

Radiology–Histopathology Correlation in Osteosarcoma: Insights from Multimodal MRI Approaches

Introduction

Osteosarcoma is the most common malignant bone tumor in children and adolescents. Chemotherapy response, measured histologically by tumor necrosis (>90%), is the key survival predictor. Advanced MRI techniques such as DWI, DCE-MRI, and DKI offer non-invasive biomarkers that correlate with histopathologic response, improving early treatment assessment and surgical planning.

Aim

To evaluate the radiology–histopathology correlation in osteosarcoma using multiparametric MRI (DWI, DCE, DKI) and identify imaging biomarkers predictive of chemotherapy response.

Methods

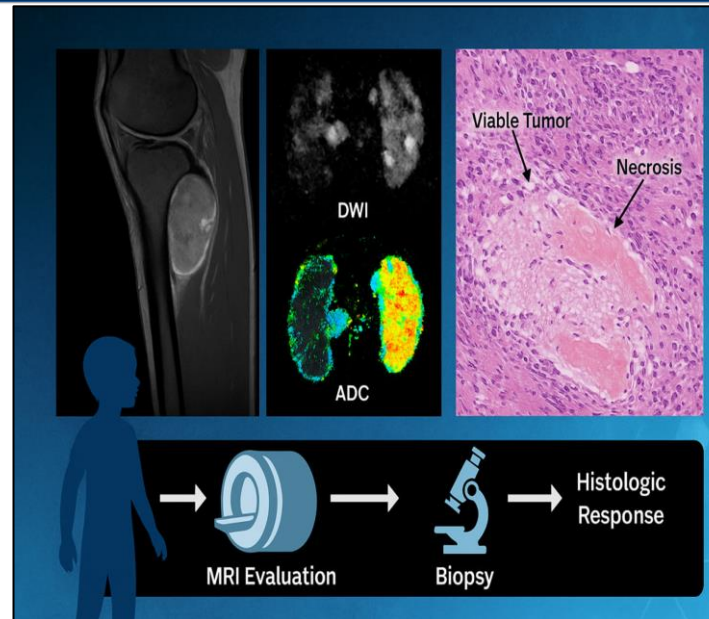
A PubMed search using the search terms “osteosarcoma”, “childhood” and “chemotherapy”.
• Search was limited to articles published over the last ten years.

A generated list of 5 articles were included.

Inclusion criteria: pediatric and adolescent osteosarcoma patients underwent multimodal MRI before and after chemotherapy. Quantitative MRI parameters (ADC, MD, MK, Ktrans) were correlated with histologic necrosis percentage after resection. Data included diffusion and perfusion metrics, histologic co-registration, and feature extraction to classify response.

References

1. Teo et al., PLOS ONE, 2022.
2. Liu et al., Korean J Radiol, 2019.
3. Benvenuti et al., Eur Radiol, 2021.
4. Jain et al., Cancer Res, 2005.
5. Reddick et al., Radiology, 2001



Results

ADC and MD showed significant correlation with histologic necrosis ($r > 0.6$, $p < 0.01$).

- Good responders had higher post-treatment ADC and MD values.
- DCE-MRI parameters indicated reduced perfusion in responders.
- DKI demonstrated improved differentiation of viable vs. necrotic tissue.
- Imaging–pathology fusion improved prediction accuracy of treatment response.

Discussion

Functional MRI parameters mirror microstructural and vascular changes caused by chemotherapy. Integrating radiologic and histopathologic findings allows earlier assessment of treatment response and helps tailor therapy. DKI adds value by capturing diffusion heterogeneity beyond Gaussian assumptions. Radiology–pathology correlation supports precision medicine and adaptive treatment strategies.

Conclusion

Multiparametric MRI—especially DKI—shows promise as a non-invasive biomarker of osteosarcoma chemotherapy response. Correlating MRI with histopathology enhances diagnostic accuracy and guides personalized management.

