SPECT Studies of the Skeletal System

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Single photon emission computed tomography (SPECT) has, in the last decade, established a critical role in routine diagnosis. The impact has indeed been such as to generate the need for a new range of scintigraphic equipment, the multi-head cameras. These have become required in part for the optimal application of new radiopharmaceuticals but also have been essential in order to meet the ever-increasing demand for the procedure in providing maximum diagnostic accuracy of many Nuclear Medicine studies. Foremost amongst these has been skeletal scintigraphy which exemplifies the impact in improving detection of lesions by delineation of their site and size. The advantage of minimising the superimposed radioactivity from overlying and underlying structures is typified by the readiness with which avascular necrosis of the femoral head can be identified by removal of the surrounding hyperaemia which masks the classical photopaenia. However, the ability to achieve an accurate image at a plane at a prescribed depth is most characteristically shown by the study of a vertebra, a bone of irregular contour and subject to a variety of pathological disorders at different sites within it. The various focal abnormalities resulting from these can be localised exactly, readily distinguishing, for example, those in the body from those in the neural arch. In the investigation of malignancy, it is often possible to identify many more metastatic deposits than suspected. The major clinical role, however, lies in the diagnosis of the range of benign disorders which can afflict the vertebrae ranging from infection to arthritis. In particular, the alterations resulting from trauma, such as pars interarticularis stress fracture, are readily seen. Consequently SPECT has an indispensable role in the investigation of low back pain, some series having shown that up to 30% of vertebral abnormalities could only be identified with SPECT. Many authors, therefore, have suggested that all such patients warrant investigation with SPECT, a daunting prospect in view of the extremely common nature of the complaint. Certainly it is warranted in order to demonstrate whether radiological abnormalities in a vertebra are of clinical significance by being associated with radionuclide uptake, indicative of current osteoblastic activity. This fundamental property of bone scanning, its exquisite sensitivity in demonstrating altered physiology, also confers a major utility of SPECT in the investigation of facio-maxillary disorders, such as mandibular condylar hyperplasia, as well as delineating the extent of tumour and infection in and around the skull. Nevertheless, because of the additional time and the necessity for lack of movement during the procedure, handicaps when studying children and individuals in pain, it is critical that there be definitive decisions as to which patient and diagnostic problem SPECT is likely to provide additional information for. We, for example, have found that little value is obtained with SPECT in patients with primary bone tumours although others have reported an increased accuracy in detecting pulmonary metastases in osteogenic sarcoma. However, we believe that the ability of SPECT to delineate abnormal accumulation has provided a new approach to the evaluation of knee pain, especially when post-traumatic, since the identification of the presence or absence of focal abnormalities can be critical to patient management. The frequency of these various disorders in which SPECT is so useful explains why the procedure has become such a routine high-volume examination in so many departments.