Use of PET & PET/CT in the prognostic evaluation of tumour behaviour

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The clinical use of PET in oncology continues to increase worldwide due to the availability of hybrid PET/CT scanners, ^{18}F-FDG and a growing amount of evidence supporting investment in technology and training of professionals. PET and PET/CT is useful for diagnosing and staging a variety of cancers and this is the reason why most PET scans are performed. Accurate staging potentially optimizes therapy and is prognostically important. In addition, PET is a quantitative technology and metabolic processes within the tumour can be measured before and during therapy. Finally, PET is a universally applicable technology and novel tracers are being developed for clinical situations where FDG alone is not enough.

A large majority of PET scans are currently performed as a diagnostic routine to guide clinical decisions regarding treatment options. Historically, PET has been especially useful for evaluating the spread of disease. There are numerous examples of whole-body PET scans showing distant metastatic disease, eliminating the option of local treatment with surgery or radiotherapy for curative intent. On the other hand, anatomical imaging with CT is often required to investigate the relation of the tumor towards adjacent structures. Both modalities are therefore required for optimal staging and the increased diagnostic accuracy often provides opportunities for more advanced and individualized treatments.

PET scanners measure the regional concentration of tracer rather than relative count distribution. In the clinical setting, such measurements might be useful either alone or in combination with CT for tumour characterization and for earlier decisions regarding change of therapy. The magnitude of tracer uptake in some tumours can provide information on malignancy grade (brain tumours) and cellular differentiation (lung cancer), relevant for prognosis in the individual patient. In some tumour types (Hodgkin's lymphoma, GIST etc) treatment evaluation with FDG-PET has already become clinically accepted. Some recent trials indicate that FDG can predict treatment response also in some more common cancers (lung, colon). It is generally perceived that imaging using PET and PET/CT will have a role beyond the use of CT alone in evaluation of response to novel targeted drug therapies. Basic concepts of tumour treatment response evaluation using PET and CT will be covered in the lecture.

Tumour biology is complex and glucose uptake as studied by FDG is not the optimal tracer in all patients. Numerous experimental tracers for imaging of other aspects of tumour behavior have been tested in clinical trials, both for diagnosis and for treatment evaluation, and some are beginning to gain wider acceptance. As new targeted drugs for smaller populations are being developed, PET scanning with new targeted tracers and more advanced imaging protocols might be needed to optimize patient prognosis.