

### **Three-material decomposition with spectral CT for early diagnosis of osteoporosis**

- Osteoporosis is a skeletal disorder that affects postmenopausal women and older adults, leading to reduced bone mass and increased fracture risk. Early diagnosis is crucial for timely treatment and fracture prevention.
- Bone mineral density (BMD) estimation is important for assessing osteoporosis, with trabecular tissue providing key insights. Current clinical standards for BMD assessment, such as Dual-Energy X-ray Absorptiometry (DXA) and Quantitative Computed Tomography (QCT), have limitations.
- Spectral CT overcomes these limitations by employing dual-energy techniques. It quantifies materials based on distinct attenuation properties at different energy levels. A more recent advancement is the dual-layer detector CT (DLCT).
- Three-material decomposition is a technique that shows potential for BMD quantification without the need for a calibration phantom and addresses the influence of adipose tissue.
- This review explores the application of three-material decomposition in spectral CT for osteoporosis BMD assessment, evaluating existing techniques, strengths, and limitations. It also discusses the potential of spectral CT coupled with three-material decomposition algorithms in early diagnosis and management of osteoporosis, as well as future directions for technological advancements and improved BMD analysis.