

MODERN DIAGNOSTIC AND TREATMENT APPROACHES IN BONE SARCOMAS

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Abstract. Bone sarcomas are rare but highly aggressive malignant tumors that arise from bone tissue and mainly affect children, adolescents, and young adults. Among them, osteosarcoma and Ewing sarcoma are considered the most clinically significant due to their rapid progression, high metastatic potential, and complex treatment requirements. The present article discusses the relevance of early diagnosis, modern imaging techniques, combined treatment strategies, and prognostic factors in patients with bone sarcomas. Special attention is given to the importance of multidisciplinary care, including chemotherapy, surgery, radiology, pathology, rehabilitation, and psychological support.

Keywords: Bone sarcoma, osteosarcoma, Ewing sarcoma, malignant bone tumor, chemotherapy, surgery, diagnosis, metastasis, oncology.

Bone sarcomas represent a small proportion of all malignant tumors, but their clinical importance is very high because they often occur in young patients during active periods of growth and social development. The disease may significantly affect physical activity, emotional well-being, education, and quality of life. In many cases, the first symptoms are nonspecific and may resemble sports trauma, muscle strain, or inflammatory conditions. Pain, swelling, limited movement, and pathological fractures are among the most common clinical manifestations.

The relevance of this topic is also associated with the aggressive nature of bone sarcomas. These tumors can spread rapidly, especially to the lungs and other bones. Early diagnosis is therefore essential for improving survival rates and reducing the risk of disability. Modern oncology has achieved considerable progress in the treatment of localized bone sarcomas, but metastatic and recurrent cases remain difficult to manage. The aim of this article is to analyze the main clinical features, diagnostic methods, treatment approaches, and prognostic aspects of bone sarcomas, with particular attention to osteosarcoma and Ewing sarcoma.

This article is based on the analysis of scientific literature, clinical guidelines, and recent publications devoted to malignant bone tumors. The study used a descriptive and analytical approach to summarize current knowledge about diagnosis, treatment, and prognosis. Special attention was paid to imaging methods, histological verification, chemotherapy protocols, surgical techniques, and rehabilitation measures.

The analysis shows that early clinical suspicion plays a decisive role in the diagnosis of bone sarcomas. Persistent bone pain, especially pain that increases at night or does not disappear after rest, should be considered an alarming symptom. Swelling near a joint, limitation of movement, and unexplained fractures require further examination. Radiography is usually the first diagnostic method. It may reveal bone destruction, periosteal reaction, and irregular tumor margins. Magnetic resonance imaging is used to determine the local spread of the tumor, involvement of soft tissues, neurovascular structures, and the exact size of the lesion. Computed tomography of the chest is important because the lungs are the most frequent site of metastasis. Final diagnosis is confirmed by biopsy and histopathological examination.

Treatment of bone sarcomas requires a multidisciplinary approach. In osteosarcoma, chemotherapy is usually administered before and after surgery. This helps reduce tumor size, destroy microscopic metastases, and evaluate tumor response to treatment. Surgical removal of the tumor is a central part of therapy. In modern practice, limb-salvage surgery is preferred whenever possible. This method allows preservation of the affected limb while maintaining oncological safety.

Ewing sarcoma is also treated with systemic chemotherapy, surgery, and sometimes radiotherapy. Since this tumor is more sensitive to radiation than osteosarcoma, radiotherapy may be used when complete surgical removal is not possible or when the tumor is located in anatomically difficult areas.

Prognosis depends on several factors, including tumor size, location, presence of metastases, histological response to chemotherapy, and completeness of surgical resection. Patients with localized disease have significantly better outcomes than those with metastatic disease. The presence of lung metastases at diagnosis remains one of the most important negative prognostic factors.

Rehabilitation is an essential part of treatment. After surgery, patients often need physiotherapy, prosthetic support, pain management, and psychological assistance. Young patients may face fear, anxiety, changes in body image, and difficulties returning to school or normal daily life. Therefore, successful treatment should not be limited only to tumor removal but should also include restoration of function and social adaptation.

Conclusion. Bone sarcomas are rare but serious malignant tumors that require early recognition and specialized treatment. Modern diagnostic imaging, histological verification, chemotherapy, and advanced surgical techniques have improved the prognosis of many patients. However, metastatic and recurrent forms remain a major challenge. Further development of personalized medicine, targeted therapy, and rehabilitation programs may improve survival outcomes and quality of life for patients with bone sarcomas.