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Incidental Diagnosis of Multiple Myeloma on MRI Brain with A Short Review of Literature

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Abstract

Multiple Myeloma (MM) is a malignant disease that is caused as a result of the abnormal proliferation of plasma cells in the bone marrow. Magnetic resonance imaging (MRI) has the upper hand in radiological investigations as it has excellent bone, bone marrow and tissue differentiation. We report a case of a middle-aged woman who presented to us with a history of headache and a decrease in vision in the right eye for a week; later on, diagnosed as a case of multiple myeloma.

Keywords: Multiple Myeloma, Lytic Lesions, Retinal Detachment

List of Abbreviations

MM: Multiple Myeloma
MRI: Magnetic Resonance Imaging

Introduction

Multiple myeloma is a malignant monoclonal gammopathy defined as a chronic, progressive neoplastic proliferation of the plasma cells in which there is a production of immunoglobulins that principally occurs in the bone marrow but may also appear in other organ systems. The abnormal immunoglobulin causes a decrease in the production of normal red blood cells, white blood cells, platelets and alteration in the serum calcium levels. MRI helps in the identification of the involved parts like bones and soft tissues. MRI offers information about the morphology and the identification of bone marrow and soft tissue involvement. Dynamic contrast-enhanced MRI and diffusion-weighted sequences provide additional information about bone marrow vascularity and cellularity. A case of multiple myeloma in a 56-year-old female has been discussed in this case report.

Case Presentation

A 56-year-old female presented to our hospital with sudden onset painless vision loss in the right eye and headache since one week. The headache, as described by the patient, was global and moderate in intensity, and there was no perception of light in the right eye. On fundus examination, there were tortuous and dilated retinal veins with dot-blot haemorrhages in all four quadrants in the right eye. She had no neurological deficit on the clinical examination. She was advised a magnetic resonance imaging (MRI) scan of the brain for further evaluation.

The MRI revealed multiple, small, well-defined masses in the calvarium, greater wing of left sphenoid with extra-dural plus extra-conal components, clivus and right lateral wall of sphenoid sinus, which appeared hypointense on T1, T2 & FLAIR sequences and hyperintense on STIR [Figure 1]. These masses also showed avid post-contrast enhancement [Figure 2]. In the right orbit, there was a V-shaped membrane showing fluid signals on all sequences, in the posterior segment attached posteriorly to the optic disc, suggestive of a retinal detachment [Figure 1]. The differential diagnosis of multiple myeloma and metastatic deposits in the skull was given based on the MRI findings. For further work-up, she was sent for blood investigations, renal and liver profile, serum calcium and alkaline phosphatase levels. Her blood picture revealed pancytopenia, the values of RBCs, WBCs and platelets being 6.4 mg/dl, 5700 cu/mm and 45 000/cms, respectively. After viewing the reports, she was advised for a bone marrow aspiration which revealed that there were 40% plasma cells in her marrow. To confirm, she was also sent for serum protein electrophoresis, which suggested monoclonal gammopathy (M-band=7.5g/dL).

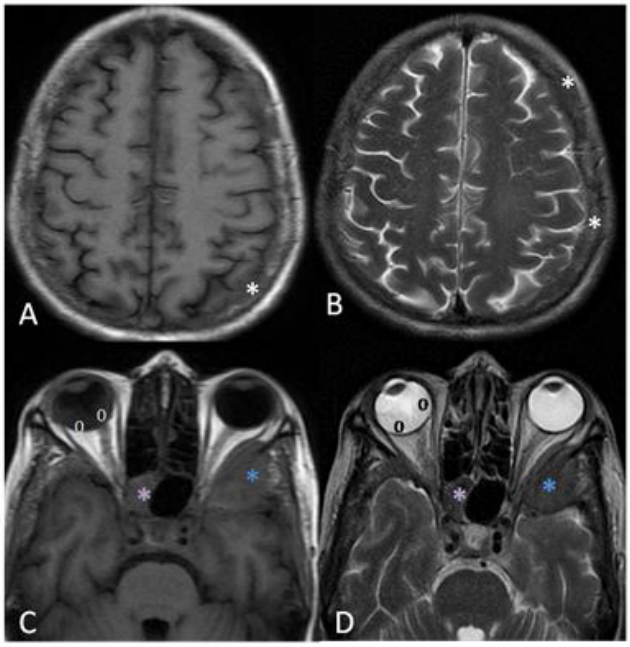

Figure 1: Axial sections from T1 (A & C) and T2 (B & D) weighted images MRI brain depicting well-defined, hypointense masses in the calvarium (white asterisk), greater wing of left sphenoid with extra-dural and extra-conal components (blue asterisk), clivus and right lateral wall of the sphenoid sinus (purple asterisk). In the right orbit, there is a V-shaped membrane showing fluid signals on T1 and T2WI, in the posterior segment attached posteriorly to the optic disc, suggestive of retinal detachment (black and white circles).

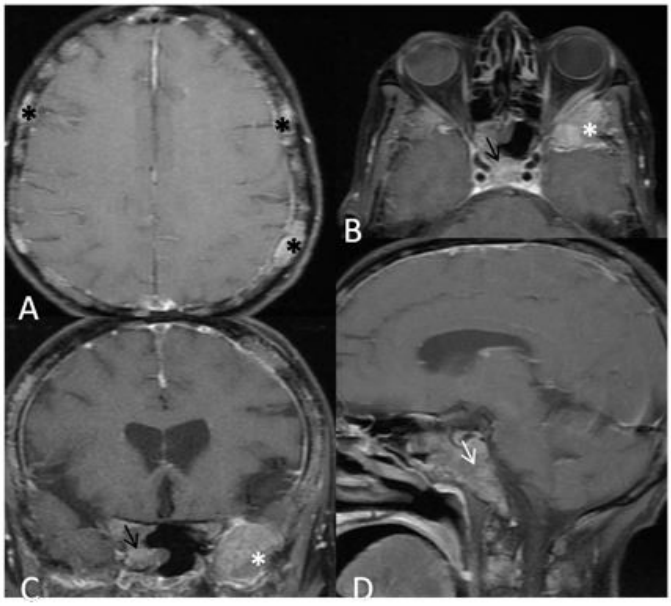

Figure 2: (A, B, C & D) Post-contrast T1WI axial, coronal and sagittal images from MRI brain showing well-defined, intensely enhancing masses in the calvarium (black asterisk), greater wing of left sphenoid with extra-dural and extra-conal components (white asterisk) and right lateral wall of the sphenoid sinus (black arrows), and clivus (white arrow).

On the basis of MRI findings, the differential diagnosis of plasma cell disorders and metastatic deposits were considered. However, on further detailed evaluation using the blood profile, bone marrow aspiration and plasma cell electrophoresis, multiple myeloma was considered as the final diagnosis.

Discussion

Multiple myeloma is a common malignancy in patients above 40; 70% of cases are diagnosed between ages 50 and 70 with a median age of diagnosis being 70 years; there is a male predilection (M: F 2:1). It accounts for 1% of all malignancies and 10-15% of all hematological neoplasms. Black populations are affected at nearly twice the rate as White populations. Abnormal proliferation of plasma cells leads to a malignant plasma cell disorder which is commonly known as multiple myeloma. This disorder causes bone pain with laboratory abnormalities consisting of anaemia, hypercalcaemia, high erythrocyte sedimentation rate with normal C-reactive protein, and a high total level of serum protein with overproduction of globulins (IgM, IgA) resulting in a low albumin to globulin ratio. There is also a hyperuricaemia due to increased cell turnover and proteinuria with urinary excretion of Benz-Jones light chain immunoglobulin, both of which are nephrotoxic, leading to a renal failure. There may also be an immunoglobulinopathy associated retinal detachment. The disease evolves from an asymptomatic premalignant stage, monoclonal gammopathy of undetermined significance (MGUS), over smouldering multiple myeloma (SMM), to symptomatic MM with end-organ damage, such as hypercalcemia, renal impairment, anaemia and bone disease [1,2].

There are four main patterns for presentation of multiple myeloma: disseminated form with multiple round lytic lesions, disseminated form with diffuse osteopenia, solitary plasmacytoma and osteosclerosing fibroma. Multiple myeloma lesions are usually disseminated through the axial skeleton and most commonly affects vertebrae, ribs, skull, pelvic girdle and proximal appendicular skeleton. The differential diagnosis of lytic skull lesions include metastasis, multiple myeloma, hemangioma, sarcoidosis, Paget's disease, plasmacytomas which can be differentiated using imaging modalities like radiographs, CT, MRI, PET CT along with the clinical details.

Calvarial lesions are usually asymptomatic and are incidentally discovered on MRI or computerized tomography (CT). Clinical history and blood investigations play an important part in aiding the radiological diagnosis [3-5]. MRI is superior to detect bone marrow involvement.

The lesions appear hypointense on T1WI, hyperintense on T2WI and show contrast enhancement. The signal intensities on MR images are based on the proportionate composition of red and

yellow marrow and to a lesser extent mineralized matrix. [6,7] Lesions with a high amount of water and high cellularity are seen on STIR images as hyperintense structures, with corresponding hypointensity on T1WI. Five different infiltration patterns have been described on MRI, the most common pattern being the "salt and pepper" pattern of inhomogeneous bone marrow infiltration. The other four patterns of lesions include the normal bone marrow despite the microscopic cell infiltration, focal involvement, homogeneous diffuse infiltration and combined diffuse and focal infiltration. In our case, the focal infiltration pattern was seen.

The presence and number of focal lesions are significant prognostic factors which determine the progression from MGUS or SMM to MM. The IMWG consensus statement now recommends that SMM patients with more than one unequivocal focal lesion with diameter > 5 mm should be considered symptomatic that requires treatment. Patients with equivocal focal lesions are advised to repeat the MRI after three to six months. In case of progression on MRI, patients should be considered symptomatic who need therapy. Patients who have MGUS and focal lesions on MRI have an increased risk of progression to myeloma. Till date, there is no recommendation of MRI as part of the routine workup for patients with MGUS unless there are clinical features that increase suspicion of progression to MM.

Skeletal survey using x-ray is the most cost-effective modality for diagnosing multiple myeloma but the detection of lytic lesions may be challenging due to overlying structures. It has limited sensitivity since the lytic lesions are detected only when there is 30-50% loss of trabecular bone. Whole body low dose computed tomography has a higher sensitivity than skeletal survey. FDG/PET has the ability to differentiate metabolically active and inactive disease sites which is the gold standard method for evaluation and monitoring of response to therapy as recommended by the IMWG.

There are various complications of multiple myeloma including anemia, bone marrow failure, bleeding disorders, renal insufficiency, pathologic fractures, intracranial plasmacytomas, leptomeningeal carcinomatosis.

Our case is unique, as the patient presented with non-specific features of myeloma and was incidentally diagnosed on the basis of suspicion on MRI findings. Thus, MRI brain should be thoroughly evaluated, as there may be imaging features that aids in making the final diagnosis.

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