

Monophasic Fibroblastic Synovial Sarcoma. Diagnostic and Post-Treatment Assessment by MRI and ADC: Case Report

Sarcoma sinovial monofásico de tipo fibroblástico.
Evaluación diagnóstica por RM y postratamiento mediante ADC: Presentación de un caso



Key words (MeSH)

Diffusion
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Sarcoma, synovial
Magnetic resonance imaging



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Palabras clave (DeCS)

Difusión
Diagnóstico por imagen
Sarcoma sinovial
Imagen por resonancia magnética

Summary

Synovial sarcomas represent 2 to 10% of all the primary tissue malignancies and occupy the fourth place in the list of most common soft tissue sarcomas. According to the World Health Organization (WHO), this neoplasm is classified under the category of tumors of uncertain differentiation and is considered an intermediate to high-grade malignancy. Although the standard treatment is surgical excision, alternative treatments such as radiotherapy and chemotherapy have been proposed due to its high rate of recurrence in cases when it is associated with metastasis or positive resection margins. Imaging plays a key role in the diagnosis, staging and assessment of treatment of this disease. New techniques in Magnetic Resonance Imaging such as diffusion and Apparent Diffusion Coefficient (ADC) mapping are useful to further characterize these neoplastic lesions and to assess treatment response. In this article we present a patient with monophasic synovial sarcoma in which the use of these new imaging techniques was essential for the diagnosis and evaluation post-treatment.

Resumen

El sarcoma sinovial representa entre el 2 al 10 % de todas las malignidades primarias de tejidos blandos, situándose en el cuarto lugar en frecuencia de los sarcomas de tejidos blandos. Es una neoplasia clasificada por la WHO (World Health Organization) bajo la categoría de tumores de diferenciación incierta, considerándose una malignidad entre intermedio y alto grado. El tratamiento estándar es la escisión quirúrgica, sin embargo, por su alta recurrencia y en los casos en que se asocia a metástasis o márgenes positivos después de la resección, se han planteado otros tratamientos como la quimio y radioterapia. La imaginología juega un papel importante en el diagnóstico, la estadificación y evaluación de la respuesta al tratamiento. Nuevas técnicas como el uso de difusión y mapas de ADC (Apparent Diffusion Coefficient, o coeficiente de difusión aparente) en resonancia magnética (RM) son útiles para evaluar las lesiones tumorales y la respuesta al tratamiento. En este artículo se presenta el caso de un paciente con un sarcoma sinovial monofásico, el diagnóstico por imágenes y evaluación del tratamiento mediante técnicas avanzadas de resonancia magnética como la difusión.

Introduction

We present the case of a patient who consulted for a progressive mass sensation of eight years of evolution, on the medial aspect of the proximal forearm. Magnetic

resonance imaging (MRI) was performed and after a histological study, synovial sarcoma was diagnosed.

He started treatment with chemotherapy. Subsequently, control MRI was performed, in which response

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to treatment was found, with a decrease in size and restriction in the diffusion of the lesion.

We reviewed the clinical case, the information concerning the literature and then describe the radiological findings of the diagnosis and response to the treatment of synovial sarcoma.

This entity affects patients between 15 and 40 years, being its most common location, in 80 to 90% of cases, the extremities and near the joints. The most affected sites in two thirds of the patients are the lower limbs, followed by the upper limbs (1).

Etiology

Synovial sarcoma is a mesenchymal tumor and although it does not originate from the synovia, it is named after a similar histological appearance (1).

Three histological types are known that are denominated as monophasic, such as the case that is presented (figure 1), biphasic and poorly differentiated. The monophasic subtype is the most common and represents up to 60% of the lesions. It is made up of mesenchymal cells. The biphasic subtype represents 30% of the lesions and is characterized by the epithelial cell component and fibroblasts. The poorly differentiated subtype tumor presents epitheloid cells with a high rate of cellular replication, corresponds to 15% of synovial sarcomas and is considered a high-grade tumor; Due to its histological characteristics it can be confused with small round cell neoplasms, such as Ewing's sarcoma (2).

Epidemiology

This tumor represents between 2 to 10% of all primary malignancies of soft tissues and is ranked fourth in frequency among soft tissue sarcomas. The affection between men and women is the same; but it prevails in young people and young adults, with an average age of 32 years, although cases have been reported in the extremes of life (3). In pediatric age, it is the most common non-rhabdomyosarcomatous soft tissue sarcoma (4).

Clinic

Patients usually present with a palpable, slow-growing, late-diagnosis lesion. The average duration of symptoms is 3 years and at the time of diagnosis the size of the lesion is variable, the majority can exceed 5 cm in diameter. The main symptom is pain; however, it may have other manifestations depending on the engagement site and neighboring structures that are affected.

These lesions, despite treatment, have a high recurrence and, depending on the histological grade, can be delayed as a metastatic disease. Other less frequent sites of involvement have been reported in the literature, such as in the head, neck, chest and abdomen (5).

Imaging findings

In X-ray studies, the appearance of synovial sarcoma is nonspecific, it can manifest as a soft tissue lesion in the vicinity of a joint, associated with eccentric calcifications in 30% of cases. There may be

extrinsic bone involvement, erosions or periosteal reaction, without being malignant and in a small percentage, less than 5%, the behavior is aggressive with invasion and bone destruction (1).

Computed tomography (CT) shows the previously described findings and better defines the soft tissue compromise whose signal is heterogeneous and similar or smaller than that of the muscle, the enhancement is heterogeneous, and in some cases areas of necrosis or bleeding appear (6)

Ultrasound shows a solid, hypoechoic, lobulated lesion, well defined in most cases, suggesting a less aggressive process. Diffuse vascularization is observed at Doppler assessment in the areas where the solid tumor is located (1).

MRI is the image study of choice for the evaluation of synovial sarcoma. This diagnostic modality allows to determine its extension, the relationship with neighboring tissues, and tissue characterization, reducing possible differential diagnoses. In the sequences with T1 information a lobulated mass is observed, of heterogeneous signal intensity, similar to that of the muscle, of greater intensity in sequences with T2 information. In the sequences with T2 information, heterogeneity in signal intensity can be observed due to the composition of the lesion due to necrotic-hemorrhagic areas (high signal), solid tissue (moderate intensity) and calcified or collagen areas (low signal). This finding has been called "triple sign" (figure 2) and is between 35 to 55% of cases of synovial sarcomas, although it is not specific to this entity. After the administration of contrast medium, the lesion in most cases is heterogeneous (7).

The imaging findings may have a prognostic value, since it has been found that tumors with calcifications are less aggressive and those that have hemorrhagic transformation, extensive necrosis or triple sign, as in the case presented (figure 2), are aggressive lesions that decrease the probability of disease-free survival (8).

Treatment and prognosis

The treatment is based on local control with surgery; however, due to its closeness and intimate contact with neurovascular structures adjacent to the joint, total resection may be technically more difficult, which is why a wide resection is performed. According to the evaluation of margins, it should be supplemented with adjuvant therapy to reduce the risk of recurrence. The 5-year survival rate is between 36% and 76%, and local relapse and lung metastasis are the most common manifestations (9).

The monitoring by images has value in soft tissue tumor lesions, such as synovial sarcoma with which the presence of tumor recurrence, involvement of adjacent tissues, surgical margins and response to treatment can be determined. Advanced MRI sequences, such as diffusion and its apparent diffusion coefficient (ADC) allow the qualitative and quantitative determination of the behavior of tumor lesions, since the degree of restriction to diffusion is directly proportional to tissue cellularity and the integrity of the cell membrane and inversely proportional to the extracellular space. These differences can be useful to estimate the histological composition of the tumors and establish approximate values of ADC, based on the known principle of restriction to the diffusion of water particles in lesions with high cellularity and their values in the ADC map (10).

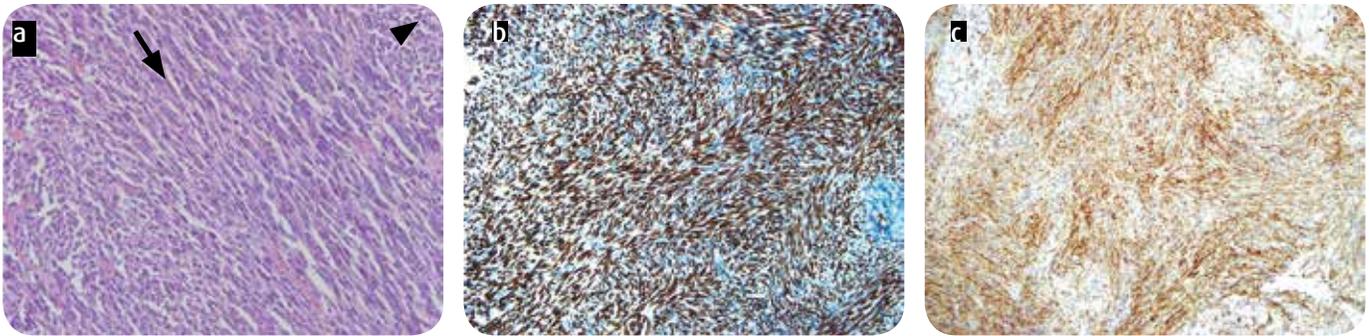


Figure 1. Histological study images. a) Hematoxylin eosin stain with 40X zoom, identifies oval cells, uniform, without glandular component, organized in layers (black arrow) and fascicles (arrow head). b) Immunohistochemistry study, expression of TLE1. A strong nuclear positivity is observed in the tumor cells (Zoom 20x). c) Immunohistochemistry study, expression of BCL-2. A strong and diffuse cytoplasmic positivity is observed (Zoom 20x).

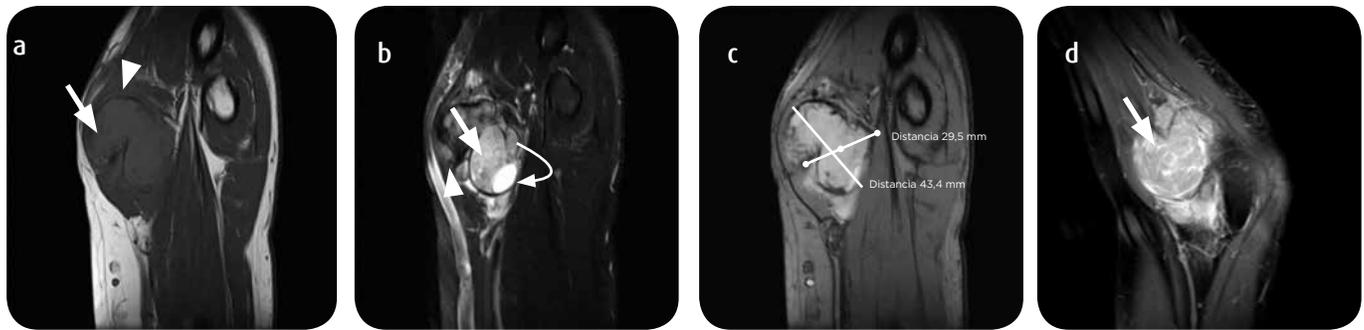


Figure 2. Magnetic resonance of the pre-chemotherapy elbow. a) Axial sequence with T1 information in flexion of the elbow, abduction of the shoulder, supination of the forearm and wrist FABS (flexion, abduction and supination) is usually used to visualize the tendon of the biceps, in this case by functional limitation secondary to the tumor, in which lobulated and well-defined lesion is identified, with a heterogeneous signal, with areas of intermediate signal in the muscle (white arrow), in contact with the muscular structures (arrow head) and located in deep planes. b) Its solid component is of greater signal intensity (white arrow), in the axial plane with T2 information, and with fat saturation FABS, with peripheral areas of low signal, probably by calcifications-collagen matrix (arrowhead) and can have cystic-necrosis areas (curved arrow). These different signal intensities in sequences with T2 information are known as the "triple sign" and are very suggestive of a sarcomatous lesion. c) Axial sequence GRE T2 FABS measures 43.4 × 29.6 mm. d) The lesion significantly enhances in sequence with T1 information, sagittal fat saturation after administration of contrast medium (white arrow).

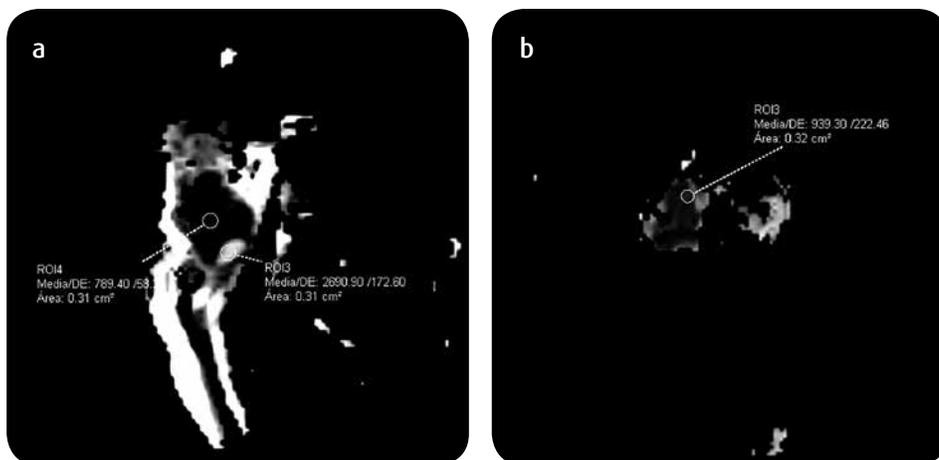


Figure 3. a) Sagittal ADC map of the pre-treatment lesion. b) Map of post-chemotherapy sagittal ADC, with an increase in the quantitative value in the ADC indicated by the ROI [ROI4 in a) and ROI3 in b)] that suggest, by imaging, a decrease in the tumor burden and response to treatment.

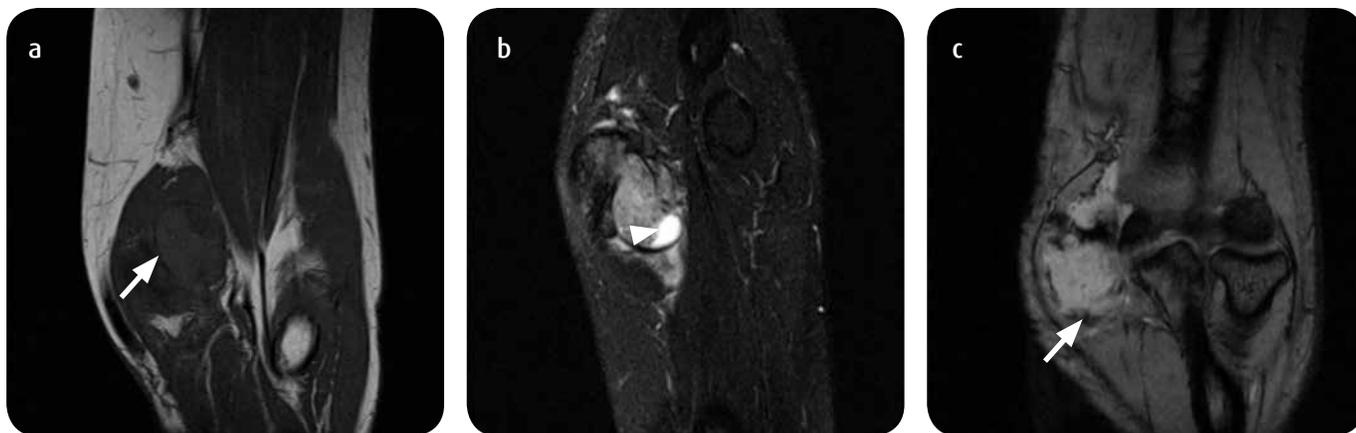


Figure 4. Post-chemotherapy elbow MRI. a) Sequence with axial T1 information FABS demonstrates the decrease in size (white arrow) of the lesion compared to previous MRI (figure 2). b) FABS sequence with T2 information, fat saturation Measured in the axial plane 28.6×16 mm, there are some areas of necrosis (arrow head). c) In the axial plane Sequence with information T2 GRE FABS, there is an increase in calcification (white arrow) with respect to the previous study.

Case presentation

A 44-year-old male patient with no relevant medical history consulted for mass history in the proximal and medial area of the left forearm with slow and progressive growth during 8 years of evolution, in the last year with predominantly nocturnal pain and palpation. Initially it was treated with physiotherapy and physical means, without improvement.

In the physical examination of admission, a localized mass was observed in the proximal third of the forearm and medial aspect, below the epitrochlea, of approximately 6.5×11.5 cm from the epitrochlea towards distal, soft, painful on palpation, with evidence of collateral circulation, not very mobile and probably adhered to deep planes.

Therefore, an immediate MRI was performed for further characterization and possible biopsy planning and treatment. In the MRI of the left elbow, a lesion with a tumoral aspect was found, heterogeneous, with septa, necrotic and solid areas, without fatty components. The mass displaces the tendinous structures, especially the flexor compartment and contacts the vasculo-nervous package, without compromising it. There is no reactive synovitis or infiltrative phenomenon in the adjacent structures. The enhancement of the contrast medium is heterogeneous, as described in figure 2.

The ADC diffusion and map images showed values of the ADC index of 0.789 per $10^{-3} \text{ mm}^2 / \text{second}$ in the solid portion and 2.69 by $10^{-3} \text{ mm}^2 / \text{second}$ in the liquid area (figure 3). The values and findings described are compatible with malignant tumor lesions of sarcomatous lineage (10).

An excisional biopsy was performed of soft tissue tumor of the medial aspect of the left elbow, which resulted in a malignant mesenchymal splanchnic neoplasm, with positive immunohistochemistry for TLE-1, BCL 2 and focally for EMA, CK, CD99. The findings favor the diagnosis of fibroblastic monophasic synovial sarcoma, as described in figure 1.

Due to the location of the lesion, the histological subtype and the age of the patient, he was considered a candidate to receive chemotherapy with mesna, adriamycin, ifosfamide and dacarbazine (MAID) neoadjuvant $\times 4$ cycles for limb salvage.

At the end of the last cycle of chemotherapy, a new MRI was per-

formed in order to evaluate the response, in which a decrease in the size of the lesion was found, with a diameter proximal to distal of the 29 mm tumor lesion (previous 43.4 mm) and a transverse diameter of 17 mm (previous to 29.6 mm), which suggests a partial response to treatment (figure 4).

In the control, the diffusion index is 0.94 and 2.61 per $10^{-3} \text{ mm}^2 / \text{second}$ (figure 3b), which suggests an increase in the index in the solid portion, due to a decrease in cellularity. With the described result, it was defined to program for surgical procedure of limb salvage and adjuvant radiotherapy.

Discussion

Synovial sarcoma is considered a moderate-high malignancy neoplasm, slow growing, with recurrence potential and metastatic compromise. It is the fourth soft tissue tumor in frequency and with compromise up to 90% of the extremities in sites near the joints (1). Symptoms are progressive, with a slow-growing mass sensation and vary according to the size and commitment of the neurovascular structures adjacent to the lesion.

MRI is the study of choice in synovial sarcoma, with suggestive findings such as the "triple sign" (figure 2). Conventional MRI sequences, as well as diffusion techniques and ADC, allow the characterization of the post-treatment lesion. A decrease in the size of the lesion and an increase in the quantitative values of the ADC map suggest response to treatment. For the diffusion and ADC sequences, 1.5 and 3 T devices are used, in this case with a protocol in which a factor b with values of b_0 , b_{400} , $b_{1000} \text{ mm}^2 / \text{s}$, fat suppression sequences, matrix of 128×128 and 8 NEX (number of acquisitions).

The other parameters depend on the extent of the tumor, the amplitude of the anatomical region to be studied and the type of antenna. The indicative parameters that are used are: $\text{TR} > 3000$ ms (normally between 3,000-5,000 ms), TE minimum 75-90 ms; Cutting thickness: 3-6 mm; GAP: < 1 mm with an acquisition time of 3-4 minutes. In this case, to determine the quantitative value of the ADC in $\text{mm}^2 / \text{second}$ of the tumor lesion, a ROI (region of interest) of sufficient size is located to include only the most solid and

homogeneous portion of the tumor, without becoming contaminated with the necrotic, cystic, calcified or hemorrhagic areas, and it is repeated with similar measurement in the subsequent controls; an ROI of 0.32 cm² was decided for this case.

Synovial sarcoma represents 10% of sarcomas in soft tissues and should be considered in the context of a lesion involving the extremities in the vicinity of the joint.

The final diagnosis is histological and MRI provides valuable information, such as localization, extension, commitment of nearby structures and response to treatment.

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