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Radiogenomics: Integrating Imaging and Genomic Data in Cancer Prognostication.

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Introduction

Radiogenomics is an emerging interdisciplinary field that bridges medical imaging and genomic science to improve cancer prognostication and personalized therapy. By correlating quantitative imaging phenotypes with tumor genomic profiles, radiogenomics offers a non-invasive approach to predict molecular characteristics, disease progression, and treatment response. Imaging modalities such as magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET) generate rich spatial data that can reveal tumor heterogeneity, while genomic sequencing provides insight into the molecular drivers of malignancy. Integrating these datasets enables clinicians to identify imaging biomarkers linked to specific genetic alterations, potentially reducing the need for invasive biopsies and improving real-time monitoring of tumor evolution. This integration also supports the development of predictive models that can stratify patients based on risk, guiding tailored treatment strategies and ultimately improving clinical outcomes [1, 2, 3, 4, 5].

Conclusion

The integration of imaging and genomic data through radiogenomics holds transformative potential in the field of cancer prognostication. By harnessing the strengths of both domains—imaging's spatial and morphological detail and genomics' molecular specificity—radiogenomics can enable earlier, more precise, and less invasive cancer characterization. This approach not only enhances diagnostic accuracy but also supports truly personalized oncology, where treatments are adapted to the unique biological and phenotypic profile of each patient's tumor. As computational methods and data integration technologies continue to advance, radiogenomics is poised to become a critical tool in precision medicine, leading to improved patient survival and quality of life.

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