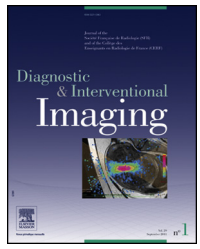
Diagnostic and Interventional Imaging (2016) **97**, 5—18



REVIEW /*Musculoskeletal imaging*

Multimodality evaluation of musculoskeletal sarcoidosis: Imaging findings and literature review

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KEYWORDS
Sarcoidosis;
Diagnostic imaging;
Musculoskeletal system;
Positron emission tomography

Abstract Whilst the detailed X-ray features of thoracic manifestations of sarcoidosis are now clearly defined and known by most radiologists, the same does not apply to osteoarticular and muscular features of the disease, which may however raise major diagnostic problems, either because they are the presenting features of the disease (7% of cases) or because they develop during its course. The bony lesions of sarcoid dactylitis (classical Perthes-Jüngling disease) are very characteristic and well known. Many other presentations of bone and bone marrow sarcoidosis may however raise major diagnostic difficulties, particularly uni- or multifocal osteolytic and sclerotic forms of the disease. The articular manifestations of sarcoidosis are difficult to distinguish from those of the other inflammatory and degenerative arthropathies. The muscular lesions in sarcoidosis are generally clinically silent and therefore often missed. MRI has shown them to be very common in active sarcoidosis. Acute forms carry a good prognosis whereas chronic lesions are a presenting feature of multi-organ sarcoidosis. Finally, clinicians should always think about the possibility of an iatrogenic origin for musculoskeletal abnormalities seen in sarcoidosis, particularly those related to corticosteroid therapy.

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http://dx.doi.org/10.1016/j.diii.2014.11.038

General features of sarcoidosis and its ''rheumatological'' manifestations

Sarcoidosis, major clinical features and features of progression

The skin lesions of sarcoidosis were described for the first time by Jonathon Hutchinson, surgeon and cellular pathologist in 1863, although he had linked these to the tophaceous gout from which the patient was suffering. Besnier, a dermatologist, described the symmetrical skin lesions of the extremities in 1889 whereas Boeck, also a dermatologist, reported ''multiple benign skin sarcoidosis'' and suspected that the disease was the systemic, a concept which was confirmed by Schaumann in 1926 who named it ''lymphogranulomatosis benigna'' to distinguish it from malignant lymphoma, the histological features of which may be similar whereas its clinical natural history is of course extremely different. The term sarcoidosis is therefore due to Boeck. The disease has long been known by the acronym Besnier-Boeck-Schaumann's disease (BBS in common language).

The pathogenesis of sarcoidosis still involves many unknown features. The existence of familial cases suggests an inherited role through susceptibility to specific infectious or non-infectious environmental agents. The basic histological appearance is that of the sarcoid granuloma, made up of epithelioid cells and giant cells with no caseous necrosis (Fig. 1) [1].

Sarcoidosis classically presents in adults under 40 years old with a peak incidence at between 20 and 29 years old. The presenting features are usually relatively non-specific general signs of weight loss, asthenia, fever, deterioration in general health and evidence of mediastinal lymphadenopathy in suggestive sites, often associated with parenchymal disease. Note that 50% of patients suffering from thoracic sarcoidosis are asymptomatic.

The extra-thoracic features of sarcoidosis may be the presenting features of the disease and are seen in half of symptomatic patients. The characteristic skin lesions such as erythema nodosum and lupus pernio are seen in a quarter of patients [2]. Ocular presenting features are common, as are hepatic, splenic, parotid central nervous system and urogenital disease.

The clinical progression of the disease is very variable: it has been suggested that subjects with black skin have more severe forms of the disease. Extension of lesions is correlated with the natural progression of the disease. Two thirds of patients achieved spontaneous remission whereas 10 to 30% progressed to chronic disease. An insidious onset with multiple extra-pulmonary sites carries a poor prognosis. Some sites seriously worsen the prognosis, particularly cardiac disease. Recurrences are believed to be more common in musculoskeletal disease.

The most classical treatment given is corticosteroid therapy, which may achieve a rapid response resulting in regression and stabilization. Relapses are seen in 16 to 74% of cases when the treatment is decreased or stopped. If treatment fails or in forms of the disease which are highly aggressive from the outset, immunosuppressant therapies such as methotrexate, azathioprine or cyclophosphamide are commonly used.

''Rheumatological'' aspects of sarcoidosis; general features

Joint manifestations of sarcoidosis are the most common sites in the locomotor system, with a prevalence of 10 to 35% being reported depending on the series. These are often a presenting feature of the disease.

Bony sarcoidosis is rarer, although it is under-estimated as it is often asymptomatic. It develops later in the course of the disease and is only seen in advanced sarcoidosis. The reported prevalence in the literature is 1 to 15% and it is commoner in women and in people with black skin (African-Americans, West Indians, etc.). Phalangeal involvement is typical and the best known to radiologists (Perthes-Jüngling disease).

The muscular features of sarcoidosis are often asymptomatic and are almost always found on routine muscle biopsies [3,4]. There are three forms of these: chronic myopathy, nodular myopathy and acute myopathic disease.

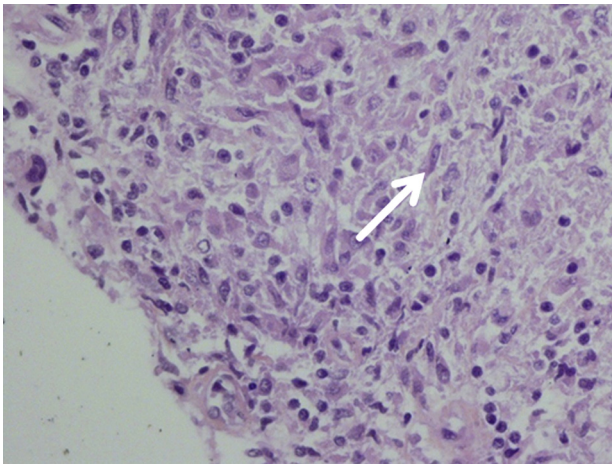

Figure 1. Histological section (MAG ×40) of a bone biopsy. Granuloma with epithelioid cells and lymphocyte crown — Langerhans cell: extended dendritic cell (arrow).

Imaging for sarcoidosis and for its ''rheumatological'' features

General features

If initial musculoskeletal sarcoidosis is suspected, the first diagnostic imaging approach is to investigate for other sites, particularly thoracic, which are present in over 90% of patients. If chest radiography is normal, a sub-millimeter section CT scan should be performed particularly if respiratory function tests confirm the presence of abnormalities. In practice the diagnosis is often made late in patients with isolated musculoskeletal sarcoidosis.

Isotopic imaging has an important role to play in the diagnosis of sarcoidosis in general and its musculoskeletal sites in particular (Table 1). Bone scintigraphy with ^{99m}Tc labelled bisphosphonates is a sensitive [5] but relatively non-specific method for detecting musculoskeletal sites, which has the advantage of being ''whole body'' investigation. The