Skeletal Radiol (2000) 29:413–416

CASE REPORT

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Angiosarcoma associated with chronic lymphedema (Stewart-Treves syndrome) of the leg: MR imaging

Received: 20 August 1999
Revision requested: 28 October 2000
Revision received: 31 January 2000
Accepted: 8 February 2000

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Abstract Magnetic resonance (MR) imaging findings of two patients with Stewart-Treves syndrome are presented. MR imaging showed edematous changes in the subcutaneous fat and skin masses that proved to be angiosarcomas. MR signal intensity of the tumor was low compared with fat on T1-weighted images and intermediate and heterogeneous on T2-weighted images. In one patient, administration of intravenous Gd-DTPA showed marked enhancement in the early phase, which persisted until the delayed phase. These finding on dynamic MR imaging may reflect the abundant vascular spaces seen in these tumors.

Key words Angiosarcoma · Lymphedema · Stewart-Treves syndrome · Leg · MR imaging

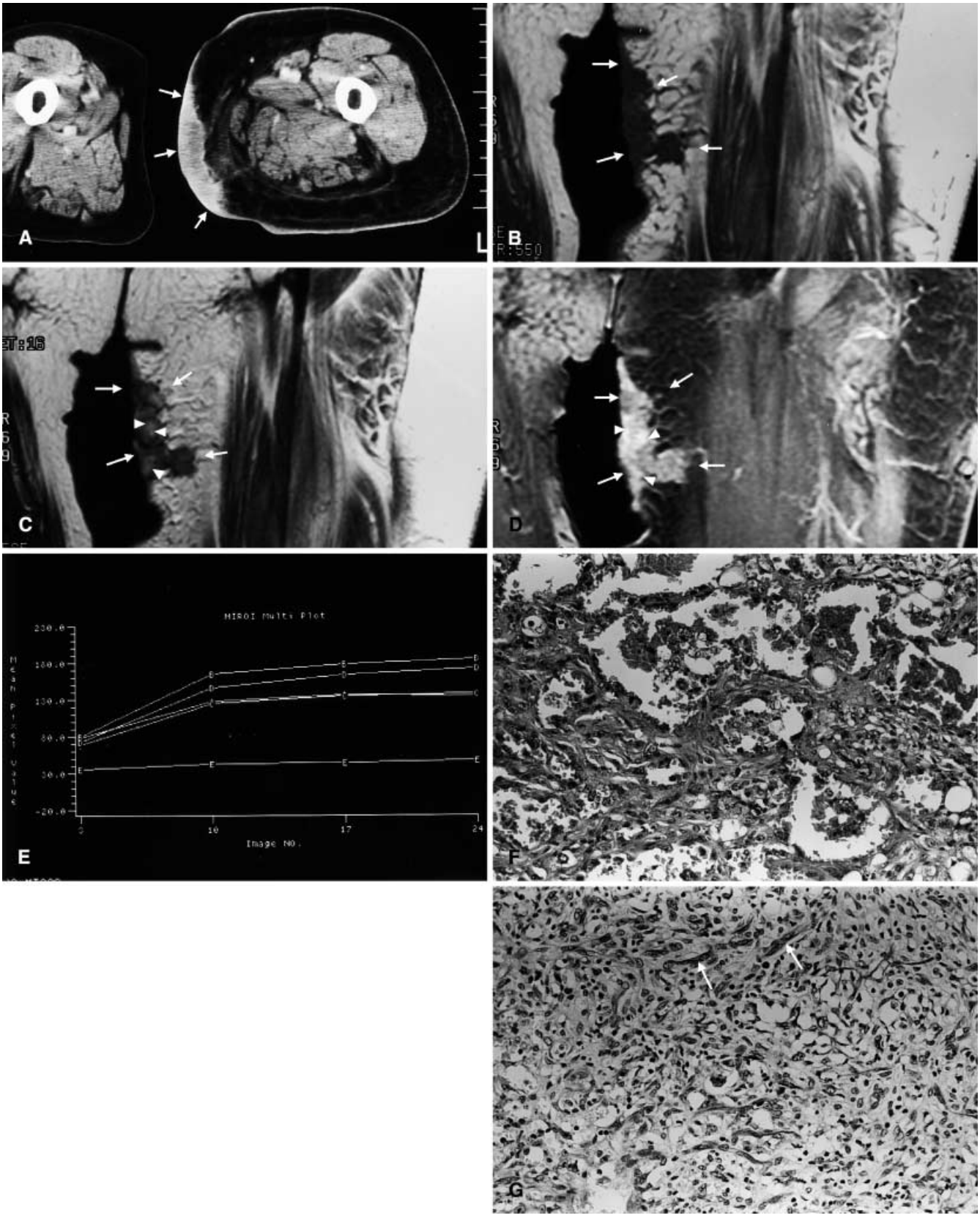
Introduction

Angiosarcomas occasionally arise in the extremities with chronic lymphedema, and have been called Stewart-Treves syndrome. In previous reports, angiosarcomas arising in the upper extremities after mastectomy constituted the majority of the cases. In this report we present the MR imaging findings in patients who had angiosarcoma of the lower extremity after hysterectomy, which is a relatively uncommon association.

Case reports

Case 1

A 74-year-old woman was admitted for investigation of increasing skin nodules on her left thigh. She had suffered from lymphedema of the left lower extremity for 18 years after hysterectomy and radiation therapy (dose unknown) for carcinoma of the uterine cervix. Physical examination revealed dark-red skin and a subcutaneous mass measuring 8 cm in diameter on the medial aspect of her left thigh. A computed tomography (CT) scan showed increased density of the subcutaneous fat and an irregular-shaped mass in the diffusely swollen thigh. After intravenous administration of iodinated contrast medium, the mass enhanced significantly (Fig. 1A). On magnetic resonance (MR) imaging, the mass showed low signal intensity on T1-weighted images and low to intermediate and heterogeneous signal intensity on T2-weighted images compared with fat (Fig. 1B, C). It consisted of relatively high and low signal components on T2-weighted images (Fig. 1C). Dynamic MR imag-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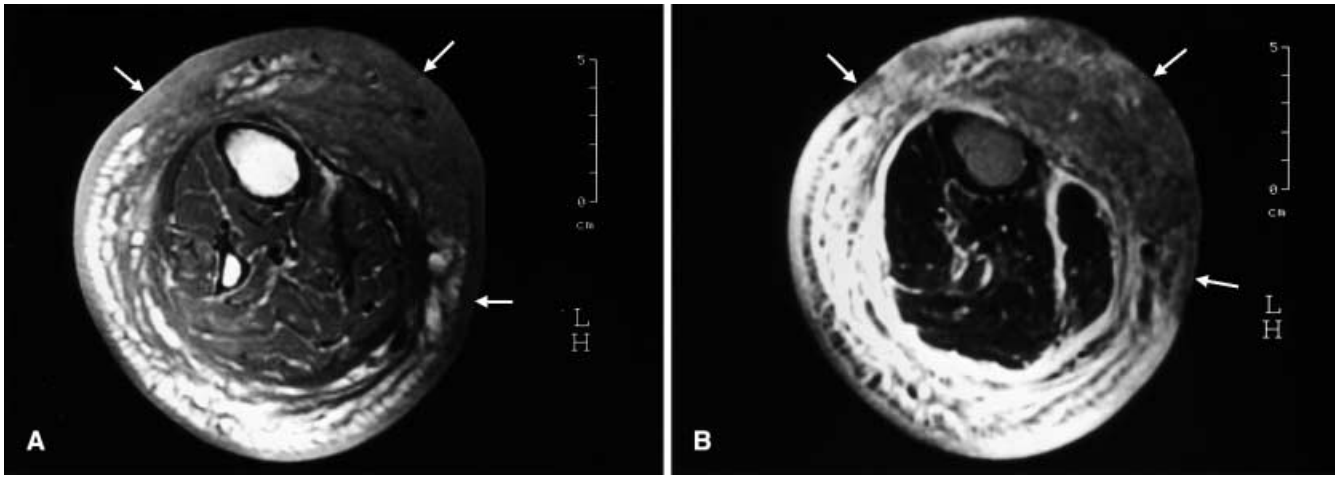

Fig. 2A, B Case 2. Stewart-Treves syndromein a 63-year-old woman. **A** Axial T1-weighted spin-echo MR image (TR/TE, 800/25 ms) reveals swelling of the right thigh and a mass of low signal intensity (*arrows*) with respect to adjacent fat on the anteromedial aspect of the right thigh. **B** Axial T2-weighted spin-echo MR image with fat suppression (TR/TE, 2360/100 ms) shows the mass (*arrows*) having intermediate and heterogeneous signal

◀ **Fig. 1A–G** Case 1. Stewart-Treves syndromein a 74-year-old woman. **A** CT scan after intravenous administration of iodinated contrast medium shows edematous subcutaneous fat and an enhancing mass (*arrows*) on the medial aspect of the subcutaneous tissue. **B** Coronal T1-weighted spin-echo MR image (TR/TE, 550/9 ms) demonstrates a mass of low signal intensity (*arrows*) with respect to the surrounding fat on the medial aspect of the left thigh. **C** Coronal T2-weighted fast-spin-echo MR image (TR/TE, 5000/100 ms) reveals a mass (*arrows*) of low to intermediate and heterogeneous signal compared with fat. The mass consists of relatively high signal (*arrowheads*) and low signal components. **D** Dynamic MR imaging with fast-multiplanar-spoiled-GRASS sequence (TR/TE/flip angle 120/1.7/60°) shows strong enhancement of the mass (*arrows*) persisting toward the delayed phase. The areas with stronger enhancement (*arrowheads*) correspond to relatively high signal intensity areas on T2-weighted images. **E** The time-intensity curve reveals progressive and persistent enhancement. **F** Histological examination shows proliferation of atypical cells that form irregular vascular channels. Mitotic cells are noted (hematoxylin-eosin stain, original magnification ×200). **G** Immunohistochemical study demonstrates that some spindle-shaped tumor cells are positively stained for anti-factor-VIII antigen (*arrows*) (×200)

ing after intravenous administration of gadopentetate dimeglumine revealed significant enhancement of the mass in the early phase, which persisted to the delayed phase. A portion of the mass showed more marked enhancement than the rest (Fig. 1D, E).

Total surgical removal of the tumor was carried out. Histological examination of the resected specimen showed proliferation of atypical cells forming many irregular-shaped vascular channels in the dermis and subcutis. Some vascular lumina were empty and others contained erythrocytes (Fig. 1F). Some tumor cells stained positively for factor-VIII-related antigen immunohistochemically, suggesting their differentiation into vascular endothelium (Fig. 1G). These findings were consistent with angiosarcoma. Two components of the cell groups were intermingled in the tumor. One component had dilated vessels, narrow stroma and relatively few tumor cells, and the other had capillary-sized vessels, wide fibrous stroma and solid nests of tumor cells. The patient was disease-free 6 months after surgery.

Case 2

A 63-year-old woman had suffered from lymphedema of the right lower extremity for 15 years after hysterectomy, dissection of the inguinal lymph nodes and radiation therapy for carcinoma of the uterine cervix. On admission dark-red colored skin and subcutaneous nodules measuring 12 cm in diameter were observed on the anterior aspect of the right inguinal region and lower leg. MR imaging revealed a mass of low signal compared with fat on T1-weighted images and intermediate and heterogeneous signal on fat-suppressed T2-weighted images (Fig. 2A, B). Surgical biopsy of the subcutaneous nodules in the right inguinal region and lower leg was performed. Histological examination showed proliferation of atypical tumor cells and formation of many irregular vascular channels, which were compatible with angiosarcoma. Amputation of the right lower extremity was performed, but the patient died of multiple metastases 1 year after surgery.

Discussion

Stewart and Treves first reported lymphangiosarcoma associated with post-mastectomy chronic lymphedema in 1948 [1]. Angiosarcoma arising in chronic lymphedema has been named Stewart-Treves syndrome, particularly in patients developing angiosarcoma many years after surgical treatment of carcinoma of breast. This tumor, which is now classified as angiosarcoma [2], was reported by many early authors as a

lymphangiosarcoma because it is a vascular tumor arising in chronically dilated lymphatic vessels [1]. The tumor is now considered to originate from vascular endothelium rather than from lymphatic cells [3, 4], although differentiation between hemangiosarcoma and lymphangiosarcoma is difficult by light- or electron-microscopic or immunohistochemical study.

About 90% of reported cases occurred in the upper extremities after mastectomy for breast carcinoma [5]. Such tumors also occasionally occur in the lower extremities in association with chronic lymphedema [5]. The causes of lymphedema in the lower extremities include hysterectomy for uterine carcinoma, trauma, and infection [5]. The frequency of this disease after hysterectomy is unknown, but it occurs in the upper extremity in 0.07–0.45% of patients who survive 5 or more years after mastectomy [5, 6].

The average duration of the lymphedema before the tumor occurs is 10 years and 3 months (range 1–26 years). Lymphedema from causes other than mastectomy has a relatively longer duration before angiosarcoma is discovered: 19 years and 10 months on average (range 6 months to 46 years) [7]. The prognosis in Stewart-Treves syndrome is poor. The median survival was 19 months in one series and 2 years and 10 months in another [7].

There have been a few reports describing the radiological findings of angiosarcoma with lymphedema. Kazerooni et al. [8] reported a case with CT findings that showed extreme skin thickening, multiple cutaneous nodules, marked increase in the attenuation of subcutaneous fat, and collection of fluid within muscles and surrounding tissue. Gelmetti et al. [9] reported a case with MR findings that showed a mass of hypointensity on T1-weighted images and hyperintensity on T2-weighted images, and heterogeneous enhancement following intravenous administration of gadolinium (without dynamic MR imaging).

In our cases, the mass in the edematous subcutaneous fat tissue had a low signal compared with fat on T1-weighted images and intermediate and heterogeneous signals on T2-weighted images. Histological examination in case 1 showed that the vascular channels of the tumor were not as large and numerous as in cavernous hemangioma, which shows very high signal intensity on T2-weighted MR images. In both cases, the mass had relatively high and low signal components on T2-weighted images. Histologically, the former may correlate with the component observed in case 1 which had dilated vessels and narrow stroma with few tumor cells, and the latter with the component containing small vessels and wide fibrous stroma with a solid nest of tumor cells. The signal intensity on T2-weighted images may reflect the proportion of vascular spaces to tumor cells and fibrous stroma.

In addition to documenting the exact extent of the mass, the dynamic MR images showed early and continuous enhancement of the mass. Dynamic contrast-enhanced MR findings in soft tissue angiosarcoma have not been reported. Suvipapun et al. [10] reported angiosarcoma of the liver which enhanced in a peripheral nodular fashion on immediate post-gadolininium MR images, and showed centripetal progression of enhancement on delayed images mimicking a cavernous hemangioma. They stated that it might be reasonable to assume that the intensity of enhancement during this immediate post-gadolinium phase reflects the size and number of feeding vessels, which might also be an index of tumor angiogenesis. In our first case, the striking enhancement in the early phase of dynamic MR imaging may reflect abundant neovascularity throughout the tumor, and the persistence of the enhancement to the delayed phase may reflect enhancement of the vascular spaces and fibrous stroma of the tumor. We assume that the areas with stronger enhancement may reflect the component with relatively large vessels and narrow stroma. MR imaging is useful in demonstrating angiosarcomas in limbs swollen because of lymphedema. Whether the improved local staging will result in improved prognosis is unclear.

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