Choose Your Collimator Wisely: Inappropriate Collimator Selection During a $^{177}$Lu-DOTATATE Posttreatment Scan

Justin G. Peacock$^{1,2}$ and Taylor S. Young, RT(R)(CT)(ARRT), CNMT$^3$

$^1$Department of Radiology and the Radiological Sciences, Uniformed Services University, Bethesda, Maryland; $^2$Department of Military Medical Operations, Armed Forces Radiobiology Research Institute, Bethesda, Maryland; and $^3$Department of Radiology, Brooke Army Medical Center, San Antonio, Texas

Proper collimator selection is critical to obtaining high-quality, interpretable nuclear medicine images. Collimators help eliminate scatter, which leads to poor spatial resolution and blurry images. We present the case of a posttherapy $^{177}$Lu-DOTATATE (Lutathera) patient who was initially imaged with a low-energy, high-resolution collimator routinely used in $^{99m}$Tc imaging. On image review, the patient was reimaged with the appropriate medium-energy, high-resolution collimator, which resulted in improved image quality. When reviewing the quality of images, it is important to understand modifications to the imaging that can significantly improve image quality and interpretation.

Key Words: quality control; collimator; image resolution

$^{177}$Lu-DOTATATE (Lutathera; Novartis) posttreatment scan, resulting in poor imaging characteristics compared with the correct collimator.

CASE REPORT

At our institution, $^{177}$Lu-DOTATATE patients routinely undergo whole-body planar $\gamma$-camera imaging the day after treatment. This imaging is performed to ensure correct radiotherapy localization and to assess potential new sites of disease. On the day in question, the technologist did not switch the low-energy, high-resolution collimator to the MEHR collimator. The images were brought to the nuclear radiologist for review before patient discharge (Fig. 1). Together, the physician and the technologist realized that the images were noisy and had poor spatial resolution. After a discussion about the reasons for the poor image quality, the technologist realized that the wrong collimator had been used in the study. After the collimator was switched to an MEHR collimator, imaging was repeated (Fig. 2). The subsequent images were of much higher quality, with improved spatial resolution and contrast-to-noise ratios.

DISCUSSION

We describe a patient who was treated with $^{177}$Lu-DOTATATE but for whom the technologist did not switch to the correct collimator (MEHR) for $^{177}$Lu after treatment, instead keeping the most common collimator on the camera, which was the low-energy, high-resolution collimator. This type of collimator lets scattered high-energy $\gamma$-rays pass through the thinner septa more readily than does an MEHR collimator. These scattered high-energy $\gamma$-rays result in poorer spatial resolution and blurry images.
images (Fig. 1). As the field of nuclear medicine moves to different radionuclides, such as $^{177}$Lu, technologists need to check the radiopharmaceutical and match the peak energy with the correct collimator. High-energy collimators should be used for radionuclides such as $^{131}$I, medium-energy collimators should be used for radionuclides such as $^{111}$In or $^{177}$Lu, and low-energy collimators should be used for radionuclides such as $^{99m}$Tc. The experience taught the technologists and physicians how to review images for quality and ways to improve that quality through collimator selection.

CONCLUSION

Currently, general nuclear medicine clinics focus predominantly on $^{99m}$Tc-labeled radionuclides; the collimator thus does not need to be changed as frequently as in the past. As new radionuclides enter nuclear medicine practice, it is important to learn about their properties for safety and high-quality imaging. An important step in ensuring high-quality imaging is selecting the correct collimator for the imaged radioisotope. In this case, we learned that the MEHR collimator provides higher-quality images than the low-energy, high-resolution collimator for this scan after $^{177}$Lu-DOTATATE treatment.

DISCLOSURE

No potential conflict of interest relevant to this article was reported. The opinions and assertions expressed here are those of the authors and do not necessarily reflect the official policy or position of the Uniformed Services University or the Department of Defense.

REFERENCES