



Brain Metastases in a 12-Year-Old Girl with Osteosarcoma: A Case Report

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Received 2019 January 20; Revised 2019 April 07; Accepted 2019 April 22.

Abstract

Introduction: Osteosarcoma accounts for about 3% of childhood cancers and this tumor is the most common primary bone tumor. Lung and bones are the most common sites of metastases. Brain metastases are very rare and account for approximately 1.8% to 5.6% of all metastases.

Case Presentation: In this study, we reported osteosarcoma in a 12-year-old girl with primary lung metastases and subsequent brain metastases.

Conclusions: In patients with osteosarcoma and evidence of pulmonary metastasis, performing brain imaging, even without evidence of neurologic sign and symptoms is reasonable.

Keywords: Child, Osteosarcoma, Brain Metastases

1. Introduction

Osteosarcoma is a primary malignant bone tumor that is characterized by osteoid producing malignant cells (1). This tumor accounts for about 3% of childhood cancers (2). The patients with osteosarcoma present with localized pain and swelling of the affected area (3). The most common sites of primary tumors in children and young adults include the distal femur, proximal tibia, and proximal humerus (4). Between 15% to 20% of patients have the demonstrable macrometastatic disease at the time of presentation (5). The dissemination of osteosarcoma pattern is hematogenous, due to the lack of lymphatic drainage of long bones (6). The most common sites of metastasis are the lungs, followed by other bones (5). Brain metastases are very rare, and account approximately 1.8% to 5.6% of all metastases with prior pulmonary metastasis (5, 6).

2. Case Presentation

A 12-year-old girl admitted after falling and trauma to her right shoulder with persistent pain in her shoulder. She complained from chronic cough since 1 month earlier. Chest and shoulder X-ray were obtained and showed severe involvement of both lungs (Figure 1A) and humerus bone (Figure 1B) with calcified lesions. Brain computerized tomography scan (CT scan) was normal.

Complete blood count and biochemistry values were within normal range but alkaline phosphatase was elevated (12400 U/L, Normal < 350 U/L).

The biopsy was performed and conventional osteosarcoma, osteoblastic subtype was reported.

Chemotherapy was started with ifosfamide, adriamycin, and cisplatin-based regimen. Nine weeks after treatment, the patient complained from headache and suffered a seizure. Brain CT scan showed calcified lesion with peripheral edema in the left occipital lobe (Figure 2I) and smaller one in the left frontal lobe (Figure 2II) in favor of brain metastases.

3. Discussion

Brain metastases are rare in osteosarcoma and lung tumoremboli invading the brain is the main cause of metastases (7). This metastasis locates through the anterior circulation to the gray-white matter junction (8), as was seen in the patient's imaging. 2-year survivals for patients with metastatic disease and patient with recurrent disease is less than 10% to 30% (9).

Ten to 15% of patients with pulmonary involvement have simultaneous central nervous system metastasis (10).

Patients with metastasis to the central nervous system have a very bad prognosis, and they will survive just for a



Figure 1. Calcified lesions in both lungs (A) and right humerus bone (B)



Figure 2. Calcified lesion with peripheral edema in the left occipital lobe (I) and smaller one in the left frontal lobe (II), in nine weeks after treatment

few months. Only in the absence of active pulmonary lesions, craniotomy or radiosurgery may help them to have long-term survive (11).

Mean time of brain metastasis from initial diagnosis is approximately 18.9 ± 21.1 months (12).

Yonemoto et al. (13) and Marina et al. (14) advocated performing brain imaging periodically, in patients with pulmonary metastasis, even without neurologic signs.

In the study by Paulino et al. they used radiotherapy to slow neurological deterioration in patients with the brain metastasis (15), and in the other research, Flannery et al. recommend Gamma Knife Stereotactic Radiosurgery (GK-SRS) as a new modality in the treatment of these patients (16).

Five-years overall survival (OS) for patients with relapsed osteosarcoma is less than 25%. The 5-year OS of patients presenting with metastatic disease at diagnosis is also about 20% to 30% (17) and overall the mean survival of patients with the brain metastasis is about 18 months following its detection (12).

Unfortunately, despite aggressive chemotherapy and palliative radiotherapy, the patient of this research died after 1 month.

3.1. Conclusions

In patients with osteosarcoma and evidence of pulmonary metastasis, performing brain imaging is reasonable, even without evidence of neurologic sign and symptoms.

Acknowledgments

None declared.

Footnotes

Authors' Contribution: None declared.

Conflict of Interests: The authors have no conflict of interest to be disclosed.

Ethical Considerations: This study was approved by ethical committee of Mazandaran University of Medical Sciences.

Financial Disclosure: None declared.

Funding/Support: None declared.

Patient Consent: Written informed consent was obtained from the patients' parents for publication of this case report.

References

1. Doval DC, Chacko M, Sinha R, Choudhury KD, Sharma A, Rao A, et al. A rare case of brain metastasis in a patient with osteosarcoma. *South Asian J Cancer*. 2017;**6**(1):36–7. doi: [10.4103/2278-330X.202572](https://doi.org/10.4103/2278-330X.202572). [PubMed: [28413797](https://pubmed.ncbi.nlm.nih.gov/28413797/)]. [PubMed Central: [PMC5379894](https://pubmed.ncbi.nlm.nih.gov/PMC5379894/)].
2. Durfee RA, Mohammed M, Luu HH. Review of osteosarcoma and current management. *Rheumatol Ther*. 2016;**3**(2):221–43. doi: [10.1007/s40744-016-0046-y](https://doi.org/10.1007/s40744-016-0046-y). [PubMed: [27761754](https://pubmed.ncbi.nlm.nih.gov/27761754/)]. [PubMed Central: [PMC5127970](https://pubmed.ncbi.nlm.nih.gov/PMC5127970/)].
3. Meyers PA, Gorlick R. Osteosarcoma. *Pediatr Clin North Am*. 1997;**44**(4):973–89. doi: [10.1016/S0031-3955\(05\)70540-X](https://doi.org/10.1016/S0031-3955(05)70540-X). [PubMed: [9286295](https://pubmed.ncbi.nlm.nih.gov/9286295/)].
4. Saeter G. ESMO Minimum Clinical Recommendations for diagnosis, treatment and follow-up of osteosarcoma. *Ann Oncol*. 2003;**14**(8):1165–6. doi: [10.1093/annonc/mdp154](https://doi.org/10.1093/annonc/mdp154).
5. Kebudi R, Ayan I, Gorgun O, Agaoglu FY, Vural S, Darendeliler E. Brain metastasis in pediatric extracranial solid tumors: Survey and literature review. *J Neurooncol*. 2005;**71**(1):43–8. doi: [10.1007/s11060-004-4840-y](https://doi.org/10.1007/s11060-004-4840-y). [PubMed: [15719274](https://pubmed.ncbi.nlm.nih.gov/15719274/)].
6. Link MP, Gebhardt MC, Meyers PA. *Principles and practice of pediatric oncology*. 5th ed. Lippincott Williams and Wilkins; 2005. p. 1075–113.
7. Deutsch M, Orlando S, Wollman M. Radiotherapy for metastases to the brain in children. *Med Pediatr Oncol*. 2002;**39**(1):60–2. doi: [10.1002/mpo.10042](https://doi.org/10.1002/mpo.10042). [PubMed: [12116085](https://pubmed.ncbi.nlm.nih.gov/12116085/)].
8. Singh SK, Leeds NE, Ginsberg LE. MR imaging of leptomeningeal metastases: Comparison of three sequences. *AJNR Am J Neuroradiol*. 2002;**23**(5):817–21. [PubMed: [12006284](https://pubmed.ncbi.nlm.nih.gov/12006284/)].
9. Kager L, Zoubek A, Potschger U, Kastner U, Flege S, Kempf-Bielack B, et al. Primary metastatic osteosarcoma: Presentation and outcome of patients treated on neoadjuvant Cooperative Osteosarcoma Study Group protocols. *J Clin Oncol*. 2003;**21**(10):2011–8. doi: [10.1200/JCO.2003.08.132](https://doi.org/10.1200/JCO.2003.08.132). [PubMed: [12743156](https://pubmed.ncbi.nlm.nih.gov/12743156/)].
10. Hettmer S, Fleischhack G, Hasan C, Kral T, Meyer B, Bode U. Intracranial manifestation of osteosarcoma. *Pediatr Hematol Oncol*. 2002;**19**(5):347–54. doi: [10.1080/08880010290057363](https://doi.org/10.1080/08880010290057363). [PubMed: [120788666](https://pubmed.ncbi.nlm.nih.gov/120788666/)].
11. Onodera H, Yoshida Y, Sakakibara Y, Kono T, Uchida M, Tanaka Y, et al. A case of intracerebral metastasis in osteosarcoma without active pulmonary metastasis. *Br J Neurosurg*. 2012;**26**(1):91–3. doi: [10.3109/02688697.2011.581771](https://doi.org/10.3109/02688697.2011.581771). [PubMed: [21707240](https://pubmed.ncbi.nlm.nih.gov/21707240/)].
12. Shweikeh F, Bukavina L, Saeed K, Sarkis R, Suneja A, Sweiss F, et al. Brain metastasis in bone and soft tissue cancers: A review of incidence, interventions, and outcomes. *Sarcoma*. 2014;**2014**:475175. doi: [10.1155/2014/475175](https://doi.org/10.1155/2014/475175). [PubMed: [24757391](https://pubmed.ncbi.nlm.nih.gov/24757391/)]. [PubMed Central: [PMC3976890](https://pubmed.ncbi.nlm.nih.gov/PMC3976890/)].
13. Yonemoto T, Tatezaki S, Ishii T, Osato K, Takenouchi T. Longterm survival after surgical removal of solitary brain metastasis from osteosarcoma. *Int J Clin Oncol*. 2003;**8**(5):340–2. doi: [10.1007/s10147-003-0341-9](https://doi.org/10.1007/s10147-003-0341-9). [PubMed: [14586763](https://pubmed.ncbi.nlm.nih.gov/14586763/)].
14. Marina NM, Pratt CB, Shema SJ, Brooks T, Rao B, Meyer WH. Brain metastases in osteosarcoma. Report of a long-term survivor and review of the St. Jude Children's Research Hospital experience. *Cancer*. 1993;**71**(11):3656–60. doi: [10.1002/1097-0142\(19930601\)71:11<3656::AID-CNCR2820711130>3.0.CO;2-L](https://doi.org/10.1002/1097-0142(19930601)71:11<3656::AID-CNCR2820711130>3.0.CO;2-L). [PubMed: [8490913](https://pubmed.ncbi.nlm.nih.gov/8490913/)].
15. Paulino AC, Nguyen TX, Barker JJ. Brain metastasis in children with sarcoma, neuroblastoma, and Wilms' tumor. *Int J Radiat Oncol Biol Phys*. 2003;**57**(1):177–83. doi: [10.1186/s40880-015-0038-2](https://doi.org/10.1186/s40880-015-0038-2). [PubMed: [12909231](https://pubmed.ncbi.nlm.nih.gov/12909231/)].
16. Flannery T, Kano H, Niranjana A, Monaco EA 3rd, Flickinger JC, Kofler J, et al. Gamma knife radiosurgery as a therapeutic strategy for intracranial sarcomatous metastases. *Int J Radiat Oncol Biol Phys*. 2010;**76**(2):513–9. doi: [10.1016/j.ijrobp.2009.02.007](https://doi.org/10.1016/j.ijrobp.2009.02.007). [PubMed: [19467792](https://pubmed.ncbi.nlm.nih.gov/19467792/)].
17. Mialou V, Philip T, Kalifa C, Perol D, Gentet JC, Marec-Berard P, et al. Metastatic osteosarcoma at diagnosis: Prognostic factors and long-term outcome—the French pediatric experience. *Cancer*. 2005;**104**(5):1100–9. doi: [10.1002/cncr.21263](https://doi.org/10.1002/cncr.21263). [PubMed: [16015627](https://pubmed.ncbi.nlm.nih.gov/16015627/)].