# ***Summary***

The skeletal system is a frequent target of metastatic disease and early detection of bone metastases has an important impact on the patient's management, disease outcome and the quality of life of the patient.

In clinical practice, multimodality algorithms are widely applied in case of suspected metastatic bone disease, including conventional X-ray, skeletal scintigraphy, positron emission tomography (PET), computed tomography (CT) and magnetic resonance imaging (MRI). Plain radiographs have a low sensitivity for the detection of bone metastases and only become apparent after a loss of more than 50% of bone mineral content. At present, 99mTc phosphonate-based skeletal scintigraphy is the standard method for initial staging.

However, at an early stage of disease, lesions may remain invisible in the absence of an osteoblastic response. Furthermore, false-positive findings may arise by a misinterpretation of tracer uptake in healing fractures or degenerative disease.

Recent studies have indicated that whole-body fluorodeoxyglucose (FDG)-PET increases the specificity of bone marrow screening compared with scintigraphy, due to tracer uptake directly into malignant cells.

Fused PET-CT scanners combine the functional data of PET with the anatomical information of CT scanners in a single examination and have further improved diagnostic accuracy and lesion localization. Moreover, the CT image data allow assessment of paraosseous tumor expansion and provide information on the extent of osteolysis as well as criteria of bone stability.

In contrast, MRI is an imaging technique that provides visualization of the bone marrow components at a high spatial resolution and has proven to be very sensitive for the early detection of bone marrow pathologies. The fact that 40% of skeletal metastases occur in the appendicular skeleton stresses tile need for accurate bone marrow imaging covering the whole body anatomy.

However, different requirements in coil setup, sequence design and slice positioning, as well as time-consuming patient repositioning procedures in the past, have delayed the realization of whole-body MR imaging as a clinical application. With the recent introduction of high field multi-channel whole-body scanners, covering the patient's anatomy from head to toe, with its lack of ionizing radiation and excellent soft tissue contrast, MRI has become a promising candidate for whole-body bone marrow screening.

Various studies have described the efficiency of MRI over CT and skeletal scintigraphy in the detection of primary bone neoplasms and metastases.

The combination of noncontrast TI-weighted. Spin-echo (SE) sequences and fat-suppressed short-tau inversion recovery (STIR) imaging proved to be most accurate in the detection of malignant bone marrow disorders and an excellent negative and positive predictive value especially for STIR-imaging has been described in literature.

Additionally, MRI enables precise assessment of the tumor extent within the bone marrow and into paraosseous structures, such as the spinal canal. WBMRI represents an imaging modality that potentially can detect bone metastases at an early stage of growth, before an osteoblastic host reaction occurs. [11]

## Criteria for characterization of lesions:

***In Whole body MRI the lesions were analyzed as follow:***

**1)** Lesions were considered *metastatic* if there is diffuse or focal hypointense bone marrow signal intensity relative to adjacent or contra-lateral normal marrow, in T1 weighted FSE sequences, and corresponding diffuse or focal iso to hyperintense bone marrow signal intensity relative to signal intensity of the normal subdued bone marrow, in which the signal was higher than adjacent normal muscle or non-degenerated disc in the FSE-IR sequences.

**2)** *To* ***differentiate metastatic from benign lesions,*** additional criteria like the bull's eye sign and halo sign were considered as described by ***Schweitzer et al., (1993)*** [(67)] according to which, there was high probability of benign lesions where areas of high signal intensity can be found within the lesion on T1-Weighted images, where as a rim of high signal intensity in T2-Weighted images was indicative of malignancy. [(67)]

**3)** For the spine, additional criteria for ***malignant infiltration*** include bulging of the posterior margin of the vertebral body, signal intensity changes extending into the pedicles and paraosseous tumor extension.

**4)** Lesions were considered as *uncertain,* when differentiation between a metastatic and benign process, such as osteoporotic fracture or bone marrow reconversion, was not possible.

**5)** The lesion was considered *benign* when it is located directly adjacent to degenerative changes of the vertebral end plates or near joint surfaces or when the lesion displays high T1 signal intensity. [(68)]

# ***Conclusion***

It could be stated that WB-MRI is a strongly sensitive, non contrast, radiation free technique for screening of the entire body in a reasonable time for assessing osseous and extraosseous metastatic deposits, with high sensitivity and specificity, even more than skeletal scintigraphy.