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ASO AUTHOR REFLECTIONS

ASO Author Reflections: Radiomics for Predicting Survival Outcomes After Hepatic Resection of Colorectal Liver Metastases

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PAST

Colorectal cancer (CRC) is a leading cause of cancer-related mortality worldwide, with liver metastases (CRLM) critically impacting prognosis. Accurate preoperative risk stratification is crucial for delivering personalized therapies, informed surgical decision making, and improving long-term survival.[1,2] Although diagnostic imaging techniques, such as computed tomography (CT) and magnetic resonance imaging (MRI), play a crucial role in diagnosing and monitoring patients with CRC, they are limited in predicting recurrence and survival. Prognostic stratification currently relies on clinical, pathological, and molecular markers (RAS/BRAF status, microsatellite instability [MSI] status, carcinoembryonic antigen levels), which can be invasive, expensive, or only available after resection of CRLM. Radiomics has emerged as a promising non-invasive method for extracting a large amount of quantitative information from medical images, reflecting tumor heterogeneity and microenvironmental alterations. Despite this potential, previous studies have been limited by small patient cohorts from single centers, a lack of external validation, and poor reproducibility.[3]

PRESENT

In our study,[4] we proposed CT-based radiomic models, integrated with baseline clinical data, to predict recurrence, local recurrence, and disease-specific mortality after radical surgery of CRLM. An external multicenter validation was conducted to assess the transportability and generalizability of our models across various acquisition protocols and patient management strategies. Among different approaches, models incorporating radiomic features from residual liver parenchyma (BKG) demonstrated superior specificity in predicting recurrence, underscoring the prognostic relevance of parenchymal changes beyond metastatic lesions. At the same time, patients with a higher risk of recurrence/local recurrence had lesions with higher heterogeneity and greater variability in the intensity patterns. This suggests that features capturing tumor heterogeneity, such as entropy and variance, could be associated with a more aggressive tumor biology. Clinical parameters, including lesion number, size, and use of neoadjuvant chemotherapy, remained relevant predictors, indicating that radiomics could be integrated in clinical practice without replacing established clinical factors.

FUTURE

Future work should validate radiomic models in larger, prospective, multicenter cohorts. Further efforts should focus on automating radiomic feature extraction to rapidly obtain comparable radiomic data across different scanners, thereby promoting faster integration and transportability of machine learning-driven models in clinical practice.[3] Integration with genomic and molecular profiling, within radiogenomics frameworks, may enhance predictive accuracy. Clinically, radiomic-based early recurrence prediction could be particularly relevant, as early recurrence is often correlated to more aggressive tumor biology and unfavorable

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prognosis. Accurate identification of patients at high risk of early recurrence can help improve follow-up strategies and guide decisions on perioperative treatment.

DISCLOSURES Simona Marzi, Antonello Vidiri, and Gian Luca Grazi have no potential conflicts of interest to declare, including any financial, personal, or other relationships with other people or organizations, that could inappropriately influence this work.

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