



IRANIAN JOURNAL OF NUCLEAR MEDICINE

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INSTRUCTION TO AUTHORS

Aims and Scope

Iranian Journal of Nuclear Medicine is a peer-reviewed biannually journal of the Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, covering basic and clinical nuclear medicine sciences and relevant application. The journal has been published in Persian (Farsi) from 1993 to 1994, in English and Persian with English abstract from 1994 to 2008 and only in English language form the early of 2008 two times a year. The "Iran J Nucl Med" is indexed and abstracted in the world-known bibliographical databases including SCOPUS, ESCI (Emerging Sources Citation Index), EMBASE, EBSCO, DOAJ, ISC, Index Copernicus, IMEMR, SID, Google Scholar, Ulrichsweb™, ROAD, Sherpa Romeo, EuroPub, MIAR, CIVILICA, ABCD Index, Scientific Indexing Services, Electronic Journals Library, Academic Resource Index, CiteFactor, Magiran. The journal has an international editorial board and accepts manuscripts from scholars working in different countries.

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List all authors when there are six or fewer; when there are seven or more, list the first six, then "et al" :

Mackness MI, Mackness B, Durrington PN, Fogelman AM, Berliner J, Lusis AJ, Navab M, Shih D, Fonarow GC. Paraoxonase and coronary heart disease. *Curr Opin Lipidol*. 1998 Aug;9(4):319-24.

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Halpern SD, Ubel PA, Caplan AL. Solid-organ transplantation in HIV-infected patients. *N Engl J Med*. 2002;347:284-7.

Article, no author given:

Cancer in South Africa. *S Afr Med J*. 1994 Dec;84(12):15.

Chapter in a book:

Phillips SJ, Whisnant JP. Hypertension and stroke. In: Laragh JH, Brenner BM, editors. *Hypertension: pathophysiology, diagnosis, and management*. 2nd ed. New York: Raven Press; 1995. p. 465-78.

Book, personal author(s):

Ringsven MK, Bond D. *Gerontology and leadership skills for nurses*. 2nd ed. Albany (NY): Delmar Publishers; 1996.

Book, editor(s) as author:

Norman LJ, Redfern SJ, editors. *Mental health care for elderly people*. New York: Churchill Livingstone; 1996.

Book, Organization as author and publisher:

Institute of Medicine (US). *Looking at the future of the Medicaid program*. Washington: The Institute; 1992.

Article in electronic form:

Morse SS. Factors in the emergence of infectious diseases. *Emerg Infect Dis* [serial online] 1995 Jan-Mar [cited 1996 Jun 5];1(1):[24 screens]. Available from: URL: <http://www.cdc.gov/ncidod/EID/eid.htm>

Conference proceedings:

Kimura J, Shibasaki H, editors. Recent advances in clinical neurophysiology. *Proceedings of the 10th International Congress of EMG and Clinical Neurophysiology*; 1995 Oct 15-19; Kyoto, Japan. Amsterdam: Elsevier; 1996.

Conference paper:

Bengtsson S, Solheim BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Rienhoff O, editors. *MEDINFO 92. Proceedings of the 7th World Congress on Medical Informatics*; 1992 Sep 6-10; Geneva, Switzerland.

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Abstracts*

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*The abstracts published in this supplement have been edited by the Scientific Committee of the 26th Annual Iranian Congress of Nuclear Medicine and were not subject to the standard reviewing process of the "Iranian Journal of Nuclear Medicine".

A1 Enhancing restaging of a colorectal cancer patient: The advantage of [^{99m}Tc]Tc-FAPI-46 over conventional CT in detecting metastases

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Introduction: Colorectal cancer (CRC) is the third most common cancer globally, with metastatic disease carrying a poor five-year survival of ~14%. Accurate detection of metastases is critical for restaging and treatment planning. While contrast-enhanced CT (CECT) is standard, it often misses small peritoneal deposits and micrometastases. Fibroblast activation protein (FAP) is overexpressed in >90% of CRC stroma, making FAP-targeted imaging with radiolabeled inhibitors (FAPI) a promising alternative.

Methods: We present a 73-year-old man with colon adenocarcinoma diagnosed 18 months earlier, treated with total colectomy and chemoradiotherapy. Due to recurrent abdominal pain, he underwent metastatic workup with both CECT and [^{99m}Tc]Tc-FAPI-46 SPECT/CT. Imaging findings were correlated with surgical and histologic confirmation.

Results: CECT identified one hypodense peritoneal lesion adjacent to the left psoas muscle. In contrast, [^{99m}Tc]Tc-FAPI-46 SPECT/CT detected three distinct foci of abnormal radiotracer uptake: near the left 7th intercostal space, adherent to the left lateral abdominal wall at L2, and adjacent to the left psoas at L3. All three were confirmed as metastatic peritoneal deposits on re-operation and histology. The two additional lesions missed by CECT were small and obscured between bowel loops.

Conclusion: This case demonstrates superior sensitivity of [^{99m}Tc]Tc-FAPI-46 SPECT/CT over CECT for detecting peritoneal metastases in postoperative CRC. While Ga-68 FAPI PET/CT offers higher image quality, ^{99m}Tc-labeled SPECT remains more accessible and cost-effective. Integrating FAPI-SPECT/CT into restaging protocols may improve metastasis detection, refine staging accuracy, and guide clinical decision-making in CRC patients.

Keywords: [^{99m}Tc] Tc- FAPI; SPECT/CT; Contrast-enhanced CT; Colorectal cancer; Metastasis

A2 ⁶⁸Ga-PSMA PET radiomics in prostate cancer: Current evidence and future perspectives

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Introduction: ⁶⁸Ga-PSMA PET/CT has become an essential molecular imaging modality for the detection, staging, restaging, and treatment selection of prostate cancer. However, conventional PET metrics such as SUVmax and SUVmean provide limited information regarding intratumoral heterogeneity. Radiomics enables the extraction of quantitative first-order, shape, and texture features that may better characterize tumor biology. To summarize current evidence regarding the diagnostic, prognostic, and theranostic applications of ⁶⁸Ga-PSMA PET radiomics in prostate cancer.

Methods: A focused narrative review of original studies and review articles evaluating radiomics and machine-learning approaches using ⁶⁸Ga-PSMA PET imaging was performed. Applications including tumor detection, prediction of International Society of Urological Pathology (ISUP) grade, lymph-node involvement, biochemical recurrence, treatment response, overall survival, and ¹⁷⁷Lu-PSMA therapy were analyzed.

Results: First-order features, including range, mean absolute deviation (MAD), interquartile range (IQR), and kurtosis, together with texture features derived from the Gray-Level Co-occurrence Matrix (GLCM), such as inverse variance, and higher-order features from the Gray-Level Run-Length Matrix (GLRLM) and Gray-Level Size Zone Matrix (GLSZM), were associated with tumor aggressiveness, ISUP grade, lymph-node metastasis, biochemical recurrence, treatment response, and overall survival. In metastatic castration-resistant prostate cancer, a radiomics signature combined with patient age achieved an area under the receiver operating characteristic curve (AUC) of 0.82 for predicting response to ¹⁷⁷Lu-PSMA therapy.

Conclusion: ⁶⁸Ga-PSMA PET radiomics provides quantitative biomarkers of tumor heterogeneity that complement conventional SUV measurements and show considerable potential for improving prostate cancer detection, biological characterization, risk stratification, and personalized treatment planning.

Keywords: Prostate cancer; ⁶⁸Ga-PSMA PET/CT; Radiomics; Theranostics; Tumor heterogeneity

A3 ¹⁷⁷Lu-DOTATATE treatment response assessment in gastroenteropancreatic neuroendocrine tumors using ⁶⁸Ga-DOTATATE

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Introduction: Gastroenteropancreatic neuroendocrine tumors, a heterogeneous type of neoplasm, are considered to be effectively treated with ¹⁷⁷Lu-DOTATATE; however, treatment response varies amongst patients. Identifying factors affecting treatment can be greatly aided by the specification of ⁶⁸Ga-DOTATATE PET imaging. This study aims to investigate the relationship between extracted pre-treatment ⁶⁸Ga-DOTATATE PET radiomics features and ¹⁷⁷Lu-DOTATATE treatment response in patients with gastroenteropancreatic neuroendocrine tumors.

Methods: In this retrospective study, 30 ⁶⁸Ga-DOTATATE PET scans of gastroenteropancreatic neuroendocrine tumors were aggregated from six treatment centers. Radiomics features were extracted from the resampled images. Then, the features' statistical distributions were examined so that logarithmic transformation could be applied to the selected features if necessary. Dimensionality reduction and elimination of highly correlated features were achieved through correlation filtering. Feature harmonization using the parametric COMBAT method was performed to mitigate the variation induced by technical variations among centers. Ultimately, the association of each feature with treatment response was examined by adjusting for the effects of age and gender using a univariate generalized linear model. Based on the results of the univariate analysis, five features were selected as inputs to the multivariate models. Four multivariate models were fitted based on the study hypothesis, and the best model was selected based on the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and log-likelihood metrics. To examine the stability of the results, a sensitivity test was also performed following outlier center removal and nonparametric COMBAT.

Results: Study results showed that Maximum2DDiameterSlice ($p \approx 0.0047$), Kurtosis ($p \approx 0.0051$), and Age ($p \approx 0.034$) were significantly associated with treatment response. Following the sensitivity analysis, the associations of Maximum2DDiameterSlice and Kurtosis remained statistically significant after exclusion of the external center ($p \approx 0.020$ and $p \approx 0.014$, respectively). Following non-parametric COMBAT harmonization, these associations remained significant ($p \approx 0.003$ and $p \approx 0.004$, respectively), supporting the stability of the findings.

Conclusion: A potential role for some radiomic features in response treatment assessment of gastroenteropancreatic neuroendocrine tumors to ¹⁷⁷Lu-DOTATATE is suggested by findings of this study; however, the results need further confirmation with larger sample sizes.

Keywords: ¹⁷⁷Lu-DOTATATE; Gastroenteropancreatic neuroendocrine tumors; ⁶⁸Ga-DOTATATE; Radiomics

A4 Next generations of PET: A combination of time-of-flight, quantum imaging, and artificial intelligence

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Introduction: Advances in positron emission tomography (PET) may overcome long-standing physical and technical limitations and transform PET from a mainly diagnostic modality into an integrated platform for disease characterization, prognosis, treatment planning, and response assessment. This review examines emerging technologies shaping next-generation PET and their impact on molecular imaging.

Methods: A narrative review of publications from 2016 to 2026 was conducted using PubMed/MEDLINE, Scopus, Web of Science, and IEEE Xplore. Relevant articles on PET instrumentation, time-of-flight (TOF) technology, quantum-enabled imaging, artificial intelligence, and cost-effective detector design were identified and critically examined.

Results: Recent developments have improved sensitivity, temporal resolution, image quality, quantification, and efficiency. LAFOV scanners offer 10- to 40-fold higher sensitivity, enabling subminute acquisitions or reduced activity. Ultrafast TOF approaching 10 ps could localize annihilation events with millimetric precision and advance direct positron emission imaging, reducing reliance on reconstruction and improving signal-to-noise ratio. Quantum-enabled approaches, including positronium imaging, may provide biomarkers of tissue oxygenation, microenvironmental properties, and disease state. Artificial intelligence is being integrated into detector-signal processing, denoising, motion and attenuation correction, reconstruction, quantification, segmentation, and treatment-response prediction. Lower-cost materials, including plastic scintillators, may support more accessible PET systems.

Conclusion: Future PET will likely result from integrating hardware and computational innovations rather than a single breakthrough. Combining ultrafast TOF, extended axial coverage, quantum-enabled imaging, cost-effective detectors, and artificial intelligence may enable faster, lower-dose, quantitative, informative, and personalized molecular imaging.

Keywords: TOF PET; Quantum entanglement; Whole-body PET; Artificial intelligence; Molecular imaging

A5 From molecular imaging to clinical management: The emerging value of FAPI PET/CT in non-oncologic diseases—a systematic review

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Introduction: Fibroblast activation protein inhibitor (FAPI) PET/CT has emerged as a promising molecular imaging modality beyond oncology, with potential applications in a wide range of non-oncologic diseases. This systematic review evaluates the emerging clinical value of this approach in diagnosis, disease assessment, treatment monitoring, and patient management.

Methods: We performed a systematic search in Scopus, PubMed, and Web of Science from inception to June 2026, supplemented by citation tracking. Of 832 initial records, 68 peer-reviewed English original studies met inclusion criteria. Studies reporting diagnostic accuracy, prognostic value, or clinical impact of FAPI PET/CT in non-oncologic diseases were assessed for methodological quality using QUADAS-2 and bias following PRISMA 2020 guidelines. Data on SUV measures, sensitivity, specificity, and clinical outcomes were extracted.

Results: FAPI PET/CT enabled effective patient monitoring and management. In acute MI, serial imaging revealed peak uptake at week 1 (TBR_{max} 4.0), declining to 2.7 by week 12 ($P < 0.001$), thereby monitoring dynamic fibrotic activity; baseline uptake predicted adverse LV remodeling at 1 year ($r = 0.87$, $P < 0.001$), guiding risk stratification. In hepatic fibrosis, SUV_{mean} increased from 0.61 (F0/1) to 2.17 (F4) with 85.7% accuracy, outperforming Fibroscan; renal SUV_{max} rose from 3.92 to 7.67 ($P < 0.05$). FAPI also detected more lesions than FDG (98.1% vs. 40.6%, $P < 0.001$), enabling early identification of high-risk patients for individualized therapy decisions and treatment monitoring.

Conclusion: FAPI PET/CT enables non-invasive assessment of myocardial, hepatic, and renal fibrosis with prognostic value and superior diagnostic accuracy, supporting clinical risk-stratification and therapy monitoring across multiple organ systems.

Keywords: Fibroblast activation protein inhibitor; Positron emission tomography; Non-oncologic diseases

A6 Machine learning-assisted ¹⁷⁷Lu-DOTATATE treatment response prediction using ⁶⁸Ga-DOTATATE PET/CT imaging and radiomics features in gastroenteropancreatic neuroendocrine tumors

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Introduction: While gastroenteropancreatic neuroendocrine tumors have shown promising results with ¹⁷⁷Lu-DOTATATE, treatment response varies among patients. Thus, a method for predicting response using identifiers extracted before treatment initiation is important for treatment planning and informed decision-making for both clinicians and patients. Machine learning models have proven themselves to be an effective tool for predicting treatment response in multiple studies for different neoplasms. In this study, we explore the efficacy and performance of machine learning models for predicting the ¹⁷⁷Lu-DOTATATE treatment response in gastroenteropancreatic neuroendocrine tumors using radiomics features extracted from ⁶⁸Ga-DOTATATE PET images.

Methods: 28 ⁶⁸Ga-DOTATATE PET scans of gastroenteropancreatic neuroendocrine tumors located in the liver, resulting in 277 samples, were collected for this study, and radiomics features were extracted from the resampled images. 20 percent of the samples were split and set aside as an unseen test set while maintaining target class distribution and ensuring that samples of a patient are not present in both the train and test sets simultaneously (grouping). Random forest and XGBoost machine learning models were trained using the train dataset with an 8-fold stratified grouped cross-validation strategy accounting for both target class distribution and grouping considerations mentioned. Using a recursive feature elimination strategy and based on the area under the ROC

curve (AUC) metric, top-performing features were selected and used for re-training of the models using only the selected features. Finally, the performance of the trained models was evaluated on the feature-selected test datasets using AUC, precision, recall, f1-score, and accuracy metrics.

Results: Both models performed reasonably well within the limitations of the study. The random forest model achieved better results with AUC, precision, recall, f1-score, and accuracy scores of 0.76, 0.73, 0.65, 0.67, and 0.75, respectively. In the case of the XGBoost model, the respective scores of 0.67, 0.64, 0.63, 0.63, and 0.70 were achieved.

Conclusion: Based on the achieved results and considering the low number of samples, the random forest model outperforms the XGBoost model, showing the potential of using machine learning models for treatment response prediction of gastroenteropancreatic neuroendocrine tumors to ¹⁷⁷Lu-DOTATATE treatment using extracted radiomics features.

Keywords: Random forest; XGBoost; ¹⁷⁷Lu-DOTATATE; Gastroenteropancreatic neuroendocrine tumors; ⁶⁸Ga-DOTATATE; Radiomics

A7 Portable PET brain imaging: Recent advances in compact scanning technologies for neurological applications

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Introduction: The traditional whole-body PET scanners have limitations, including high cost, limited availability, fixed installation requirements, and poor optimization for brain imaging. Recent technological advances in the specialized portable PET brain scanners offer the opportunity to extend molecular neuroimaging from traditional imaging centers to the bedside and specialized neurological care centers. This review aims to provide a brief overview of recent technological advances in portable PET brain imaging and assess its current and future applications in neurological disorders.

Methods: A narrative review of the literature published from 2016 to 2026 was conducted using PubMed/MEDLINE, Scopus, Web of Science, and IEEE Xplore. Primary research articles, technical papers, and relevant peer-reviewed articles discussing portable, compact, helmet-mounted, and brain-specific PET systems were retrieved.

Results: Portable brain PET systems have demonstrated significant improvements in spatial resolution, sensitivity, and patient-specific imaging capabilities compared to standard whole-body PET scanners. The compact design of the scanners minimizes the distance between the detector and the brain and improves photon detection efficiency, while also reducing the administered activity and acquisition time. The use of AI-based reconstruction methods and motion correction further improves image resolution and quantitative performance.

Conclusion: Portable brain PET promises to revolutionize neuroimaging, monitoring, and applied research with the development of the new radiotracers, and AI-based image processing. Future research should focus on clinical validation, workflow integration, and demonstration of cost-effectiveness to facilitate widespread adoption in neuroscience practice.

Key words: Portable PET; Brain imaging; Neuroimaging

A8 Machine learning-based design and optimization of polymer/high-Z oxide composites for photon shielding

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The development of advanced radiation shielding materials necessitates two factors. Firstly, the materials must demonstrate efficacy in terms of attenuation efficiency. Secondly, they must take into account structural, environmental, and biomedical limitations. Conventional shields composed of lead and concrete present significant challenges due to their toxicity and weight. This has led to a growing demand for the development of smart and lightweight replacement shields. In this study, we propose a novel machine learning-based framework that integrates photon-matter interactions with predictive modeling to inform energy-specific designs of polymer/oxide composites. In this study, we employed xraylib simulations across a range of energies, spanning from 20 to 662 keV, to model attenuation parameters (μ/ρ) through the integration of diverse machine learning algorithms. Specifically, tree-based ensemble methods (Random Forests and Gradient Boosting) predicted attenuation factors with nearly perfect ($R^2 \approx 0.99$, $MAE < 0.4$) accuracy, thus accelerating the development of composite formulations specifically targeting photon energies. The exploratory nature of the framework provides a variety of systems to consider. We

confirm that Pb-free systems and those rich in Bi₂O₃ and SnO₂ are excellent materials for developing medical imaging shielding. High-Z optimized blends demonstrated polymers with the desired density and efficiency for shielding that can be used to maintain nuclear facilities. The present framework constitutes a departure from conventional experimentation, which is predicated on the paradigm of trial and error. In contradistinction, it will furnish an energy-specific roadmap for the data-driven design of intelligent, sustainable, and application-based radiation shielding materials.

Keywords: Radiation shielding; Mass attenuation coefficient; Machine learning models; Photon-matter interactions

A9 ⁶⁸Ga-DTPA-functionalized magnetic silica nanoparticles for PET/MRI imaging

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Introduction: Positron emission tomography/magnetic resonance imaging (PET/MRI) combines the high molecular sensitivity of PET with the superior anatomical resolution of MRI. Magnetic iron oxide nanoparticles represent promising multimodal imaging platforms due to their biocompatibility and versatile surface functionalization. In this study, we developed ⁶⁸Ga-DTPA-functionalized magnetic silica nanoparticles for dual PET/MRI imaging applications.

Methods: Fe₃O₄ nanoparticles were synthesized via a co-precipitation method and subsequently coated with silica to enhance colloidal stability. DTPA was conjugated to the nanoparticle surface to enable chelation of ⁶⁸Ga obtained from a ⁶⁸Ge/⁶⁸Ga generator. Radiolabeling efficiency, radiochemical purity, and in vitro stability were assessed using radio-thin layer chromatography (radio-TLC). Biodistribution studies and PET imaging were conducted in BALB/c mice following intravenous administration.

Results: The nanoparticles demonstrated high radiochemical purity and favorable in vitro stability. In vivo studies revealed predominant uptake in the liver and spleen, consistent with clearance via the mononuclear phagocyte system. PET imaging clearly delineated biodistribution patterns, with minimal nonspecific uptake and low bone accumulation, indicating stable coordination of ⁶⁸Ga.

Conclusion: ⁶⁸Ga-DTPA-functionalized magnetic silica nanoparticles exhibited stable radiolabeling and predictable in vivo behavior, supporting their potential as a dual PET/MRI imaging platform following appropriate targeting modifications.

Keywords: Gallium-68; Magnetic nanoparticles; PET/MRI; DTPA; Molecular imaging

A10 Design and performance evaluation of a multi-pinhole collimator in a high-resolution microSPECT system using Monte Carlo simulation

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Introduction: Small animal imaging has many applications, including the development of radiopharmaceuticals. To measure the performance of imaging systems, Monte Carlo (MC) simulations have been developed significantly. The HiReSPECT II scanner, a high-resolution microSPECT system equipped with a parallel-hole collimator, is designed for small animal imaging. However, the use of parallel-hole collimators in such systems limits their performance for imaging small fields of view. Therefore, the purpose of this research is to design and evaluate the performance of a multipinhole collimator in a high-resolution microSPECT system using MC simulation method.

Methods: Validation of a small animal SPECT scanner equipped with a lead hexagonal parallel hole collimator, CsI(Na) pixelated crystal and SiPM photodiodes was performed by comparing the measured results with simulated

data. In the next step, one SPH collimator and one MPH collimator were designed and their performance was assessed in planar and tomographic settings by GATE simulator.

Results: The difference between simulated and measured spatial resolution was about 5%. Two tungsten collimators including one SPH collimator and one MPH collimator were designed. The value of system spatial resolution for SPH collimator with a magnification factor of 5.31 is 0.73 mm in air and 0.87 mm in the scattering medium. Besides, the value of the system spatial resolution for the MPH collimator with a magnification factor of 1.63 is 1.59 mm in air and 1.62 mm in the scattering medium. The smallest diameter of the hot rod that can be distinguished in the reconstructed images of Derenzo phantom for two collimators is 0.7 and 1.3 mm, respectively.

Conclusion: Based on the findings of this study, the use of single pinhole and multipinhole collimators over parallel-hole collimators in the HiReSPECT II scanner is recommended as they provide better spatial resolution and appropriate sensitivity in imaging small fields of view.

Keywords: Collimator design; Monte Carlo; GATE; HiReSPECT II; SPECT

A11 Preliminary theranostic candidates for Glioblastoma tumors based on Substance P derivatives

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Introduction: Substance P (SP) is a neuropeptide with high-affinity to neurokinin 1 receptor (NK₁R). It is involved in angiogenesis, mitosis and the progression of some tumors especially Glioblastoma multiforme (GBM) by overexpression of NK₁Rs. The distribution density of NK₁Rs correlates with the degree of malignancy. SP analogues could be developing radiopharmaceuticals for specific targeting of GBM via NK₁Rs.

Methods: In our previous studies two derivatives of SP were synthesized and labeled with ^{99m}Tc and ¹³¹I radioisotope for theranostic application in GBM. The stability, protein binding and partition coefficient were examined. They evaluated by docking software and then the in vitro tests on human U87MG cell line and in vivo bio distribution studies on normal mice were done. After that some new small ligands were designed and evaluated by docking software and MD simulations. They are capable of radiolabeling with ⁶⁸Ga for PET and radiolabeling with ¹⁷⁷Lu, ²¹²Pb and ²²⁵Ac for Therapy.

Results: The proposed radioligands were interacted with crystal structure of NK₁R acquired from PDB and displayed binding energies around -8 to -9 kcal/mol. The radiolabeling with Lu-177 showed an average radiochemical Purity of 98%. Protein binding to human serum was 23 %. It was stable up to 10 days in saline and up to 4 days in human serum. A value of 0.48 log P was calculated for radiolabeled peptide. Internalization study on U87MG cells showed a rapid binding to the cell membrane after 0.5 h and a slight increase in specific internalization during 4h. Saturation binding test concluded a mean K_d of 3.51 ± 0.89 nM. Biodistribution studies showed high accumulation in kidneys and salivary glands regions 1 h and 4 h post-injection of radiopeptide.

Conclusions: These derivatives could be theranostic candidates for GBM and other NK₁R positive tumors. Design and further evaluations of new derivatives by ²²⁵Ac, ²¹²Pb, ¹³¹I and ¹⁸F are ongoing.

Keywords: Glioblastoma; NK₁R; Theranostic

A12 Cytotoxicity comparison of ^{99m}Tc-labeled peptide antagonist and agonist targeting the somatostatin receptor 2 in AR42J cells

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Auger electrons are low-energy particles with a high linear energy transfer (LET) that release their energy over extremely short distances, typically within a few nanometers. Consequently, their biological effects are strongly influenced by the intracellular localization of the radionuclide. To investigate whether the cell membrane represents a more effective molecular target than the cytoplasm for Auger electron therapy, we examined whether the radiotoxicity of ^{99m}Tc depended on its subcellular distribution. The cellular behavior of two peptide-based radiopharmaceuticals was compared: ^{99m}Tc-TECANT-1, which targets the cell membrane, and ^{99m}Tc-TEKTROTYD, which is primarily directed toward the cytoplasm. The results demonstrated that ^{99m}Tc-TECANT-1 exhibited stronger binding to AR-42-J cells than ^{99m}Tc-TEKTROTYD. Furthermore, the receptor agonist ^{99m}Tc-TEKTROTYD was localized

in more than 90% of the cytoplasm, whereas ^{99m}Tc-TECANT-1 was associated with approximately 60–80% of the cell membrane. Assessment of cell survival using the MTS assay revealed significantly greater cytotoxicity when ^{99m}Tc was localized at the cell membrane rather than in the cytoplasm. These findings suggest that, similar to ¹⁶¹Tb, the cell membrane may be a more radiosensitive target for Auger electrons emitted by ^{99m}Tc than the cytoplasm. The results further indicate that receptor antagonists labelled with therapeutic amounts of ^{99m}Tc could potentially be useful in the treatment of certain cancers. Nevertheless, additional studies, particularly detailed dosimetric investigations, are required to confirm and further characterize these observations.

Keywords: Radionuclide therapy; Auger electron; ^{99m}Tc radiopharmaceuticals

A13 Effects of fixed-activity versus weight-based dosing on tumor and kidney dosimetry of [¹⁷⁷Lu]Lu-PSMA-617 radioligand therapy: A physiologically based pharmacokinetic modeling study

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Introduction: Personalized dosimetry may help reduce interpatient variability in prostate-specific membrane antigen (PSMA)-targeted radioligand therapy (RLT). This study evaluated how fixed-activity and body-weight-based dosing of [¹⁷⁷Lu]Lu-PSMA-617 RLT affects the dependence of tumor and kidney absorbed doses (ADs) on body weight.

Methods: A simplified three-compartment physiologically based pharmacokinetic (PBPK) model comprising blood, tumor, and kidneys was implemented in MATLAB SimBiology (Version 6.4.1). The model incorporated systemic circulation, distribution to the tumor and kidney, albumin binding, PSMA binding and internalization, and renal clearance. Six virtual body-weight scenarios (61, 71, 81, 91, 101, and 116 kg), all with a height of 160 cm, were simulated to assess the effect of body weight, with kidney volume scaled accordingly. Fixed activity dosing (7.4 GBq) and weight-based dosing (104.2 MBq/kg) were compared with 71 kg used as the reference body weight.

Results: Fixed-activity dosing showed less variation in normalized tumor and kidney ADs across body weights, whereas weight-based dosing increased ADs variability. Compared with fixed dosing, weight-based dosing decreased kidney and tumor doses by 7.6% and 7.0%, respectively, at 61 kg, but increased them by 28.9% and 25.7% at 116 kg. The tumor-to-kidney AD ratio differed by less than 2.5% between dosing strategies.

Conclusion: In this PBPK modeling study, fixed-activity dosing resulted in more consistent tumor and kidney ADs across body weights than weight-based dosing. Although weight-based dosing substantially altered absolute ADs, it had minimal effect on the tumor-to-kidney AD ratio, suggesting no dosimetric advantage over fixed-activity administration across the investigated body-weight range.

Keywords: [¹⁷⁷Lu]Lu-PSMA-617; Radioligand therapy; Physiologically based pharmacokinetic modeling; Personalized dosimetry; Body-weight-based dosing

A14 Development, radiosynthesis, and initial clinical evaluation of [¹⁸F]FIBT, A novel [¹⁸F]-Labeled PET tracer targeting amyloid-β plaques

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Introduction: Amyloid-β (Aβ) plaques are key hallmarks of Alzheimer's disease (AD). Although [¹¹C]PiB is the gold standard for PET imaging, its short half-life limits routine clinical use. This study evaluated [¹⁸F]FIBT, a novel imidazobenzothiazole-based fluorine-18 tracer, developed to overcome high nonspecific white-matter binding.

Methods: Radiochemical synthesis of [¹⁸F]FIBT was performed via one-step nucleophilic substitution and two-step fluorination processes. Reaction conditions, radiochemical yield (RCY), synthesis time, and purity were evaluated. Binding affinity to Aβ and selectivity over tau and α-synuclein were measured. In vivo brain uptake, clearance, and

cortex-to-cerebellum standardized uptake value ratios (SUVR) were assessed in transgenic and control mice. Human PET/MR imaging and toxicity were also evaluated.

Results: The two-step method yielded higher RCY ($58 \pm 4\%$, 55 min) compared to the one-step method ($24 \pm 5\%$). Both yielded $>99\%$ purity. [^{18}F]FIBT demonstrated high A β affinity ($K_d = 0.7 \pm 0.2$ nM) and selectivity ($K_i > 1000$ nM for tau/ α -synuclein). In mice, high brain uptake and rapid clearance were observed, with a cortex-to-cerebellum SUVR of 1.68 ± 0.15 in transgenic versus 0.95 ± 0.02 in controls. Autoradiography correlated with [^3H]PiB. Human PET/MR confirmed specific cortical binding corresponding to clinical severity, with no acute toxicity.

Conclusion: [^{18}F]FIBT is a promising A β -targeting PET tracer featuring high purity, favorable yield, and strong diagnostic potential for early detection and monitoring of Alzheimer's disease.

Keywords: Amyloid-beta; Alzheimer's disease; Imidazobenzothiazole; [^{18}F]FIBT; PET imaging

A15 Diagnostic superiority of ^{68}Ga -FAPI PET/CT over ^{18}F -FDG in restaging of advanced epithelioid sarcoma

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Introduction: Epithelioid sarcoma is a rare and highly aggressive soft-tissue malignancy with a poor prognosis upon dissemination. While conventional ^{18}F -FDG PET/CT is widely used for staging, it may not fully capture the disease extent in tumors with low glycolytic activity. This report evaluates the value of fibroblast activation protein (FAP)-targeted imaging in mapping the prominent cancer-associated fibroblast (CAF) activity within the tumor microenvironment of this aggressive sarcoma.

Methods: A 58-year-old man with metastatic ES underwent longitudinal clinical monitoring, including surgery, chemotherapy, and sorafenib trial therapy guided by ctDNA analysis showing a RET exon 9 variant. During follow-up, restaging was performed using consecutive ^{18}F -FDG and ^{68}Ga -FAPI PET/CT scans to assess tumor volume, spatial distribution, and tracer avidity.

Results: Restaging ^{18}F -FDG PET/CT at 3.5 years showed physical progression, including enlargement of existing lesions and new foci, but paradoxically lower SUVmax. Conversely, ^{68}Ga -FAPI PET/CT demonstrated significant diagnostic superiority, displaying intense tracer uptake across progressing lesions and identifying occult, ^{18}F -FDG-negative metastases, including right supraspinatus and intercostal lesions. Three patterns were identified: metabolic dissociation with lesion enlargement and low FDG/high FAPI uptake; concordant response with complete resolution of early metastases; and persistent FAPI avidity in FDG-occult lesions.

Conclusion: This metabolic dissociation supports a stromal-driven invasion model in which resistant malignant cells bypass glucose dependence while promoting desmoplastic expansion through active cancer-associated fibroblasts. ^{68}Ga -FAPI PET/CT outperformed ^{18}F -FDG in defining true tumor burden in advanced ES and provides a rationale for FAP-targeted theranostic strategies.

Keywords: Epithelioid sarcoma; Fibroblast activation protein; Molecular imaging; PET/CT; Radioligand therapy

A16 TROP2-targeted radiotracers for triple-negative breast cancer imaging: A new perspective on personalized therapeutic approaches

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Triple-negative breast cancer (TNBC) represents an exceptionally aggressive, heterogeneous breast cancer subtype defined by high rates of recurrence, early metastasis, poor clinical prognosis, and therapeutic resistance. Trophoblast cell surface antigen 2 (TROP2), a cell-surface glycoprotein overexpressed in the vast majority of TNBC cases, has emerged as a premier oncologic biomarker and target for antibody-drug conjugates (ADCs) such as sacituzumab govitecan and datopotamab deruxtecan. However, treatment responses vary significantly due to spatial and temporal expression heterogeneity. Non-invasive, quantitative molecular imaging techniques, principally positron emission tomography (PET) and single-photon emission computed tomography (SPECT), are vital to quantify whole-body TROP2 expression, select suitable patients, and track therapeutic efficacy in real time. This review provides a comprehensive analysis of TROP2-targeted radiotracer development across clinical, preclinical, and computational in silico research domains. In clinical evaluation and early translational trials, radiolabeled full-length monoclonal antibodies and ADC-derived tracers, including ^{89}Zr -DFO-sacituzumab govitecan (^{89}Zr -DFO-Trodelvy) and ^{124}I -IMMU-132, exhibit high binding affinity and excellent diagnostic performance for lesion

identification and patient stratification; however, their slow blood clearance, long circulation half-life, and prolonged systemic radiation exposure limit rapid clinical workflows. To optimize imaging kinetics, clinical and preclinical innovation has prioritized smaller scaffold architectures. Intermediate-sized constructs include clinical and preclinical nanobodies, such as ⁶⁸Ga-/^{99m}Tc-MY6349, where ^{99m}Tc-MY6349 offers favorable accessibility in pilot SPECT/CT studies while ⁶⁸Ga-MY6349 targets non-competing epitopes for real-time monitoring during ADC therapy and engineered antibody fragments like ⁶⁴Cu-NOTA-Trodelvy-F(ab')₂. Additional promising platforms, such as ⁶⁴Cu-NOTA-hIMB1636, ⁶⁸Ga-NOTA-T4, the fluorinated analog ¹⁸F-AIF-RESCA-T4, and the ⁸⁹Zr-/¹⁷⁷Lu-labeled camelid-derived antibody (NY003), demonstrates high specificity and superior early tumor-to-background contrast, albeit occasionally accompanied by elevated renal retention or delayed clearance typical of full-length constructs. At the frontier of development, small-molecule and peptide-based radiotracers designed via in silico molecular docking, virtual screening, and dynamics (such as ⁶⁸Ga-NOTA-PEG₂-WP8 and ⁶⁸Ga-NOTA-GL10) offer a transformative perspective. Derived from computational simulations, midkine-derived peptide candidates exhibit nanomolar affinity, rapid target localization, low systemic toxicity, deep tissue penetration, and low production costs, providing an ideal framework for same-day diagnostic procedures and dynamic monitoring of ADC response in preclinical models. Future perspectives highlight small-molecule and peptide radiotracers as pivotal tools for same-day diagnostic procedures and targeted radiotheranostic integration with alpha- or beta-emitting radionuclide platforms (¹⁷⁷Lu, ²²⁵Ac). Compared with full-length antibodies, these small-molecule and peptide probes offer faster tumor penetration, rapid blood clearance, lower immunogenicity, and streamlined radiolabeling, making them exceptionally attractive for clinical translation despite generally lower absolute target retention. Driven by artificial-intelligence-assisted ligand optimization and standardized quantitative imaging algorithms, TROP2-targeted molecular probes can dynamically evaluate treatment response, detect emerging resistance mechanisms, and guide individualized interventions. Collectively, this evolutionary shift from antibody-based agents toward computationally designed small molecules positions TROP2 radiotheranostics as a cornerstone for non-invasive patient stratification, ADC candidate selection, and biomarker-driven clinical care in TNBC.

Keywords: TROP2 receptor; Radiotracers; Triple-negative breast cancer; *Cancer imaging; Personalized therapy*

A17 ^{99m}Tc-FAPI-46 SPECT/CT in Ewing sarcoma: Findings in diverse metastatic presentations

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Introduction: Ewing sarcoma is an aggressive tumor with early metastasis to the bone and lungs. Fibroblast activation protein (FAP) is a key marker for active stromal remodeling in the tumor microenvironment. This study evaluates the value of FAPI-targeted imaging in assessing the metastatic manifestations of this disease.

Methods: The diagnostic performance of whole-body planar and ^{99m}Tc-FAPI-46 SPECT/CT imaging, acquired following the injection of 20 mCi of the radiotracer, was evaluated in two young male patients (aged 17 and 19 years) with advanced metastatic Ewing sarcoma to determine disease extent and guide clinical management.

Results: The first patient (17-year-old) demonstrated widespread sclerotic bone metastases with periosteal reactions, alongside highly FAPI-avid pleural lesions. In the second patient (19-year-old), tumor recurrence at the site of a previous spinal surgery, an aggressive soft-tissue neck mass, and widespread lytic bone metastases with intense FAPI uptake were observed. However, thoracic uptake was discordant: pleural lesions exhibited intense uptake, whereas metastatic pulmonary nodules showed faint or absent uptake. Furthermore, the tumor-to-liver ratio (TLR) was higher in the lytic lesions of the second patient compared to the sclerotic lesions of the first patient (e.g., 116 vs. 73 in the left ilium).

Conclusion: ^{99m}Tc-FAPI-46 SPECT/CT is a powerful molecular imaging tool that provides excellent tumor-to-background contrast for detecting skeletal and soft-tissue lesions by mapping active stromal remodeling. However, the lack of uptake in certain pulmonary metastases suggests that the desmoplastic reaction may be limited in some extraskeletal presentations.

Keywords: Molecular Imaging; Tumor Microenvironment; SPECT/CT; Fibroblast activation protein inhibitor

A18 Design of a lung phantom for beta-induced Bremsstrahlung dosimetry and minimum detectable activity calculation using Geant4

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Introduction: Inhaling ⁹⁰Sr during nuclear emergencies, or pulmonary shunting in ⁹⁰Y radioembolization, presents critical dosimetric challenges. As pure beta emitters, their in-vivo detection relies entirely on capturing Bremsstrahlung radiation generated via Coulomb scattering in tissue. This study designs a tissue-equivalent lung phantom in Geant4 to simulate this beta-to-Bremsstrahlung conversion for accurate internal dosimetry.

Methods: A human thorax was modeled in Geant4 using electromagnetic physics libraries to precisely track beta deceleration and Bremsstrahlung yield. A 3x3-inch NaI(Tl) detector was simulated, and its positioning was anatomically optimized for maximum efficiency. To ensure realistic radiation attenuation, porous Acrylonitrile Butadiene Styrene (ABS) was customized to match natural lung density (0.26 g/cm³). The Minimum Detectable Activity (MDA) for a 100-second acquisition was then calculated using standard background spectra to assess rapid triage feasibility.

Results: The optimal detector geometry was identified anterolaterally (between the abdomen and flank). The customized ABS ($Z_{\text{eff}} = 7.12$) demonstrated excellent radiological equivalence to natural lung tissue ($Z_{\text{eff}} = 7.33$). Simulating the ABS lung yielded highly consistent photon spectra, showing a negligible 2.5% MDA deviation compared to the reference lung. The 100-second MDA for the optimized setup was 4720 Bq, offering sufficient sensitivity for direct in-vivo measurements.

Conclusion: The ABS-based phantom (0.26 g/cm³) and anterolateral detection geometry provide a reliable framework for Bremsstrahlung dosimetry. An MDA of 4720 Bq with a 2.5% deviation confirms its clinical and industrial utility for the emergency triage of exposed workers and evaluating radioembolization shunting.

Keywords: Strontium-90; Radioembolization; Bremsstrahlung; Acrylonitrile Butadiene Styrene; Minimum detectable activity

A19 Radiolabeling and characterization of a trastuzumab-functionalized niosomal Nano system using lutetium-177

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Introduction: Breast cancer remains one of the leading causes of cancer-related mortality worldwide, and tumors overexpressing human epidermal growth factor receptor 2 (HER2) require highly specific targeted approaches. Radioimmunotherapy, combining the specificity of monoclonal antibodies with the cytotoxic potential of ionizing radiation, offers a promising strategy for targeted tumor therapy. This study aimed to design, synthesize, and characterize a trastuzumab-functionalized radioimmunoniosomal system labeled with lutetium-177 (¹⁷⁷Lu) for potential use in HER2-positive breast cancer therapy.

Methods: Niosomes composed of Tween 80, cholesterol, and DSPE-PEG-NH₂ (molar ratio 10:5:0.1) were prepared by the thin-film hydration method. Trastuzumab was first conjugated to the bifunctional chelator p-SCN-Bn-DOTA and radiolabeled with ¹⁷⁷Lu; the resulting radioimmunoconjugate was then attached to the niosomal surface via EDC/NHS chemistry. The system was characterized by FTIR, transmission electron microscopy (TEM), dynamic light scattering (DLS), and zeta potential analysis. Radiolabeling yield and radiochemical stability in phosphate-buffered saline (PBS) and human serum were assessed by radio-thin-layer chromatography (RTLC).

Results: FTIR confirmed successful antibody conjugation through the emergence of Amide A, Amide I, and Amide V bands. TEM showed spherical, well-dispersed particles, with the hydrodynamic diameter increasing from 95 nm (niosome) to 145 nm (immunoniosome), consistent with surface antibody coating. Zeta potential shifted from -11.7 mV to near-neutral after conjugation. Radiolabeling yield reached 100%, with stability of 98.12% (PBS) and 95.27% (human serum) after 72 hours.

Conclusion: The designed radioimmunoniosomal system exhibits suitable physicochemical and radiochemical properties, supporting its potential as a targeted radiopharmaceutical platform for HER2-positive breast cancer.

Keywords: Radioimmunotherapy; Niosome; Trastuzumab; Lutetium-177; HER2

A20 Machine learning-driven prediction of gamma-ray shielding performance in TeO₂-Bi₂O₃-BaO glass systems

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The development of high-performance, non-toxic radiation shielding materials remains a critical priority in medical imaging, nuclear technology, and industrial radiography, driven by the urgent need to replace conventional lead-based shielding with environmentally sustainable alternatives. In this study, an integrated computational and machine learning framework was developed to design and optimize a novel lead-free tellurite-based glass system ($\text{TeO}_2\text{-Bi}_2\text{O}_3\text{-BaO}$) enriched with high-atomic-number rare-earth and heavy-metal oxide dopants for enhanced gamma- and X-ray shielding. A fully-artificial neural network surrogate model, trained on a high-fidelity dataset generated from Geant4 Monte Carlo simulations spanning 0.01–200 keV, achieved exceptional predictive accuracy ($R^2 \approx 0.992$) for the linear attenuation coefficient, faithfully reproducing both Compton-scattering trends and discontinuous K-edge photoelectric features. Random Forest-based feature importance analysis identified heavy metal oxide as the dominant contributors to shielding performance, consistent with their strong photoelectric cross-sections and favorable K-edge positions. Comprehensive evaluation of the optimized glass demonstrated superior shielding capability, with a mass attenuation coefficient of $9.28 \text{ cm}^2/\text{g}$ and a half-value layer of only 0.0178 cm at 50 kVp, outperforming benchmark tellurite and lanthanum-based reference glasses across the 50–120 kVp range. Spectral transmission analysis revealed pronounced beam-hardening and near-complete soft X-ray suppression within sub-millimeter thicknesses, with approximately 69% photon fluence absorption at only 1 mm. Collectively, the optimized $\text{TeO}_2\text{-Bi}_2\text{O}_3\text{-BaO}$ glass constitutes a compact, environmentally sustainable, lead-free candidate for next-generation radiation protection in medical, industrial, and research applications.

Keywords: Shielding; Tellurite glass; K-edge absorption; Gamma-ray; Machine learning

A21 The role of building materials in an apartment on indoor radon concentration and the annual effective dose for occupants

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Radon (^{222}Rn) is one of the major sources of natural radiation exposure and is recognized as the second leading cause of lung cancer after smoking. This study investigated the contribution of building materials to indoor radon concentration and estimated the annual effective dose received by employees of a medical laboratory located in an office apartment in Mashhad, Iran. The building had a floor area of 103 m^2 and a ceiling height of 3.10 m. Granite covered 96 m^2 of the floor and 187 m^2 of the walls, while approximately 45 m^2 of utility channels were made of concrete. The radon exhalation rates from granite and concrete were measured as 0.236 and $0.121 \text{ Bq m}^{-2} \text{ h}^{-1}$, respectively, whereas the radon entry rate from utility channels was determined to be $12.4 \text{ Bq m}^{-2} \text{ min}^{-1}$. Indoor radon concentrations were estimated using a mass balance model under poor and moderate ventilation conditions. The calculated concentrations were 58 and 25 Bq m^{-3} , respectively, showing good agreement with the measured values of 68 and 26 Bq m^{-3} . Annual effective doses were estimated based on occupancy periods of 12 h day^{-1} for laboratory staff and 20 h day^{-1} for security personnel. Although the estimated doses remained below recommended limits, the results indicate that extensive use of granite and insufficient ventilation may significantly increase indoor radon levels.

Keywords: Radon; Lung Cancer; Indoor concentration; Building materials

A22 Comparative diagnostic value of $^{68}\text{Ga-FAPI-46}$ PET/CT and $^{18}\text{F-FDG}$ PET/CT for localizing sites of tumoral involvement in differentiated thyroid cancer with elevated thyroglobulin and negative radioiodine scans

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Introduction: Thyroid cancer is the most common endocrine malignancy worldwide with a favorable prognosis. However, a subset of patients with iodine-refractory thyroid cancer requires new diagnostic methods. This study aimed to evaluate the diagnostic efficacy of $^{68}\text{Ga-FAPI-46}$ PET/CT compared to $^{18}\text{F-FDG}$ PET/CT in identifying sites of tumoral involvement in differentiated thyroid cancer (DTC) patients with elevated thyroglobulin and negative iodine scans (TENIS syndrome).

Methods: In this prospective, cross-sectional study, 11 patients with TENIS syndrome underwent both $^{68}\text{Ga-FAPI-46}$ and $^{18}\text{F-FDG}$ PET/CT. Lesions were classified by anatomical compartment, and quantitative parameters (SUVmax,

tumor-to-background ratio [TBR]) were compared. Diagnostic accuracy was assessed using FDG PET/CT as the reference standard, and the impact on clinical management was evaluated.

Results: ⁶⁸Ga-FAPI-46 PET/CT was positive in 9/11 patients (81.8%), while ¹⁸F-FDG PET/CT was positive in 7/11 (63.6%). FAPI detected lesions in two patients with completely negative FDG scans. However, FDG identified more total lesions (50 vs. 30) and demonstrated higher SUV_{max} in bone and lymph node metastases. TBR agreement between tracers was excellent in the thorax, abdomen, and head and neck (ICCs 0.74–0.89). At a thyroglobulin threshold of 12.75 ng/mL, FAPI PET/CT yielded 87.5% sensitivity and 100% specificity. Clinical management was altered by FAPI in 45% of patients versus 36% by FDG.

Conclusion: ⁶⁸Ga-FAPI-46 PET/CT is a robust complementary imaging modality in TENIS syndrome, particularly valuable for detecting disease in FDG-negative patients and enabling theranostic applications. While ¹⁸F-FDG remains superior for bone and nodal metastases, FAPI offers higher patient-level detection and meaningful clinical impact.

Keywords: ¹⁸F-FDG PET/CT; ⁶⁸Ga-FAPI-46 PET/CT; Differentiated thyroid Cancer; Thyroglobulin-elevated negative iodine scan

A23 Exceptional response to short-course ¹⁷⁷Lu-PSMA radioligand therapy in a patient with metastatic hormone-sensitive prostate cancer

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Introduction: Patients with de novo high-volume metastatic hormone-sensitive prostate cancer (mHSPC) have a poor prognosis despite advances in androgen-deprivation therapy (ADT) and androgen receptor pathway inhibitors. Prostate-specific membrane antigen (PSMA)-targeted radioligand therapy (RLT) has shown significant benefit in metastatic castration-resistant prostate cancer, while its role in mHSPC is still being explored

Methods: We report the case of a 69-year-old man with de novo high-volume mHSPC who presented with a prostate-specific antigen (PSA) level of 433.75 ng/mL and extensive skeletal and nodal metastases. Initial treatment consisted of ADT with goserelin, abiraterone, and cyproterone acetate, resulting in a decline in PSA to 44.29 ng/mL. The patient subsequently received three cycles of ¹⁷⁷Lu-PSMA radioligand therapy. Treatment response was assessed using serial PSA measurements, clinical evaluation, and ^{99m}Tc-PSMA scintigraphy.

Results: Following three cycles of ¹⁷⁷Lu-PSMA therapy, the patient achieved a near-complete biochemical response, with PSA decreasing to 0.15 ng/mL. Bone pain resolved completely, indicating marked clinical improvement. Nine-month follow-up ^{99m}Tc-PSMA scintigraphy demonstrated complete regression of previously identified skeletal and nodal metastatic lesions, with no significant treatment-related adverse events observed.

Conclusion: This case demonstrates the potential efficacy and favorable safety profile of early ¹⁷⁷Lu-PSMA radioligand therapy in de novo high-volume mHSPC. The remarkable biochemical, clinical, and imaging responses support further investigation of integrating PSMA-targeted RLT earlier in the treatment course to enhance outcomes in patients with advanced hormone-sensitive disease.

Keywords: Theranostics; ^{99m}Tc-PSMA; Androgen deprivation therapy; Metastatic castration-resistant prostate cancer; Androgen receptor pathway inhibitor

A24 Lymphatic mapping and sentinel lymph node biopsy for lymph node staging of soft tissue sarcomas with high propensity for lymphatic spread

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Introduction: Regional lymph node metastasis is frequent in certain histological soft-tissue sarcomas (STS) subtypes, including rhabdomyosarcoma, synovial sarcoma, clear-cell sarcoma, angiosarcoma, and epithelioid sarcoma. Accurate nodal staging remains challenging, and diagnostic value of lymphoscintigraphy combined with sentinel lymph node biopsy (SLNB) has not been well established in high-risk tumors. This study evaluated feasibility

and diagnostic accuracy of lymphatic mapping and SLNB for lymph node staging of STS with high propensity for lymphatic spread.

Methods: In this diagnostic accuracy study, 16 patients with clinically node-negative, high-risk STS underwent preoperative lymphoscintigraphy, followed by gamma probe-guided SLNB. Histopathological findings served as reference standard. SLN detection rates and false-negative rates were used as major diagnostic indices. In patients with pathologically involved sentinel nodes, regional node dissection was done.

Results: Planar lymphoscintigraphy identified at least one SLN in 15 of 16 patients (93.8%), while SPECT/CT achieved 100% detection rate and revealed additional drainage pathways in 30% of cases. Surgical SLN identification was successful in all biopsied patients. Histopathological SLN metastases were detected in 3 of 15 patients (20%), all with alveolar rhabdomyosarcoma. Among 12 patients with negative SLNs, 4 underwent additional surgical lymph node dissection, which revealed no metastatic involvement of LNs. The remaining 8 patients demonstrated no evidence of lymphatic involvement during a median follow-up of 18.5 months, resulting in an overall sensitivity of 100% (3/3) and false-negative rate of 0% (0/3).

Conclusion: Lymphatic mapping and SLNB are feasible and accurate staging methods in STS subtypes at high risk for lymphatic dissemination, particularly alveolar rhabdomyosarcoma.

Keywords: Soft tissue sarcoma; Lymphatic mapping; Sentinel lymph node biopsy; Lymphatic spread

A25 Enhancing lymph-node assessment in differentiated thyroid cancer using PET/CT radiomics and machine learning

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Introduction: Differentiated thyroid cancer (DTC) is the most common endocrine malignancy. Although most patients achieve favorable outcomes after total thyroidectomy and radioiodine ablation, a subset presents with elevated serum thyroglobulin despite negative radioiodine whole-body scans. In these cases, identifying recurrent or metastatic lymph-node involvement relies heavily on advanced imaging. While ¹⁸F-FDG PET/CT is valuable in radioiodine-refractory or dedifferentiated disease, conventional visual assessment and SUV-based metrics often fail to reliably distinguish benign from malignant lymph nodes. This study aimed to evaluate the diagnostic performance of PET/CT-derived radiomics features combined with machine-learning algorithms for lymph-node characterization in DTC.

Methods: In the first phase of our study, 63 lymph nodes (41 benign, 22 malignant; pathology-proven) from 25 DTC patients were analyzed. Manual segmentation of suspicious nodes was followed by extraction of comprehensive radiomics features, including GLCM, GLRLM, histogram-based parameters, and multi-level wavelet features. Multiple machine-learning classifiers were trained using optimized feature-selection strategies. Histopathology and cytology served as the reference standard.

Results: Five classifiers were evaluated. Accuracy values for K-Nearest Neighbors, Support Vector Classifier, Random Forest, Nu-SVC, and Extra Trees were 63%, 63%, 69%, 66%, and 68%, respectively. Random Forest demonstrated the best performance, achieving 70% sensitivity and 68% specificity.

Conclusion: Radiomics-based PET/CT analysis combined with machine learning improved discrimination between benign and malignant lymph nodes, even at this preliminary stage. These findings highlight the potential of radiomics-enhanced ¹⁸F-FDG PET/CT as a non-invasive tool that may reduce reliance on fine-needle aspiration, improve detection of recurrent or distant nodal metastases, and support more precise risk stratification in DTC follow-up.

Keywords: ¹⁸F-FDG PET/CT; Differentiated thyroid cancer; Radiomics; Machine learning; Lymph-node metastasis

A26 Development of a pyrogallol-formaldehyde resin column for one-step pre-purification of germanium-68/gallium-68 generator eluates

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Introduction: The radiochemical yield of ^{68}Ga -based radiopharmaceuticals such as ^{68}Ga -DOTATATE is compromised by competing tetravalent cationic impurities (Ge^{4+} , Sn^{4+} , Ti^{4+}) present in $^{68}\text{Ge}/^{68}\text{Ga}$ generator eluates. Conventional cation- or anion-exchange pre-purification methods require multiple adsorption/desorption steps, prolonging synthesis time and reducing radioactivity recovery. This study developed a one-step pyrogallol-formaldehyde resin (PGR) column designed to selectively remove tetravalent cations without extending the overall synthesis workflow.

Methods: A PGR resin was synthesized by condensation of pyrogallol with formaldehyde and packed into small pre-conditioning columns (50 mg). Cation-removal efficiency was assessed by inductively coupled plasma optical emission spectrometry using both standard multi-cation solutions and authentic generator eluates. Formaldehyde leaching was quantified by gas chromatography, and biocompatibility was evaluated by MTT assay on macrophage cells. Two series of ten manual ^{68}Ga -DOTATATE radiolabeling experiments, with and without PGR pre-purification, were compared under identical conditions. Column reusability was tested over 15 consecutive production runs, and ^{68}Ge breakthrough was measured before and after PGR treatment.

Results: The PGR resin selectively adsorbed tetravalent cations, with removal efficiencies of 81.8% for Ge^{4+} , 42.4% for Sn^{4+} , and 29.8% for Ti^{4+} in standard solutions, while trivalent and divalent cations (Fe^{3+} , Ga^{3+} , Zn^{2+}) remained unaffected. In generator eluates, Sn^{4+} and Ti^{4+} were reduced to non-detectable levels. Formaldehyde release remained below 0.5 ppm, and cell viability was $98 \pm 1.7\%$, confirming biocompatibility. Radiolabeling yield increased from $58.9 \pm 6\%$ without PGR to $75.9 \pm 1.8\%$ with PGR (~17% improvement). ^{68}Ge breakthrough decreased more than 20-fold (from $0.0008 \pm 0.0001\%$ to $0.00003 \pm 0.00002\%$). Column performance remained stable, with less than 2% yield loss, for up to 10 consecutive uses.

Conclusion: The PGR column provides a simple, single-step, biocompatible, and reusable pre-purification method that simultaneously improves radionuclidic purity and radiolabeling efficiency of ^{68}Ga -based radiopharmaceuticals without prolonging synthesis time, offering a practical alternative to conventional ion-exchange pre-purification in both manual and automated clinical workflows.

Keywords: Gallium-68; Pyrogallol resin; One-step pre-purification; Tetravalent cations; DOTATATE

A27 Next-generation targeted alpha radioligand therapy with actinium-225: design strategies for novel chelator, linker and targeting-ligand platforms in refractory cancers

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Targeted alpha therapy using actinium-225, an alpha-emitting radionuclide with a physical half-life of about 9.9 days and a multi-step alpha-emitting decay chain, has attracted growing interest for treating cancers resistant to standard therapies. The high linear energy transfer and short tissue range of alpha particles concentrate DNA double-strand breaks within targeted cells while limiting damage to surrounding tissue. This review synthesizes current literature on actinium-225-based radioligand platforms, structured conceptually as radionuclide-chelator-targeting-vector conjugates. Established examples such as actinium-225-PSMA and actinium-225-DOTATATE were examined alongside emerging targets including FAP, HER2 and integrins, with attention to chelator coordination chemistry, complex stability, and dosimetric challenges arising from daughter-radionuclide redistribution. Across the reviewed literature, actinium-225 radioligand therapy shows encouraging responses in resistant prostate cancer and neuroendocrine tumors previously treated with lutetium-177 analogues, though most clinical evidence derives from small, non-randomized, single-center studies. Key unresolved challenges include chelator suitability for actinium coordination chemistry, radiolytic and in-vivo complex stability, off-target uptake in salivary glands and kidneys, and the complexity of microdosimetry at the cellular level. Advancing actinium-225 radioligand therapy toward broader clinical use will depend on next-generation chelator and linker design, improved tumor retention with reduced normal-tissue uptake, and refined dosimetric modelling, collectively aimed at increasing the therapeutic index of this rapidly evolving class of radiopharmaceuticals.

Keywords: Actinium-225; Targeted alpha therapy; Chelator; Radioligand therapy; Refractory cancer

A28 Dosimetric impact of spherical versus dolomitic-layered balloon geometries in ^{131}Cs liquid-source intracavitary brachytherapy for glioblastoma multiforme

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Introduction Photon self-absorption in liquid ¹³¹Cs bulk sources limits the dose efficiency and dose uniformity around intracerebroventricular brachytherapy balloons. This study aimed to compare the dosimetric properties of two balloon geometries: a fully spherical balloon (similar to GliaSite) and a dolomitic layered balloon (outer radioactive shell with inner blue core).

Methods For the perfect spherical balloon (volume 33.5cm³), experimental validation was performed with thermoluminescence dosimetry (TLD GR-200) on a new spherical phantom and Monte Carlo simulation (code MCNP5). For the layered balloon, the dolomite geometry (active volume 6–7cm³) was simulated with the same code and TG-43-like formalism and compared with the spherical geometry. Parameters such as dose rate, radial dose function $g(r)$, anisotropy function $F(r, \theta)$ and activity required for a reference dose of 60Gy at a distance of 0.5 cm from the balloon surface were calculated as a uniform comparison criterion.

Results The $\pm 8\%$ agreement between TLD measurements and MCNP5 simulations ($\pm 12.3\%$ uncertainty) confirmed the accuracy of the spherical balloon model; the calculated dose rate in water was 0.0127 Gy/h at 0.5 cm depth per 37MBq. The layered geometry increased the dose efficiency by about 8% (1.08 ± 0.02) compared to the spherical balloon with an uncertainty of $\pm 6-8\%$, and the required efficiency decreased by about 7% (0.93 ± 0.02); the anisotropy at $\theta = 90^\circ$ improved from the range of 0.80–0.85 to 0.87–0.93, without significant changes ($\sigma = 1\%$) in the radial dose drop profile ($GI \approx 1.75$).

Conclusion Geometric rearrangement of the ¹³¹Cs liquid source from the conventional spherical to the lamellar state reduces self-absorption and improves near-field dose uniformity, while maintaining depth dose compliance; it is a promising approach for optimizing balloon design in next-generation glioblastoma brachytherapy.

Keywords: Brachytherapy; ¹³¹Cs liquid-source; GBM; TG43-like; Self-absorption

A29 Development and physicochemical characterization of a Lu-177-Labeled Bevacizumab immunoniosome as a novel platform for targeted radioimmunotherapy

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Introduction: Targeted radionuclide therapy has emerged as an effective strategy for cancer treatment; however, its clinical application remains limited by nonspecific biodistribution and systemic toxicity. This study aimed to develop and characterize a novel Lu-177-labeled bevacizumab immunoniosome as a targeted radioimmunotherapeutic nanoplatform with improved delivery efficiency and radiochemical stability.

Methods: Nanoniosomes composed of Tween 80, cholesterol, and DSPE-PEG-NH₂ were fabricated using the thin-film hydration method. Bevacizumab was purified, conjugated with p-SCN-Bn-DOTA, radiolabeled with Lu-177, and subsequently immobilized on the nanoniosome surface through EDC/NHS coupling. The prepared system was characterized by dynamic light scattering (DLS), zeta potential analysis, RTLC, radiochemical stability assessment and the biodistribution studies and was performed in normal female BALB/c mouse.

Results: The fabricated nanoniosomes exhibited an average particle size of 89.4 nm, which increased to approximately 115 nm after antibody conjugation, confirming successful immunoniosome formation. The zeta potential shifted from -11.7 mV toward neutrality following antibody attachment. Radiochemical purity reached 100%, while radiochemical stability remained high at 100%, 99.09%, and 98.67% after 2, 48, and 96 hours, respectively, demonstrating excellent in vitro stability, the accumulation of the radiolabeled immunoniosome in lungs, liver, spleen and other tissues demonstrates a similar pattern to the other radiolabeled anti-VEGF nanoniosomes.

Conclusion: The developed Lu-177-labeled immunoniosome demonstrated favorable physicochemical characteristics, excellent radiochemical stability, and an appropriate nanoscale size for targeted drug delivery. These findings suggest that this nanoplatform has considerable potential for future targeted radioimmunotherapy applications and warrants further biological evaluation.

Keywords: Lu-177; Immunoniosome; Bevacizumab; Radioimmunotherapy; Targeted drug delivery

A30 ⁶⁸Ga-Pentixafor PET/CT as a noninvasive alternative in evaluation of suspected aldosterone-producing adenomaHaniye Elahifard^{1*}, Amin Saber Tanha¹, Sara Shakeri², Nasrin Raeisi¹, Ramin Sadeghi¹, Emran Askari¹¹Nuclear Medicine Research Center, Mashhad University of Medical Sciences, Mashhad, Iran²Cancer Research Center, RAZAVI Hospital, Imam Reza International University, Mashhad, Iran

Introduction: Primary aldosteronism is a common cause of secondary hypertension, but localization of aldosterone-producing adenomas remains challenging. Although adrenal vein sampling is the reference standard for lateralization, it is invasive and not universally available. Chemokine receptor-4-targeted imaging with Ga-68 Pentixafor has recently emerged as a promising noninvasive approach for identifying aldosterone-producing lesions.

Methods: We report the case of a 54-year-old woman presenting with recurrent hypertensive crises and a lipid-rich right adrenal adenoma detected incidentally on computed tomography angiography. Biochemical evaluation was inconclusive for both pheochromocytoma and primary aldosteronism. Ga-68 DOTATATE PET/CT scan was performed to exclude pheochromocytoma, followed by Ga-68 Pentixafor PET/CT scan to evaluate chemokine receptor-4 expression.

Results: Ga-68 DOTATATE PET/CT scan demonstrated no radiotracer uptake within the adrenal lesion, making pheochromocytoma highly unlikely. In contrast, Ga-68 Pentixafor PET/CT scan revealed focal uptake in the lipid-rich adrenal adenoma (SUV_{max}= 6.4), supporting its functional significance as an aldosterone-producing adenoma. Given the high clinical suspicion for primary aldosteronism and the invasive nature of adrenal vein sampling, the patient was treated with spironolactone, resulting in satisfactory clinical improvement.

Conclusion: This case highlights the potential clinical utility of Ga-68 Pentixafor PET/CT scan tomography as a noninvasive functional imaging modality for identifying aldosterone-producing adenomas when conventional biochemical and anatomical evaluations are inconclusive. Chemokine receptor-4-targeted imaging may complement existing diagnostic algorithms and facilitate individualized management of patients with suspected primary aldosteronism

Keywords: CXCR4; DOTATATE; Adrenal vein sampling; Adrenal adenoma; Primary aldosteronism

A31 MINERP: Minimally invasive non-endoscopic radioguided parathyroidectomy for primary hyperparathyroidism: A pilot feasibility studyS Moslemi¹, M Kermansaravi¹, MR Ghasri², S Farzanehfard², Y Salehi², S Mirzakhani^{2*}, M Abbasi²¹Clinical Research Development Unit, Khanevadeh Hospital, AJA University of Medical Sciences, Tehran, Iran²Department of Nuclear Medicine, Imam Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran

Introduction: Focused parathyroidectomy can reduce operative dissection in selected patients with primary hyperparathyroidism (PHPT), but access to endoscopic equipment and rapid intraoperative parathyroid hormone (ioPTH) assays is variable. We evaluated a minimally invasive non-endoscopic radioguided parathyroidectomy (MINERP) strategy combining concordant preoperative localization with technetium-99m sestamibi gamma-probe guidance. To assess the feasibility, operative performance, safety, and short-term biochemical outcomes of MINERP in carefully selected patients with PHPT.

Methods: Four consecutive patients with biochemically confirmed PHPT and CaPTHUS scores ≥ 3 underwent MINERP at a referral teaching hospital during 2024–2025. Eligibility required concordant high-resolution cervical ultrasonography and dual-phase Tc-99m sestamibi scintigraphy. On the morning of surgery, 10 mCi Tc-99m sestamibi was administered intravenously 2–3 hours before incision. A handheld gamma probe was used for pre-incision mapping, intraoperative localization, and ex vivo confirmation using the $\geq 20\%$ rule. Procedures were performed through a 1.5–2 cm low-cervical incision without endoscopic assistance, frozen section, or ioPTH monitoring.

Results: All four patients were women aged 42–63 years (mean 52.25 ± 8.99). Preoperative calcium ranged from 10.8 to 12.1 mg/dL and PTH from 118 to 312 pg/mL. Radioguidance localized the hyperfunctioning gland in all cases. Ex vivo counts were 28%–41% of background, exceeding the predefined threshold in every patient. Operative time ranged from 26 to 30 minutes. No conversion to bilateral neck exploration or perioperative complication occurred. Histopathology confirmed benign parathyroid adenoma in all cases, and all patients achieved biochemical cure at 6 weeks.

Conclusion: MINERP was feasible and achieved successful localization, short operative times, no observed complications, and 100% short-term biochemical cure in this four-patient pilot series. Larger prospective studies with longer follow-up and comparative groups are required before broader adoption.

Keywords: Technetium-99m sestamibi; Gamma probe; CaPTHUS; Intraoperative localization; Single-gland disease

A32 Development and preclinical evaluation of a novel PEG₃-Linked ⁶⁸Ga-FAPI radiotracer with enhanced tumor retention for FAP-targeted PET imagingMahshid Kiani^{1*}, Mehdi Akhlaghi², Safura Jokar¹, Zahra Ghiamaty¹, Sara Roustaei¹, Davood Beiki²¹Department of Nuclear Pharmacy, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran²Research Center for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran

Introduction: Fibroblast activation protein (FAP) is an attractive target for cancer imaging and theranostics; however, currently available FAP inhibitors (FAPIs) exhibit rapid clearance and limited tumor retention, potentially reducing their clinical utility.

Methods: A novel PEG₃-linked FAPI derivative, [⁶⁸Ga]Ga-FAPI-MKG, was designed by incorporating a PEG₃ linker into the FAPI-04 scaffold to improve pharmacokinetic properties. Following synthesis and radiolabeling with gallium-68, the tracer was evaluated through in vitro characterization, biodistribution and blocking studies in BALB/c mice bearing CT-26 tumors, and PET/CT imaging.

Results: [⁶⁸Ga]Ga-FAPI-MKG was obtained with radiochemical purity exceeding 98% and demonstrated high in vitro stability (RCP >90% after 120 min). Compared with the reference tracer [⁶⁸Ga]Ga-FAPI-46, it exhibited higher tumor uptake (7.18 ± 0.56 %ID/g at 60 min; 3.20 ± 0.11 %ID/g at 120 min), prolonged tumor retention, and improved tumor-to-background contrast. Biodistribution studies revealed dual hepatobiliary and renal clearance, while blocking studies confirmed FAP-specific uptake.

Conclusion: Strategic PEG₃ linker incorporation significantly enhanced tumor accumulation and retention while maintaining excellent radiochemical characteristics. These findings identify [⁶⁸Ga]Ga-FAPI-MKG as a promising candidate for further development as a FAP-targeted PET imaging agent and a potential radiotheranostic platform.

Keywords: Cancer-associated fibroblasts; PET imaging; Molecular imaging; Theranostics

A33 Development of ⁶⁸Ga-(acac)-ECD via a lipophilic intermediate: An exploratory strategy to improve BBB penetration of Gallium-68 tracersFateme Ebrahimi^{1*}, Sara Roustaei¹, Zahra Ghiamaty¹, Amin Mokhtari Kheirabadi², Davood Beiki^{1,2}, Mehdi Akhlaghi²¹Department of Nuclear Pharmacy, School of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran²Research Center for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran

Introduction: Cerebral perfusion imaging is essential for managing neurological disorders including stroke, dementia, epilepsy, and brain tumors. While ^{99m}Tc-labeled agents (ECD and HMPAO) remain the standard SPECT tracers, PET provides superior spatial resolution, sensitivity, and quantitative accuracy. The increasing availability of ⁶⁸Ge/⁶⁸Ga generators has renewed interest in ⁶⁸Ga radiopharmaceuticals. However, the hydrophilicity of Ga³⁺ limits blood–brain barrier (BBB) penetration. This study developed a more lipophilic ⁶⁸Ga-labeled ECD derivative and evaluated its radiochemical, physicochemical, and preliminary biological properties.

Methods: ⁶⁸Ga was eluted from a ⁶⁸Ge/⁶⁸Ga generator and converted to ⁶⁸Ga(acac)₃ on a cation-exchange resin using acetylacetone in acetone. The intermediate was reacted with ECD in ethanol. Radiochemical purity was determined by iTLC. Stability was evaluated in PBS (pH 7.4) and saline for 120 min. Lipophilicity (log P) was measured by the n-octanol/water partition method. Biodistribution was assessed in healthy male Wistar rats at 10-, 30-, and 60-min post-injection, followed by static PET/CT imaging at 60 min.

Results: Both ⁶⁸Ga(acac)₃ and ⁶⁸Ga-(acac)-ECD showed radiochemical purity >98%. The final complex retained >90% stability at 60 min and >85% at 120 min. Log P increased from 0.3 to 0.6, indicating improved lipophilicity. Biodistribution demonstrated rapid blood clearance, higher brain uptake than ⁶⁸Ga-ECD (0.9 %ID/g at 10 min, 0.6 %ID/g at 60 min), and predominant hepatobiliary excretion. PET/CT confirmed cerebral localization and hepatobiliary clearance.

Conclusion: Acetylacetonate-mediated labeling yielded a ⁶⁸Ga-(acac)-ECD complex with high radiochemical purity, adequate stability, and measurable BBB penetration. These findings support ⁶⁸Ga(acac)₃ as a promising intermediate for developing lipophilic ⁶⁸Ga PET tracers for cerebral perfusion imaging.

Keywords: Gallium-68; Ethyl cysteinate dimer; Acetylacetonate; Cerebral perfusion; Blood–brain barrier; PET

A34 Preparation and preclinical studies of ¹⁷⁷Lu-CHX-A"-DTPA-antiCD20 for clinical use in treatment of Non-Hodgkin's LymphomaMohammad Alizadeh^{1,3}, Behrouz Alirezapour^{2*}, Mohammad Ahmadi², Saeed Kakaei²¹Department of Clinical Biochemistry, School of Life Sciences, Zanjan University of Medical Sciences, Zanjan, Iran²Radiation Application Research School, Nuclear Science and Technology Research Institute, Tehran, Iran

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Introduction: Rituximab is a monoclonal chimeric antibody which has been approved by US FDA for immunotherapy of Non-Hodgkins' lymphoma (NHL). In the present study, we prepared Rituximab as an anti-CD20 antibody via identical chelator, CHX-A-DTPA labeled with ¹⁷⁷Lu [T_{1/2} = 6.73 d, E_βmax = 497 keV, E_γ = 113 (6.4 %), 208 (11%) keV] and performed preliminary biodistribution studies in normal mice.

Methods: Rituximab (30 mg) was conjugated with CHX-A-DTPA, the average number of the chelator conjugated per mAb was calculated. CHX-A-DTPA-Rituximab was labeled with ¹⁷⁷Lu (60 mCi, 2.22 GBq) then RCP and immunoreactivity by Raji cell line and serum stability of labeled compound were determined. The biodistribution studies was performed in female BALB/c mice (i.v., 100 microl, 20±5 µg mAb, 6, 12, 24, 48 and 96 h).

Results: ¹⁷⁷Lu-CHX-A-DTPA-Rituximab was prepared (RCP: 98% ± 0.5, Specific Activity 4.1 ± 0.7 µCi/µg). Conjugation reaction of chelator (50 molar excess ratio) to antibody resulted in a product with the average number of chelators attached to a mAb (c/a) of 3.9 ± 0.4. Labeling yield with Lu-177 in 400µg concentration of bioconjugate was 92.5% ± 2.1. In vitro and in vivo stability of radioimmunoconjugate was investigated respectively 92% ± 2.6 in the PBS and 86% ± 1.8 in the serum over 144 h. The immunoreactivity of the radioimmunoconjugate was found to be 84% in CD20-positive Raji cells and only 2% in CD20-negative CHO cells. The biodistribution of ¹⁷⁷Lu-CHX-A-DTPA-Rituximab complex in normal mice at 6, 12, 24, 48 and 96 h after intravenous administration, expressed as (%ID/g). Biodistribution studies demonstrated prolonged blood circulation during the early phase, followed by predominant hepatic clearance with minimal bone uptake, reflecting favorable in vivo pharmacokinetics.

Conclusion: ¹⁷⁷Lu-CHX-A-DTPA-Rituximab is a potential compound for radioimmunotherapy of Non-Hodgkin's Lymphoma (NHL) in oncology.

Keywords: Anti-CD20; Rituximab; Lu-177; Non-Hodgkin Lymphoma; Raji cell line

A35 Targeting the non-delineable: FAPI PET-guided tumor volume delineation in radiotherapy planning across various tumors: A comprehensive review

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Introduction: Accurate gross tumor volume (GTV) delineation remains a critical yet error-prone step in radiotherapy (RT) planning. Conventional imaging and [¹⁸F]FDG PET/CT are limited by poor tumor-to-background contrast and non-specific inflammatory uptake. ¹⁸F/⁶⁸Ga-labeled fibroblast activation protein inhibitor (FAPI) PET, which targets cancer-associated fibroblasts (CAFs) within the tumor microenvironment, offers a biologically distinct and potentially superior alternative. This study aimed to evaluate the potential impact of FAPI PET on RT planning and field delineation.

Methods: A systematic literature search of PubMed/MEDLINE was conducted using FAPI PET and RT planning-related terms, with no publication-year restriction. The search was last updated in April 2026. Studies evaluating FAPI/FAPI PET/CT or PET/MRI for RT target volume delineation were included. Reviews, editorials, letters, and preclinical studies were excluded.

Results: Seventeen eligible studies, encompassing 336 patients across eight tumor types -esophageal cancer, head and neck cancer, glioblastoma/glioma, adenoid cystic carcinoma, pancreatic ductal adenocarcinoma, nasopharyngeal carcinoma, lung cancer, and lower gastrointestinal malignancies - were included. FAPI PET consistently yielded larger GTVs than conventional imaging and [¹⁸F]FDG PET. RT plans were modified in up to 43% of patients. A tumor-to-background ratio of more than 2–3 (corresponding to approximately 40–50% SUVmax) emerged as the optimal segmentation threshold across most epithelial tumors.

Conclusion: FAPI-based semi-automatic contouring significantly reduced interobserver variability compared with manual CT-based delineation. FAPI PET provides biologically grounded, complementary, and, in several settings, superior GTV delineation for RT planning. Prospective multicenter trials with clinical outcome endpoints are needed to validate its integration into standard RT workflows.

Keywords: FAPI PET; Radiotherapy planning; Tumor volume delineation; Cancer-associated fibroblasts; Gross tumor volume

A36 the potential role of ^{99m}Tc-FAPI SPECT/CT in the staging of mucinous appendiceal adenocarcinoma

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Introduction: Mucinous adenocarcinomas frequently demonstrate low uptake on ¹⁸F-FDG PET/CT because of their low cellularity and abundant extracellular mucin, limiting the sensitivity of conventional metabolic imaging. Fibroblast activation protein inhibitor (FAPI)-based imaging has emerged as a promising alternative by targeting cancer-associated fibroblasts within the tumor stroma.

Methods: We report the case of a 55-year-old woman who presented with bilateral adnexal masses and elevated carcinoembryonic antigen (CEA). Diagnostic evaluation included malignancy workup, adnexal biopsy, intraoperative assessment, bone scintigraphy, and ^{99m}Tc-FAPI SPECT/CT. Histopathological examination established the diagnosis of appendiceal mucinous adenocarcinoma.

Results: The appendix was identified as the primary tumor site. Bone scintigraphy initially demonstrated widespread skeletal metastases, which were clearly confirmed on ^{99m}Tc-FAPI SPECT/CT. In addition, FAPI imaging revealed extensive soft-tissue involvement involving the peritoneum, appendiceal region, and pleura, providing comprehensive whole-body staging beyond skeletal disease. These findings highlight the ability of FAPI imaging to characterize the full extent of metastatic spread in a mucinous malignancy, despite the known limitations of ¹⁸F-FDG PET/CT in this tumor subtype.

Conclusion: This case demonstrates the potential value of ^{99m}Tc-FAPI SPECT/CT as a comprehensive staging modality for metastatic appendiceal mucinous adenocarcinoma. By accurately depicting both osseous and soft-tissue disease, FAPI imaging may overcome the limitations of FDG PET/CT in mucinous tumors and support patient selection for FAPI-targeted theranostic approaches in advanced disease.

Keywords: Fibroblast activation protein; Mucinous neoplasm; Peritoneal carcinomatosis; SPECT/CT

A37 Gallium-68 FAPI-2286 positron emission tomography: in-house production and clinical case experience in breast cancer imaging

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Introduction: Fibroblast activation protein (FAPI) is a serine protease highly expressed on cancer-associated fibroblasts within the stroma of most epithelial tumors, including breast cancer, while remaining minimal in normal adult tissue; this specificity makes gallium-68 FAPI an attractive positron emission tomography tracer, particularly where fluorodeoxyglucose (FDG) uptake is limited by low glucose avidity or high physiological background.

Methods: We report in-house production of the DOTA-conjugated ligand gallium-68 FAPI-2286, achieving a radiochemical purity of 95-98%, and a clinical case series of fifty patients, predominantly women with breast cancer, imaged to evaluate primary tumor and metastatic disease detection; a subset of cases was further explored for potential peptide-targeted radionuclide therapy pairing with lutetium-177.

Results: Across the case series, gallium-68 FAPI-2286 imaging consistently provided high tumor-to-background contrast and identified metastatic lesions that were not visualized on fluorodeoxyglucose positron emission tomography in the same patients. Theranostic evaluation with lutetium-177 FAPI-2286 was initiated in selected cases but has not yet reached a conclusive treatment endpoint.

Conclusion: This in-house clinical experience supports gallium-68 FAPI-2286 as a sensitive imaging agent in breast cancer, particularly for detecting metastases missed by FDG, and highlights early theranostic potential that warrants further prospective evaluation and multicenter collaboration.

Keywords: FAPI-2286; Gallium-68; Fibroblast activation protein; Breast cancer; Theranostics

A38 Genotype- and resistance-informed therapy in radioiodine-refractory differentiated thyroid cancer: A systematic scoping review and clinical framework

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Introduction: Radioiodine-refractory differentiated thyroid cancer (RAIR-DTC) is biologically heterogeneous, and therapeutic decisions increasingly require integration of histology, molecular genotype, disease kinetics, treatment exposure, and progression pattern rather than radioiodine status alone. To synthesize evidence on genotype-directed systemic therapy, mechanisms of resistance, molecular reassessment, liquid biopsy, oligoprogression, and salvage sequencing in RAIR-DTC, and to propose an adaptive clinical framework.

Methods: A structured scoping-review framework with narrative synthesis was developed in accordance with Joanna Briggs Institute guidance and PRISMA-ScR/PRISMA-S principles. Evidence domains included randomized and nonrandomized treatment studies, molecular and genomic investigations, biomarker studies, redifferentiation research, resistance studies, and clinically informative case-based evidence. Direct RAIR-DTC evidence was prioritized, while basket-trial, cross-tumor, and preclinical data were explicitly classified as indirect evidence.

Results: Randomized evidence supports VEGFR-targeted multikinase inhibitors for progressive RAIR-DTC: sorafenib improved median progression-free survival to 10.8 versus 5.8 months, lenvatinib to 18.3 versus 3.6 months, and cabozantinib to 11.0 versus 1.9 months after prior VEGFR-targeted therapy. RET and NTRK fusions represent established predictive biomarkers for genotype-matched therapy, whereas common RAS, TERT, PI3K-pathway, and mitochondrial alterations remain context-dependent or investigational. At progression, resistance may be on-target, bypass-mediated, clonal, non-genetic, or related to inadequate exposure. Tissue re-biopsy and circulating tumor DNA are complementary when results may alter management. Selected oligoprogression may be treated locally while an otherwise active systemic therapy is continued.

Conclusion: RAIR-DTC should be managed as a dynamic biological state rather than by a fixed drug sequence. An adaptive strategy integrating histology, actionable genotype, treatment exposure, progression pattern, and resistance biology is supported by current evidence, but prospective studies are needed to determine whether resistance-informed sequencing improves long-term outcomes.

Keywords: Molecular profiling; Multikinase inhibitors; RET fusions; NTRK fusions; Liquid biopsy

A39 Assessment of indoor radon concentration and investigation of the impact of building characteristics on residential buildings in Mashhad, Iran

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Introduction: Indoor radon is recognized as the second leading cause of lung cancer after smoking and represents one of the most important sources of natural radiation exposure. This study investigated indoor radon concentration in 100 residential rooms in Mashhad, Iran, and evaluated the influence of floor level, natural ventilation, floor covering, and wall covering materials.

Methods: Indoor radon concentration was measured using a calibrated RTM-1688-2 continuous radon monitor. Statistical analyses were performed to evaluate the relationship between radon concentration and building characteristics.

Results: The measured indoor radon concentrations ranged from 1 to 678 Bq m⁻³, with a mean value of 115.23 ± 135.92 Bq m⁻³ and a median of 51.50 Bq m⁻³. Approximately 38% of the investigated rooms exhibited radon concentrations exceeding 100 Bq m⁻³, the reference level recommended by the World Health Organization. Ground-floor rooms and poorly ventilated dwellings generally showed higher indoor radon concentrations than upper-floor and adequately ventilated rooms. Floor covering and wall covering materials also influenced radon variability, although their effects were less pronounced.

Conclusion: The results demonstrate that building characteristics significantly affect indoor radon accumulation in residential buildings. Improving natural ventilation and implementing radon-resistant construction practices can effectively reduce indoor radon exposure. These findings provide valuable information for residential radon monitoring and public health planning in Iran.

Keywords: Indoor radon; Residential buildings; Natural ventilation; Radon concentration

A40 Establishment of in-house manufacturing infrastructure for gallium-68 labelled DOTA-Exendin-4 for insulinoma imaging targeting the glucagon-like peptide-1 receptor

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Introduction: Insulinomas, though usually benign, are frequently missed by conventional cross-sectional imaging and even somatostatin-receptor PET, since these tumors often express low somatostatin receptor density. In contrast, benign insulinomas overexpress the glucagon-like peptide-1 receptor (GLP-1R) at very high, uniform density, enabling highly specific targeting even for sub-centimeter lesions. Gallium-68 DOTA-Exendin-4, a GLP-1R-targeted PET tracer, has demonstrated superior sensitivity for insulinoma localization compared with conventional modalities.

Methods: The in-house radiolabelling protocol for ⁶⁸Ga-DOTA-Exendin-4 has been established at Pars Isotope Company using an operational ⁶⁸Ge/⁶⁸Ga generator, an automated synthesis module, and an in-house quality-control laboratory with validated HPLC and radio-TLC methods. The DOTA-Exendin-4 peptide precursor is obtained from an external supplier.

Results: Preliminary in-house production confirms the feasibility of routine ⁶⁸Ga-DOTA-Exendin-4 manufacturing within existing infrastructure at Pars Isotope Company, ahead of formal validation for clinical use planned for 1405-1406 (Iranian calendar, 2026-2027).

Conclusion: Domestic manufacturing of ⁶⁸Ga-DOTA-Exendin-4, already underway with all required infrastructure operational, is expected to provide Iranian nuclear medicine centers with a highly specific tool for pre-operative insulinoma localization and for evaluation of congenital hyperinsulinism, complementing existing somatostatin-receptor and cross-sectional imaging options.

Keywords: Gallium-68; DOTA-Exendin-4; GLP-1 receptor; Insulinoma; PET/CT

A41 [¹⁷⁷Lu]Lu-FAPI-2286 radioligand therapy in heavily pre-treated patients with advanced breast and gastrointestinal cancers: A single-center retrospective experience

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Background: Breast and gastrointestinal (GI) cancers remain leading causes of cancer-related mortality worldwide, particularly in the metastatic setting, where therapeutic options are limited, and drug resistance inevitably develops. This study aims to evaluate the feasibility and safety of [¹⁷⁷Lu]Lu-FAPI-2286 in patients with breast and GI cancers.

Methods: In this retrospective, single-center, observational analysis, we evaluated the safety, tolerability, and preliminary efficacy of [¹⁷⁷Lu]Lu-FAPI-2286 in 14 patients with advanced metastatic breast (n = 10) and GI (n = 4) malignancies who had exhausted standard therapies. Adverse events were graded per CTCAE. Clinical response was assessed by evaluating symptomatic outcomes and biochemical markers, and radiographic assessment was performed using post-therapy imaging.

Results: The cohort (median age 46.5 years) was heavily pre-treated, with extensive bone, liver, and lung metastases. [¹⁷⁷Lu]Lu-FAPI-2286 was generally well tolerated; hematologic toxicity included Grade 3 anemia in two patients and one case of Grade 4 thrombocytopenia. Two patients experienced transient post-administration pain flares. Symptomatic pain relief was reported in four patients (28.6%), particularly among those with predominant bone metastases. Onset occurred approximately one week after therapy and lasted up to one month between cycles. Radiographic outcomes showed stable disease (SD) in 28.6% and progressive disease (PD) in 21.4% of evaluable patients; however, 50% of patients could not be evaluated radiographically due to rapid clinical decline. Median follow-up was 3.25 months (range: 2-17.5 months).

Conclusions: In this study, [¹⁷⁷Lu]Lu-FAPI-2286 demonstrated feasibility and an acceptable safety profile, with meaningful palliative benefits in a subset of patients. No objective responses were observed, and the primary benefit was palliative.

Keywords: Targeted radionuclide therapy; Fibroblast activation protein; [¹⁷⁷Lu]Lu-FAPI-2286; Breast cancer; GI tumor

A42 Production and preclinical evaluation of carrier-added Yttrium-90 Hydroxyapatite for radiosynovectomy

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Introduction: ⁹⁰Y is a beta-emitting radionuclide having advantageous physical properties for targeted radionuclide therapy. The production of carrier-added ⁹⁰Y at the Tehran Research Reactor (TRR) is the objective of this study. The produced ⁹⁰Y was used for the preparation of ⁹⁰Y-HA and evaluation of its performance in a rat knee model for radiosynovectomy.

Methods: An enriched ⁸⁹Y₂O₃ target (99.999% enrichment, 100 mg) was irradiated with neutron flux of 3×10¹³ n/cm².s in the TRR to produce carrier-added ⁹⁰Y via the ⁸⁹Y(n,γ)⁹⁰Y reaction. After irradiation, radionuclide and radiochemical quality-control tests were performed. HA particles were labeled with ⁹⁰Y, and radiochemical purity was evaluated. The ⁹⁰Y-HA was injected into rat knee joints. Biodistribution and retention studies were performed on the injected knees

Results: The specific activity of 259 GBq/g of ⁹⁰Y was achieved at the end of irradiation. The radionuclide purity of reactor-produced ⁹⁰Y was acceptable according to HPGe detector and liquid scintillation counting (LSC) results. The only detected gamma-emitting impurity was ⁸⁸Y, which was present at a negligible level. LSC analysis confirmed ⁹⁰Y as the predominant beta-emitting radionuclide, with ⁸⁹Sr identified as the only beta-emitting impurity at a negligible level. Radiochemical purity of ⁹⁰YCl₃ and ⁹⁰Y-HA were determined via RTLC (>99.0%). The ⁹⁰Y-HA showed favorable retention in the injected knee joint and negligible accumulation in the non-target joint, suggesting a limited systemic redistribution and suitable localization for radiosynovectomy.

Conclusion: The reactor-based production of carrier-added ⁹⁰Y provides an alternative method for preparing ⁹⁰Y-HA without dependence on ⁹⁰Sr/⁹⁰Y generators. Favorable joint retention supports its potential for radiosynovectomy.

Keywords: Yttrium-90; Radiosynovectomy; Radiopharmaceutical

A43 Conceptual design of a gallium-68 labelled B7-H4-targeted radiotracer for molecular imaging of the immune checkpoint protein VTCN1 in solid tumors

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Introduction: B7-H4 (VTCN1), a B7-family immune checkpoint protein, is overexpressed in several solid tumors, including breast, ovarian, endometrial, renal and pancreatic cancers, and contributes to an immunosuppressive tumor microenvironment. Given heterogeneous expression across tumors, non-invasive imaging could support tumor characterization and patient selection for emerging B7-H4-targeted therapies, including antibody-drug conjugates.

Methods: This concept review outlines a proposed gallium-68 labelled B7-H4-targeted radiotracer, structured as a targeting moiety, referred to in preliminary notes as BCH, conjugated through a chelator such as DOTA, NOTA or NODAGA. The precise molecular identity of the B7-H4-binding component has not been confirmed in available literature; this ambiguity is an open question requiring clarification before characterization proceeds. General radiolabelling and PET-imaging principles for gallium-68 conjugates were reviewed for context.

Results: Based on published B7-H4 biology and general gallium-68 tracer design, a small-format binder such as a nanobody or antibody fragment would favor gallium-68, with its 67.7-minute half-life and same-day imaging, over zirconium-89, better suited to slower-clearing full antibodies. Desirable tracer properties identified were high target affinity, rapid blood clearance, minimal non-specific binding, and in-vivo chelate stability. No radiolabelling or imaging data specific to this candidate exist, and B7-H4-targeted PET remains preclinical relative to established tracers such as gallium-68-PSMA, gallium-68-DOTATATE or gallium-68-FAPI.

Conclusion: A gallium-68 labelled B7-H4-targeted tracer is a scientifically attractive but currently conceptual approach to non-invasive B7-H4 phenotyping, with potential future use as a companion diagnostic for B7-H4-directed therapies. Confirming binder identity and generating preliminary radiochemical and binding data are necessary next steps before experimental evaluation.

Keywords: Gallium-68; B7-H4; VTCN1; Immune checkpoint; PET/CT; Molecular imaging

A44 Pushing the boundaries: A step forward using the ¹⁷⁷Lu-PSMA RLT in mCRPC patients with relative contraindication

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Introduction: Metastatic castration-resistant prostate cancer (mCRPC) is a lethal stage of prostate cancer characterized by progression despite standard treatments. PSMA-targeted radioligand therapy with ¹⁷⁷Lu-PSMA has shown meaningful clinical benefit and PSA response in unselected mCRPC cohorts. However, patients with relative contraindications are often excluded from prospective studies.

Methods: We conducted a retrospective cohort study of mCRPC patients with at least one predefined adverse baseline clinical or laboratory criterion (i.e., WBC <3,800/μL, PLT <100×10³/μL, ECOG ≥2, age >80, Hb <9.4 g/dL, eGFR ≤60 mL/min, ALP >1,000 U/L, LDH >250 U/L) treated with ¹⁷⁷Lu-PSMA.

Results: A total of 125 patients with mCRPC who had one or more relative contraindications were included in the analysis. Participants had a median follow-up of 7 months. PSA50 response rates were highest in the high ALP and high LDH groups: 46.9% and 46.8%, respectively. Mean PSA progression-free survival was highest, at 7.21 months, in the high LDH subgroup. Longitudinal laboratory assessments showed stability of WBC counts in the leukopenia subgroup ($\chi^2(2) = 0.737$, $p = .692$) and Hb values in the anemia subgroup ($\chi^2(2) = 2.571$, $p = .276$). In the impaired renal function subgroup, eGFR values increased over treatment cycles ($p < .001$). Reductions in ALP and LDH were observed over serial measurements ($p = .031$ and $p = .040$, respectively).

Conclusions: ¹⁷⁷Lu-PSMA RLT is feasible in mCRPC patients with relative contraindications and can yield meaningful PSA responses and variable survival outcomes. While hematologic and renal toxicities were generally manageable, individual risk-benefit assessments remain essential.

Keywords: Lu-PSMA; Metastatic castration-resistant prostate cancer; PSA response; Anemia, Contraindication

A45 Clinical outcomes and angiographic findings in patients with suspected balanced ischemia despite normal myocardial perfusion imaging

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Introduction: Balanced ischemia may lead to false-negative myocardial perfusion imaging (MPI) results, delaying the diagnosis of significant coronary artery disease (CAD). This study evaluated the epidemiological characteristics, angiographic findings, and clinical outcomes of patients with suspected balanced ischemia despite normal MPI

Methods: In this prospective cohort study, 164 patients with symptoms suggestive of CAD and normal MPI findings who were clinically suspected of having balanced ischemia were enrolled at Kowsar Hospital, Sanandaj. Demographic data, cardiovascular risk factors, angiographic findings, revascularization procedures, and clinical outcomes were collected using a standardized checklist. Statistical analyses were performed using Stata version 16, with $P < 0.05$ considered statistically significant

Results: Of the 164 patients, 51.2% were female. Hypertension (64.0%) was the most common cardiovascular risk factor, followed by diabetes (30.5%), hyperlipidemia (29.3%), and smoking (26.2%). During follow-up, 9 patients (5.5%) died. Coronary angiography was performed in 48 patients (29.3%), revealing significant stenosis in the left anterior descending (LAD) artery (27.1%), right coronary artery (16.7%), and left circumflex artery (16.7%). Three-vessel disease was identified in 31.3% of patients undergoing angiography. Percutaneous coronary intervention and stent implantation most frequently involved the LAD

Conclusion: Despite normal MPI findings, a substantial proportion of patients with suspected balanced ischemia had significant multivessel CAD, particularly involving the LAD. These findings underscore the limitations of MPI in detecting balanced ischemia and support further diagnostic evaluation in patients with persistent clinical suspicion

Keywords: Balanced ischemia; Myocardial perfusion imaging; Coronary artery disease; Coronary angiography; Percutaneous coronary intervention

A46 Spatial mapping of scatter radiation in coronary angiography: A clinical and phantom-based dosimetry studyReza Afzalipour¹, Mohammad Zamani Rarani², Seyed Reza Mirlohi^{3*}¹Department of Radiology, Faculty of Para-Medicine, Hormozgan University of Medical Sciences, Bandar Abbas, Iran²Department of Anatomical Sciences, Medical School, Hormozgan University of Medical Sciences, Bandar Abbas, Iran³Student Research Committee, Faculty of Para-medicine, Hormozgan University of Medical Sciences, Bandar Abbas, Iran

Introduction: Scattered X-rays remain a source of occupational exposure during coronary angiography because cardiologists and staff work close to the patient. This study aimed to map scatter radiation and assess how C-arm projection, operator position, and measurement height influence exposure.

Materials and Methods: The study was conducted in 2024 at the Angiography Center of Shahid Mohammadi Hospital, Bandar Abbas, Iran, after ethics approval (IR.HUMS.REC.1403.167). Scatter radiation was measured with a solid-state PIN-diode dosimeter in clinical and phantom phases. Clinical measurements were obtained from 25 patients at heights of 100, 150, and 165 cm above the floor, corresponding to waist, thyroid, and eye levels. In the phantom phase, measurements were repeated at -20, 0, and +20 cm from the reference operator position and at the same heights. Dose-area product and irradiation time were recorded, and scatter-dose-rate-to-DAP-rate coefficients were calculated.

Results: Scatter dose rate differed significantly with height, operator position, and C-arm projection ($p < 0.05$). In PA fluoroscopy at the reference phantom position, mean dose rates at 100, 150, and 165 cm were 291.6, 118.4, and 74.9 $\mu\text{Gy/h}$, respectively. Cine imaging produced a dose rate approximately 3.87 times that of fluoroscopy ($p = 0.001$). Repositioning reduced the maximum measured dose by 41.6%. The highest and lowest scatter exposures were observed in LPO45° and PA projections, respectively.

Conclusion: Scatter radiation around the angiography table was non-uniform. Operator position and C-arm geometry had a marked effect on exposure, indicating that changes in staff positioning and projection choice may reduce occupational dose without compromising clinical performance.

Keywords: Coronary angiography; Scatter radiation; Occupational exposure; Radiation protection; Dosimetry

A47 Automated radiosynthesis and clinical implementation of fluorine-18 fluoroethyl-L-tyrosine for glioma imaging in Iran

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Introduction: Fluorine-18 fluoroethyl-L-tyrosine is an amino acid positron emission tomography tracer used for glioma imaging. This study aimed to establish a fully in-house, Good Manufacturing Practice-compatible production process in Iran, from precursor synthesis to clinical formulation, emphasizing speed, quality, stability, reproducibility, and clinical applicability.

Methods: O-(2-tosyloxyethyl)-N-trityl-L-tyrosine tert-butyl ester was synthesized in-house and used for automated radiosynthesis on an optimized cassette-based IBA Synthera platform. Vacuum, nitrogen flow, and reactor sealing pressure were controlled. The process comprised nucleophilic fluorination, hydrolysis, cartridge-based purification, and citrate-buffer formulation. Quality control included radiochemical identity and purity by high-performance liquid chromatography and radio-thin-layer chromatography, residual solvents by gas chromatography, pH, radionuclidic identity, half-life, endotoxin, sterility, and retention-time matching with an in-house non-radioactive reference standard.

Results: Total synthesis time was 35 ± 1 min, and non-decay-corrected radiochemical yield at end of synthesis was $35 \pm 1.5\%$. Radiochemical purity was $99.44 \pm 0.21\%$ by radio-thin-layer chromatography and $99.28 \pm 0.15\%$ by high-performance liquid chromatography. Residual ethanol and acetonitrile were below United States Pharmacopeia limits, endotoxin was below 175 EU/V, and sterility tests passed. The product remained within specification for at least 12 h. Three consecutive batches showed minimal variation, with relative standard deviation below 0.05%. Clinical imaging with standardized uptake value assessment supported neuro-oncology use.

Conclusion: A rapid, reproducible, and clinically implemented in-house production process was established, enabling reliable national access to fluorine-18 fluoroethyl-L-tyrosine for routine glioma imaging.

Keywords: Fluorine-18 fluoroethyl-L-tyrosine; Glioma imaging; Automated radiosynthesis; Clinical implementation; Positron emission tomography

A48 Improving half-dose single photon emission computed tomography image quality using three-dimensional anisotropic diffusion filter in the projection domainMiad Homrian^{1*}, Peyman Sheikhzadeh^{2,3}¹Department of Medical Physics and Biomedical Engineering, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran²Department of Nuclear Medicine, School of Medicine, Imam Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran³Research Center for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran

Introduction: Reducing the injected dose in single photon emission computed tomography is clinically important, but half-dose projection data have high noise and reduced quality. Standard two-dimensional filters often blur edges, and cross non-local means alone cannot correct intensity and structural differences between half-dose and full-dose projections. This study presents a practical full-dose guided framework for improving half-dose projections.

Methods: Paired full-dose and half-dose projection data were used. The half-dose data were first gain-corrected using a global factor estimated from positive pixels, followed by slice-wise histogram matching to full-dose projections. Three-dimensional anisotropic diffusion was then applied across projection views to suppress noise while preserving edges. Finally, full-dose guided filtering restored fine structural details. Parameters including gradient threshold, number of iterations, degree of smoothing, neighborhood size, and conduction method were optimized through hierarchical grid searches. Error was defined as the percentage of voxels with absolute difference greater than two percent of the full-dose maximum.

Results: Compared with full-dose, the original half-dose projections showed 19.45 percent error. Full-dose guided cross non-local means achieved 18.48 percent. The proposed pipeline reduced the error to 8.82 percent with initial parameters, then to 5.11 and 2.11 percent after coarse and fine optimization. Ultra-fine optimization with conduction method selection further reduced the error to 1.39 percent.

Conclusion: The proposed combination of full-dose structural guidance, three-dimensional anisotropic diffusion, and hierarchical parameter optimization effectively improved half-dose projection quality, reducing voxels with more than two percent difference from 19.45 to 1.39 percent. This practical framework may support dose reduction in single photon emission computed tomography while maintaining image quality.

Keywords: Half-dose; Full-dose; Projection domain; Anisotropic diffusion; Guided filtering

A49 Deep learning for detecting renal anomalies in ^{99m}Tc-EC renography scansSajjad Sadeghpour^{1*}, Salman Soltani², Atena Aghaee¹, Taha Shooshtari¹, Ramin Sadeghi¹, Emran Askari¹, Somaye Barashki¹¹Nuclear Medicine Research Center, Mashhad University of Medical Sciences, Mashhad, Iran²Kidney Transplantation Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

Introduction: Dynamic renography with Technetium-99m Ethylenedicysteine (^{99m}Tc-EC) is a standard imaging technique for assessing renal function; however, its interpretation is complex due to subtle abnormalities and image variability. This study aimed to develop and evaluate convolutional neural network (CNN) models for detecting renal anomalies in ^{99m}Tc-EC renography scans, enhancing diagnostic accuracy and facilitating timely interventions.

Methods: A retrospective analytical study used data from 317 patients collected from 2013 to 2024. Of the 317 samples, 201 and 36 were used for training and validation, respectively, and the remaining 80 were used for testing (44 positive cases and 36 negative cases). Imaging data were standardized to train several deep learning models, including DenseNet, EfficientNet, ResNet, InceptionV3, and InceptionResNetV2. The primary model, InceptionResNetV2, was modified for binary classification. Performance was assessed based on accuracy, sensitivity, precision, F1-score, and Area Under the Curve (AUC).

Results: The results of this study are presented at the patient level. Different models exhibited varied performance, with accuracies ranging from 38.75% to 62.5%, AUCs from 0.329 to 0.689, and F1-scores from 0.068 to 0.977, highlighting challenges in achieving balanced detection. Regarding the AUC and F1-score, the InceptionResNetV2 and DenseNet169 models achieved the best performance with the values of 0.689 and 0.977, respectively.

Conclusion: The InceptionResNetV2 model shows promise as a diagnostic tool for detecting renal anomalies in ^{99m}Tc-EC renography scans. However, limitations in dataset size and image quality indicate that further enhancements, advanced preprocessing techniques, and alternative algorithms are needed to improve clinical applicability.

Keywords: Deep learning; Renal scan; ^{99m}Tc-EC; Renal anomaly detection, InceptionResNetV2

A50 Diagnostic superiority of ⁶⁸Ga-FAPI PET/CT over somatostatin receptor imaging in low-secretory medullary thyroid carcinoma with widespread skeletal metastasesFatemeh Taheri^{1,2*}, Amin Saber Tanha^{1,2}, Robabeh Beygom Aboutorabi³, Mahdi Rostami^{1,2}, Emran Askari¹¹Nuclear Medicine Research Center, Mashhad University of Medical Sciences, Mashhad, Iran²Student Research Committee, Mashhad University of Medical Sciences, Mashhad, Iran³Department of Endocrinology, Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad, Iran

Introduction: Medullary thyroid carcinoma (MTC) can present with diagnostic challenges, particularly when biochemical markers are discordant with conventional imaging findings. This case highlights the limitations of somatostatin receptor (SSTR)-targeted imaging and the superior diagnostic performance of fibroblast activation protein inhibitor (FAPI) PET/CT.

Methods: A 78-year-old woman with a history of MTC (total thyroidectomy and lymph node dissection, followed by radiotherapy) presented with persistently elevated serum calcitonin (195 pg/mL) and CEA (15.46 ng/mL). Due to biochemical progression and a negative follow-up 99mTc-octreotide scan, a ⁶⁸Ga-FAPI PET/CT was performed for further evaluation.

Results: 99mTc-octreotide whole-body and SPECT/CT imaging demonstrated no abnormal tracer uptake, despite identifying sclerotic lesions in the thoracic spine. In contrast, ⁶⁸Ga-FAPI PET/CT revealed multiple intense FAPI-avid foci throughout the skeleton, including the previously noted non-octreotide-avid sclerotic lesions. Notably, serum calcitonin levels were disproportionately low relative to the extensive disease burden on FAPI PET/CT, consistent with a low-secretory MTC phenotype.

Conclusion: This case underscores the diagnostic superiority of ⁶⁸Ga-FAPI PET/CT over SSTR-targeted imaging in detecting skeletal metastases in MTC, particularly in low-secretory or dedifferentiated variants. The findings suggest that FAPI imaging could significantly improve disease staging and potentially guide FAP-targeted radioligand therapy in patients with SSTR-negative, advanced MTC.

Keywords: Theranostics; Fibroblast activation protein; Medullary thyroid carcinoma; ⁶⁸Ga-FAPI PET/CT; Low-secretory MTC

A51 Comparative Monte Carlo assessment of GAGG:Ce and NaI(Tl) scintillators for quantitative SPECT imaging in ²²⁵Ac targeted alpha therapyMaryam Saed^{1*}, Hojjat Mahani²¹Department of Biomedical Engineering, Faculty of Engineering, University of Science and Culture, Tehran, Iran²Radiation Applications Research School, Nuclear Science and Technology Research Institute, Tehran, Iran

Introduction: Targeted alpha therapy has emerged as a promising therapeutic approach for advanced malignancies, and quantitative SPECT imaging of ²²⁵Ac-labeled radiopharmaceuticals is critical for therapy monitoring and personalized dosimetry. However, ²²⁵Ac imaging remains challenging due to its complex decay cascade and high-energy photon emissions limiting conventional SPECT performance. This study evaluated GAGG:Ce and NaI(Tl) scintillators for ²²⁵Ac SPECT using Monte Carlo (MC) simulations.

Methods: GATE MC simulations were conducted using a spherical source containing 5 MBq of ²²⁵Ac and including the complete decay cascade with associated X-ray and gamma emissions. A tungsten dual-sided tapered pinhole SPECT system equipped with a 10-mm-thick NaI(Tl) detector was modeled and compared with an identical GAGG:Ce configuration. Energy windows of 10%, 15%, and 20% were evaluated for the 218 keV (²²¹Fr) and 440 keV (²¹³Bi) photopeaks. A new figure of merit (FOM), formulated as the ratio of primary counts to square root of combined primary and scatter counts, was introduced for detector assessment.

Results: The 440 keV photopeak demonstrated higher sensitivity than the 218 keV emission for both detectors. GAGG:Ce consistently outperformed NaI(Tl), achieving approximately twofold higher sensitivity at the 20% window centered on 440 keV. Increasing energy window width improved sensitivity but increased scatter fraction. The highest FOM values were obtained using the 20% window around 440 keV.

Conclusion: GAGG:Ce demonstrated superior simulated performance compared with NaI(Tl) for ²²⁵Ac SPECT. The optimized configuration provided the most favorable sensitivity–scatter balance, supporting further development of advanced detector technologies for quantitative ²²⁵Ac imaging.

Keywords: Monte Carlo; Targeted alpha therapy; ²²⁵Ac; NaI(Tl); GAGG:Ce

A52 Can Rose's metal improve ²²⁵Ac imaging? A GATE study of an alternative collimator material?Hojjat Mahani^{1*}, Maryam Saed²

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Introduction: Standard lead and tungsten collimators present limitations for ²²⁵Ac SPECT imaging due to the radionuclide's complex decay scheme, high-energy photon emissions, and characteristic X-rays induced within collimator materials, particularly in the 70–90 keV range. This study investigated Rose's metal, a low-melting fusible alloy, as an alternative collimation material for ²²⁵Ac SPECT using accurate GATE Monte Carlo (MC) simulations.

Methods: The impact of collimator composition on ²²⁵Ac imaging performance was investigated using a detailed GATE MC model of a dual-sided tapered pinhole SPECT camera. A spherical 5 MBq ²²⁵Ac source was simulated with tungsten and Rose's metal collimators, with the latter modeled as an alloy containing approximately 50% Bi, 25–28% Pb, and 22–25% Sn. Performance was evaluated at the 218 keV (²²¹Fr) and 440 keV (²¹³Bi) emissions using 20% energy windows. Sensitivity, spatial resolution, and detected photon components, including primary, scattered, and penetrated events, were quantified.

Results: At 440 keV, Rose's metal achieved a sensitivity of 1.80E-3 cps/Bq compared with 9.83E-4 cps/Bq for tungsten, corresponding to an approximately 83% increase. Rose's metal increased the primary photon fraction (41.5% vs. 37.7%) and reduced relative scatter/penetration contribution (11.1% vs. 19.2%). Despite slightly higher absolute scattered and penetrated events, their relative contribution decreased due to increased total detected counts. Spatial resolution remained comparable between materials.

Conclusion: Rose's metal demonstrated enhanced sensitivity, favorable photon transport characteristics, and reduced characteristic X-ray contamination compared with conventional Pb/W collimators, supporting its potential as a lightweight alternative for quantitative ²²⁵Ac SPECT imaging.

Keywords: Monte Carlo; Collimator; ²²⁵Ac; Rose's metal; Tungsten

A53 Specific volumetric and geometric calibration of dose calibrators for Lu-177: Ensuring reliable administered activity in Iran's nuclear medicine therapy centers

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Introduction: Accurate determination of administered activity is crucial for effective and safe nuclear medicine procedures. Dose calibrators must provide accurate and traceable measurements, with calibration traceability maintained through the Secondary Standard Dosimetry Laboratory (SSDL) in Iran. However, differences between standard calibration geometries and clinical containers and volumes can introduce measurement uncertainties, particularly in Lutetium-177 radionuclide therapy. This study aims to determine volume- and geometry-specific correction factors and establish calibration protocols for clinically used geometries in Iranian nuclear medicine centers.

Methods: Measurements were performed using the Fidelis Secondary Standard Radionuclide Calibrator as the reference system, ensuring traceability to the UK national standards maintained by NPL. Both dose calibrators (PTW Curiemeter 3 and Capintec CRC-25R) were initially calibrated using 10R glass vials as the reference geometry. Subsequently, subsidiary calibrations were performed according to Measurement Good Practice Guide No. 93 using 3mL AVA Luer-lock and 5mL Mina Luer-slip syringes to evaluate clinically relevant geometries. Geometry- and volume-dependent correction factors were then determined.

Results: The results demonstrated that the response of the Capintec CRC-25R dose calibrator exhibited a marked dependence on the measurement geometry of Lu-177. Compared with the reference calibration geometry (10R vial), the relative differences were +4.7% and +6.2% for the 3mL and 5mL syringes, respectively. Furthermore, the response of the PTW Curiemeter 3 dose calibrator showed a pronounced dependence on syringe volume. Relative to the reference calibration geometry, the corresponding relative differences were –4.7% and –3.4% for the 3mL and 5mL syringes, respectively.

Conclusion: Clinical measurement geometries can introduce significant deviations in Lu-177 activity measurements. The application of geometry- and volume-specific correction factors improves measurement accuracy, strengthens traceability, and enhances quality assurance and patient safety in radionuclide therapy.

Keywords: Dose calibrator; Radionuclide therapy; Traceability; Nuclear medicine; Secondary standard dosimetry laboratory

A54 Local production feasibility of gallium-68 labeled Trivehexin: Pilot radiolabeling and quality control validationHamed Navid¹, Lila Araghloei^{1*}, Majid Assadi², Esmail Jafari²¹Pars Isotope Company, Tehran, Iran²Bushehr Medical University Hospital, Bushehr, Iran

Introduction: Integrin alpha-v-beta-6 is a transmembrane cell-adhesion receptor that is minimally expressed in normal adult epithelium but is strongly upregulated during epithelial tumor invasion and active tissue fibrosis, making it an attractive positron emission tomography imaging target with reported diagnostic value in pancreatic, head and neck and lung malignancies, as well as idiopathic pulmonary fibrosis.

Methods: Using an externally sourced Trivehexin precursor peptide, we established and tested an in-house radiolabeling protocol with gallium-68 eluted from an on-site germanium-68/gallium-68 generator and an automated synthesis module, together with a validated quality-control workflow based on high-performance liquid chromatography and radio thin-layer chromatography.

Results: Pilot, non-clinical batches of gallium-68 Trivehexin were successfully produced, achieving a radiochemical purity above eighty percent, confirming the feasibility of the established production and quality-control process.

Conclusion: These results show that the essential infrastructure, precursor supply and validated quality-control methods for local Trivehexin production are already in place. This presentation aims to inform nuclear medicine centers and prospective partners that this work has begun, supporting future collaboration toward clinical translation.

Keywords: Trivehexin; gallium-68; Integrin alpha-v-beta-6; Radiolabeling; Quality control

A55 From center to edge: Prognostic implications of spatial metabolic heterogeneity, normalized hotspot-to-centroid and perimeter distance on PET Imaging. A systematic review and meta-analysisSajjad Sadeghpour^{1*}, Ramin Sadeghi¹, Atena Aghaee¹, Habibollah Dadgar²¹Nuclear Medicine Research Center, Mashhad University of Medical Sciences, Mashhad, Iran²Cancer Research Center, Nuclear Medicine and Molecular Imaging Department, Razavi Hospital, Mashhad, Iran

Introduction: Tumor heterogeneity remains a major challenge in oncology, influencing prognosis and treatment response. Novel PET-derived spatial radiomic features, including the normalized hotspot-to-centroid (NHOC) and normalized hotspot-to-perimeter (NHOP) distances, aim to quantify intratumoral metabolic heterogeneity and spatial distribution of metabolic activity. These biomarkers may provide biologically interpretable indicators of tumor aggressiveness and patient outcomes. The aim of this study was to systematically evaluate the prognostic and predictive performance of NHOC and NHOP derived from PET imaging across different tumor types.

Methods: A systematic review and meta-analysis were conducted according to PRISMA guidelines. PubMed/MEDLINE and Google Scholar were searched up to March 2026. Studies evaluating NHOC or NHOP extracted from PET imaging in cancer patients were included. Hazard ratios (HRs) for overall survival (OS) and progression-free survival (PFS) were pooled using random-effects models.

Results: Ten studies involving 1,496 patients were included. Elevated NHOC was statistically significantly associated with worse OS (HR of 2.313, 95% CI [1.418, 3.775], $p = 0.001$). Subgroup analysis showed a strong association in lung cancers (2.864, 95% CI [2.018, 4.063], $p < 0.001$), while results in breast cancer and glioma were inconclusive due to limited data. Decrease in NHOP demonstrated a non-significant trend toward poorer PFS (HR = 2.92, 95% CI: 0.71–11.92). Predictive models based on NHOC showed moderate performance (AUC up to 0.77).

Conclusions: PET-derived spatial biomarkers, particularly NHOC, show promise as prognostic indicators of tumor aggressiveness and survival outcomes. Larger multicenter studies with standardized imaging protocols are needed to validate their clinical utility.

Keywords: Normalized hotspot-to-centroid distance; Normalized hotspot-to-perimeter distance; Radiomics; [¹⁸F]FDG PET scan

A56 Artificial intelligence in nuclear theranostics: Advancing molecular imaging toward personalized radionuclide therapyMR Ghasri^{1,2}, S Mirzakhani¹, Y Salehi¹, S Farzanehfard¹, M Abbasi¹, V Johari Majd^{2*}¹Department of Nuclear Medicine, Imam Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran²The School of Electrical and Computer Engineering, Tarbiat Modares University, Tehran, Iran

Introduction: Nuclear theranostics has emerged as a major component of precision oncology by integrating molecular imaging with targeted radionuclide therapy. Despite clinical advances in radiopharmaceutical platforms such as ¹⁷⁷Lu-PSMA and ¹⁷⁷Lu-DOTATATE, challenges including tumor heterogeneity, treatment response variability, and individualized dosimetry remain important limitations. Artificial intelligence (AI) provides new opportunities to extract quantitative biomarkers and improve personalization throughout the theranostic workflow. This review aims to summarize current and emerging applications of AI in nuclear theranostics, focusing on molecular imaging analysis, patient selection, personalized dosimetry, treatment response prediction, and future adaptive radionuclide therapy strategies.

Methods: A narrative review was performed by integrating recent evidence regarding AI applications in PET/SPECT imaging, radiomics, deep learning, radiopharmaceutical therapy, and precision oncology. Relevant studies evaluating AI-based reconstruction, segmentation, quantitative imaging biomarkers, predictive modeling, and dosimetric optimization were critically reviewed.

Results: AI approaches have demonstrated potential in improving molecular imaging quantification, automated lesion characterization, and extraction of imaging biomarkers associated with tumor phenotype and therapeutic response. In PSMA-targeted and somatostatin receptor-targeted therapies, machine learning and radiomics models have shown promising results for patient stratification and outcome prediction. AI-assisted dosimetry may facilitate individualized treatment planning by improving organ and tumor dose estimation. However, current evidence remains predominantly retrospective, and clinical translation is limited by challenges including data heterogeneity, external validation, interpretability, and workflow integration.

Conclusion: AI represents a promising enabling technology for transforming nuclear theranostics from conventional target-based treatment selection toward personalized and adaptive radionuclide therapy. Future clinical implementation will require standardized datasets, prospective validation, and multidisciplinary collaboration to ensure reliable and clinically meaningful integration of AI into precision nuclear oncology.

Keywords: Radiomics; Deep learning; Molecular imaging; Radiopharmaceutical therapy; Personalized dosimetry

A57 From automated radiosynthesis to clinical myocardial perfusion imaging with fluorine-18 flurpiridaz in Iran

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Introduction: Dependence on imported precursors and synthesis materials remains a barrier to sustainable cardiac positron emission tomography services. To address this limitation, an automated production platform for fluorine-18 flurpiridaz was developed in Iran using a domestically synthesized precursor and locally prepared reagents, followed by preclinical evaluation and clinical implementation for myocardial perfusion imaging.

Methods: No-carrier-added fluorine-18 fluoride was produced via the oxygen-18(p,n)fluorine-18 reaction and processed on a cassette-based IBA Synthera module. Fluoride was trapped on a QMA cartridge, eluted with a Kryptofix 2.2.2-based system, and dried at 115°C. The domestic tosylate precursor, 5 mg in 2 mL anhydrous acetonitrile, was radiolabeled at 100–120°C for 600 s. After purification and formulation, radiochemical identity and purity were evaluated by high-performance liquid chromatography. Process performance was evaluated across more than 25 successful productions, followed by preclinical and clinical myocardial imaging.

Results: The optimized process achieved a radiochemical conversion of $22 \pm 3\%$, with final radiochemical purity consistently exceeding 90%. Stable performance was maintained across more than 30 productions. Preclinical studies demonstrated clear myocardial localization. Clinical administration yielded high-quality myocardial perfusion images with favorable cardiac visualization under routine clinical conditions.

Conclusion: Automated production and clinical implementation of fluorine-18 flurpiridaz were successfully established using a domestic precursor and locally prepared reagents. Consistent production performance and successful patient imaging support sustainable domestic supply for clinical myocardial perfusion positron emission tomography.

Keywords: Fluorine-18 flurpiridaz; Myocardial perfusion imaging; Automated radiosynthesis; Cardiac positron emission tomography

A58 Recent advances in nanoparticle-enabled radioimmunotherapy for cancer treatment: Current progress and future perspective

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Introduction: Radioimmunotherapy has emerged as a promising therapeutic strategy for metastatic and disseminated cancers by combining targeted radionuclide therapy with immune-mediated antitumor effects. However, its clinical efficacy remains limited by rapid systemic clearance, non-specific uptake, heterogeneous intratumoral distribution, and dose-limiting toxicity.

Methods: This narrative review summarizes recent advances in nanoparticle-enabled radioimmunotherapy based on findings from recent preclinical and early clinical studies. Particular emphasis is placed on liposomes, metallic nanoparticles, metal-organic frameworks (MOFs), and other multifunctional nanocarriers that improve radionuclide delivery, radiosensitization, immune activation, and theranostic performance.

Results: Nanoparticle-based platforms enhance tumor accumulation, prolong circulation time, increase radionuclide loading, and improve tumor-selective radiation delivery. High-atomic-number nanomaterials amplify local radiation dose, while tumor microenvironment-responsive nanocarriers enable controlled payload release within hypoxic or acidic tumor regions. Furthermore, nanoformulated alpha- and beta-emitting radionuclides combined with immunotherapeutic agents have demonstrated enhanced tumor control, increased immunogenic cell death, and stronger systemic antitumor immune responses in preclinical studies. Theranostic nanoplateforms additionally facilitate real-time imaging, personalized dosimetry, and treatment monitoring.

Conclusion: Nanoparticle-enabled radioimmunotherapy represents a promising strategy for overcoming major limitations of conventional radiopharmaceutical therapy. Continued optimization of nanocarrier design, biodistribution, stability, and clinical translation is expected to accelerate the development of more precise, effective, and personalized radiopharmaceutical therapies for advanced cancers.

Keywords: Nanoparticles; Radioimmunotherapy; Radiopharmaceutical Therapy; Theranostics; Cancer

A59 Organ dosimetry following I-124 PET/CT in adult patients with differentiated thyroid carcinoma

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Introduction: I-124 PET/CT has become an important imaging modality for pre-therapeutic dosimetry and individualized management of differentiated thyroid carcinoma (DTC). Because organ radiation dose is influenced by iodine biokinetics and thyroid uptake, accurate internal dosimetry is essential for optimizing diagnostic protocols while minimizing radiation exposure to normal tissues. This study evaluated organ absorbed doses following I-124 PET/CT in adult patients using Monte Carlo simulation.

Methods: Monte Carlo simulations were performed using the GATE platform with anatomically realistic adult reference computational phantoms. I-124 biodistribution was modeled according to ICRP biokinetic data for oral and intravenous administration under thyroid-blocked, low-, medium-, and high-uptake conditions. Organ absorbed doses were calculated for the thyroid and major radiosensitive organs.

Results: Thyroid absorbed dose increased markedly with increasing thyroid uptake, showing an approximately 43-fold increase between the thyroid-blocked and high-uptake conditions. Intravenous administration produced thyroid absorbed doses approximately 15% higher than oral administration. In contrast, total body absorbed dose varied by less than 4% across different thyroid uptake conditions and showed negligible dependence on the administration route.

Conclusion: Monte Carlo-based internal dosimetry demonstrated that thyroid uptake predominantly affects thyroid absorbed dose, whereas radiation exposure to most normal organs remains relatively unchanged. These findings support the use of patient-specific dosimetry to optimize I-124 PET/CT protocols and improve individualized imaging strategies for adult patients with differentiated thyroid carcinoma.

Keywords: I-124; PET/CT; Internal dosimetry; Monte Carlo simulation; Differentiated thyroid carcinoma

A60 Spatial resolution and image quality assessment in the Xtrim preclinical PET system: A comparative study of ¹⁸F and ⁶⁸Ga

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Introduction: One of limitation of preclinical PET is the spatial resolution, which is particularly important for the detection of small structures. This parameter is affected by physical factors such as positron range and reconstruction algorithms. In this study, spatial resolution and image quality were evaluated using ¹⁸F and ⁶⁸Ga in the Xtrim PET system.

Methods: The spatial resolution was evaluated by measuring the point-source at various distances from the center of the field of view (FOV), based on FWHM and FWTM values in axial directions. The NEMA NU4-2008 phantom was scanned to quantify Spill Over Ratio (SOR) in air- and water-filled cold chambers. The images were reconstructed by OSEM algorithm (4 iterations, 5 subsets; 200×310 system matrix) under the following conditions: no resolution recovery, resolution recovery based on PSF (2 mm FWHM), and Gaussian filtering at $\sigma = 0.5$ and $\sigma = 1$.

Results: Resolution recovery decreased FWHM and FWTM for both radionuclides, but it degraded from the center toward the edge of the FOV. This increase was approximately 12% for ⁶⁸Ga and 35% for ¹⁸F in the radial direction. ¹⁸F showed better spatial resolution than ⁶⁸Ga, due to its shorter positron range. Gaussian filtering decreased noise but increased blurring, especially at $\sigma = 1$. The SOR was higher for ⁶⁸Ga than for ¹⁸F and illustrated a larger increase in the water chamber. Applying resolution recovery reduced SOR, while Gaussian filtering slightly increased them.

Conclusion: The Xtrim PET image quality and spatial resolution depend on radionuclide properties and reconstruction methods.

Keywords: Spatial Resolution; Resolution recovery; Spill-Over ratio

A61 Optimization of the acquisition protocol for quantitative Y-90 bremsstrahlung SPECT imaging

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Introduction: Y-90 bremsstrahlung SPECT imaging plays an important role in post-radioembolization verification of microsphere distribution and quantitative dosimetry. However, the continuous bremsstrahlung energy spectrum without a distinct photopeak makes optimization of the imaging protocol challenging. This study aimed to determine the optimal energy window and collimator combination for quantitative Y-90 bremsstrahlung SPECT imaging using Monte Carlo simulation.

Methods: A validated model of the Siemens Symbia T dual-head SPECT/CT system was implemented in the GATE Monte Carlo simulation toolkit. Bremsstrahlung SPECT acquisitions were simulated using Medium-Energy Medium-Resolution (MEMR) and High-Energy Medium-Resolution (HEMR) collimators over multiple energy windows. Projection data were generated using a 128 × 128 matrix, 4.8 mm pixel size, and 128 projections over 360°. Projection data were reconstructed using the open-source Software for Tomographic Image Reconstruction (STIR) package based on the ordered-subsets expectation maximization (OSEM) algorithm. Image quality was quantitatively evaluated using spatial resolution, sensitivity, contrast, signal-to-background ratio (SBR), contrast-to-noise ratio (CNR), and percentage of useful field-of-view (%FOV).

Results: Quantitative evaluation of all investigated imaging metrics identified the combination of the 90–130 keV energy window and the HEMR collimator as providing the optimal balance between sensitivity and scatter rejection, resulting in the highest overall image quality for quantitative Y-90 bremsstrahlung SPECT imaging.

Conclusion: The combination of the HEMR collimator and the 90–130 keV energy window provides an optimized acquisition protocol for quantitative Y-90 bremsstrahlung SPECT imaging and may improve activity quantification and post-radioembolization dosimetry in clinical practice.

Keywords: Y-90; SPECT; Monte carlo

A62 Actinium-225 DOTATATE in neuroendocrine tumors: Evidence, precision patient selection, and future integration

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Introduction: Although ¹⁷⁷Lu-DOTATATE has transformed the management of advanced somatostatin receptor (SSTR)-positive neuroendocrine tumors (NETs), durable disease control remains limited in a proportion of patients because of inter- and intratumoral heterogeneity, receptor dynamics, metabolic dedifferentiation, and the radiobiological limitations of β -particle therapy. Targeted alpha therapy with ²²⁵Ac-DOTATATE provides high-linear-

energy-transfer radiation over a very short tissue range, producing complex and largely irreparable DNA damage. To critically synthesize current evidence regarding the clinical role of ²²⁵Ac-DOTATATE in NETs, focusing on therapeutic activity, precision patient selection, safety, dosimetry, resistance to β -PRRT, and future clinical integration.

Methods: This clinical-translational narrative review integrated available evidence on the radiobiological rationale, radiochemistry, preclinical development, clinical experience, mechanisms of β -PRRT failure, toxicity, dosimetric challenges, patient-selection strategies, combination approaches, and emerging alpha-emitting radiopharmaceuticals.

Results: Published studies demonstrate reproducible antitumor activity and generally acceptable short-term safety in carefully selected patients, particularly after progression on ¹⁷⁷Lu-DOTATATE. Disease stabilization and partial responses have been reported, whereas complete radiological responses remain uncommon and outcomes are heterogeneous. Current evidence is derived predominantly from small retrospective, single-center, and early-phase cohorts, limiting definitive conclusions regarding comparative efficacy and survival benefit. Patients with high and relatively homogeneous SSTR expression, limited FDG-avid aggressive disease, preserved renal and bone-marrow function, favorable performance status, and prior benefit from β -emitter PRRT appear to represent the most suitable candidates. Important unresolved issues include optimal administered activity, retreatment intervals, individualized dosimetry, long-term renal and hematologic toxicity, radionuclide supply, and the role of sequencing or tandem strategies.

Conclusion: ²²⁵Ac-DOTATATE should currently be viewed as a promising precision-selected and complementary strategy rather than a replacement for established β -emitter PRRT. Prospective multicenter studies, standardized dosimetry and treatment protocols, reliable radionuclide production, and biologically informed selection frameworks are required before broader routine implementation.

Keywords: Targeted alpha therapy; Peptide receptor radionuclide therapy; Theranostics; Somatostatin receptor; Radionuclide dosimetry

A63 Deep learning-based automated segmentation and histopathological subtype classification of pancreatic tumors in ¹⁸F-FDG and ⁶⁸Ga-DOTATATE PET/CT images: A multicenter study

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Introduction: Positron emission tomography/computed tomography (PET/CT) provides complementary anatomical and metabolic information for noninvasive pancreatic tumor evaluation; however, manual delineation is time-consuming, observer-dependent, and poorly reproducible. This study aimed to develop a deep learning-based framework for automated segmentation and classification of pancreatic tumors in ¹⁸F-FDG and ⁶⁸Ga-DOTATATE PET/CT images.

Methods: This retrospective multicenter study included 138 patients with histopathologically confirmed pancreatic tumors who underwent pretreatment staging PET/CT with either ¹⁸F-FDG or ⁶⁸Ga-DOTATATE at four nuclear medicine centers. Acquiring the scans before treatment minimized potential treatment-related effects on tumor uptake, morphology, and lesion boundary definition. The final cohort included 87 patients with PDAC and 51 patients with PNETs. Incomplete examinations, severe artifacts, poor PET/CT registration, or discordance between imaging and histopathological findings were excluded. Two nuclear medicine specialists independently performed manual three-dimensional tumor delineation on fused PET/CT images. The resulting masks were compared and reviewed, and consensus masks were finalized as expert-validated ground-truth labels. Following quality control, PET/CT images were converted to NIfTI format and spatially resampled, while data augmentation was applied

during model training. A 3D nnU-Net model was trained for automated tumor localization and segmentation. The segmented tumor regions were subsequently used as inputs to an automated deep learning classification model for PDAC/PNET subtype prediction. The integrated framework was designed to receive PET/CT data and generate both a three-dimensional tumor mask and the corresponding histopathological subtype. Segmentation performance was analyzed separately for each radiotracer using metrics such as the Dice similarity coefficient and sensitivity, while classification performance was assessed using metrics such as balanced accuracy and the area under the receiver operating characteristic curve.

Results: The segmentation pipeline was optimized separately for the ¹⁸F-FDG and ⁶⁸Ga-DOTATATE PET/CT datasets. Fivefold cross-validation yielded initial raw Dice scores ranging from 0.75 to 0.80 for pancreatic tumor segmentation, with further improvement observed after application of the post-processing pipeline. The resulting segmented tumor volumes were subsequently used as inputs to a dedicated classification model for automated differentiation between PDAC and PNET based on complementary textural and morphologic information extracted from PET and CT images. Preliminary classification performance, including balanced accuracy and area under the receiver operating characteristic curve, exceeded 0.80. Further optimization is ongoing to improve the robustness and reliability of the final classification results.

Conclusion: This multicenter study demonstrated the promising performance for automated pancreatic tumor segmentation on both ¹⁸F-FDG and ⁶⁸Ga-DOTATATE PET/CT. Accurate lesion delineation is essential for tumor localization, quantitative assessment, follow-up evaluation, and subsequent subtype analysis. The use of ⁶⁸Ga-DOTATATE imaging represents a potentially novel direction for pancreatic tumor segmentation. Overall, the framework provides a comprehensive and reproducible approach to image-based pancreatic tumor characterization and supports diagnostic decision-making.

Keywords: Tumor segmentation; nnU-Net; PDAC; PNET

A64 Synthesis, radiolabeling, and biodistribution evaluation of a novel hyperbranched polyglycerols-based radiotracers for targeting PSMA in prostate cancer

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Introduction: Prostate-specific membrane antigen (PSMA) is a valuable target for prostate cancer imaging and therapy. This study aimed to improve the rapid blood clearance and suboptimal tumor uptake and retention of radiolabeled PSMA by developing a hyperbranched polyglycerol (HPG)-based PSMA conjugate.

Methods: HPG was synthesized via a one-step ring-opening multibranching polymerization (ROMBP) technique and sequentially functionalized with a PSMA-targeting ligand and a tris(hydroxypyridinone) (THP) chelator. The final construct was radiolabeled with gallium-68 or technetium-99m. Physicochemical properties, including lipophilicity (log P) and in vitro stability, were evaluated. In vivo biodistribution and imaging were assessed in LNCaP tumor-bearing nude mice using PET/SPECT/CT.

Results: The THP-HPGs-PSMA derivative (170 kDa, 5-6 PSMA ligands, and 7-8 THP chelators per polymer molecule) achieved radiochemical purity >99%. [⁶⁸Ga]Ga-THP-HPG-PSMA had high stability (>95% after 120 min), and log P of -1.56 ± 0.18. Blood uptake was 13.95 ± 0.75 and 11.82 ± 0.88 %ID/g at 30 and 120 min, respectively. Tumor uptake reached 7.12 ± 0.27, 7.40 ± 0.63, and 7.91 ± 0.20 %ID/g at 30, 60, and 120 min, respectively. Clearance was predominantly hepatobiliary with reduced renal excretion. [^{99m}Tc]Tc-THP-HPG-PSMA showed tumor uptake of 8.74 ± 0.25, 9.41 ± 0.42, and 9.80 ± 0.41 %ID/g at 4, 8, and 16 h. Blocking studies reduced tumor uptake from 7.12 ± 0.27 to 0.93 ± 0.53 %ID/g.

Conclusion: Radiolabeled THP-HPG-PSMA demonstrates improved pharmacokinetics, enhanced tumor uptake, prolonged tumor retention, and favorable tumor-to-blood ratios, indicating strong potential for PSMA-targeted prostate cancer applications.

Keywords: Prostate cancer; PET imaging; Gallium-68; HPG polymer; THP chelator; Molecular imaging

A65 Monte Carlo dosimetric comparison of gold nanoparticle-assisted Lu-177 and Tb-161 targeted radionuclide therapy for liver tumors

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Introduction: Targeted radionuclide therapy (TRT) is an established treatment approach for primary and metastatic liver tumors. Although Lu-177 is widely used clinically, Tb-161 has attracted attention due to additional conversion and Auger electron emissions, enabling enhanced microscopic energy deposition. High-Z nanoparticles, particularly gold nanoparticles (AuNPs), can further increase local dose through secondary electron generation. This study aimed to compare AuNP-mediated dose enhancement in Lu-177- and Tb-161-based TRT using Monte Carlo simulation.

Methods: Monte Carlo simulations were performed using Geant4 version 11.1.3 with Livermore low-energy electromagnetic physics models. A 1 cm³ liver tumor within a soft-tissue equivalent phantom was modeled. Homogeneous distributions of radionuclides and AuNPs were assumed. Three AuNP concentrations (7, 18, and 30 mg/mL) were evaluated. Absorbed dose, Dose Enhancement Factor (DEF), and spatial energy deposition were calculated under identical conditions.

Results: AuNP incorporation increased tumor absorbed dose for both radionuclides, with DEF increasing with nanoparticle concentration. Tb-161 consistently showed greater enhancement than Lu-177. The mean DEF ratio of Tb-161 to Lu-177 was 1.51 across all concentrations. This improvement was attributed to the higher contribution of short-range conversion and Auger electrons from Tb-161, resulting in enhanced secondary electron production and localized energy deposition around AuNPs.

Conclusion: Tb-161 combined with high-Z nanoparticles may provide a promising strategy for increasing tumor dose deposition in TRT. These findings highlight the potential of nanoparticle-assisted Tb-161 therapy and support further preclinical studies for personalized TRT optimization.

Keywords: Monte Carlo simulation; Dose enhancement factor; Lu-177; Tb-161; High-Z nanoparticles

A66 Challenging ^{99m}Tc-PSMA avid mandibular mass in prostate cancer patient

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Introduction: An 88-year-old man was evaluated for a left mandibular mass, presenting a rare manifestation of a metastatic malignancy.

Methods: Diagnostic evaluation included a tissue biopsy, immunohistochemical staining for NKX3.1, and serum Prostate-Specific Antigen (PSA) testing. For further systemic assessment, ^{99m}Tc-MDP and ^{99m}Tc-PSMA SPECT/CT scans were performed. The patient was subsequently treated with hormonal therapy using a GNRH agonist.

Results: The biopsy initially showed an undifferentiated carcinoma, but positive NKX3.1 staining and high PSA levels confirmed a prostatic source. The SPECT/CT scans revealed radiotracer uptake in the mandible along with several sclerotic foci throughout the skeleton. Following the initiation of GNRH agonist therapy, the mandibular mass demonstrated a visible decrease in size.

Conclusion: This case highlights the importance of utilizing specific markers like NKX3.1 and PSA to identify metastatic prostate cancer in atypical locations, and demonstrates the visible clinical responsiveness and size reduction of such metastatic masses to GNRH agonist therapy.

Keywords: Bone expansion; Mandible; PSMA

A67 Tracer uptake dependent of bias in conventional image reconstruction algorithms: Implications on MR-based attenuation correction in PET/MRI systems

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Introduction: MR-based attenuation correction (MRAC) is still a major challenge in quantitative PET/MRI imaging. Accordingly, there were two main objectives of this study; to assess bias related to different reconstruction algorithms and then to determine dedicated error in different classifications of μ -maps on PET data using a reconstruction algorithm that generates minimum and SUV-independent bias.

Methods: A simulation study was done for data on the pelvic region using digital phantom and clinical data. The clinical study used data related to 10 patients undergoing whole-body ¹⁸F-FDG PET/CT using Biograph 16 PET/CT

scanner (Siemens Medical Solutions, Erlangen, Germany). PET images were acquired with voxel size of 4.07×4.07×5 mm³ and dimensions of 168×168. In the first step, sinograms of the original PET data were attenuated and corrected with reference μ -maps and then reconstructed with different reconstruction algorithms. After selecting the reconstruction algorithm with the least bias, an MRAC study was done on the pelvic region using different μ -maps.

Results: In regions such as cortical bone, it was observed that yield of relative error in tests that ignored bone were -74±16%, -40±18%, and -18±21% in SUVs of 1.25, 2.5, and 5, respectively; while such noticeable difference was negligible in cases that applied the reference μ -map.

Conclusion: In contrast with OSEM algorithms, the MLEM algorithm with 1000 iterations had no influence on accuracy of the reconstructed image. Using this MLEM, the MRAC study resulted in more error in the PET data corrected with inaccurate μ -maps. Lesions with low SUV were more prone to bias using inaccurate μ -maps than those with higher SUV. This presents a challenge for cancer monitoring using the PET/MRI utilizing inaccurate μ -maps during treatment.

Keywords: PET/MRI; MRI-base attenuation correction; Prostate imaging

A68 PET/CT in precision cardiology

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The growing emphasis on precision cardiology has highlighted the importance of imaging techniques that provide patient-specific information beyond conventional anatomical assessment. Hybrid positron emission tomography/computed tomography (PET/CT) combines functional and molecular imaging with detailed anatomical visualization, making it a valuable tool for the diagnosis and management of cardiovascular diseases. PET/CT enables the evaluation of key biological processes, including myocardial perfusion, glucose metabolism, inflammation, and tissue viability, while CT offers accurate structural and coronary artery assessment. This complementary approach has proven useful in a variety of clinical settings, such as coronary artery disease, cardiac sarcoidosis, infective endocarditis, cardiac amyloidosis, myocarditis, and the identification of high-risk atherosclerotic plaques. By providing comprehensive information on both disease activity and cardiac morphology, PET/CT supports more accurate diagnosis, improved risk stratification, and individualized therapeutic planning. Recent developments in targeted radiotracers and quantitative image analysis have further expanded the clinical applications of PET/CT. In addition, the integration of artificial intelligence and advanced image-processing techniques is expected to improve diagnostic performance and facilitate personalized treatment decisions. Although challenges such as limited availability, high costs, radiation exposure, and the need for standardized imaging protocols remain, PET/CT continues to play an increasingly important role in modern cardiovascular medicine. Overall, PET/CT represents a powerful imaging modality that supports precision cardiology by enabling more individualized diagnosis, prognosis, and treatment, ultimately contributing to improved patient care and clinical outcomes.

Keywords: Nuclear cardiology; PET/CT; Myocardial perfusion; Viability; Sarcoidosis; Amyloidosis

A69 Comparative evaluation of DTPA and DOTA chelators for Yttrium-90 functionalized magnetic nanoparticles: Implications for targeted radionuclide therapy

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Introduction: Selecting an appropriate bifunctional chelator is a critical step in developing stable yttrium-90-based nano radiopharmaceuticals. Although DTPA and DOTA are widely used for radiometal complexation, their performance may differ depending on nanoparticle surface chemistry and labeling conditions. This study comparatively evaluated the influence of these chelators on the radiochemical characteristics and biological performance of silica-coated magnetic nanoparticles intended for targeted radionuclide therapy.

Methods: Published experimental findings and recent advances in radiopharmaceutical nanotechnology were critically analyzed to compare DTPA and DOTA-functionalized magnetic nanoparticles. The evaluation focused on chelator loading capacity, radiolabeling efficiency, reaction conditions, complex stability, and reported biodistribution characteristics. Current literature was also reviewed to identify factors influencing clinical translation of yttrium-90 magnetic nanoplatforms

Results: Comparative analysis indicated that DTPA generally provides higher labeling efficiency under mild reaction conditions, whereas DOTA offers superior thermodynamic stability but often requires elevated temperatures and longer incubation periods. Both systems demonstrated favorable in vivo stability when appropriate labeling protocols were applied. Recent studies suggest that surface engineering, polyethylene glycol modification, and active targeting ligands may substantially improve circulation time and reduce nonspecific reticuloendothelial uptake, thereby enhancing therapeutic performance.

Conclusion: The choice of chelator should be guided by the intended clinical application and nanoparticle design. DTPA remains advantageous for rapid radiolabeling, while DOTA may be preferable when maximum complex stability is required. Future developments should integrate optimized chelation chemistry with targeted nanocarriers to improve the safety and efficacy of yttrium-90 radionuclide therapy.

Keywords: Yttrium-90; DTPA; DOTA; Magnetic nanoparticles; Radionuclide therapy

A70 ¹⁸F-Flurpiridaz PET myocardial perfusion imaging: Emerging opportunities for quantitative nuclear cardiology

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Introduction: Myocardial perfusion imaging (MPI) is an established noninvasive technique for diagnosing coronary artery disease (CAD). Compared with SPECT, PET provides higher spatial resolution, attenuation correction, shorter imaging protocols, and quantitative assessment of myocardial blood flow (MBF). Among emerging PET tracers, ¹⁸F-flurpiridaz has shown considerable promise owing to its high myocardial extraction, favorable pharmacokinetics, and longer half-life, allowing centralized production and exercise stress imaging. This review summarizes recent clinical evidence supporting its application in nuclear cardiology.

Methods: A literature review was performed using PubMed, Scopus, and Web of Science. Clinical trials, comparative studies, reviews, and current guidelines evaluating ¹⁸F-flurpiridaz PET MPI were analyzed, focusing on diagnostic accuracy, image quality, MBF quantification, radiation dosimetry, and comparison with established PET and SPECT tracers.

Results: Published studies demonstrate that ¹⁸F-flurpiridaz provides excellent myocardial image quality, high target-to-background contrast, and accurate detection of obstructive CAD. High first-pass extraction enables reliable MBF quantification. Its longer physical half-life supports distribution to centers without on-site cyclotrons and facilitates both pharmacologic and exercise stress imaging. Recent advances in quantitative PET software and artificial intelligence further improve diagnostic performance.

Conclusion: ¹⁸F-Flurpiridaz is a promising next-generation PET myocardial perfusion tracer with excellent diagnostic performance and practical clinical advantages. Its favorable biological characteristics and compatibility with quantitative PET support its future integration into routine nuclear cardiology.

Keywords: ¹⁸F-Flurpiridaz; PET Myocardial perfusion imaging; Coronary artery disease; Quantitative PET; Cardiovascular imaging

A71 Explainable artificial intelligence for PET/CT-based precision oncology: current advances, clinical applications, challenges, and future perspectives

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Positron emission tomography/computed tomography (PET/CT) has become an essential imaging modality in nuclear medicine, providing valuable functional and anatomical information for cancer diagnosis, staging, treatment response assessment, and prognosis evaluation. However, the increasing complexity and volume of PET/CT imaging data have created a need for advanced computational approaches capable of extracting clinically meaningful patterns beyond conventional visual interpretation. Artificial intelligence (AI), particularly deep learning and radiomics-based approaches, has demonstrated remarkable potential in improving image analysis, tumor characterization, and personalized oncology decision-making. Despite these advances, the limited interpretability of many AI models remains a major barrier to their clinical translation. Explainable artificial intelligence (XAI) has emerged as a promising solution by providing insights into the decision-making process of complex algorithms and enhancing physician confidence in AI-assisted diagnosis. Techniques such as SHapley Additive exPlanations (SHAP), Local Interpretable Model-agnostic Explanations (LIME), and gradient-based

visualization methods have enabled researchers to identify imaging features contributing to AI predictions. This narrative review discusses recent advances in the application of explainable AI in PET/CT-based precision oncology, focusing on radiomics, deep learning approaches, clinical applications, and challenges associated with implementation. Furthermore, future perspectives regarding multimodal AI integration, clinical validation, and the development of trustworthy AI systems in nuclear medicine are highlighted. The integration of explainable AI with PET/CT imaging may represent a significant step toward personalized cancer management and improved clinical decision support.

Keywords: Artificial intelligence; Explainable AI; PET/CT imaging; Radiomics; Deep learning; Precision oncology; Nuclear medicine

A72 Monte Carlo dosimetry of Lu-177 lesions with non-uniform uptake patterns: implications for AI-accelerated theranostic workflows

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Introduction: Artificial intelligence is being investigated to accelerate Lu-177 SPECT/CT dosimetry, yet the dosimetric consequences of heterogeneous tumor uptake—a common clinical reality—remain underexplored in AI training and validation datasets. This study quantified self-dose distributions in lesions with three clinically relevant uptake patterns to establish a benchmark for AI-based dose predictions.

Methods: Monte Carlo simulations were performed with GATE (Geant4) for 20-, 30- and 40-mm spherical water-phantom lesions at 24×10^6 primary beta particles per case. Three uptake patterns were modelled: uniform, core-dominant (core:rim concentration ratio 3:1) and rim-dominant (1:3). Dose-volume histograms, radial profiles, D95/mean ratios, homogeneity indices, and 2-mm shell leakage were calculated.

Results: Uniform lesions provided the highest D95/mean (0.84 for 40 mm) and lowest shell leakage ($\leq 6.5\%$), while rim-dominant lesions showed the lowest D95/mean (0.38 for 40 mm) and highest shell leakage (7.5%). Core-dominant patterns exhibited the most heterogeneous intralesional dose (homogeneity index up to 2.5). Mean dose scaled with diameter^{-2.96} across all patterns ($R^2=1.0$), consistent with the inverse-square law for beta emitters.

Conclusion: Rim-dominant uptake significantly reduces target coverage and increases surrounding-tissue spill, potentially compromising treatment efficacy. These quantitative benchmarks provide a physical reference for training and validating AI algorithms, supporting the development of robust, generalizable AI-assisted dosimetry for heterogeneous lesions in Lu-177 theranostics.

Keywords: Monte Carlo dosimetry; Lu-177; Theranostics; Prostate cancer; Non-uniform uptake

A73 Neurocircuitry-based relative perfusion SPECT indices are associated with short-term clinical improvement during SSRI treatment in anxiety disorders

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Introduction: Brain perfusion SPECT may provide complementary information about treatment-associated neurobiological changes in anxiety disorders. This study investigated whether changes in neurocircuitry-based relative perfusion indices were associated with short-term clinical improvement during selective serotonin reuptake inhibitor (SSRI) treatment.

Methods: Twenty adults with generalized anxiety disorder or panic disorder underwent [^{99m}Tc]Tc-ethyl cysteinate dimer brain SPECT before and four weeks after initiation of routine-practice SSRI treatment. Talairach-based regional count values generated by Scenium were normalized to global brain uptake. A fear-related composite was calculated from the amygdala, anterior insula, and dorsal anterior cingulate cortex, whereas a regulatory prefrontal composite included the ventromedial prefrontal, dorsolateral prefrontal, and rostral anterior cingulate cortices. A fear-minus-regulatory imbalance index was also derived. Within-participant changes, responder-group differences, and correlations with improvement in Hamilton Anxiety Rating Scale scores were evaluated.

Results: Hamilton Anxiety Rating Scale scores decreased from 28.2 ± 2.8 at baseline to 17.1 ± 6.5 at week four. Fear-related relative perfusion decreased from 109.8 ± 3.0 to 104.7 ± 4.1 , whereas regulatory prefrontal perfusion increased from 92.5 ± 2.6 to 96.2 ± 3.3 . Consequently, the imbalance index decreased from 17.4 ± 5.0 to 8.5 ± 6.8 . All three changes remained significant after Holm adjustment. Changes in these indices were greater among the 12 clinical responders than among the eight non-responders. Clinical improvement correlated strongly with fear-

related perfusion reduction ($p = 0.914$), regulatory perfusion increase ($p = 0.815$), and imbalance-index reduction ($p = 0.892$); all Holm-adjusted p values were <0.0001 .

Conclusion: Short-term clinical improvement during SSRI treatment was associated with coordinated changes in globally normalized relative perfusion across predefined fear-related and regulatory prefrontal regions. These exploratory findings support further investigation of neurocircuitry-based SPECT indices as treatment-sensitive research measures in larger controlled cohorts.

Keywords: Anxiety disorders; Brain perfusion SPECT; Selective serotonin reuptake inhibitors; Clinical response; Limbic–prefrontal circuitry

A74 Beyond surgical margins: FDG PET/CT reveals metabolically active residual disease after subtotal resection of primary cardiac angiosarcoma

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Introduction: Primary cardiac angiosarcoma is an exceptionally rare but highly aggressive malignancy with infiltrative growth, frequent right-sided cardiac involvement, and early metastatic potential. Because complete resection is often limited by local invasion, defining viable residual disease and whole-body disease extent after surgery is crucial for subsequent oncologic management. This case highlights the incremental role of whole-body 18F-FDG PET/CT after subtotal resection of a primary cardiac angiosarcoma.

Methods: A 49-year-old man pre

sented with progressive dyspnea and syncope. Transthoracic echocardiography identified a cardiac mass, while cardiac magnetic resonance imaging demonstrated a large infiltrative lesion involving the right atrioventricular groove with extension toward the base of the right ventricle. Urgent surgery was performed; however, extensive local infiltration prevented complete excision and only subtotal resection was feasible. Histopathology confirmed high-grade primary cardiac angiosarcoma. Postoperative whole-body 18F-FDG PET/CT was subsequently performed to characterize residual viable disease and assess systemic disease extent.

Results: 18F-FDG PET/CT demonstrated intense hypermetabolic activity at the right atrioventricular junction and base of the right ventricle, with an SUVmax of approximately 21, consistent with metabolically active residual tumor. A separate focal hypermetabolic pericardial lesion measuring approximately 13 × 20 mm (SUVmax approximately 13.5) indicated additional locoregional involvement. No abnormal FDG uptake suggestive of distant metastatic disease was identified on whole-body imaging. Mild linear sternal uptake corresponded to recent postoperative change.

Conclusion: In this rare and aggressive cardiac malignancy, 18F-FDG PET/CT provided clinically relevant information beyond postoperative anatomic assessment by demonstrating viable residual tumor, revealing additional locoregional disease, and surveying the whole body for distant metastases in a single examination. These findings support a complementary role for FDG PET/CT in postoperative metabolic restaging after incomplete resection of primary cardiac angiosarcoma and in refining disease extent for subsequent multidisciplinary treatment planning.

Keywords: Cardiac angiosarcoma; FDG PET/CT; Residual disease; Metabolic restaging; Oncologic imaging

A75 Specific dosimetry of eye structures in occupational exposure to radioactive medical waste containing iodine-131

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Introduction: Most previous studies have focused on the assessment of lens dose in nuclear medicine workers, and there is limited information about the dose to different eye structures in medical radioactive waste management workers. The aim of this study was to estimate the absorbed dose to the cornea, lens, and retina in occupational exposure to waste containing the radioisotope I-131.

Methods: The absorbed dose to eye structures was estimated using the MCNPX code in a realistic medical radioactive waste management scenario. The simulation model included the actual geometry of the waste storage facility, the actual waste inventory, the movement path of the workers, and a detailed anatomical model of the eye. The validity of the model was also examined by comparing the simulation results and experimental measurements of the equivalent environmental dose rate.

Results: The annual dose to the cornea, lens, and retina was estimated to be 19.555, 19.903, and 19.042 μSv per year, respectively. The doses received by these three structures were in a close range, but the lens received the highest dose. The annual dose to the lens was significantly lower than the recommended occupational dose limit of the International Commission on Radiological Protection (ICRP). The benchmark results also showed a good agreement between the simulated and measured values, and the average relative difference between the two methods was 12.7%.

Conclusion: The results of this study showed that the developed Monte Carlo model is capable of estimating the doses to different structures of the eye in realistic scenarios of medical radioactive waste management. This approach can help to more accurately assess occupational exposure and optimize radiation protection programs for nuclear medicine center workers.

Keywords: Eye dosimetry; Radioactive medical waste; Iodine-131; Radiation protection; Monte Carlo simulation

A76 Design and optimization of a multilayer nanocomposite metamaterial shield for nuclear medicine: A genetic algorithm-Monte Carlo approach

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Neutron therapy and gamma imaging in nuclear medicine require efficient, lightweight shields with minimal thickness. This study designs and optimizes a multilayer nanocomposite metamaterial shield for simultaneous neutron and gamma shielding using a genetic algorithm and Monte Carlo simulation (MCNPX). A four-layer shield (WO_3/epoxy 0.4cm, $\text{Bi}_2\text{O}_3/\text{epoxy}$ 0.4cm, $\text{PE/B}_4\text{C}$ 0.6cm, and 40 cm concrete) was optimized via genetic algorithm to minimize dose and weight. Three MCNPX simulations were performed: neutron source (1 MeV), gamma source (0.511 MeV), and secondary capture gamma rays. The optimal shield (0.4, 0.4, 0.6, and 40 cm) reduced neutron flux by 98.3%. Dose equivalents were $2.63\text{E-}21$ Sv/n (neutron) and $1.84\text{E-}23$ Sv/y (gamma). Secondary gamma contributed only 0.7% of the total neutron dose. All values are far below the $1 \mu\text{Sv/h}$ public limit. The GA-Monte Carlo approach is reliable for designing multilayer shields. The proposed non-toxic, lightweight composite offers a promising alternative to conventional lead and concrete in nuclear medicine.

Keywords: Metamaterial shield; Genetic algorithm; Monte Carlo simulation; MCNPX; Nuclear medicine

A77 Design and implementation of an algorithm for small-animal PET and micro-CT image registration for multimodal imaging applications in preclinical research

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Introduction: Registration of small-animal PET and micro-CT scans is crucial for preclinical applications involving quantitative image analysis. It is a challenging task because of unavoidable misalignment from standalone imaging systems and the inherent differences between the two imaging modalities. Since PET and micro-CT images are based on different physical principles, there is no direct correspondence between voxel intensities. Micro-CT provides micrometer-scale anatomical information, while PET provides millimeter-scale functional metabolic data. This paper presents an automatic registration algorithm to overcome these issues.

Methods: A rigid transformation model followed by a coarse-to-fine multiscale strategy acquired. An initial Point Spread Function (PSF) matching step compensates for inherent resolution disparities.

The first stage uses the Covariance Matrix Adaptation Evolution Strategy (CMA-ES), an evolutionary optimization capable of exploring complex search spaces to find a global optimum. The second stage relies on Powell's derivative-free optimization.

Generalized Partial Volume Estimation-based Mutual Information (GPVE-MI) is used as a similarity metric. Once registration has been successfully completed, the system automatically adjusts the relevant DICOM metadata, representing PET/micro-CT images as a paired series. Registration validated using Target Registration Error (TRE).

Results: Performance evaluated using preclinical studies. The multiresolution strategy effectively avoids convergence to local optima while maintaining accurate registration. Quantitative evaluation using anatomical landmarks yielded a mean TRE of 0.46 mm, corresponding to sub-voxel accuracy in the PET spatial resolution.

Conclusion: This study provides a solution for the registration of preclinical PET/micro-CT images. By integrating PSF matching and multiresolution optimization, it achieved sub-voxel registration to address alignment problems.

Keywords: Small-animal PET; micro-CT; Image registration; Image fusion; Preclinical imaging

A78 Evaluation of feasibility and early clinical response of Rhenium-188/Yttrium-90 topical radiopharmaceutical for treatment of basal cell carcinoma: A pilot study

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Introduction: Basal cell carcinoma (BCC) is the most common non-melanoma skin cancer. Standard treatments may be unsuitable for patients with multiple, recurrent, or cosmetically sensitive lesions. Topical Yttrium-90 and Rhenium-188 radiopharmaceuticals may offer a non-invasive, tissue-sparing alternative. This pilot study evaluated the feasibility and six-month clinical response of topical radiopharmaceutical therapy in BCC.

Methods: This pilot study was conducted from 2024 to 2026 at the Research Center for Nuclear Medicine of Shariati Hospital, in collaboration with the Skin and Leprosy Research Center and Tumor Clinic of Razi Hospital. Patients with histopathologically confirmed BCC provided written informed consent. Lesion depth was assessed by 20-MHz ultrasonography. Lesions ≥ 2.5 mm were treated with Yttrium-90, while lesions < 2.5 mm received Rhenium-188. The radiopharmaceutical was applied topically for approximately 60–90 minutes to deliver a target dose of 50 Gy. Patients were followed at 2 weeks and 1, 2, 3, and 6 months. Ultrasonography was performed at baseline and six months, with dermoscopy at six months. Biopsy was performed when clinically indicated.

Results: Seven patients were enrolled; three received Rhenium-188 and four received Yttrium-90. The median treatment duration was approximately 90 minutes. Mild local adverse effects, including dryness, pruritus, burning, ulceration, and minor bleeding, were observed and successfully managed with saline irrigation and topical mupirocin when required. At six months, ultrasonography showed complete resolution of the hypoechoic lesion in five patients. Dermoscopy identified residual lesions in two patients, who subsequently underwent retreatment.

Conclusion: Topical Yttrium-90 and Rhenium-188 therapy appears feasible, well tolerated, and associated with favorable early clinical and ultrasonographic responses in BCC. Larger studies with longer follow-up are warranted to establish long-term efficacy and safety.

Keywords: Basal cell carcinoma; Topical radiopharmaceutical therapy; Yttrium-90; Rhenium-188

A79 Clavicular osteoradionecrosis with ^{99m}Tc-FAPI-46 uptake in a patient with breast cancer

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Introduction: Osteoradionecrosis (ORN) is a rare but serious complication of radiotherapy, characterized by bone necrosis within irradiated fields. FAP-targeted imaging with ^{99m}Tc-FAPI-46 has emerged for cancer staging but can show uptake in benign conditions, including radiation-induced fibrosis and ORN, risking false-positive interpretation as metastasis.

Methods: We report a 65-year-old woman with a 10-year history of right invasive ductal breast cancer, treated with mastectomy and 50 Gy radiotherapy. Five years later, left supraclavicular nodal metastases prompted additional 50 Gy to the supraclavicular region. She recently developed right cervical nodal metastases and a left supraclavicular ulcer, and underwent ^{99m}Tc-FAPI-46 SPECT/CT within a clinical trial.

Results: Whole-body ^{99m}Tc-FAPI-46 imaging showed multiple cervical uptake foci corresponding to metastatic lymphadenopathy. A focal uptake at the left thoracic inlet localized to the medial left clavicle on SPECT/CT. CT revealed geographic osteolysis with irregular sclerotic margins, cortical disruption, and adjacent muscle atrophy—findings diagnostic of clavicular ORN. Non-FAPI-avid fibrotic changes were also seen in the left upper lung, confined to the prior radiation field. ORN typically affects the medial clavicle (within the radiation field), whereas metastases favor the lateral end.

Conclusion: This case highlights ^{99m}Tc-FAPI-46 uptake in clavicular osteoradionecrosis as a potential imaging pitfall in breast cancer restaging. Radiation-induced fibroblast activation via cytokines such as TGF- β 1 and IL-1 β likely drives FAPI avidity in ORN. Recognizing characteristic CT features and anatomic distribution helps distinguish ORN from metastatic disease, preventing misdiagnosis and guiding appropriate multidisciplinary management.

Keywords: ^{99m}Tc-FAPI-46; SPECT/CT; Breast cancer; Osteoradionecrosis; Pitfall

A80 Recent advancements in probe design for radiotheranostics

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Radiotheranostics has revolutionized precision oncology by coupling diagnostic imaging with targeted radionuclide therapy. However, the translation from bench to bedside is often hindered by suboptimal tumor residence time, off-target accumulation (e.g., salivary gland, renal, and hematologic toxicities), and radiochemical instabilities. Probe design has evolved from serendipitous discovery to precision modular engineering. Optimizing the spatial orientation, linker hydrophilicity, and chelator stability directly dictates the therapeutic index. Mastering these design principles enables the nuclear medicine team to rationally select, interpret, and personalize next-generation radiotheranostic regimens in clinical practice.

Core innovations in probe engineering:

1. Targeting vector evolution & multimerization:
 - Beyond conventional monomers, homodimers and heterodimers enhance binding avidity, cellular internalization, and tumor retention without disproportionately increasing off-target background exposure.
 - Clinical paradigm shifts favor receptor antagonists and small scaffold proteins/nanobodies over intact antibodies to avoid daughter-recoil redistribution in targeted alpha therapy (TAT).
2. Pharmacokinetic tailoring & linker chemistry:
 - Incorporation of albumin-binding moieties (ABMs) tunes blood circulation half-life to match radionuclide physical decay.
 - Rational charge modification dramatically reduces non-specific renal, splenic, and bone marrow uptake, optimizing tumor-to-background therapeutic ratios.
3. Chelator innovations & theranostic radionuclide matching:
 - Introduction of next-generation chelators addresses radiolysis and transchelation.
 - Development of true matched isotopic and targeted alpha emitters bypasses hypoxic radioresistance and achieves double-strand DNA cleavage even in micrometastatic disease.
4. Nanotheranostics & multifunctional platforms:
 - Radionuclide-labeled nanoparticles offer intrinsic or chelator-mediated multi-isotope loading, enabling combinatorial therapies (radiotherapy with photothermal/immunotherapy).

This continuing medical education (CME) presentation highlights the latest paradigms in the “molecular blueprint” of theranostic probes (targeting vector, linker, chelator, modifier, and radionuclide), providing clinicians and radiopharmaceutical scientists with actionable insights into rational probe engineering, pharmacokinetic (PK) optimization, and emerging clinical theranostic pairs.

Keywords: Radiopharmaceutical; Theranostic; Probes

A81 ¹⁷⁷Lu-PSMA-617 SPECT/CT for early prediction of overall survival in participants with metastatic castration-resistant prostate cancer

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Introduction: To predict overall survival (OS) after enzalutamide plus ¹⁷⁷Lu-PSMA-617 using quantitative parameters at ¹⁷⁷Lu-PSMA-617 SPECT/CT at 6 weeks, as well as prostate-specific antigen (PSA) response, in participants with metastatic castration-resistant prostate cancer.

Method: This secondary analysis of the multisite prospective ENZA-p trial included participants who received enzalutamide plus ¹⁷⁷Lu-PSMA-617. SPECT/CT was performed 24 hours after each treatment, and total tumor volume (TTV) and mean standardized uptake value were compared between the first (baseline) and second (6-week) doses. TTV complete response (CR) at SPECT/CT was defined as TTV less than 1 mL at dose 2, and deep PSA response was defined as 90% or greater PSA reduction at dose 2. Relationships between TTV CR and deep PSA response at dose 2 and OS were examined.

Results: This analysis included 74 men (median age, 71 years [IQR, 66–78 years]). Median follow-up was 33 months (95% CI: 28, 37). Median OS was 31 months (95% CI: 25, 33), and the 2-year survival rate was 70% (95% CI: 58, 79). Median TTV was 236 mL (IQR, 81–688 mL) at baseline and 65 mL (IQR, 12–215 mL) at 6 weeks. Median change in TTV was –57% (IQR, –89% to –38%); 4.1% (three of 74) of participants had an increase in TTV, and 16% (12 of 74) had TTV CR. Deep PSA response was seen in 63% (45 of 71) of participants. The 2-year survival rate with TTV CR was 83% (95% CI: 48, 96), versus 67% (95% CI: 54, 77) without TTV CR (hazard ratio, 0.26 [95% CI: 0.08, 0.85]; log-rank P = .02). The 2-year survival rate was 76% (95% CI: 58, 87) with deep PSA response without TTV CR (log-rank P = .05 vs TTV CR) and 54% (95% CI: 33, 71) with neither deep PSA response nor TTV CR (log-rank P = .003 vs TTV CR).

Conclusion: TTV CR at ¹⁷⁷Lu-PSMA-617 SPECT/CT at 6 weeks was associated with improved OS and may be a valuable tool for treatment personalization with ¹⁷⁷Lu-PSMA-617.

Keywords: ¹⁷⁷Lu-PSMA-617; SPECT/CT; Total tumor volume; Overall survival

A82 Fibroblast activation protein (FAP): Biology, molecular imaging, and emerging therapeutic strategies in cancer

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Introduction: Fibroblast activation protein (FAP) is a membrane-bound serine protease that is highly expressed in cancer-associated fibroblasts (CAFs) within the tumor microenvironment while remaining minimally expressed in normal adult tissues. FAP contributes to extracellular matrix remodeling, tumor growth, angiogenesis, immune suppression, invasion, and metastasis. Because of its restricted expression pattern and essential role in tumor progression, FAP has emerged as an attractive biomarker for cancer diagnosis and a promising therapeutic target. This review aimed to summarize current knowledge regarding the biological functions of FAP, its role in the tumor microenvironment, recent advances in FAP-targeted molecular imaging, and emerging therapeutic strategies, with particular emphasis on fibroblast activation protein inhibitor (FAPi)-based radiopharmaceuticals.

Methods: A narrative literature review was conducted using electronic databases including PubMed, Scopus, Web of Science, and Google Scholar. Articles published between 2006 and 2025 were searched using combinations of the following keywords: Fibroblast Activation Protein (FAP), Cancer-Associated Fibroblasts (CAFs), Tumor Microenvironment, FAPi, Molecular Imaging, PET/CT, Radionuclide Therapy, Targeted Therapy, Theranostics, and Radiopharmaceuticals. Original research articles, review articles, clinical studies, and relevant preclinical investigations published in English were included. Studies unrelated to FAP biology, imaging, or therapeutic applications, duplicate publications, conference abstracts without full text, and non-English articles were excluded.

Results: The reviewed studies consistently demonstrate that FAP is highly expressed in cancer-associated fibroblasts across a broad spectrum of solid tumors and plays a crucial role in extracellular matrix remodeling, tumor progression, immune suppression, angiogenesis, and therapeutic resistance. Recent evidence indicates that FAPi-based PET imaging provides excellent tumor-to-background contrast and superior lesion detection in several malignancies. In addition, preclinical and early clinical studies suggest that FAP-targeted radionuclide therapy represents a promising therapeutic strategy with favorable safety profiles and encouraging antitumor efficacy. Emerging nanotechnology-based delivery systems and combination approaches with immunotherapy may further enhance the clinical potential of FAP-targeted treatment.

Conclusion: FAP represents one of the most promising stromal biomarkers in modern oncology. Its restricted expression in normal tissues together with its broad involvement in cancer progression makes it an ideal target for both molecular imaging and targeted therapy. Continued clinical investigation and optimization of FAP-targeted theranostic strategies may significantly improve precision oncology and personalized cancer treatment in the future.

Keywords: Fibroblast activation protein; Cancer-associated fibroblasts; Radiopharmaceutical; Theranostic

A83 CT radiomics features for maximum standard uptake value estimation in non-small cell lung cancer: A machine learning approach for lesion metabolic estimation

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Introduction: To investigate the association between CT-derived radiomic features and PET-derived maximum standardized uptake value (SUVmax) in non-small cell lung cancer (NSCLC) and to develop machine learning models for non-invasive SUVmax estimation.

Methods: This multicenter study included 174 patients with histopathologically confirmed NSCLC who underwent pretreatment ¹⁸F-FDG PET/CT imaging. Tumors were segmented using LIFEx software, and CT images were preprocessed according to IBSI recommendations before radiomic feature extraction. Feature selection was performed using Spearman correlation, false discovery rate correction, and multicollinearity filtering. Five regression algorithms (LASSO, Elastic Net, Random Forest, Gradient Boosting, and XGBoost) and an ensemble model were evaluated using a fully nested leave-one-out cross-validation framework. Model performance was assessed using R², RMSE, MAE, and Spearman correlation coefficients.

Results: Twenty-five radiomic features were significantly associated with SUVmax, of which seven independent predictors remained after feature selection. Surface-to-volume ratio showed the strongest negative correlation with SUVmax ($p = -0.79$), whereas GLSZM texture features exhibited strong positive correlations. Random Forest achieved the best predictive performance ($R^2 = 0.63$, RMSE = 3.62, MAE = 2.65), with Pearson and Spearman correlations of 0.79 and 0.81, respectively. Furthermore, 82.2% and 99.4% of predictions were within ± 5 and ± 10 SUV units of the measured values.

Conclusion: CT radiomic features are significantly associated with tumor metabolic activity and enable accurate estimation of PET-derived SUV_{max}. Random Forest demonstrated the highest predictive performance, suggesting that CT-based radiomics combined with machine learning may provide a practical complementary approach for metabolic characterization of NSCLC when PET/CT is unavailable.

Keywords: Radiomics; Non-small Cell Lung Cancer; Machine learning; PET/CT; Tumor

A84 Evaluating cellular microdosimetry of targeted radionuclide therapy for micrometastasis treatment: A Monte Carlo study

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Introduction: Targeted radionuclide therapy (TRT) is a novel approach for eradicating disseminated tumor cells (DTCs), micrometastases, and circulating tumor cells (CTCs). Risk of distant recurrence can be predicted based on clinicopathological and genomic features, response to neoadjuvant treatment, or other biomarkers. TRT must be capable of eradicating lesions of various sizes, including micrometastases, single cells, and clusters of CTCs and DTCs. Due to the limited penetration of beta particles in small lesions, radionuclides that emit Auger and internal conversion electrons are suitable candidates, owing to their short range and localized energy deposition. In this study, ¹¹⁹Sb, ¹²³I, and ^{195m}Pt were evaluated, and their S-values were calculated using Monte Carlo simulations within GATE.

Methods: The cell geometry consisted of two concentric water spheres for the cell and nucleus, and a shell for the membrane. Activity of 1 MBq was considered for three source configurations (nucleus, cytoplasm, membrane) using GATE. Cell (5 µm) and nucleus (4 µm) dimensions were based on lymphocytes and V79 cells. Simulations were benchmarked against MIRDcell and PENELOPE.

Results: ^{195m}Pt delivered the highest absorbed dose to the nucleus (2983 Gy for N←CM), followed by ¹¹⁹Sb (1490 Gy) and ¹²³I (191 Gy). Auger and Coster-Kronig electrons dominated in nuclear configuration, while IC electrons contributed more in cytoplasmic and membrane configurations.

Conclusion: Despite favorable dosimetric performance of ¹¹⁹Sb and ^{195m}Pt, production and isotopic purity challenges require further investigation. This study provides precise microdosimetric data for selecting appropriate radionuclides.

Keywords: Cellular dosimetry; Micro dosimetry; Targeted radionuclide therapy; Monte Carlo simulation; S values

A85 Correlation between anthropometric indices and myocardial perfusion scan findings in patients undergoing myocardial perfusion imaging in Yazd, Iran

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Introduction: Cardiovascular disease is the leading cause of death worldwide, and obesity is among its principal modifiable risk factors. Excess adiposity

is closely linked to hypertension, dyslipidemia, coronary artery disease, and ischemic stroke. This study evaluated the correlation between anthropometric indices and myocardial perfusion scan findings in patients undergoing myocardial perfusion imaging.

Methods: This analytical cross-sectional study used a convenience sample of 600 patients referred for myocardial perfusion imaging at the Nuclear Medicine Department of Shahid Sadoughi and Afshar Hospitals, Yazd, Iran, during 2018–2019. A pre-designed checklist recorded age, sex, height, weight, ischemia severity, lung/heart ratio (LHR), transient ischemic dilation (TID), and anthropometric indices (waist circumference, waist-to-height ratio, conicity index, and body mass index). Data were analyzed in SPSS version 22.

Results: Of 600 patients, 412 (68.9%) were female and 188 (31.1%) were male. LHR was positive in 4 patients (0.7%) and TID in 38 (6.4%). Ischemia was absent in 66.2% of patients, mild in 25.4%, moderate in 3.3%, severe in 2.7%, and 2.3% had old myocardial infarction. No anthropometric index differed significantly by TID status, but the

conicity index was significantly higher in LHR-positive patients. Body mass index, waist and hip circumference, waist-to-height ratio, and conicity index all differed significantly by ischemia severity ($p < 0.05$).

Conclusion: Anthropometric indices are significantly associated with myocardial perfusion scan findings, specifically lung/heart ratio and ischemia severity, supporting their use as simple, low-cost tools in cardiovascular risk assessment.

Keywords: Anthropometric indices; Myocardial perfusion imaging; Obesity

A86 Baseline [¹⁸F] FDG PET/CT radiomics and SUV_{max} for predicting treatment response in Hodgkin's lymphoma

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Introduction: Baseline [¹⁸F] FDG PET/CT provides metabolic information in Hodgkin's lymphoma, but the predictive value of SUV_{max} and radiomics remains uncertain. This study evaluated their ability to predict treatment response.

Methods: Ninety-six lesions from 34 patients were classified as complete response ($n=58$), partial response ($n=26$), or progressive disease ($n=12$). A total of 1,592 radiomics features were assessed using the Kruskal-Wallis test, epsilon-squared effect sizes, and Benjamini-Hochberg false-discovery-rate correction. Predictive performance was evaluated using one-versus-rest ROC analysis and five-fold patient-grouped cross-validation with multinomial logistic regression.

Results: SUV_{max} differed significantly across response groups ($p=0.006$) but showed limited multiclass predictive performance (macro-AUC=0.49; balanced accuracy=0.33). Seventy-nine radiomics features were nominally significant, although none remained significant after false-discovery-rate correction. Exponential_GLRM_Short Run Emphasis showed the strongest univariate association ($p=0.004$; $q=0.48$; epsilon-squared=0.099) and the highest grouped cross-validated macro-AUC (0.63), with a balanced accuracy of 0.408. Sixteen radiomics features achieved a macro-AUC ≥ 0.60 , and none reached 0.65. SUV_{max} showed relatively strong discrimination for progressive disease (AUC=0.752), whereas radiomics features performed better for complete and partial response.

Conclusion: Baseline SUV_{max} differed among response groups but had weak standalone multiclass predictive value. Selected radiomics features provided modestly improved discrimination, although none remained significant after multiple-comparison correction. Larger patient-level studies using nested cross-validation and multivariable models integrating metabolic and radiomic biomarkers are warranted.

Keywords: Hodgkin's lymphoma; [¹⁸F] FDG PET/CT; Radiomics; SUV_{max}; Treatment response

A87 Count-rate dependence of ureteral flow metrics in dynamic renal scintigraphy and its mitigation by within-ureter permutation normalization

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Introduction: Quantitative ureteral flow metrics derived from dynamic renal scintigraphy may be strongly influenced by count statistics, limiting their validity for cross-patient comparison, particularly in pediatric imaging where administered activity and count density vary substantially. This study quantified count-rate dependence in intensity-based ureteral flow metrics and evaluated a novel self-referenced approach, Segmental Ureteral Refilling Analysis (SURA), designed to reduce this dependence without external calibration.

Methods: Forty-six ureters from 23 pediatric patients undergoing ^{99m}Tc-ethylenedicycysteine dynamic renal scintigraphy (13–15 s/frame) were analyzed. Three optical-flow-based metrics—cumulative upward mass fraction, upward intensity per pixel per frame, and upward event frequency—were compared with SURA. In SURA, the ureter was divided into segments and refilling activity was quantified relative to 500 temporal permutations of the same acquisition, preserving count level and signal distribution while disrupting temporal structure. Count-

rate dependence was assessed using Spearman correlation between mean ureteral counts per pixel and each quantitative metric.

Results: The three optical-flow metrics demonstrated strong positive correlations with count density ($\rho=0.91, 0.66$, and 0.51 ; all $p<0.001$), indicating substantial count-rate dependence. Anscombe variance stabilization reduced count-related variation in phantom data (residual swing $<2\%$) but also markedly reduced physiological discrimination in an illustrative reflux-versus-control comparison (0.446 vs 0.451). In contrast, SURA-derived metrics showed weak, non-significant associations with count density ($\rho=0.12-0.26$; $p>0.08$), indicating substantially reduced sensitivity to variations in count statistics.

Conclusion: Intensity-based ureteral flow metrics in dynamic renal scintigraphy are strongly influenced by count density and may therefore be unreliable for direct cross-patient comparison. Within-acquisition permutation normalization provides a self-referenced alternative that substantially reduces count-rate dependence without requiring population-derived thresholds or external calibration constants. SURA may provide a more robust framework for quantitative assessment of ureteral tracer kinetics in low-count pediatric scintigraphy and warrants prospective clinical validation.

Keywords: Dynamic renal scintigraphy; Ureteral kinetics; Permutation testing; Pediatric nuclear medicine

A88 Radiopharmaceutical administration during breastfeeding

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Administering radiopharmaceuticals to lactating patients presents critical diagnostic, clinical, and ethical dilemmas. Breastfed infants are subject to dual radiation exposure: internal irradiation via the ingestion of radioactive breast milk and external exposure due to close physical contact with the mother. Historically, insufficient or conflicting clinical guidance has frequently led to overly conservative decisions, such as the unnecessary and permanent cessation of breastfeeding. Transfer of radiopharmaceuticals into breast milk is favored by low molecular weight, minimal plasma protein binding, and high lipophilicity. Peak concentrations in milk generally occur 3 to 4 hours post-administration, with excretion fractions remaining below 10% for the vast majority of compounds. Frequent breast pumping is essential during interruption periods; it sustains milk production and accelerates activity clearance from breast tissue. Expressed milk can be safely stored and subsequently fed to the infant after undergoing decay for 10 physical half-lives. Decision-making in lactating patients must be individualized and evidence-based. Proactive pre-scan screening, clear written instructions, and tailored interruption timelines guarantee infant radioprotection while avoiding the unjustified abandonment of breastfeeding benefits. The primary objective of this continuing medical education (CME) lecture is to review the pharmacokinetics of radiopharmaceutical excretion into human milk, re-evaluate infant radiation dose constraints (utilizing the widely accepted 1 mSv threshold), and provide an evidence-based, unified clinical framework for daily departmental practice.

Keywords: Radiopharmaceutical; Infants; Breastfeeding; Nuclear medicine

A89 SUV-stratified comparison of [¹⁸F] FDG PET radiomic features between bone and soft-tissue lesions in Ewing sarcoma

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Introduction: Ewing sarcoma primarily affects bone but may involve adjacent soft tissue or metastatic sites. Although [¹⁸F] FDG PET/CT is widely used for staging and response assessment, conventional metrics do not fully characterize intralesional heterogeneity. PET radiomics may provide complementary information, but radiomic features can depend on metabolic activity, raising uncertainty about their comparability between bone and soft-tissue lesions. We evaluated tissue-related differences in PET radiomic features after SUV stratification.

Methods: Baseline PET/CT images were retrospectively analyzed. Lesions were manually segmented in 3D Slicer, and 93 first-order and texture features were extracted using PyRadiomics with a fixed bin width; shape features were excluded. Fifty-five bone or soft-tissue lesions were analyzed after excluding nine mixed lesions. Using the median SUV, lesions were divided into Group 1 ($n=25$; 14 bone, 11 soft tissue) and Group 2 ($n=30$; 18 bone, 12

soft tissue). Within each stratum, features were compared using the Mann-Whitney U test, with rank-biserial correlation for effect size and Benjamini-Hochberg false-discovery-rate correction.

Results: In Group 1, 41 of 93 features showed nominal differences ($p < 0.05$; minimum $p = 0.007$), but none remained significant after FDR correction (minimum $q = 0.063$). In Group 2, 13 features were nominally significant, with absolute rank-biserial correlations of 0.44-0.53; none remained significant after FDR correction (minimum $q = 0.237$).

Conclusion: No PET radiomic feature differed significantly between bone and soft-tissue lesions within either SUV stratum after multiple-testing correction. These findings indicate no detectable tissue-specific radiomic differences in this cohort after SUV stratification. Larger, balanced studies are needed to assess the reproducibility of PET radiomic features across lesion tissue types.

Keywords: Ewing sarcoma; [^{18}F] FDG PET/CT; Radiomics; SUV stratification; Tissue heterogeneity

A90 Inter-cycle dosimetric variability of ^{177}Lu -DOTATATE in metastatic neuroendocrine tumors

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Introduction: This study assessed how the absorbed dose rate in tumors at 24 hours post-injection varies from one cycle to another during ^{177}Lu -DOTATATE therapy. Cycle-dependent changes were quantified using Monte Carlo simulations based on patient-specific data.

Methods: A total of five individuals with neuroendocrine tumor metastases were included in the study. Each patient underwent four cycles of ^{177}Lu -DOTATATE therapy, with a constant administered activity of 7.4 GBq per cycle. Single-photon emission computed tomography (SPECT) was performed 24 hours after every injection. Voxel-level tumor dosimetry was carried out using a Monte Carlo framework. Overall, 92 absorbed dose evaluations were obtained across 25 distinct lesions throughout all treatment cycles.

Results: A statistically significant reduction in tumor volume was observed over the course of treatment ($F(3, 21.5) = 4.11$, $p = 0.019$). For the 25 evaluated lesions, the percentage change in total tumor absorbed dose across cycles varied from 26.0% to 114.4%, with a mean of $63.4\% \pm 27.4\%$ and a median of 63.2%.

Conclusion: A notable finding was that tumor absorbed dose changed considerably from one cycle to another, even though the injected activity was identical in all cycles. This underscores the need for patient-specific activity prescription and cycle-by-cycle dosimetric evaluation in ^{177}Lu -DOTATATE therapy. The results support moving from fixed-activity protocols toward individualized, imaging-based, dosimetry-guided treatment planning.

Keywords: Dosimetry; ^{177}Lu -Dotatate; Neuroendocrine tumor

A91 Preliminary [^{18}F]FET PET/CT findings for preoperative glioma characterization: correlation with MRI and histopathology

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Introduction: Gliomas show marked heterogeneity in biological behavior and prognosis. Although MRI remains the standard modality for preoperative assessment, reliable grading may be challenging, particularly in indeterminate lesions. [^{18}F]FET PET/CT provides metabolic information and may improve lesion characterization beyond structural imaging. This study evaluated preliminary dynamic [^{18}F]FET PET/CT findings in preoperative glioma patients and correlated them with MRI and histopathology.

Methods: Five patients with suspected glioma underwent 50-min list-mode [^{18}F]FET PET/CT. Data were reconstructed into 5-min frames and analyzed using two-time windows (10–20 and 40–50 minutes) for dual-time-

point assessment. Lesion SUVmax and tumor-to-background ratio (TBR) were measured and compared with preoperative MRI and postoperative histopathology.

Results: Quantitative values varied between patients. All lesions showed rapid early uptake followed by relative late retention, without rapid washout. Early SUVmax was 3.73-6.83 and late SUVmax 3.97-6.73; early TBR was 2.04-3.93 and late TBR 2.11-4.49. MRI suggested high-grade glioma in four patients and was indeterminate in one, later diagnosed as oligodendroglioma, CNS WHO grade 2. Histopathology showed three glioblastomas, CNS WHO grade 4, and one oligodendroglioma, CNS WHO grade 2; one result was pending. The shared qualitative pattern, despite variable absolute measures, suggests complementary biological information from [¹⁸F]FET PET/CT.

Conclusion: In this small preliminary series, preoperative [¹⁸F]FET PET/CT provided metabolic information complementary to MRI and histopathology. Rapid early uptake with relative retention and no rapid washout was observed in all lesions. These findings support the feasibility of dynamic and shortened dual-time-point imaging, but do not establish grading utility. Larger prospective studies are needed to validate kinetic parameters and assess incremental value for glioma characterization.

Keywords: Fluoroethyl-L-tyrosine; Positron emission tomography computed tomography; Glioma; Magnetic resonance imaging

A92 Comparative evaluation of deep learning architectures for ultra-low dose CT scans

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Introduction: Ultra-Low-dose computed tomography (ULDCT) imaging offers the advantage of reduced radiation exposure but is associated with increased image noise and degradation in image quality, which may limit diagnostic utility. Deep learning-based image-to-image translation has been increasingly investigated as an approach for transforming ULDCT images toward standard-dose CT (SDCT) quality. Therefore, we evaluated several deep learning approaches for ULDCT-to-SDCT image translation.

Methods: In this study, three deep learning architectures, a Residual U-Net, Pix2Pix, and a Swin Transformer-based network (Swin-Net), were evaluated for ULDCT-to-SDCT reconstruction. The dataset comprised repeated CT acquisitions from 16 patients, with 11 patients included in the final analysis, and low-dose acquisitions obtained at 10–30 mA and 120 kV. The data were divided on a patient-wise basis into 2851 training, 548 validation, and 702 test slices. Image-to-image translation performance was evaluated using quantification parameters such as PSNR and SSIM, with additional error-based metrics used for further analysis.

Results: Swin-Net achieved the highest PSNR of 33.67 dB, while Residual U-Net achieved the highest SSIM of 0.9680. Pix2Pix obtained lower performance, with a PSNR of 32.29 dB and SSIM of 0.9210. Qualitative examination of the reconstructed images additionally revealed residual streak artifacts and localized structural differences that were not always apparent from the global quantitative metrics.

Conclusion: The results highlight discrepancies between quantitative image-similarity metrics and the qualitative appearance of reconstructed images, emphasizing the limitations of relying solely on global numerical metrics for ULDCT-to-SDCT image translation. These findings support the need for more transparent and interpretable evaluation strategies, including explainable AI (XAI), particularly for medical imaging applications where image fidelity and anatomical preservation are critical.

Keywords: Ultra-Low-dose computed tomography; Image translation; Swin-Net; Pix2pix; Residual U-Net; Deep learning

A93 Myocardial fibroblast activation on ⁶⁸Ga-FAPI PET/CT as a prognostic marker in coronary artery disease-related cardiac dysfunction

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Introduction: ⁶⁸Ga-FAPI PET/CT is an imaging modality for assessing myocardial fibroblast activity and may provide prognostic information in cardiac disease. This study investigated whether myocardial FAPI uptake can

predict functional recovery after revascularization and short-term cardiac outcomes in patients with left ventricular dysfunction secondary to coronary artery disease (CAD).

Methods: In this cohort study, 20 patients with impaired left ventricular function underwent ^{99m}Tc-MIBI SPECT/CT, ¹⁸F-FDG PET/CT, and ⁶⁸Ga-FAPI PET/CT imaging. Total myocardial, remote myocardial, and hibernating myocardial FAPI uptake were assessed and compared with baseline ejection fraction (EF), post-revascularization EF, change in EF (Δ EF), and the occurrence of cardiac events. Statistical analyses included the Wilcoxon signed-rank test and Spearman correlation.

Results: Total FAPI uptake was not significantly associated with the FDG-MPI abnormality score ($p = 0.089$). Neither baseline FAPI uptake nor uptake in remote or hibernating myocardium showed a significant correlation with baseline EF or changes in EF following revascularization. In contrast, higher FAPI uptake in myocardial and remote regions was significantly associated with subsequent cardiac events and the need for therapeutic intervention.

Conclusion: Baseline myocardial FAPI uptake does not appear to reliably predict EF or functional recovery after revascularization. However, increased FAPI uptake, particularly in myocardial and remote regions, may serve as a potential marker of increased risk for adverse cardiac events in patients with CAD and left ventricular dysfunction. Larger multicenter studies using standardized quantitative imaging approaches are warranted to further establish the prognostic value of ⁶⁸Ga-FAPI PET/CT.

Keywords: Coronary artery disease; ⁶⁸Ga-FAPI; PET/CT; Prognosis

A94 Fifty shades of PSMA-avid rib lesions: A comprehensive review

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Introduction: While prostate-specific membrane antigen (PSMA)-targeted imaging has revolutionized metastatic detection, unspecific bone uptake (UBU)—particularly in the ribs—is a common but diagnostically challenging finding in prostate cancer (PCa) patients. This review aims to synthesize current evidence on PSMA-avid rib lesions in PCa and to propose a structured approach for differentiating true metastases from benign mimics.

Methods: A comprehensive literature search across PubMed, EMBASE, Scopus, and Web of Science identified relevant studies on PSMA imaging interpretation, tracer-specific patterns, rib lesion morphology, and clinical correlates. Data on uptake intensity, CT features, lesion number, location, tracer type, patient-specific risk factors, and follow-up behavior were extracted and analyzed.

Results: Most solitary rib lesions are benign, particularly in low-risk patients or when located in the anterior/lateral arcs. Metastatic lesions are more likely to present as multiple foci, show cortical destruction on CT, exhibit high uptake intensity, and occur in patients with elevated PSA, high Gleason score, or ongoing androgen deprivation. ¹⁸F-PSMA-1007 is especially prone to UBU in the ribs compared to ⁶⁸Ga-PSMA-11. Based on these variables, we propose a clinical decision tree to guide interpretation of PSMA-avid rib lesions.

Conclusion: Accurate interpretation of rib lesions on PSMA PET/CT requires a multimodal, context-sensitive approach. Our diagnostic decision tree guides precise differentiation of benign versus metastatic rib lesions, enhancing staging accuracy and clinical decision-making. Biomarker-guided therapies offer potential for personalized treatment, though rib-specific validation remains a critical need.

Keywords: Prostate cancer; PSMA PET/CT; Rib metastasis; Unspecific bone uptake

A95 Can ^{99m}Tc-HYNIC-PSMA-11 SPECT/CT localize the intra-prostatic tumor? A single-center study

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Introduction: PSMA PET/CT has a comparable accuracy to multiparametric MRI for detecting intra-prostatic lesions. However, data are limited regarding the value of uptake intensity and modified PRIMARY-like score using 99mTc-HYNIC-PSMA-11 SPECT/CT for localization of the intra-prostatic tumor, correlated with trans-rectal ultrasonography-guided (TRUS) biopsy histopathological findings.

Methods: In this retrospective study, 99mTc-HYNIC-PSMA-11 SPECT/CT scans of 97 treatment-naïve patients referred for staging were assessed in a blinded manner. The tumor-to-liver ratio (TLR) was calculated as the highest prostate tumoral uptake relative to the liver, and, for each patient, a modified PRIMARY-like score was reported. Each prostate gland was divided into six sextants according to the mITNM criteria, and the readers were asked to indicate whether the tumor involved each sextant. The results of the systematic biopsy were correlated with the scan results.

Results: The patients had a mean age of 67.0 ± 7.3 years and a PSA level of 24.4 ± 25.6 . Of the 582 evaluated sextants, 354 (60.8%) were reported as cancerous on pathology and 324 (55.7%) as PRIMARY-positive (score >2) on scan. Regarding ISUP grade group (GG) ≥ 1 , ≥ 3 , and ≥ 4 , the reader's accuracy did not change significantly (63.6%, 69.1%, and 58.9%, respectively). The best AUC achieved for TLR, and the modified PRIMARY-like score was 0.864 and 0.784 for the prediction of ISUP ≥ 2 , respectively.

Conclusion: The best discriminatory thresholds for TLR and modified PRIMARY-like score using 99mTc-HYNIC-PSMA-11 SPECT/CT are achieved when differentiating ISUP GG 1 from ≥ 2 . Overall, 99mTc-HYNIC-PSMA-11 SPECT/CT can be a valuable diagnostic option for patients with newly diagnosed prostate cancer.

Keywords: ^{99m}Tc-HYNIC-PSMA-11; SPECT/CT; Intra-prostatic tumor; PRIMARY-like score

A96 A digital twin for multiscale dosimetry of ¹⁷⁷Lu/²²⁵Ac-PSMA radioligand therapy

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Radiopharmaceutical therapies (RPTs), particularly ¹⁷⁷Lu- and ²²⁵Ac-labeled PSMA radioligands, have shown promise in treating metastatic castration-resistant prostate cancer (mCRPC), yet complete tumor eradication remains limited by tumor heterogeneity and the absence of fully personalized dosimetry. To address these challenges, this study develops a computational digital twin framework that integrates physiologically based pharmacokinetic (PBPK) modeling with convection-diffusion-reaction (CDR) equations to capture both temporal and spatial dimensions of radiopharmaceutical distribution within tumors. A heterogeneous microvascular network, generated to represent tumor-induced angiogenesis, provides the structural basis for coupling these models across subcellular (fibronectin, tumor angiogenesis factor signaling), cellular (endothelial cell migration, radiopharmaceutical uptake), and tissue-level scales. Using this framework, we simulate the spatiotemporal distribution of ¹⁷⁷Lu-PSMA and ²²⁵Ac-PSMA within tumors and generate corresponding planar images via Monte Carlo simulation. Dosimetric analysis is then performed on both the true spatiotemporal distributions and the simulated planar images, allowing direct comparison between idealized and clinically realistic imaging-based dose estimates. Microdosimetry and radiobiological simulations, coupled with the PBPK model, are further used to calculate biologically effective dose (BED) and RBE-weighted absorbed dose. By comparing these outputs, we identify which Dose Volume Histogram (DVH) features best predict therapeutic response and examine how cellular-level heterogeneity in radiopharmaceutical uptake influences radiobiological damage. This integrated modeling approach offers a step toward individualized treatment planning in radiopharmaceutical therapy.

Keywords: Digital twin; Radiopharmaceutical therapies; ¹⁷⁷Lu-PSMA; ²²⁵Ac-PSMA

A97 Prognostic impact of liver metastases on [¹⁷⁷Lu]Lu-PSMA therapy outcomes in metastatic castration-resistant prostate cancer

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Introduction: This study assessed the efficacy, safety, and laboratory changes of lutetium-177 [¹⁷⁷Lu]Lu-PSMA-617 in metastatic castration-resistant prostate cancer (mCRPC) patients with liver metastasis.

Methods: Retrospective cohort of 208 mCRPC patients stratified by baseline liver metastasis status. Eligibility required confirmed mCRPC, PSMA-avid lesions, and ECOG score of 0–2. Liver metastases were identified via contrast-enhanced CT, magnetic resonance imaging (MRI) or [⁶⁸Ga]Ga-PSMA PET/CT. Primary endpoints: overall survival (OS) and PSA progression-free survival (PSA-PFS). Secondary endpoints: PSA50 response rate (≥ 50.0% PSA decline), laboratory trends, and Common Terminology Criteria for Adverse Events (CTCAE) v5.0 toxicities. Comparisons used Mann–Whitney, Fisher’s exact, and t-tests. Survival estimated via Kaplan–Meier, parameter changes via analysis of variance (ANOVA), and prognostic factors via Cox regression.

Results: Twenty-five patients (12.0%) had liver metastases. Median follow-up: 9.0 months (95% confidence interval [CI]: 7–11). Cohort median OS: 14.0 months (95% CI: 12–20). Liver metastases group showed shorter OS (6.0 vs 18.0 months, $p < 0.001$) and independent prognostic impact (hazard ratio [HR] = 2.53, 95% CI: 1.41–4.55, $p = 0.002$). Median PSA-PFS: 7.0 months overall, shorter with liver metastases (3.25 vs 8.0 months). PSA50 response: 50.8% overall, similar between groups (47.0% vs 51.4%). Grade 3–4 hematologic/renal toxicities were rare and comparable across subgroups.

Conclusion: Liver metastases strongly predict worse survival and shorter biochemical control in mCRPC patients treated with [¹⁷⁷Lu]Lu-PSMA-617. Nevertheless, approximately 50.0% of liver-metastatic patients achieved clinically meaningful PSA responses, and the treatment was well tolerated with low severe toxicity. Results indicate visceral disease primarily impacts efficacy rather than safety, supporting ongoing use of [¹⁷⁷Lu]Lu-PSMA-617 in this population.

Keywords: Metastatic castration-resistant prostate cancer; Lutetium-177; Liver metastases; Radioligand therapy; Overall survival

A98 Efficacy and safety of Lutetium-177 (¹⁷⁷Lu)-PSMA-617 in metastatic castration-resistant prostate cancer patients with superscan pattern: A retrospective cohort study

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Introduction: Lutetium-177 (¹⁷⁷Lu)-PSMA-617, a targeted radioligand therapy, has demonstrated significant survival benefits in patients with metastatic castration-resistant prostate cancer (mCRPC). Its application in patients with a superscan pattern, indicative of extensive skeletal metastases, is less studied due to concerns about hematologic toxicity from bone marrow involvement.

Methods: This study analyzed 133 mCRPC patients treated with ¹⁷⁷Lu-PSMA-617, divided into Superscan and Non-superscan groups. PSA response (≥50% decline), PSA progression free survival (PFS), overall survival (OS), and treatment safety were assessed.

Results: Among 133 patients, 17 (12.8%) exhibited a superscan pattern. The overall PSA response rate was 45.8%, (47.0% in the superscan group versus 45.6% in the non-superscan group; $p = 0.485$). Median PSA PFS was 8 months overall (95% CI: 5.5–10.4), with 4 months (95% CI: <1–10.5) in the superscan group and 8 months (95% CI: 5.6–10.3) in the non-superscan group ($p = 0.311$). Median OS was 13 months overall (95% CI: 8.6–17.3), with 6 months (95% CI: <1–18.7) in the superscan group and 14 months (95% CI: 9.3–18.6) in the non-superscan group ($p = 0.052$). Significant but manageable decreases were seen in platelet (PLT) and Alkaline phosphatase (ALP), and no significant changes in Hemoglobin (Hb), white blood cells (WBC), Lactate dehydrogenase (LDH), or creatinine, with no differences between superscan and non-superscan groups. Baseline hemoglobin was a significant

predictor of OS (HR = 0.6, $p = 0.001$), while superscan pattern did not show statistical differences (HR = 1.0, $p = 0.949$).

Conclusion: This retrospective study suggests that ^{177}Lu -PSMA-617 is a feasible and safe radioligand therapy for mCRPC patients with a superscan pattern, showing comparable PSA response rates to non-superscan patients.

Keywords: Superscan; ^{177}Lu -PSMA; Radioligand therapy; Prostate cancer

A99 Beyond SUV: An educational and methodological review of dynamic PET kinetic analysis and parametric imaging

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Conventional static PET provides a single-time-point estimate of radiotracer uptake, commonly summarized by standardized uptake value (SUV), but it cannot fully characterize tracer delivery, transport, binding, metabolism, or retention. Dynamic PET overcomes this limitation by acquiring time-resolved data and enabling quantitative kinetic analysis. This review summarizes the principal steps of dynamic PET quantification, from input-function determination and tissue time–activity curve (TAC) extraction to kinetic modeling and parametric imaging. Plasma input functions may be obtained by arterial blood sampling, image-derived input functions, or population-based approaches. Major analysis strategies include compartmental modeling, graphical methods, and non-compartmental or data-driven techniques. Compartmental models estimate physiologically meaningful rate constants such as K_1 , k_2 , k_3 , and k_4 . Graphical approaches simplify kinetic estimation; Patlak analysis is used for effectively irreversible uptake to estimate the net influx rate (K_i), whereas Logan analysis is applied to reversible kinetics to estimate total distribution volume (VT). Data-driven and spectral approaches provide flexible characterization of heterogeneous kinetics without imposing a rigid compartment structure. Emerging artificial intelligence methods may further enable direct estimation of kinetic parameters and parametric maps from dynamic PET data. Dynamic PET therefore extends molecular imaging beyond SUV by providing biologically specific quantitative biomarkers. Reliable clinical translation requires accurate input functions, appropriate temporal sampling, robust TAC extraction, model selection consistent with tracer biology, and methodological standardization.

Keywords: Dynamic PET; kinetic modeling; Input function; Time–activity curve; Patlak analysis; Logan analysis; Compartmental modeling; parametric imaging

A100 Prognostic value of interim post-treatment SPECT/CT following [^{177}Lu]Lu-PSMA therapy in patients with metastatic castration-resistant prostate cancer: A systematic review and meta-analysis

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Introduction: Lutetium-177 (^{177}Lu)-PSMA radioligand therapy (RLT) is established for metastatic castration-resistant prostate cancer (mCRPC), but radiologic monitoring during the treatment lacks standardization. While interim PSMA PET/CT offers accuracy, post-treatment ^{177}Lu -PSMA SPECT/CT provides practical advantages for early response assessment. This systematic review and meta-analysis evaluate the prognostic value of interim post-treatment SPECT/CT parameters on survival outcomes in mCRPC patients.

Methods: Following PRISMA guidelines and PICO framework, PubMed/MEDLINE, Scopus, and Google Scholar were searched up to December 2025 for studies on mCRPC patients receiving ^{177}Lu -PSMA RLT with early post-treatment SPECT/CT. Inclusion required cohort designs reporting hazard ratios (HRs) for overall survival (OS) and PSA-progression-free survival (PSA-PFS). Data extraction included study characteristics, imaging protocols, and outcomes. Quality was assessed using the Oxford CEBM tool. Random-effects meta-analysis pooled HRs; heterogeneity (I^2) and publication bias (funnel plots, Egger's test, trim-and-fill) were evaluated.

Results: Seven studies (648 patients) were included. Pooled HRs showed emerging new lesions associated with worse OS (HR=2.78, 95% CI: 1.91–4.06, $p<0.001$) and PSA-PFS (HR=4.72, 95% CI: 1.57–14.15, $p=0.006$). Total tumor volume (TTV) increases predicted inferior OS (HR=1.80, 95% CI: 1.29–2.50, $p<0.001$) and PSA-PFS (HR=2.86, 95% CI: 2.12–3.85, $p<0.001$). SUVmean and SUVmax reductions were non-significant. Heterogeneity was low-moderate and publication bias had minimal impact post-adjustment.

Conclusion: Interim ^{177}Lu -PSMA SPECT/CT offers prognostic insights, with new lesions and TTV increases signaling poor outcomes. Standardization and prospective validation are needed to integrate it into clinical practice.

Keywords: [^{177}Lu]Lu-PSMA therapy; SPECT/CT; mCRPC; Interim imaging; Prostate cancer

A101 Optimization of ^{177}Lu -3BP-227 radiolabeling for neurotensin receptor-1 targeted radionuclide therapy

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Introduction: In recent years, targeted radionuclide therapy (TRT) using lutetium-177 (^{177}Lu)-based radiopharmaceuticals has attracted considerable attention in nuclear medicine and oncology, providing opportunities for personalized molecularly targeted cancer therapy. 3BP-227 is a novel non-peptide antagonist targeting neurotensin receptor 1 (NTR1) that can be labeled with ^{177}Lu and has emerged as a promising NTR1-targeted radioligand for the treatment of NTR1-expressing malignancies. Preclinical and early clinical studies have demonstrated the therapeutic potential of ^{177}Lu -3BP-227, particularly in NTR1-positive tumors. Therefore, optimization of the radiolabeling conditions of 3BP-227 with ^{177}Lu is an important step toward its further development as a potential radiopharmaceutical for NTR1-targeted radionuclide therapy. This study aimed to optimize the radiolabeling of the novel NTR1-targeting agent 3BP-227 with ^{177}Lu by evaluating key radiolabeling parameters, including ligand amount, buffer composition, radioactivity, and reaction time.

Methods: The radiolabeling of 3BP-227 with ^{177}Lu was investigated by varying the amount of 3BP-227, buffer composition, radioactivity, and reaction time. Radiochemical purity (RCP) was evaluated under different labeling conditions to determine the optimal radiolabeling parameters.

Results: The highest radiochemical purity of ^{177}Lu -3BP-227 was achieved using gentisic acid and sodium ascorbate under optimized conditions at 95 °C for 45 minutes. Optimization of the 3BP-227 volume further demonstrated that 50 μL was the optimal volume for achieving the highest radiochemical purity.

Conclusion: The optimized radiolabeling conditions demonstrated that 3BP-227 can be efficiently labeled with ^{177}Lu under controlled conditions. These findings provide a promising basis for further preclinical evaluation of ^{177}Lu -3BP-227 as a potential NTR1-targeted radiopharmaceutical for targeted radionuclide therapy.

Keywords: 3BP-227; ^{177}Lu ; NTR1; Radiolabeling, Targeted radionuclide therapy

A102 Clinical impact of uptake time on FDG PET/CT interpretation in lymphoma

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Introduction: Uptake time is a key factor influencing fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) findings in lymphoma. Variations in the interval between tracer injection and image acquisition may affect standardized uptake values (SUVs), lesion detectability, and response assessment. This review summarizes current evidence regarding the clinical impact of uptake time on FDG PET/CT interpretation in lymphoma.

Methods: A literature review was conducted using published studies and international guidelines evaluating the effects of uptake time on quantitative PET parameters, delayed imaging, Deauville score, and treatment response assessment in Hodgkin and non-Hodgkin lymphoma.

Results: The reviewed studies consistently showed that prolonged uptake time generally increases FDG uptake in lymphoma lesions, resulting in higher SUV values, while background activity changes less markedly. Delayed imaging may improve lesion conspicuity and lesion-to-background contrast in selected patients, although its routine use is not supported by current evidence. Standardization of uptake time was repeatedly identified as essential for reliable quantitative measurements and consistent Deauville-based response assessment. The literature also highlights that inflammatory uptake remains an important source of false-positive findings regardless of imaging timing.

Conclusion: Current evidence indicates that uptake time has a significant impact on quantitative PET measurements and clinical interpretation in lymphoma. Standardized imaging protocols are essential for accurate response assessment, while delayed imaging appears most valuable in selected clinical situations rather than routine practice.

Keywords: FDG PET/CT; Lymphoma; Uptake time; Deaville score; Response assessment

A103 Treatment discontinuation in metastatic castration-resistant prostate cancer patients treated with [¹⁷⁷Lu]Lu-PSMA-617: A retrospective real-world study

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Introduction: Despite the efficacy of Lutetium-177 (¹⁷⁷Lu)-PSMA-617 in Metastatic Castration-Resistant Prostate Cancer (mCRPC), high discontinuation rates limit its therapeutic potential. This study aimed to characterize discontinuation reasons, timing, predictive factors, and survival impact in a real-world cohort.

Methods: We retrospectively analyzed 208 mCRPC patients treated with ¹⁷⁷Lu-PSMA-617 between 2017 and 2024. Discontinuation was defined as cessation before six cycles. Reasons were categorized as disease progression, serious adverse events, patient-related factors, physician decision, death, or miscellaneous. Early discontinuation was defined as <3 cycles. Logistic regression and Cox models identified predictors of discontinuation and overall survival (OS).

Results: Median cycles received were 3 (IQR 2–5); 169 patients (81.2%) discontinued, with 92 (44.2%) early discontinuations. Disease progression (43.8%) and serious adverse events (21.9%) were leading causes. Multivariate analysis revealed baseline creatinine (OR 5.50, P=0.050) and ALP (per 100 U/L; OR 1.12, P=0.032) predicted overall discontinuation, while Gleason score (OR 2.11, P=0.009), hemoglobin (OR 0.62, P<0.001), and platelet counts (OR 0.54, P=0.004) predicted early discontinuation. Median OS was 13 months overall, 11 months in discontinuers vs. 22 months in completers (P<0.001), and 5 vs. 20 months in early vs. non-early groups (P<0.001). Treatment discontinuation (HR 1.95, P=0.001) and hemoglobin (HR 0.68, P<0.001) independently predicted OS.

Conclusion: Over 80% of mCRPC patients discontinued ¹⁷⁷Lu-PSMA-617, driven by progression and toxicity, with early discontinuation linked to aggressive disease and poor hematologic reserve. Discontinuation independently worsens survival, emphasizing the need for careful selection and supportive interventions to improve adherence and outcomes.

Keywords: Metastatic castration-resistant prostate cancer; ¹⁷⁷Lu-PSMA-617; Treatment discontinuation; Overall survival; Predictive factors

A104 Beyond six cycles: Efficacy and safety of extended ¹⁷⁷Lu-PSMA radioligand therapy in metastatic castration-resistant prostate cancer

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Introduction: Standard ¹⁷⁷Lu-PSMA radioligand therapy (RLT) for metastatic castration-resistant prostate cancer (mCRPC) comprises 6 cycles. Evidence on extending treatment beyond this course is limited. To compare efficacy and safety of extended (>6 cycles) versus standard (6 cycles) ¹⁷⁷Lu-PSMA RLT in mCRPC.

Methods: In this retrospective double-center cohort study, patients with mCRPC who received ≥6 cycles of ¹⁷⁷Lu-PSMA RLT were stratified into Standard (n=12) and Extended (n=33) groups based on continued clinical benefit without unacceptable toxicity. Endpoints included PSA50 response, PSA progression-free survival (PSA-PFS), overall survival (OS, via 9-month landmark analysis), and CTCAE v5.0-graded toxicity.

Results: Forty-five patients (median age 70 years) received 306 cycles total. PSA50 response was numerically higher in the Extended group (78.7% vs. 58.3%; p=0.178), and 38.4% of responders achieved a second PSA50

response with additional cycles. Mean PSA-PFS (21.1 vs. 13.1 months; $p=0.173$) and landmark OS (30.6 vs. 21.8 months; $p=0.198$) favored the Extended group without reaching significance. On multivariable analysis, only PSA50 achievement independently predicted improved OS (HR 0.178, 95% CI 0.05–0.54; $p=0.003$), cycle number did not. Grade 3-4 adverse events were infrequent, confined to the Extended group (anemia 9.1%, leukopenia 3.0%), with no significant rise in toxicity during extended cycles and no treatment-related deaths.

Conclusion: Extending ^{177}Lu -PSMA RLT beyond 6 cycles in selected patients showed favorable, non-significant trends in response and survival with an acceptable safety profile, supporting individualized extension pending prospective confirmation.

Keywords: ^{177}Lu -PSMA radioligand therapy; Metastatic castration-resistant prostate cancer; Extended treatment cycles; Overall survival

A105 Maximizing diagnostic yield: A systematic review and deep dive into PSMA PET scan protocol variations for prostate cancer

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Introduction: Prostate-specific membrane antigen (PSMA) PET has become a highly accurate imaging modality for prostate cancer (PCa), demonstrating superior diagnostic performance. However, substantial variability exists in imaging protocols beyond standard time-point acquisition, and the clinical value of these variations remains unclear. The aim of this study is to systematically review and compare PSMA PET protocols in PCa patients, focusing on detection rates and potential advantages, using extracted data from published studies.

Methods: A systematic review was conducted in PubMed and Scopus through August 2025 for studies evaluating various PSMA PET protocols, including early, delayed, diuretic-aided, and hybrid/multiphasic imaging. Eligible studies included original research comparing these approaches with standard imaging.

Results: Ninety-seven studies ($n = 8,428$ patients) were included. Early imaging improved visualization of prostate bed and peri-bladder lesions, increasing detection of local recurrence by 912% and enhancing tumor-to-background ratios up to fourfold, particularly in biochemical recurrence (BCR) with low PSA levels. Late imaging (24 h post-injection) consistently increased lesion contrast, detected additional lesions (up to 38.5%), and altered staging in up to 66.7% of cases, especially in equivocal or low-PSA settings. Diuretic-aided protocols reduced urinary artifacts, improved diagnostic confidence (63% to 91%), and revealed previously obscured lesions. Hybrid and multiphasic protocols demonstrated incremental gains in sensitivity and specificity, particularly in selected BCR populations, though benefits were context-dependent.

Conclusion: Additional PSMA PET acquisitions provide complementary, scenario-specific diagnostic advantages but yield modest overall incremental benefit. Their judicious use, particularly in low-PSA BCR, equivocal findings, and pelvic disease, is recommended.

Keywords: Prostate-specific membrane antigen PET scan; Prostate cancer; Lasix-aided imaging; Early imaging; Late imaging; Standard acquisition

A106 Synthetic CT generation from Non-Attenuation-Corrected PET brain images using SwinUNETR: A feasibility study

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Introduction: Computed tomography (CT) plays an important role in PET imaging for attenuation correction, anatomical localization, and diagnostic information. However, CT acquisition may not be feasible in dedicated PET-only systems or when minimizing radiation exposure is important, limiting accurate attenuation correction. This study investigates the feasibility of generating synthetic CT images from NAC PET images using a deep learning-based approach.

Methods: In this study, 66 brain FDG PET/CT studies from two hospitals were used to train a SwinUNETR model (MONAI framework). Fifteen percent were reserved for internal validation, and 15 independent studies formed an external test set. CT images were resampled to PET space to account for field-of-view and grid differences, then normalized (CT: divided by 1000; PET: by maximum voxel value). Patient bed and non-head regions were removed. The model was trained for 230 epochs using combined L1/SSIM loss, Adam optimizer (initial LR 10^{-4} , piecewise decay). Performance was evaluated using MAE, PSNR, and SSIM.

Results: On the external test set, the model achieved MAE of 0.1028 ± 0.0040 (normalized HU units), PSNR of 28.41 ± 1.16 dB, and SSIM of 0.9525 ± 0.0110 . Visual inspection showed the synthetic CT images preserved overall cranial anatomy and major bone-air-soft tissue boundaries. However, qualitative assessment revealed blurring and reduced structural detail in fine skull-base structures.

Conclusion: This study demonstrates the feasibility of generating synthetic CT images from NAC PET brain scans using a SwinUNETR-based deep learning model. The proposed approach preserved overall anatomical structure, although further refinement in fine skull-base structures remains an area for improvement. These findings support the potential of deep learning-based CT synthesis to facilitate attenuation correction workflows without additional CT acquisition.

Keywords: Positron emission tomography; Synthetic CT; Deep learning; Medical image translation

A107 Incidentalomas on ¹⁸F-FDG PET/CT: Clinical significance and reporting considerations

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Introduction: Incidentalomas are unexpected lesions or abnormalities detected during imaging performed for unrelated clinical indications. With the increasing use of ¹⁸F-FDG PET/CT in oncologic imaging, incidental findings are encountered frequently and require appropriate recognition and reporting because of their potential clinical significance. To review the spectrum of incidental findings on ¹⁸F-FDG PET/CT and highlight their clinical importance, diagnostic implications, and recommended management strategies.

Methods: A narrative review of the published literature was conducted using major scientific databases, including PubMed and Scopus, focusing on incidental findings detected on ¹⁸F-FDG PET/CT and their reported prevalence, malignancy risk, and recommended diagnostic work-up.

Results: Incidental FDG-avid lesions may represent benign, premalignant, or malignant conditions. One of the most clinically important examples is focal thyroid FDG uptake, which has a reported malignancy rate of approximately 30–50%, warranting further evaluation with thyroid ultrasonography and, when indicated, fine-needle aspiration biopsy. Appropriate characterization and standardized reporting of incidental findings can facilitate timely diagnosis and improve patient management.

Conclusion: Incidentalomas are common on ¹⁸F-FDG PET/CT and should be recognized as clinically relevant findings rather than overlooked observations. Knowledge of their imaging characteristics, differential diagnosis, and evidence-based management recommendations is essential for accurate interpretation, standardized reporting, and optimal patient care.

Keywords: Incidentalomas; ¹⁸F-FDG PET/CT

A108 Alpha-particle therapy: Challenges and solutions in imaging, radiation protection, and dosimetry

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Introduction: Targeted Alpha Therapy (TAT) represents a transformative therapeutic modality in nuclear medicine. Alpha emitters deliver high-linear energy transfer (LET) radiation over a path length of only a few cell diameters, maximizing tumor cell killing while sparing adjacent normal tissues. However, the physical decay chains, recoil effects, and accompanying photon/particulate emissions of therapeutic alpha-emitting radionuclides introduce complex challenges in quantitation, dosimetry, and operational radiation safety.

Methods: This review synthesizes current evidence and technical guidelines regarding clinically relevant alpha emitters, including ²²³Ra and ²²⁵Ac. Key parameters evaluated encompass decay kinetics, daughter radionuclide redistribution due to alpha recoil, SPECT/scintigraphic imaging protocols utilizing low-abundance gamma/X-ray

emissions, quantitative internal dosimetry workflows, and radiation protection strategies for clinical personnel and patient post-treatment management.

Results: Alpha-emitting radionuclides frequently decay through cascade pathways generating radioisotopes with diverse half-lives and chemical behaviors. Alpha recoil often breaks chemical bonds between the radionuclide and chelator, posing risks of daughter redistribution (such as ²¹³Bi in the ²²⁵Ac cascade) to non-target organs. Quantitative imaging of alpha therapies is limited by low photon yields and complex scatter spectra, necessitating optimized energy windows (e.g., dual-peak SPECT acquisition), Monte Carlo simulations, and advanced reconstruction algorithms. Internal dosimetry remains essential to assess therapeutic index and prevent critical organ toxicity. Operationally, despite the short range of alpha particles in tissue, high-energy gamma and beta co-emissions demand robust shielding often comparable to positron-emitting isotopes. Due to high radiotoxicity and high inhalation dose coefficients, radiopharmacy handling mandates specialized containment, including HEPA-filtered hoods, double gloving, and alpha-sensitive contamination monitoring. Furthermore, patient management strategies emphasize controlled excreta handling, specific precautions for incontinence, and systematic protocols for post-treatment hospital or surgical procedures.

Conclusion: Maximizing the therapeutic index of alpha emitters requires an integrated framework combining advanced nuclear physics, precise multi-energy imaging for pharmacokinetic tracking, and rigorous internal dosimetry. Implementing standardized, proactive radiation protection protocols ensures the safe translation and widespread clinical adoption of targeted alpha therapies in routine oncology practice.

Keywords: Targeted alpha therapy; Alpha-emitting radionuclides; Nuclear medicine; Internal dosimetry; Radiation protection; SPECT imaging; Monte Carlo simulation

A109 Bone mineral densitometry in children: Pearls and pitfalls

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Measurement of bone density is an integral part of bone fragility management in pediatrics. Dual Energy X-ray Absorptiometry (DXA) is the most commonly performed method for bone mineral density (BMD) assessment in children. In this chapter various aspects of BMD measurement in children are provided in detail including acquisition, processing, analyzing, and reporting. Special challenges in children including lack of database for comparison, size dependence, size adjustment, and follow up in a growing skeleton have all been addressed.

Key words

Bone mineral density; Dual energy X-ray absorptiometry; DXA, BMC; Children; Pediatric; Bone

A110 Safety and feasibility of lutetium-177 prostate-specific membrane antigen therapy in glioblastoma

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Introduction Glioblastoma (GBM) is the most common primary malignant tumor of the brain with high morbidity and mortality without an effective therapeutic option currently. This study aimed to evaluate the feasibility and safety of [¹⁷⁷Lu] Lu-prostate-specific membrane antigen (PSMA) therapy in patients with progressive/persistent refractory glioblastoma.

Methods This is a prospective single-arm pilot clinical trial with inclusion of 10 patients with progressive/persistent GBM on standard of care therapy. After evaluation of eligibility by [99m Tc] Tc-PSMA single-photon emission computed tomography (SPECT)/low-dose CT, the patients received 2–6 cycles of 100–150 mCi with 4–5 weeks interval, and toxicity was assessed with regular hematologic and renal function tests as well as clinical history and examination. The response to therapy was also evaluated with magnetic resonance imaging (MRI).

Results Among 23 patients who were referred for this trial, 10 patients finally were included and received 3–6 cycles of [¹⁷⁷Lu] Lu-PSMA therapy. No hematologic or renal toxicity was noted. Clinical improvement or stability was seen in 9/10 patients. The comparison of MRI before and after therapy revealed 3 patients with partial response, 4 patients with stable disease and 3 patients with progressive disease. Six-month and 1-year survival rates were 100% and 80% after first dose of [¹⁷⁷Lu] Lu-PSMA therapy.

Conclusion This study demonstrated that [¹⁷⁷ Lu] Lu-PSMA therapy could be a safe and potentially effective salvage therapy in progressive/persistent GBM and should be more evaluated with further dedicated study to assess more precise selection criteria and therapeutic protocol and timing.

Keywords: Glioblastoma; [¹⁷⁷ Lu]Lu-PSMA therapy; [^{99m}Tc]Tc-PSMA; SPECT/CT

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