High Sensitivity in Low-dose Gallium-68 PET Study Guides Patient Management

Case submitted by Jaslok Hospital & Research Centre, Mumbai, India

Introduction

Oncology patients typically undergo PET/CT imaging for diagnosis, staging and treatment monitoring of the disease. Recent improvements in PET detector technology have enabled higher sensitivity, leading to exceptional image quality that allows for the use of lower dose, shorter scan times and excellent small lesion detectability. Simultaneous advancements in PET image reconstruction, specifically consistent and accurate PET quantitation, further enhance the information available to clinicians to both properly stage and follow disease.

The benefit of time-of-flight (TOF) PET imaging has been documented in literature, namely that TOF reconstruction leads to a higher contrast recovery versus noise trade-off with faster, more uniform convergence[1] and better definition of small lesions and image details, improved uniformity and noise reduction.[2] However, the following clinical case demonstrates that a non-TOF PET/CT system with high sensitivity and image quality can also increase clinical confidence to provide an informed course of treatment.

Patient history

A 72-year-old man with a six-month history of headaches, a loss of hearing and visual disturbances was referred for a CT scan of the head. A lesion was detected on the left side base of the skull and was confirmed as meningioma. The patient underwent surgery to remove the lesion. Within one year, the patient returned for two additional surgeries to remove a residual lesion at the skull base.

The patient's symptoms reoccurred and an MRI was ordered to help determine if additional lesions had developed or were possibly not initially detected. Additionally, a TOF PET/CT study with Gallium-68 (^{68}Ga) was also performed, showing a strong uptake in the base of the skull. Based on the results of these imaging studies, which identified additional lesions, stereotactic radiosurgery (SRS) with a Gamma Knife™ was scheduled.

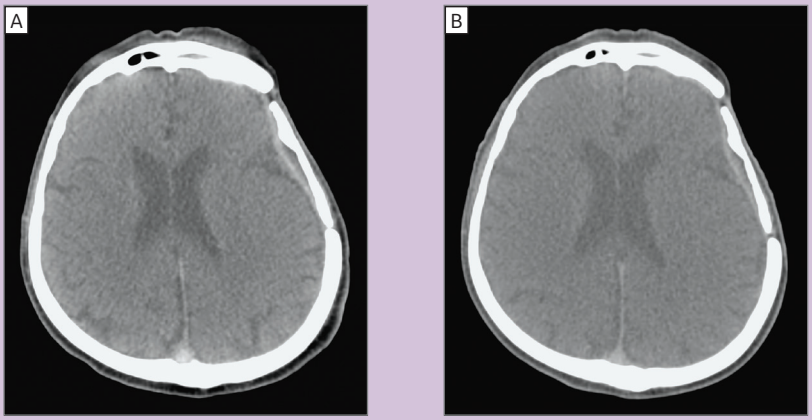

Figure 1. (A) CT from TOF system and (B) CT from Discovery IQ 5-Ring system.

> *"With the Discovery IQ 5-Ring PET/CT, the clinician could visualize sub-centimeter lesions that were not previously seen on a prior TOF PET/CT."*

Three months after the SRS, the patient still had recurring symptoms. The patient was also offered peptide receptor radionuclide therapy with ^{90}Y-DOTATOC[3] since the patient had already undergone three traditional surgical resections and one SRS.

The patient was referred to Jaslok Hospital for a ^{68}Ga DOTATOC[3] PET/CT study on the Discovery™ IQ PET/CT with a 26 cm AFOV, which has the highest NEMA sensitivity in the industry, up to 22 cps/kBq.[4] Based on the results of this study, the patient would be referred either for a second SRS or ^{90}Y-DOTATOC[3] therapy.

With the images obtained by Discovery IQ, a significant difference in image quality was noted that led to the detection of new lesions compared to the prior TOF PET/CT study. Three to four additional sub-centimeter lesions were clearly visible—these were only faintly detected retrospectively on the prior PET/CT and not seen at all on the MR images or on the CT portion of the PET/CT. Additionally, due to the high sensitivity of Discovery IQ, half the dose used in the prior PET/CT study was administered to the patient—from 3 mCi to 1.5 mCi.[5]

Based on the results of the Discovery IQ study, the patient was recommended for ^{90}Y-DOTATOC[3] therapy and not another SRS as the lesions were deemed too small for any type of surgery.

Discussion

With the Discovery IQ 5-Ring PET/CT, the clinician could visualize sub-centimeter lesions that were not previously seen on a prior generation TOF PET/CT. While the literature indicates TOF provides high image resolution, it is clear from this patient case that a non-TOF system that provides high sensitivity and image quality, such as Discovery IQ 5-Ring, can help the clinician clearly see the lesions. Further, the ability to lower dose provides additional benefits to the patient, especially oncology patients who often receive follow-up PET/CT studies for treatment monitoring and post-therapy evaluations.

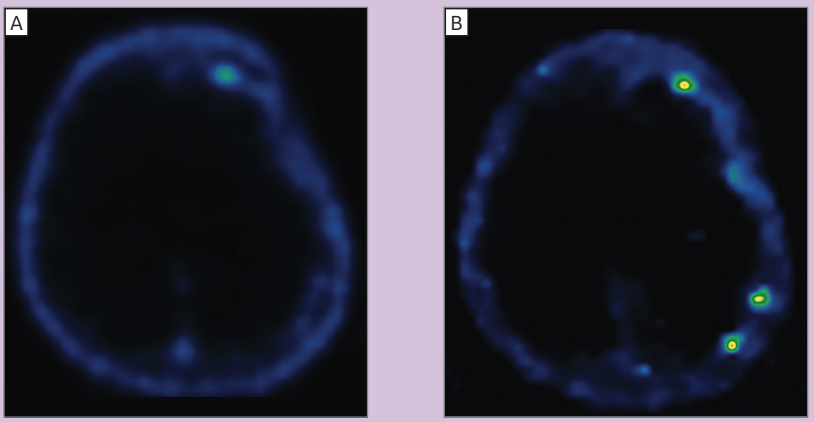

Figure 2. (A) TOF PET compared to (B) Discovery IQ 5-Ring PET images. Using the same imaging parameters, the Discovery IQ images depict the lesions more clearly than the TOF images.

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An added benefit of Discovery IQ 5-Ring is the fast scan time. Previously, a whole-body PET would require seven to eight bed positions, or nine if imaging down to the feet/toes. Now, a whole-body PET scan can be completed in four to five bed positions for the same coverage. The imaging time for each bed position has also decreased, from 2.5 minutes to 1.5 minutes—and it may be possible to achieve a 1 minute imaging time per bed position. This translates to a reduction in the exam time from 12 to 15 minutes down to approximately 7 minutes. ■

1. Karp JS, Suleman S, Daube-Witherspoon ME, Muehllehner G. The benefit of time-of-flight in PET imaging: Experimental and clinical results. J Nucl Med, 2008 Mar; 49(3): 462–470.
2. Lois C, Jakoby BW, Long MJ, et al. An Assessment of the Impact of Incorporating Time-of-Flight Information into Clinical PET/CT Imaging.
3. Radiopharmaceuticals discussed here may not be approved in every country; may not be available in all markets.
4. Comparing Discovery IQ 5-Ring to other PET/CT scanners as reported in ITN online comparison charts (April 2014).
5. Consult full prescribing information for indications for use and administration information of radiopharmaceutical.

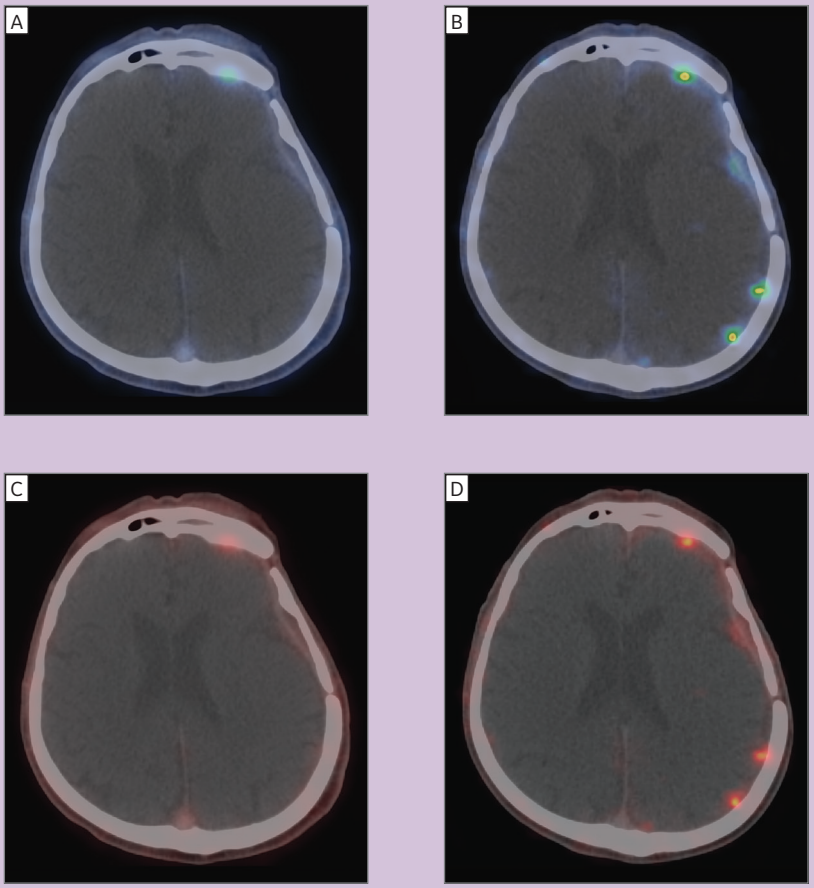

Figure 3. In the (B, D) Discovery IQ 5-Ring PET/CT images, the lesions are clearly visible compared to the (A, C) TOF images.