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OPENING LECTURE - Future prospects in diagnostic and therapeutic nuclear medicine

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For the last two decades a technological revolution has deeply changed the field of application of nuclear medicine. Today PET/CT imaging using 18F-Fluorodeoxyglucose (FDG) is considered as the standard imaging technique in oncology for tumor staging, detection of recurrence and early evaluation of response to treatment. PET/MRI could shortly become the standard imaging technique in neurology. Molecular radiotherapy has also made great progress with the rapid development of radioimmunotherapy (RIT) and radiopeptide therapy (RPT).

For diagnostic imaging, FDG radiopharmaceutical is the only one to be used in routine practice but a lot of fluorinated compounds are currently clinically evaluated and some of them will be approved in the coming years. In oncology several fluorinated radiopharmaceuticals, evaluated in ongoing clinical studies, will allow to visualize tumor functions such as apoptosis, tumor neo-angiogenesis, hypoxia etc···and then to better determine optimal therapeutic strategy. In neurology FDA approved in 2012 Amyvid™ (Florbetapir F 18 Injection) for use in patients being evaluated for Alzheimer's disease and other causes of cognitive decline. Amyvid is thus the first radioactive diagnostic agent approved for PET imaging of beta-amyloid neuritic plaques in the brain.

However the use of fluorine-18 for PET imaging has some limitations and innovative positron-emitting radionuclides are needed. Among them, gallium-68, obtained from a germanium-68/gallium-68 generator and copper-64 with relatively short half-lives and zirconium-89 and iodine-124 with longer half-lives have been the most extentively studied radionuclides and will be routinely used in the next years.

For molecular radiotherapy, efficacy of RIT and RPT has been clearly documented in some clinical settings and new radiopeptides and radioconjugates labeled with lutétium-177, yttrium-90 and perhaps copper-67 will likely be approved for treatment of a panel of cancers especially in the most favorable situation of disseminated microscopic residual disease. Finally the use of alpha particle-emitting radionuclides such as astatine-211, lead-212, bismuth-213 or actinium-225 will be developed for treatment of clusters of malignant cells and isolated tumor cells at the very early stage of cancer progression.

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