Bone cancer – a future perspective, new tracers and new directions in diagnosis

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Bone scintigraphy with technetium-99m (99mTc) bisphosphonates remains an extensively used diagnostic tool in the evaluation of malignant primary or secondary bone tumours in adult and paediatric patients. Upon its great sensitivity in the diagnosis of bone metabolism changes, it enables a total body skeletal image in one single examination. However due to the lack of specificity of these radiotracers, two main strategies are being applied to increase the diagnostic accuracy of our classic "bone scan". One strategy consists in correlating with a morphological imaging another is to improve the tracing agents. The Appropriateness Criteria, established by the American College of Radiology, dictate that for the initial evaluation and characterization of a bone lesion, conventional radiographs should be the first line of imaging. Cross-sectional imaging, such as computed tomography (CT) or magnetic resonance imaging (MRI) combined with single photon emission computed tomography (SPECT) or positron emission tomography (PET) in the hybrid scanners, i.e. SPECT/CT, PET/CT or PET/MR, have gained incremental acceptance. These multimodality imaging techniques allow differentiation between benign and malignant lesions and improve the sensitivity, specificity and diagnostic accuracy in the detection of bone metastases [1]. 123I-mIBG imaging has superseded the use of 99mTc-technetium bone scans for the detection of skeletal metastases in the majority of children with neuroblastoma [2]. In the era of possible 99mTc-shortage, cyclotron- or other generator-produced radionuclides have been extensively investigated for the development of new bone-seeking agents. Bone and tumour specific tracers using positron-emitters are being developed in order to increase the relatively poor spatial resolution, limited diagnostic specificity and reduced sensitivity for bone marrow disease of the 99mTc-radiolabelled tracers. We will present an overview of recent clinical applications of PET tracers such as 18F-fluoride (NaF) as a bone-specific tracer, 68Ga-BPAMD (a novel DOTA-based bisphosphonate) as a bone-specific and potential theragnostic agent, metabolic tracers like 18F-FDG and 18F-choline and tumour-specific receptor-targeting tracers like 68Ga-DOTATOC as a known theragnostic in neuroendocrine carcinoma[3], as well as the most recently developed 64Cu-Bombesin antagonist for prostate cancer.

References