FDITE217 Basic principles of theranostics

(Zsuzsanna Besenyei)

Description:

During the course students will be acquainted with the concept of theranostics, the integrated application of diagnostic and therapeutic methods in nuclear medicine oncology. The clinical significance of combining imaging procedures with targeted radionuclide therapies, the most important radiopharmaceuticals and their areas of application will be presented.

Topics:

Basic concepts and history of theranostics

- Definition and development of theranostics
- The concept of paired diagnostic and therapeutic radiopharmaceuticals
- Overview of clinical applications

Hybrid imaging in theranostics

- Role of PET/CT and SPECT/CT
- Dosimetry planning and therapeutic response evaluation
- Quantification methods

Radiopharmaceuticals in theranostics

- Diagnostic and therapeutic isotope pairs
- Principles of radiopharmaceutical design
- Pharmacokinetics and biodistribution

Thyroid theranostics

- Radioiodine diagnostics and therapy
- Treatment of differentiated thyroid cancer
- Dosimetry and side effects

Theranostics of neuroendocrine tumors I. - Diagnostics

- Somatostatin receptor imaging
- Ga-68 DOTATATE/DOTATOC PET/CT

- Patient selection for therapy

Theranostics of neuroendocrine tumors II. - Therapy

- Peptide receptor radionuclide therapy (PRRT)
- Lu-177 DOTATATE treatment
- Monitoring of therapeutic response

Prostate theranostics

- PSMA-based imaging (Ga-68 PSMA PET/CT)
- Lu-177 PSMA therapy
- Patient selection and treatment protocols

Treatment of bone metastases

- Bone scintigraphy and PET/CT diagnostics
- Ra-223 alpha-emitter therapy
- Sm-153 and other beta-emitters

Theranostics of lymphomas

- FDG PET/CT in staging and follow-up
- Possibilities of radioimmunotherapy
- Y-90 ibritumomab tiuxetan

Theranostics in neuro-oncology

- Imaging of brain tumors (FDG, amino acid tracers)
- Therapeutic options and clinical trials
- Monitoring and prognosis

Clinical applications of various PET radiopharmaceuticals

- PET tracers beyond FDG in oncology
- PSMA, DOTATATE, FET, FCH, FAPI
- Indications and diagnostic value

Locoregional treatment of liver tumors

- Selective internal radiation therapy (SIRT)
- Y-90 microsphere treatment

- Patient selection and dosimetry

Dosimetry and radiation protection in theranostics

- Principles of patient dosimetry
- Radiation exposure of critical organs
- Protection of personnel and environment

Future directions and case presentations

- Development of new radiopharmaceuticals
- Therapeutic applications of alpha-emitters
- Discussion of complex cases

Literature:

H-J. Biersack, L.M. Freeman (eds.): Clinical Nuclear Medicine, Springer-Verlag 2007, ISBN 978-3-540-28025-5

R. Hustinx, K Muylle (eds.): European Nuclear Medicine Guide, EANM, ISBN 978-90-78876-13-7

Rajendra Prasad, Murali Mohan Yallapu: Advancements in cancer theranostics Spinger 2025 ISBN978-981-95-0937-9