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Immunotherapy and Targeted Therapies in Bone Cancer Treatment

Lora Bernhard*

Department of Orthopaedics, ETH Zurich, Zurich, Switzerland

Perspective

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***For Correspondence:**
Lora Bernhard, Department of Orthopaedics, ETH Zurich, Zurich, Switzerland
E-mail: lora.bernhard@ethz.ch

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DESCRIPTION

Bone cancer, though rare compared to other forms of cancer, can be aggressive and challenging to treat. The two primary types of bone cancer are primary bone cancers, such as osteosarcoma and Ewing sarcoma and secondary bone cancers, which arise from metastasis of cancers originating in other organs like breast, prostate or lung. Traditionally, treatment for bone cancer has involved surgery, chemotherapy and radiation therapy. However, advancements in immunotherapy and targeted therapies are increasingly shaping the landscape of bone cancer treatment, offering hope for more effective and less toxic treatment options.

Immunotherapy in bone cancer treatment

Immunotherapy a type of cancer treatment that harnesses the body's immune system to fight cancer, has shown promise in the treatment of various cancers, including bone cancer. The goal of immunotherapy is to boost the immune system's natural ability to recognize and destroy cancer cells.

Checkpoint Inhibitors: Checkpoint inhibitors are a class of immunotherapy drugs that block checkpoint proteins from binding with their partner proteins. These checkpoint proteins, like PD-1 (Programmed Cell Death Protein 1) and PD-L1 (Programmed Death-Ligand 1) act as "brakes" on the immune system, preventing immune cells from attacking cancer cells. Inhibiting these checkpoints can allow immune cells to better recognize and kill cancer cells.

Cytokine therapy: Cytokine therapy involves the administration of cytokines, which are proteins that help regulate the immune system. These can include interleukins and interferons, which have shown the potential to stimulate immune responses against bone tumors.

The use of interleukin-2 and interferon-alpha has been explored in clinical trials for various sarcomas, showing some success in boosting immune responses against osteosarcoma cells.

Cancer vaccines: Cancer vaccines aim to stimulate the immune system to recognize and fight cancer cells by targeting specific antigens found on the surface of cancer cells. Although vaccines are widely used in preventing cancers such as cervical and liver cancers, research is underway to develop therapeutic cancer vaccines for bone cancers. These vaccines aim to help the immune system recognize specific proteins found in bone sarcomas and thereby improve tumor recognition and destruction.

Targeted therapies in bone cancer treatment

Targeted therapies are designed to interfere with specific molecules that are involved in the growth and spread of cancer cells. These therapies are often more precise than traditional chemotherapy, which targets rapidly dividing cells indiscriminately and tend to have fewer side effects.

Tyrosine Kinase Inhibitors (TKIs): Tyrosine kinases are enzymes that play a key role in the signaling pathways that control cell division and growth. Mutations in tyrosine kinase receptors can lead to cancer cell proliferation. Tyrosine Kinase Inhibitors (TKIs) target these receptors and block their activity, thus inhibiting cancer cell growth.

Monoclonal antibodies: Monoclonal antibodies are laboratory-made molecules that can bind to specific proteins on the surface of cancer cells, blocking their activity or marking them for destruction by the immune system.

Angiogenesis inhibitors: Angiogenesis is the process by which tumors develop new blood vessels to supply themselves with nutrients and oxygen. Inhibiting angiogenesis can starve tumors, limiting their growth and spread. Drugs that block angiogenesis, such as bevacizumab, have been used in treating various cancers, including sarcomas. Bevacizumab and other angiogenesis inhibitors are being investigated for their ability to treat bone cancers, particularly in combination with other therapies.

Immunotherapy and targeted therapies represent a new frontier in bone cancer treatment. These approaches offer the potential for more effective and less toxic treatments compared to traditional chemotherapy. While there are challenges to overcome, particularly in adapting these therapies to the unique biology of bone cancers, advancements are being made and these therapies are becoming a critical part of the treatment landscape for both primary and metastatic bone cancers. With continued research and innovation, the future holds great promise for improving the prognosis and quality of life for patients with bone cancer.