Preface

Precision Medicine and PET/ Computed Tomography: Emerging Themes for Future Clinical Practice

Rathan M. Subramaniam, MD, PhD, MPH

Editor

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In this second issue of a two-part series of *PET Clinics*, which is dedicated to collate the immense value of PET/CT for implementation of precision medicine, we cover esophageal cancer, gastric cancer, and pancreatic cancer, including neuroendocrine tumors, melanoma, sarcoma, uterine and ovarian cancers, cardiovascular disorders, and PET/MR imaging. Emerging themes include nuclear medicine theragnostics, PET/MR imaging, and artificial intelligence and data analytics.

The neuroendocrine tumors paved the first wave of nuclear medicine theragnostics: diagnosis with ^{68}Ga DOTATATE PET/CT facilitating targets with expression of somatostatin receptors and peptide receptor radionuclide therapy with ^{177}Lu DOTATATE, a beta emitter. ^{68}Ga DOTATATE was approved by the US Food and Drug Administration (FDA) in 2016 and is now reimbursed by the US Centers for Medicare and Medicaid Services. In a recently concluded randomized controlled phase 3 trial of ^{177}Lu -DOTATATE for midgut neuroendocrine tumors, 229 patients,¹ who had well-differentiated, metastatic midgut neuroendocrine

tumors, received either ^{177}Lu -DOTATATE (116 patients) at a dose of 7.4 GBq every 8 weeks (four intravenous infusions, plus best supportive care including octreotide long-acting repeatable [LAR] administered intramuscularly at a dose of 30 mg) (^{177}Lu -DOTATATE group) or octreotide LAR alone (113 patients) administered intramuscularly at a dose of 60 mg every 4 weeks (control group). The estimated rate of progression-free survival at month 20 was 65.2% in the ^{177}Lu -DOTATATE group and 10.8% in the control group. The response rate was 18% in the ^{177}Lu -DOTATATE group versus 3% in the control group ($P < .001$). In the planned interim analysis of overall survival, 14 deaths occurred in the ^{177}Lu -DOTATATE group and 26 in the control group ($P = .004$). This is a landmark trial for the field of theragnostic nuclear medicine and molecular imaging and likely will lead to US FDA approval of ^{177}Lu -DOTATATE therapy in the future.

PET/MR imaging provides superior soft tissue characterization than PET/CT can render. PET/MR imaging with precision PET radiopharmaceuticals can provide multiparametric information about tumors for diagnosis and prognosis and in combination with theragnostic

radiopharmaceuticals would make an impact on patient outcomes. More efforts in organizing prospective clinical studies to demonstrate the value of PET/MR imaging, improving work flow and implementations, attenuation correction improvements to reduce biases in quantitative measurements, and advanced quantitative analytics are necessary to reap the full benefits of this emerging clinical modality.

Impact of artificial intelligence using medical imaging, including PET/CT and PET/MR imaging, will facilitate precision medicine. Medical imaging data comprise about 90% of all medical data, which provide enormous opportunities exploring artificial intelligence in tumor detection, making precision therapy decisions and prognosis. Within the next 10 to 20 years, artificial intelligence will impact the medical imaging workflow and patient management.

The future of PET/CT, PET/MR imaging, and nuclear medicine theragnostics is as bright as ever we have seen.

Rathan M. Subramaniam, MD, PhD, MPH
Department of Radiology
The University of Texas
Southwestern Medical Center
5323 Harry Hines Boulevard
Dallas, TX 75390-8896, USA

E-mail address:

rathan.subramaniam@UTsouthwestern.edu

REFERENCE

1. Strosberg J, El-Haddad G, Wolin E, et al. Phase 3 trial of ¹⁷⁷Lu-dotatate for midgut neuroendocrine tumors. *N Engl J Med* 2017;376(2):125–35.