Continuing Medical Education Article

Radiotracer Imaging of Peripheral Vascular Disease

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Disclosure
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Target Audience
This article contains information of value to a wide audience, including the general nuclear medicine community, nuclear medicine technologists, nuclear cardiologists, and physicians involved in the evaluation and management of patients with peripheral vascular disease.

Objectives
On successful completion of this activity, participants should be able to…
1. Compare the currently available imaging modalities used to assess peripheral vascular disease (PVD).
2. Understand the recent progress made in radiotracer-based evaluation of PVD.
3. Describe the potential role of targeted imaging of perfusion and angiogenesis in the evaluation of PVD.

Questions
1. What is a limitation of ultrasound in the evaluation of PVD?
   A. High cost.
   B. Difficulty in assessment of microvascular disease.
   C. Availability of equipment and operator.
D. Sensitivity and specificity in detecting severe stenosis.

2. Describe an advantage of using a hybrid SPECT/CT or PET/CT system to detect PVD.
   A. Ability to colocalize high-sensitivity SPECT and PET images with high-resolution anatomic CT images.
   B. High spatial resolution compared with other imaging modalities.
   C. Low amount of ionizing radiation exposure.
   D. Direct visualization of vessel morphology.

3. $^{201}$Tl has been used as a tracer for the evaluation of both myocardial and skeletal muscle perfusion. However, it has fallen out of favor because of which characteristic of the tracer?
   A. Emission of high energy.
   B. High first-pass extraction.
   C. Long half-life (73 h).
   D. Less “redistribution” of radiotracer after injection.

4. $^{99m}$Tc-sestamibi is a lipophilic, cationic complex mostly retained by cells via passive diffusion. How has it been used to study PVD?
   A. Identification of regional reductions in lower-extremity rest and stress perfusion in asymptomatic patients in the early stages of atherosclerosis.
   B. Studying the various pathways involved in peripheral angiogenesis.
   C. Using blood vessel morphology to guide vascular interventions.
   D. Measuring oxygen consumption and absolute blood flow.

5. All of the following are applications using $^{18}$F-FDG PET/CT to study PVD except…
   A. Assessing glucose metabolism in acute and subacute PVD disease states.
   B. Studying atherosclerosis in PVD through targeted imaging of macrophage infiltration.
   C. Understanding skeletal muscle physiology by measuring glucose uptake.
   D. Direct measurement of blood flow and skeletal muscle perfusion.

6. Although many angiogenesis targets are potentially available for in vivo assessment, nuclear imaging studies investigating peripheral angiogenesis have primarily focused on which of the following?
   A. Imaging of macrophages.
B. Imaging of inflammatory cytokines.
C. Imaging of extracellular matrix proteins.
D. Imaging of VEGF receptors and integrin activation.

7. Which characteristic of $^{18}\text{F}-\text{FDG}$ makes it an attractive tracer for the study of atherosclerosis?
A. Conversion to FDG-6 phosphate and subsequent trapping in the cytosol of metabolically active cells such as macrophages.
B. Short half-life allowing repeated measurement of blood flow reserve.
C. Avid uptake in skeletal muscle.
D. Wide availability of SPECT imaging.

8. Compared with $^{15}\text{O}$-water, a compound commonly used in PET imaging of flow, $^{18}\text{F}$-flurpiridaz has which advantage in PET stress flow imaging?
A. Better ability to detect resting skeletal muscle flow due to higher extraction.
B. Longer half-life allowing for exercise imaging of both PVD and heart.
C. Ability to easily perform serial imaging because of shorter half-life.
D. Current Food and Drug Administration approval for imaging of absolute cardiac flow.

9. Why is pH (low) insertion peptide, pHLIP, a useful marker for targeting various biologic processes?
A. Ability for peptide configuration change under different pH conditions.
B. Ability for peptide configuration change under different lactate levels.
C. Extensive commercial availability of pHLIP-radiounuclide tracers.
D. Stability of peptide to withstand a wide range of temperatures.

10. Which of the following statements regarding radiotracer imaging of deep vein thrombosis is not true?
A. Radiotracer imaging of DVT has been shown to be a more sensitive technique for assessing DVT than compression ultrasound.
B. Uptake of $^{18}\text{F}$-FDG is increased in thrombosed veins, compared with nonthrombosed veins, as shown by PET imaging.
C. Multiple radiolabeled peptides are effective at identifying DVT.
D. Radiotracer imaging has been shown to possess low sensitivity and specificity for the detection of DVT.