiology for the tumor thrombus is microseeding of the tumor during the explantation of the previous EVAR and creation of the aortobi-iliac bypass in March 2023. Surgical procedures are recognized risk factors for tumor embolism owing to manipulation of the primary neoplasm.[6,7] In this patient, the left RCC and the left kidney were never removed surgically and were in situ at the time of the aortobi-iliac bypass surgery. The primary neoplasm was, however, never manipulated during the procedure.

Hematogenous dissemination, a well-recognized phenomenon in cancer metastasis, with seeding into solid organs,[8] is not likely in this patient, as his transthoracic echocardiogram did not demonstrated a patent foramen ovale (PFO). However, it cannot be excluded because this test only demonstrates 88% sensitivity for PFO,[9] and dissemination from the venous system through a PFO is still considered possible, given the propensity of RCC to invade the renal veins, as aforementioned.

The computed tomography angiogram reported a thickened ureter adjacent to the left common iliac artery at the site of the aortoiliac anastomosis, described as a conglomerate of cells with thickened ureteric epithelium, which could suggest a potential site for direct invasion into the arterial system. Although less likely, it is possible that the finding of tumor cells in the proximal thrombus is due to tumor present at this site, disturbed by the embolectomy balloon.

Given the rarity of tumor embolization causing ALI, there are limited data to guide management. The most commonly used technique found in the literature describing management of ALI from tumor embolization is femoral thromboembolectomy.[6] Although achieving immediate success and limb salvage in most cases, the long-term prognosis remains poor owing to the underlying malignancy.[6] Cases of successful nonoperative management with anticoagulation therapy have also been reported as yielding equivalent results to surgery.[10] Therefore, the management for this rare events rests on the treating surgeon.

DISCLOSURES

None.

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