AI-Enhanced Prediction of TACE Outcomes in HCC: Unlocking Clinical Insight and Precision

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Purpose

- To synthesize published data on the development and performance of artificial intelligence (AI) and machine learning (ML) models designed to predict therapeutic response to transarterial chemoembolization (TACE) in patients with hepatocellular carcinoma (HCC).

Materials and Methods

- This educational exhibit primarily utilizes a comprehensive, evidence- and case-based review of the current literature on the use of AI and ML for predicting outcomes following TACE in patients with HCC.
- A PubMed search using the terms ‘AI,’ ‘ML,’ ‘TACE,’ and ‘HCC' and a review of published clinical trials and systematic reviews were conducted

Results

- Major society guidelines endorse TACE as the standard of care for intermediate-stage HCC, but response is highly variable owing to tumor biology, liver function, and vascularity. [1]
- AI-driven ML/DL can analyze large, multimodal datasets, integrating clinical, laboratory, and omics information to detect complex patterns that improve prognostication. [1]
- No universally validated tool currently exists to predict which patients will benefit from TACE. [1]
- Pre-treatment CT-based AI models (e.g., radiomics-random-forest) have reported area under the curve (AUC) values up to 0.95 and accuracies > 89 %. [2]
- Pre-treatment MRI-based AI models show positive associations with response prediction, achieving AUCs > 0.90 (e.g., peritumoral MRI radiomics, AUC 0.911). [1]
- Integrated models that combine clinical features, laboratory results, and radiological variables consistently outperform models using imaging alone or manual measurements. [1]
- In a systematic review of 64 studies (13,412 patients), combined predictive models demonstrated numerically superior performance for forecasting TACE efficacy. [1]

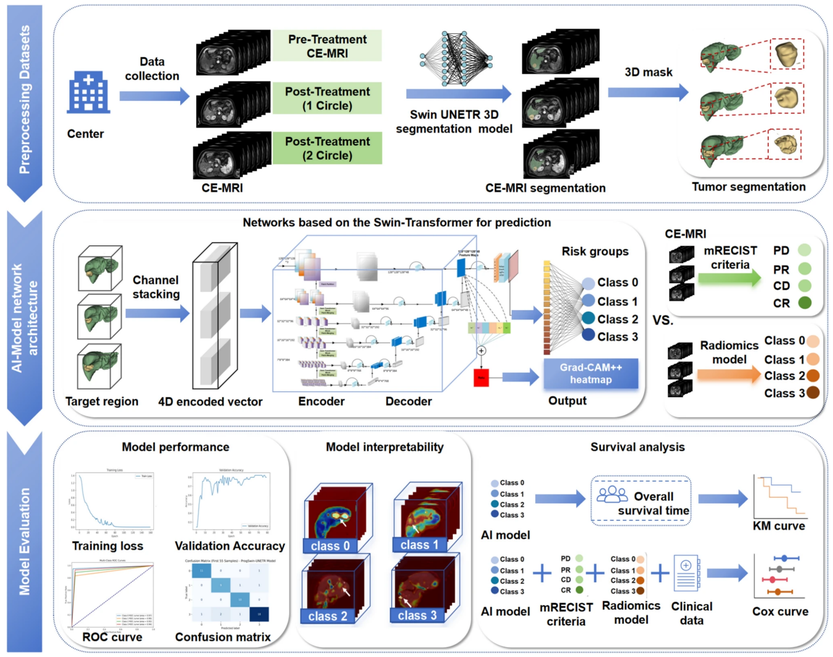

Figure 1: Adapted from Cho et al. Workflow of the ProgSwin-UNETR model for HCC patients. Preprocessed DBI-MRI data and 3D liver/tumor masks were analyzed with the Swin-UNETR architecture, and prognostic performance was evaluated against radiomic models and mRECIST criteria.[1]

Conclusions

- AI-enhanced predictive modeling refines patient selection and personalizes TACE planning, leading to more effective treatment strategies.
- Embedding AI analysis of pre-treatment scans with comprehensive clinical data offers a practical route to integrate AI into multidisciplinary tumor-board decisions.
- Future work should focus on external validation, standardization of radiomic pipelines, and seamless incorporation of AI outputs into clinical workflows to achieve precision medicine for HCC patients undergoing TACE. [3]

References

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