Future Trends and Applications in Diagnostic Nuclear Medicine

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RADIATION DOSE TO PATIENTS IN DIAGNOSTIC NUCLEAR MEDICINE

ICRP Digital Events

Next-Generation Imaging Systems & AI Reconstruction

- Total-body / half-body PET/CT: up to 40× higher sensitivity → <1 mSv studies & faster scans
- Deep-learning CT reconstruction, photon-counting CT: 30–70 % dose reduction

Nuclear Medicine Imaging for Clinical Decision-Making and Individualized Treatment

- **Oncology**
  - Prostate cancer: PSMA-ligand PET detects oligometastases → Enables metastasis-directed external-beam-radiotherapy → Improve patients' prognosis (including overall survival)
  - Breast cancer: ^{18}F-FES PET visualizes ER-positive lesions → Guides hormone therapy or local treatment → Improve patients' prognosis
  - ^{68}Ga/^{18}F-FAPI PET for various tumours and inflammation
- **Cardiology:** ^{18}F -Flurpiridaz PET assesses myocardial perfusion with higher accuracy → Improves coronary artery disease detection
- **Neurology**
  - Amyloid PET integral to Alzheimer's biological diagnosis & anti-amyloid therapy selection
  - Tau PET visualizes Tau pathologies in Alzheimer diseases → Spots Tau-positive patients → Enhances development of therapies such as anti-Tau drugs (such as tau-targeting antisense oligonucleotides)

Companion Diagnostics for Novel Radionuclide Therapies

- ^{68}Ga-SSTR2 PET → selects NET patients for ^{177}Lu-DOTATATE / ^{225}Ac-DOTATATE
- ^{68}Ga/^{18}F-PSMA PET → guides ^{177}Lu-PSMA-617 & ^{225}Ac-PSMA therapy in prostate cancer
- ^{89}Zr-Girentuximab (CAIX) PET → developing ^{177}Lu-CAIX RLT for renal cell carcinoma
- ^{111}In-ETN029 SPECT → imaging DLL3 to guide ^{225}Ac-ETN029 therapy in SCLC, NEPC, and NEC
- ^{68}Ga-NeoB PET → screens breast & GI tumors for ^{177}Lu-NeoB RLT