Case report: solitary bone plasmacytoma: the unusual case of extra-cranial mini brain

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ABSTRACT
Solitary plasmacytoma is an uncommon tumor. We present a case in an unusually young patient demonstrating the mini brain sign that has been published in a couple of reports as a diagnostic radiological pattern produced by plasmacytoma. Identification of “mini brain appearance” on imaging can direct the radiologist and clinicians to the diagnosis of plasmacytoma and obviate the necessity of pre-operative biopsy.

CASE PRESENTATION
A 25-year-old male patient presented with weakness of both upper and lower limbs with gait disturbance for 1 month. There was no history of trauma.

INVESTIGATIONS
Hematological evaluation revealed an elevated erythrocyte sedimentation rate. Radiographic examination included CT that showed an osteolytic lesion with soft tissue component involving C7 and D1 vertebral bodies (Figure 1). MRI showed a lytic lesion in C7 and D1 vertebral body appearing mildly isointense on T1 weighted (T1W) images and hyperintense on T2 weighted (T2W) images compared to adjacent normal vertebral bodies signal (Figure 2). T1 weighted post IV Gad contrast shows intense homogeneous enhancement. (Figure 3). Associated radially arranged thickened cortical struts appearing hypointense on gradient echo image, mimicking cortical sulci in the brain with a similar imaging appearance was seen on CT scan (Figure 4). It was also noted that cortical thickening was seen in the posterior element of C7 vertebra as well (Figure 5). Based on the characteristic imaging findings, a provisional diagnosis of vertebral plasmacytoma was made. The diagnosis was confirmed by post-operative excised tumor histopathological analysis (Figures 6 and 7).

DIFFERENTIAL DIAGNOSIS
First pathology with such characteristic sign is plasmacytoma; however, other possible diagnoses along with radiological differentiating features include aggressive hemangioma and paget’s disease, which have different MRI signal characteristics than our case. Primary bone tumors usually show specified radiological features for each type with occasional overlap, but there was no mini brain sign or trabecular bone pattern reported in any of it. Primary bone lymphoma shows permeative bone destruction patterns rather than clear defined borders or bone trabeculation. Vertebral compression fracture usually will lack a soft tissue component and metastasis is a possibility; however, lesions are usually located in pedicles and tend to cause pathological compression fracture if vertebral bodies were involved. Lastly, chronic osteomyelitis, however, is less likely as the intervertebral discs are preserved in this case where they tend to be involved and destructed in the latter.

TREATMENT
Pre-operative digital subtraction angiography (DSA) has been performed for tumor embolization to facilitate surgical excision (Figure 8). Surgical removal of the tumor was successful. The patient symptoms had improved gradually after the surgery.

OUTCOME AND FOLLOW UP
On outpatient follow-up patient is able to walk on his own with total regain of his upper and lower limbs power. He was referred to a different facility to continue with radiotherapy/chemotherapy treatment.

DISCUSSION
Solitary plasmacytoma is a rare tumor and observed in 3–7% of patients with plasma cell neoplasms.1-4 The lesion is commonly found in the axial skeleton with a pre-dominant

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Lytic component.\textsuperscript{4} Often, the lesion is present for many years as a single lesion; however, occasionally it can progress to multiple plasmacytomas. An association with multiple myeloma has been observed, but plasmacytoma can present prior to laboratory findings of multiple myeloma for years.\textsuperscript{1–3,5}

There are many vertebral-based tumors encountered in the practice of radiology, which show non-specific radiological features in terms of MRI signal characteristics and specially if the whole vertebral body was involved. This case report illustrates the appearance of a mini brain sign on axial images of MRI, which has been described in few prior case reports and a case series.\textsuperscript{1–6}

The characteristic appearance of thickened radially arranged cortical bands that resemble cortical sulci (hence the name) has been suggested to be a result of a stress-like effect caused by lytic process of the plasmacytoma directing the rest of the unaffected bone component to increase size and thickness to compensate for the damaged and weakened component. This radiological feature has been described on MRI in literature but a retrospective comparison with CT depict those dense bands clearly as well; however, no supporting data from literature is available. A probable explanation for this appearance is more suggestive of plasmacytoma known of less aggressive nature that appears to be unique to this tumor compared with other malignant tumors aggressively destroying the bone with no radiological evidence of expected bone repair features such as sclerosis and thickening.\textsuperscript{1,4}

A case control study conducted in San Paulo-Brazil evaluating the sensitivity and specificity of mini brain sign observed on MRI to diagnose multiple myeloma and plasmacytoma revealed sensitivity of 80%, the specificity was 97.6%. The study reported
a 100% specificity and sensitivity providing that differential diagnosis have included spinal neoplastic lesions only concluding its significant reliability to establish diagnosis of multiple myeloma or plasmacytoma.6

Trabecular bone thickening has been a reported radiological feature of hemangioma and paget’s disease;7 however, both lack the appearance of mini brain on axial MRI imaging, neither demonstrate a low signal on T1 weighted image and high signal on T2 weighted image.1 In our case T1 weighted images shows an iso-intense signal; however, the mini brain sign was more suggestive of the diagnosis.

A possible limitation is a potential mimic of the mini brain appearance that has been described in literature in patients who develop infection post-spinal fusion surgeries in addition to those who had undergone vertebral bone grafting where the material shows randomly oriented positions that could possibly resemble the cortical struts seen in our mini brain. Thus clinical correlation is the key in differentiating those conditions from a neoplasm.1

Identification of “mini brain appearance” on imaging can direct the radiologist and clinicians to the likely diagnosis of plasmacytoma and obviate pre-operative biopsy even in young age presentation as we have described in our case.
Figure 7. Immunohistochemistry markers were positive for CD38 (A) and CD138 (B). CD79a some cells were positive (C). κ is strongly positive (D). λ was negative (not shown).

Figure 8. Pre-operative DSA shows the lesion to be hypervascular (A) post-embolization had significantly reduced vascularity (B). DSA, digital subtraction angiography.
LEARNING POINTS

1. The case presented has shown a classic radiological sign of plasmacytoma even at a young age directing radiologists to the diagnosis and obviating the need for pre-operative biopsy.
2. The described sign has been reported in vertebral body plasmacytoma only; however, in the current case, it has been well-demonstrated in posterior vertebral elements as well.

PATIENT CONSENT

Written informed consent for the case to be published (including images, case history and data) was obtained from the patient(s) for publication of this case report, including accompanying images.

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