

FDITE222 Theranostics in neurooncology

(Zsuzsanna Besenyi)

Description:

During the course students will be acquainted with nuclear medicine diagnostics of central nervous system tumors and the possibilities of theranostic approaches in neuro-oncology. The application of various PET and SPECT radiopharmaceuticals, the role of molecular imaging in treatment decisions, and innovative therapeutic methods will be presented.

Topics:

Basics of neuro-oncology and imaging challenges

- Classification and epidemiology of primary brain tumors
- Significance of the blood-brain barrier in diagnostics and therapy
- Conventional imaging (MRI, CT) and the role of nuclear medicine

FDG PET/CT in brain tumor diagnostics

- Mechanism of FDG uptake in the brain
- Grading and differential diagnosis of gliomas
- Differentiation between pseudoprogression and true progression

Amino acid tracers in brain tumor imaging

- FET (F-18 fluoroethyl-tyrosine) PET
- FDOPA and other amino acid analogs
- Tumor delineation and biopsy target determination

Molecular characterization of brain tumors

- IDH mutation and other biomarkers
- Correlation of molecular imaging and histology
- Possibilities of personalized diagnostics

Theranostic approach to glioblastoma

- Diagnostic strategies in high-grade gliomas
- Monitoring of therapeutic response

- Recurrence detection and treatment options

Nuclear medicine diagnostics of brain metastases

- Detection of multiple metastases
- Differential diagnosis (metastasis vs. radiation-induced changes)
- Support for therapeutic decision-making

Meningiomas and low-grade tumors

- Role of somatostatin receptor imaging
- Application of DOTATATE PET/CT in meningiomas
- Theranostic possibilities

Peptide receptor radionuclide therapy (PRRT) in neuro-oncology

- Lu-177 DOTATATE treatment of meningiomas
- Patient selection and treatment protocols
- Dosimetry and side effects

Possibilities of radioimmunotherapy

- Monoclonal antibodies in brain tumors
- Intratumoral and intrathecal applications
- Results of clinical trials

Innovative therapeutic approaches

- Alpha-emitter therapies (Ac-225, At-211)
- Development of conjugated radiopharmaceuticals
- Targeted alpha therapy (TAT) in neuro-oncology

CSF metastases and leptomeningeal carcinomatosis

- Diagnostic methods
- Intrathecal radiotherapy
- Theranostic approaches

Support of radiotherapy planning with nuclear medicine

- Determination of biological tumor volume
- FET PET-based radiotherapy planning

- Dose escalation and boosting

Complex case presentations and future directions

- Presentation of multimodal approach through cases
- New radiopharmaceuticals in clinical trials
- Application of artificial intelligence in neuro-oncological imaging

Literature:

C. Aktolm, S.J. Goldsmith: Nuclear Oncology, Lippincott Williams&Wilkins, 2014, ISBN 978-1451186857

A.Varrone, S. Morbelli, V.Garibotto (eds): Clinical nuclear medicine in neurology, Springer-Verlag 2022, ISBN 978-3-030-83600-9