New PET Radiopharmaceuticals: Clinical Applications and Pharmaceutical Quality Assurance

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Clinical PET has grown rapidly over the last 15 years, but has been almost exclusively based on 18F-FDG. However, the situation is changing, with wider use of other 18F labelled tracers developed in academic settings, plus the entry of several commercial products. In addition, other positron emitting radionuclides are being introduced.

Academic tracers. 18F-fluoride produces high quality bone scans. There has been great interest in 18F-FLT as a marker of cell proliferation, however there have been problems in validating it as a biomarker. 18F-fluoromethylcholine and 18F-fluoroethylcholine make the results obtained with 11C-choline in prostate cancer more widely available [1].

Commercial tracers. Last year we saw the licensing of two 18F-labelled amyloid agents, Florbetapir (AmyVid) and florbetaben (NeuraCeq), with a third agent, flutemetamol (Vizamyl) likely to be available soon [2]. At present, these three tracers will compete for an uncertain market in ruling out Alzheimer’s disease (AD). However, they could become more important in the future as therapies for AD are developed. Fluciclatide is a marker of angiogenesis (new blood vessel formation) which is a target of some anticancer drugs. Fluciclovine (FACBC) is a synthetic amino acid which shows promise for imaging of prostate cancer [1]. Cardiac PET imaging is expanding with flupiridaz [3] and BFPE for perfusion, CardioPET for fatty acid metabolism, and LMI-1195 for adrenergic innervation.

Other radionuclides. Longer lived positron emitting radionuclides such as 124I and 89Zr are showing promise, particularly for antibody labelling [4]. Generator produced 82Rb is becoming more widely used for myocardial perfusion imaging. A range of tracers labelled with generator produced 68Ga are under evaluation, most notably 68Ga-DOTATOC/DOTATATE and 68Ga-anti-PSMA [5].

Quality assurance. Maintaining pharmaceutical quality is a challenge with short lived positron emitters. However, changes in practice are raising the standards. Many tracers are now prepared with single use disposable sterile cassettes on computer controlled synthesizers [6].

Conclusion. After many years of growth based on the single tracer FDG, PET is broadening its portfolio with new tracers and new indications. Logistical challenges remain in provision of a range of tracers but these are being overcome. Safety and efficacy remain the primary objectives.

References: