Case Resolution

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See case presentation on page 138.

DIAGNOSTIC: Multiple myeloma

DISCUSSION

Multiple myeloma (MM) is the most frequent primary malignant bone tumor in adults. It is an hematological neoplasm that arises from the monoclonal proliferation of plasma cells that produce immunoglobulins (commonly IgG) and infiltrate hematopoietic sites (red bone marrow).

MM is a characteristic disease of the elderly. 70% of MM cases are diagnosed between the ages of 50 and 70 (median age at diagnosis, 69 years) and it is more common in men (male:female ratio 2:1). It represents 1% of all malignant neoplasms and 10% of all hematological diseases.

The clinical presentation is varied and includes progressive bone pain, which is initially intermittent and then constant, worsening with activity and, consequently, lasting all day. Other frequent associated clinical and biochemical findings are anemia, kidney failure, proteinuria, and hypercalcemia.

Occasionally, the clinical presentation of MM can be a complication of this disease, such as pathological fracture (vertebral compression fracture, long bone fracture, typically of the proximal femur) and recurrent infections (pneumonia caused by hypogammaglobulinemia and leukopenia). In rare cases, the initial presentation may be a peripheral polyneuropathy, especially associated with the osteosclerotic form and as part of the POEMS syndrome (polyneuropathy, organomegaly, endocrinopathy, myeloma, and sclerotic lesions).

Biochemical findings include: normocytic normochromic anemia, reverse albumin / globulin ratio (low albumin, high globulin), monoclonal gammopathy (IgA or IgG spike), Bence-Jones protein in urine (Ig light chain), hypercalcemia, decreased or normal alkaline phosphatase associated with altered osteoblastic function (may increase if there is a pathological fracture) and kidney failure.

It manifests with a wide range of radiographic abnormalities that can be summarized in four main patterns: 1) well-defined multiple lytic lesions predominantly affecting the axial skeleton, 2) diffuse skeletal osteopenia, 3) solitary plasmacytoma, a single large lesion more commonly appearing in a vertebral body or in the pelvis, and 4) osteosclerotic myeloma.

MM distribution corresponds to the red bone marrow in the elderly individual, predominant involvement of the axial and proximal appendicular skeleton is observed: vertebral body (most frequent), rib, skull, shoulder girdle, pelvis and long bones. On images, the vast majority of MM lesions are purely lytic, clearly defined and with endosteal scalloping when they lean on the bone cortex. However, 3% of patients may have sclerotic lesions.

Plasmacytoma represents the solitary plasma cell neoplasm that can progress to MM (Figures 2 and 3).

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How to cite this article: Trueba R. Postgraduate Orthopedic Instruction – Imaging. Case Resolution. *Rev Asoc Argent Ortop Traumatol* 2021;86(2):281-284. https://doi.org/10.15417/issn.1852-7434.2021.86.2.1329

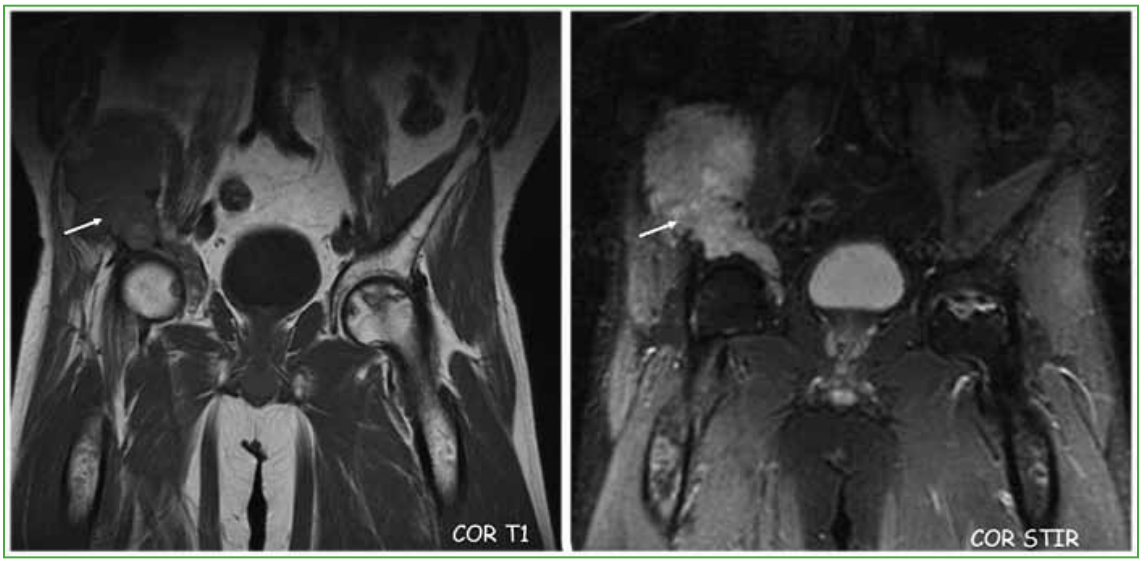

Figure 2. Magnetic resonance, coronal plane. An expansive lesion in the right iliac bone compatible with a plasmacytoma is detected in a patient with myeloma confirmed by clinical and biochemical examination. The lesion is expansive, with a low signal in the T1 sequence and a high signal in the T2 sequence. In addition, avascular necrosis of the bone is seen in the left femoral head.

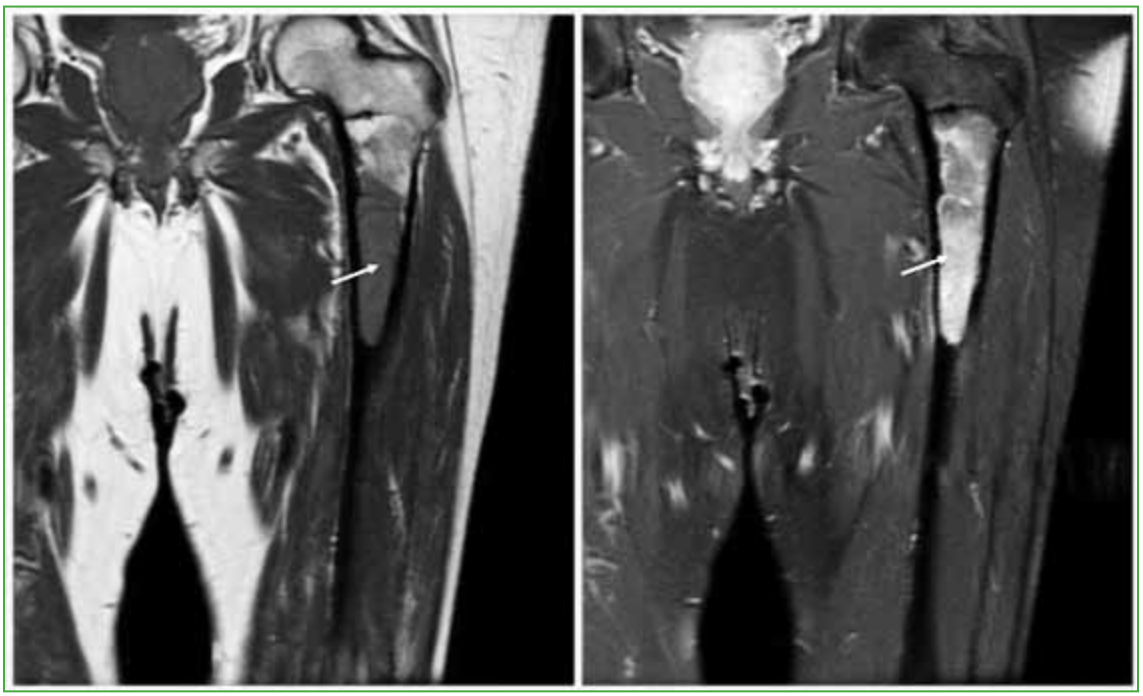

Figure 3. Magnetic resonance, coronal plane. Another case of plasmacytoma is observed. In this patient, the lesion infiltrated the proximal shaft of the left femur.

Disseminated MM has two common radiographic features, although it should be noted that radiographs may initially be normal in symptomatic patients. The two main patterns are: numerous, well-circumscribed, lytic bone lesions (more common), such as raindrop skull (Figure 4) or generalized osteopenia, often associated with vertebral compression fractures/vertebra plana.

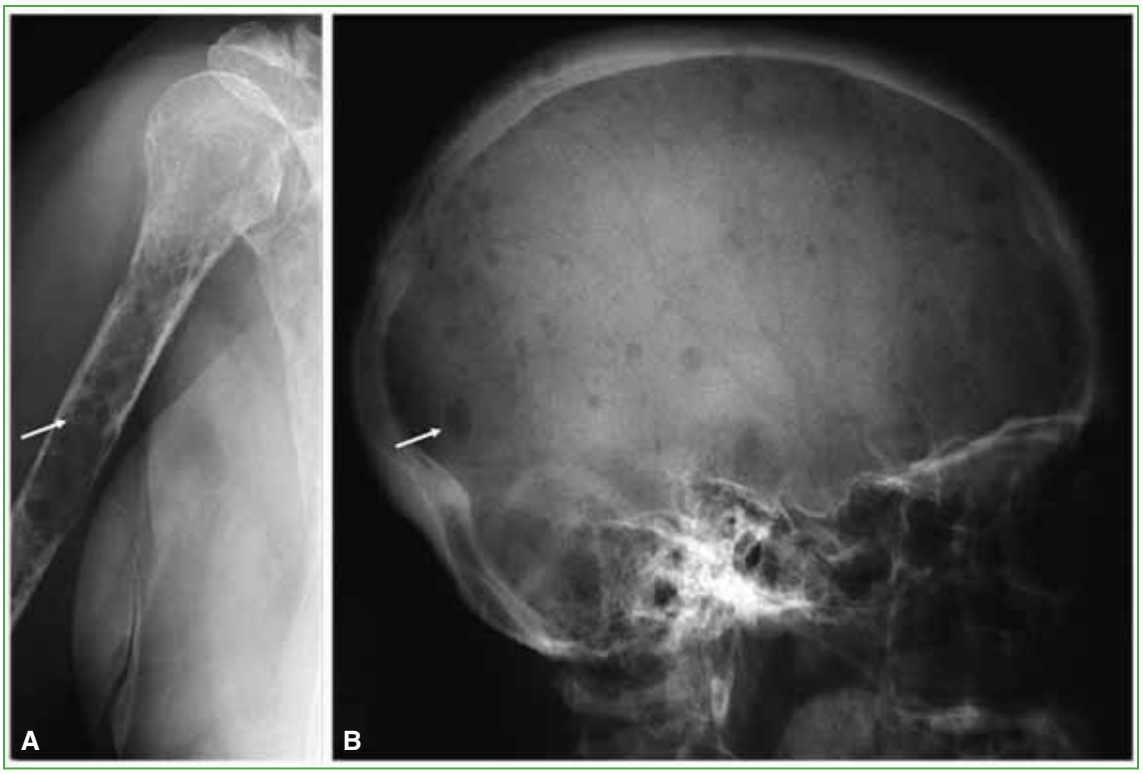

Figure 4. Right humerus (**A**) and skull (**B**) radiograph. Multiple lytic images of different sizes are observed.

MRI is more sensitive in detecting multiple lesions compared to the standard plain film skeletal survey and CT. Five patterns have been described: normal bone marrow signal, diffuse involvement, focal involvement, combined diffuse and focal involvement and variegated. Most frequently used MR sequences for the evaluation of bone marrow are conventional T1 and T2 sequences. In the T1 sequence, signal is typically low, whereas in T2 it is high with fat suppresion. The lesions show signal enhancement in T1 sequence with a contrast medium. They usually exhibit restricted diffusion (DWI) compared to the low signal of normal marrow.

In patients with disseminated MM, the bone scintigraphy shows variable results due to the potential lack of osteoblastic activity. Larger lesions may be either hyperactive (hot) or photopenic (cold).

F-18 FDG PET-CT is effective in identifying the distribution of disease. F-18 FDG uptake by the myeloma lesions can detect bone lesions not identified on radiography, especially in patients diagnosed with plasmacytoma.

The main differential diagnosis is that of widespread bony metastases (Figure 5). An imaging finding that favors the diagnosis of bone metastases over that of multiple myeloma is the involvement of vertebral pedicles rather than the isolated or predominant involvement of vertebral bodies.

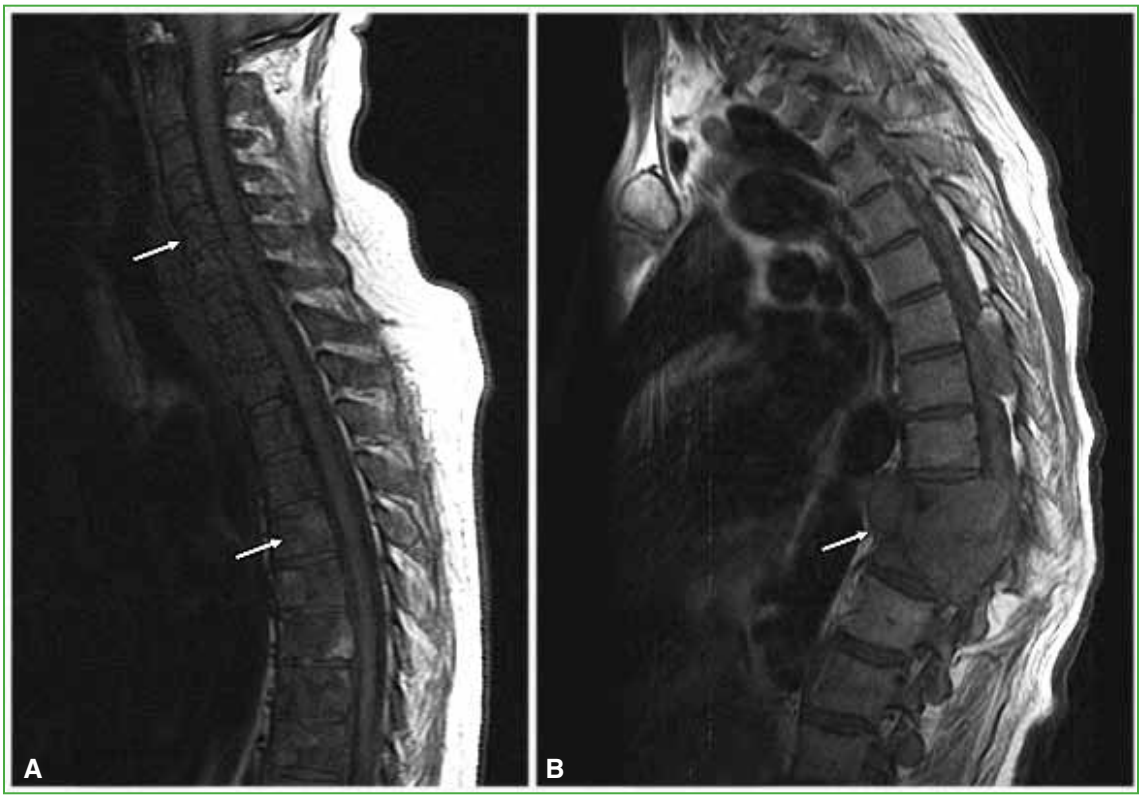

Figure 5. Magnetic resonance, sagittal plane, T1-weighted sequence. Example of vertebral metastases in the cervicodorsal spine (**A**) and a single expansive lesion in the dorsal vertebral body (**B**) with posterior extension. Cervicodorsal metastatic lesions replace the normal bone marrow signal from the vertebral bodies. Its finding on images is very similar to that of myeloma.