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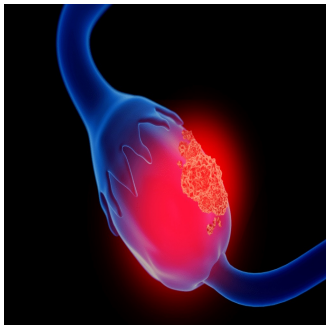
Transforming Ovarian Cancer Prognosis with Radiomics



High-grade serous ovarian cancer (HGSOC) is one of the deadliest gynaecological malignancies, often presenting at advanced stages and characterised by poor survival outcomes. Despite advancements in surgical techniques and chemotherapy, the relapse rate remains significant, with many patients experiencing disease progression within a year of initial treatment. The need for reliable prognostic tools to guide treatment strategies is therefore paramount.

Radiomics, a field leveraging advanced computational analysis of medical images, offers a new dimension in precision oncology. The CT-based Radiomic Prognostic Vector (RPV) is a pioneering tool that predicts overall survival (OS) and tumour biology, enabling clinicians to make more informed decisions about treatment pathways. The validation of this tool across independent patient cohorts underscores its potential to transform the management of HGSOC.

Radiomics: Revolutionising Cancer Imaging

Radiomics is an innovative approach that analyses quantitative imaging features extracted from medical scans, providing insights far beyond what is visible to the human eye. This technology bridges the gap between imaging and tumour biology, correlating features such as texture, shape and intensity with clinical outcomes. In the context of HGSOC, where outcomes vary widely even among patients receiving standardised treatments, radiomics offer objective and non-invasive risk stratification.

The RPV, derived from conventional contrast-enhanced CT scans, exemplifies the power of radiomics. It uses a combination of radiomic features to calculate a score correlating with OS and tumour biology. A high RPV score indicates a stromal-rich phenotype, a hallmark of poor prognosis. This is significant because stromal-dominant tumours are more resistant to therapy, with a higher likelihood of disease recurrence. Identifying such tumours before treatment begins allows for tailored therapeutic strategies, ensuring patients receive the most appropriate care.

External Validation of the Radiomic Prognostic Vector

External validation is critical in translating any prognostic tool from research to clinical practice. In the case of the RPV, a study involving an independent cohort of 198 patients provided robust evidence of its predictive value. These patients were treated for HGSOC at a European Society of Gynaecologic Oncology (ESGO)-certified centre and underwent CT imaging before surgery. Their ovarian masses were segmented, and RPV scores were calculated and analysed in relation to survival outcomes.

The findings were striking. Patients classified as RPV-high had a median OS significantly shorter than those with RPV-low or medium scores. Multivariate analysis confirmed that a high RPV score was independently associated with poor OS, alongside established prognostic factors such as the advanced International Federation of Gynecology and Obstetrics (FIGO) stage and the presence of residual disease after surgery. Interestingly, the RPV score was not significantly associated with progression-free survival (PFS), likely reflecting the complex interplay between tumour biology and treatment responses.

The study also validated the biological underpinnings of the RPV. Tissue samples from RPV-high tumours exhibited markedly higher stromal content, confirmed through fibronectin staining. This aligns with previous findings linking stromal-rich phenotypes to poor prognosis in ovarian and other cancers. The ability of the RPV to identify these high-risk cases before surgery underscores its potential as a decision-support tool, guiding clinicians in selecting the most appropriate treatment approach.

Clinical Implications and Future Directions

The clinical utility of the RPV lies in its ability to personalise treatment strategies for women with HGSOC. Currently, the decision to perform extensive cytoreductive surgery is based on clinical assessments and imaging findings, which often fail to capture the biological complexity of the tumour. The RPV adds a new layer of information, enabling clinicians to identify patients unlikely to benefit from upfront surgery. For these patients, alternative approaches such as neoadjuvant chemotherapy can be considered, sparing them the risks of surgery while potentially improving outcomes.

Moreover, the RPV's ability to stratify patients based on tumour biology opens avenues for targeted therapies. Stromal-rich tumours, for instance, may respond better to drugs targeting the tumour microenvironment. This represents a significant step towards precision oncology, where treatments are tailored not only to the clinical stage but also to the tumour's molecular and histological characteristics.

However, integrating the RPV into routine clinical practice is not without challenges. The current validation study relied on manual segmentation of ovarian tumours, a time-consuming process that requires significant expertise. Developing automated segmentation tools could streamline this process, making the RPV more accessible. Additionally, larger prospective studies are needed to further validate its predictive value and assess its impact on patient outcomes.

The CT-based Radiomic Prognostic Vector represents a paradigm shift in the management of high-grade serous ovarian cancer. Leveraging advanced imaging analytics provides a non-invasive, objective method for predicting survival and tumour biology. The successful external validation of the RPV underscores its robustness and potential for clinical application, offering a means to personalise treatment strategies and improve outcomes for patients with this aggressive disease. With further development and integration, the RPV could become a cornerstone of precision oncology, transforming how we approach women's care with HGSOC.

Source: **European Radiology**

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