

RADIOLOGICAL STAGING OF METASTATIC OVARIAN TUMORS AND COMPARATIVE DIAGNOSIS ACCURACY OF CT AND MRI

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DOI: <https://doi.org/10.5281/zenodo.17811508>

Received	Accepted	Published
09 October 2025	16 November 2025	29 November 2025

ABSTRACT

A retrospective analysis was conducted on 30 patients diagnosed with metastatic ovarian tumors. Few patients underwent through CT while other went through MRI scans as part of their diagnostic workup. For lesions indeterminate on ultrasound, MRI increases the specificity of imaging evaluation, thus decreasing benign resections. CT is useful in diagnosis and treatment planning of advanced cancer. Both CT and MRI are valuable tools in the radiological staging of metastatic ovarian tumors, with MRI showing slightly higher sensitivity and specificity. However, the choice of imaging modality should consider the clinical context, availability, and potential radiation risks.

Keywords:

INTRODUCTION

Ovarian cancer is the leading cause of death from gynecologic malignancies and among the most common gynecologic cancers [1]. It involves the rapid proliferation of abnormal cells capable of invading nearby tissues and metastasizing to distant organs [2]. Although it accounts for only 1.3% of all new cancer cases, ovarian cancer ranks as the fifth leading cause of cancer-related deaths in women, with a lifetime risk of 1.3% [3]. The 5-year survival rate remains largely unchanged over time 70–80% for early-stage and 20–25% for advanced-stage disease [4]. Late detection results from nonspecific symptoms, lack of effective screening tools, a long occult phase, rapid tumor progression, and frequent recurrence of therapy-resistant disease [5].

Magnetic Resonance Imaging (MRI) is a non-invasive technique that produces high-quality cross-sectional images using radiofrequency radiation and magnetic fields [6]. For ovarian cancer staging, MRI and CT show comparable accuracy 78–88% for MRI and 53–92% for CT [7]. In clinical practice, CT is usually the first-line imaging tool due to the vague symptoms of ovarian cancer and its ability to reveal ascites, papillary projections, septations, and thick-walled cysts with contrast enhancement [8]. CT is also preferred for follow-up, showing 58–84% sensitivity and 60–100% specificity; however, it struggles to detect lesions smaller than 5 mm [4]. The Digital Imaging and Communications in Medicine (DICOM) standard is used for storing and transmitting medical images. It ensures interoperability among

devices from different manufacturers, including PACS, servers, and imaging workstations [9]. DICOM supports image exchange with standardized metadata, defining objects for images, studies, and reports essential for diagnostic workflows [10].

1.1 Working Principle:

A powerful magnetic field is produced by the machine's magnet during the MRI scanning

procedure. A steady magnetic field causes the patient's target body part's hydrogen ions to align. The aligned hydrogen ions then move out of the way when radiofrequency waves are blasted at them, returning the ions to their equilibrium condition. After some "shifting" and "working on," an associated computer system transforms the spin echoes (signal) of hydrogen ions into the photographs [11].

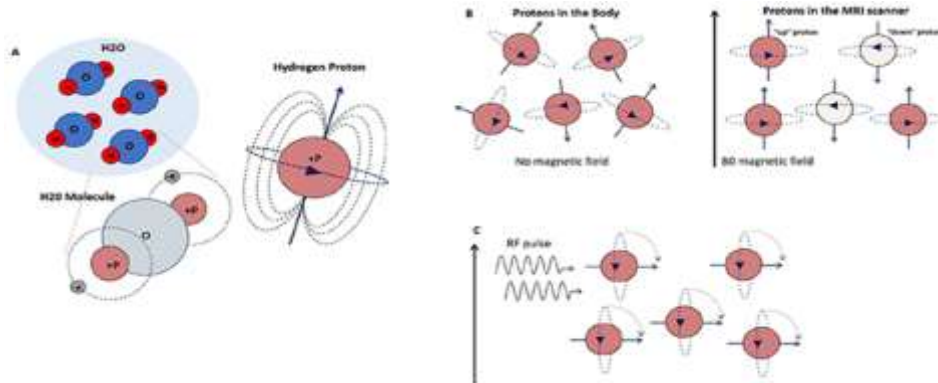


Figure 1.1: Working principle of MRI (A) Proton in water act like a tiny magnet and spins on its axis (B) protons align with the B₀ magnetic field in the MRI scanner. (C) When a pulse or wave of RF frequency equal to the precessional frequency of the proton is applied, the "up" protons absorb the RF energy and flip away from the B₀ field.

CT scan produces cross-section images by directing a beam of released photons along an object's plane from specific angle locations in a single rotation. When the photons, or X-rays, are dispersed, absorbed, or transmitted through the item, some of them are released. Attenuation is the process of reducing the strength of X-rays by only including those that are scattered or absorbed. The X-ray detector is not affected by X-rays that are attenuated as a result of interactions with the object. A comprehensive reconstruction of the scanned object is produced by collecting photons that are sent through the object at each angle on the detector and using a computer to visualize the data. The electron density distribution in the measured object is represented by the 3D gray value data structure that was obtained in this manner [12]

2. Scan parameters and Protocols:

Women aged 25-70 years who were suspected with ovarian cancer. A total of 10-15 patient reports and images were collected for each imaging modality (CT and MRI) from BVH, resulting in a dataset of 20-30 patient reports for analysis. Participants were recruited from one hospital.

2.1 MRI protocols:

The MRI scans were performed on a Canon Vantage Orian machine with a magnetic field strength of 1.5 Tesla. The imaging protocol consisted of slice thicknesses ranging from 2.5 to 3.5 millimeters. The signal averages ranged from 0.85 to 1, and the acquisition time took approximately 13-17 minutes. Gadolinium-based contrast agents (paramagnetic substances), including Omniscan, Magnovist, and Dotarem, were used to enhance image quality.

2.2 CT scan protocols:



Figure 2.2: Setup of CT scanning

The computed tomography (CT) examinations were conducted using a Toshiba Aquilion Prime 160 slice scanner (6th generation CT scanner), operating at a voltage of 412V with direct

homogeneous technology. The scan protocol employed a slice thickness of 1 mm, with axial body scans acquired in 3.5 seconds. Contrast enhancement was achieved using iodinated agents, specially Omnipaque and Ultravist.

3. Result and Discussions:

3.1 MRI Findings

In figure 3.1, Bilateral cystic ovarian masses giving T2 shading sign consistent with endometriomas cysts is evident from image findings of 25 years old female. Large cystic masses are seen in bilateral adnexa, appearing hyperintense on T1WI and hypointense on T2WI. Mass lesion in right adnexa is bilocular and measure about 52×57 mm while in left adnexa is unilocular & measure about 50×54 mm.

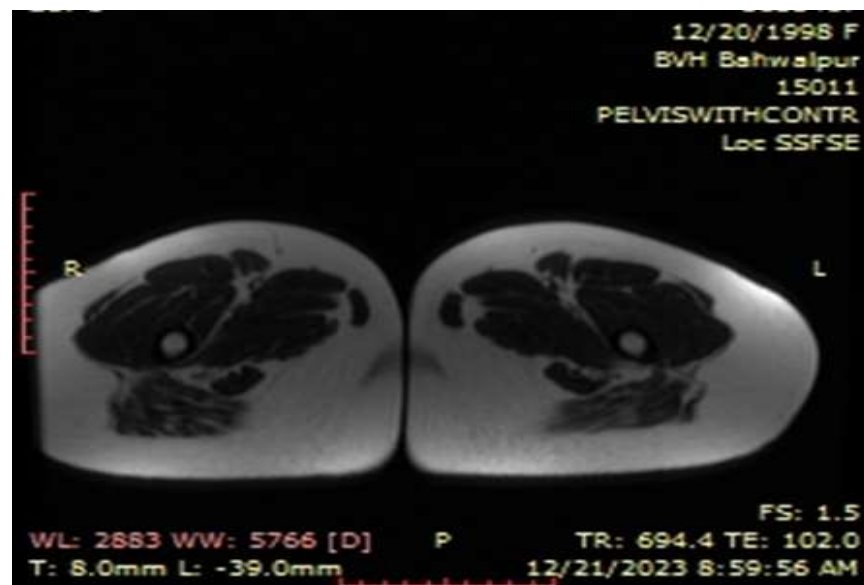


Figure 3.1.1: Figure: T2 shading sign consistent with endometriomas cysts due to bilateral cystic ovarian masses

In figure 3.2, a 32 years old patient with bilateral cystic ovarian masses likely suggestive of bilateral endometriomas. Large cystic masses are seen in bilateral adnexa, appearing hyperintense on T1WI

and hypointense on T2WI, no signal compression seen on FS sequence representing hemorrhage. Mass lesion in right adnexa measuring about 76×103×133 mm (AP×TR×CC)



Figure 3.1.2: Large cystic masses in bilateral adnexa

In figure 3.3, imaging findings are suggestive of a large abdominopelvic complex mass, likely arising from right ovary. An abnormal lobulated complex mass measuring approximately 29 cm in craniocaudal dimension, containing multiple cystic foci is seen arising from the right side in pelvic and reaching upper abdomen and showing avid enhancement of solid components on post contrast study.



Figure 3.1.3: Large abdominopelvic complex masses likely arising from right ovary

Figure 3.4, represents Bilateral cystic ovarian masses most likely endometriomas is evident in 22 years old female. Large cystic lesions are seen in bilateral adnexa, appearing hyperintense on T1WI and hypointense T2WI. T2 shading sign is also noted which is very suggestive of endometriomas. Mass lesion in right adnexum is bilocular measuring about 60×62 mm in size while in left adnexum is also bilocular and measure about 67×45 mm in size.



Figure 3.1.4: Bilocular mass lesion in right and left adnexum. Bilateral cystic ovarian masses(endometriomas)

3.2 CT scan findings:

In figure 3.2.1, Imaging findings shows evidence of small bilateral complex cystic ovarian masses in 69 years old female with enhancing septations visualized in pelvic region, largest one on right side measuring 21×20 mm & left sided mass measures 29×18 mm in size.



Figure 3.2.1: Bilateral smaller complex cystic ovarian masses with pelvic omental mottling and gross ascites.

In figure 3.2.2, Right ovary is enlarged 48×36 mm, shows cystic and soft tissue component; enhancing soft tissue measures almost 21.3 mm. Left ovary is unremarkable and there is gross abdominopelvic ascites. Few enlarged lymph nodes are noted in pelvis and para-aortic and paracaval regions.

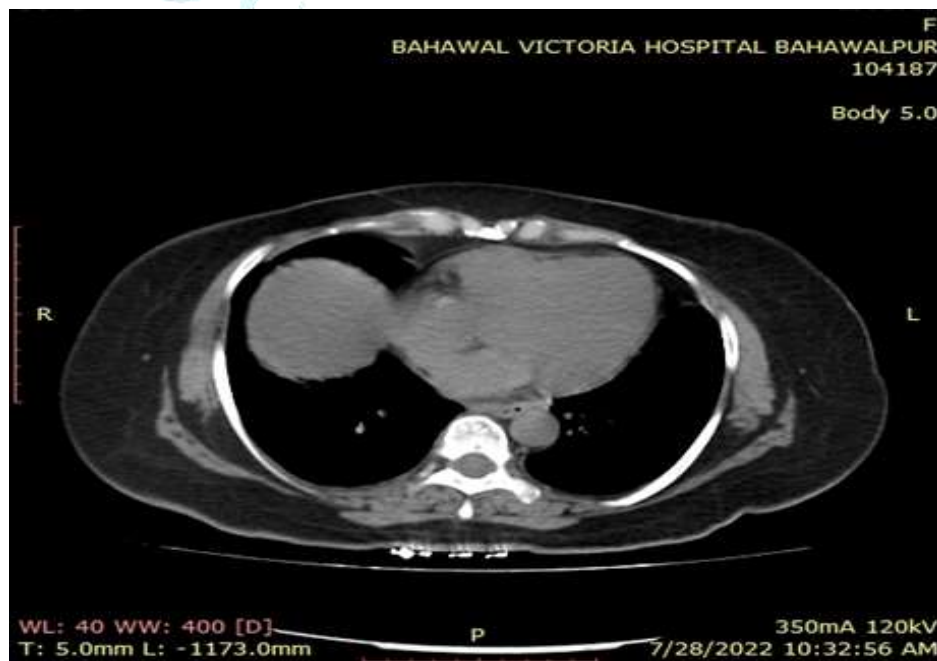


Figure 3.2.2: Right ovary mass with omental caking, abdominopelvic gross ascites and lymphadenopathy

In figure 3.2.3, there is multiloculated cystic mass with internal enhancing septations noted in right adnexa likely ovarian in origin extending to above umbilical region measures 15×16 cm (CC×TR). Cystic mass also noted in left ovary measures about 48×45 mm in size.



Figure 3.2.3: Bilateral complex cystic ovarian masses

Figure 3.2.4, shows that right ovary is not identified consistent with history of surgery. No abnormal enhancing solid or cystic mass is seen in pelvis. Uterus appears normal with mild fluid in endometrial cavity. Left ovary is normal and shows a follicular cyst (31×25 mm). Minimal fluid is seen in pelvis may be post operative. No abdominopelvic lymphadenopathy is seen. No evidence of any omentomesenteric disease. No obstructive uropathy is seen on either side and bowel loops are normal.



Figure 3.2.4: Biopsy proven case of borderline mucinous tumour of RT ovary; current imaging findings are consistent with no residual/ recurrent solid or cystic enhancing mass in pelvis.

Conclusion

CT and MRI are essential and complementary imaging modalities in the radiological staging of metastatic ovarian tumors. While CT offers speed, accessibility, and efficiency in initial evaluations, MRI provides superior soft tissue characterization and greater diagnostic precision without radiation exposure. An informed, patient-centered approach guided by clinical needs, available resources, and safety considerations will ensure optimal imaging selection. Continued research and standardized imaging protocols are crucial to further enhance diagnostic accuracy, treatment planning, and overall patient outcomes in metastatic ovarian cancer management.

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