Clinical Case Report

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Multifocal intraosseous hemangioma

A case report

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Abstract

Rationale: Multifocal intraosseous hemangioma, which affects multiple body parts, is rare. The selection of appropriate lesion sites for biopsy and effective treatment in multifocal intraosseous hemangioma is challenging. Here, we report a case of multifocal intraosseous hemangioma.

Patient concerns: A 49-year-old woman was admitted to our department with a chief complaint of aggravated lumber pain for 10 days.

Diagnoses: Radiographic imaging revealed lesions involving the bilateral ribs, lumbar vertebrae, ilium, pubis, and proximal femur. Open biopsy in the ilium established the pathological diagnosis of intraosseous hemangioma.

Interventions: For the symptomatic lumbar spine, the patient selected radiotherapy as the initial treatment.

Outcomes: As of the one-year follow-up, no symptoms of recurrence have been observed.

Lessons: This rare case demonstrates the importance of the selection of the appropriate lesion to confirm the diagnosis and effective treatment for patients with multifocal disease. Radiotherapy plays an important role in the treatment of patients with symptomatic vertebral hemangiomas without neurologic deficits.

Abbreviations: CT = computed tomography, MRI = magnetic resonance imaging.

Keywords: intraosseous hemangioma, multifocal, radiographic features, radiotherapy

1. Introduction

Intraosseous hemangiomas are benign vascular tumors that account for less than 1% of all bone tumors.[1] These rare, slow-growing tumors exhibit female predominance, with a male-to-female ratio of 1:2.[2] These tumors are most commonly observed in the spine (30%–50%) and skull (80%), with the involvement of long and flat bones being very rare.[2–6] Intraosseous hemangiomas are rarely multifocal, being generally unifocal within a single bone or region.[7–9] Few reports have described multifocal intraosseous hemangiomas involving different parts of the human body (Table 1),[7,10,11] which vary in clinical manifestation and treatment options. Given their rarity and variable radiological appearance, intraosseous hemangiomas of long and flat bones are not easily diagnosed. Diagnosis in multifocal diseases is very difficult. Here, we report a rare case of multifocal intraosseous hemangioma in a 49-year-old female, with uncommon sites, including the bilateral ribs, lumbar vertebrae, ilium, pubis, and proximal femur, being involved. The radiographic features and pathological appearance were typical. In this report, we focus on the radiographic features of each region of involvement, the selection of biopsy sites and subsequent treatment.

2. Case presentation

A 49-year-old woman was admitted to our department with a chief complaint of repeated lumbar pain for 20 years and aggravated symptoms for 10 days. Twenty years prior, the patient began to experience lumbar pain after strenuous activity and downward bending. No radicular pain referred pain, numbness, or disability was noted. Although the symptoms were persistent, the patient did not visit a hospital for further examination and treatment because the severity of her symptoms was progressing slowly, and the pain was alleviated after recumbent rest. Fifteen years prior, the patient started to experience slight pain in the left chest without dyspnea or disability. Because the pain in the left chest had seldom occurred in recent years, she did not seek medical treatment. Ten days before admission, the lumbar pain was exacerbated after heavy labor, but sensory disturbance of the lower limbs was not observed.

Computed tomography (CT) of the lumbar region at the patient's local hospital suggested the possibility of a tumor in the

Editor: N/A.

KY and FT contributed equally to this work.

All procedures in studies involving human participants were performed in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 declaration of Helsinki and its later amendments or comparable ethical standards.

Written informed consent was obtained from the patient in the study.

The authors declare that they have no conflicts of interest to disclose.

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Medicine (2019) 98:2(e14001)

Received: 17 August 2018 / Received in final form: 6 December 2018 / Accepted: 13 December 2018

http://dx.doi.org/10.1097/MD.0000000000014001

Table 1

Summary of reports in the literature on multifocal intraosseous hemangioma.

Case report	Age/gender	Tumor location	Clinical manifestation	Method of diagnosis confirmation	Treatment
Syal et al 2007[10]	20/male	Skull, mandible, vertebra, pelvis, and tibia	Profuse bleeding from the right retromolar region	Biopsy	Transosseous transcutaneous embolization with N-butylcyanoacrylate
Jungwirth et al 2014[11]	74/female	Spine, rib and proximal humerus	None, accident	Surgical specimen biopsy	Surgical resection of the rib
Weinandt et al 2016[7]	76/female	Spine and ribs	Intercostal paresthesia, shortness of breath and some episodes of tachycardia	Surgical specimen pathological examination	Surgical resection of the tumor in the chest wall and the lumbar vertebrae
Our case	49/female	Bilateral ribs, lumbar vertebra, ilium, pubis and proximal femur	Repeated lumbar pain and occasional chest pain	Incision biopsy	Radiotherapy

third lumbar vertebra, and she was advised to visit our hospital for further treatment. The X-ray obtained in our hospital revealed a "fence" change at her third lumbar vertebra (Fig. 1). A bone scan revealed multi-bone nuclide uptake, including uptake in the bilateral ribs, third lumbar vertebra, and right ilium, pubis, and proximal femur (Fig. 2). Tumor markers including CEA, CA125, CA199, and AFP, exhibited normal levels. Thus, additional CT scans of the chest, pelvic and lumbar vertebrae were performed. The chest and pelvic CT images revealed bone destruction in the 2 affected ribs, with a soft tissue mass with well-defined margins and expansile lesions in the right ilium and pubis, respectively (Figs. 3 and 4). CT examination of the lumbar vertebrae revealed a "polka-dot" sign with a slight compression fracture of the third lumbar vertebra (Fig. 1). On magnetic resonance imaging (MRI), the lumbar lesion presented with long T1 and T2 signals and extended into the spinal canal (Fig. 1).

Based on the clinical presentation and imaging results, metastatic diseases and multiple myeloma were excluded. To confirm the diagnosis and given the success rate and safety of the operation, an open biopsy of the ilium was performed. An intraosseous hemangioma with a typical pathological appearance was pathologically confirmed (Fig. 5). The patient selected radiotherapy instead of surgery as the initial treatment for her lumbar spine. The patient received lumbar vertebrae radiotherapy with a total dose of 40 Gy. During the first year of follow-up, the pain was alleviated, and no signs of recurrence were noted.

3. Discussion

An intraosseous hemangioma diffusely distributed to different human body sites is unusual. The majority of reported multifocal intraosseous hemangiomas are regionally distributed, with the tumors being limited to 1 specific body part, such as the spine, lower extremities or skull.[7,12] The main differential diagnosis in our case was an epithelioid hemangioma, which is a type of vascular tumor. An epithelioid hemangioma is a locally aggressive tumor composed of cells that exhibit an endothelial phenotype and epithelioid morphology.[13] Epithelioid hemangiomas typically involve long tubular bones and the lower extremities, and approximately 18 to 25% of intraosseous epithelioid hemangiomas are multifocal with a regional distribution. The pathological image of the ilium revealed the proliferation of capillary-sized vessels in osseous tissue without an endothelial phenotype. However, we cannot exclude the possibility that the 4 lesions were different tumors. It was not possible to perform an incision biopsy for all lesions, especially in the ribs. Thus, we chose the ilium instead of the ribs and vertebrae as the open biopsy site because this site offers easy exposure, easy

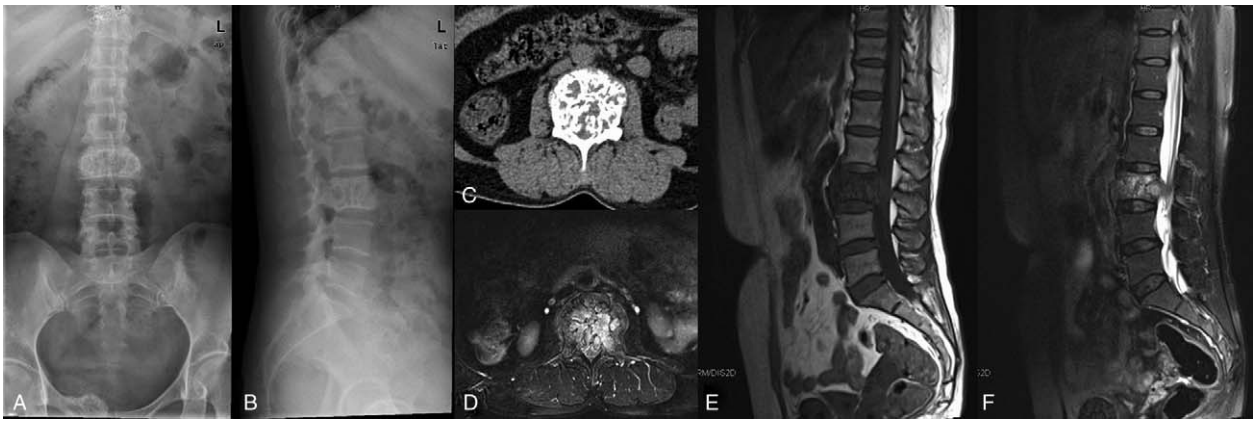

Figure 1. Images of the third lumbar vertebra. The radiographs of the lumbar vertebrae with anteroposterior projection A and lateral projection B reveal that the lesion is located in the third lumbar vertebra and presents with typical vertical vertebral striation due to the thickened trabeculae. The vertebral body exhibits decreased density with slight bone expansion. C, An axial CT image demonstrating the classical "polka-dot" appearance and vertically oriented vertebral lucency separated by thickened trabecular bone. D, An axial T2-weighted sequence MR image revealing a heterogeneous, high-signal-intensity lesion with multiple punctate areas that resemble the "polka dot" sign. E and F, Sagittal MR images of T1-weighted and T2-weighted sequences. The lesion has low signal intensity on T1-weighted SE and high signal intensity on T2-weighted SE MR images. Both sequences reveal slight dural sac compression. CT = computed tomography.

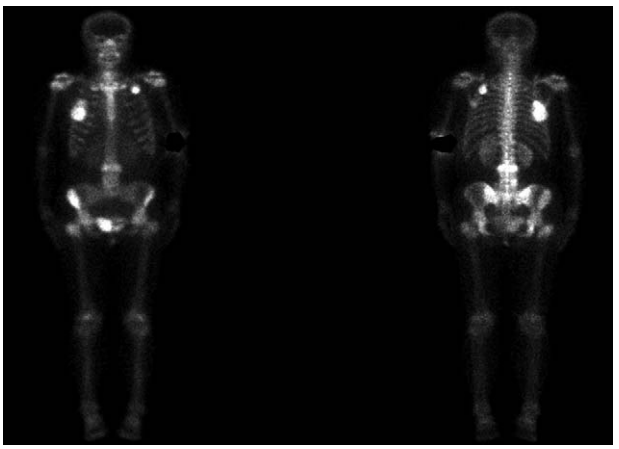

Figure 2. A bone scan of the patient revealing multifocal involvement, including involvement of the bilateral ribs; third lumbar vertebra; and right ilium, pubis, and proximal femur; with increased isotope uptake.

bleeding control and a low rate of complications. After reviewing the literature on intraosseous hemangiomas, we discussed the clinical characteristics of the 4 lesions and found that each lesion conformed to the characteristics of intraosseous hemangiomas.

Vertebral hemangiomas are typically asymptomatic and are often found incidentally by plain radiographs, CT or MRI. Most vertebral hemangiomas are latent and do not require specific treatment. Only 3.7% of vertebral hemangiomas may become active and symptomatic, typically causing only pain. However, for a small subset of affected patients, vertebral hemangiomas may become aggressive and invade the spinal canal and/or paravertebral space, leading to neurologic deficits.[9] The imaging appearance of a vertebral tumor and lumbar tenderness indicated that the disease in our case was aggressive. The term "aggressive" refers to the presence of radiological features such as extension beyond the vertebral body, destruction of the cortex, and invasion of the epidural and paravertebral spaces.[6,8,14] Based on the radiological features, a vertebral hemangioma can be classified as typical, atypical, or aggressive.[14] In cases of compressive vertebral hemangiomas, the clinical and radiological classifications typically match because of the associations between compressive symptoms and aggressive behavior. The affected vertebral body presented as a "fence" change on plain radiography, which is considered a typical feature of hemangiomas in the spine. The axial CT image revealed a lesion with a typical "polka-dot" pattern, with the thickened vertical trabeculae appearing as small punctuate areas of sclerosis. MR images of intraosseous hemangiomas typically exhibit variable signal intensities on T1-weighted sequences and high signal intensities on T2-weighted sequences due to water in the stagnant blood within the hemangioma.[1,15] The MRI findings in our case exhibited soft tissue extension into the spinal canal. The clinical symptoms of the patient included lumbar tenderness. Laredo et al[8] described 6 radiographic and CT features that are observed at significantly high rates in aggressive vertebral hemangiomas:

(1) involvement of the entire vertebral body,
(2) extension into the neural arch,
(3) cortical expansion,
(4) thoracic location (T3–T9),
(5) an irregular honeycomb pattern, and
(6) a soft tissue mass.

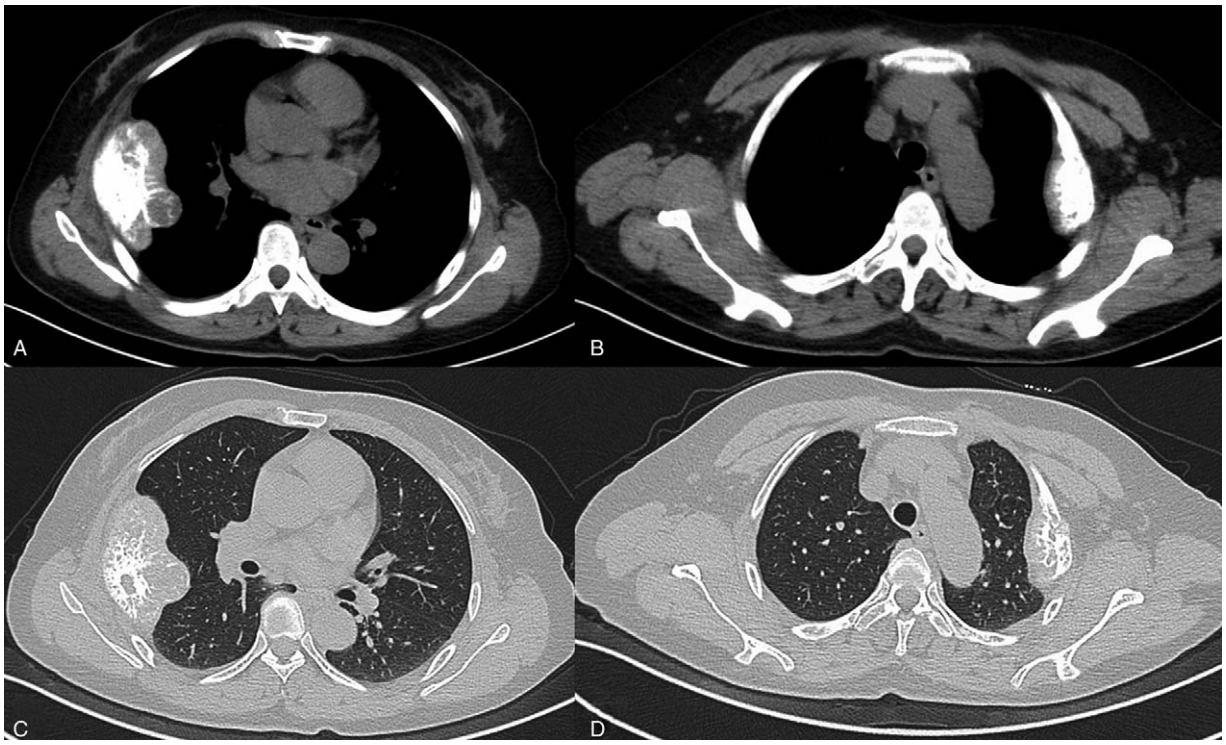

Figure 3. CT images of the chest. A and B, An axial soft tissue window CT image revealing a bony lesion with a well-defined expansile soft tissue component in the bilateral ribs. C and D, An axial bone window CT image showing a combination of trabeculation and matrix ossification within both the intramedullary component and the extraosseous extension in the bilateral ribs. CT = computed tomography.

Figure 4. Images of the pelvis and proximal femur. A, An AP radiograph of the pelvis and proximal femur revealing a lytic lobular lesion with sclerotic margin in the right ilium, an expansile lobular lytic lesion in the right pubis, and a lobular lesion with sclerotic margins in the right femur. B, A coronal CT image demonstrating a lobular lesion with focal cortical destruction and extensive internal matrix ossification in the right ilium and a lobular lesion with intramedullary matrix ossification in the right proximal femur. C, A coronal CT image showing a combination of trabeculation and matrix ossification within the right pubis intramedullary and punctate calcification in the extraosseous extension with a well-defined margin. CT = computed tomography.

The authors suggested that when 3 or more features are present in association with nerve root pain, aggressive vertebral hemangiomas should be suspected.[8]

Rib tumors represent 5.9% of primary bone tumors, and 89% are malignant. Thus, the diagnosis of a rib lesion is challenging. However, biopsy is not recommended due to the high risk of bleeding. The differential diagnosis of a rib tumor may include metastatic and primary malignant tumors (chondrosarcoma, osteogenic sarcoma, myeloma, and Ewing sarcoma) or benign tumors (fibrous dysplasia, eosinophilic granuloma, chondroma, and hemangioma).[5] The imaging results of rib hemangiomas characteristically exhibit expansile and well-circumscribed lesions with a thin, intact bony cortex; fine bony trabeculae; and no associated pleural effusion.[8] The arrangement of fine bony trabeculae in a rib hemangioma can confer a "honeycomb" appearance to the medullary cavity of the rib.[3,7] Expansive

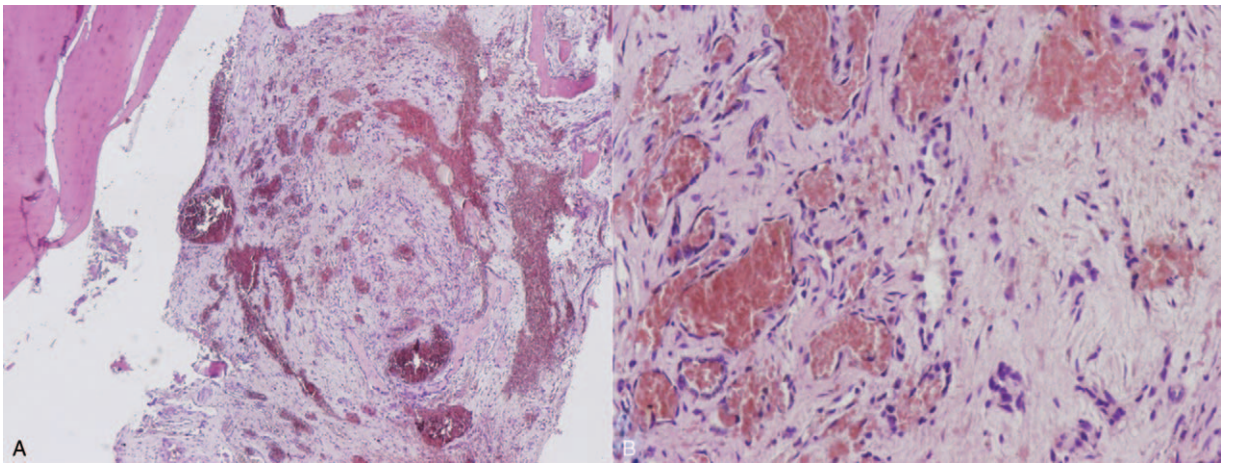

Figure 5. Microscopic pathological images of the patient. A, Hematoxylin-eosin staining at low magnification (×40) and B, high magnification (×200) revealing the proliferation of capillary-sized vessels in the osseous tissue. Cytologic atypia is not apparent.

growth by a rib hemangioma beyond the disrupted bony cortex, which suggests an aggressive lesion, has been previously described in only a few cases.[3,5,9] Although rib hemangiomas may mimic aggressive lesions in the imaging results, these tumors are typically asymptomatic or exhibit slow growth.[3,4,9] The first episode of chest pain in the patient in our study occurred 15 years prior, but slight pain occurred occasionally and resolved spontaneously. A "polka-dot" pattern is not common for rib lesions. In rib hemangiomas, the ribs exhibit soft tissue mass extension with a well-defined margin.[16] The majority of cases of rib hemangiomas are treated by en bloc resection of the tumor.[3,17–21] Given that more than half of all rib tumors are malignant, surgical resection of rib hemangiomas occasionally confirms the diagnosis. Needle biopsy carries a risk of seeding the needle tract and should not be performed unless multiple myeloma or metastatic disease is strongly suspected.[22] Moreover, needle biopsy of a cavernous hemangioma carries a high risk of bleeding, which is difficult to control at this site. Open biopsy has some disadvantages that may interfere with providing therapy. For example, infection of the biopsy wound may delay initiation of the appropriate therapy, and the initial resection may interfere with the identification of the area that should be removed in a subsequent radical resection.[23]

The possibility of long bone hemangiomas is typically not considered in the initial diagnosis.[2] Hemangiomas in long bones, such as the femur and humerus, occasionally present with a "soap-bubble" appearance such that the tumor may be diagnosed as a giant cell tumor, fibrous dysplasia, an aneurysmal bone cyst, or a chondrosarcoma. Bone scans are nonspecific due to the variable degrees of radiotracer uptake and the absence of tracer accumulation. In our scintigraphy study, the 6 lesions exhibited increased isotope uptake in a triple-phase image, which is consistent with the vascular nature of the lesions.

The classical findings of these different diagnostic features help contribute to a definite imaging-based diagnosis. Histology is required for the diagnosis of patients without pathognomonic radiological features. In our case, the typical radiological characteristics of the lesions including a "fence" appearance on X-ray, a "polka-dot" pattern on axial CT images, and high signal intensity on T2-weighted MR images were highly suggestive of bone hemangioma. However, a final diagnosis depends on a pathological biopsy.

The treatment of intraosseous hemangioma depends on the symptoms in each affected region. In general, as degradation may occur during the growth of a bone hemangioma, the vascular tissue may be replaced by fibrous tissue, and self-healing is achieved.[24] Therefore, asymptomatic patients should be closely followed-up without receiving any extensive therapy. For our patient, lumbar pain was the only complaint; therefore, our discussion here focuses on the treatment of hemangiomas involving the vertebral column. Currently, the main treatment options include surgery, intraarterial embolization, vertebroplasty, and radiotherapy. However, no consensus has been reached to date regarding the management of vertebral hemangiomas. The purpose of surgery is spinal cord or nerve root decompression and, occasionally, partial removal of the tumor. Bleeding is the main risk during the operation. Mirovsky reported 4 patients who underwent preoperative transarterial embolization followed by laminectomy and vertebroplasty of the affected level and 2 patients who were treated with vertebroplasty alone. At an average follow-up period of 35 months, all patients exhibited an overall uneventful postoperative course and varying degrees of symptomatic relief.[25] Published studies indicate that radiotherapy also plays an important role in the treatment of vertebral hemangiomas. Ranen and colleagues treated 7 consecutive patients with symptomatic vertebral hemangiomas using a fixed dose of external beam radiotherapy. All patients exhibited improvement in muscle power, which increased over time. Pain relief with improvement of quality of life was achieved in all patients.[26] Mathew et al treated a patient with acute, high-grade spinal cord compression caused by a vertebral hemangioma with radiotherapy and steroid treatment alone, and noted that clinical and radiological improvement may require several months to occur.[27] A study from a single center retrospectively analyzed 137 cases and, demonstrated the efficacy of radiotherapy in improving pain secondary to vertebral hemangiomas. The recommended dose was 36 to 40 Gy delivered in 2-Gy fractions.[28] In our case, the patient selected radiotherapy instead of surgical decompression or vertebroplasty as the initial treatment. The lumbar vertebrae radiotherapy dose was 40 Gy. No symptoms of recurrence have been observed as of the 1-year follow-up.

Despite the presence of multifocal lesions in the ilium, pubis and proximal femur in our case, the pelvic ring and proximal femur exhibited good strength and a low risk of pathological fracture. Thus, we did not perform surgery on this patient. Treatment of long bone hemangioma depends on the extent and site of lesion involvement. Localized, well-circumscribed lesions are easily treated by intralesional excision, radiotherapy or, occasionally, direct cement injection. Large lesions in long bones are difficult to treat. Zhan et al treated a young patient with a lesion that exhibited greater than 50% involvement in the femoral neck without articular surface involvement. Curettage of the lesion and an allograft fibular cortical strut were employed along with a proximal locking plate and screw. The patient recovered with excellent hip function, and the allograft fibula strut incorporated well and strengthened the femoral neck. No recurrence was observed at 39 months of follow-up.[6] Lucia et al reported a cavernous hemangioma of the proximal femur in a young male who received en bloc resection of a tumor due to the large range of involvement and high risk of pathologic fracture.[29]

4. Conclusion

Multifocal intraosseous hemangiomas that affect different body parts are rare. Although pathological diagnosis, in this case, was established after an open biopsy, the typical radiological characteristics of the lesions, including a "fence" appearance on X-ray images a "polka-dot" pattern on axial CT images, and high signal intensity on T2-weighted MR images, were highly suggestive of an intraosseous hemangioma. This rare case demonstrates the importance of the selection of the appropriate lesion to confirm the diagnosis and effective treatment for patients with multifocal disease. Radiotherapy plays an important role in the treatment of patients with symptomatic vertebral hemangiomas without neurologic deficits.

Author contributions

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Writing – review & editing: Chongqi Tu.

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