



Association of Imaging Producers & Equipment Suppliers
European Industrial Association for Nuclear Medicine and Molecular Healthcare

Pictorial View of Nuclear Medicine

SPECT/CT in Clinical Use (1)

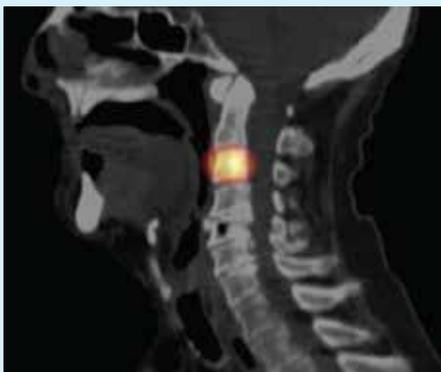
What is SPECT/CT?

SPECT/CT combines two imaging methods in one system: **Single Photon Emission Computed Tomography** and **X-ray Computed Tomography**. This combination allows the acquisition of two complementary, tomographic image volumes under the same conditions. SPECT provides functional imaging while CT provides anatomical and morphological images of the same body areas.

Advantages of SPECT/CT include the wide range and availability of molecular tracers. CT adds the possibility to **localise exactly** the tracer uptake and provides the anatomical context to this functional information. The combination of both modalities improves the image quality by delivering an accurate method to correct for the attenuation of the gamma-rays.

SPECT/CT in Oncology

SPECT/CT applications are primarily to be found in oncology. The combined modality allows accurate localization of primary tumours and metastases and the differentiation of benign and malignant uptake of the tracer.



CT scan (above) and SPECT/CT scan (below) of a patient with **skeletal cancer metastases** using ^{111}In -Octreotide. Study identifies clearly functioning metastases in C3 vertebrae.



SPECT/CT study of a 61 year old female patient with vulva cancer. The sentinel lymph node was not seen in planar scintigraphy images but appeared clearly in the right inguinal region on SPECT/CT with $^{99\text{m}}\text{Tc}$ -Nanocolloids (above).

Lymphoscintigraphy with SPECT/CT

Sentinel node (SN) detection in the pre-surgical evaluation of the node distribution in **breast cancer** became a standard of care in this field. Negative finding in SN histopathologic analysis confirms absence of cancer spreading. Supplementary axillary dissection becomes unnecessary, avoiding for the patient heavy side-effects. SPECT/CT helps to identify and precisely localise the SN but gives also information of utmost importance for the surgeon. This technique is not limited to breast cancer, but applied to other cancers such as **melanomas, head and neck cancers or gynaecological cancers** (e.g. vulva).

Further examples of the advantage of the combined SPECT/CT technology in oncology include the better identification of the adrenal masses in pheochromocytoma (with ^{123}I -MIBG) or the localization of neuroblastomas in paediatric populations.

SPECT/CT in infection

Localization of osteomyelitis: infection of bone and soft tissues of the foot is improved with SPECT/CT using $^{99\text{m}}\text{Tc}$ -Besilesomab (right).



Applications of SPECT/CT in imaging infection include infection related pain in bone, the diabetic foot, post-device implantation (areas surrounding prosthesis, vascular prosthesis or LV-assist devices) or infected areas without abscess, fever of unknown origin, orthopaedics and in post-transplant patients. The number of potential applications is regularly increasing including for rheumatologists which have with SPECT/CT the ideal tool for precise localization of osteoblastic areas.



Pictorial View of Nuclear Medicine

SPECT/CT in Clinical Use (2)

SPECT/CT in bone imaging and muscular/skeleton imaging

Bone imaging is the second most important application of SPECT/CT. It is efficient in musculo-skeletal imaging and even more in extremity imaging (hands, feet).



Extremity imaging: ^{99m}Tc HDP SPECT/CT study performed on an 80-year-old patient with severe ankle pain and suspected stress fracture. SPECT/CT exam reveals markedly increased vascularity and delayed uptake.

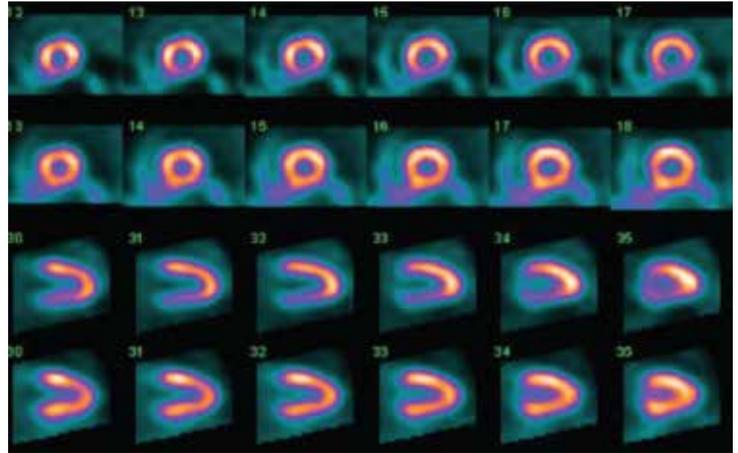
SPECT/CT using the ^{99m}Tc -DPD tracer in **osteocondrosis** (right).

In **bone scintigraphy**, SPECT/CT will be able to give in one screening the information about differences between malignant and benign sites, saving a lot of time for the diagnostic and reducing the stress for the patient. Exact diagnosis of e.g. spinal, shoulder or knee pain can benefit from SPECT/CT.



SPECT/CT in Cardiology

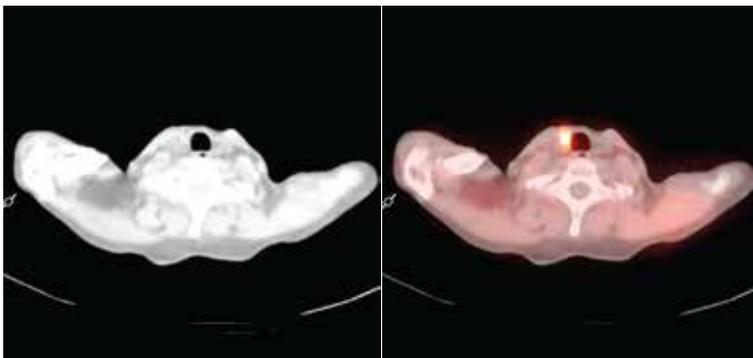
SPECT/CT allows to perform SPECT imaging with good attenuation correction, thus, improving both the quality of images and diagnosis. SPECT/CT allows also stratification of patients at intermediate risk for CAD, contributing to a more efficient use of invasive diagnostic coronary angiography.



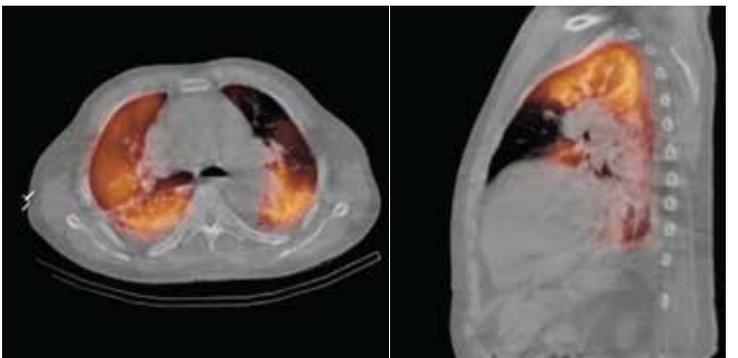
^{99m}Tc -Sestamibi myocardial perfusion and function study in a 58 year old male patient being evaluated for **myocardial ischemia** (above) showed reduced perfusion in inferior-septal wall (upper line) that improved significantly with attenuation correction in SPECT/CT (line below). It completely changed the initial high probability of ischemia to low probability. Further investigation demonstrated patient to be normal.

Other applications for SPECT/CT

In theory SPECT/CT could find applications in almost any indication in which SPECT is already routinely in use. Presently SPECT/CT is also explored in **pulmonary embolism**, **parathyroid** and **thyroid** imaging.



Transverse views from a SPECT/CT study of a 32 year old female patient with a suspected parathyroid adenoma. ^{99m}Tc -Sestamibi identifies the location of the parathyroid adenoma on the CT image.



A 72 year old male patient with chest evaluated for possible pulmonary embolism with a ^{99m}Tc -MAA **lung perfusion** tracer. A defect in the lingular segment of the superior lobe of the left lung is apparent on SPECT/CT only.