A Rare Case of Radiotherapy-Related Cutaneous Angiosarcoma in the Upper Arm: MRI and Angiographic Features

HSIOU-CHUN LIN1 HSIO-YUN CHANG1 YUNG-CHENG WANG1 MIN-YEN SHI2 TZE-WAN TANG1

Department of Radiology1, Department of General Surgery2, Cathay General Hospital, Taipei, Taiwan

ABSTRACT

Cutaneous angiosarcoma is extremely rare, accounting for less than 1% of all sarcomas. Most of the cases are directly diagnosed according to clinical information and surgical–pathological examination, without imaging studies. We report a rare case of cutaneous angiosarcoma in the left upper arm with a history of postoperative radiotherapy for left breast cancer 24 years previously. Magnetic resonance imaging and angiography were performed to obtain additional reference and imaging results.

Angiosarcomas are rare tumors that originate from vascular endothelial cells, and most angiosarcomas are aggressive with poor prognosis [1-8]. Cutaneous angiosarcoma is the most common type and has several variants [2, 4]. Previous radiotherapy and lymphedema are two of the known risk factors [1-5, 7-9]. Cutaneous angiosarcoma is generally diagnosed according to clinical information and surgical–pathological examination, rarely to imaging studies [1, 4]. We present a case of cutaneous angiosarcoma in the left upper arm with a history of operation and radiotherapy for breast cancer and provide imaging data on preoperative magnetic resonance imaging (MRI) and angiography.

CASE REPORT

A 60-year-old woman was diagnosed with left breast cancer at age 36, when she underwent left modified radical mastectomy and radiotherapy 17 times. Thereafter, for approximately 10 years, she noticed a palpable mass on the medial side of the left upper arm; this mass was associated with numbness of the arm. Erythromatous rash with skin retraction and occasional local soreness of the left shoulder were noted during the past year. No fever, chills, or body weight change was reported. The MRI findings revealed an approximately 9 × 5.8 × 2.2-cm carpet-like, uniformly thick, cutaneous–subcutaneous lesion at the medial aspect of the left upper arm. This lesion presented homogeneous low signal intensity on T1WI, faint high signal intensity on T2WI, and diffuse heterogeneous gadolinium-contrast enhancement (Fig. 1). Angiography of the left upper extremity was performed, revealing a mild hypervascular tumor stain without an early arteriovenous (AV) shunt (Fig. 2). Hypervascular lesions, such as cutaneous angiosarcomas, hemangiomas, or low-flow vascular malformations (LFVMs), were suspected.

The patient underwent surgical resection, which showed a 11.5-cm-long, 8.0-cm-wide, and 2.5-cm-deep ellipse of the skin and subcutis. The skin surface was smooth and yellow–gray. Pathological analysis revealed a well-differentiated angiosarcoma as infiltrating vascular channels lined with atypical plump endothelial cells, with the foci of anastomosis in the reticular dermis and subcutis (Fig. 3). Positive CD31 and negative D2-40 immunostaining was observed. The overlying epidermis indicated no marked pathological change.
DISCUSSION

Among all cases of adult cancers, approximately 1% are sarcomas, and angiosarcomas account for 2% of all sarcomas [2, 4]. Angiosarcomas can be observed in the cutaneous tissues, deep soft tissues, bones, and breasts [2, 4]. Most soft tissue sarcomas are deeply located. By contrast, cutaneous angiosarcoma, the most common form of angiosarcoma, is located in the skin and superficial soft tissues, accounting for approximately 60% of reported cases.

**Figure 1.** MR images of left upper extremity reveals cutaneous angiosarcoma of left upper arem in a 60-year-old woman with history of operation and radiation for left breast cancer 24 years ago. A 9 x 5.8 x 2.2 cm carpet-like rather uniform thick cutaneous subcutaneous lesion at medial aspect of left upper arm, with hypointensity on T1WI a, faint hyperintensity on T2-TIRM b, and diffuse heterogeneous enhancement on fat suppressed Gd-T1WI, axial c. and coronal d.
cases of angiosarcoma [5, 6]. Cutaneous angiosarcoma has several variants such as angiosarcoma of the scalp and face, lymphedema-associated angiosarcoma (Stewart–Treves syndrome), radiation-associated angiosarcoma, and epithelioid angiosarcoma [1, 2, 4, 5, 9, 10]. Up to 95% of cutaneous angiosarcomas occur in the scalp and face [2, 4].

Risk factors for angiosarcomas include chronic lymphedema, previous radiotherapy, carcinogens, hormonal status, foreign bodies, immunosuppression, and familial syndromes (type 1 neurofibromatosis, Klippel–Trenaunay–Weber syndrome, and Maffucci syndrome) [8, 10]. Radiation- or lymphedema-induced secondary angiosarcoma occurs in older age groups, with a mean age of 65 years [1]. Chronic lymphedema-associated angiosarcoma (Stewart–Treves syndrome), accounts for approximately 10% of cutaneous angiosarcomas [5, 9, 11]; this syndrome is believed to occur because of derangements in lymphatic drainage related to impaired immune surveillance and loss of control of endothelial proliferation [2, 4, 9]. Lymphedema is secondary to surgery or obesity, and Stewart–Treves syndrome generally involves the upper extremities [9]. The risk of radiation-induced sarcomas varies from 0.03% to 0.8% [2]. Radiation affects the vasculature, particularly at the capillary level, forming granulation tissues that enhance the irradiation field [7]. Most cases are associated with a total radiation dose of 30–124 Gy, with an average latency period of up to 12 years from the initial radiotherapy [1-3]. Moreover, approximately one-third of radiation-induced angiosarcomas occur in a previously irradiated field [1, 2].

The first case of angiosarcoma after radiotherapy for breast cancer was reported in 1936 [1]. Radiation may induce the metaplastic transformation of the primary cancer, which is associated with irreversible DNA damage [1]. This criterion was modified by Arlen et al for including tissues adjacent to the irradiated field [1]. In our case, the cutaneous angiosarcoma developed at the medial aspect of the left forearm, in the vicinity of the field irradiated for treating breast cancer; thus, the angiosarcoma is probably attributable to irradiation.

The appearance of cutaneous angiosarcoma varies [2, 5, 7, 9]. In approximately 79% of patients, the lesions are painless [1, 4]. Lymphedema- and radiation-associated angiosarcomas generally develop as violaceous infiltrating plaques or nodules, similar to benign angiomas, chronic hematomas, or atypical telangiectasia [1, 2, 5, 7]. Diagnosis of angiosarcoma is difficult because of its rarity and nonspecific physical appearance after differentiation from other vascular lesions or radiation-induced changes [1, 4, 7, 8, 11].

Because cutaneous angiosarcoma is rare, little is known regarding its clinical appearance, natural history, or imaging features [1, 4-7]. We present the MRI and conventional angiography findings of this case because previous studies have not adequately reported these findings. The MRI results revealed a carpet-like, cutaneous–subcutaneous lesion with homogeneous hypointense T1 signal intensity, hyperintense T2 signal intensity, and diffuse intense enhancement, which is crucial for determining the
tumor extent and size according to its inherent superior soft tissue resolution. On performing conventional angiography of the left upper extremity, this cutaneous angiosarcoma revealed mild vascularity with staining and no early AV shunt. According to our experience, some angiosarcomas possess rich vascularities, which show prominent serpentine vessels, dense circumscribed areas of contrast staining, and an early AV shunt [11-13, 17, 18]. Conventional angiography reveals vasculature of the tumor, providing information on the hemodynamic blood flow, which may facilitate surgical planning.

According to the imaging features and tumor location of our case, differential diagnosis should include hemangiomas, LFVMs, and some cutaneous–subcutaneous superficial tumors. Hemangiomas are common benign vascular tumors, which may be superficial or deep. The MRI findings of soft tissue hemangiomas are predominantly isointense to muscles, often demonstrating variable amounts of a high T1 signal of fat content and generally showing an extremely high T2 signal intensity. This intensity reflects stagnant blood within the vascular space, with the scattered foci of low T2 signal intensity corresponding to calcified phleboliths, thrombosed canals, and septates [11-13, 15-18]. Hemangiomas with characteristic imaging findings can generally be differentiated clearly from other vascular tumors. Vascular malformations are congenital, mainly since birth or childhood [13, 15, 16]; they are subcategorized according to their flow dynamics as LFVMs (venous, lymphatic, capillary, capillary–venous) and high-flow vascular malformations (arteriovenous malformations and fistulas) [15, 16]. LFVMs, venous or capillary type, are the most common vascular malformations and typically show high T2 signal intensity and diffuse delayed enhancement. Phleboliths are the most favorable indicator of venous malformations [15,
In cutaneous angiosarcoma, because of the overlapping of some radiological features among vascular malformations, hemangiomas, and angiosarcomas, a specific diagnosis is difficult to obtain without clinical expertise and characteristic imaging findings.

Other cutaneous–subcutaneous superficial tumors, some accompanied by typical imaging findings, are mostly nonspecific [13, 15, 16]. Malignant superficial vascular lesions of soft tissues are rare and are differentiated into hemangiendotheliomas, hemangioepicytomas, and Kaposi sarcomas [8, 11-16]. Hemangiendotheliomas arise from vascular endothelial cells, involving the deep structures of the extremities [11-13]. Furthermore, hemangioepicytomas develop from the cells of Zimmerman around vessels, generally at middle age and most commonly in the thigh, with rich tumor vascularization [11-13]. Kaposi sarcomas are multicentric, malignant vascular tumors arising from endothelial cells, and approximately 66% of them are located in the cutaneous tissues, with marked enhancement [11-14].

Microscopically, cutaneous angiosarcomas often involve the dermis extensively, leading to various patterns such as vascular channels, sheets of cells, and poorly differentiated morphology [2, 5]. These angiosarcomas may also invade deep structures, such as the fascia and subcutis [5]. Immunohistochemical staining is limited and less specific, with factor VIII and Ulex europaeus agglutinin I positive in tumor cells of vascular differentiation, and endothelial markers such as CD31, CD34, EN4, BMA120, OKM5, E92, HCL-1, and B721 antigens [1, 2, 4, 9].

Treatment options for angiosarcomas include wide surgical excision, palliative chemotherapy, or radiotherapy [1, 2, 4, 5]. Although surgery alone has high recurrence rates and yields no clear surgical margins, the clinical roles of other adjuvant treatments are less defined [1, 2, 4, 5]. Adjuvant chemotherapy may not be beneficial, and radiotherapy should be avoided because of its toxicity of repeated administration [1, 5]. Because of the vascular origin of angiosarcomas, angiogenesis inhibitors are considered for treatment [2]. Other treatments, including CO2 laser, Mohs surgery, immunotherapy, intra-arterial doxorubicin hydrochloride infusion, are also administered [4].

Despite treatment, angiosarcomas have poor prognosis because of high local recurrences of approximately 70% and systemic metastases of approximately 50% in the lymph nodes, bones, liver, lung, or spleen [1, 2, 4-6, 8, 10]. The 5-year survival rate is 10%, and median survival is 1.8 years [1, 2, 4, 6, 10]. The survival rate is twofold higher in patients without metastasis at initial diagnosis compared with those with it, highlighting the association of the survival rate and metastasis [5, 6]. Larger size, multifocality, retroperitoneal position of lesions, higher Ki67 values, and an age of more than 70 years are associated with reduced survival rates [5, 6].

CONCLUSION

We present MRI and angiographic features of a rare case of cutaneous angiosarcoma in the left upper arm of an old woman with a history of radiotherapy for left breast cancer. Although the imaging results provided no distinguishing characteristics of angiosarcoma, they could facilitate determining the tumor extent and its vasculature for treatment planning. Thus, MRI and angiography of cutaneous angiosarcomas can offer clinicians information on potential early detection and superior treatments.

REFERENCES

Cutaneous angiosarcoma


