Radionuclide examinations of the skeleton

The most frequently used method of nuclear medicine for imaging the skeleton is scintigraphy , with the help of which we are able to visualize the pathological process already at the metabolic level. Even after forty years of using this method in indicated cases, scintigraphy of the skeleton is the most accessible and most sensitive imaging and surpasses even more advanced imaging methods such as CT or MR examinations. It displays changes in bone tissue earlier than an X-ray examination and, due to the low radiation exposure, has no major contraindications and can therefore be repeated. The method is highly sensitive, but not very specific. However, its specificity increases after correlation with other examinations of the skeleton (planar X-ray, CT, MR).

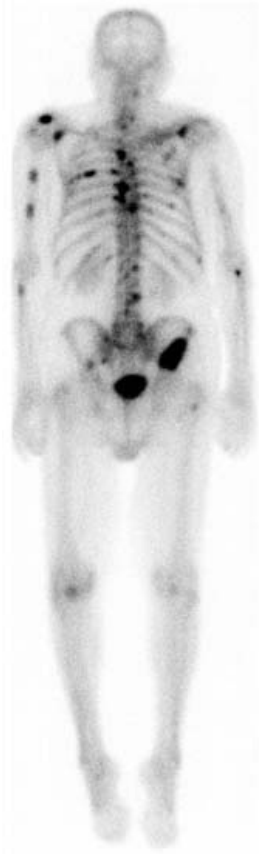
The principle of the method

The method is based on evidence of a change in the distribution of the osteotropic radiopharmaceutical and the detection of its gamma radiation by a scintillation camera. Skeletal scintigraphy is performed in several versions:

- three-phase bone scintigraphy,
- whole body bone scintigraphy,
- targeted bone tomographic scintigraphy SPECT ,
- targeted static planar bone scintigraphy.

Radiopharmaceuticals

Osteotropic radiopharmaceuticals based on phosphate complexes labeled with 99m Tc are most commonly used for scintigraphy - most often 99m Tc-MDP (methylene diphosphate) and 99m Tc-HDP (oxidronate). These drugs bind to hydroxyapatite crystals after parenteral administration. This bond is considerably stronger than the bond to the organic part of the bone matrix. Factors that influence radiopharmaceutical accumulation are: **bone blood flow** and **osteoblastic** activity . The unbound radiopharmaceutical is eliminated from the body by the kidneys.



Skeletal scintigraphy – multiple prostate cancer metastases

Examination technique

Patient preparation

No special preparation is necessary, the patient does not need to be fasting, but should be sufficiently hydrated. From the anamnestic point of view, previous injuries, fractures, operations and pharmacological anamnesis are important, which can affect the metabolism of bone tissue and the subsequent distribution of the radiopharmaceutical. To eliminate artifacts, it is good if the patient has an empty bladder and his body does not contain any metal objects.

Self examination

Whole body scintigraphy

An important part of this examination is the time interval between the administration of the radiopharmaceutical and the scintigraphic examination. The time interval, which varies between 2-5 hours, deepens the difference in the activity of the radiopharmaceutical in the bone marrow and the surrounding soft tissues. This interval depends on age, weight and associated cardiac and renal diseases.

- children under 1 month − images are difficult to interpret or illegible,
- adolescents − increased activity in bone growth zones,
- older adults − with age, the activity of bone tissue decreases and the time interval increases.

Bone focused tomographic scintigraphy (SPECT)

Tomographic scintigraphy deliberately selected for a certain part of the skeleton - most often these are difficult to assess areas, the border of which belongs, for example, to the skull or pelvis.

Three-phase bone scintigraphy

Combination of dynamic and static scintigraphy. The examination begins after the intravenous administration of the radiopharmaceutical. This method evaluates three parameters - blood **flow** and **distribution** in the vascular system and **accumulation in bone tissue** . It consists of three phases:

- 1st phase (angiographic) − follows immediately after the application of the osteotropic radiopharmaceutical.

Represents a representation of the regional flow in a given part of the skeleton,
- 2nd phase (blood pool) − follows the 1st phase and captures the transfer of the radiopharmaceutical into the extracellular spaces of soft tissues and bones,
- 3rd phase (bone) − metabolic scintigraphy after 2 to 5 hours.

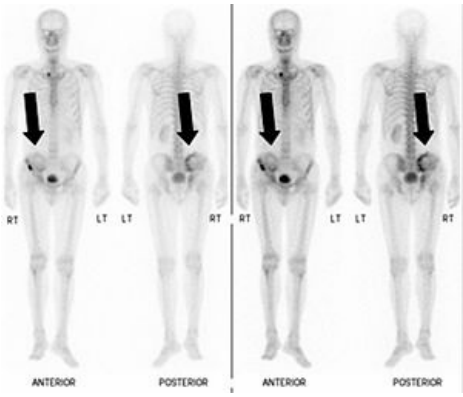
Indication

- tumor damage to the skeleton − primary and secondary,
- non-cancerous skeletal disease,
- differential diagnosis of the etiology of bone damage or bone pain.

Tumor damage to the skeleton

Non-neoplastic skeletal damage

- osteomyelitis,
- Perthes disease ,
- M. Paget ,
- Arthritis ,
- Complications of endoprostheses.



Skeletal scintigraphy with metastases in the pelvis

Links

Related Articles

- SPECT
- Scintigrafy
- Radionclide examination of the respiratory tract
- Radionuclide examinations of the thyroid gland

Source

- KUPKA, Karel – KUBINYI, Jozef – ŠÁMAL, Martin. *Nukleární medicína.* 1. edition. P3K, 2007. 185 pp. ISBN 978-80-903584-9-2.
- KUBINYI, Jozef. *Scintigrafie skeletu* [online]. [cit. 2015-03-10]. <https://el.lf1.cuni.cz/unm_vysetreni_skeletu>.