

Single-bed, whole-body ^{68}Ga DOTATATE PET/CT delineation of neuroendocrine tumor metastases

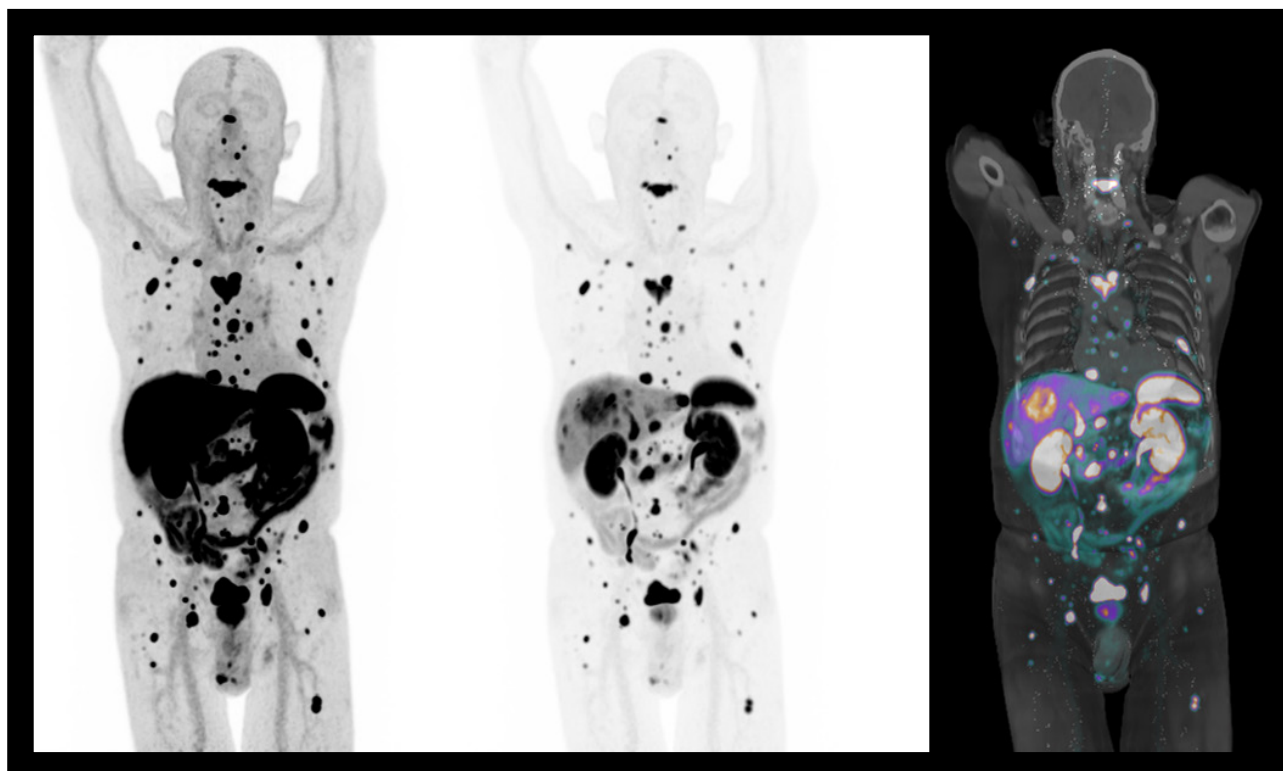
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Data and images courtesy of Inselspital, Bern, Switzerland

History

A 74-year-old male with a primary duodenal neuroendocrine tumor was referred for ^{68}Ga DOTATATE PET/CT staging to evaluate suspected metastases.

One hour and 17 minutes following a 4.3 mCi (158 MBq) intravenous (IV) injection of ^{68}Ga DOTATATE, the patient underwent a 10-minute, single-bed, whole-body PET/CT

acquisition on a Biograph Vision Quadra™ scanner.

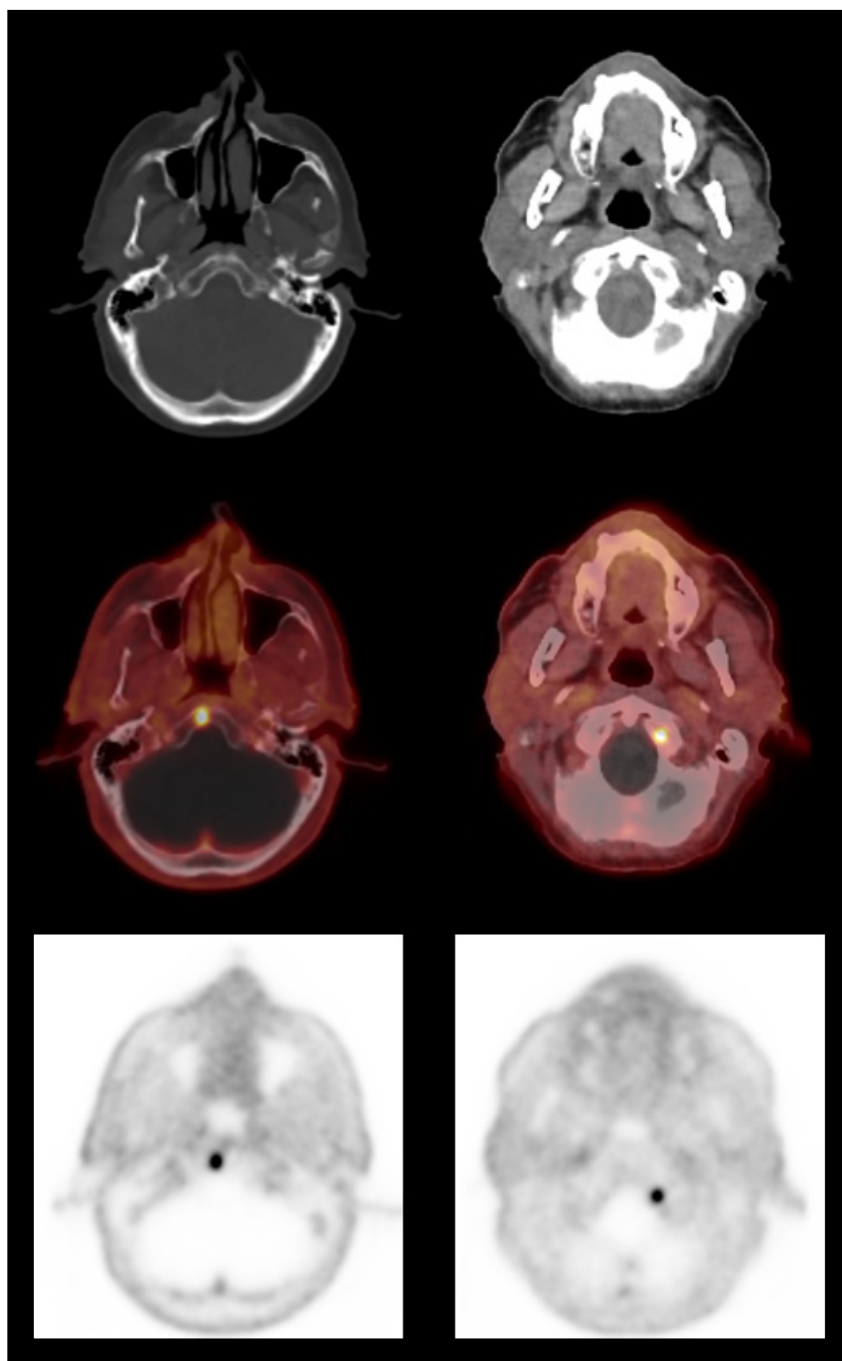


- 1 Whole-body PET MIP images show extensive metastases throughout the body ranging from the vertex to the thighs, including multiple metastases in the thorax, liver, intestines, spine, pelvis, and bilateral femur. The PET MIP with a wider window setting (middle) helps differentiate between normal liver and ^{68}Ga DOTATATE-avid liver metastases. The volume-rendered PET/CT image (right) also shows extensive metastases in the bones, liver, and intestines.

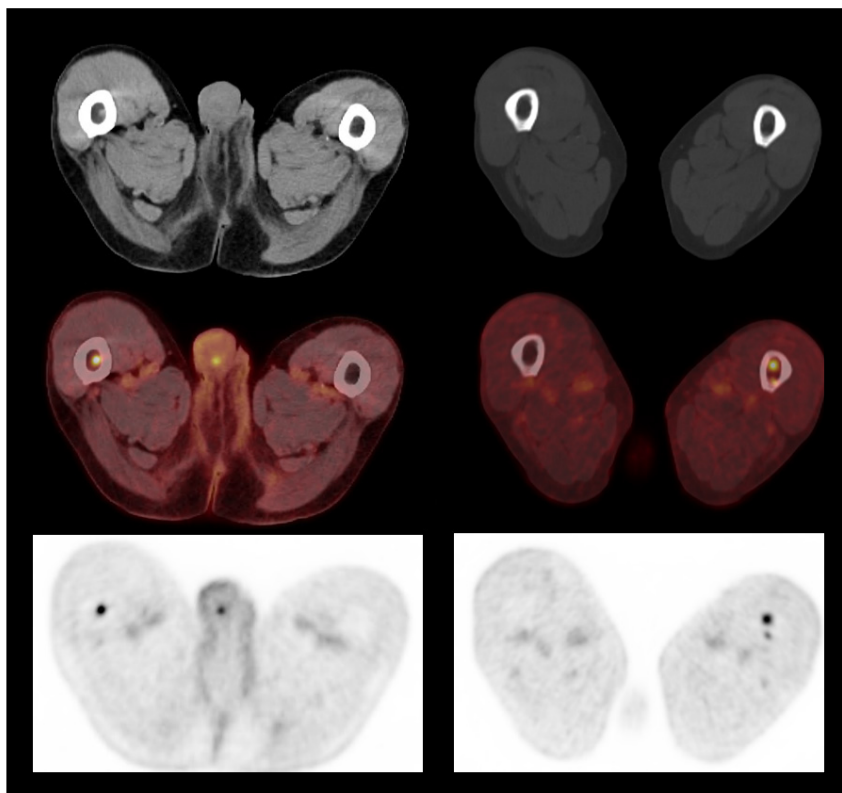
Findings

As seen in Figure 1, there are extensive metastases observed throughout the body with lesions in the bone, liver, and intestines. The physiological uptake of radionuclides in the normal liver parenchyma, spleen, kidney, ureter, bladder, bilateral adrenal glands, and pituitary gland appears within normal limits.

As observed in Figures 2 and 3, the upper- and lower-most metastatic lesions—ranging from the skull base to the thighs—are sharply defined with equally high contrast-to-background levels due to the Biograph Vision Quadra's 106 cm axial PET field of view (FoV), which enabled the single-bed, whole-body acquisition for this particular patient measuring 172 cm (5'7") in height.

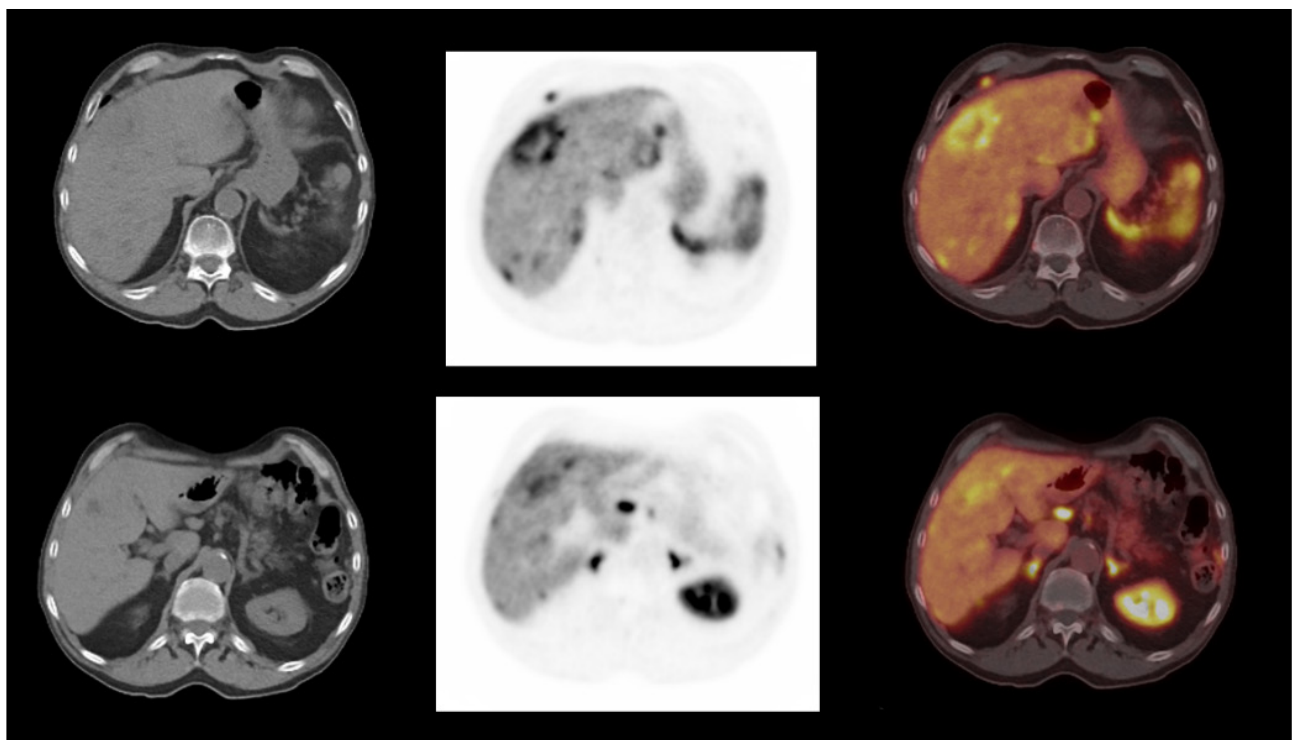


2 Axial CT, PET/CT, and PET images show the uppermost (near vertex) small bony metastases in the skull base and the upper cervical vertebrae. These lesions are defined with a high contrast to the background similar to the rest of the body.

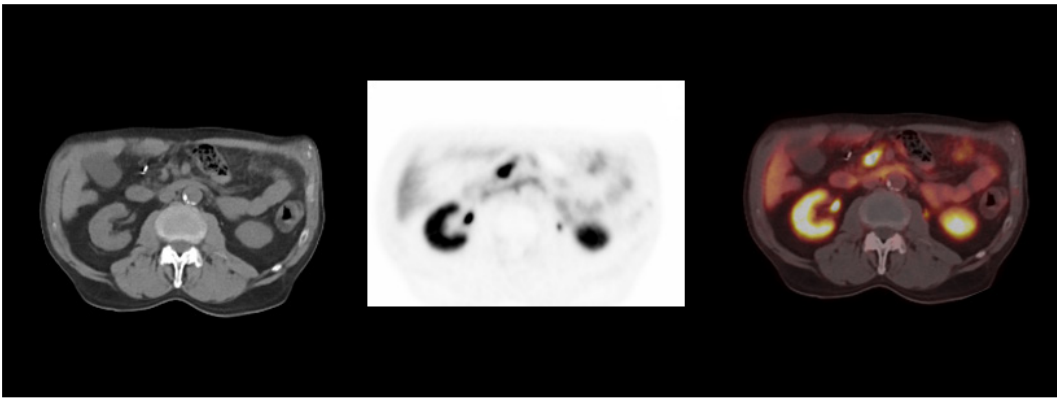


There are multiple metastases visualized from the primary neuroendocrine tumor, indicating high somatostatin-receptor density and intense avidity for ^{68}Ga DOTATATE. These findings help inform the recommendation for the patient to proceed with ^{177}Lu DOTATATE radionuclide therapy. By using DOTATATE-labeled ligands, this will help ensure that a similar level of therapeutic tracer intensity within lesions can be achieved for a high and sustained radiation dose to the metastatic lesions without undue normal tissue irradiation.

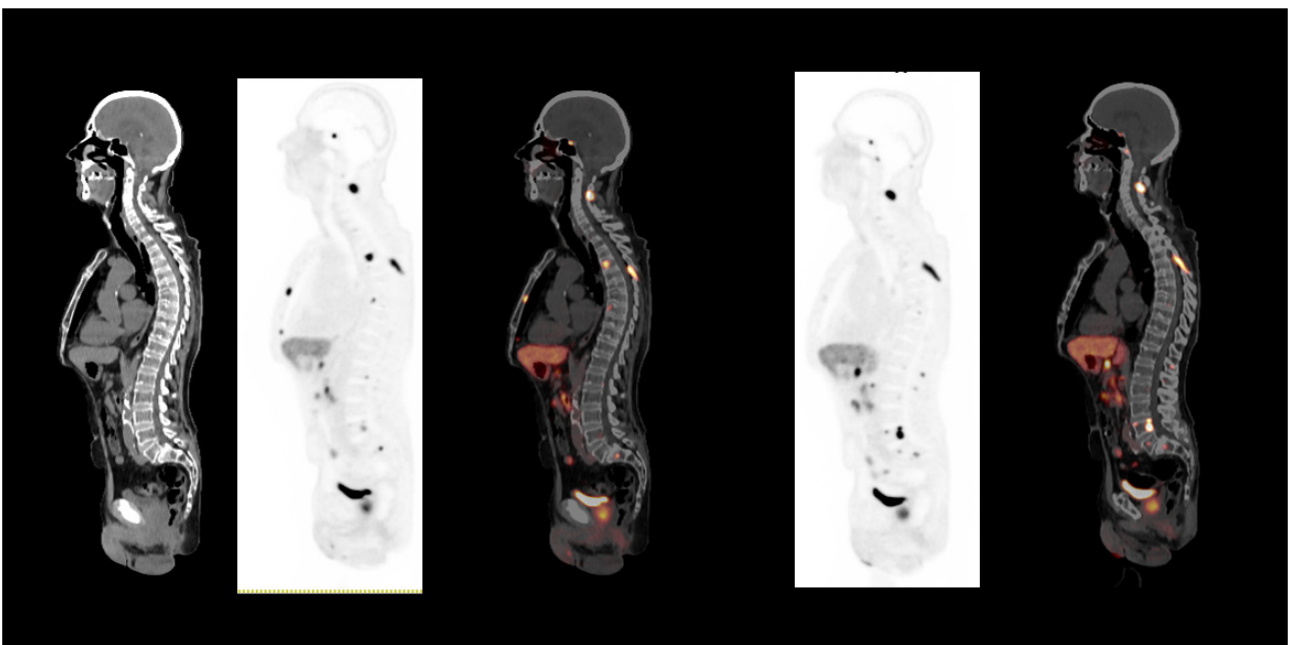
3 Axial CT, PET/CT, and PET images show the lowermost (near mid-thigh) metastatic lesions within the bone marrow shaft of both femurs. A small metastatic lesion in the cortex of the left femoral shaft and an additional small lesion in the scrotal wall are also visualized.



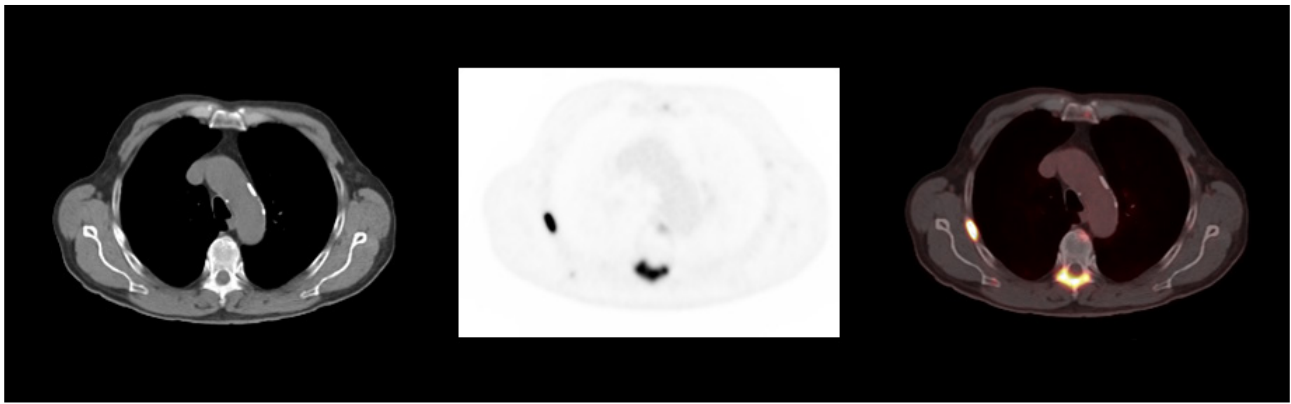
4 Axial CT, PET, and PET/CT images at two different levels through the liver show large liver metastases in segment 8 with central necrosis. Additional lymph node metastases at the porta-hepatis level as well as intense uptake in the bilateral adrenals are also visualized.



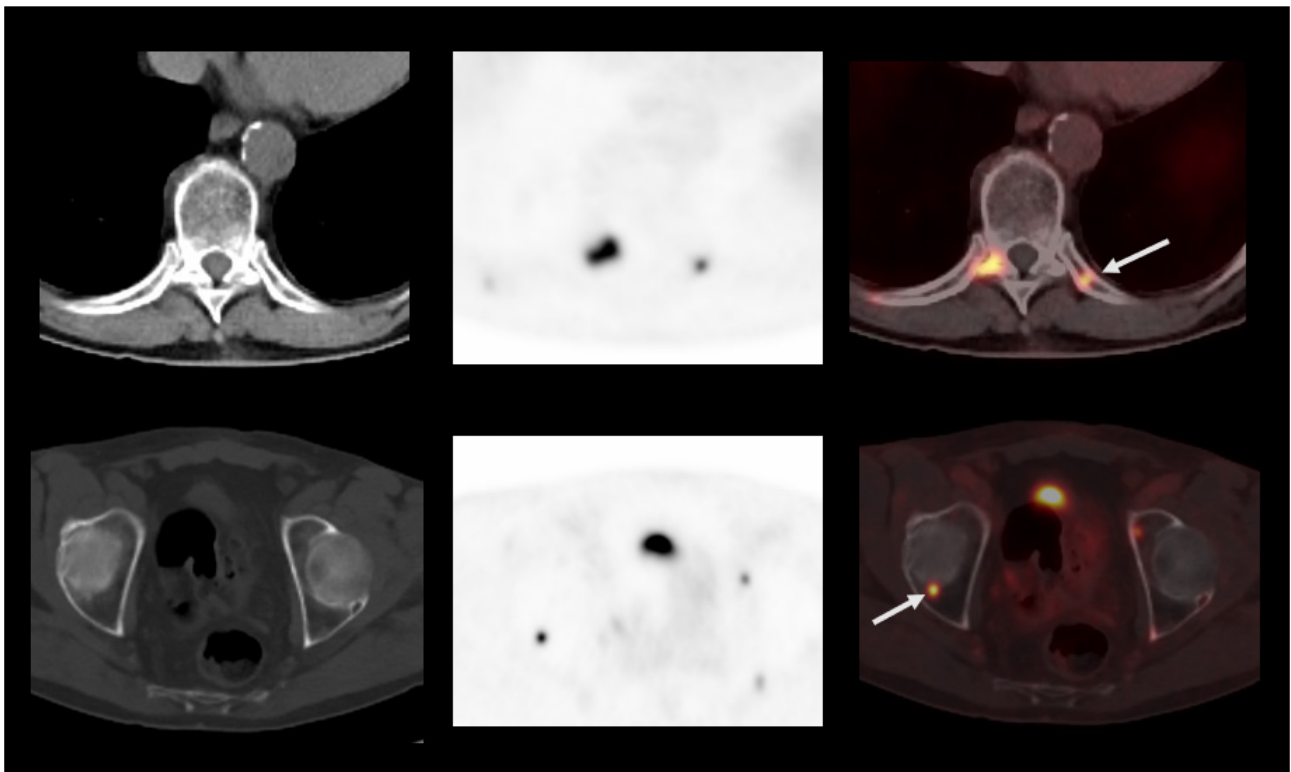
5 Axial CT, PET, and PET/CT images show intense ^{68}Ga DOTATATE uptake in the intestinal lesions with a high level of renal cortical tracer retention.



6 Sagittal CT, PET, and PET/CT images show multiple skeletal metastases with high ^{68}Ga DOTATATE uptake in the L4 lumbar vertebral body and upper sacrum in addition to the spinous process of the thoracic spine and the sternum. The sagittal CT shows focal lytic changes in the lumbar vertebral lesion.



- 7** Axial CT, PET, and PET/CT images of the thoracic vertebral level show intense ^{68}Ga DOTATATE uptake in the spinous process and bilateral lamina of the T5 vertebrae, demonstrating the high somatostatin-receptor density of the skeletal metastases. A rib lesion with similar uptake intensity is also visualized.



- 8** Axial CT, PET, and PET/CT images show small (6 mm in diameter) skeletal metastases in the rib and acetabular margin with high lesion contrast.

Discussion

Although skeletal lesions are possible in the extremities of a patient with a neuroendocrine tumor, metastatic lesions are primarily expected in the vertex-to-mid-thigh region. In this particular case, the 106 cm axial PET FoV enabled vertex-to-mid-thigh imaging, thus providing the accurate visualization of the smallest lesion in the skull base at one end of the FoV as well as the focal marrow metastases in the shaft of the femur at the other end of the FoV—all within a single bed acquisition. Even the smallest lesions with dimensions of 5-6 mm are visualized with precise delineation.

There are clinical benefits to be acknowledged in having the ability to conduct single-bed, whole-body imaging, which include reduced scan times and effective doses. In general, the use of the 106 cm axial PET FoV in the PET/CT oncology setting should be adequate in meeting most clinical requirements for oncological conditions requiring vertex-to-mid-thigh imaging.

Conclusion

This case demonstrates the role of ^{68}Ga DOTATATE PET/CT imaging in the evaluation of somatostatin-receptor density within neuroendocrine tumor metastases. The 10-minute, single-bed, whole-body images acquired with Biograph Vision Quadra's 106 cm axial PET FoV helped define metastatic burden and inform radionuclide therapy plans that involved the use of DOTATATE-labeled ligands. ●

Examination protocol

Scanner: Biograph Vision Quadra

PET		CT	
Injected dose	4.3 mCi (158 MBq) ^{68}Ga DOTATATE	Tube voltage	120 kV
Post-injection delay	1 hour and 17 minutes	Tube current	80 ref mAs
Acquisition	Single-bed, whole-body; 440 x 440 matrix, PSF+TOF 4i5s, Gaussian filter 2	Slice collimation	32 x 1.2 mm
Scan time	10 minutes		

The outcomes achieved by the Siemens Healthineers customer described herein were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (eg, hospital size, case mix, level of IT adoption) there can be no guarantee that others will achieve the same results.

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