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The Occurrence of Brain Metastasis in Pediatric Osteosarcoma

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Introduction

Osteosarcoma is one of the most common primary malignant bone tumors in children and adolescents, characterized by the production of osteoid or immature bone by malignant cells. Although osteosarcoma predominantly affects the long bones, particularly the femur, tibia, and humerus, it can occur in any bone of the body. The peak incidence occurs during periods of rapid skeletal growth, typically in adolescents between the ages of 10 and 20 years. Despite advances in the understanding and treatment of osteosarcoma, its management remains challenging, and the prognosis for patients with metastatic disease is poor. The most common sites of metastasis in osteosarcoma are the lungs, followed by bone and regional lymph nodes. However, brain metastases in pediatric osteosarcoma are an unusual and rare occurrence, making them a significant subject of clinical investigation [1].

Osteosarcoma is an aggressive form of cancer that originates in the bone and is most commonly diagnosed in children, adolescents, and young adults. It typically presents as a painful, enlarging mass at the site of involvement, often accompanied by swelling and tenderness. The majority of osteosarcomas arise in the metaphysis of long bones, particularly around the knee joint (femur, tibia) and the humerus. Osteosarcomas are characterized by the production of osteoid, which is a bone-like tissue formed by malignant osteoblasts. In terms of treatment, osteosarcoma is primarily managed through a combination of surgical resection and chemotherapy. Advances in multi-agent chemotherapy have significantly improved survival rates for patients with localized osteosarcoma, with survival rates reaching around 70-75% for those without metastasis at the time of diagnosis. However, for patients with metastatic disease at diagnosis or those who develop metastases during treatment, the prognosis is much worse, with survival rates dropping dramatically [2].

Description

The metastatic behavior of osteosarcoma is most commonly observed in the lungs, where hematogenous spread occurs through the bloodstream. Lung metastases are detected in approximately 20-30% of patients at diagnosis and in 50-70% of patients during the course of the disease, especially after treatment. Bone metastasis is another common site of spread and can occur in both the axial and appendicular skeleton. However, the occurrence of brain metastases in osteosarcoma is rare. Brain metastases have been reported in only a small fraction of osteosarcoma patients, with estimates ranging from 1% to 4% in pediatric cases. Given this rarity, brain metastasis is considered an unusual and often late complication of osteosarcoma. The mechanisms underlying brain metastasis remain poorly understood, but it is generally thought to be due to hematogenous spread through the bloodstream, bypassing the Blood-Brain Barrier (BBB), although direct invasion from adjacent structures is also a potential route. The pathogenesis of brain metastasis in osteosarcoma is complex and not entirely understood. While hematogenous spread is the primary route for metastasis in osteosarcoma, the brain is an organ with a unique vascular architecture that includes the blood-brain barrier, which serves as a selective filter that prevents most pathogens and large molecules from entering the Central Nervous System (CNS). This poses a challenge for metastatic cells to colonize the brain [3].

Metastatic osteosarcoma cells may secrete factors that alter the integrity of the endothelial cells in the brain's blood vessels, making it easier for tumor cells to cross the blood-brain barrier. Osteosarcoma cells may induce angiogenesis, which results in the formation of new, leaky blood vessels that facilitate the movement of metastatic cells into the brain. Osteosarcoma cells might have mechanisms that allow them to evade the immune system, enabling them to survive and proliferate once they have entered the brain. In rare cases, osteosarcoma tumors that are located in close proximity to the brain or spinal cord can extend directly into the CNS *via* local invasion. This is much less common than hematogenous spread. Once osteosarcoma cells enter the brain, they may cause a range of neurological symptoms, depending on the location of the metastases. These symptoms may include headaches, seizures, cognitive changes, focal neurological deficits, and signs of increased intracranial pressure. The location of the metastatic lesions in the brain is crucial in determining the clinical presentation. Diagnosing brain metastasis in pediatric osteosarcoma presents several challenges. Brain metastases are rare, and symptoms may be subtle, particularly in the early stages. Neurological symptoms may be mistaken for side effects of chemotherapy or radiation therapy, which can further complicate the diagnosis [4].

The treatment of brain metastasis in pediatric osteosarcoma remains a significant challenge due to the rarity of this condition and the aggressive nature of the disease. The management approach depends on several factors, including the number and size of brain metastases, the patient's overall health, and the extent of systemic disease. If the brain metastasis is limited to a single lesion or a small number of lesions, surgical resection may be considered. The goal is to remove the metastatic lesion and alleviate any associated symptoms such as intracranial pressure. However, complete resection may not always be possible due to the location of the metastasis or the presence of multiple lesions. Whole-Brain Radiation Therapy (WBRT) or stereotactic radiosurgery (SRS) are the primary modalities used to treat brain metastases. WBRT is often used in cases with multiple metastases, while SRS is typically reserved for patients with a limited number of lesions. Both approaches aim to control tumor growth and alleviate neurological symptoms. However, radiation therapy may have long-term cognitive effects, particularly in pediatric patients, and the potential for neurotoxicity must be considered when deciding on treatment. Chemotherapy is the cornerstone of treatment for osteosarcoma. In cases where brain metastasis occurs, chemotherapy may be used in an attempt to control systemic disease and prevent further metastases. However, the blood-brain barrier limits the effectiveness of many chemotherapy agents. High-dose methotrexate, doxorubicin, and cisplatin are commonly used in the treatment of osteosarcoma, but their penetration into the brain may be limited. Research into novel therapies, including targeted treatments and immunotherapy, is ongoing. While these approaches hold promise for other types of cancer, their role in the treatment of brain metastasis in osteosarcoma is still being evaluated [5].

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Conclusion

Brain metastasis in pediatric osteosarcoma is an uncommon but severe complication that poses significant challenges in diagnosis and treatment. While the primary focus of research and clinical management has been on lung metastases, the occurrence of brain metastasis underscores the need for greater attention to the neurological aspects of osteosarcoma. Early detection and multidisciplinary management are key to optimizing outcomes for these patients. As research continues into more effective treatments, the hope is that better therapeutic strategies, including the use of targeted therapies and immunotherapies, will improve survival rates and quality of life for patients with brain metastasis in osteosarcoma. However, given the rarity of this condition, larger studies are needed to better understand its pathophysiology, risk factors, and optimal treatment strategies.

Acknowledgement

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Conflict of Interest

None.

References

1. Italiano, Antoine, Olivier Mir, Simone Mathoulin-Pelissier and Nicolas Penel, et al. "Cabozantinib in patients with advanced Ewing sarcoma or osteosarcoma (CABONE): A multicentre, single-arm, phase 2 trial." *Lancet Oncol* 21 (2020): 446-455.
2. Choueiri, Toni K., Mayer N. Fishman, Bernard Escudier and David F. McDermott, et al. "Immunomodulatory activity of nivolumab in metastatic renal cell carcinoma." *Clin Cancer Res* 22 (2016): 5461-5471.
3. Yonemoto, Tsukasa, Shin-ichiro Tatezaki, Takeshi Ishii and Katsunobu Osato, et al. "Longterm survival after surgical removal of solitary brain metastasis from osteosarcoma." *Int J Clin Oncol* 8 (2003): 340-342.
4. Patchell, Roy A., Phillip A. Tibbs, William F. Regine and Robert J. Dempsey, et al. "Postoperative radiotherapy in the treatment of single metastases to the brain: A randomized trial." *Am J Med Acc* 280 (1998): 1485-1489.
5. Hall, W. A., H. R. Djalilian, E. S. Nussbaum and K. H. Cho. "Long-term survival with metastatic cancer to the brain." *Med Oncol* 17 (2000): 279-286.

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