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Recent advances in Ga-68 Radiopharmaceuticals and Ga-68 Bisphosphonates for the theranostic management of Neuroendocrine tumours.

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BACKGROUND/GOAL/Objectives of the Study: Renaissance of 68Ga-labelled peptides has given new dimension to theranostic imaging of Neuroendocrine Tumors and Prostate Cancer. The outstanding success of 68Ga-labelled agents in the last decade is primarily due to availability of reliable, long-lived 68Ge/68Ga Generators, extensive automation, development of new macrocyclic linker based 68Ga chemistry, and a huge amount of clinical data in a short time.

METHODOLOGY: Somatostatin receptors are over-expressed in neuroendocrine tumours such as pituitary adenoma, neuroblastoma and small cell lung carcinoma etc. These tumours are diagnosed with 68Ga-DOTA-TATE and are effectively treated with 177Lu-DOTA-TATE. The huge success in the management of neuroendocrine tumours led to rapid development in theranostic approach for prostate cancer mamagement, as there was no specific diagnostic or treatment tool available prior to this agent. Urologists, endocrinologists and oncologists were very excited and they passed on the benefits to the patients, the ultimate winners.

RESULTS & DISCUSSIONS: Availability of ionic 68Ga from the 68Ge/68Ga generator is the key to the recent developments. Equally important is the development of macrocyclic linkers such as DOTA, NOTA etc. The ability of these linkers enabled the scientists to radiolabel a large number of ligands for clinical applications. The most extensively used agents are 68Ga-DOTA-TATE for neuroendocrine tumours, and 68Ga-PSMA for prostate cancer. The bifunctional chelators such as DOTA and NOTA were shown to bind 68Ga and 177Lu with equal efficiency and offered kinetic stability and thermodynamic stability, which is the under-pinning success for theranostic developments in the last decade.
New approaches are developed for Therapy, which includes combined PRRT (with other treatment modalities) such as Chemotherapy (Capecitabine, Doxorubicin), Kinase inhibitors (Sunitinib, Sorafenib), intraoperative use of probes after PRRT with 177Lu and applications. Alpha emitters (eg. 225Ac, 213Bi, and 223Ra) were shown to be highly effective. Frank Roesch's group have shown that Bisphosphonates were good theranostic agents to deliver beta radiation to the bones and soft-tissues to augment therapeutic efficacy.

CONCLUSION:
Recent developments in "Theranostic approach"are the BEST thing to happen in nuclear medicine in the past decade. They have created extensive enthusiasm around the world to apply this technology for the benefit of the patients.

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