Myositis Ossificans Presenting as a Tumor of the Cervical Paraspinal Muscles

Thomas M. Beck[1], Helmut Rasch[2], Elisabeth Bruder[3], Rolf W. Hügli[4], Christoph Kettelhack[1]

Abstract
Myositis ossificans (MO) is a benign heterotopic bone formation within muscle or soft tissue that is predominantly initiated by trauma. The diagnostic challenge is to distinguish it from bone and soft tissue malignancies. The most common location of MO is the muscles of the thigh and the upper arm, whereas the neck is only rarely involved. A broad range of theories about the etiology of MO exists in the literature, but minor or major trauma can be found in almost every instance. We present a patient in which additional hybrid imaging with single-photon emission tomography (SPECT) and computed tomography helped to confirm the diagnosis of MO in the paraspinal cervical muscles.

Key Words
Myositis ossificans · Paraspinal muscles · Single-photon emission tomography · Hybrid imaging

Eur J Trauma Emerg Surg 2010;36:257–9
DOI 10.1007/s00068-009-8094-4

Case Report

A 33-year-old female presented at our institution with a history of cervical pain for several weeks. Right-sided neck pain initially started after heavy physical activity and even increased after chiropractic manipulation of the neck. At clinical examination she presented with local tenderness of the right paraspinal cervical area. An MRI already arranged by the family doctor showed a $8 \times 3 \times 4$ cm oval-shaped intramuscular lesion in the right lateral neck with surrounding soft-tissue edema (Figure 1). No plain X-ray studies were performed. The histological examination of a CT-guided core needle biopsy showed a myxoid, mesenchymal spindle-cell lesion with formation of immature and mature woven bone trabeculae without cellular atypia, consistent with heterotopic ossification (Figure 2). There was no lace-like osteoid, and the lesion revealed a clear-cut zonation pattern with central immature and peripheral mature areas (Figures 3, 4). Therefore, it was deemed that, in conjunction with the clinical and radiological findings, the CT-guided and therefore representative core needle biopsy provided no histological evidence of a malignant tumor. The CT itself had already revealed a peripheral rim calcification around the lesion with decreased attenuation of the center of the mass. Both findings were highly suspicious for MO.

To verify the diagnosis of MO, hybrid imaging with bone scintigraphy and SPECT-CT was performed. Scintigraphy demonstrated an increased uptake in the right paraspinal cervical area, supposing an early stage of MO. These findings were matched with an additional SPECT/CT (Figure 4).

Conservative treatment with nonsteroidal antinflammatory drugs (NSAID) led to a significant clinical improvement in a follow-up examination after six weeks. Because of complete remission of all clinical symptoms after six months, we saw no indication for a follow-up CT.

Discussion

MO is a benign heterotopic bone formation in muscle or other soft tissue. Heterotopic ossification is defined

[1] Department of Surgery, University Hospital of Basel, Basel, Switzerland,
[2] Department of Nuclear Medicine, University Hospital of Basel, Basel, Switzerland,
[3] Institute for Pathology, University Hospital of Basel, Basel, Switzerland,
[4] Department of Radiology, University Hospital of Basel, Basel, Switzerland.

Received: June 13, 2008; revision accepted: March 22, 2009;
Published Online: May 7, 2009

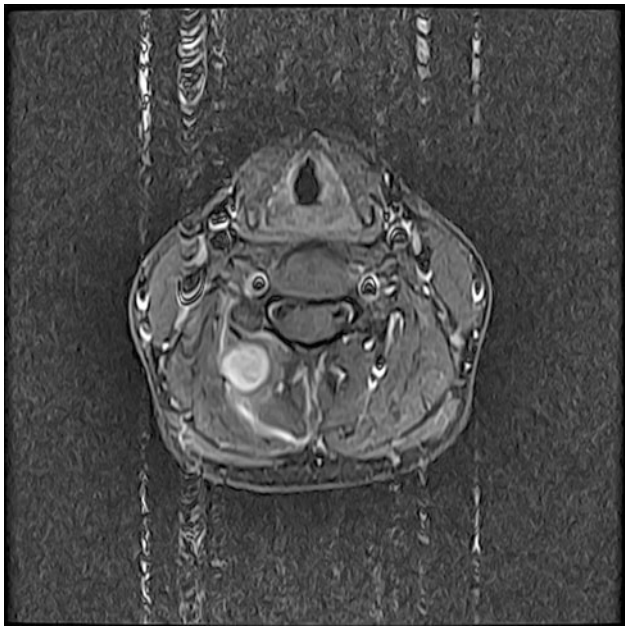

Figure 1. MRI, tumor of the right paraspinal muscles.

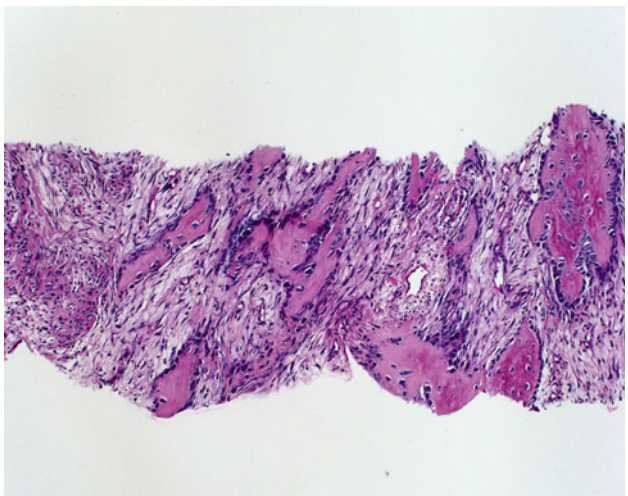

Figure 2. Histopathology of CT-guided core needle biopsy. Overview of the center of the needle biopsy showed interwoven spindle cells to the left with increasing organization into woven bone trabeculae to the right. There is regular osteoblast rimming of trabeculae. PAS × 100.

by the presence of lamellar bone in soft tissues [1] and malignant transformation is rare. In most cases the MO is locally limited as consequence of direct trauma. Prevalence is significantly higher in males than females [2]. Three different types of MO are described: a progressive form, an atraumatic myositis circumscripta, and most commonly a traumatic myositis ossificans circumscripta [3].

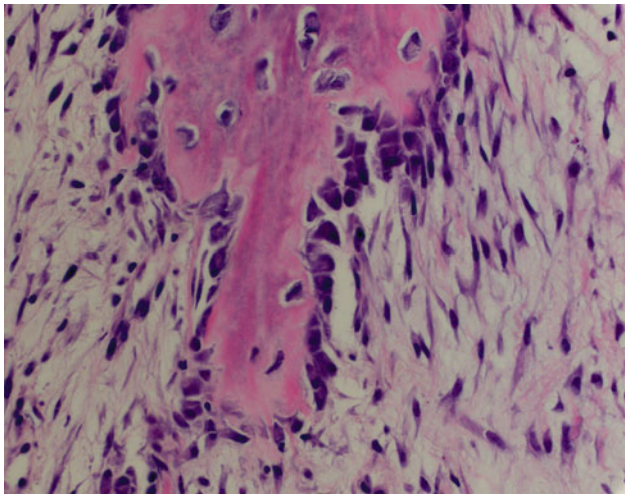

Figure 3. Detail of peripheral woven bone trabecule showed bland cytology of rimming osteoblasts and surrounding spindle cells. There were no mitotic figures, and no atypical mitotic figures in particular. H&E × 400.

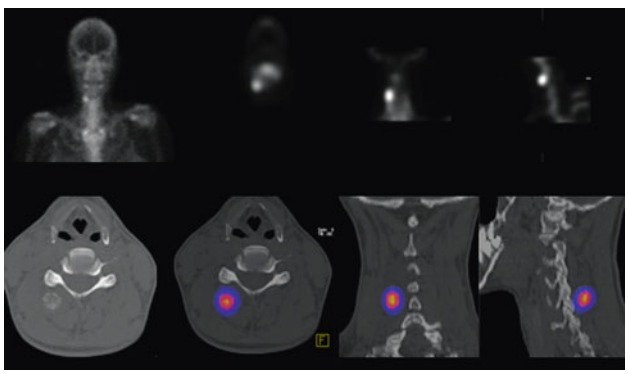

Figure 4. *Above*: scintigraphy with increased uptake on the right paraspinal region. *Below*: CT (on the *left*) and combined information from CT and scintigraphy (hybrid imaging).

Many theories on the pathogenesis of traumatic myositis ossificans exist, and there is little agreement concerning the underlying mechanism [2, 4].

Myositis ossificans normally occurs caudal to the clavicles. The head and neck muscles are only rarely affected, and in this region the most commonly affected sites are the muscles of mastication [5, 6]. So far, only a few cases of MO affecting the paraspinal muscles have been reported. Our case is the first one to use hybrid imaging with SPECT and CT in one modality.

There is no consensus regarding the treatment of MO in the literature. After a clear-cut diagnosis, our institutional approach is primarily conservative. In addition, several authors suggest that operative treatment should only be chosen in special cases. Surgery should be postponed as long as possible to minimize

functional disturbance and to allow spontaneous regression. It is an option in patients with serious pain, restricted function or involvement of neurovascular structures. Surgical excision is the therapy of choice in cases of unclear histology/behavior to exclude malignant disease [7], but surgical excision should only be performed after complete maturation. If excision occurs earlier during the phase of high metabolic activity there is a high risk for recurrence.

However, most importantly, myositis ossificans must be differentiated from malignant tumors. Specifically, on MRI the appearance of MO is variable and depends on the maturity of the lesion. In the early phase, MO has to be distinguished from a soft-tissue sarcoma/extraskeletal osteosarcoma. Early MO is associated with surrounding edema that is not typically present in soft-tissue sarcoma. Edema, which is best seen on MRI as well as on CT, may be present in other lesions such as abscesses, rhabdomyolysis or hematoma [8]. With a slight degree of calcification, synovial sarcoma, rhabdomyosarcoma, and malignant fibrous histiocytoma can be excluded, because these tumors can show calcification. In early and mature MO, osteosarcoma and chondrosarcoma should be considered.

CT can characterize the typical findings of myositis ossificans, but it provides no information on the activity of the lesion. The most decisive clue in the differential diagnosis of osteosarcoma is the exquisite zonal pattern of myositis ossificans, discernible in both histology as well as imaging. Histologically, the center retains its population of fibroblasts; however, it merges with an adjacent intermediate zone that contains osteoblasts that deposit ill-defined trabeculae of woven bone. The most peripheral zone contains well-formed mineralized trabeculae that closely resemble cancellous bone [9]. While osteosarcomas show a more ossified portion in the center of the lesion and indefinite boundaries, myositis ossificans is associated with an egg-shaped peripheral appearance of calcifications and a radiolucent center [3].

Concerning the metabolic activity of the lesion, scintigraphy has a high sensitivity and produces comparable results to MRI [7]. Hybrid imaging combines the high specificity and the precise anatomical information of CT with the high sensitivity to activity of scintigraphy.

Hybrid imaging with SPECT-CT can be a useful tool for the management of MO. It provides state of the art anatomical imaging with CT and the ability to determine the lesion activity via SPECT. In cases of planned surgical excisions, the level of metabolic activity in SPECT may be helpful for identifying the time for intervention.

Conflict of interest statement

The authors declare that there is no actual or potential conflict of interest in relation to this article.

References

1. Vanden Bossche L, Vanderstraeten G. Heterotopic ossification: a review. J Rehabil Med 2005;37:129–36.
2. Dudkiewicz I, Salai M, Chechik A. A young athlete with myositis ossificans of the neck presenting as a soft-tissue tumour. Arch Orthop Trauma Surg 2001;121:234–7.
3. Sarac S, Sennaroglu L, Hosal AS, Sozeri B. Myositis ossificans in the neck. Eur Arch Otorhinolaryngol 1999;256:199-201.
4. Mevio E, Rizzi L, Bernasconi G. Myositis ossificans traumatica of the temporal muscle: a case report. Auris Nasus Larynx 2001;28:345–7.
5. Ackerman LV. Extra-osseous localized non-neoplastic bone and cartilage formation (so-called myositis ossificans): clinical and pathological confusion with malignant neoplasms. J Bone Joint Surg Am 1958;40-A:279–98.
6. Baysal T, Baysal O, Sarac K, Elmali N, Kutlu R, Ersoy Y. Cervical myositis ossificans traumatica: a rare location. Eur Radiol 1999;9:662–4.
7. Saussez S, Blaivie C, Lemort M, Chantrain G. Non-traumatic myositis ossificans in the paraspinal muscles. Eur Arch Otorhinolaryngol 2006;263:331–5.
8. Parikh J, Hyare H, Saifuddin A. The imaging features of post-traumatic myositis ossificans, with emphasis on MRI. Clin Radiol 2002;57:1058–66.
9. Kumar V, Abas A, Fausto N. Robbins and Contran. Pathologic basis of disease. 7th Edition. Philadelphia: Elsevier Saunders, 2005.

Address for Correspondence
Thomas M. Beck, MD
Department of Surgery
University Hospital of Basel
Spitalstrasse 21, 4031, Basel
Switzerland
Phone (+41/61) 2652525, Fax -57356
e-mail: tbeck@uhbs.ch