Case Report

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Distal femur osteosarcoma in a seven-year-old: a case report on acute symptom presentation

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Introduction and importance: Osteosarcoma is an exceptionally serious, uncommon disease in children with morbidity, mortality, and psychological burdens.

Case presentation: In this report, the authors present the case of a previously healthy 7-year-old girl who exhibited continuous, painful limping. Plain imaging and a MRI scan revealed the presence of a lytic lesion in the femur on the left side. The diagnosis of osteosarcoma was confirmed. There was no significant familial history of cancer. The girl and her family underwent the operation and chemotherapy, received follow-up and support for a year, and both the patient and the medical team expressed a lot of satisfaction.

Clinical discussion: The survival and prognosis from osteosarcoma in the literature was 59% for all patients at a median follow-up up 54 months, current treatment of osteosarcoma involves chemotherapy and limb surgery, with (60–80)% of patients in remission after 5 years.

Conclusion: This case emphasizes the importance of promptly considering osteosarcoma in a child when the clinical presentation and medical imaging align with the diagnosis.

Keywords: chemotherapy, family medicine, oncology, osteosarcoma, pediatrics

Background

Osteosarcoma is a primary malignant bone tumor that occurs in children and adolescents[1,2]. This tumor typically arises in the metaphyseal regions of long bones, particularly around the knee, with the distal femur and proximal tibia accounting for ~60–75% of cases[3].

Epidemiologically, osteosarcoma's annual incidence is three cases per million in the general population, with a higher incidence observed in males compared to females[4]. The peak incidence coincides with the adolescent growth spurt, suggesting a potential link between rapid bone growth and tumor development[4]. Researchers have identified several predisposing factors, including genetic predispositions like Li-Fraumeni syndrome and hereditary retinoblastoma, as well as environmental factors like prior radiation exposure[5]. Furthermore, Paget's disease of bone, a disorder characterized by abnormal bone remodeling, also increases the likelihood of osteosarcoma development in affected bones. These associations underscore the importance of genetic screening and surveillance in high-risk populations to facilitate early detection and management of osteosarcoma[6].

HIGHLIGHTS

- The clinical manifestations, radiologic findings, and prognosis for the most prevalent benign and malignant bone-forming tumors in children are important issues.
- Early detection can improve disease management and save children's lives.
- Never underestimate any lesion or any child's limping or pain.

Osteosarcoma is characterized by its aggressive nature and propensity for early metastasis, predominantly to the lungs. The 5-year survival rate for localized disease ranges from 60 to 70% but drops significantly for metastatic or recurrent disease[7].

Early detection of osteosarcoma is crucial for improving prognosis. Symptoms such as localized bone pain and swelling are often attributed to more benign conditions, delaying diagnosis. Advanced imaging techniques and a high index of suspicion are important for early diagnosis, which impacts treatment outcomes and survival rates[8].

The diagnostic workup for osteosarcoma typically includes a combination of imaging studies and biopsy. Initial imaging with X-rays often reveals a mixed lytic and sclerotic lesion with a periosteal reaction. MRI is employed to assess the local extent of the tumor and its relationship to surrounding soft tissues and neurovascular structures, while CT scans of the chest are performed to detect pulmonary metastases, which are common in osteosarcoma patients[9].

A definitive diagnosis is obtained through a biopsy, which is crucial for histopathological examination. The biopsy should be

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performed in a manner that does not compromise future surgical resection[10].

Osteosarcoma treatment typically involves both surgery and chemotherapy to achieve the best possible outcomes. Surgery is essential for removing the primary tumor, often using limb-salvage techniques to maintain as much function as possible. After surgery, chemotherapy eradicates any remaining cancer cells and reduces the risk of recurrence. The combination of high-dose methotrexate, doxorubicin, and cisplatin (MAP regimen) has significantly improved survival rates, although managing metastatic cases remains a challenge[11]. This case report has been reported in line with Surgical CAse Report (SCARE) 2023[12].

Case presentation

A 7-year-old Palestinian girl, free past medical and surgical history, with no history of allergy of drug or food, visited the clinic for distal lateral Femoral shaft pain and limping in her left leg that started when she was playing with her sister a week earlier and did not resolve. There was no other history of physical injury or trauma that could account for this sudden presentation. The pain was mostly at night, centered in the proximal femur a to patella, and extended downwards towards the ankle.

The patient described the pain as severe, that felt like electric shocks, and disturbed her sleep the three days prior to the clinic visit. She complained of mild gastrointestinal symptoms including nausea and decreased appetite.

No coexisting medical and surgical conditions were present. The girl maintained a consistently healthy lifestyle. And no family history of any inherited disease or disability.

During the physical examination, the patient was unable to support her body weight on her left leg, resulting in an abnormal gait. Left leg extension, internal rotation, and external rotation of the knee were normal. There was limited active and passive flexion, with a maximum range of 30°. She was unable to resist flexion or extensions, and complained of pain during active and passive range of motion of the left ankle, including flexion, extension, inversion, and eversion. When asked to refrain from extending her toes and ankle, she was unable. The neurological examination, which assessed fine touch and pain sensation from the first lumbar vertebra (L1) to the first sacral vertebra (S1), was normal. The patellar and Achilles reflexes exhibited no abnormalities.

Vibration on the joint between the proximal tibia and fibula caused pain. Upon close examination, a slight swelling was observed without any signs of bruising. Applying light pressure on the proximal fibula and tibia caused intense discomfort. The examination of the patella, quadriceps (including the patellar tendon), hamstrings, and gastrocnemius did not elicit any pain. The leg musculoskeletal and neurological exam was entirely normal.

A plain radiograph showed a poorly defined growth measuring 44 cm on the left mid-distal tract of the left femur shaft. A cytolytic lesion was seen in Figure 1.

Both a sarcoma and an aneurysmal bone cyst (ABC) were the probable diagnoses when the patient was admitted. The results of the MRI showed abnormal signal intensity in the mid-distal tract of the left femur shaft extending for 16 cm of the maximum crphalocaudal diameter with the diffuse cortical thickness (Fig. 2).

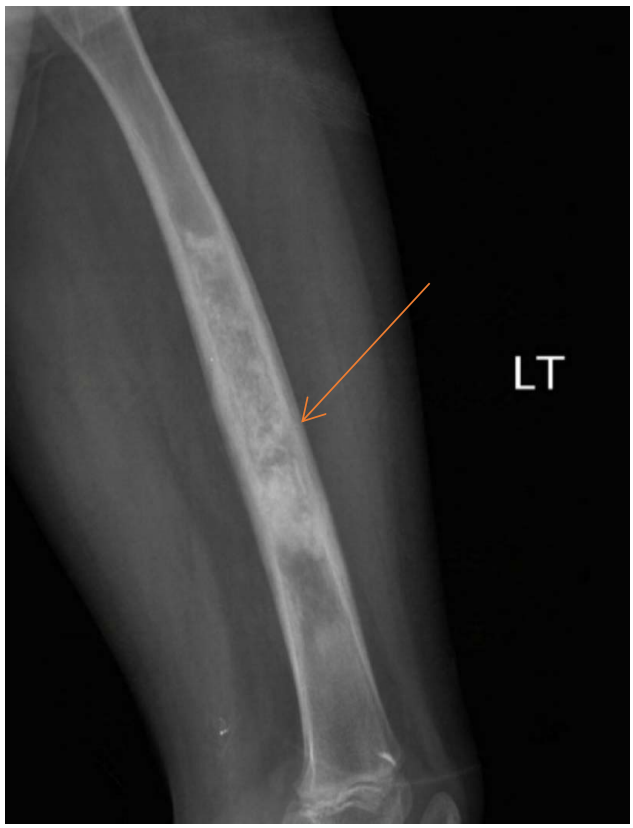

Figure 1. Plain radiograph of the femur, shows a cytolytic lesion over the lateral femoral shaft. A growth measuring 4×4 cm was observed on mid-distal tract of the left femur shaft area.

ABCs typically show fluid-fluid levels on MRI, which were absent in this case. Additionally, ABCs are associated with a lack of osteoid production, unlike osteosarcomas[13]. Osteosarcoma with focal necrosis present was the most likely diagnosis.

Patient outcomes and follow-up

Sarcoma outcome: after the treatment regimen, which included subtotal femur replacement operation (Fig. 3), surgical resection of the tumor and seven Docetaxel-cisplatin combination (DC) adjuvant chemotherapy, the patient had a positive clinical response. The surgical margins were clear of malignancy, and postoperative follow-up showed no immediate recurrence. The patient tolerated chemotherapy well, and no severe complications were reported during the treatment period.

Follow-up and monitoring: the patient was followed up with regular clinical evaluations and imaging studies, including follow-up MRIs and plain radiographs. Follow-up MRIs were performed every 3–6 months during the first year. After 1 year, follow-up frequency will reduced based on the clinical and radiological findings, with annual MRIs and chest CTs to monitor for pulmonary metastasis, a common site of spread for osteosarcoma[14].

Long-term monitoring: as per standard osteosarcoma follow-up protocols, the patient continues to be monitored for potential late recurrence or metastasis. Regular serum alkaline phosphatase levels were also checked as part of the surveillance. At the last

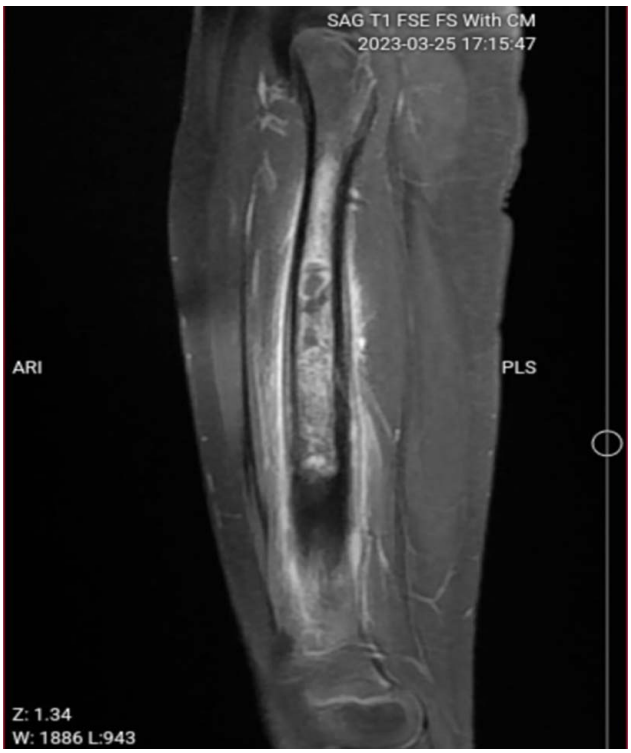

Figure 2. MRI of the left femur, shows diffuse cortical thickening, periosteal reaction and some extra osseous component. The growth measured 16 cm of maximum cephalocaudal diameter in mid-distal tract of left femur.

follow-up, ~12 months post-treatment, the patient showed no signs of recurrence on imaging or physical examination.

Functional and psychological recovery: the patient has gradually returned to normal activities, although some limitations in strenuous physical activities remain. She has received ongoing. psychological support to cope with the emotional impact of her diagnosis and treatment. Both she and her family have expressed satisfaction with her care and outcomes.

The patient and family have been closely involved in the follow-up care plan, which is crucial for early detection of any recurrence or metastasis. The prognosis remains cautiously optimistic, with plans for continued long-term surveillance over the next several years.

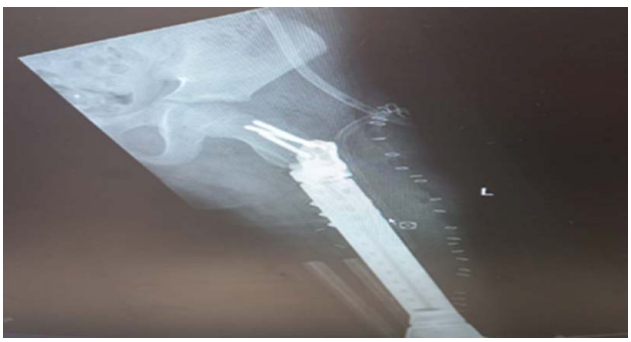

Figure 3. Anterior-posterior radiograph of the left femur demonstrates cemented, mobile-bearing, modular, and expandable distal femur endoprosthesis.

Discussion and limitations

This case study does not attempt to increase or widen treatment methods for osteosarcoma rather than its focus on enhancing health promotion, prognosis, prevention, and early identification. The survival and prognosis from osteosarcoma in a study with more than 2000 patients was 59% for all patients at a median follow of 54 months. The 3-year and 5-year overall survival following biopsy were 79% and 71%, respectively. The rate of 8% decline over 2 years underscores the need for additional study in this sector to improve the overall prognosis for affected individuals[15].

The diverse appearances of osteosarcoma makes diagnosis difficult, leading to treatment delays and possibly unfavorable patient outcomes. The diagnosis of osteosarcoma was important to consider in this case because of the nonspecific left thigh pain symptoms and swelling in a 7-year-old girl. Furthermore, this patient was young to have osteosarcoma since the appearance normally peaks around 16 years of age, sometimes coinciding with growth spurts. Males appear are slightly more impacted than females in this age bracket[16].

Most individuals diagnosed with osteogenic sarcoma of the limbs often report discomfort before observing any soft tissue enlargement. This pattern occurs in primary bone tumors, as the stretching of the periosteum typically produces discomfort prior to the tumor being visually obvious. Pain can also come from bone deterioration and the development of tiny stress fractures. The beginning of abrupt and acute pain may suggest a substantial pathological fracture is appearing in 15% of pediatric patients[17].

The second most frequent symptom associated with osteogenic sarcoma is swelling, generally due to the presence of a soft tissue tumor. Although nearly 90% of osteosarcomas display soft tissue extension, some patients may not mention swelling as a symptom[17].

Radiologically, these tumors are characterized by osteoblastic lesions with different amounts of osteoid production, cartilage and fibrous tissue; it is the matrix mineralization that CT scans demonstrate. At times, sclerosing osteoblastic osteosarcoma could appear as ivory vertebrae. The telangiectatic form of the disease presents as a lytic lesion, and fluid-fluid levels may be seen on MRI. Enhancing thick septae and nodular solid components distinguishes it from aneurysmal bone cysts. For example, in spinal osteosarcomas prognosis is worse than peripheral ones. Secondary osteosarcomas can occur after radiation therapy or in Paget's disease[18].

Other malignant tumors such as Ewing's sarcoma osteogenic lymphoma, chondrosarcoma, rhabdomyosarcoma, leiomyosarcoma, bone metastasis (usually occurs in people 40 years of age and older), big cells tumor, aneurysmal bone cyst, and osteomyelitis should be considered in the differential diagnosis. In addition, there are additional diagnoses that may be confused with OS, including Paget's disease, nonossifying fibroma, myositis ossificans, fracture callus, ossifying hematoma, osteochondroma, osteoma, and gigantic bone island[18,19].

For many years, cisplatin, doxorubicin, and high-dose methotrexate with citrovorum rescue have been the main course of chemotherapy for children and adolescents. About 70% of patients experience a permanent cure from this approach[19]. Before starting chemotherapy, a port is inserted to make the frequent blood draws and drug/fluid infusions easier. Dosage modifications are adjusted based on careful monitoring of the

side effects of chemotherapy, including hair loss, nausea, vomiting, myelosuppression, and mucositis. Cisplatin may cause permanent hearing loss and kidney failure. Doxorubicin can cause heart toxicity[18]. The patient and parents should be made aware of these possibilities as well as the possible hair loss and nausea.

Neoadjuvant chemotherapy, which lasts 7 weeks, is typically followed by surgical management. After the first 2 weeks of cisplatin and doxorubicin chemotherapy, patients have 2 weeks to recuperate from the acute toxicity. Patients are then given cisplatin and doxorubicin for another round of treatment following 2 weeks of weekly high-dose methotrexate. This process continues indefinitely until surgery. Patients also have 7 weeks of adjuvant chemotherapy following surgery, with the same medications and cycles. Changing the chemotherapeutic medicines in a patient with less than 90% tumor necrosis upon resection does not seem to improve prognosis[20].

As described, current treatment of osteosarcoma involves preoperative chemotherapy followed by limb surgery, with (60–80)% of patients in remission after 5 years[18].

Time and availability of data was not easy, the patient seems to be tired some times and need only psychological support, the shortage of medication and medical equipment made some stress of all of us.

Conclusion

In conclusion, improving the prognosis of osteosarcoma requires early identification. This case study emphasizes the importance of early detection, prevention, and health promotion. Studies raise concerns about survival rates and highlight the need for more research to enhance results. In cases involving childhood bone pain, it is imperative to maintain a high degree of suspicion for osteosarcoma due to its nonspecific symptoms and atypical age of presentations. Because of the poor socioeconomic situation and limited health access in countries like Palestine, cases like this 7-year-old may experience delays in diagnosis and treatment. Physicians should maintain a high index of suspicion.

Ethical approval

Our institution (Palestine Polytechnic University) gave ethical approval.

Consent

Written informed consent was obtained from the patient's parents/legal guardian for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

N.S.: writing the manuscript and writing – review and editing; S. W.: conceptualization and writing – review and editing; Z.S. and O.N.: data curation and writing – review and editing; F.A.: methodology and software; J.A.: investigation and supervision; S. S.: writing – review and editing.

Conflicts of interest disclosure

The authors declare that there is no conflict of interest regarding the publication of this article.

Research registration unique identifying number (UIN)

1. Name of the registry: not applicable.
2. Unique identifying number or registration ID: not applicable.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): not applicable.

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Data availability statement

All data are available with the corresponding author when needed.

Provenance and peer review

Our paper has not been published previously.

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References

[1] Belayneh R, Fourman MS, Bhogal S, *et al*. Update on osteosarcoma. Curr Oncol Rep 2021;23:71.
[2] Picci P. Osteosarcoma (Osteogenic sarcoma). Orphanet J Rare Dis 2007; 2:6.
[3] Mirabello L, Troisi RJ, Savage SA. International osteosarcoma incidence patterns in children and adolescents, middle ages and elderly persons. Int J Cancer 2009;125:229–34.
[4] Ottaviani G, Jaffe N. The epidemiology of osteosarcoma2009;152:3–13.
[5] Savage SA, Mirabello L, Wang Z, *et al*. Genome-wide association study identifies two susceptibility loci for osteosarcoma. Nat Genet 2013;45: 799–803.
[6] Ralston SH, Corral-Gudino L, Cooper C, *et al*. Diagnosis and management of paget's disease of bone in adults: a clinical guideline. J Bone Miner Res 2019;34:579–604.
[7] Kager L, Zoubek A, Pötschger U, *et al*. Primary metastatic osteosarcoma: presentation and outcome of patients treated on neoadjuvant cooperative osteosarcoma study group protocols. J Clin Oncol 2003;21:2011–8.
[8] Stiller CA, Bielack SS, Jundt G, *et al*. Bone tumours in European children and adolescents, 1978–1997. Report from the automated childhood cancer information system project. Eur J Cancer 2006;42: 2124–35.
[9] Luetke A, Meyers PA, Lewis I, *et al*. Osteosarcoma treatment – where do we stand? A state of the art review. Cancer Treat Rev 2014;40: 523–32.
[10] Isakoff MS, Bielack SS, Meltzer P, *et al*. Osteosarcoma: current treatment and a collaborative pathway to success. J Clin Oncol 2015; 33:3029–35.

[11] Bielack SS, Hecker-Nolting S, Blattmann C, *et al*. Advances in the management of osteosarcoma. F1000Res 2016;5:2767.
[12] Sohrabi C, Mathew G, Maria N, *et al*. The SCARE 2023 guideline: updating consensus Surgical CAse REport (SCARE) guidelines. Int J Surg Lond Engl 2023;109:1136.
[13] Patel NR, Salunke AA, Lewis VO. Imaging of primary bone sarcomas and mimickers. J Clin Orthop Trauma 2018;9:190–7.
[14] Chou AJ, Geller DS. Osteosarcoma treatment: current strategies and future directions. J Clin Oncol 2016;34:3191–7.
[15] Smeland S, Bielack SS, Whelan J, *et al*. Survival and prognosis with osteosarcoma: outcomes in more than 2000 patients in the EURAMOS-1 (European and American Osteosarcoma Study) cohort. Eur J Cancer 2019;109:36–50.
[16] DePalma M, Gupta S, Nguyen J, *et al*. Do not miss the tumor: a novel presentation of osteosarcoma. Case Rep Pediatr 2021;2021:1–4.
[17] Mirabello L, Troisi RJ, Savage SA. Osteosarcoma incidence and survival rates from 1973 to 2004: Data from the Surveillance, Epidemiology, and End Results Program. Cancer 2009;115:1531–43.
[18] Patnaik S, Jyotsnarani Y, Uppin SG, *et al*. Imaging features of primary tumors of the spine: A pictorial essay. Indian J Radiol Imag 2016;26:279–89.
[19] Chou AJ, Malek F. *Orthopaedic Knowledge Update: Musculoskeletal Tumors* 3rd. American Academy of Orthopaedic Surgeons; 2014. Osteosarcoma of bone.
[20] Stitzlein RN, Wojcik J, Sebro RA, *et al*. Team approach: osteosarcoma of the distal part of the femur in adolescents. JBJS Rev 2017;5:e5.