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Constructing a PANoptosis-based prognostic signature to evaluate the immune landscape and therapeutic response in clear cell renal cell carcinoma

Key words: Pyroptosis, apoptosis, and necroptosis (PANoptosis); Clear cell renal cell carcinoma (ccRCC); Prognosis; Tumor immune microenvironment; Immunotherapy response

Research Summary

This work primarily focused on identifying PANoptosis-related genes (PRGs) in clear cell renal cell carcinoma (ccRCC) for patient stratification and prognosis prediction.

Major results

- **Identified five PRGs (ZBP1, TNFSF14, CDKN3, PTHLH, HMOX1) forming PANI, independently associated with ccRCC patient prognosis.**
- **PANI, combined with clinical factors in a Nomogram, shows high predictive accuracy.**
- **High PANI patients exhibit unique co-mutation patterns, lower survival probabilities, and enriched immune-related functional features, indicating an activated immune environment.**
- **These patients show increased sensitivity to immunotherapy and anticancer drugs.**
- **ZBP1 knockdown significantly reduces the proliferation and migration of ccRCC cells.**

Innovation points

- **Identification of Key PANoptosis-related genes (PRGs)**
- **PANoptosis Index (PANI) Development**
- **Multi-Omics Data Integration**
- **Personalized Treatment Facilitation**
- **Immune Microenvironment and Efficacy Prediction**
- **Experimental Validation**