

## Quantitative Comparative Analysis of Bone Scan and Diffusion-Weighted MR Imaging in Primary Malignant Bone Tumours – A Prospective Observational Study

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### Abstract

**Introduction:** Primary malignant bone tumours show wide biological heterogeneity. Conventional bone scintigraphy reflects osteoblastic activity, whereas diffusion-weighted magnetic resonance imaging (DW-MRI) provides quantitative information on tumour cellularity through apparent diffusion coefficient (ADC) values. This prospective observational study aims to compare bone scintigraphy and DW-MRI in the quantitative assessment of primary malignant bone tumours.

**Methodology:** This prospective observational study included patients with histopathologically proven primary malignant bone tumors who underwent both DW-MRI and <sup>99m</sup>Tc MDP bone scintigraphy prior to treatment. Primary tumors were segmented on MRI and corresponding regions were mapped on bone scintigraphy images. Each tumor was subdivided into multiple segments, and segment-wise mean ADC values and tumor-to-normal-tumor (T/NT) uptake ratios were calculated. Intratumoral heterogeneity was assessed using coefficient of variation for both ADC and T/NT values. Correlation between ADC and T/NT ratios was evaluated using Pearson and Spearman correlation analysis. Statistical significance was set at  $p < 0.05$ .

**Initial Results:** A total of 10 patients (6 with osteosarcoma, 2 with Ewing sarcoma and 2 with chondrosarcoma) were included in the analysis. A total of 298 tumour segments (173 segments were from osteosarcoma, 73 from Ewing sarcoma, and 52 from chondrosarcoma) were evaluated to quantify tumour heterogeneity and to evaluate the correlation between apparent diffusion coefficient (ADC) values and tumour-to-normal tissue (T/NT) uptake ratios.

### ADC Parameters Showing Intratumoral Heterogeneity

Tumor Type	Mean ADC ( $\times 10^{-3}$ mm <sup>2</sup> /s)	ADC SD	ADC CV
Osteosarcoma	1.26	$0.44 \times 10^{-3}$	35.4%
Ewing sarcoma	1.20	$0.31 \times 10^{-3}$	25.5%
Chondrosarcoma	1.42	$0.59 \times 10^{-3}$	42.0%

A statistically significant difference in ADC heterogeneity was observed among primary malignant bone tumors ( $p < 0.05$ ), with chondrosarcoma showing the highest coefficient of variation, followed by osteosarcoma, while Ewing sarcoma demonstrated the lowest intratumoral variability.

### Bone Scan T/NT Ratio Heterogeneity

Tumor Type	Mean T/NT	T/NT SD	T/NT CV
Osteosarcoma	6.16	5.73	92.98%
Ewing sarcoma	2.40	1.61	67.0%
Chondrosarcoma	2.85	2.10	73.7%