

Biology and Pathology

Cardiovascular Disease

Introduction to Molecular Imaging Contrast Agents and their Application in Cardiovascular Disease

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Learning Objectives:

- To understand the pros and cons of the different types of contrast agents for a range of imaging techniques.
- To be able to describe the differential accumulation of small molecule vs. nanoparticle contrast agents in diseased tissues.
- To be able to contrast design agents for targeted imaging to aspects of cardiovascular diseases.

This educational presentation will focus on the basics of molecular imaging contrast agents for cardiovascular diseases. The types of contrast media used for the range of imaging modalities will be described, i.e. radionuclides, fluorophores, gadolinium chelates, iron oxides, microbubbles, gold nanoparticles and so forth. The strengths and limitations of such agents will be explained. For example, fluorescence imaging is relatively sensitive, but has poor depth penetration. Near-infrared fluorophores can ameliorate this depth limitation to some extent. We will cover approaches to targeting, such as non-specific accumulation, the use of targeting ligands, biomimicry, cell tracking and activatable agents. The potential imaging targets in atherosclerosis and myocardial infarctions will be discussed, such as monocytes/macrophages, collagen, fibrin, angiogenesis, VCAM-1, MMPs and so on. The different concepts will be illustrated with examples from the literature, where agents are employed in relevant disease models.

Relevant Publications:

1. Chen, W., Cormode, D. P., Fayad, Z. A., and Mulder, W. J. M. (2011) Nanoparticles as magnetic resonance imaging contrast agents for vascular and cardiac diseases. *Wiley Interdisciplinary Reviews-Nanomedicine and Nanobiotechnology* 3, 146-161.
2. Kircher, M. F., and Willmann, J. K. (2012) Molecular Body Imaging: MR Imaging, CT, and US. Part I. Principles. *Radiology* 263, 633-643