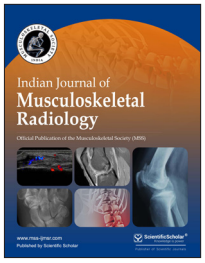
ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

www.mss-ijmsr.com

Indian Journal of Musculoskeletal Radiology



Editorial

Newer frontiers in dual energy CT as applied to musculoskeletal imaging

S. Narayan[1], R. S. Negi[2]

[1]Department of Radiology and Imaging, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India, [2]Department of Radiology and Imaging, University Hospital Lewisham, London, United Kingdom.

***Corresponding author:**
R. S. Negi,
Department of Radiology and Imaging, University Hospital Lewisham, London, United Kingdom.

raj.negi9@gmail.com

Received : 01 December 2022
Accepted : 07 December 2022
Published : 21 December 2022

DOI
10.25259/IJMSR_44_2022

Quick Response Code:

The prevalence of vertebral compression fracture (VCF) is high and the clinical management and prediction of outcome depend largely on the age of the fracture. Differentiation of acute versus chronic fracture, on imaging, has been primarily dependent on presence of marrow edema. In addition to differentiate acute versus chronic benign VCF, detection of marrow edema is the key to diagnose occult fractures in sacrum, scaphoid, or femoral neck especially in setting of osteoporosis or, to detect the complications around metallic prosthesis. Interestingly, most of these clinical conditions are first evaluated with computerized tomography (CT) in an acute setting, within the hospital services. Conventional CT is a readily available technique to evaluate patients with back pain, suspected VCFs or insufficiency fractures, and provides excellent details of cortical and cancellous bone along with the fracture margins. High prevalence of VCF picked up on routine abdominal and thoracic CT imaging for other clinical indications is another area that increases the management dilemma, mainly limited by its inability to pick up marrow edema in acute fractures.

Magnetic resonance imaging (MRI) is an established and well-documented modality for evaluation of marrow-related pathologies. However, its availability in the setting of acute back pain or trauma may be limited in the emergency department. Implants, pacemakers, and life-support devices can further restrict the evaluation of these patients with MRI under given conditions.

With technological advancements, it is now possible to separate and characterize different materials within the bones, namely, calcium, red marrow, and yellow marrow. This is achieved by scanning the patient at two different energy levels, low-energy beam at 80–100 kVp, and at a higher energy spectrum of 130–140 kVp. This provides additional diagnostic value to the patient care without any significant increase in radiation dose and has an established role in crystal characterization (monosodium urate detection), metal artifact reduction, and collagen imaging.

Virtual non-calcium (VNCa) reconstructions technique that enables subtraction of calcium from cancellous and cortical bone, further potentiates evaluation of bone microarchitecture and marrow simultaneously in dual energy CT (DECT) rendering. The technique now allows us to better assess isolated marrow and differentiate edematous marrow from normal marrow: A former domain of MRI. This has ushered a new era of CT imaging in musculoskeletal applications proving its role in detection and assessment of benign VCFs, insufficiency fractures, and occult fractures of the scaphoid and femoral neck. These were areas where diagnostic dilemma existed with initial imaging and limited use of/delay in obtaining MRI often

compounded definitive management of the patients. It is also of value in situations where the routine CT evaluation fails to pick up an abnormality or in challenging situations like evaluation of subtle periprosthetic fractures where metallic artifacts hinder the quality of images on both CT and MRI examinations.

Studies have suggested that mean DECT numbers for detection of bone marrow edema in VNCa images have very high sensitivity and specificity. Thus, DECT bears the advantage of combining the benefits of conventional CT in evaluating osseous structures with those of MRI in assessing bone marrow, as a single imaging modality. It also provides us with an easily available and faster alternative to MRI in assessment of these disease conditions.

Apart from marrow evaluation, DECT has proven its role in estimating bone mineral density (BMD) accurately with a significant correlation between T-scores of dual-energy X-ray absorptiometry and BMD assessment by CT. It can be of immense use in quantifying fragility fracture risk and can serve as one stop shop for varied osseous assessments. Virtual monoenergetic images performed by utilizing DECT, especially with artifact reduction algorithm software, allow evaluation of bone-metal interface with good quality images in implant imaging. Use of DECT is reliable and has been validated adequately for the diagnosis of gout, leading to its incorporation in the ACR/EULAR 2015 Gout Classification Criteria.

However, the specificity of DECT is dependent on parameters such as acquisition technique and reader experiences and has to be used with caution. With further refinement in technology, considering its wider availability and faster scanning time, DECT may obviate the need for confirmatory MRI in an emergency setting and will play an important role in musculoskeletal radiology practice.

RESOURCES

1. Ali IT, Wong WD, Liang T, Khosa F, Mian M, Jalal S, *et al*. Clinical utility of dual-energy CT analysis of bone marrow oedema in acute wrist fractures. AJR 2018;210:842-7.
2. Karaca L, Yuceler Z, Kantarci M, Cakir M, Sade R, Calikoglu C, *et al*. The feasibility of dual energy CT in differentiation of vertebral compression fractures. Br J Radiol 2016;89:20150300.
3. Yang P, Wu G, Chang X. Diagnostic accuracy of dual energy computed tomography in bone marrow oedema with vertebral compression fractures: A meta-analysis. Eur J Radiol 2018;99:124-9.

How to cite this article: Narayan S, Negi RS. Newer frontiers in dual energy CT as applied to musculoskeletal imaging. Indian J Musculoskelet Radiol 2022;4:71-2.