A Slow-growing Prepatellar Mass in a 31-year-old Woman

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History and Physical Examination

A 31-year-old woman was referred with a slow-growing mass located anterior to the right patella. The swelling had been present for over 5 years without causing complaints. During the 3 months before presentation, however, the mass had progressively enlarged and was associated with some local tenderness, which the patient treated with nonsteroidal antiinflammatory drugs.

On clinical examination, the healthy-appearing young woman had a prepatellar soft tissue mass (Fig. 1). The mass was firmly attached to the patella, had a diameter of 5 cm, and was painful at palpation. The mass had a firm consistency and could be delineated from other surrounding structures. No functional impairments were found at the right knee. Further physical examination

did not reveal additional information; in particular, there were no enlarged lymph nodes at the right leg or groin.

Radiography (Fig. 2), magnetic resonance imaging (MRI) (Fig. 3), and a whole-body computed tomography (CT) scan were performed.

Based on the history, physical examination, and imaging studies, what is the differential diagnosis?

Imaging Interpretation

On radiographic examination, there was prominence of the soft tissues in the prepatellar region with no calcification evident (Fig. 2). There were no irregularities of the patellar surface. MRI examination revealed a well-encapsulated tumor located in the area of the prepatellar bursa. Though centered in the prepatellar soft tissues, the tumor extended posterosuperiorly into the quadriceps tendon, posteroinferiorly into the proximal patellar tendon, and medially into the retinaculum. On axial images, subtle signs of erosion of the anteromedial patellar surface were seen (Fig. 3A). The tumor had a craniocaudal diameter of 6 cm, a transverse size of 6 cm, and an anteroposterior diameter of 2 cm. At the medial side of the patella, the anteroposterior diameter reached almost 4 cm. The tumor had heterogeneous signal intensity slightly higher than surrounding muscles on T1-weighted images (Fig. 3B) and increased signal intensity on T2-weighted images (Fig. 3C). The tumor also demonstrated enhancement after the administration of intravenous gadolinium. Whole-body CT scanning, the standard procedure used to detect metastasis in our hospital, did not reveal any signs of secondary localizations.

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Each author certifies that his or her institution has approved the reporting of this case report, that all investigations were conducted in conformity with ethical principles of research, and that informed consent was obtained.

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Fig. 1 A photograph of the right knee of the patient at initial presentation shows a swelling located anterior to the patella.

Differential Diagnosis

Liposarcoma
 Malignant fibrous histiocytoma
 Chronic prepatellar bursitis
 Synovial sarcoma
 Clear cell sarcoma

Fig. 2 A lateral plain radiograph of the right knee shows prominence of the prepatellar soft tissues without involvement of the patella.

Percutaneous Jamshidi[®] needle biopsies and histologic studies of the lesion were performed (Fig. 4).

Based on the history, physical examination, imaging studies, and histologic appearance, what is the diagnosis and how should this patient be treated?

Histology Interpretation

Gross inspection of the resected tumor revealed solid, pale yellowish to pinkish tissue with focal brown pigmentation. Histologically, solid islands and strands of oval or polygonal pale cells were embedded in paucicellular collagenous stroma (Fig. 4A). The tumor cells showed somewhat vesicular oval or slightly irregular nuclei with a plump nucleolus. Mitotic figures were scarce. The cytoplasm was pale and focally contained brown pigment, positive to Schmorl's stain for melanin. Immunohistochemical studies revealed positivity for melanocyte markers melanocytic differentiation antigen (Melan-A) (MART-1), monoclonal antibody directed against group 100 proteins (HMB45), microphthalmia-associated transcription factor (MITF), and protein related to neural differentiation (S-100) and negativity for keratins and epithelial membrane antigen (EMA) (Fig. 4B–D). Cytogenetic analysis revealed a t(12;22)(q13;q12) translocation, characteristic of clear cell sarcoma of soft tissues.

Diagnosis

Clear cell sarcoma of soft tissues.

Discussion and Treatment

A 31-year-old woman presented with a slow-growing mass located anterior to the right patella. The differential diagnosis included liposarcoma, malignant fibrous histiocytoma, chronic prepatellar bursitis, synovial sarcoma, and clear cell sarcoma.

Based on the radiographic findings, we placed liposarcoma on the top of the differential diagnosis. Histologically, however, liposarcoma was ruled out by the absence of atypical lipoblasts. The absence of clinical symptoms in the preceding 5 years argued against chronic prepatellar bursitis and was a relatively ominous sign pointing toward a tumor. In addition, chronic bursitis is a reactive lesion histologically characterized by inflammation and tissue repair. The invasion of the bone and tendons that was seen in our patient also led us away from bursitis and liposarcoma and made synovial sarcoma, malignant fibrous histiocytoma, and clear cell sarcoma more probable. Synovial sarcoma is

Fig. 3A–C (A) An axial T1-weighted MR image shows a large tumor located anterior to the right patella. Subtle signs of erosion of the anteromedial surface can be seen. (B) A sagittal T1-weighted MR image shows the signal intensity of the tumor being slightly higher compared with the surrounding muscles. The close relation of the tumor with the quadriceps and patellar tendon can be seen. (C) A sagittal T2-weighted MR image of the right knee reveals a well-encapsulated prepatellar tumor with increased signal intensity.

usually a densely cellular tumor of small spindle cells, with or without an epithelial component, which may be evident morphologically or may require immunohistochemical demonstration of keratin. Chronic bursitis and synovial sarcoma might have been expected to present with some calcifications in this area. Malignant fibrous histiocytoma generally presents as either a myxoid or a spindle cell tumor or shows the appearance of a pleomorphic large cell sarcoma. The immunohistochemical profile and the demonstration of the t(12;22)(q13;q12) translocation, characteristic of clear cell sarcoma, firmly established the diagnosis.

A clear cell sarcoma of soft tissues is a rare tumor, accounting for less than 1% of all soft tissue neoplasms [3, 7]. The tumor was initially described by Enzinger in 1965 [3]. The tumor is sometimes called “melanoma of soft parts,” referring to the presence of melanin and positive melanoma-associated immunostaining with HMB45 [7]. Differentiation between clear cell sarcoma and a soft tissue metastasis of melanoma may be problematic. However, melanoma only very rarely presents with a soft tissue metastasis in the absence of a detectable skin or mucous membrane tumor. In addition, the t(12;22)(q13;q12)

translocation is pathognomonic of clear cell sarcoma of soft tissues; it does not occur in melanoma [5, 7]. A clear cell sarcoma can occur at any age but predominantly affects female patients aged between 20 and 40 years [3, 5, 7, 15]. Over 95% of all clear cell sarcomas are located in the extremities, with the foot and ankle affected in approximately 40% [3, 4, 7]. Less commonly, the lesion is located around the knee, thigh, forearm, elbow, shoulder, neck, and trunk [4, 7]. Our patient had a lesion in the prepatellar region, which has been reported only three times before [9, 12, 13]. Patients usually report a slow-growing mass that may cause local tenderness or pain [7]. A substantial delay in seeking medical attention by patients is characteristic, with a mean delay of 5 years and delays of more than 20 years in some cases. Diameters of the lesions at presentation vary from 1 to more than 15 cm [2, 7].

Conventional radiographic examination shows a non-calcified mass and is noncontributory in most cases [1, 6, 8]. Involvement of underlying bone is rare but has important clinical implications when present [2]. As with soft tissue tumors in general, MRI is the imaging technique of choice. The general appearance of clear cell sarcoma on MRI is that of a nonaggressive tumor, but signs of ingrowth

Fig. 4A–C (A) A photomicrograph of the lesion reveals typical groups of spindle cells with clear cytoplasm surrounded by collagenous stroma (Stain, hematoxylin and eosin; original magnification, $\times 200$) (B) A histologic overview shows islands and strands of middle-sized oval to angular tumor cells amidst sclerotic stroma (Stain, hematoxylin and eosin; original magnification, $\times 310$). (C) The tumor cells show strong positivity for melanosomal antigen group 100, recognized by monoclonal antibody HMB45 (brown) (Original magnification, $\times 1250$).

Fig. 5 A postoperative radiograph shows the reconstructed patella.

into surrounding structures may be present. On T1-weighted images, the lesions are homogeneous and slightly hyperintense to the surrounding muscles [2, 6, 8, 16]. Melanin has paramagnetic effects, resulting in shortening of T1 and T2 and thereby a high signal intensity on T1-weighted images and a low signal intensity on T2-weighted images. High signal on T1-weighted images can be used to distinguish a clear cell sarcoma from most other soft tissue tumors that lack the presence of melanin [1]. However, increased intensity on T1-weighted images is certainly not pathognomonic for melanin, since it also indicates the presence of fat, blood, or certain stages of proteinaceous material. In our case, the lesion showed increased signal intensity on T2-weighted images, which may be attributed to cellularity and high cytoplasmic index that counteract the effect of melanin [1]. In general, the tumors show greater variation in signal intensity relative to muscle on T2-weighted images and foci of hypointensity may be present due to the intralesional melanin [1].

On histologic examination, clear cell sarcomas show a characteristic combination of histomorphologic and immunohistochemical findings, as illustrated in our case. The reciprocal translocation between the long arms of chromosomes 12 and 22 [$t(12:22)(q13;q12.2)$] is pathognomonic [6, 16].

The mainstay of treatment of clear cell sarcoma is wide surgical resection. Margins should be tumor free, and in selected cases, amputation of the whole extremity should be considered [4]. The additional values of adjuvant chemotherapy or radiotherapy are not well defined. However, in a large meta-analysis, chemotherapeutic treatment with

doxorubicin showed an improvement in the 10-year survival of 7% in patients with soft tissue sarcomas [14]. Some investigators showed a substantially better outcome in their series of patients treated with adjuvant radiotherapy [2]. However, the small number of patients in these studies does not allow any firm conclusions and further research in this area is warranted. Another therapeutic option reported to have limited success in patients with advanced states of clear cell sarcoma is isolated limb perfusion [5]. Local recurrence, regional lymph node metastasis, and distant metastasis, especially to lungs and bones, are common. In his original report, Enzinger [3] recognized a local recurrence rate of 85%. However, due to more aggressive surgical strategies nowadays, reported recurrence rates are clearly lower and vary between 5% and 25% [2, 5, 10, 11]. Metastases are more common than local recurrences and reported incidences exceed 50% [2, 5]. In a reported series of 30 patients, 13 (43%) patients had regional lymph node metastasis. All patients with lymph node metastasis subsequently had distant metastases develop. The total number of patients suffering from distant metastasis was 18 (60%) [2]. Tumor size predicts the prognosis, with tumors exceeding 5 cm having higher risk of early recurrence [11, 15]. Another investigation showed patients with a tumor size less than 2 cm have better survival rates [2]. The overall prognosis of clear cell sarcoma remains poor, with a 5-year survival of 54% for the whole group and 65% in cases of confirmed localized disease [2].

We performed wide en bloc excision of the tumor, including a patellectomy, in our patient. Gross specimen examination showed signs of ingrowth into the patella, patellar tendon, and medial retinaculum. The resection margins were free of tumor. After the tumor had been removed, the extensor apparatus was reconstructed using a tendon-patella-tendon allograft. A vascularized autograft of the ipsilateral medial gastrocnemius muscle was used to cover the remaining considerable soft tissue defect (Fig. 5). Postoperatively, the patient received cast therapy for 6 weeks. After this period, she was mobilized and received a knee brace allowing gradually more flexion of the knee. Inguinal lymph node metastases became evident 2 months after the initial surgery. Retrospective restudy of the preoperative whole-body CT images did not reveal these metastases. Inguinal lymph node dissection was performed and the patient was free of manifest disease for almost 6 months. Then however, she presented with progressive

ascites due to liver metastases. Her condition rapidly declined and she finally passed away within a year after her initial presentation.

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