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Case Report

# Multiple myeloma with intractable lumbar pain and diagnostic challenge with MRI: A case report☆,☆☆,★,★★

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ABSTRACT

We present a 63-year-old male patient with intractable bone pain and rapidly progressive osteoporosis, who was diagnosed with multiple myeloma (MM) by CT despite normal magnetic resonance imaging (MRI) findings. The gold standard diagnostic modality for MM is MRI as it can be used to sensitively evaluate bone marrow, however, the current case highlights that MRI is not always accurate in evaluating MM. CT in combination with MRI could be used for secondary osteoporosis with intractable bone pain in order to determine the diagnosis, treatment, and prognosis.



## Introduction

Multiple myeloma (MM) is a hematologic malignancy characterized by the uncontrolled proliferation of malignant plasma cells in the bone marrow, monoclonal protein in the blood or urine, and associated organ dysfunction [1]. The incidence of MM is known to increase with age with approximately 50 new cases occur per 100,000 persons each year in patients with an average age of 80 years at diagnosis [2]. The diagnosis of MM requires bone marrow aspiration or biopsy, most commonly from the iliac crest, that shows a bone marrow plasma cell population >10% with myeloma-related organ/tissue impairment [3]. MM accelerates osteoclast activity and suppresses

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osteoblast function, leading to osteolytic lesions [4]. The value of modern imaging for patients with MM is demonstrated by the diagnostic criteria for symptomatic MM. The criteria include (1) the presence of one or more osteolytic lesions detected by computed tomography (CT), whole-body low dose CT, or positron emission tomography (PET)-CT and conventional radiography (CR) and (2) the presence of one or more focal bone marrow lesions on magnetic resonance imaging (MRI) [3].

The typical findings on CR are punched-out lesions without reactive sclerosis of the surrounding bones [4]. Other features include diffuse osteopenia, fractures, and, rarely, osteosclerosis [5]. CT shows similar features to CR, but can also reveal smaller osteolytic lesions that CR cannot [4]. On MRI, diverse signal patterns, ranging from normal-appearing bone marrow to focal lesions or diffuse bone marrow infiltration, have been described [6]. On spin-echo T1-weighted images (T1WI), the MR signal intensity is typically decreased, but shows marked enhancement after the administration of contrast material [7]. Fat components account for the variability of patterns. Lesions typical of myeloma appear to have a lower fat content than normal bone marrow, resulting in a lower signal intensity in T1WI than the intervertebral disc [8]. Even in advanced stages of this disease, up to 20% of MR examinations can have normal findings [7]. A fluorodeoxyglucose (FDG) PET/CT scan and traditional technetium bone scintigraphy can also help to guide the diagnosis. Active lesions on a FDG PET/CT show hyper-metabolism when compared to the background level [9]. Meanwhile, a traditional technetium bone scintigraphy scan may detect lytic lesions in 35%-60% of patients with MM [4]. However, some papers have reported that the specificity and sensitivity of bone scintigraphy in detecting MM are lower than those of CR [10]. Here, we report a MM case with a diagnostic challenge using MRI.

## Case report

A 63-year-old man with a history of diabetes and hypertension had been experiencing lower back pain for 3 months. He had previously undergone interbody fusion surgery with posterior instrumentation fixation at the lumbar 1-2 (L1-2) level. About three months before visiting our hospital, he underwent a lumbar spine MRI which revealed spinal stenosis at the L4-5 level and multilevel disc herniations. The bone marrow signal was heterogeneous, but within the normal limits when adjusted for the patient's age. A posterior lumbar interbody fusion of the L4-S1 levels was performed to relieve the spinal stenosis. For three months postoperatively, the patient was under absolute bed rest without any medication. Despite the surgery, the patient's lower back pain did not improve. He was hospitalized three more times and underwent two more lumbar spine MRIs (Magnetom Essenza, 1.5T, Siemens). for evaluation of his intractable pain.

Due to the lack of symptomatic improvement, the patient was transferred to our hospital by ambulance. He then underwent a medial branch block due to the working diagnosis of L3-4 spinal stenosis. His symptoms persisted despite a slight improvement. The patient then underwent lumbar spine multidetector CT (CT Ingenuity Core 128, Philips) at our hospital for the first time. CT revealed many, small osteolytic lesions throughout the scanned skeleton that were not detected earlier by the three lumbar spine MRIs (Fig. 1). The osteolytic lesions were not surrounded by osteosclerotic rims. In addition, many osteolytic lesions were detected via simple radiographs of the skull, both humeri, pelvis, both femurs, and both tibia (Fig. 2). Comparing the pelvic CRs taken at the external hospital and our hospital, we found that the patient's osteoporosis had progressed very rapidly, despite a time difference of only 73 days (Fig. 3). It is important to note that he had not been previously treated for osteoporosis or other osteoporosis-related diseases. Therefore, the imaging findings were strongly suggestive of MM.

Biochemical investigations revealed hypercalcemia ($Ca^{2+}$ 11mg/dL, normal range [NR] 8.8-10.6mg/dL), mild anemia (hemoglobin 11.1g/dL, NR 13-17g/dL), elevated serum $\beta$2 microglobulin (3.43mg/L, NR 0.61-2.37mg/L), elevated serum free light chain kappa type (2440 mg/L, NR 3.3-19.4mg/L), and elevated urine free light chain kappa and lambda type (151.32 mg/L, NR 2.04-10.37mg/L). A diagnosis of MM, kappa type was finally confirmed by bone marrow biopsy, which showed 35.4% clonal bone marrow plasma cells. The patient was treated with VTD (combination of bortezomib (Velcade), thalidomide (Thalomid) and dexamethasone).

The patient has provided informed consent for the publication of this report.

## Discussion

Many papers have previously examined the sensitivity of CR, CT, and MR imaging in the diagnosis of MM. In several studies that compared the sensitivity of CR and MR imaging in the detection of bone involvement in MM, the degree of skeletal involvement was considerably underestimated on CR. CR is associated with a false-negative rate of 30%-70% [11–13]. In two papers that compared and analyzed the sensitivity of MM manifestation between CR and CT, CT was shown to be more sensitive [6,14]. Another study of 41 newly diagnosed MM cases found that whole-body MRI was superior to whole-body CT in detecting bone lesions in the skeleton. In that study, CT resulted in significant understaging in 11 of 41 patients with myeloma [15]. Therefore, by common consensus, MRI has become the gold standard for the diagnostic imaging of MM, followed by CT and CR [15,16].

In contrast to previous reports, osteolytic lesions caused by MM in the current case were not detected by multiple spinal MRIs. Despite a heterogeneous bone marrow signal on T1WI, the signal was higher than the intervertebral disc signal. Therefore, it was considered to be within the normal range. Only after a CT scan were numerous osteolytic lesions without sclerotic portions throughout the entire spine revealed. According to Mahnken et al.[6], 27.8% of the study population presented with two or more lytic bone lesions on CT that were not adequately recognized on MRI. As a result, the diagnosis was underestimated on MRI, but CT imagery guided clinical

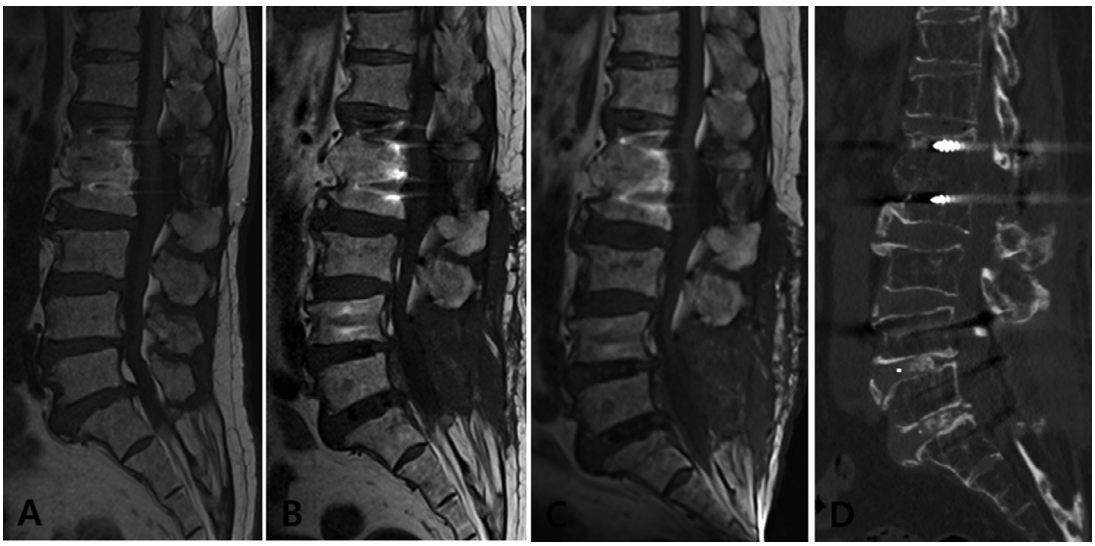


**Fig. 1 – Initial lumbar spine MRI (A) was performed to evaluate the cause of intractable lower back pain. Follow up lumbar spine MRIs were performed 33days (B) and 54 days (C) after initial examination. MRIs showed multiple disc lesions with postoperative changes. The bone narrow signal was heterogeneous, but within the normal range considering the patient's age. CT (D) which was taken 64 days after the initial MR examination revealed many, small osteolytic lesions throughout the visible thoracic and lumbar spine that were not detected by three previous MRIs.**

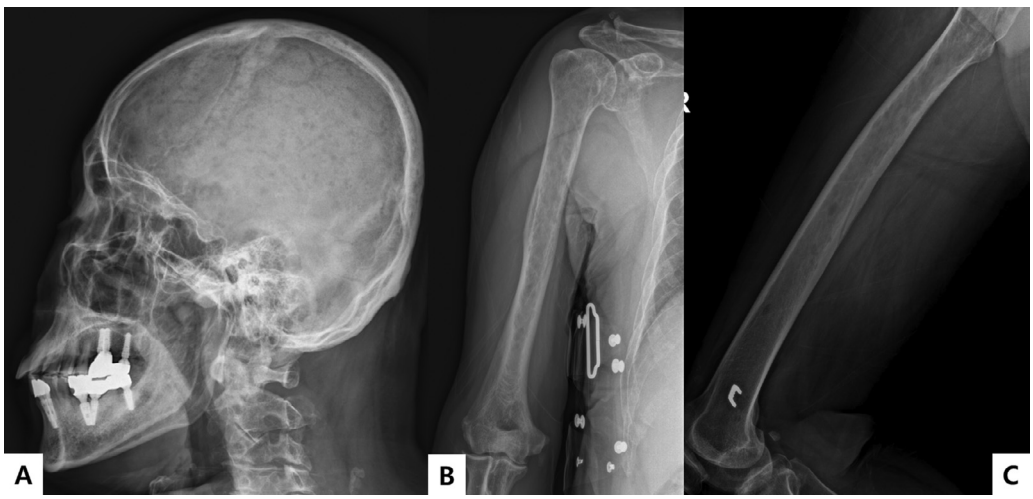


**Fig. 2 – Simple radiography of the skull (A), right humerus (B), and right femur (C) showed multiple osteolytic lesions, compatible with multiple myeloma.**

suspicion for MM. In our case, MRI, as well as bone scintigraphy, revealed no evidence of MM.

Osteoporosis is a metabolic skeletal disease defined as a reduction of bone mineral density below a defined lower limit of normal. The World Health Organization defines osteoporosis as a T-score less than −2.5 SD. Primary osteoporosis is defined when there is no cause. Secondary osteoporosis occurs due to a range of caused including endocrine disease, chronic illness, medications, nutritional distribution, etc. The imaging findings of osteoporosis need to be carefully considered to review why MRI did not display the underlying MM in this case. Since the patient did not have a history of osteoporosis, MM was a plausible explanation for the sudden osteoporotic deterioration. It is important to note that osteoporosis can also have a heterogeneous signal intensity on T1WI [17]. This occurs with the onset of osteoporosis because the cellular component of the bone marrow is reduced, while the fat component is increased [17]. Therefore, in some cases, MM and osteoporosis can exhibit similar imaging features. In such situations, correlation with CT could result in an accurate diagnosis.

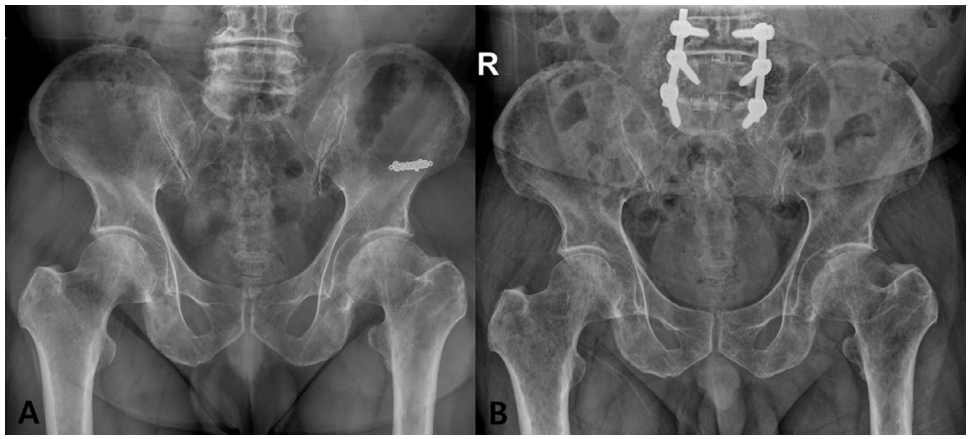


**Fig. 3 – Pelvic X-rays taken at the first outside hospital (A) and our hospital (B), showing that the osteoporosis had progressed very rapidly, despite a time difference of only 73 days.**

In addition, consideration of the secondary causes of osteoporosis in males, such as hematological disorders, endocrinological conditions, hypogonadism, glucocorticoid treatment, and alcoholism, is crucial [18]. Furthermore, in elderly and postoperative patients, MM and other hematological tumors induce a similar clinical picture to that of primary osteoporosis [18]. MM must be considered and ruled out in patients with fragility fractures and a fast-clinical course. Initially, the osteoporosis was attributed to the immobilization following lumbar surgery. However, secondary osteoporosis can be ascribed to MM.

Besides, the pelvis as well as the spine, are important to consider. While the rapidly progressive bone marrow changes were not detected on the spinal CR, the changes were visible on the pelvic CR. To the best of our knowledge, this is the first report of MM that was detected on spinal CT and pelvis CR. Although MRI is presently the modality of choice for the diagnosis of MM, in some cases, particularly those with a normal or multiple tiny well-defined radiolucent lesions (salt and pepper pattern) of MM involvement, CT should be considered.

## Conclusion

Here, we presented a case of MM involving the whole spine that was detected on CT only. MRI is currently the modality of choice for the diagnosis and evaluation of MM. In this case, we found that CT imaging detected osteolytic lesions, even when MRI indicated a normal skeletal appearance. Therefore, CT in combination with MRI, could be used as the method of choice. Furthermore, especially in male patients, osteoporotic conditions should undergo careful screening for secondary osteoporosis in order to determine the diagnosis, treatment, and prognosis accurately. A rapidly progressing clinical course and long-standing, unresolved bone pain are highly suggestive symptoms of a hematological neoplasm such as MM.

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