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TECHNICAL NOTE

Intra-operative Ultrasound as a Tool to Assess Free Borders of Primary Vascular Aortic Tumors During Resection

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Introduction: Primary vascular tumors are rare and, in general, have a poor prognosis. Complete resection is associated with a better prognosis. Radical resection depends on safe discrimination of tumor borders.
Technical summary: A 54 year old woman presented with abdominal pain. Imaging revealed a mass in the thoracic aorta, highly suspicious of angiosarcoma which was confirmed post-operatively by histological analysis. Open surgery was performed. Prior to clamping of the aorta, intra-operative ultrasound established clear delineation of the tumor borders.
Conclusion: Intra-operative ultrasound was, in this case, a safe and easy method to determine the tumor borders, providing a simple guide to *in toto* tumor removal.

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INTRODUCTION

Primary aortic sarcomas are extremely rare, with approximately 145 cases described worldwide.[1] The angiosarcoma, originating from endothelium, was first described in 1873,[2] and to date, about 45 cases have been reported in the literature.[1,3—8] Symptoms of primary aortic sarcomas often include abdominal pain and symptoms of occlusive vascular disease, such as acute embolic ischemia, claudication, and renovascular hypertension. More rarely, accompanying symptoms such as fever, fatigue, and weight loss are present.[1,3,5] The intravascular tumor may mimic occlusive aortic and/or gastrointestinal disease, thereby delaying the diagnostic process, which may contribute to a poorer prognosis of these highly malignant neoplasms, which metastasize to bone, lung, liver, skin, and kidney.[3,4] The reported mean survival is 16 months (median, 7 months) for all patients, increasing to 20 months (median 10 months) after surgical treatment.[3] Complete tumor resection provides the best chance of cure and prolonged survival.[5]

The objective was to introduce the use of intra-operative ultrasound as a tool for establishing tumor borders, as exemplified in a recent case of angiosarcoma in the thoracic aorta.

SURGICAL TECHNIQUE

A 54 year old woman presented with 8—10 months of abdominal pain. There was 12 kg weight loss that may have been due to abdominal pain, and non-specific lower extremity symptoms described as strange, neurogenic, sometimes cold feelings from the legs. She had never smoked and had a previous medical history of second degree atrio-ventricular block, hypertension, migraine, and Grave's disease. Because of her symptoms, she underwent gastro-endoscopic evaluation as well as non-contrast computed tomography (CT) imaging, which did not reveal any abnormalities. The symptoms persisted, and CT angiography, magnetic resonance imaging (MRI) and fludeoxyglucose positron emission tomography/CT (FDG-PET/CT) scans (Fig. 1A,B) were performed. These revealed an intraluminal polypoid mass in the thoracic aorta located on level of the 10th and 11th thoracic vertebra. The FDG-PET/CT scan showed the process to be hypermetabolic, differentiating it from an atherosclerotic plaque and mural thrombus, and providing a strong suspicion of a vascular tumor. The imaging showed no signs of distant metastases.

Open surgical resection of the tumor with prosthetic replacement of the aorta was performed. It was conducted under left heart perfusion during clamping of the aorta, with retrograde perfusion from the left femoral artery. After exposure of the affected aorta, intra-operative ultrasound with a 9 MHz linear probe was used to identify the cranial and caudal limits of the tumor prior to clamping. Ultrasound was conducted in B-mode, since the angiosarcoma had very different echodensity and texture compared with the normal, albeit slightly atherosclerotic, vascular wall

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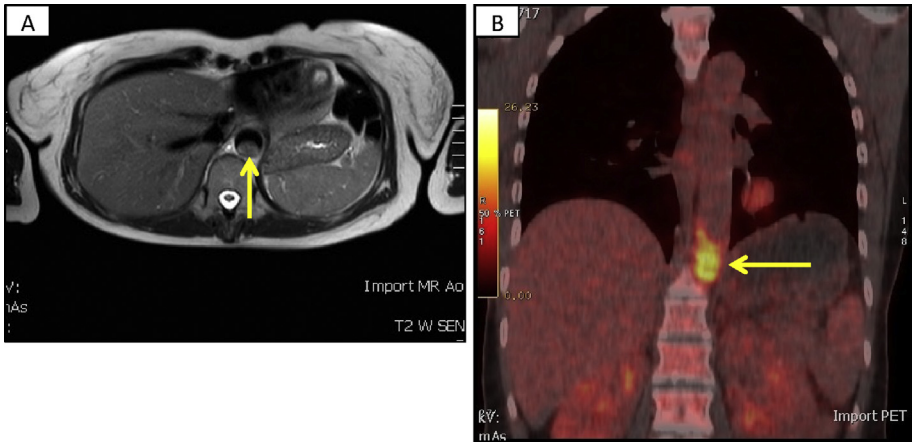

Figure 1. Diagnostic T2 weighed MRI (A) and FDG-PET/CT (B); yellow arrows indicate the tumor.

(Fig. 2A). This was done for two purposes: first, to ensure removal of the entire tumor with generous margins (Fig. 2B), and second, to assist clamp placement to avoid inadvertent crushing or fragmentation of the tumor.

Subsequent pathological analysis confirmed the diagnosis of angiosarcoma arising from the intima, with clear resection margins. After an uneventful post-operative period, the patient underwent adjuvant chemotherapy, as recommended by the oncologists on the basis of the little knowledge that exists on post-operative treatment of angiosarcomas. Subsequent follow up PET/CT scans have unfortunately shown metastases in the ribs. It is not known if the metastases occurred before or after the operation, as the operation was one month after the primary scans.

DISCUSSION

Angiosarcoma is a rare but aggressive neoplasm of which little knowledge exists, making diagnosis and treatment a challenge. In this case the patient presented with abdominal pain and weight loss, not uncommon for patients with this type of cancer.[1,3–5] An intraluminal mass identified on CT angiography can be difficult to distinguish from the much more frequently observed atherosclerotic plaques or mural thrombus. Little has been described regarding the use of FDG-PET in the diagnostic process.[1,6] In the present case, FDG-PET and MRI both increased the suspicion of malignancy.

If there is no evidence of metastatic disease, radical resection with prosthetic replacement is recommended[3] as, according to the literature, total tumor resection is one of the only treatments associated with longer survival. Other than conventional frozen section analysis, no methods of intra-operative demarcation have been described previously. Direct intra-operative ultrasound, as a supplementary imaging modality to the PET-CT and MR scans, provided clear tumor delineation with minimal

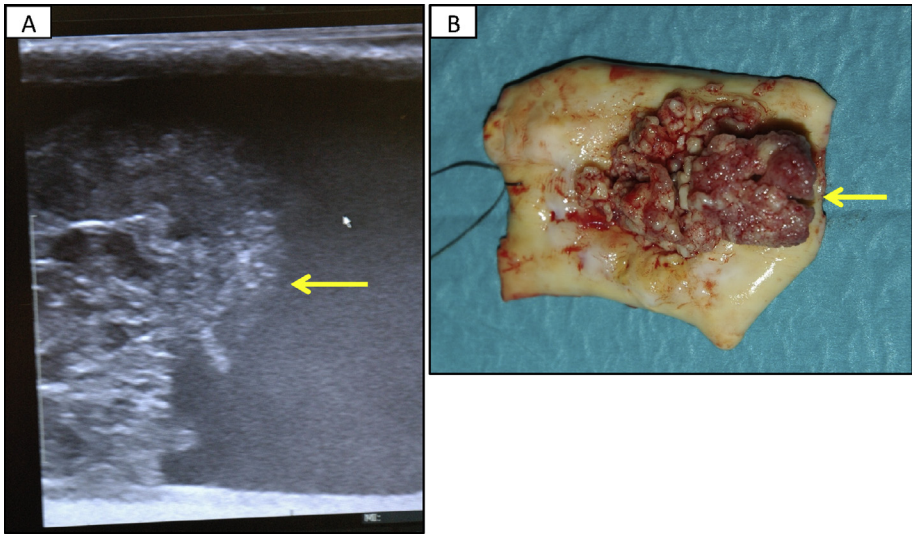

Figure 2. Intra-operative ultrasound image (A) showing altered echodensity of the aortic (lightest) polypoid tumor (light, yellow arrow) and blood (darker); photograph of the removed aorta (B) *in toto* after having been cut open, displaying the angiosarcoma, yellow arrows presenting the identical (distal) extent of the tumor.

disturbance to the aorta, thus minimizing the risk of tumor spread.

CONCLUSION

Use of intra-operative ultrasound, is safe and effective as an adjunct in the open surgical resection of primary tumors of the aorta.

CONFLICT OF INTEREST

None.

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REFERENCES

1 Ramjee V, Ellozy S. Aortic angiosarcoma masquerading as a thoracic aortic aneurysm. *J Vasc Surg* 2009;**50**(6):1477—80.
2 Brodowski W. Primäres Sarkom der Aorta thoracica mit Verbreitung des Neugebildes in der unteren Körperhälfte. *Jahresb Leistung Fortschr ges Med* 1873;**8**:243—6.
3 Chiche L, Mongrédien B, Brocheriou I, Kieffer E. Primary tumors of the thoraco-abdominal aorta: surgical treatment of 5 patients and review of the literature. *Ann Vasc Surg* 2003;**17**(4):354—64.
4 Seelig MH, Klingler PJ, Oldenburg WA, Blackshear JL. Angiosarcoma of the aorta: report of a case and review of the literature. *J Vasc Surg* 1998;**28**(4):732—7.
5 Fatima J, Duncan AA, Maleszewski JJ, Kalra M, Oderich GS, Gloviczki P, et al. Primary angiosarcoma of the aorta, great vessels, and the heart. *J Vasc Surg* 2013;**57**(3):756—64.
6 Sibille L, Ilonca D, Oziol E, Gandilhon P, Micheau A, Vernhet-Kovacsik H, et al. FDG PET/CT in aortic angiosarcoma. *Clin Nucl Med* 2010;**35**(2):134—7.
7 Brylka D, Demos TC, Pierce K. Primary angiosarcoma of the abdominal aorta: a case report and literature review (aortic angiosarcoma). *Abdom Imaging* 2009;**34**(2):239—42.
8 Thalheimer A, Fein M, Geissinger E, Franke S. Intimal angiosarcoma of the aorta: report of a case and review of the literature. *J Vasc Surg* 2004;**40**(3):548—53.