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Evaluating the Role of MRI in the Diagnosis of Female Pelvic Disorders: A Case Series of Patients from a Tertiary Care Hospital

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Abstract: ***Background**: Magnetic Resonance Imaging (MRI) has emerged as a pivotal diagnostic tool in the assessment of pelvis pathology, offering unparalleled soft tissue contrast and detailed anatomic information. This paper reviews the diverse applications of MRI in evaluating various pelvic disorders. Advantages of MRI over traditional imaging modalities were discussed, particularly its ability to provide multiplanar imaging, reduce the need for ionizing radiation, and enhance tissue characterization. **Methods**: In our present retrospective case series of 11 abnormal female pelvis, which we evaluated on 1.5 Tesla MRI scanner, we came across a different & diverse case spectrum of abnormal female pelvis involving uterus and ovaries. The study was done in the Department of Radio - diagnosis, Jorhat Medical College, and Hospital for a period of 6 months from March, 2023 to August, 2023. The age group of patients included in this series range from 16 years to 60 years, including patients of reproductive age group and post - menopausal age group. **Results**: We found 11 pelvic conditions including multiple fibroids, adenomyosis of uterus, dermoid cyst, complex ovarian cyst, paraovarian cyst, neoplastic conditions of both uterus and ovary with certain inflammatory conditions. MRI was significantly superior to ultrasound in the evaluation of the tumour extension, myometrium invasion, detection of lymph nodes and parametrical involvement. **Conclusions**: 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 tumours helps in the surgical planning.*

Keywords: Pelvis, MRI, Ultrasound

1. Introduction

In the pelvis are located urogenital and gastrointestinal organs, and pelvic pathologies affect females in all different age groups. Patients commonly present with gynaecological complains such as menstrual irregularities, abnormal pelvic bleeding, and infertility and extra - gynaecological symptoms such as dysuria and painful defecation can also manifest.

Ultrasound is the initial imaging modality of choice of the female pelvis. It can determine the organ or site of abnormality and provide a diagnosis or short differential diagnosis in most patients. Doppler sonography helps assess normal and pathologic blood flow.1 Due to certain limitations of Ultrasonography, MRI has been using widely for diagnosing pelvis pathology in female due to its multiplanar imaging capacity, excellent inherent soft tissue contrast resolution and tissue specific diagnosis leading to easy recognition of origin of the lesion.[2, 3] It also helps in pre - surgical evaluation by providing a road map because of the better depiction of soft tissue planes in and around the lesion; apart from its anatomic localization, especially when biopsy or FNAC and later surgical resection is indicated.[2, 3, 4, 5, 6]

In this article we have evaluated about 11 cases of abnormal female pelvis in the patients of age group 16 – 60 years of age, evaluation being done on 1.5 T latest MRI imaging scanner at Jorhat Medical College and Hospital, Jorhat district of Assam (India).

This paper reviews the diverse applications of MRI in evaluating various pelvic disorder, such as uterine fibroids, endometriosis, ovarian tumours, cervical and endometrial carcinomas. Advantages of MRI over traditional imaging modalities were discussed, particularly its ability to provide multiplanar imaging, reduce the need for ionizing radiation, and enhance tissue characterization. Special attention was given to advancements in functional imaging techniques, including diffusion - weighted imaging and dynamic contrast - enhanced MRI, which further improve diagnostic accuracy. Additionally, we highlighted the integral role of MRI in pre - operative planning, treatment monitoring, and the assessment of complications in pelvic surgeries.

2. Materials and Methods

This case series study is a retrospective case evaluation of 11 different cases of abnormal pelvic pathologies; ascertained by clinical evaluation and referred by the clinical departments for MRI evaluation. The study was conducted in Department of Radiodiagnosis and Imaging, Jorhat Medical College and Hospital, Jorhat, Assam (India) during months of March to August 2023. The study was conducted on 1.5 T MRI scanner, using standard MRI protocols & sequences including T1, T2

WI with fat suppression wherever required, in all three planes along with STIR coronal and sagittal images and axial DWI. The age group included in our case series was 16 to 60 years and most common presenting complaints were pain in abdomen, infertility and menstrual irregularities.

Patient - related demographic details including name, age, sex, address, marital status, occupational history, past history, past surgical history, dietary habits, presenting clinical signs and symptoms as well as details of laboratory investigations were taken into consideration. MRI evaluation of the 11 cases of abnormal female pelvis was done after taking proper history and ruling out any contraindications for MRI study.

Preliminary ultrasound examination of pelvis with full bladder was done for prior assessment of lesion for size, location, margins, number and relation with surrounding structures, so that focus on such structures could be done while performing MRI. Patient was imaged in supine position with pelvic /body coil, followed by various standard MRI sequences used routinely in MRI pelvis protocols. Basic T1, T2 and STIR sequences in three different planes were obtained along with axial gradient dual echo in - phase and out - phase imaging (for detection of macroscopic fat). In addition, diffusion weighted images along with ADC mapping were obtained in axial planes.

The images were studied and lesion / lesions in each study were identified with respect to site, location, number. The lesion characteristics like size, shape, margins, number of lesions (single or few or multiple), mass effect on adjoining structures, wall characteristics of any cyst, any septae and its characteristics, any focal nodularity or papillary projections in cyst were taken into consideration for determining whether the lesion in question is benign or malignant and whether there was necessity of any contrast study for better lesion characterization.

3. Results and Discussion

The list of the 11 cases evaluated by MRI study is as below:

Case 1: - Age of 42 years / female – A multiparous patient presented with pain in lower abdomen and menorrhagia was referred to us for USG for initial evaluation. USG study revealed multiple hypoechoic mass lesions within the myometrium, a hyperechoic mass lesion within the endometrial cavity causing its expansion and blurring of endo - myometrial junction. These findings were confirmed on MRI evaluation with additional findings of bulky uterus showing multiple well - defined T2 hypointense lesions in anterior and posterior myometrium of the body of uterus, causing contour bulging. There is widening of anterior junctional zone with multiple T2 hyperintense cysts within. Study also reveals an enhancing polypoidal mass lesion showing heterogeneously hyperintense on T2WI noted to descend into the cervix abutting the endometrium posteriorly.

Final diagnosis: **Bulky uterus with multiple uterine leiomyomas, endometrial polyp and anterior myometrial adenomyotic changes**.

Case 2: - 38 years / female – A middle aged thirty - eight years old female came with vague pain and fullness in the lower abdomen towards the right side and was referred for USG for initial evaluation by OBGY department. Ultrasound reveals a large well - defined anechoic cyst with internal septations; arising in the pelviadnexal region. Ovaries were not visualised separately on USG. Further MRI study showed large, multiloculated thin walled T1/T2 hyperintense cystic mass in pelviadnexal region measuring approx.18x10x20cm with enhancing few internal mural nodules.

Outcome: Patient was operated and sample was sent for histopathological correlation. Left ovary was visualised during OT.
Final diagnosis: **Mucinous cystadenocarcinoma of right ovarian origin**.

Case 3: - 28 years / female – A young twenty - eight years old female presented with chief complaint of severe cyclical recurrent lower abdominal pain every month, radiating to the back with on and off fever. On preliminary USG, bulky ovaries with blurring of endo - myometrial zone with multiple dilated tubule - cystic structures with incomplete setations in bilateral adnexa was found. MRI findings revealed bulky uterus with asymmetrical thickening of posterior myometrium and blurring of posterior endo - myometrial junction. Uterine adhesion with mid and upper rectum noted in the form of T2/STIR hyperintense soft tissue component, showing contrast enhancement and diffusion restriction. There were multiple dilated tubule - cystic structures with incomplete septations seen in bilateral adnexa with T2 hyperintense internal collection. The dilated tubular structures showed contrast enhancement with adhesion to lateral pelvic wall and bowel loops. Bilateral ovaries could not be delineated separately.

Final diagnosis: **Bulky uterus with features of deep pelvic endometriosis in the form of focal adenomyotic changes in uterus, bilateral endometriotic cysts with surrounding adhesions causing distortion of pelvis anatomy.**

Case 4: - 47year / female – Presented with pain in lower abdomen with large abdomen. On initial ultrasound there is a large solid - cystic multiloculated lesion noted withing the pelvi - adnexal region. MRI findings revealed a large solid - cystic multiloculated pelvi - adnexal lesion showing T1 hypo and T2 hyperintensity with post - contrast enhancement of solid component and internal septa. There was abutment, displacement of surrounding structures noted. Left ovary could not be visualised separately. Right ovary appeared normal.

Final diagnosis: **A large pelvi - adnexal solid - cystic lesion of neoplastic aetiology - more likely a serous neoplasm. (ORADS 5).**

Management - CA - 125 was raised. Patient was operated and lesion was sent for histopathological correlation and it turned out to be malignant in origin.

Case 5: - 28 years / female – A young married female (age twenty - eight years) came to Gynaecology OPD with complaints of pain in lower abdomen associated with white

PV discharge. On ultrasound study, there was 5x4 cm sized benign cystic lesion arising from right adnexa. Right ovary was normal. A 3.5x2.8cm cystic lesion with internal septations within the left ovary. On MRI Right ovary was normal. There was a T2 hyper and T1 hypointense lesion with no internal septations and solid component noted adjacent to right ovary without post contrast enhancement and diffusion restriction. There was another T1 hypo and T2 hyperintense cystic lesion with T1 hyperintense enhancing internal septa noted in left ovary.

Final diagnosis: **Right ovarian paraovarian cyst with left sided complex ovarian cyst (ORADS 2).**

Case 6: - 45 years / female – Presented with pain in the abdomen and fever. Patient was sent for MRI from gynaecology department. On MRI, T1/T2 hypointense multiloculated tubule - cystic lesion showing minimal peripheral enhancement noted in right adnexal region. Left ovary showed a T1 hyperintense lesion showing suppression on FS images with a T1/T2 hypointense focus showing blooming artifact on GRE.

Final diagnosis: **Right sided hydrosalpinx with possible cystic teratoma of left ovary.**

Case 7: - 59 years / female – Presented with post - menopausal bleeding with burning micturition. On gynaecological examination mass lesion noted within the cervical canal and patient was sent for MRI. On MRI, T2 hyperintense mass lesion noted involving anterior and posterior lips causing expansion of cervix with diffusion restriction and post contrast enhancement along with involvement of adjacent structures. There was another T2 hypointense lesion noted in fundus without post contrast enhancement.

Final diagnosis: **Malignant cervical growth {FIGO - IIB} with small intramural uterine myoma (FIGO - IIB).**

Management - Biopsy was done and malignant cells was found on tissue sample.

Case 8: - 42 - year - old woman with low backache had undergone pelvic MRI, and on scan she had bulky uterus measuring about 8.8x7.3x10.4 cm in size with globular fundus with multiple ill - defined T2 hypointense lesions diffusely distributed within the body and uterine fundus. There was effacement of endo - myometrial junction with predominantly in the posterior aspect. There was asymmetric enlargement of involved posterior wall of body of uterus as compared to anterior wall. The focal involved area had few tiny T2 high SI myometrial cysts.

Final diagnosis - **Bulky uterus with adenomyosis.**

Patient was referred to Gynaecology department for further opinion and treatment.

Case 9: - 27 years / female – Presented with infertility and backache. Initial USG showed presence of bilateral ovaries in POD with multiple hypoechoic cystic lesion withing the bilateral ovaries. Focal adenomyotic changes were noted. On MRI there was multiple T1 hyperintense lesions within the bilateral ovaries with adhesion of ovaries with each other. Mild enhancement seen on post contrast study.

Final diagnosis: **Pelvic endometriosis.**

Case 10: - 40 years / female – Patient was directly sent for MRI pelvis from gynaecology department. MRI study revealed a large, multiloculated cystic lesion with papillary projections in abdominopelvic region showing T1 hyperintensity and T2 hypointensity with enhancement of papillary projections and abutment of adjacent structures. Right ovary was not visualised separately. Left ovary appeared normal.

Final diagnosis: **Right adnexal neoplastic aetiology - possibly mucinous in origin (ORADS4)**

Management - CA - 125 and HPE correlation was given

Case 11: - 55 year/ female - MRI study reveals a solid - cystic lesion noted in left adnexa showing T1 hyperintensity and markedly hypointense on T1FS. Solid mural dermoid plug noted within the lesion. There were two separate uterine cavities with 2 separate cornua united to form single cervix. Left uterine cavity was bulky, showing adenomyotic changes.

Final diagnosis: **Bicornuate unicolis uterus with left ovarian dermoid cyst and adenomyotic changes on left uterine cavity.**

Representative Cases:

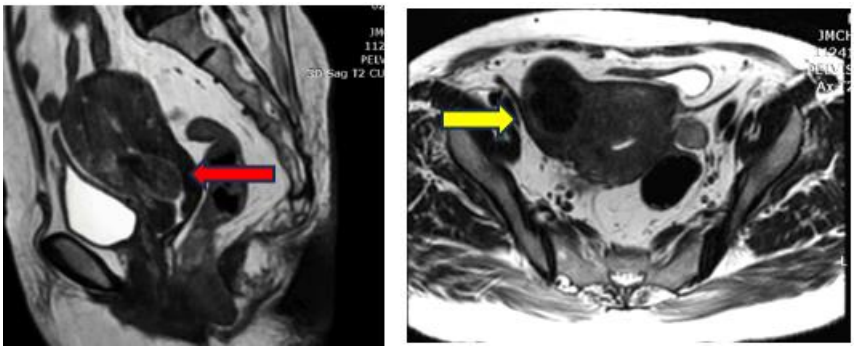

Figure 1A `and 1B: Bulky uterus with endometrial polyp (Red arrow) and Uterine myoma (Yellow arrow)

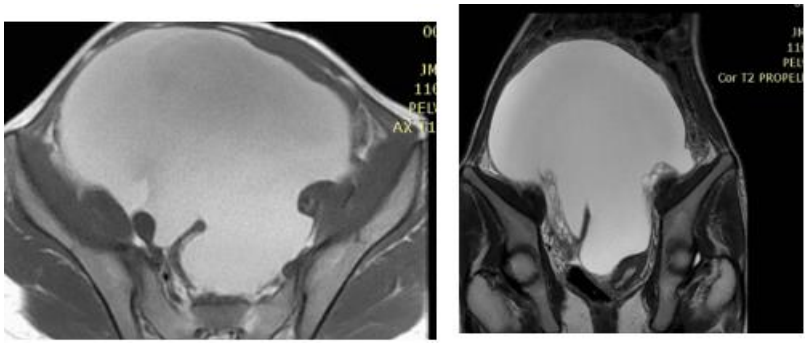

Figure 2A and 2B: Mucinous cystadenocarcinoma showing hyperintensity on both T1 and T2 images.

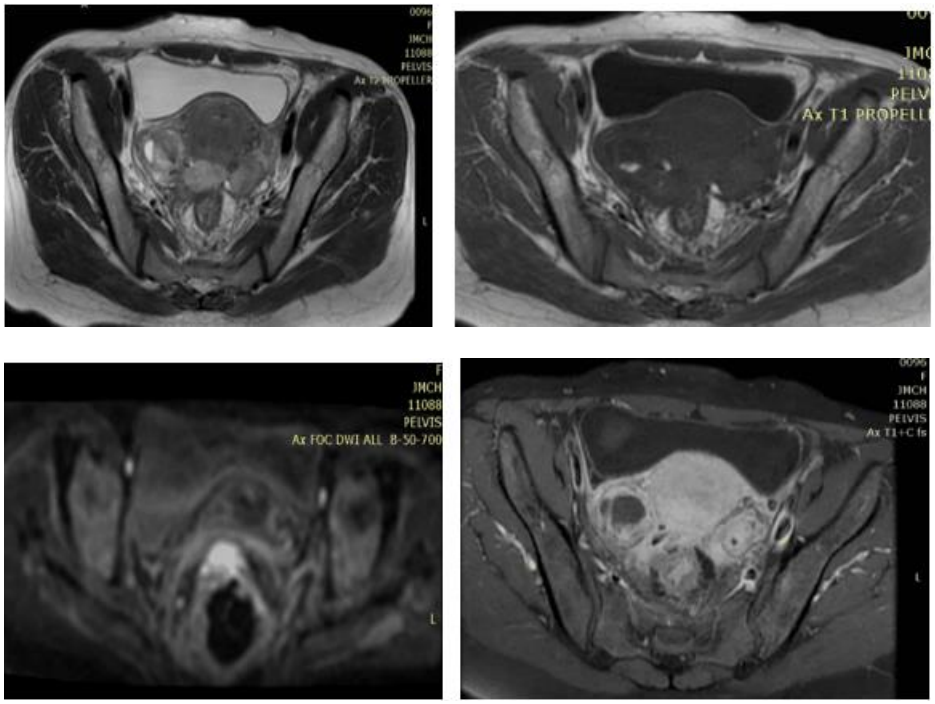

Figure 3 (A - D): Deep pelvic Endometriosis

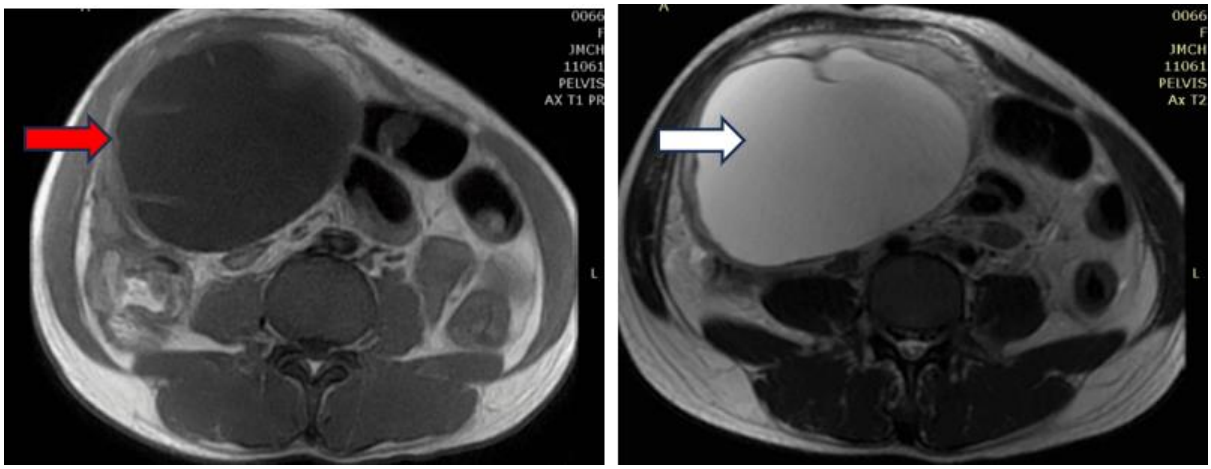

Figure 4A and 4B: Ax T1 (Red arrow) and Ax T2 (White arrow) showing hypointense and hyperintense multiloculated large cystic lesion respectively consistent with Serous neoplasm

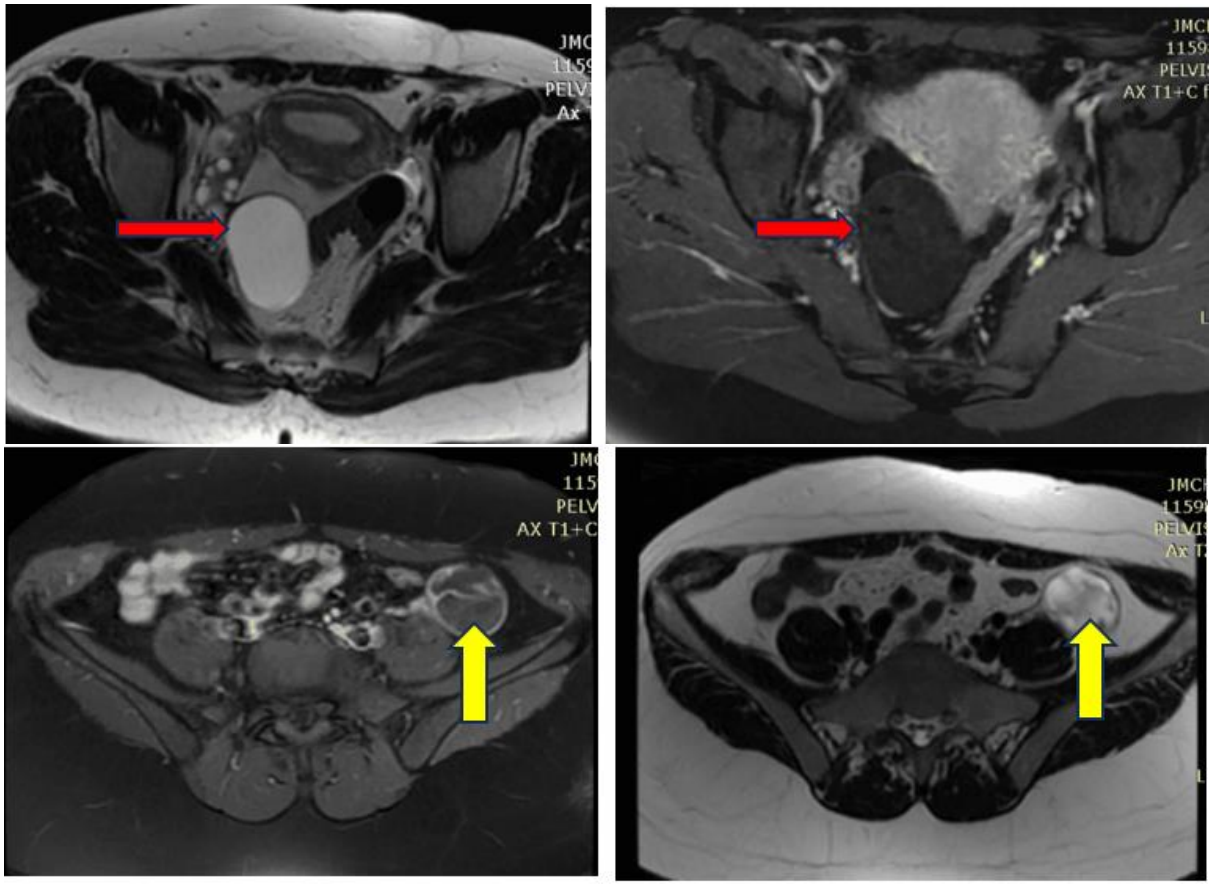

Figure 5A and 5B: Right Paraovarian cyst shown by red arrow and left ovarian complex cyst shown by yellow arrow.

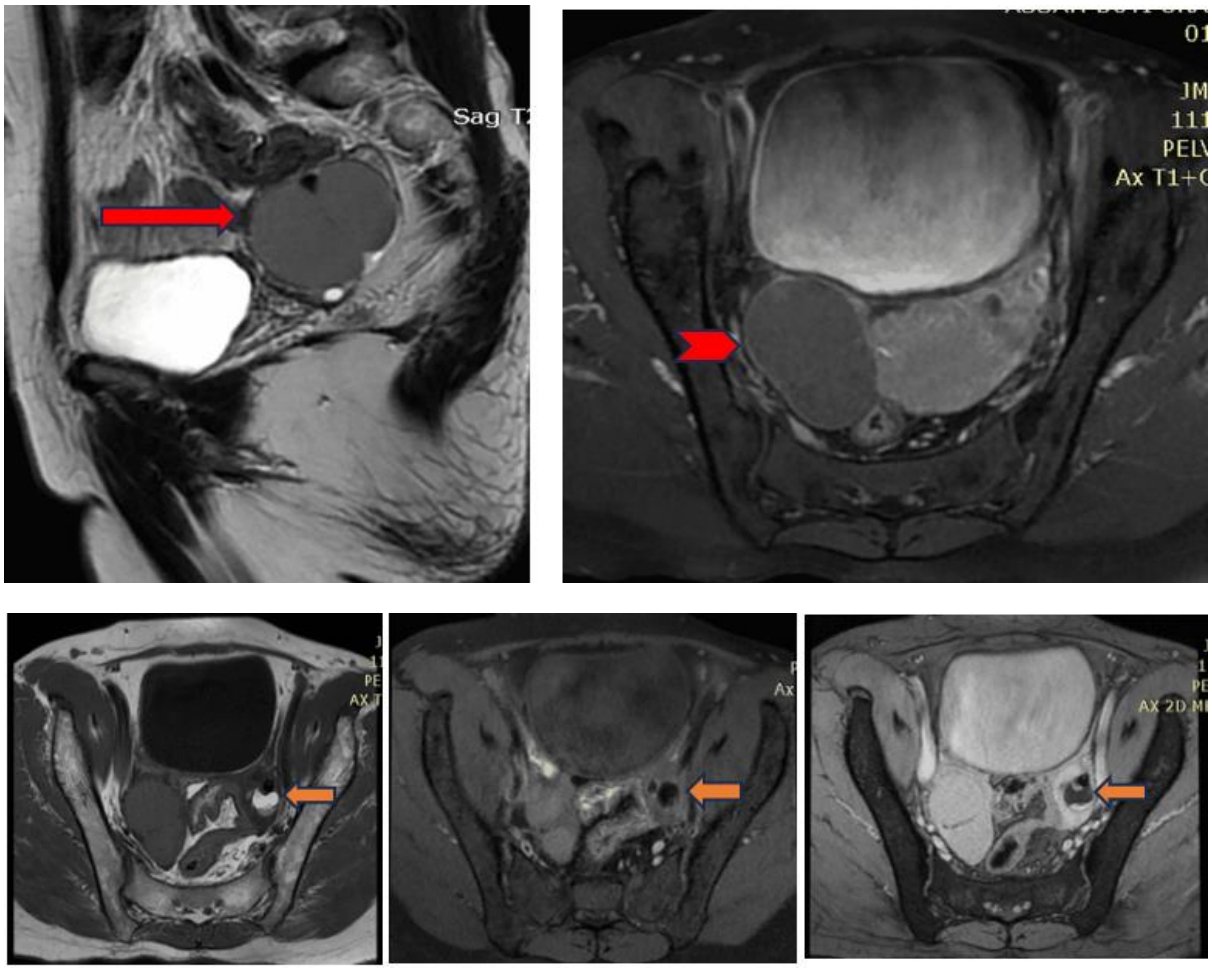

Figure 6 (A - E): Right sided hydrosalpinx shown by red arrow and left ovarian dermoid cyst shown by orange arrow.

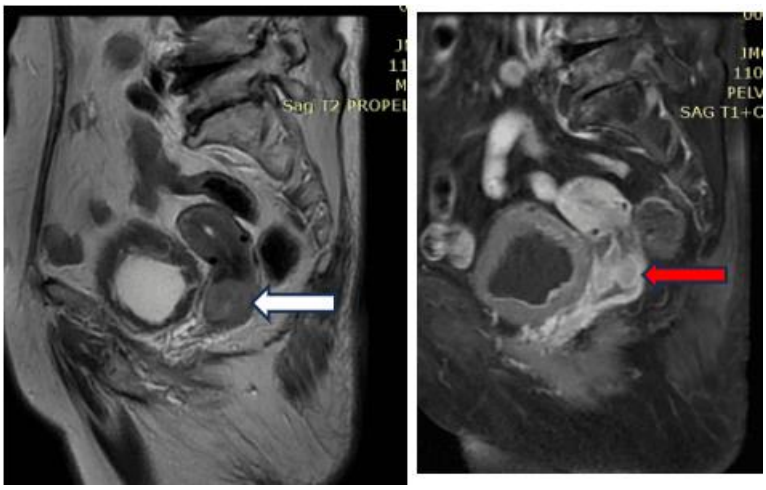

Figure 7A and 7B: Sagittal T2w image showing hyperintense lesion (White arrow) in the cervix with post contrast enhancement on Sagittal T1+c study (red arrow)

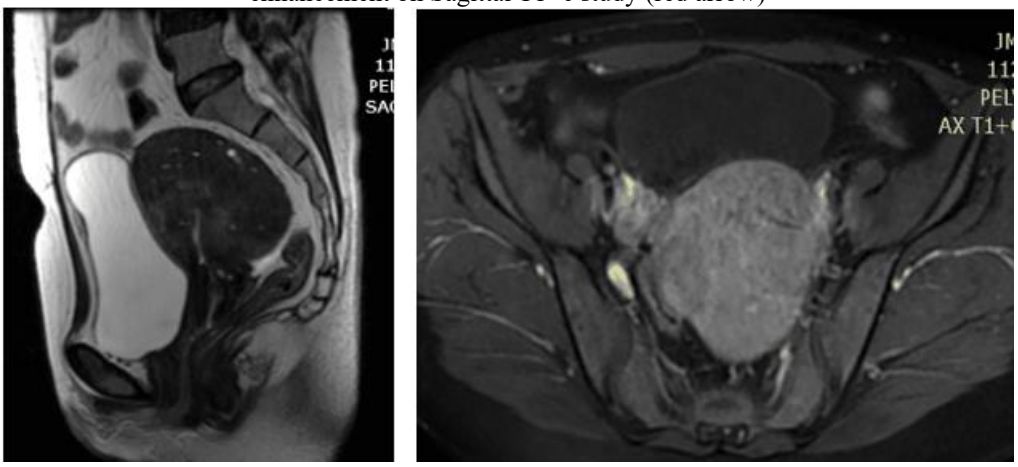

Figure 8A and 8B: Sagittal T2w image showing bulky uterus with blurred endo - myometrial junction and multiple myometrial cysts. Axial T1+c study shows no abnormal enhancement.

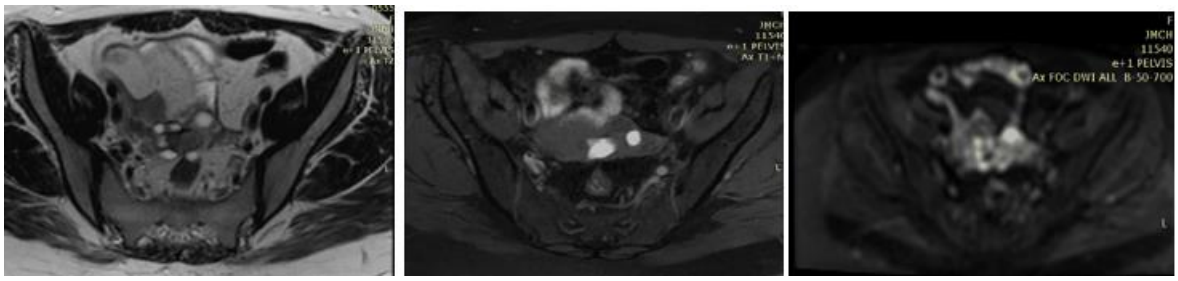

Figure 9A, 9B and 9C: Bilateral ovaries in POD with T1 hyperintense cysts within showing minimal surrounding diffusion restrictions.

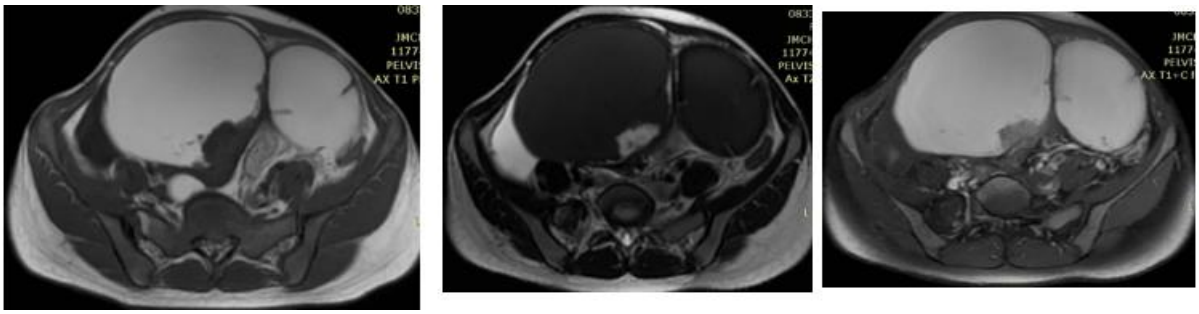

Figure 10A, 10B and 10C: Axial T1 hyperintense and T2 hypointense pelviadnexal cystic lesion with mural nodule showing post contrast enhancement on T1+c study.

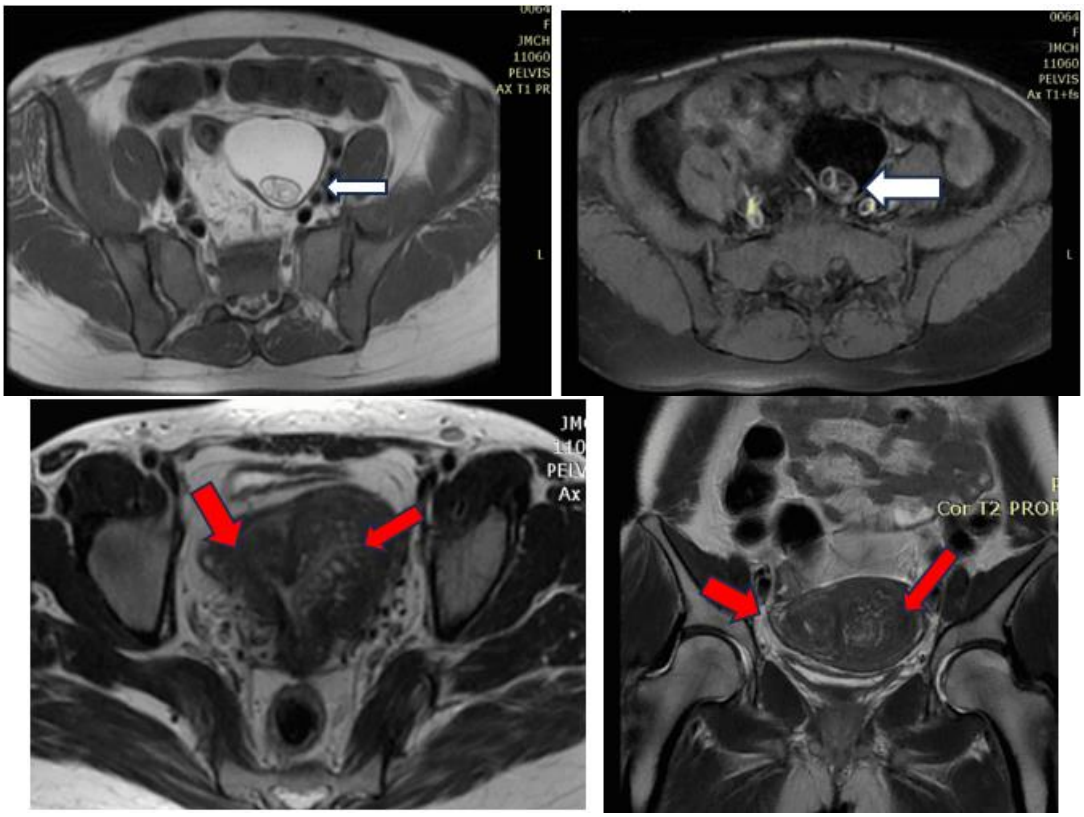

Figure 11A, 11B, 11C and 11D: T1 hyperintense lesion with dermal plug on left adnexa with signal loss on fs image. (White arrow). There are two uterine cavities with two cornua joining to form single cervix, with one uterine cavity is bulky showing adenomyotic changes. (Red arrow).

4. Summary and Conclusions

MRI plays a critical role in the evaluation of pelvic masses, providing high - resolution images that help differentiate between benign and malignant lesions. Its non - invasive nature and lack of ionizing radiation make it a preferred modality in various clinical scenarios, such as pre - operative planning and disease assessment. However, limitations such as cost, availability, and patient tolerance must be considered.

In conclusion, the utilization of MRI in evaluating pelvic masses is indispensable for accurate diagnosis and effective treatment planning.

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