RSNA Press Release

Novel Photon-Counting CT Improves Myeloma Bone Disease Detection

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OAK BROOK, Ill. — New CT technology paired with artificial intelligence (AI)-based noise reduction offers superior detection of bone disease associated with multiple myeloma at lower radiation doses than conventional CT, according to a new study published in *Radiology*, a journal of the Radiological Society of North America (RSNA).

The new technology, known as photon-counting detector CT, debuted in the clinic in 2021 after decades of development. By directly converting individual x-ray photons into an electric signal, photon-counting detector CT can decrease the detector pixel size and improve the image’s spatial resolution.

*Francis Baffour, M.D.*

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**At A Glance**

- New CT technology paired with AI offers superior detection of bone disease associated with multiple myeloma.
- The photon-counting detector CT with deep learning noise reduction detected more lytic lesions relative to conventional CT.
- Photon-counting detector CT could make a difference in the staging of disease, potentially impact therapy choice, and ultimately, patient outcomes.
“Additionally, photon-counting CT has demonstrated much better dose efficiency than
standard CT, which allows for acquisition of ultra-high-resolution images of large areas of
the body,” said study lead author Francis Baffour, M.D., diagnostic radiologist at the Mayo
Clinic in Rochester, Minnesota.

This potential for improved image quality in whole-body low-dose scans inspired Dr.
Baffour and colleagues to study the technology in people with multiple myeloma, a disease
that forms in a type of white blood cell found in the bone marrow called a plasma cell. Bone
disease characterized by areas of bone destruction known as lytic lesions is found in
approximately 80% of multiple myeloma patients.

The International Myeloma Working Group recommends low-dose, whole-body CT to
evaluate associated bone disease. Much less is known about photon-counting detector CT is
this setting.

Dr. Baffour and colleagues compared photon-counting detector CT with conventional
low-dose, whole-body CT in 27 multiple myeloma patients, median age 68 years. The
patients underwent whole-body scans with both types of CT and two radiologists compared
the images.

“We felt this was a prime example to showcase the ultra-high-resolution of photon-counting
CT at low scanning doses,” Dr. Baffour said.

The researchers also applied a deep learning AI technique developed at Mayo Clinic’s CT
Clinical Innovation Center to reduce the noise in the very sharp photon-counting images. CT
noise refers to an unwanted change in pixel values in the image, often loosely defined as the
grainy appearance on cross-sectional imaging. The photon-counting detector CT with deep
learning noise reduction demonstrated improvement in visualization and detected more
lesions relative to conventional CT.

“We were excited to see that not only were we able to detect these features of multiple
myeloma disease activity more clearly on the photon-counting scanner,” Dr. Baffour said,
“with deep learning denoising techniques that allowed us to generate thinner image slices,
we were able to detect more lesions than on the standard CT.”

The researchers hope to conduct follow-up studies on patients with multiple myeloma
precursor states to see if photon-counting detector CT finds bone lesions that would upstage
these patients to active multiple myeloma.

“Our excitement as scientists and radiologists in these results stems from our realization that
this scanner could make a difference in the staging of disease, potentially impact therapy
choice, and ultimately, patient outcomes.”

They also want to look at photon-counting detector CT in other instances in which low-dose
protocols are beneficial, for instance, in pediatric or pregnant patients or screening
applications.

“Already there are ongoing studies to determine how low we can go with scanning doses
while still obtaining diagnostic CT images,” Dr. Baffour said. “So, there is much on the
horizon and so much potential for photon-counting detector CT in clinical care.”

Dr. Baffour credited his colleagues, Cynthia McCollough, Ph.D., and Joel Fletcher, M.D.,
directors of Mayo Clinic’s CT Clinical Innovation Center, for their work in developing clinical applications of photon-counting detector CT.

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“Photon-counting Detector CT with Deep Learning Noise Reduction to Detect Multiple Myeloma.”
Collaborating with Drs. Baffour, McCollough and Fletcher were Nathan R. Huber, Ph.D., Andrea Ferrero, Ph.D., Kishore Rajendran, Ph.D., Katrina N. Glazebrook, M.D., Ch.B., Nicholas B. Larson, M.S., Ph.D., Shaji Kumar, M.D., Joselle M. Cook, M.B.B.S., Shuai Leng, Ph.D., and Elizabeth R. Shanblatt, Ph.D.

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For patient-friendly information on whole-body CT, visit *RadiologyInfo.org.*