

Clear Cell Sarcoma of Tendons and Aponeuroses: Histogenesis and Mode of Treatment

Clear cell sarcoma of tendons and aponeuroses is a rare, slow-growing malignant tumor arising from the tendons and aponeuroses of the lower extremity, more often in the foot. Although it appears to be a benign tumor, the clear cell sarcoma can be a malignant sarcoma capable of local recurrences or distant metastases. Microscopically, there is a rather distinctive picture characterized by discrete nests and fascicles composed of spindle cells, and a small round-to-ovoid nucleus containing a central prominent basophilic nucleolus. Since there is some controversy over the best way to treat this disease, and since its histogenesis is still unknown, the authors elected to report the case of a 28-year-old white male for three reasons: first, to illustrate that the tumor is of neural crest derivation; second, to show that an ultrastructural evaluation of the tumor is imperative in some cases; and lastly, to suggest that amputation is the treatment of choice in localized disease.

Richard J. Langen, DPM¹
Aggrey J. Nyongo, MD²

Manop Huntrakoon, MD³
Mark E. Landry, DPM⁴

Clear cell sarcoma is a malignant tumor that represents approximately 1% of all malignancies in men and 0.6% in women. Early reports indicated a female preponderance but not of any significant degree. The average age of patients developing the tumor is 30 years. The most common site of the tumor is the lower extremity (1).

Clear cell sarcoma of tendons and aponeuroses is a rare, slow-growing malignant tumor arising chiefly from the tendons and aponeuroses of the feet (1). The designation of clear cell sarcoma covers several histogenetically different neoplasms, some melanocytic in origin and others of mesenchymal derivation, akin to synovial sarcoma. The clinical course is characterized by slow but relentless progression with frequent recurrences and eventual distant metastases (2).

Material and Methods

Case Report

A 28-year-old Caucasian male presented with a "lump" in his right foot. He had noticed this for the

previous 9 months and had seen another podiatrist on two occasions for this complaint. Although the lesion was initially painless, it gradually became painful. The pain increased with weightbearing. This finally forced the patient to withdraw from his job where he worked as a laborer. The patient received 100 mg of Butazolidin⁵ twice a day for 5 days but received no relief.

The patient was then referred to the authors. Upon physical examination, the patient was a well-developed, well-nourished white male and appeared to be in general good health. His past medical history was unremarkable except for an appendectomy in his childhood. There was a well circumscribed tender mass in the plantar lateral aspect of the right foot, measuring approximately 4 cm. in diameter. The location of the mass was confirmed by magnetic resonance imaging (MRI). The plain, soft radiological examination had been reported as negative. The vascular, neurologic, and other areas of musculoskeletal systems were normal.

Surgery. Under general anesthesia, the area of the mass was explored. An 8-cm. transverse incision was made from dorsal lateral to plantar lateral over the midportion of the right foot. The incision was carried down to the level of the plantar fat pad. After the fat pad had been incised, a large, yellowish, soft tissue mass measuring 4 × 2.5 × 2 cm. was identified. It infiltrated along the fascial plane distally. Once the margins had been properly freed, the mass was completely excised,

From the University of Health Sciences/Kansas City Podiatric Residency program, Kansas City, Missouri.

¹ Submitted while podiatric resident. Address correspondence to: 10000 College Boulevard, Suite 120, Overland Park, Kansas 66210.

² Department of Pathology.

³ Department of Pathology and Oncology, Kansas University Medical Center, Kansas City, Kansas.

⁴ Director of Residency Training. Masters of Science Degree. 0449/2544/89/2802-0112\$02.00/0

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⁵ Ciba-Geigy, Summit, New Jersey.

although the tissue in the fascial plane distally appeared as if it was also involved with the tumor. This tissue was removed utilizing a forcep and Metzenbaum⁶ scissors. Due to the large cavity left by the excision, Penrose drain⁷ was placed in the lateral aspect of the foot. The area was closed in layers and primary skin closure was performed.

The patient was contacted approximately 9 months following the first surgery. He was doing well, and returned to work as a laborer. No recurrence of the metastasis was acknowledged. He was fit with a new prosthesis and satisfied with the result.

Pathology

The tissue submitted for histopathologic examination consisted of a yellowish, gritty, firm, irregular-shaped mass measuring $4.0 \times 2.5 \times 2.0$ cm (Fig. 1). There was no necrosis. There were two additional flat, grayish tan tissues measuring $1.0 \times 0.5 \times 0.5$ cm. All of these were fixed in buffered formaldehyde. In addition to the usual hematoxylin and eosin preparation, small fragments of the tumor were submitted for electron microscopy.

Results

Histologic examination of the tumor showed solid nests and fascicles of briskly mitotic, pale, fusiform, and cuboidal cells (Fig. 2). They had large and deeply basophilic nucleoli. An occasional multinucleated cell was also seen. The neoplastic cells were embedded in fibrous, thinly vascular stroma with individual cells being enclosed by reticulin. Although stain for hemosiderin was weakly positive, staining for melanin using Fontana Masson stain was negative. Both PAS and mucin stains were negative. A presumptive diagnosis of clear cell sarcoma was made.

Electron microscopic study revealed the premelanosomes (Figs. 3 and 4) only after an extensive search. Immunohistochemical stain for the tumor showed a strong S-100 reaction in the tumor cells. This confirmed the diagnosis of clear cell sarcoma of tendons and aponeuroses, which is also known as malignant melanoma of soft tissues.

Because of the pathologic finding that this lesion was a fully malignant sarcoma capable of local recurrence, as well as distant metastases, a below-the-knee amputation was recommended. A "metastatic work-up" including computerized tomographic scan of the chest, and bone scans, were found to be negative; a below-the-knee amputation was performed with immediate

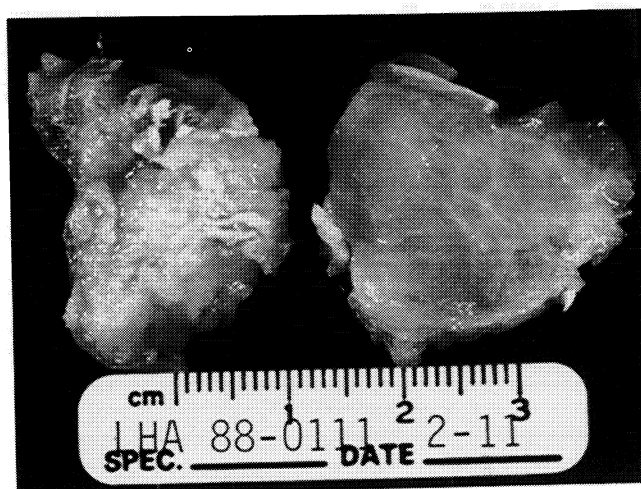


Figure 1. The bisected surfaces of the tumor.

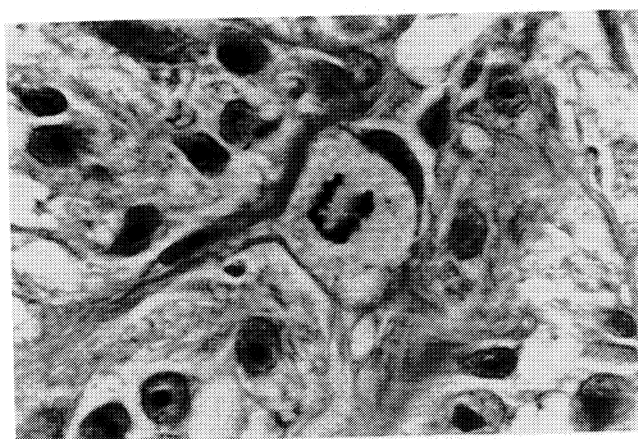


Figure 2. Microscopic appearance of the tumor showing cells with clear cytoplasm and a brisk mitotic activity (H and E $\times 400$).

application of a prosthesis. The patient returned to his regular job after 6 weeks of convalescence.

Discussion

Clear cell sarcoma of tendons and aponeuroses, first defined as a distinctive entity by Enzinger (1) in 1965, is an uncommon soft tissue neoplasm. This rare tumor which arises in the subcutaneous tissue of the extremities, more often near the foot and ankle, presents as a slow-growing, firm and movable mass, which is painless. Although it appears to be a benign tumor, the clear cell sarcoma can be a malignant sarcoma capable of local recurrences or distant metastasis. Due to its rarity, the first reported case in podiatric journals was reported by Johnson and Uhlman in 1980 (3). It commonly is reported in adults with some preponderance in women (4). It has occurred in patients in the age range of 12 to 65 years but the median age at onset of symptoms is approximately 24 years. The duration before treatment

⁶ Baxter-V. Mueller Co., Chicago, Illinois 60648.

⁷ Argyle Division of Sherwood Medical, St. Louis, Missouri 63103.

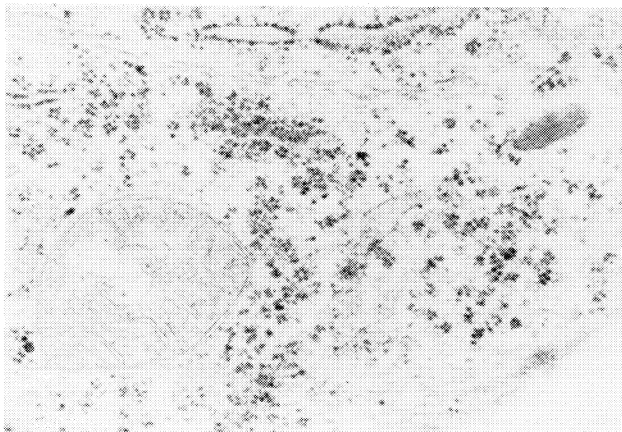


Figure 3. Ultrastructure of the tumor exhibiting a premelanosome (right upper corner) and mitochondrion at left lower corner ($\times 31,500$).

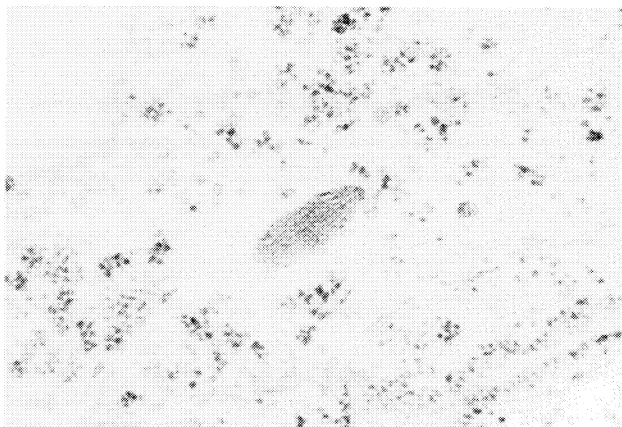


Figure 4. Ultrastructure of the tumor exhibiting a premelanosome at the center ($\times 50,000$).

is 3.5 years, with an average survival time of 6 years from time of initial treatment (5).

Enzinger (1), in his study of 21 patients, reported that the feet were the most common site with four of the tumors affecting the Achilles tendon, three the ankle region or heel, four the plantar aponeuroses, and one the fourth toe. Four tumors occurred in the region of the knee.

Grossly, the tumors are well defined and some appear to be encapsulated. The size ranges between 2 and 12 cm. It ranges in hue from gray to white (1, 5).

Microscopically, there is a rather distinctive picture characterized by discrete nests and fascicles composed of spindle cells, a pattern further enhanced by intersecting collagenous trabeculae, sometimes delicate, sometimes coarse, often bleeding with the underlying tendinous and aponeurotic structures. Cytoplasmic glycogen often is present, as are iron granules. Melanin is present approximately half of the time. Another distinctive feature observed is the combination of a rela-

tively small, round-to-ovoid nucleus, containing a central prominent basophilic nucleolus (6).

This sarcoma is difficult to diagnose histologically. Malignant melanoma may have histologic patterns identical to that of clear cell sarcoma. One can raise the question of whether some or all clear cell sarcoma are unusual variants of malignant melanoma (7, 8). The presence of S-100 protein, a selective marker for neural crest derivatives, has been clearly shown in every case of a recent series of 15 (9). This finding has been confirmed elsewhere (2). The support for that clear cell sarcoma is of neural crest origin has led some to use the alternate name "malignant melanoma of soft parts" (2, 10-12).

Radiographically, an uncalcified soft tissue mass is evident typically on conventional studies. Osseous involvement is unusual and chiefly manifested as aggressive-appearing extrinsic invasion with cortical destruction and a permeative pattern of medullary bone (11, 13). Successful application of computerized tomography (CT) can be performed to enable the physician assessment of the extent of involvement by the neoplasm. The ability of CT to determine the extent of involvement of soft tissue and bone by such a lesion is important (12).

Clear cell sarcoma, although malignant, remains at the primary site for a long time without showing signs of aggressiveness. It has a tendency to recur, and eventual metastases are common (4). Most often, the metastases involve the regional lymph nodes, lungs, skeleton, heart, liver, and brain. It may even metastasize to the oral cavity (5).

As mentioned previously, this sarcoma is somewhat difficult to diagnose histologically. Its clinically relentless course demands early recognition and aggressive therapy. It would seem that an early aggressive surgical approach to these lesions, often requiring amputation, should include the appropriate regional lymph node dissection (14). Wide excision, with associate dissection of regional lymph nodes, constitutes accepted therapy, although amputation may be indicated for lesions around articulations (2, 15).

The clinical course of clear cell sarcoma is variable. The original series of Enzinger (1) suggested a given prognosis with over 75% recurrence within a year and death with metastases in about 60%. More recent series have suggested that the tumor has a protracted course with numerous recurrences and metastases leading to death in approximately 50% of cases (9, 15-17).

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