

Vienna, Austria

Annual Congress of the
European Association of Nuclear Medicine

October 21 –25, 2017
Vienna, Austria

Mini Course 3 – Interactive (Technologists)

Sunday, October 22, 17:00-18:00

Session Title

Bone and Joint - Pitfalls and Artefacts

Chair

MarieClaire Attard (Nijmegen)

Programme

17:00 - 18:00 Willem Grootjans (Leiden): Bone and Joint – Pitfalls and Artefacts

Summary

Conventional nuclear medicine imaging with bone seeking radiotracers is the most widespread diagnostic method when visualising a myriad of bone pathologies, ranging from inflammatory, metabolic, and oncological disorders. Planar whole body bone scintigraphy is usually performed with a technetium-99m (^{99m}Tc) labelled diphosphonate that is intravenously administered to the patient.

However, several factors have to be taken into consideration in order to successfully depict true-positive elements in a bone scan including careful radiopharmaceutical preparation, proper administration of the radiopharmaceutical to the patient, and regular quality control of the imaging equipment. For example, injections that are not introduced intravenously can produce extravasation of the radiotracer that is seen on the bone scan images as a star artefact. Metallic objects may be seen as areas of decreased focus of uptake that might be mistaken for pathology. Furthermore, hardware failure, such as photomultiplier tube (PMT) malfunction, may cause defects to appear in the image. Anatomical variants could also mimic pathology, such as a double ureter, a dis-adjoined manubrium, or the excessive use of shoulder muscles seen in sportsmen or swimmers.

Other artefacts such as the radiopharmaceutical preparation also plays an important part in the correct demonstration of a bone scan. Improper preparation of the radiopharmaceutical can cause significant changes in the biodistribution of the administered compound. Furthermore, urine contamination is one of the most common artefacts seen on a bone scan. Instructions regarding proper hygiene after micturition is important to limit contamination as much as possible.

Imaging of complex three dimensional anatomy with planar scintigraphy can be quite challenging to interpret due to the projection overlapping anatomical structures on a two dimensional images, reducing the sensitivity for detecting pathologies. Use of additional spot views or the combination of planar scintigraphy with single photon emission computed tomography (SPECT) examinations with or without the use of X-ray computed tomography (CT) images can help considerably in the proper assessment of anatomy of the vertebral column, pelvis and cranium.

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Evaluation of the skeletal pathology using sodium fluoride (NaF) hybrid positron emission tomography (PET) /CT imaging has been performed. When compared to the planar scintigraphy and SPECT/CT imaging the NaF PET/CT scan is more sensitive for detecting and more specific for evaluating bone pathologies. However, similar to planar bone scintigraphy and SPECT/CT imaging, there are a myriad of factors that can introduce artefacts such as improper attenuation correction and artefacts arising due to errors in image reconstruction. Planar bone scintigraphy is useful for the diagnosis, staging, and response monitoring in a number of pathologies. However, the medical technologist and nuclear medicine physician should be wary of the occurrence of artefacts, anatomical variants, and patient medical history for proper interpretation of bone scans.

Educational Objectives

Understand the biological uptake and tracer mechanism in a bone scan.

- Recognise the different types of artefacts and pitfalls in Bone and Joint Imaging.
- Understand the importance of proper radiopharmaceutical preparation and injection.
- Correlate anatomical variants to possible artefacts and/or pitfalls or pathology.
- Be aware of the different imaging modalities available to confirm or exclude artefacts and/or presence of pathology.
- Recognise the importance of quality control.

Key Words

Bone Scan, biodistribution, radiopharmaceutical preparation, SPECT/CT, PET/CT, artefacts, pitfalls, metallic objects, focus of uptake, anatomical variants, bone pathology, NaF.

Take Home Message

- When in doubt always repeat the scan, removing pieces of clothing or changing position.
- Additional views help in confirming or excluding pathology.
- In areas of complex anatomy, acquisition of SPECT/CT can help in diagnosis by improving sensitivity and specificity of the examination.
- Quality control helps to recognise trends in equipment that might lead to failure, and in turn leading to possible artefacts.