Case report

Occult large epiphyseal solitary plasmacytoma at multidetector row computer tomography detected by magnetic resonance imaging

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Abstract. Myeloma or Kahler-Bozzolo disease represents around 1% of all malignant tumors and 10% of the haematological variety; it is a B-lymphocellular malignant neoplasia which originates from plasma cells that produce monoclonal immunoglobulin, infiltrating in and destroying the adjacent bone tissue. Myeloma may be distinguished at radiological imaging in four distinct types: single osseous lesions (solitary plasmacytoma), diffused skeletal effects (myelomatosis), diffused osteopenia and sclerosing myeloma. It is known that initial osteolysis may not be shown through radiographic examination or CT; the lysis only becomes evident when there is a bone loss of over 50%, usually in the presence of a =/> 0,5 cm focal lesion. We present here the clinical-radiological aspects of a solitary bone plasmacitoma (SBP) of the knee of a 35 year old male which was not evidenced at radiological examination or CT but was evident as a 3 cm focal alteration at MR. The lesion was confirmed by PET and the histological diagnosis was performed by a CT guided bioptic sample. (www.actabiomedica.it)

Key words: Epiphyseal solitary plasmacytoma, knee, MDCT, MRI, PET

Introduction

Multiple myeloma (MM) is a clonal B-lynphocyte neoplasm of terminally differentiated plasma cells that produce monoclonal immunoglobulin, infiltrating in and destroying the adjacent bone tissue.

It represents around 1% of all malignant tumors, and 10% of the haematological variety.

The annual incidence in the United States is around 4 per 100,000 population per year. The median age at diagnosis is 65 years.

Myeloma may be distinguished at radiological imaging in four distinct types: single osseous lesions (solitary plasmacytoma), diffused skeletal effects (myelomatosis), diffused osteopenia and sclerosing myeloma (1, 2).

It is known that initial osteolysis cannot be detected through CT or radiographic examination, since the lysis becomes evident only when the bone loss exceeds 50% (3).

No more than 5% of patients with plasma cell myeloma are affected by solitary bone plasmacytoma (SBP). Its diagnosis requires same important criteria as a single area of bone destruction due to clonal plasma cells; a normal bone marrow without evidence of clonal plasma cell proliferation; normal findings on skeletal survey and magnetic resonance imaging (MRI) of the spine, pelvis, proximal femora, humery;

absence of anemia, hypercalcemia or renal impairment attributable to myeloma; low serum or urinary level of monoclonal protein and preserved levels of uninvolved immunoglobulins (4).

We present a case of SBP that we have diagnosed in the right knee of a young man.

In particular we highlight its clinical- radiological aspects and the important role of MRI, positron emission tomography(PET) and computed tomography(CT)-guided biopsy.

Case report

A 35 year-old man without history of trauma, malignancy, systemic inflammatory disease or blood dyscrasia came to our observation because of pain and functional impotence of the right knee for around 1 month.

Conventional radiographic examinations in the standard projection of the right knee were normal (Fig. 1).

Ten days after radiographic examination, the patient underwent magnetic resonance imaging (MRI) of the right knee with and without intravenous injection of 0.2 mmol/kg of Gadolinium-gadobenato meglumino (Gd-BOPTA, Multihance, Bracco, Milan, Italy), at 2,5 ml/sec after 50 and 70 sec.

A MR scanner (Magnetom Vision, 1. 5 Tesla, Siemens, Erlangen, Germany) with a coil surface was used for the study. The MR imaging protocol included sagittal Spin Echo (SE) T1 w (TR/TE 608/20) and STIR (TR/TE 848/18 FA 30°) sequences; Multi-echo (TR/TE 3000/16-98 ETL5) axial sections, Gradient Echo (GE) (TR/TE 995/26 flip angle 30°) coronal sections and GE 2D (TR/TE 995/26 FA 90°) axial sequences with spectral saturation of the fat signal after intravenous administration of intravenous Gd-BOPTA, using a FOV of 18-20 cm, with 256x 256 matrix and 1 acquired signal.

MRI, at the level of the femoral condyles, demonstrated a 3 cm round lesion with distinct margins. It was hypointense on T1 and proton density weighted imaging, hyperintense on T2-weighted imaging, and demonstrated mild enhancement following intravenous gadolinium administration (Fig. 2, 3).

After 2 days, the right knee of the patient was examined with a 16–detector row computed tomography (CT) scanner (Sensation 16; Siemens Medical Systems, Forchheim, Germany). For data acquisition, section collimation of 16 x 0.75 mm, section width of 0.75 mm, and

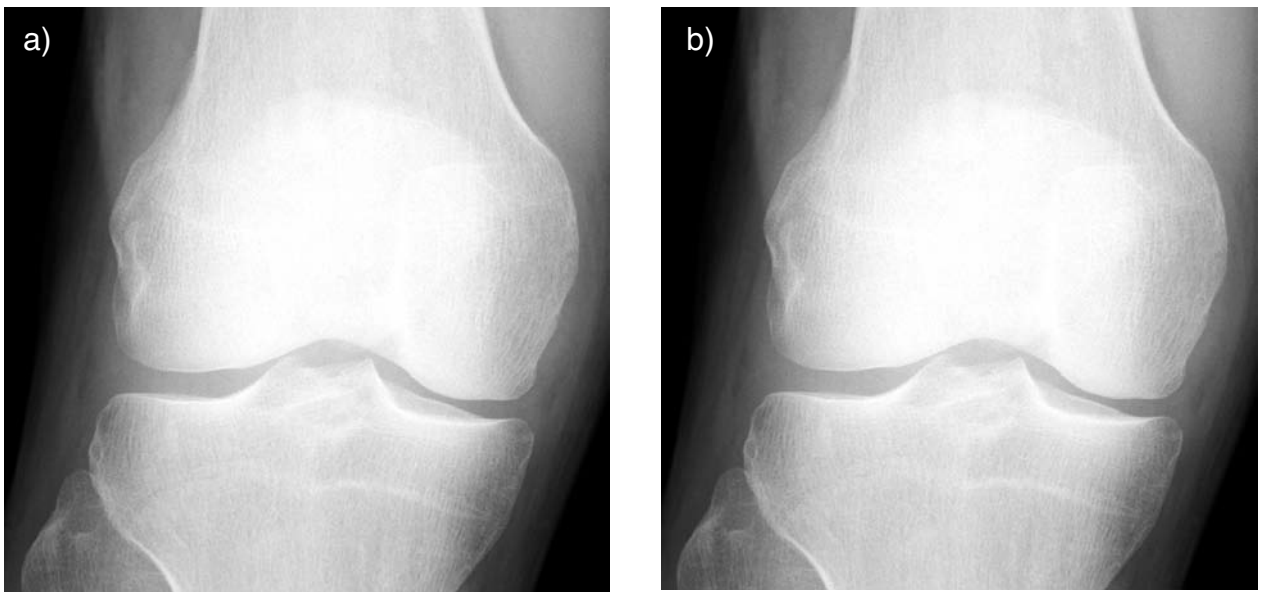

Figure 1. Conventional radiographic examinations in the standard projection of the right knee were normal; frontal (a) and (b) lateral views

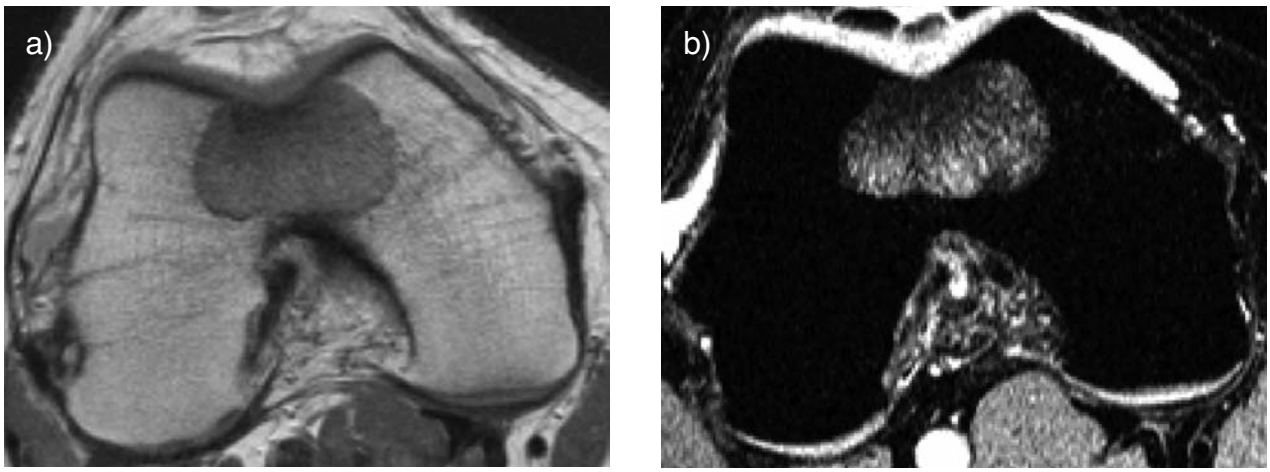

Figure 2. MRI proton density (a) and STIR (b) sequences, axial views. At the level of the femoral condyles, note a 3 cm hypointense (a) and hyperintense (b) round lesion with distinct margins

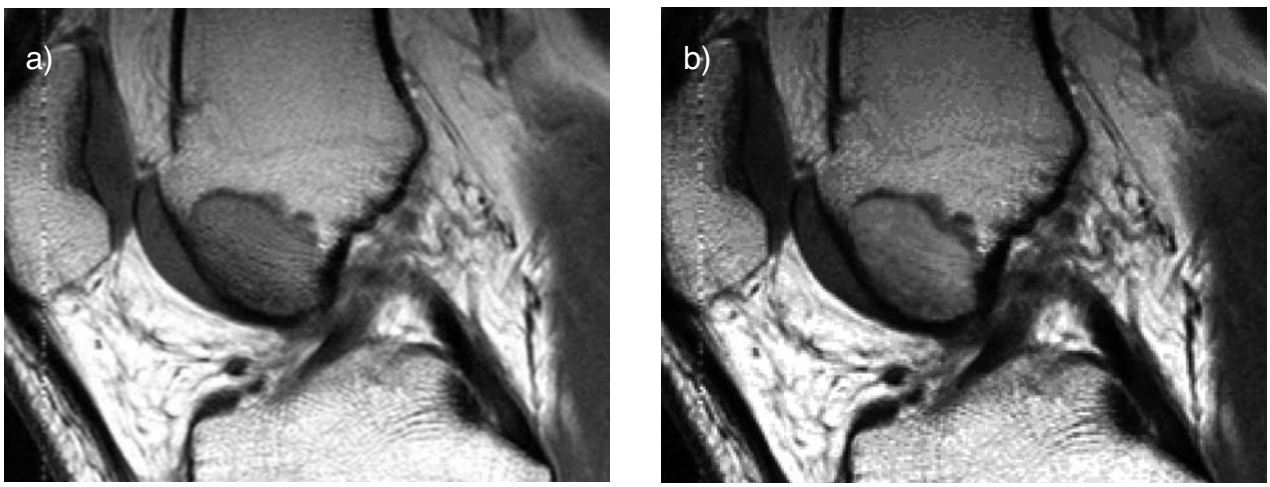

Figure 3. Sagittal views SE T1 w, before (a) and after (b) intravenous Gd-BOPTA administration. Note in "b" a mild enhancement of Gd-BOPTA in the femoral lesion

reconstruction increment of 0.3 mm were used. Tube current was 120 mAs, and tube voltage was 120 kV.

CT showed normal bone density and trabeculation, without evidence of the lesion (Fig. 4a). Positron emission tomography after 8 days from MRI confirmed a solitary lesion (Fig. 5a). A CT-guided biopsy, after 18 days from MRI, was consistent with multiple myelomatosis cells and normal bone marrow without evidence of clonal plasma cell proliferation (Fig. 4b, 5b). We found a single area of bone destruction due to clonal plasma cells.

We also verified normal findings on skeletal survey and MRI of the spine, pelvis, proximal femora, humery and the absence of anemia, hypercalcemia, renal impairtment. Moreover we found low serum or urinary level of monoclonal protein and preserved levels of uninvolved immunoglobulins.

All these clinical- radiological elements let us to formulate diagnosis of SBP.

Three months after chemotherapy and radiation, a follow up MRI demonstrated changes related to the biopsy, but no residual tumour (Fig. 6).

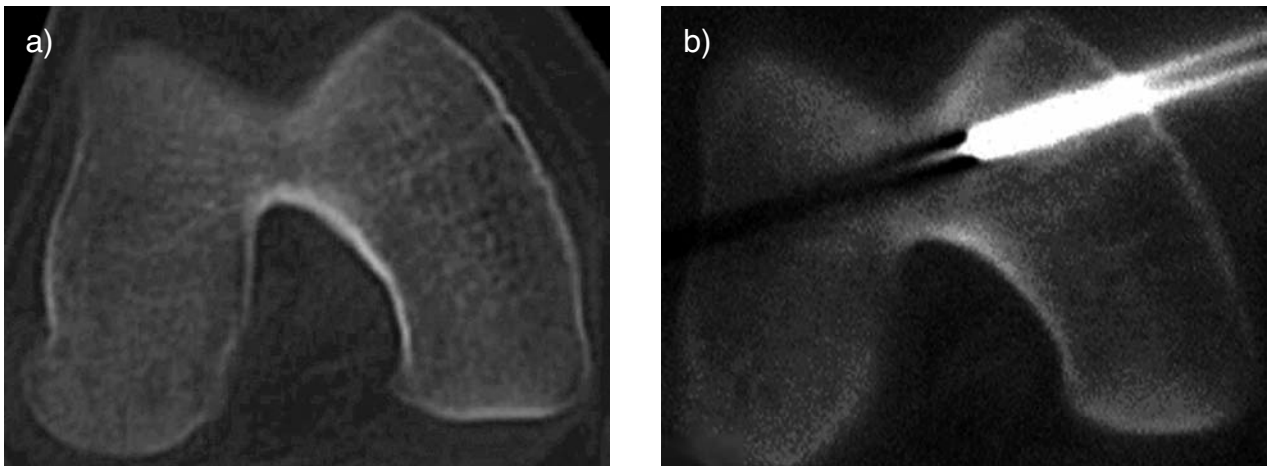

Figure 4. 16-MDCT shows normal bone density and trabeculation, without evidence of the lesion (a). A CT-guided biopsy, was performed after 18 days from MRI (b)

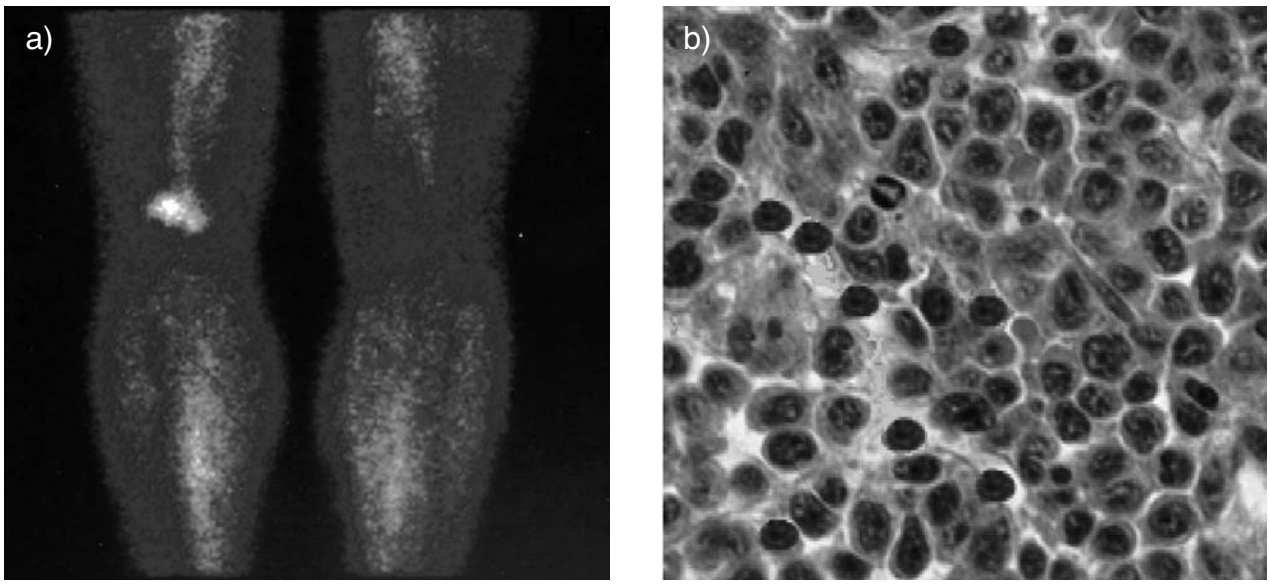

Figure 5. Positron emission tomography after 8 days from MRI confirmed a solitary lesion of the right knee (a). Histological finding of the lesion: multiple myelomatosis cells (b)

Discussion

The variability of radiologic examination of myeloma (solitary plasmacytoma, myelomatosis, diffused osteopenia, localized osteosclerosis) is a function of the type of growth of the tumoral foci in the bone marrow (5).

Although lythic lesions or diffused demineralisation is present in 80% of the cases, 55% of patients with focal pattern and 50% of those with diffused patterns detected with MRI do not present lythic lesions at radiology (6).

Moreover, more than 20% of all radiological and magnetic resonance exams may show normal results (7).

However radiographic examination is still today the preliminary instrument for the diagnosis which all patients with suspected myeloma undergo.

For years this technique has represented the only

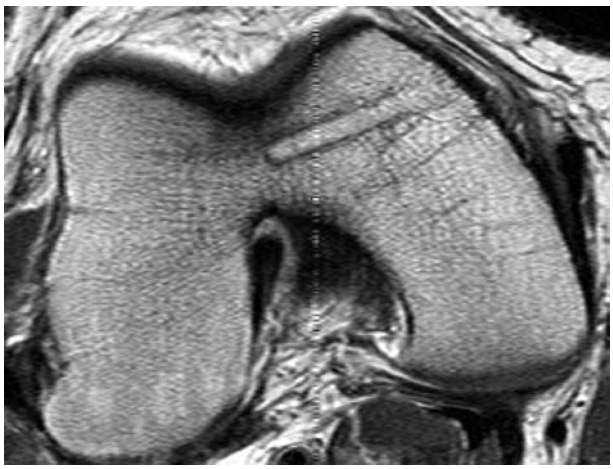

Figure 6. Axial view SE T1w. The Follow up 3 months after chemotherapy and radiation, demonstrates changes related to the biopsy, but no residual tumor

means for evaluating and monitoring bone damage caused by the neoplasia, representing one of the principal evaluation parameters in stadiation according to the Durie-Salmon criteria (8).

The scarce sensitivity in the preliminary stages (lysis becomes evident when there is a bone loss of more than 50%) and the difficulty in studying certain bone segments give rise to limits that are no longer acceptable, given the development of more advanced imaging techniques (9).

The CT spiral multidetector has certainly showed itself to be more sensitive than radiographic examination in the detection of bone lysis, but it is still conditioned in the diagnosis of the survey of the associated bone with consequent negativeness in the initial stages (1).

Nevertheless, the possibility of using low collimations and obtaining valid multiplanar reconstructions has allowed accurate evaluations of the advanced forms with very evident bone alterations, particularly in the areas of major risk of fracture as well as the detection of possible areas of the disease outside the bone (10).

CT may also play an essential role in the use of agobiopsies for lesions hidden at CT, based on images of lesions obtained with MRI.

MRI is the chosen method in the study of pathologies electively affecting bone marrow, since it can offer a direct evaluation.

It also proved to be extremely useful in the detection of initial forms which have not yet given rise to lyses, in the pre-treatment stadiation of the pathology, and in the correlation of its results with the prognosis (11).

In the presented case, MRI detected a lesion of large dimensions (3 cm) that was not detected at CT, without the use of gadolinium.

Although it is not possible to draw conclusions from a single event, it can be assumed that a solid skeletal marrow focal lesion, with the MRI characteristics that were previously described (signal hyperintensity in the T2 w and STIR and hypointensity in the lightly and homogeneously impregnated paramagnetic cm) supported by a negative CT report provides a high diagnostic probability of solitary plasmacytoma.

It is evident that the intensity pattern of the MRI signal seen in our case is not specific for a plasmacytoma, since the same effect may be observed in skeletal metastases of different hystotypes. Moreover, as skeletric metastases grow, they cause skeletal lyses and, at times, thickening or mixed aspects which can be detected through radiographic examination, or even better at CT.

It is known that initial osteolysis may not be shown through radiographic examination or CT ; the lysis only becomes evident when there is a bone loss of over 50%, usually in the presence of a =/> 0,5 cm focal lesion (3).

The chosen method for the detection of substitutive skeletal lesions is scintigraphy with diphosphonates, which evaluates the elevated metabolism of the osteoblasts in the presence of osteolysis producing a panoramic view.

As mentioned above, a solitary plasmacytoma is not evident, since in this neoplasia the neoplastic cells can release humoral factors which inhibit the osteoblastic activity.

In order to be identified at CT, a round skeletal focal lesion of 3 cm shown at MRI should have been a metastasis and should have determined an alteration in the bone density of the lythic type or of the thickening type or mixed (depending on the nature of the primitive tumour).

Thanks to the intrinsic contrast resolution between tissues, MRI is a technique that is very sensitive

to changes in the skeletal spongiform and, therefore, represents an ideal method for the study of myeloma.

Taking into account the data reported in literature, we believe that, in the near future, MRI will be a II level instrument, following radiographic examination, when a diagnostic uncertainty is present and for the stadiation of these neoplasms, thanks to the intrinsic characteristics of the technique, to the panoramic nature and to the reduced time of execution of the exam, made possible by the recent introduction of 32 channel phased array total body coils.

It is hoped that this exam will be extended to appendicular and peripheral bone seatings which, although they do not contain bone marrow, can also be involved even if only rarely.

In spite of the outstanding diagnostic possibilities offered by this technique, it is worth remembering that in around 20% of cases of negative results, the MR shows a bone marrow location which is the cause of an under stadiation in 10% of patients (7).

PET covers, today, an important role in the characterization of lesions of suspect heteroplastic nature; so far, the results emerging from some studies have pointed out its importance, but, above all, they have showed its usefulness in monitoring the response to therapy (12, 13).

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Accepted: November 24th 2008
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