

Precision Cardio-Oncology and Nuclear Imaging



Current applications, molecular innovations and future directions

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CENTRAL MESSAGE

Nuclear imaging can show perfusion, metabolic and inflammatory changes before left ventricular ejection fraction (LVEF) falls. It complements echo and cardiac MRI in selected patients.

BACKGROUND & AIM

Cardiac toxicity affects cancer survivors. Routine surveillance emphasizes function; molecular changes may emerge earlier.
Aim: review PET, SPECT and hybrid imaging in precision cardio-oncology.

REVIEW APPROACH

Structured narrative review, not a clinical trial or meta-analysis.
PubMed, Embase and Scopus through August 2025; thematic synthesis of applications and barriers.

PRACTICAL PATHWAY

- 1 Baseline risk + echo/strain
- 2 Select PET/SPECT for a specific question
- 3 Integrate imaging + clinical data

CLINICAL APPLICATIONS

- PET perfusion quantifies blood flow and microvascular dysfunction.
- FDG-PET examines metabolism and inflammation, including suspected checkpoint inhibitor myocarditis.
- MUGA measures LVEF in selected cases but exposes patients to radiation.
- PET/CT and PET/MRI combine molecular and anatomic data.

LIMITATIONS & NEXT STEPS

Protocols, tracer access, cost, radiation exposure and workforce capacity limit routine use. This narrative synthesis has selection bias and no pooled effect estimate. Prospective, multicenter studies must establish standardized endpoints and show clinical benefit.

MULTIMODALITY IMAGING

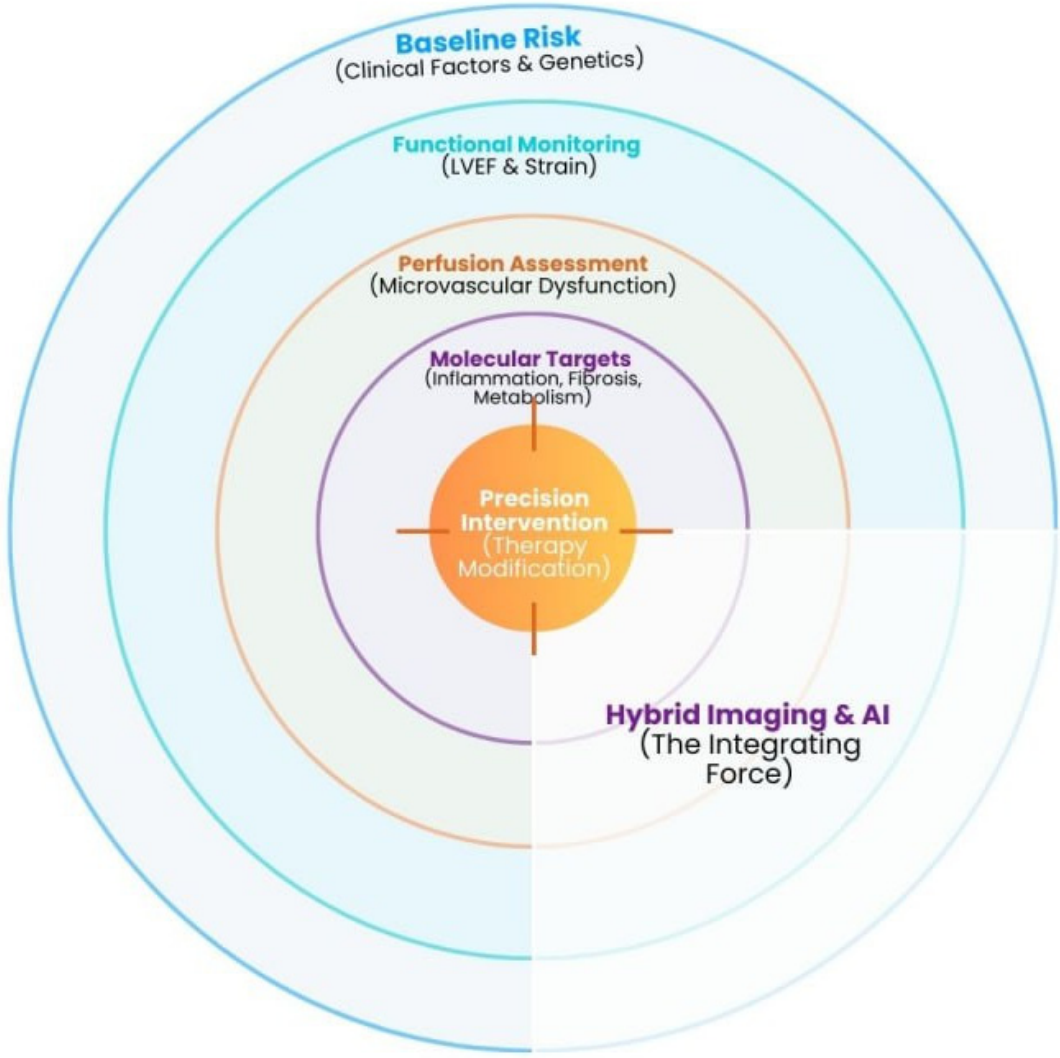


Figure 1. Nuclear and multimodality imaging workflow in cardio-oncology.
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MOLECULAR TARGETS

- Perfusion: PET tracers measure myocardial blood flow.
- Inflammation: 18F-FDG detects altered glucose uptake; preparation matters.
- Fibroblast activation: FAPI is investigational for early remodeling.
- Autonomic injury and apoptosis: MIBG and annexin-based probes are emerging.

[1] Ayalew et al. Cancers 2026, 18, 1625. doi:10.3390/cancers18101625