

## Advances in Musculoskeletal Radiology: A Comprehensive Review

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## **Nuclear medicine**

Nuclear medicine is a specialized branch of medical imaging that employs the use of radioactive substances and advanced detection technology to provide unique insights into the functioning of the human body at the molecular and cellular levels. Unlike conventional imaging techniques that primarily visualize anatomical structures, nuclear medicine focuses on the physiological processes occurring within tissues and organs [7]. It has emerged as a crucial tool for both diagnosis and treatment in various medical specialties, including oncology, cardiology, neurology, and endocrinology. By administering radiopharmaceuticals, which emit gamma rays or positrons, nuclear medicine enables healthcare professionals to track the distribution of these radiotracers and assess organ function, offering a wealth of information that complements traditional diagnostic methods. The versatility of nuclear medicine in diagnosing and monitoring a wide range of conditions makes it an indispensable component of modern healthcare, continually evolving with technological advancements and playing a pivotal role in personalized medicine [8].

## **Clinical Applications**

### **Sports medicine**

Musculoskeletal radiology plays a vital role in diagnosing and managing sports-related injuries. This includes the evaluation of stress fractures, ligament tears, and muscle strains, which are critical for athletes' return to play.

### **Orthopedics**

The field of orthopedics heavily relies on musculoskeletal imaging for preoperative planning and postoperative assessment. Customized implants and patient-specific surgical techniques are benefiting from 3D reconstructions and modeling [9].