Involuted intraosseous lipoma of the sacrum showing high signal intensity on T1-weighted magnetic resonance imaging (MRI)

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Abstract Involuted intraosseous lipoma with extensive fat necrosis resulting in cyst formation (Milgram stage III) is distinguishable from lesions without necrosis (stage I) or lesions with focal fat necrosis (stage II), based on differences in signal intensity on magnetic resonance imaging (MRI). Fat tissue has a high signal intensity on both T1- and T2-weighted MR images, whereas the extensive fat necrosis that results in cyst formation shows high signal intensity on T2-weighted images and low intensity on T1-weighted images. We report a patient in whom an intraosseous lipoma with high signal intensity on both T1- and T2-weighted MRI was found to be extensively involuted on histopathologic examination. Intraosseous lipoma appears to undergo spontaneous involution. In some patients, therefore, surgical excision may not be necessary. A correct preoperative diagnosis should reduce the necessity for a biopsy or surgery. Although lesions classified as stage I or II are easily identified by MRI, those of stage III are difficult to diagnose preoperatively by this method.

Key words Intraosseous lipoma · Sacrum · Magnetic resonance imaging · Fat necrosis · Involution

Introduction

Intraosseous lipomas are benign tumors that occur in approximately 1 of 1000 bone tumor patients. The lesion primarily consists of fat tissue. Intraosseous lipomas frequently involute spontaneously through the processes of infarction, calcification, cyst formation, and reactive bone formation. In some instances, the lipocytes of the original lesion may not be identifiable histopathologically, but lipomas with involutional changes have characteristic radiographic and microscopic morphologic features.

Based on his clinicopathological study of 66 cases, Milgram advocated classifying intraosseous lipoma into three stages by the degree of involution: stage I, solid tumors composed of viable fat cells; stage II, transitional phase tumors with partial fat necrosis and focal calcification, but regions of viable fat cells as well; and stage III, late phase tumors in which the fat cells have died and there is a variable degree of cyst formation, calcification, and reactive woven bone formation. He reported that local treatment was usually sufficient for stage III intraosseous lipomas and that these lesions were treatable by observation alone. Because intraosseous lipoma appears to undergo spontaneous involution, surgical excision may not be necessary when an accurate assessment of the degree of involution and accurate preoperative stage diagnosis are possible.

Blacksin et al. used MRI for a more definitive diagnosis in their radiologic-pathologic correlation study: lesions consisting of variable fat tissue had a high signal intensity on both the T1- and T2-weighted MR images, whereas those with extensive fat necrosis had a low signal intensity on the T1-weighted scans and high intensity on the T2-weighted scans. This finding has yet to be confirmed, because the MRI manifestation of stage III has been described in only two patients.

We report a patient with a stage III intraosseous lipoma, whose MRI findings were representative of stage II.

Case report

A 49-year-old Japanese man was referred to us because of a sacral tumor seen on a plain radiograph taken for the presenting complaint of back pain. There was no...
significant medical or family history. Rectal examination detected a palpable hen-egg-sized, bony hard, smooth-surfaced tumor in the anterior aspect of the sacrum. The intraosseous radiolucent lesion present on the lateral plain radiograph was round and well demarcated, and protruded into the pelvic cavity. The anterior cortex in the fourth and fifth sacral vertebrae was eroded, and calcification was visible in the center of the lesion (Fig. 1). Computed tomography (CT) detected a well marginated, low-density lesion and areas of central calcification (Fig. 2). MR examinations were done with a permanent magnet system at a field strength of 0.3T (MRP-7000-0; Hitachi Medical, Tokyo, Japan). Section thickness was 9 mm, with a 1-mm gap between sections. Standard spin echo sequences were obtained for the coronal and sagittal planes. Coronal T1-weighted imaging was done at TR 700/TE 25, and sagittal T2-weighted imaging at TR 2000/TE 90. The T1-weighted coronal plane image showed a high signal intensity, and the T2-weighted sagittal plane image showed slightly high intensity within the lesion (Fig. 3a,b). The lesion was cold on a Tc-99m-methylene diaphosphonate (MDP) bone scan.

**Surgical procedure**

Surgery was performed 2 weeks after the preoperative radiographic examinations. The tumor was resected using a posterior approach, fenestrating the lateral side of the hiatus sacralis. The entire lesion appeared to be a cystic cavity with sclerotic rims of reactive new bone containing serous fluid, rather than a solid mass of tissue. After the fluid was suctioned off, no solid mass of tissue which might give a high signal intensity on a T1-weighted MRI was detected.

As much as possible of the thin soft brownish tissue lining the cystic cavity wall was scraped away, and the small tissue fragments obtained were submitted to histopathological examination.

**Pathological observations**

The lining tissue was composed of mature fat cells and extensive degenerative, necrotic fat cells, interspersed with irregular woven bone trabeculae (Fig. 4). Histologically, these findings were consistent with stage III intraosseous lipoma.

**Discussion**

MRI is a low-specificity imaging method, but its differentiation of tissue components, such as hematoma, fat,