



Involvement of jawbones as a radiographic sign in multiple myeloma – case series reports

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Abstract

Multiple myeloma is the most common bone tumour characterised by the uncontrolled proliferation of malignant plasma cells. The study presents two case reports of patients with multiple myeloma with manifestation in the maxillofacial region, visualised with the use of a panoramic radiograph. The patients were admitted to hospital due to back pain caused by pathological changes in the vertebral column, including low-energy fractures. The treatment involved a combination of radiotherapy and chemotherapy. Patients were referred for panoramic X-ray and oral cavity sanitation, which revealed an increase in bone mineral loss and the presence of multiple osteolytic lesions. Similar radiological findings were observed in the jaws of both patients. Radiography, including dental panoramic radiographs, plays a crucial role in the detection of osteolytic lesions associated with multiple myeloma. Dentists, during routine check-ups, can be the first to detect osteoporotic changes in the bones.

Key words

multiple myeloma, panoramic radiography, osteolytic lesions

INTRODUCTION

Multiple myeloma (MM, plasmocytic myeloma, plasma cell myeloma) is a malignant neoplasm of the haematopoietic system, characterized by uncontrolled proliferation of monoclonal plasmocytes in the bone marrow. It is the most common bone tumour in humans and the second most common haematologic neoplasm [1–2]. The majority of MM patients are older adults, with an average diagnosis age of 69 years and an average death age of 74 years. Fatigue and bone pain are the most common symptoms. Other general symptoms include hypercalcaemia, renal insufficiency and anaemia. Symptoms most commonly observed in patients in the oral cavity are swellings or diffuse infiltrates, without inflammatory foci in the mucosa and skin.

Approximately 90% of patients with MM develop bone lesions during the course of their illness, mainly in the flat and long bones, 30% of cases are observed in the facial part of the skull, which emphasizes the importance of imaging examinations in diagnosis and follow-up [3–5]. Osteolytic lesions in mineralized bone can be detected through conventional radiography, computed tomography (CT), or CT in positron emission computed tomography (PET/CT), with whole-body low-dose CT emerging as the new standard for their initial detection, endorsed by European Society for Medical Oncology (ESMO) and European Migrant Network (EMN), replacing conventional skeletal surveys for diagnosis. Magnetic Resonance Imaging (MRI) is valuable for detecting both focal and diffuse infiltration patterns associated with multiple myeloma, providing crucial insights into tumour

mass and potential cytogenetic risk factors. In particular, the EMN recommends MRI primarily for asymptomatic patients with osteolytic lesions detected on CT. Additionally, 18F-FDG-PET/CT is a viable option for evaluating bone lesions in the context of multiple myeloma diagnosis.

Panoramic radiographic evaluation is not currently included in the protocols of the International Myeloma Working Group (IMWG) for complete radiographic investigation in patients with MM. However, due to its wide availability and potential for detecting bone lesions, it may contribute to the early diagnosis of myeloma by dentists. On radiographic imaging, the characteristic lesions are round radiolucencies without a sclerotic rim. These lesions are described as stippled or punched-out [4–6]. Despite the fact that panoramic radiographs are valuable and technically easy procedures for determining lesions, it should be recognized that there are obvious limitations in these x-rays, including distortions, magnifications, and difficulties in identifying the relationship of the lesions with vital structures. An additional limitation of a panoramic X-ray in the diagnosis of multiple myeloma is the fact that it only allows for the diagnosis of the maxillofacial area. Due to the non-specific radiological image, the differential diagnosis includes giant cell tumour, mucormycosis, cysts and sclerosis.

OBJECTIVE

The aim of the study was to present a series of case reports of patients with multiple myeloma with manifestation in the maxillofacial region, visualized with the use of a panoramic radiograph.

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CASE REPORTS

Case Report 1. A 52-year-old woman diagnosed with plasma cell tumour of the L3 vertebral body was admitted to the Department of Traumatology and Orthopaedic Surgery with severe back pain. The patient underwent transpedicular stabilization of L2-L5 and decompression of the L3 spinal cord through laminectomy. A series of radiotherapy to the lumbar spine with a dose of 20 Gy was applied in the patient, and in the case of a plasma cell myeloma diagnosis, the future treatment plan included chemotherapy. Laboratory test showed a decreased level of haemoglobin (Hb 11.2g/dL) and elevated calcium (Ca^{++} 2.64 mmol/l). Other lab results were normal. Based on the histopathological examination, a plasma cell tumour of the L3 vertebral body was diagnosed.

The patient was directed to the Chair and Department of Oral Surgery of the Medical University of Lublin by the haematologist for the purpose of oral cavity sanitation. The dental surgeon referred the patient to the Department of Radiodiagnostics, Medical University of Lublin for panoramic X-ray. The first examination was performed five years before the diagnosis of multiple myeloma revealed generalised thinning of the bone structure and small, well-defined without sclerotic rim also called as ‘punched out appearances’, and single, unilocular round radiolucencies located in the region of the roots of tooth 36 and right angle of the mandible. The current panoramic radiograph showed a progression of lesions, i.e. the presence of many well-defined, unilocular, multiple osteolytic lesions of various sizes, particularly in the area of the body and both angles of the mandible, as well as an increase of mineral bone loss [Fig. 1].

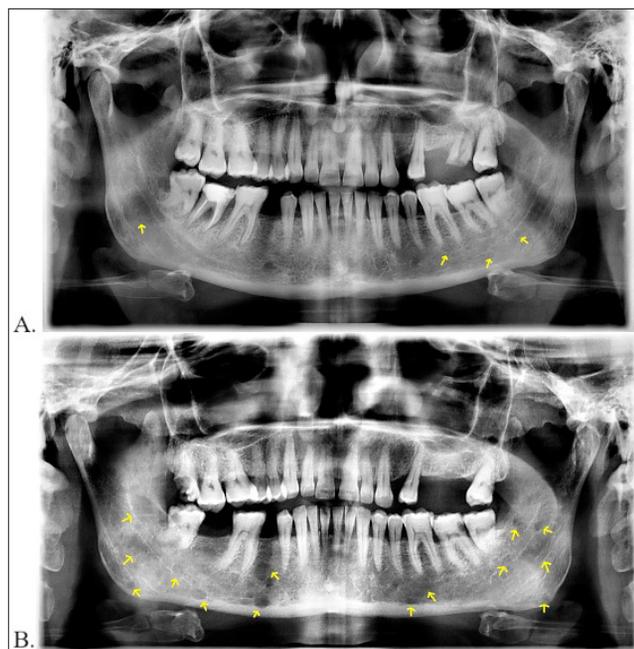


Figure 1. Case Report 1. Panoramic radiographs illustrating the presence of multiple osteolytic lesions, particularly in the area of the body and both angles of the mandible, A – 5 years before, B – patient’s radiograph at the time of establishing diagnosis of multiple myeloma.

Case Report 2. The second patient was a 49-year-old female diagnosed with multiple myeloma. The patient experienced low energy fractures of the vertebral bodies of L3, L4, and Th9. Radiation therapy was performed on the area of the

thoracic vertebral column. The patient was resistant to first-line chemotherapy (VTD), and as the second-line received ixazomib-Rd. Laboratory test showed a decreased level of haemoglobin (Hb 8.6g/dL). The patient was referred for facial CT scan. The examination revealed multiple scattered osteolytic lesions within the bony structures of the craniofacial bones and base of the skull, jaw, and cervical vertebrae. The patient reported for oral cavity treatment. The dental surgeon referred the patient to the Department of Radiodiagnostics of the Medical University in Lublin for panoramic X-ray and CBCT. These examinations confirmed the presence of well-defined large multiple radiolucencies without sclerotic rim located in the both ramus and the body of the mandible, in the areas of mandibular premolars and molars [Fig. 2].

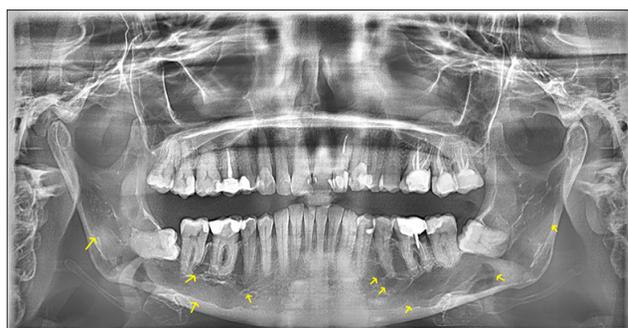


Figure 2. Case Report 2. Panoramic radiograph showing radiolucencies in the bone structure of both ramus and the body of the mandible, in the areas of mandibular premolars and molars

DISCUSSION

The evolution of myeloma destroys the balance between the activity of the osteoblasts and the osteoclasts, which leads to the suppression of bone formation of the osteoblasts and the decoupling of the activation of the osteoclasts [3]. With the progression of the disease, bone formation decreases, resorption increases, and bone loss accelerates, leading patients to pathological fractures and potential invasion of soft tissue.

Radiography plays a crucial role in identifying osteolytic lesions associated with multiple myeloma. However, panoramic radiography, often used for jaw examinations due to its ease of use, cost-effectiveness, and low radiation doses, has its limitations. They include distortions, magnifications, and challenges in determining lesion relationships with vital structures. Furthermore, panoramic X-rays only present the maxillofacial area, limiting their scope. Although panoramic radiograph is not a part of the International Myeloma Working Group (IMWG) protocols, dentists frequently employ panoramic radiography and are often the first to detect bone osteoporotic lesions.

Panoramic imaging alone is not typically used for the first assessment of multiple myeloma. While panoramic X-rays can reveal abnormalities in the jaws, these findings are usually non-specific and might not provide enough information for a definitive diagnosis of multiple myeloma. Accidental discovery of jaw lesions can occur, but a conclusive diagnosis and staging of the disease require additional tests.

Maxillofacial lesions in multiple myeloma are not always first seen in the jaws. In fact, foci in the facial area occur in the later stages of the disease. This manifestation suggests

that the malignant tumour has spread and is affecting bones and tissues in the face, indicating an advanced stage of the condition. The most common locations of multiple myeloma lesions are the lumbar spine, pelvis, and ribs. Foci in these areas are typically detected first, and maxillofacial involvement happens as the disease progresses.

For the diagnosis and staging of myeloma, the preferred initial imaging examination remains the skeletal survey. Patients suspected of having multiple myeloma undergo a radiographic skeletal survey, typically including lateral skull radiographs, anteroposterior (AP) and lateral spine views, and AP views of the humeri, ribs, pelvis, and femora. These bones are crucial for accurate diagnosis and staging. CT and MRI are highly effective for diagnosis, with MRI serving as the gold-standard modality for detecting bone marrow involvement and ruling-out spinal cord compression. PET/CT offers valuable prognostic insights and helps assess therapy responses.

In 2014, the IMWG updated MM diagnosis criteria, stating that the presence of more than one lytic lesion on CT, Whole Body Low Dose Computed Tomography (WBLDCT), or PET/CT regardless of detection on skeletal radiography and more than one unequivocal (≥ 5 mm in size) bone marrow focal lesion (FL) on MRI, fulfills the criteria for MM-related bone disease.

On panoramic radiography, multiple myeloma foci often present as small round bone lesions lacking a sclerotic margin, distinguishing them from the osteoporotic foci typically observed during disease expansion [1]. Internally, these lesions commonly exhibit shallow and multilocular bone destruction. Lesions with undefined edges and cortical bone destruction are associated with more aggressive forms of the disease.

Radiologically, three distinct forms of plasma cell myeloma can be identified. In the first form, the bone image appears normal, or bone resorption is so minimal that it is challenging to detect. In the second form, multiple round lucencies without a sclerotic border are visible, indicating the presence of multiple foci of plasma cell proliferation within the bone marrow. In the third form, there is a generalized thinning of the bone structure and osteoporotic foci, resulting from the complete infiltration of the bone marrow by cancer cells.

Multiple myeloma radiographic images are not pathognomonic and require differential diagnosis of other pathological diseases. MM, along with other important bone marrow diseases, such as Ewing's sarcoma and histiocytic lymphoma, and aggressive haematological diseases, such as thalassemia, sickle cell anaemia, and leukemia, can cause bone defects and destruction [3].

Based on X-ray images, clinicians can differentiate multiple myeloma from conditions such as Ewing's sarcoma, histiocytic lymphoma, thalassemia, sickle cell anaemia, and leukemia. In X-ray images of Ewing's sarcoma, periosteal reactions and bone formation are present, creating a moth-eaten appearance, which helps distinguish it from osteomyelitis. Radiologically, lymphoma appears with ill-defined foci, onion-skin periosteal reactions, and a 'teeth floating in space' appearance. Thalassemia X-ray images show osteoporosis, widening of the medullary cavity, a 'hair-on-end' skull appearance, bone and marrow inflammation, facial bone overgrowth, enlargement of the dental socket outline,

bite disturbances, and foci in trabecular bone appearance. In leukemia X-ray images, foci resembling inflammatory lesions of the periapical region are present, poorly defined lucencies that can expand within the periodontal space. Foci spread within the marrow cavity without expanding the compact plates. In contrast, multiple myeloma X-ray images show well-defined multiple radiolucencies that are referred to as punched-out lesions or infiltrates with a poorly defined margin.

Jawbone osteolytic foci are often observed synchronously with lesions in the skull and other bones. Cone-beam computed tomography (CBCT) has gained recognition for its high precision and lack of overlap between adjacent structures, making it an effective alternative to two-dimensional radiographs for assessing extensive bone lesions.

Patients diagnosed with multiple myeloma (MM) can experience other osteolytic foci in the facial region simultaneously. These lesions can include dental diseases such as periodontal diseases, endodontic changes, and cavities, among others. The presence of these additional facial bone disorders alongside MM can complicate the differential diagnosis process. The overlapping symptoms and radiological findings between MM and other facial conditions can make it challenging for clinicians to distinguish between them when based solely on clinical evaluation and imaging. Therefore, a comprehensive and detailed assessment, often involving a combination of clinical, radiological, and laboratory examinations, is crucial for accurate diagnosis and effective management of patients with multiple myeloma and concurrent facial bone lesions.

CONCLUSIONS

Osteolytic lesions are one of the fundamental signs of multiple myeloma, especially in areas of strong haemopoetic activity. X-rays are generally an integral part of diagnostic processes, allowing the severity of the disease to be assessed, and as an important indicator for the evaluation of clinical cases by dentists. In addition, given the wide availability of digital panoramic radiographs, this study illustrates the contribution oral assessment can make to early diagnosis, rapid treatment, and prognosis of MM patients. The dentist plays a fundamental role in the diagnosis process, not only in supporting, but also in recognizing the symptoms that may predict systemic manifestations in the maxillofacial region.

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