

Orthopaedic surgeons have embraced a variety of imaging techniques over the last decade. CT and MRI have improved the anatomical definition of abnormalities and radionuclide imaging the functional definition of disease. Progress continues in trying to define the sites of disease and the nature of its activity using magnetic resonance spectroscopy (MRS)<sup>1-3</sup> and positron emission tomography (PET).<sup>4-8</sup> It was therefore surprising that a recent paper by Cheng and Thompson<sup>9</sup> made no mention of PET.

PET allows the visualisation of the metabolic activity of disease. In orthopaedic surgery it is of most help in the diagnosis of malignant tumours and their recurrence, the staging of tumours and the monitoring of their response to therapy, and in the diagnosis of osteomyelitis.

The positron-emitting tracers may be used to define glucose metabolism (<sup>18</sup>F-fluorodeoxyglucose (FDG)), amino-acid uptake (<sup>11</sup>C-methionine; <sup>11</sup>C-tyrosine), DNA turnover (<sup>18</sup>F-fluoro methyl thymidine (FLT)), tissue hypoxia (<sup>18</sup>F-fluoromisonidazole) and possible bone turnover (<sup>18</sup>F-fluoride). Tumours and infection show increased uptake of FDG which can therefore be used in both circumstances.

Primary malignant tumours presenting to the orthopaedic surgeon are either of bone or the connective tissues, i.e., sarcoma of bone or soft tissue. These are rare and should be dealt with at centres where there is a multidisciplinary team available to provide the necessary expertise<sup>10</sup> which should include imaging facilities to give accurate localisation and characterisation of the primary tumour. FDG imaging of soft-tissue sarcomas can distinguish high-grade from low-grade tumours and benign lesions,<sup>4,8,11</sup> although the separation of low-grade from benign lesions is not possible. Metabolic imaging with FDG combined with MRI may be useful in directing the surgeon to the most malignant area

within a large heterogeneous mass. Biopsy should be undertaken in conjunction with, or preferably by, the orthopaedic surgeon who will eventually carry out the definitive procedure.<sup>10</sup> A combination of imaging techniques may be used, first to define the most abnormal site by MRI/CT with FDG PET and then to carry out the biopsy using CT for guidance. The biopsy is a crucial step in the management of soft-tissue and bone sarcomas, particularly with the increasing use of adjuvant therapies before definitive surgery. Any information which helps the surgeon to take the most appropriate sample of the tissue is essential in order to make an accurate diagnosis and to prevent complications.<sup>12</sup>

FDG PET is useful in the localisation of distant and multisystem disease in patients with soft-tissue sarcomas or sarcomas of bone. The localisation of metastases from soft-tissue sarcoma in the lung, however, is not as sensitive as that with CT,<sup>7</sup> although metastases from osteosarcoma are readily visualised.<sup>13</sup> The combination of an initial whole-body FDG PET scan with a local scan of the tumour, CT of the chest and MRI of the primary lesion is probably the optimum initial appraisal to provide more precise evaluation of the primary tumour and lead to more accurate staging.

Definition of the primary tumour with a number of radiotracers will allow the determination of blood flow,<sup>14</sup> the turnover of DNA using <sup>11</sup>C-thymidine<sup>15</sup> or possibly FLT, the turnover of amino acids,<sup>16,17</sup> hypoxia of the tumour and the glucose metabolism. This will enable metabolic staging of the tumour to be done which may have a predictive value equal to or surpassing histological techniques, although this is as yet unproven. These tracers will also provide information to direct and monitor the response to neoadjuvant therapy,<sup>6,13</sup> and to allow the assessment of its delivery. An interesting study assessing the value of neoadjuvant therapy before and after treatment in osteosarcomas has shown that the FDG response after such regimes has helped to identify those tumours which have had a suitable response before operation, and may therefore influence further surgical procedures.<sup>13</sup> Although the best strategies for imaging still need to be established for these various groups of tumours,<sup>11</sup> multicentre trials should include PET in order to confirm its role.

Another area of potential use of FDG PET is in the

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