Theranostics and multimodality imaging

Constantin Lapa, Würzburg

Since the first application of radioiodine for therapy of thyroid cancer in 1946, nuclear medicine has been at the forefront of developing novel theranostic concepts in medicine. Targeting of somatostatin receptors (SSTR) in various diseases represents a well-established approach which has evolved since the early 1990s. Based on randomized controlled clinical trials, SSTR-directed multimodal imaging and therapy has been widely accepted as superior approach for managing patients with advanced NET.

In recent years, prostate specific membrane antigen has gained broad attention as one of the most promising targets for theranostics and is the topic of a multitude of ongoing studies, including therapy with β- and α-emitters. Further receptor ligands like gastrin-releasing peptide receptor antagonists are currently under evaluation as well.

C-X-C motif chemokine receptor 4 (CXCR4), a key player in tumor growth and metastasis, has been successfully addressed in hematologic diseases and is currently investigated as an adjunct to conditioning therapies prior to autologous or allogeneic stem cell transplantation. Interaction of CXCR4 and its ligand SDF-1α plays also a significant role in solid neoplasms and inflammatory conditions such as acute myocardial infarction or stroke. As another target for hematology, CD37-directed therapies using antibody radionuclide conjugates have become feasible as well.

Theranostics using multimodality imaging as basis for treatment planning offer numerous opportunities in metabolic profiling as well as assessment of tumor heterogeneity, facilitating appropriate patient selection and, ultimately, personalized medicine.