

“Role of MRI in evaluation of female pelvic masses”

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Aims & Objectives:-

- To evaluate the importance of MRI in the pelvic masses and to characterize the MRI findings in female pelvic masses.

Material and Methods:-

Study was conducted in GCS medical college, Ahmedabad and included women with clinically suspected pelvic pathology.

MRI was done using 1.5 tesla GE signa explorer machine including standard scan protocol. Pelvic masses were categorized as benign or malignant on the basis of clinical details and imaging features. The sensitivity and specificity of MRI to correctly distinguish benign from malignant pathologies was calculated over a period of 12 months from January 2021 to December 2021.

Inclusion criteria :-

- Patient with lower abdominal pain.
- Patient with menstrual irregularities.

Exclusion criteria :-

- Implanted Electric And Electronic Devices are a strict contraindication to the Magnetic Resonance Imaging, and In particular:

- Heart Pacemakers (Especially Older Types)
- Insulin Pumps
- Implanted Hearing Aids
- Neurostimulators
- Intracranial metal clips
- Metallic bodies in the eye

Result –

MRI was significantly superior to ultrasound in the evaluation of the tumor extension, myometrium invasion, detection of lymph nodes and parametrical involvement. Overall sensitivity for detection of lesion by MRI was 100%, specificity was 98.56%, positive predictive value 97.89%, and negative predictive value 100%.

Conclusion -

MRI is an excellent investigation to evaluate the female pelvic masses due to its high spatial resolution, excellent tissue contrast, and multiplanar imaging capability. Characterization of uterine and ovarian tumors helps in the surgical planning.

Keywords :- Cervix, fibroid, ovarian, pelvic, tumours.

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I. Introduction

- Pelvic masses most commonly arise from the uterus, cervix, ovaries, and fallopian tubes. In addition, pelvic masses may arise from the urinary system, gastrointestinal system, adjacent soft tissues, and metastases. Thus, the differential diagnosis for female pelvic masses is extensive. The site of origin, imaging characteristics, and clinical history may all help to narrow the differential diagnosis. Magnetic resonance imaging (MRI) is very helpful in work up of these lesions, their location, origin, and relationship to adjacent organ, peritoneal or extraperitoneal involvement, lymph nodes and lateral pelvic wall involvement.

- The application of MRI in pelvic masses goes beyond lesion detection to the extension of mass and assessment of disease staging. Establishing correct diagnosis and accurate staging is important to plan the treatment of the patient.

II. Result

MRI was significantly superior to ultrasound in the evaluation of the tumor extension, myometrium invasion, detection of lymph nodes, and parametrical involvement. Total 70 cases were studied. There were 10 patients detected with Uterine fibroid (leiomyoma), 6 patients had Endometrioma, 13 patients of Cervical carcinoma, 4 cases of Adenomyosis, 7 cases of Endometrial carcinoma, 2 patients of Paraovarian cyst, 10 cases of Epithelial neoplasm, 9 cases of Germ cell tumor, 2 cases of Ovarian torsion, 2 cases of Ectopic pregnancy, 2 cases of Tubo-ovarian abscess, 1 case of Hematocolpometra, 1 case of MRKH, 1 case of Lipomyosarcoma [Figure 1]. Overall sensitivity for detection of lesion by MRI was 100%, specificity was 98.56%, positive predictive value 97.89%, and negative predictive value 100%.

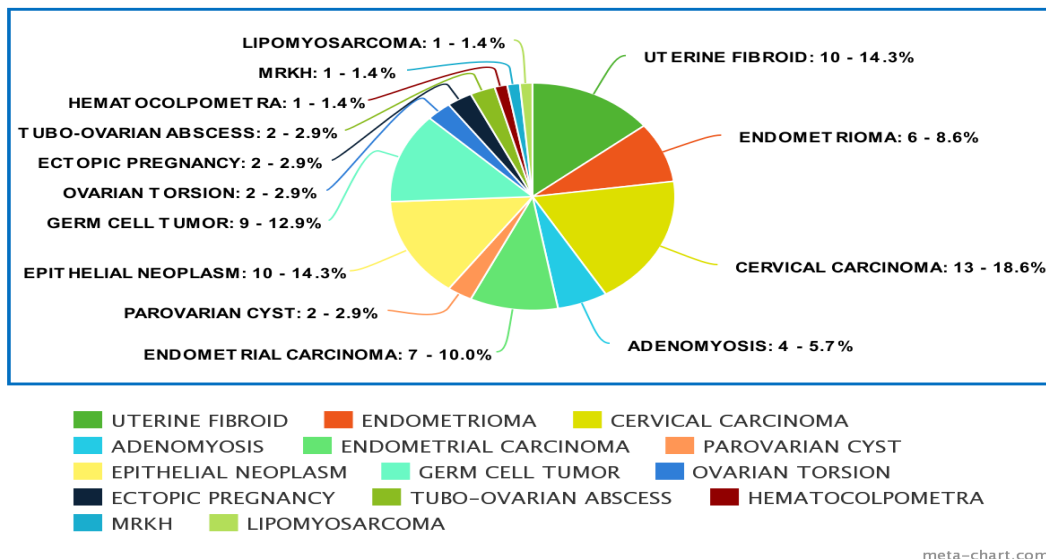


TABLE 1.
Details of descriptive data of study participants

PARAMETERS	MEAN +- SD
AGE	45.24 +- 10.41
MENOPAUSE STATUS	
PRE MENOPAUSE	24 (34.28 %)
POST MENOPASUE	46(65.71 %)
LATERALITY OF THE OVARIAN DISEASE (38)	
UNILATERAL	24 (63.15 %)
BILATERAL	14 (36.84%)

TABLE 2 .
Characterization of lesions on their MRI features.

Ovarian lesions (38)		
	FREQUENCY	PERCENTAGE
CYSTIC	11	28.94%
SOLID CYSTIC (COMPLEX)	27	71.05%
THICKNESS OF SEPTA (Lesion with septations - 32)		
THICKNESS >3 MM	10	31.2%
THICKNESS <3 MM	22	68.8%
ASCITES (70)		
PRESENT	34	48.5%

ABSENT	36	51.4%
LYMPHADENOPATHY(70)		
PRESENT	42	60%
ABSENT	28	40%

III. Discussion

The most important step in evaluation of adenexal masses is to determine whether the mass is benign or malignant as it has important role in treatment planning and to decide whether patient needs surgery. In our study 70 female patients with pelvic pathologies were studied by MRI modality. Amongst 70 cases, 58 cases underwent surgical procedures.

In our present study, the mean age was 45 years and the most commonly affected age group was 30-70 years. This was similar to other studies done by Aruna et al⁽¹⁾ where mean age was 30 years and Al-Shukri et al⁽²⁾ years. However the mean age was much higher 46 years in Adusumilli et al⁽³⁾. Benign cysts are much more common in reproductive age group, while the malignant lesions are more common in the postmenopausal age group. In our study predominant pathologies are benign lesions and hence mean age was lesser.

The three most important things that were noted for assessment of adenexal masses in our study were

1. Origin of mass
2. Characterization of mass
3. Classification of mass as either benign or malignant.

Fibroid

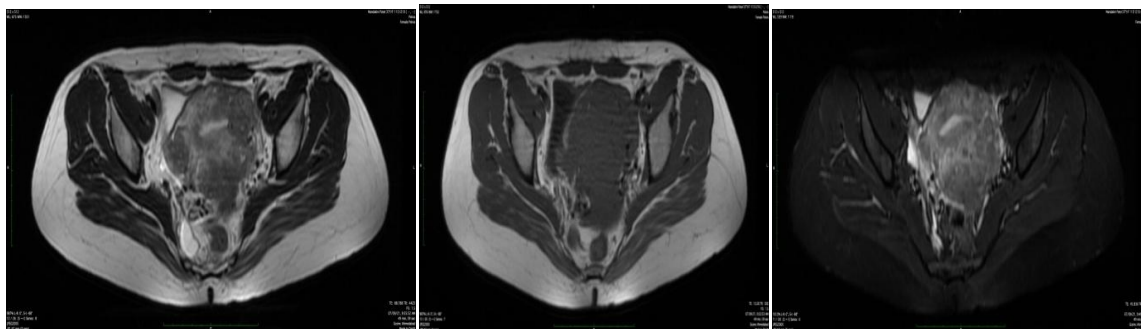
Leiomyoma or fibroid is the most common uterine neoplasm, most commonly seen in middle-aged women (20–30% in patients over 30 years)⁽⁴⁾. Clinical signs and symptoms depend on the size, location, and number of the leiomyomas. Pain and menorrhagia are the most common clinical features; it may be the cause of infertility. They are classified into intramural (within the substance of myometrium), submucosal (projecting into the endometrial canal), or subserosal (beneath the serosa).



Uterus is bulky in size and shows few well defined altered signal intensity lesions of uniform sizes in posterior wall, It appears hypointense on T2WI and STIR images.

Adenomyosis

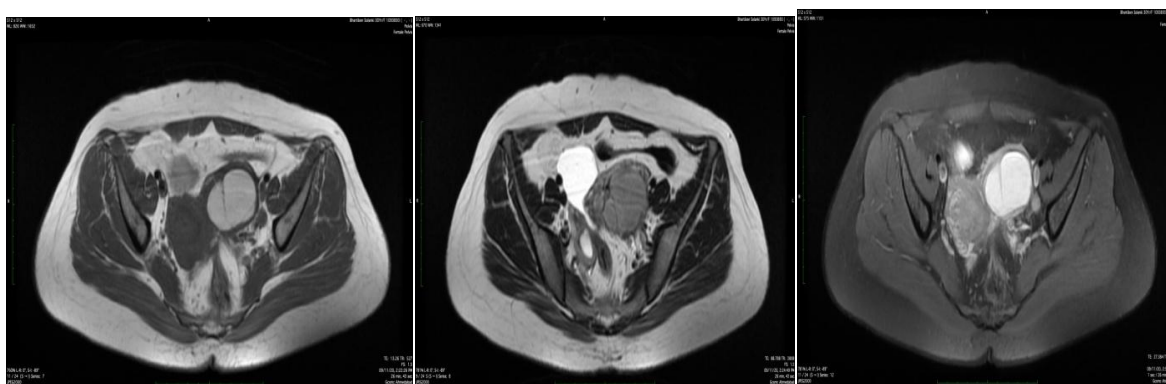
Adenomyosis is characterized by the presence of ectopic endometrial tissue in the uterine myometrium with subsequent hyperplasia of the myometrium. Usually seen in multiparous women, more than 30 years of age⁽⁵⁾. Differentiation from leiomyoma is important because treatment of both diseases is different. MRI is an excellent modality to differentiate these two entities because of its excellent tissue contrast. Adenomyosis can be diffuse or focal. MRI shows thickening of the endometrial–myometrial junctional zone forming an ill-defined low signal intensity lesion. MRI findings of adenomyosis occasionally mimic those of uterine malignancy or ovarian cancer.



Uterus appears bulky with altered signal intensity with diffuse thickening myometrium. Presence of T2W flow voids are noted in bilateral periuterine region, suggestive of congestion. On Post contrast study, the uterus shows subtle heterogeneous enhancement.

Endometrioma (chocolate cyst)

Endometrioma are the masses of endometrial tissue outside the uterus, most commonly seen on the surface of the ovary. They are seen in the females of reproductive age and present with the chronic pelvic pain and infertility. The appearance on MRI depends on the concentration of iron and protein in the fluid.^[6] Most endometriomas are very high signal on T1WI and very low signal on T2WI and high signal on T1 fat-suppressed images. MRI showed sensitivity of 90–92% and specificity of 91–98% for the diagnosis of endometrioma in adnexal masses.^[6]



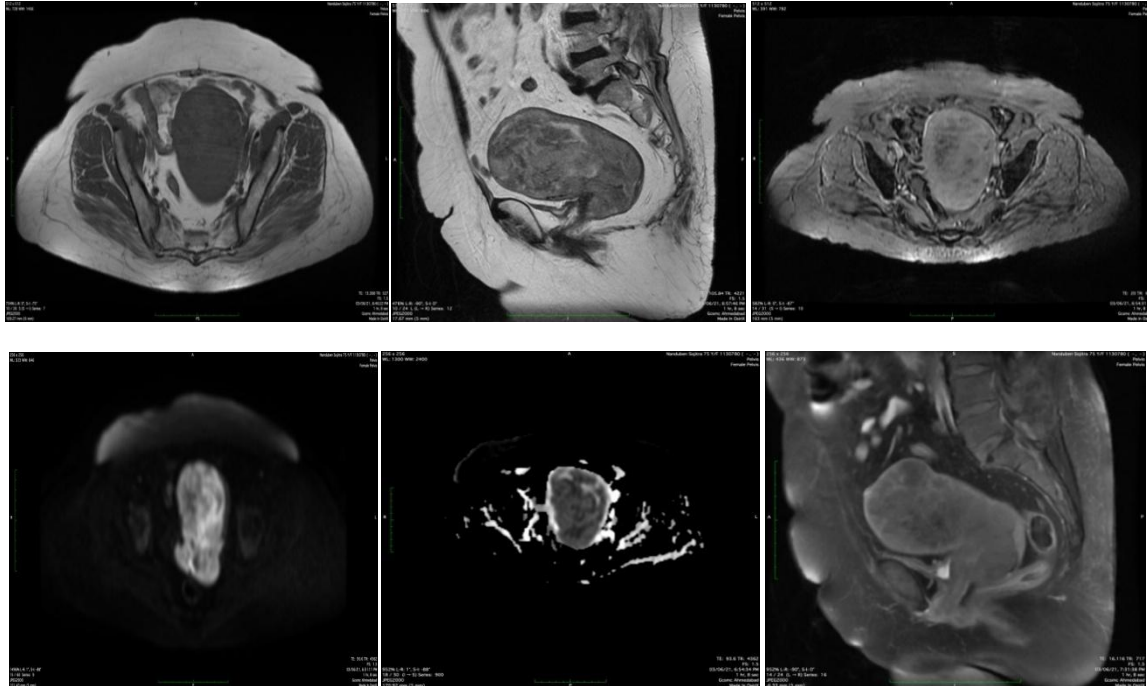
Well defined altered signal intensity with few internal septation noted in left adnexal region, The lesion appears hyperintense on T1W and iso to hyper intense (T2 shading) on T2W images. The lesion does not show suppression on PDFS /STIR images.

Endometrial carcinoma.

Abnormal vaginal bleeding in premenopausal women and vaginal bleeding in postmenopausal women are associated with high risk for endometrial carcinoma or endometrial hyperplasia. MRI is the most accurate imaging technique for the preoperative assessment of endometrial cancer because of its soft-tissue contrast resolution. MRI is useful to evaluate the tumor extension, myometrial invasion, lymph nodal involvement, and metastasis.^[7] MRI findings of endometrial carcinoma may be an exophytic tumor or diffuse endometrial thickening. These tumors have intermediate to low signal intensity on T1WI and low signal intensity on T2WI. On dynamic contrast-enhanced MRI, endometrial carcinoma enhances less than myometrium in the early phase and on delayed scan there is less distinction in enhancement.^[7]

Cervical carcinoma

Cervical carcinoma is the third most common gynecological malignancy.^[8] Five-year survival rates vary between 92% for Stage I disease and 17% for Stage IV disease.^[8] Nearly 90% of all cervical carcinomas are squamous cell carcinoma followed by adenocarcinoma (5–10%). MRI has excellent soft tissue contrast resolution, which is superior modality than computed tomography and ultrasound in the evaluation of cervical carcinoma. It is valuable in the assessment of the tumor size, depth of cervical invasion, tumor extent, and parametrial invasion.



Uterus is bulky in size shows large ill defined altered signal intensity solid cystic lesion involving uterine cavity extending to lower uterine segment and cervical region.

The lesion appears heterogeneously hypointense on T1W images and heterogeneously hyperintense on T2W and STIR images. On DWI, the lesion shows diffusion restriction. On GRE, few foci of blooming is noted. On post contrast study, the lesion shows heterogeneous enhancement.

Paraovarian cyst

Paraovarian or paratubal cysts are type of adnexal cyst that does not occur from ovary. These cysts arise from the Wolffian duct remnants of the mesovarium.^[9] They are located within the broad ligament, adjacent to ipsilateral ovary. They are typically thin-walled unilocular cysts, which appear hypointense on T1WI, and hyperintense on T2WI. Torsion or rupture of the cystic mass can occur. Rarely, it may complicate by torsion or hemorrhage.^[10]



Large well defined altered signal intensity unilocular cystic lesion noted arising from right adnexa with extending into pelvic cavity and reaching up to the umbilical region. The lesion appears hypointense on T1W and hyperintense on T2W & STIR images.

No evidence of mural nodule / internal septation noted.

Both ovaries appear normal in size.

Germ Cell Tumors

Tumors of germ cell origin are the second most common group of ovarian neoplasms, representing 15%–20% of all ovarian tumors. This group of tumors includes mature teratoma, immature teratoma, dysgerminoma, endodermal sinus tumor, embryonal carcinoma, and choriocarcinoma.⁽¹¹⁾ Of all the germ cell tumors, only mature teratoma is benign. Elevated levels of serum α -fetoprotein and human chorionic gonadotropin (HCG) can

also help establish the diagnosis. ⁽¹²⁾The diagnosis of mature cystic teratoma is straightforward at both CT and MR imaging. Adipose tissue within the Rokitansky nodule as well as the sebum rich fluid in the cyst cavity demonstrate fat attenuation at CT. Calcifications may or may not be present in the wall. A floating mass with hair or a fat-fluid interface can sometimes be identified. Pitfalls in the diagnosis of dermoid cyst at CT include fat blending in with surrounding retroperitoneal fat, occasional dermoid cysts without a fatty component, and lipoleiomyoma of the uterus, an unusual variant of myoma. ⁽¹³⁾



Case of left ovarian teratoma :Well defined altered signal intensity lesion is seen to arise predominantly from right adnexa .On T1W and T2W images, the lesion show heterogeneously hyperintense and shows suppression of hyperintense component on STIR images. The fat plane between lesion and surrounding structure to be preserved.

Epithelial Neoplasms

Epithelial ovarian neoplasms represent 60% of all ovarian neoplasms and 85% of malignant ovarian neoplasms. The two most common types of epithelial neoplasms are serous and mucinous tumors, ⁽¹⁴⁾Features that are more suggestive of benign cystic neoplasm include unilocularity of cysts, thin walls, minimal septations, and absence of papillary projections. Borderline tumors show more proliferation (papillary projections) than cystadenomas and may metastasize throughout the peritoneum but are not true malignancies.They are often seen in younger patients.

Serous tumors are the most common neoplasms in both the benign and malignant category. Because these masses are primarily cystic, the terms serous cystadenoma and serous cystadenocarcinoma are used to describe them. Mucinous ovarian tumors are less common than serous neoplasms. They represent 20% of all ovarian tumors and approximately 10% of all malignant ovarian tumors. ⁽¹⁵⁾Mucinous ovarian tumors are generally cystic but unlike serous tumors may be very large and tend to be multiloculated. ⁽¹⁶⁾

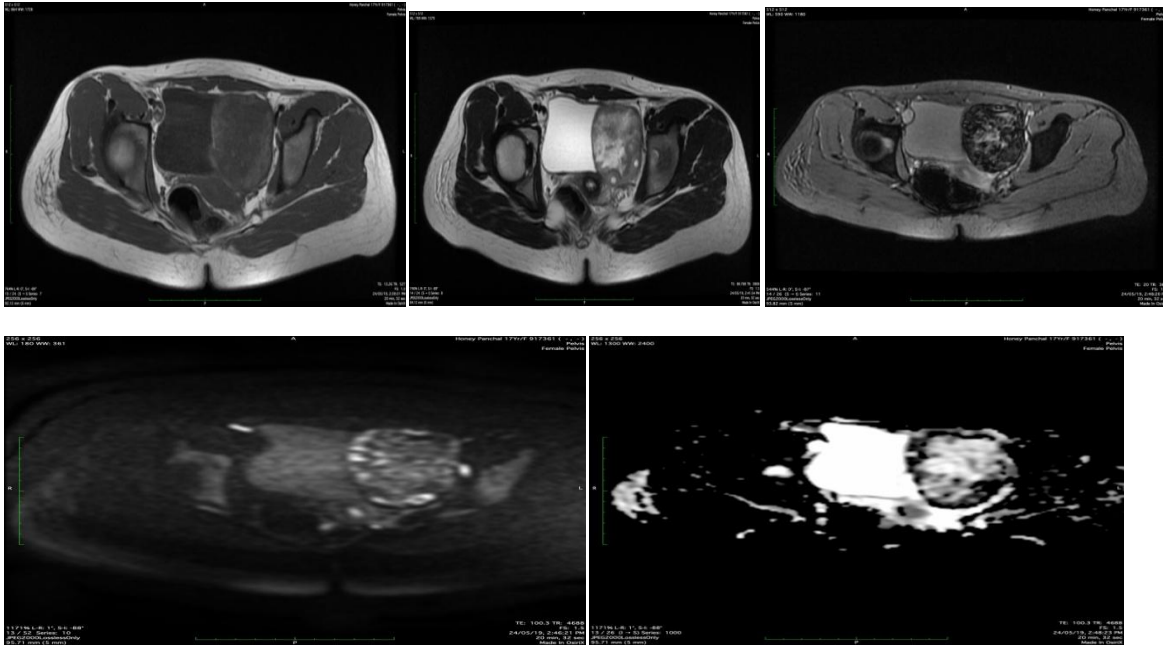


Case of left ovarian cystadenoma showing Well defined altered signal intensity lesion with internal septation is noted involving left adnexal region which appears hypointense on T1W images and hyperintense on T2W and STIR images. No evidence of any diffusion restriction is noted.

Ovarian torsion

Ovarian torsion is an uncommon cause of acute lower abdominal pain initiated by twisting of the ovarian vascular pedicle and/or the fallopian tube. If surgical intervention is delayed, torsion can lead to vascular compromise of the affected ovary, resulting in hemorrhagic infarction. ⁽¹⁷⁾The main feature of torsion is ovarian

enlargement due to venous/lymphatic engorgement, edema, and hemorrhage. Secondary signs include free pelvic fluid, an underlying ovarian lesion, reduced or absent vascularity and a twisted dilated tubular structure corresponding to the vascular pedicle.



Left ovary is grossly enlarged in size and shows peripherally arranged follicles along with T2W hyperintense central stroma within.

There is also presence of peripheral flow void noted suggesting vascular pedicles.

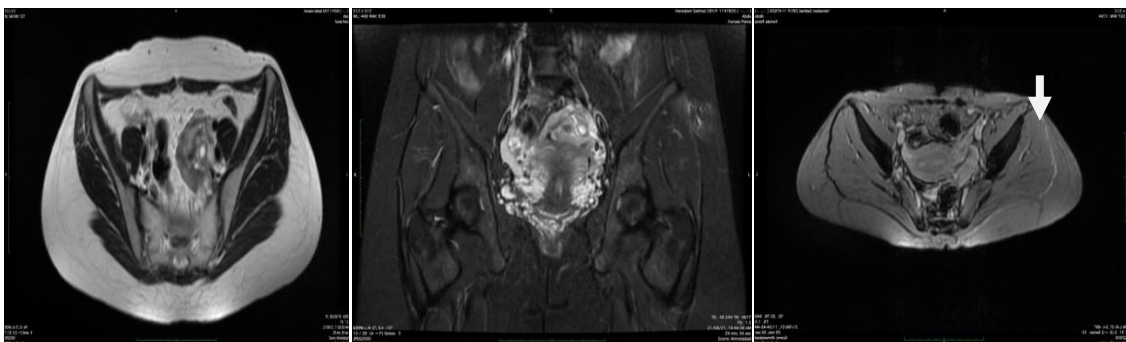
Right ovary appears to be normal.

Uterus, cervix and vagina appear to be normal.

Mild free fluid is noted in pelvis.

Ectopic pregnancy

The pregnant patient with acute abdominal pain presents a difficult diagnostic dilemma. In the pregnant patient, acute appendicitis is the most common cause of acute abdominal pain requiring surgical intervention.⁽¹⁸⁾The differential diagnosis includes entities commonly seen in young women, such as hemorrhagic ovarian cysts, ovarian torsion, cholecystitis, and renal calculi, as well as those entities specific to pregnancy, such as subchorionic hemorrhage and ectopic pregnancy. Then specific MR imaging findings of ectopic pregnancy, such as lack of an intrauterine pregnancy, isolated hemoperitoneum, tubal masses, hematosalpinx, and interstitial masses, are covered, followed by additional findings of unusual types of ectopic pregnancy, such as angular pregnancy, cornual pregnancy, and abdominal pregnancy. Finally, potential mimics of ectopic pregnancy, such as placental abnormalities, ovarian neoplasms, and corpus luteum cysts.



Presence of altered signal intensity lesion is noted in left adnexal region, which appears hypointense with few internal hyperintense areas on T1W images and hyperintense on T2W images. On DWI the lesion shows peripheral diffusion restriction.

**On SWAN images foci of blooming are noted (White arrow).
Free fluid in pelvic region and in both paracolic gutters.
MRI features are in favour of ruptured ectopic pregnancy.**

IV. Conclusion

MRI is an excellent investigation to evaluate the female pelvic masses due to its high spatial resolution, excellent tissue contrast, and multiplanar imaging capability. It is a very good modality for the tumor staging and follow-up of the cases. Certain key imaging features of uterine or adnexal pathologies on MRI are helpful in the specific diagnosis or narrow down the differential diagnosis. Characterization of uterine and ovarian tumors helps in the surgical planning.

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Conflicts of interest: There are no conflicts of interest.

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