INSIDE TODAY


Intraoperative imaging brings hospital-wide changes
See page 12


CT proves superior, but is not totally dominant, in renal tract imaging
See page 13


Pinpointing airway obstruction remains tough prospect for chest experts
See page 14

Hybrid and functional techniques pull ahead in musculoskeletal race

By Frances Rylands-Monk

Major developments in visualising tumour biology before and during treatment are likely to have a substantial impact on selecting, monitoring and guiding a specific therapy in individual patients with musculoskeletal (MSK) neoplasms – and because developments are happening so quickly, the contents of today's special focus session are highly relevant to all practising radiologists, according to speakers.

The current role of MRI in managing patients with MSK tumours is clear due to the published literature, but for newer techniques, this is not the case, explained Prof. Hans Bloem, head of imaging at Leiden University Medical Center, The Netherlands. After techniques to image gene expression of tumour biology have become more developed, researchers must prove their efficacy before they can ultimately be cost-effective and have an impact on patient survival and well-being or morbidity.


Prof. Joan C. Vilanova from Girona, Spain

The specific guidelines for staging MSK tumours follow those of the Enneking/Musculoskeletal Tumor Society or the American Joint Committee on Cancer. Although imaging plays an important role, a specific imaging guide is not widely applied because protocols tend to vary vastly between departments.

"The drawbacks of the advanced techniques are that they are not always available and the radiologist does not always know the impact of them," said Prof. Joan C. Vilanova, head of imaging at Clínica Girona, Spain, the moderator of this morning's special focus session. "It is hard to produce clear guidance as it is difficult to achieve a consensus. One of the objectives of the session, besides reviewing the latest approaches to MSK work-up, is to improve and update the guidelines in line with new imaging techniques."

It will be up to doctors how they translate these guidelines to their own practices.

"PET/CT is good for whole-body scanning, but as not all big hospitals have it, radiologists should know how to perform whole-body MRI with almost the same accuracy. Doctors must adapt and optimise existing resources to improve the diagnosis and produce meaningful reports from a clinical perspective," he noted.

Today's session promises to provide exciting answers to frequently asked questions. Speakers will elucidate on issues such as if there is suspicion of recurrence, should radiologists use PET/CT or MRI? Other responses will deal with the best technique to use for follow-up after new drugs are administered, optimal diagnostic MR sequences and how functional techniques can be used in routine clinical follow-up. ECR delegates can also listen to a debate that concerns hospitals with both PET/CT and advanced MRI, and hear which is best for follow-up imaging after surgery and chemotherapy. There are likely to be some surprising and thought-provoking responses.

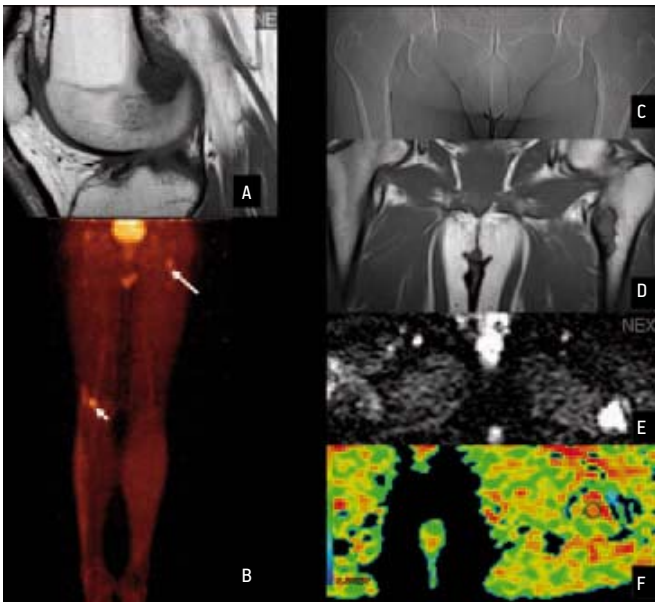
Vilanova points to the advantages of MRI, which since the 1980s has gained ground in morphological imaging and now can provide functional information too. MRI has become his department's modality of choice, because techniques such as dynamic contrast-enhanced perfusion imaging (with colour-coded mapping) and diffusion-weighted imaging (DWI) used together with conventional sequences improve diagnostic accuracy once plain film or ultrasound has yielded a suspicious finding. In addition, MRI can evaluate not only a specific region but also can offer efficient whole-body studies for staging.

Bloem's department also relies heavily on MRI. The combination of high contrast and spatial resolution has made MRI the primary tool in local staging. Dynamic Gd-chelate-enhanced MRI allows assessment of tumour viability for monitoring the effects of chemotherapy on the vascular system, and diffusion imaging can be used for detecting metastases.

"We'll have to see if diffusion MR or FDG/PET will become the standard for detecting metastases, and the race is on," Bloem said. "It is of paramount importance that radiologists and nuclear medicine physicians combine forces in developing cost-effective strategies using various imaging techniques."

Although not yet fully accepted for MSK work up, emerging hybrid techniques such as PET/CT continue to grow in importance for evaluating previously treated MSK lesions for staging, restaging, and monitoring response to therapy. Specifically in the MSK system, PET is useful for restaging primary bone tumours and soft tissue sarcomas, allowing for simultaneous detection of local recurrence, as well as distant metastatic disease. Where histology is already known, PET using FDG is sensitive to significant abnormal metabolic activity and can prove invaluable for determining whether or not there is a presence of residual, recurrent tumour. Furthermore, for evaluating the effects of new drugs, PET detects chemotherapy-induced shut down of tumour metabolism.

However, information gained from PET must be combined with the radiological component of CT to avoid diagnostic mistakes, according to Vilanova. "For instance, FDG/PET might show metabolic activity on bone fibrous dysplasia. On a patient being staged for a malignant tumour, it could be misinterpreted as bone metastases instead of a fibrous dysplasia, if PET imaging is not evaluated combining the CT or plain film," he explained (see image).


A: Sagittal T1-weighted imaging of the knee shows a bone chondrosarcoma diagnosed by biopsy. B: Staging by PET/CT shows increased activity in the distal metaphysis of right femur (short arrow), corresponding to the primary chondrosarcoma and a mild focal increase in activity in the intertrochanteric region of left femur (long arrow), suggestive of metastasis from the primary chondrosarcoma. C: Plain film of the pelvis shows a geographic lesion with well-defined sclerotic margin in the proximal left femur. D: Coronal T1-weighted MRI shows intermediate signal intensity of the lesion. E: Axial diffusion-weighted imaging demonstrates high signal intensity from the lesion within the left femur with high ADC value (2.14 x 10-3 mm2/s) on the parametric map (F) consistent with a benign tumour, represented by the colour red, due to a variant of fibrous dysplasia, liposclerosing myxofibrous tumour of the bone. The independent evaluation of PET without combining other modalities might result in the erroneous diagnosis of bone metastases. (Provided by Prof. Joan C. Vilanova)

Recently, Bloem's department collaborated with the chemistry research group to bring molecular imaging from the preclinical to the clinical stage in breast cancer patients for local staging, in particular lymph nodes. "It was a big step to move from animal model research to breast cancer patients. It is a relatively small step to extend research now to MSK," he said.

More detailed information about current and future clinical applications of PET/CT and scintigraphy will be covered by Dr. José Garcia, radiologist at PET/CT Center, CETIR, Barcelona, Spain, while Prof. Carlo Martinoli, radiologist at Cattedra di Radiologia 'R' – DICMI, Genoa, Italy, will talk about diagnostic developments in ultrasound.

Remaining challenges are notably the personalised implementation of biomarker imaging in the clinical arena and development of software platforms to analyse, integrate and quantify these huge data sets.

Multifunctional imaging, in combination with integrated quantitative data analysis, is required to phenotype cancers to allow personalised effective treatment. For this to happen, radiologists need to embrace the current preclinical possibilities and bring them to the clinical arena by focusing on how to image tumour biology. In addition, they need to work together with engineers to develop automated data analysis, according to Bloem.

"At this stage, taking the huge step towards functional imaging requires new skills. The people who will do this are the radiologists of tomorrow," he predicted.

Special Focus Session
Monday, March 5, 08:30–10:00, Room A
SF 16a: The role of advanced imaging in musculoskeletal neoplasms

- **Chairman's introduction**
  J.C. Vilanova; Girona/ES
- **Advanced MR techniques**
  J.L. Bloem; Leiden/NL
- **• PET/CT and scintigraphy**
  J.R. Garcia; Barcelona/ES
- **• Sonography: diagnostic developments**
  C. Martinoli; Genoa/IT
- **Panel discussion:**
  The role and guidelines of the imaging techniques on the management of MSK neoplasms