

Osteosarcoma: Understanding Causes, Symptoms, Diagnosis, and Treatment Approaches

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DESCRIPTION

Osteosarcoma is a rare and aggressive form of bone cancer that primarily affects children, adolescents, and young adults, although it can occur at any age. It originates in the osteoblast cells responsible for bone formation and most commonly arises in the long bones of the arms and legs, particularly around the knee and upper arm. As the most common type of primary bone cancer, osteosarcoma presents unique challenges in diagnosis and treatment due to its fast-growing and often invasive nature.

The exact cause of osteosarcoma remains unclear, but several risk factors have been identified. Genetic predisposition plays a role, particularly in individuals with inherited syndromes such as Li-Fraumeni syndrome, hereditary retinoblastoma, and Rothmund-Thomson syndrome. These genetic conditions affect tumor suppressor genes, which normally function to prevent the uncontrolled cell growth that leads to cancer. Rapid bone growth during puberty is another contributing factor, which is why adolescents are particularly vulnerable. Additionally, individuals who have previously undergone radiation therapy, particularly at a young age, may be at increased risk for developing osteosarcoma later in life.

The symptoms of osteosarcoma can be subtle in the early stages and are often mistaken for growing pains or sports-related injuries, especially in young patients. The most common symptom is persistent bone pain, often worsening at night or with physical activity. Swelling or a noticeable lump at the tumor site may develop, and the affected limb might be tender or warm to the touch. In some cases, a sudden fracture may occur due to the weakening of the bone by the tumor. As the disease progresses, it may interfere with joint movement or lead to a limp if located in the leg.

Early and accurate diagnosis of osteosarcoma is essential for effective treatment and improved outcomes. Diagnosis typically begins with a thorough medical history and physical examination, followed by imaging studies such as X-rays, Magnetic Resonance Imaging (MRI), and Computed Tomography (CT) scans to determine the size and extent of the tumor. A biopsy is then performed to confirm the presence of

cancerous cells and to differentiate osteosarcoma from other types of bone tumors. In addition, bone scans or positron emission tomography (PET) scans may be used to detect whether the cancer has spread, most commonly to the lungs or other bones.

Treatment for osteosarcoma usually involves a combination of chemotherapy and surgery, and in some cases, radiation therapy may be used. The primary goal is to remove the tumor, eliminate any microscopic cancer cells, and preserve as much limb function as possible. Neoadjuvant chemotherapy-administered before surgery-aims to shrink the tumor and make surgical removal more manageable. Following surgery, adjuvant chemotherapy is given to destroy any remaining cancer cells and reduce the risk of recurrence.

Surgical options depend on the tumor's size, location, and response to chemotherapy. Limb-salvage surgery is often possible, in which the affected bone is removed and reconstructed using a bone graft or prosthetic implant. In some cases, particularly when the tumor is extensive or involves critical structures, amputation may be necessary to achieve complete tumor removal. Advances in surgical techniques and prosthetic technology have significantly improved outcomes and quality of life for patients undergoing limb-sparing procedures.

The prognosis for osteosarcoma varies depending on several factors, including the tumor's size and location, whether the cancer has spread at the time of diagnosis, and how well it responds to chemotherapy. With current treatment protocols, the long-term survival rate for patients with localized osteosarcoma is approximately 60% to 80%. However, if the cancer has metastasized, especially to the lungs, the prognosis becomes less favorable, with lower survival rates despite aggressive treatment.

Living with osteosarcoma can be physically and emotionally challenging for patients and their families. The intensity of treatment, possible physical limitations, and the fear of recurrence all contribute to significant stress. Psychosocial support, including counseling, support groups, and rehabilitation services, plays a vital role in helping patients cope

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with the impact of the disease and its treatment. For younger patients, educational support and assistance with reintegration into school life after treatment are also important.

Research into osteosarcoma continues to evolve, with scientists exploring new therapies aimed at improving survival rates and minimizing treatment-related side effects. Targeted therapies, which focus on specific genetic or molecular features of cancer cells, are being investigated as potential treatment options. Immunotherapy, which harnesses the body's immune system to fight cancer, is another promising area of study. Clinical trials offer patients access to these cutting-edge treatments and contribute to the advancement of medical knowledge about osteosarcoma.

CONCLUSION

Osteosarcoma is a serious but treatable bone cancer that requires a multidisciplinary approach for optimal care. Early diagnosis, combined with aggressive treatment involving chemotherapy and surgery, offers the best chance for recovery. Continued research, improved treatment strategies, and comprehensive patient support are essential to enhancing outcomes and quality of life for those affected by this challenging disease.