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MRI in Ovarian Clear Cell Carcinoma Diagnosis

Ovarian clear cell carcinoma (CCC) is a distinct subtype of epithelial ovarian cancer with a relatively poor prognosis due to its limited response to platinum-based chemotherapy. Unlike high-grade serous carcinoma, which responds well to chemotherapy, CCC exhibits resistance, making early and accurate identification crucial for effective clinical management. Preoperative differentiation of CCC from other adnexal masses enables more tailored treatment planning, avoiding unnecessary chemotherapy and guiding surgical strategies. Magnetic resonance imaging (MRI), particularly when integrated with the Ovarian-Adnexal Reporting and Data System (O-RADS), provides a non-invasive means of distinguishing CCC from other ovarian malignancies. A recent review published in *Insights into Imaging* explores how MRI features, when combined with clinical and tumour marker data, can enhance the accuracy of CCC diagnosis and improve patient outcomes.

MRI Characteristics of Ovarian CCC

Ovarian CCC presents with distinct imaging features that aid in differentiating it from other adnexal masses. One of the most significant characteristics is the presence of an unilocular cystic mass, often large in size, with a high signal intensity in T1-weighted imaging (T1WI). This feature is commonly associated with endometriosis, a known precursor to CCC. The presence of mural nodules exhibiting an eccentric growth pattern further distinguishes CCC from other ovarian malignancies, which often present with multiple solid nodules or papillary projections.

In addition to qualitative features, quantitative MRI measurements provide further insight into CCC differentiation. The apparent diffusion coefficient (ADC) values for CCC tend to be higher than those of other epithelial ovarian cancers, reflecting lower tumour cellularity. The reduced cellular density of CCC affects its diffusion properties, making ADC values a useful parameter for diagnosis. Another significant MRI characteristic is the lower uterine signal intensity ratio (USIR), which helps in distinguishing CCC from more aggressive ovarian malignancies such as high-grade serous carcinoma. The ability to evaluate these MRI-based parameters preoperatively provides clinicians with a reliable diagnostic tool to assess CCC with greater precision.

Integration of Clinical and MRI Features

While MRI provides valuable morphological and quantitative data, incorporating clinical features enhances diagnostic accuracy. A patient's medical history, particularly a history of endometriosis, is a strong indicator of CCC. Endometriosis-related ovarian malignancies, including CCC, frequently develop from pre-existing endometriotic cysts, making this clinical factor highly relevant in preoperative assessments.

Serum tumour markers also contribute to the differentiation of CCC from other ovarian malignancies. Unlike high-grade serous carcinoma, which typically presents with significantly elevated CA125 and HE4 levels, CCC is often associated with lower levels of these markers. CEA, another tumour marker, has been found to have strong discriminatory power in identifying CCC. A combined approach that includes tumour marker analysis alongside MRI interpretation significantly improves the predictive accuracy of CCC diagnosis.

A comprehensive diagnostic model incorporating clinical history, tumour markers and MRI features has demonstrated superior performance compared to models relying on a single diagnostic method. Studies have shown that integrating these variables increases the area under the curve (AUC) to over 0.90, indicating high diagnostic accuracy. By leveraging a machine learning-based predictive model, clinicians can refine their assessment of ovarian masses, improving early detection and guiding appropriate treatment strategies.

Implications for Clinical Decision-Making

The preoperative differentiation of CCC from other adnexal masses has significant implications for clinical decision-making. Since CCC is inherently resistant to platinum-based chemotherapy, early identification allows oncologists to consider alternative treatment strategies that may

be more effective. For patients with CCC, primary surgical intervention may be prioritised over neoadjuvant chemotherapy, ensuring a more targeted approach to management. Additionally, patients diagnosed with CCC may require further imaging, such as pulmonary CT angiography, to assess the risk of thromboembolic complications, which are more prevalent in CCC compared to other ovarian malignancies.

Another critical implication is the role of MRI-based risk stratification in standardising diagnostic practices across different medical institutions. The O-RADS MRI scoring system provides a structured framework for assessing adnexal masses, ensuring consistency in CCC diagnosis. This system not only aids radiologists in preoperative evaluations but also enhances multidisciplinary collaboration between gynaecologic oncologists, radiologists and pathologists. By integrating MRI findings with clinical data, healthcare teams can improve communication and refine treatment planning for ovarian cancer patients.

Furthermore, the ability to accurately identify CCC before surgery can prevent unnecessary interventions and reduce the risk of misdiagnosis. Given that CCC is often diagnosed at an early stage with fewer ascites and peritoneal implants compared to other ovarian malignancies, early detection is vital for optimising patient outcomes. Standardised MRI evaluation, combined with tumour marker analysis, allows clinicians to tailor surgical and medical interventions to individual patients, improving survival rates and reducing unnecessary exposure to ineffective treatments.

MRI plays an essential role in distinguishing ovarian CCC from other adnexal masses, particularly when combined with clinical history and tumour marker evaluation. The ability to identify CCC preoperatively has significant implications for treatment planning, as it allows clinicians to avoid ineffective chemotherapy and focus on more appropriate therapeutic approaches. The integration of MRI morphological features, quantitative imaging parameters and clinical data enhances diagnostic accuracy, providing a comprehensive method for identifying CCC with high precision.

Source: **Insights into Imaging**

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Published on : Tue, 4 Feb 2025