Signature: © Pol J Radiol, 2014; 79: 228-232
DOI: 10.12659/PJR.890209

Polish Journal of Radiology
www.PolRadiol.com
CASE REPORT

Received: 2013.12.18
Accepted: 2014.01.27
Published: 2014.07.28

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Myositis Ossificans Mimicking Sarcoma, the Importance of Diagnostic Imaging – Case Report

Elżbieta Łuczyńska[1ABCDEF], Hanna Kasperkiewicz[1ABCDEF], Agnieszka Domalik[1ABCDEF], Anna Cwierz[1ABCDEF], Barbara Bobek-Billewicz[2DEF]

[1] Department of Radiology and Diagnostic Imaging, Oncology Center and Institute. M. Skłodowska-Curie in Cracow, Cracow, Poland
[2] Department of Radiology, Oncology Center and Institute. M. Sklodowska-Curie in Gliwice, Gliwice, Poland

Author's address: Anna Cwierz: Radiology and Diagnostic Imaging, Oncology Center and Institute. M. Sklodowska-Curie in Cracow, Cracow, Poland, e-mail: anna.cwierz@gmail.com

Summary

Background: Myositis ossificans is localized inflammatory process affecting skeletal muscles. Very rarely it can affect one of the neck muscles and present as a neck tumor, it can be misdiagnosed as the clinical, radiological and histological examinations can mimic a sarcoma.

Case Report: We report a 29 year old female patient with neck tumor suspected to be a sarcoma who underwent full diagnostics imaging and open bipsy with histopatological examination, afterwards surgical excision was performed.

Conclusions: The aim of this study was to present the differential diagnosis based on diagnostics imaging between MO and malignant tumors, such as parosteal sarcoma, synovial sarcoma and malignant fibrous histiocytoma.

Keywords: Computer Tomography • Myositis Ossificans • Sarcoma • Magnetic Resonance Imaging

PDF file: http://www.polradiol.com/abstract/index/idArt/890209

Background

Myositis ossificans (MO) is a non-neoplastic, self-limiting, heterotopic bone formation occurring typically in large muscles of the extremities. It may occur at any age, but is rare in infants or older patients. Men are more commonly affected than women. Around 60% to 75% of myositis ossificans cases occur as a result of trauma. In patients without history of trauma, MO can be associated with systemic diseases or it may be just idiopathic. Microscopically it is classified into three different stages: early, intermediate or late (mature), which correlate with clinical and radiological appearance. Histologically, major non-ossified central core of proliferating fibroblasts and myofibroblasts, accompanied by a minor component of osteoid and mature lamellar bone at the periphery can be seen in the early stage. In the intermediate stage almost entirely osteoid component is rimmed by active osteoblasts, the tumor is surrounded by a shell of mature lamellar bone. The late stage is characterized by typical zonal pattern (zonal phenomenon). It consists of innermost area made of proliferating fibroblasts and myofibroblasts with areas of hemorrhage and necrosis, an intermediate zone, which contains osteoblasts with immature osteoid formation and peripheral zone – the mature bone. Plain films or CT scans may reflect this histologic zoning by demonstrating typical, mature outer shell of a bone. In this late stage the lesion may regress in size and spontaneous regression of the lesion occurs in about 30% of patients.

The authors of this study present case report of a patient admitted to the hospital with suspicion of sarcoma. Number of examinations were performed, including ultrasound, CT scan and MRI.

On the basis of obtained results the following differential diagnoses were taken into consideration: parosteal ostosarcoma, synovial sarcoma, malignant fibrous histiocytoma and myositis ossificans.

The aim of this study was to present the differential diagnosis of malignant and benign tumors based on diagnostics imaging (Table 1).

Table 1. Characteristic features in diagnostic imaging according to early, intermediate and late stage of Myositis ossifcans.

Stage	Early	Intermediate	Late
X-ray attenuation	Normal/slight increase in soft tissue density	Sharply defined lesion/faint, irregular, focal calcifications within the lesion	Heavily calcified lesion Trabecular bone formation
Ultrasonography	Hypoechoic mass with a central, reflective core Lamellar hyperreflectivity at the periphery	More reflective areas around the hypoechoic mass	Diffuse, reflective areas
CT	Enlarged muscle group with normal attenuation with or without faint calcification within the lesion	Zonal phenomenon (*) Central area with the same attenuation as normal muscle	Heavily calcified lesion
MRI T1 SI	Intermediate to high	Inhomogeneous, diversified at the center	Peripheral – low Central – intermediate to high
MRI T1 +C	Diffuse, marked enhancement	Varying, non-specific enhancement	Areas of SI identical to that of normal bone marrow in all MR sequences
MRI T2 SI	Intermediate to high with/ without continuous or incontinuous low-SI rim	More irregular areas of decreased SI within the lesion Well-defined and decreased SI rim of varying thickness	
MRI edema	Extensive	Decreasing in size	Absence

(*) Zonal phenomenon: a rim of calcification of varying thickness at the periphery.

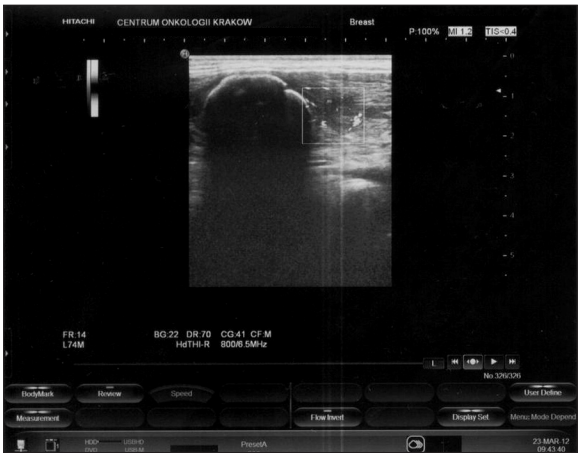

Figure 1. Ultrasound scan demonstrates peripherally calcified, hypoechoic lesion, with increased partial peripheral vascularity in color Doppler examination.

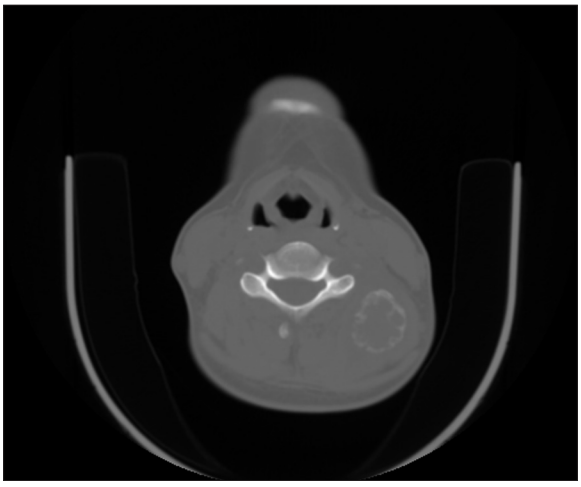

Figure 2. Axial, non-contrast computed tomography scan shows lesion with a rim of calcification at the periphery ("zonal phenomenon").

Case Report

A 29-year-old woman with no history of trauma presented with a palpable tumor of the neck. Physical examination revealed a hard, painless, poorly mobile, left-sided nodule extending from the angle of mandible to the base of the neck. In 2009 the patient underwent excision of a skin nevus located in left axilla and the back. She denied current or past significant alcohol ingestion, exposure to toxins, smoking or use of any medication.

Ultrasound examination: (Figure 1) of the neck revealed hypoechoic lesion located medially to the sternocleidomastoid muscle and inside trapezoid muscle. The tumor size was 47×20 mm. Calcification and increased vasculature were seen in tumor's periphery.

Computed tomography: (Figure 2) scans demonstrated a low-attenuating soft tissue mass, 30×28 mm in size, with peripheral calcification, located within left splenius colli and medially to levator scapulae muscle, displacing the semispinalis capitis and semispinalis colli muscles,. The lesion was extensively vascularized, especially at its periphery, by left vertebral artery. No cervical lymph node enlargement was noted.

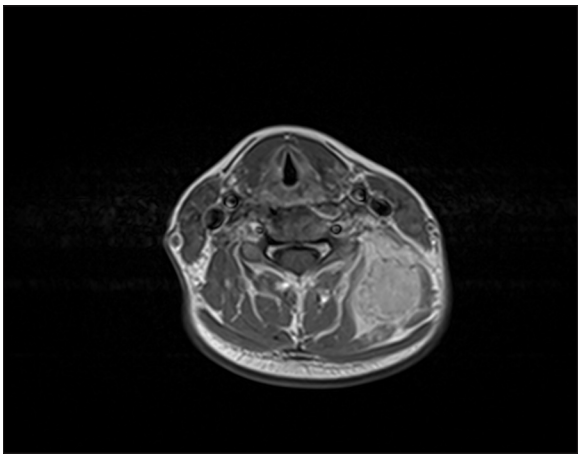

Figure 3. Axial, T1-weighted image reveals hyperintense SI of the lesion with a low-SI rim.

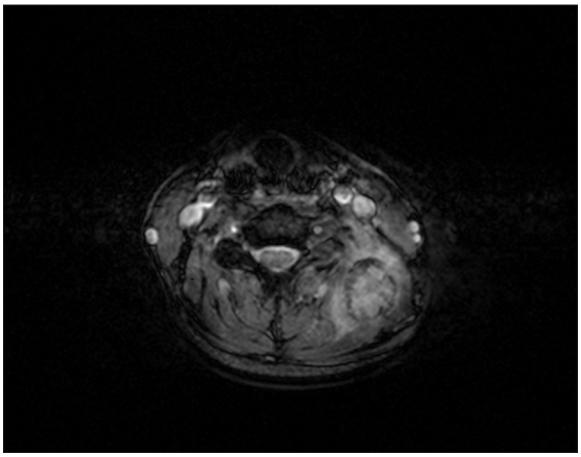

Figure 4. Axial, T2-weighted FS image shows intermediate- to high-SI of the lesion with a low-SI rim.

Magnetic Resonance Imaging with angiography: (Figures 3–6) revealed a relatively well – defined left-sided mass measuring 28×24×26 mm in diameter. The lesion was hyperintense on T1-WI and heterogeneous, isointense to hyperintense on T2-WI. Low-SI rim was seen in all sequences. T2-WI also demonstrated high-SI perilesional edema along muscle fibers. There was diffuse enhancement of the tumor and surrounding edematous region on post-contrast T1-WI.

Diagnostic imaging based on US, CT and MRI did not allow for stating an equivocal diagnosis.

Open biopsy was performed. Microscopically, specimens were consisted proliferating fusiform cells formed into fascicles. These cells demonstrated high mitotic activity. No abnormal mitotic figures or foci of necrosis were detected. Fusiform cells were admixed with numerous osteoclast–like cells. Additionally, mature bone trabeculae, well separated from fusiform cell components of the lesion, were seen. At the time of histopathological examination the differential diagnosis included MO and giant-cell soft tissue tumor. There are known publications showing that biopsy can erroneously suggest the diagnosis of osteosarcoma, especially since biopsy taken from central portion

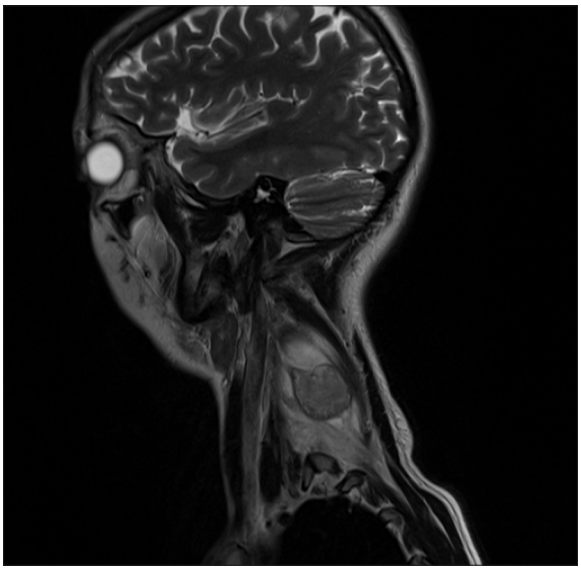

Figure 5. Sagittal, T2-weighted image shows intermediate SI of the lesion with a low-SI rim. There are perilesional areas of high SI along adjacent muscle fibers – edema.

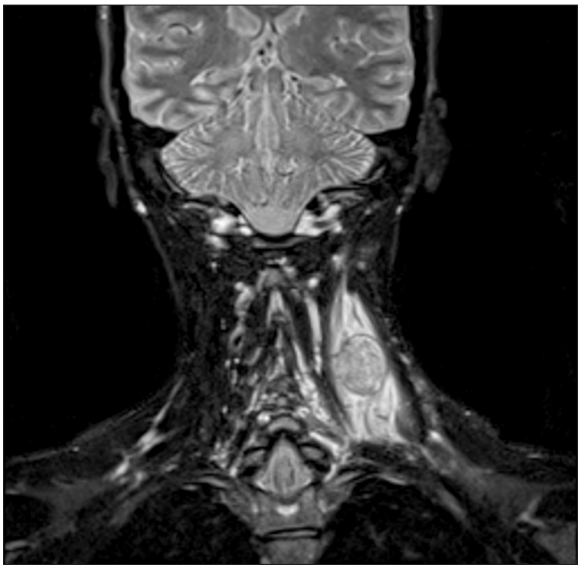

Figure 6. Coronal, T1-weighted image after administration of gadolinium contrast demonstrates marked enhancement within the lesion.

of the area affected by myositis ossificans may yield immature, undifferentiated tissue resembling a sarcoma. Histopathological examination performed after tumor excision confirmed MO.

Discussion

In this case study authors attempted to stress the importance of differentiation between MO and sarcomas, which may reveal many similarities in diagnostic imaging studies.

Parosteal osteosarcoma, a part of juxtacortical osteosarcoma group (75% of all surface osteosarcomas) is an extensively lobulated, 'cauliflower-like,' homogenously ossified mass. About 15% of tumors contain high-grade

Table 2. Differential diagnosis of malignant tumors and Myositis ossificans.

	Myositis ossificans	Parosteal osteosarcoma	Synovial sarcoma	Malignant fibrous histiocytoma
Demographics	Adolescents, young adults, M>F	Aoung adults, middle age, F>M	Adolescents, young adults, M>F	Older adults, M>F
Symptoms	Painless, enlarging, palpable mass			
Location	Extremities (large muscle)	Long tubular bones (distal femur), 90% metaphysis	Lower extremities (near the knee joint)	Retroperitoneum, proximal extremities
	Soft tissue mass	Bony mass	Soft tissue mass	Soft tissue mass 1–5% arise from or in the bone
Bone erosion or destruction	–	+	+	+
Calcifications in CT	**ES** – sometimes, faint; **IS** – peripheral, faint, irregular, focal; **LS** – heavily calcified lesion	Heavily calcified mass, more in the centre	30%, diffuse puncatate, often more concentrated at the periphery	5–20%, punctate, curvilinear, poorly defined
T1-WI SI	**ES** – intermediate to high; **IS** – variable; **LS** – *periphery* – low (mature lamellar bone), *central* – intermediate to high (bone marrow)	Low	Intermediate	Intermediate to low
T2-WI SI	**ES** – intermediate to high, **IS** – low, rim at periphery; **LS** – *periphery* – low (mature lamellar bone), *central* –intermediate to high (bone marrow)	High	High	Intermediate to high
Enhancement	**ES** – diffuse, marked; **IS** – varying, nonspecific; **LS** – usually none in mature lesions	Non-specific	Non-specific	Nodular and peripheral of solid components
Grade	None aggressive	Low grade	Aggressive	Aggressive
Histology	**ES** – *core* – major, proliferating fibroblasts and myofibroblasts *periphery* – minor, osteoid and mature lamellar bone; **IS** – *core* – minor or no proliferating fibroblasts *periphery* – osteoid component and active osteoblasts and shell of mature lamellar bone; **LS** – mature lamellar bone	Long, narrow trabeculae or ill-defined islets of osteoid, woven bone separated lying on a fibrous stroma. 15% high – grade components, low-grade carry a significant risk of dedifferantiation to high – grade sarcoma.	There are two main variants: monophasic and biphasic type. Monophasic pattern is characterized by monomorphic population of spindle-shaped cells arranged into fascicles. Classical synovial sarcoma shows a biphasic appearance with two typical cell types: *spindle cells* (fibrous-type of cells) – relatively small and uniform and found in sheets of malignant-appearing cells with minimal cytoplasm and dark atypical nuclei and *epithelial cells* – gland-, nest-, or cyst-like cells	Heterogeneous fibroblastic tumors made up of poorly differentiated fibroblasts, myofibroblasts, histiocyte-like cells with significant cellular pleomorphism, storiform architecture and also demonstrate bizarre, multi-nucleated giant cells. Histological subtypes include: storiform-pleomorphic (50–60%), myxoid (25%), inlammatory (5–10%), giant cell (5–10%), angiomatoid

ES – early stage; IS – intermediate stage; LS – late stage.

components. On the other hand, low- grade tumors carry significant risk of dedifferentiation into high-grade sarcomas. In comparison to MO, there are some cases showing the presence of bone marrow invasion. Typical findings for parosteal osteosarcoma in diagnostic imaging include a string sign, which is a thin, radiolucent line called a cleavage plane, separating the tumor from the cortex. As they grow, they are composed of dense osteoid component

attached to the outer cortex over a narrow zone. In most cases the tumor is ill defined, heavily calcified, with more dense central area. Typically, calcifications in parosteal osteosarcoma are often centrally located, while MO is extensively calcified at the periphery. In MRI pictures parosteal osteosarcomas are hypointense on both T1- and T2-weighted images due to their dense osteoid components. Necrotic and hemorrhagic parts are heterogeneously hyperintense on T2-weighted images, but dedifferentiation may also produce a hyperintense signal, which can also relate to high-grade components. Thus, high signal intensity on T2-WI of tumors of all grades does not identify a dedifferentiated component. However, contrast-enhanced images may reveal the solid component in heterogeneous areas of T2-WI and may indicate an appropriate site for biopsy.

Synovial sarcoma is a rare and aggressive soft tissue tumor, which usually grows around joints. On MRI the tumor appears sharply demarcated and cystic or multi-lobulated, with various degrees of internal septation. The effect exerted on adjacent structures usually involves displacement rather than invasion or destruction. Most tumors demonstrate heterogeneous, intermediate signal intensity on T1-weighted MRI. Lesions smaller than 5 cm are more likely to exhibit predominantly homogeneous signal intensity similar to that of adjacent muscle. Larger lesions are most often heterogeneous secondary to extensive areas of hemorrhage and necrosis. On T2-weighted images lesions are usually hyperintense, with signal intensity similar to or higher than that of adipose tissue. Approximately one third of lesions demonstrate a "triple signal pattern" on T2-weighted images; this pattern consists of a combination of [1] hyperintense fluid within cystic components with or without fluid levels, [2] intermediate-signal tissue similar in intensity to that of a muscle, and [3] slightly hypointense tissue similar in intensity to that of fibrous tissue. Apposition to bone surfaces without clearly observed separation is seen in 50–59% of cases. Moreover, apparent bone erosion or destruction may occur in 22% of synovial sarcomas, while is never observed in MO. On CT scans calcifications are demonstrated in 30% of patients; typically, diffuse, punctate calcifications are revealed. They are often more concentrated at the periphery than at the center, as in MO. In 50% of patients with synovial sarcoma, radiographic findings are interpreted as within normal ranges. If an abnormality is present, the radiograph may reveal a well-defined, round or lobulated soft tissue mass. Approximately 30% of patients have calcifications detectable by means of classical radiography. Calcifications may be focal or may spread throughout most of the tumor. They can appear fine, stippled, or opaque.

Malignant fibrous histiocytoma present as nonspecific soft-tissue mass on plain films, often lie adjacent to the diaphysis of a long bone. Calcifications within the tumor may be punctate, curvilinear, and/or poorly defined and are detected in 5–20% of patients. The appearance of the tumor on ultrasound is nonspecific. Typically, it shows a well-defined heterogeneous mass with hyperechoic areas of cellularity and hypoechoic regions of necrosis. CT typically reveals a nonspecific, large, lobulated, soft tissue mass which density is similar to adjacent muscle and demonstrate nodular and peripheral enhancement of solid regions. Central areas of low attenuation may be present, corresponding to myxoid regions, old hemorrhage, or necrosis. Fat attenuation is not observed in the tumors. MRI typically demonstrates an intramuscular, relatively well-defined mass of heterogeneous signal intensity. On T1-WI the tumor possesses intermediate to low signal intensity similar to adjacent muscle. On T2-WI signal intensity is intermediate to high. Following intravenous administration of gadolinium prominent nodular and peripheral enhancement of solid components is revealed. Signal intensity is heterogeneous if hemorrhage, calcification, necrosis, or myxoid material is presented (Table 2).

Conclusions

The aim of this study was to present the differential diagnosis between MO and malignant tumors, such as parosteal sarcoma, synovial sarcoma and malignant fibrous histiocytoma based on diagnostic imaging. Differential diagnosis based on diagnostic imaging is difficult, but possible particularly in the intermediate and late stages of MO. When the typical zonal phenomenon is present, it can suggest proper diagnosis, and biopsy, which is often misleading, can be avoided. Different types of sarcomas have to be included in the differential diagnosis due to the presence of calcifications.Recognition of the pattern of mineralization, with peripheral mature ossification, is essential for differentiation of the late stage of MO from other mineralized lesions, especially parosteal osteosarcoma. One should consider myositis ossificans a final diagnosis only after ruling out malignant diseases.

References:

1. Koob M, Durckel J, Dosch FC et al: Intercostal myositis ossificans misdiagnosed as osteosarcoma in a 10-year-old child. Pediatr Radiol, 2010 Dec; 40 Suppl 1: S34–37
2. Hanna SL, Magill HL, Brooks MT et al: Cases of the day. Pediatric. Myositis ossificans circumscripta. Radiographics, 1990, 10: 945–49
3. Jarraya M, Marcy P, Thariat J, Carlier RY: Myositis ossificans imaging: keys to successful diagnosis. Indian J Radiol Imaging, 2012; 22: 35–39