

Prevalence of Female Pelvic Pathologies: Cross-sectional Study among Patients Undergoing Magnetic Resonance Imaging for Pelvic Assessment

DEVENDRA VIKAS KULKARNI¹, SUSHANT HARI BHADANE², AJAY MRUTYUNJAYA BANI³, AMOL MURLIDHAR JAGDALE⁴



ABSTRACT

Introduction: A wide variety of pathologies affect the female genital tract. Magnetic Resonance Imaging (MRI) has recently become a useful tool for the evaluation of female pelvic pathologies owing to certain benefits over ultrasonography. This modality, in the long run would be helpful in improving early diagnosis and clinical management of many patients.

Aim: To demonstrate the wide spectrum of female pelvic pathologies that can be diagnosed using MRI.

Materials and Methods: It was a cross-sectional study carried out at Department of Radiodiagnosis among 75 patients referred to the MRI department for assessment of female pelvic

organ pathologies. Appropriate MRI sequences and multiplanar imaging were performed for every patient and findings noted in a pre-designed proforma.

Results: On MRI, 46 (61.3%) patients had Uterine and Cervical pathology and 32 (42.7%) patients had Adnexal pathology among others. Vaginal pathologies were noted in 10 (13.3%) patients. Rectal and urinary bladder pathologies were seen in 5 (6.7%) and 1 (1.3%) patients respectively.

Conclusion: The study shows that MRI was especially useful in detecting a wide spectrum of female pelvic pathologies including benign lesions such as fibroids, congenital mullerian anomalies, adenomyosis and endometriosis; and malignancies.

Keywords: Benign and malignant lesions, Pelvic malignancy, Vaginal bleeding

INTRODUCTION

A wide variety of pathologies affect the female genital tract. Patients commonly present with complaints related to these pathologies such as menstrual irregularities, abnormal pelvic bleeding, pelvic pain, infertility etc. Apart from the history and clinical examination, imaging plays a key role in the diagnosis and management of these pathologies.

MRI offers high contrast resolution, good soft tissue characterisation [1], provides multiplanar imaging capabilities and a larger field of view compared to ultrasonography and hence has recently become a useful tool for the evaluation of female pelvic pathologies [2]. It is especially useful for identification of congenital abnormalities of the uterus, evaluation of complex pelvic masses, sonographically indeterminate adnexal lesions, diagnosis of focal uterine lesions like leiomyomas and diffuse disorders like adenomyosis and detection as well as staging of gynaecological malignancies. MRI is also useful in postoperative follow-up, detecting tumour recurrence and in differentiating recurrence/residual from postoperative scarring [3]. MRI has additional advantages such as lack of ionising radiation and iodinated contrast material, and its ability to differentiate lesion from postoperative scarring in pelvic malignancies.

Therefore, MRI is now often used as a problem-solving tool in patients where ultrasound findings are not definitive [4]. Complete knowledge of the MRI sequences, imaging features of physiologic variations and pathologic conditions that affect the female pelvis can be helpful in establishing an accurate diagnosis.

However, in our experience, it is still an underutilised investigation in view of limited availability, in only the more advanced centres in the urban areas, lack of awareness amongst the clinicians of its utility and a perception of it being a prohibitively expensive investigation. This modality if used in a rational manner for appropriate indications, it can be cost-effective [5] and would serve

for early diagnosis of many female pelvic conditions which in the long run would be helpful in improving early clinical management of many patients.

Considering this background, the study was undertaken to determine the prevalence of various female pelvic pathologies among patients undergoing MRI for pelvic assessment, in the broader view of demonstrating the wide spectrum of female pelvic pathologies that can be diagnosed using MRI.

MATERIALS AND METHODS

A cross-sectional study carried out at Department of Radiodiagnosis of a tertiary care teaching hospital in Mumbai for a period of 1 year i.e., from 1st June 2013 to 31st May 2014 among patients referred to the MRI department for assessment of female pelvic organ pathologies. Institutional Ethics Committee approval was obtained before starting the study.

Inclusion and Exclusion criteria: Patients with abnormal vaginal bleeding, infertility, suspected pelvic congenital anomalies and known case of pelvic malignancy for staging and follow-up, referred for MRI of the pelvis by the Gynaecology Department were included in the study. Also, patients in whom the ultrasound findings were inconclusive or to confirm those findings or MRI was anticipated to provide additional relevant clinical or pathological information were included. However, claustrophobic patients, patients having contraindications for MRI, those in whom contrast could not be administered and patients who were unwilling to participate in the study were excluded. All the patients referred for MRI pelvis and fulfilling the inclusion and exclusion criteria were included in the study sample. Written informed consent was obtained from the study participants.

A pre-designed proforma was used for data collection. Information on patient age and clinical presentation was noted. MRI of the pelvis

was performed on a 3T Philips Achieva MRI scanner. Appropriate MRI sequences and multiplanar imaging were performed for every patient. A phased array torso surface coil was strapped around the lower abdomen and pelvis of the patient. A slice thickness of 4 mm with a slice gap of 1 mm was selected. A saturation band was placed along the anterior abdominal wall to reduce the motion artifacts produced due to respiratory movements.

Following was the protocol of MRI sequences conducted:

- T2 Weighted Turbo Spin Echo (T2W TSE) Sagittal.
- T2W TSE Axial.
- T2W TSE Coronal
- T1W TSE Axial
- T1 W TSE with fat saturation axial

In few patients, additional sequences were obtained:

- Postgadolinium T1W TSE with fat saturation
- Dynamic postgadolinium T1 TSE with fat saturation
- 3D T2W sequence
- Diffusion Weighted Imaging
- T2W TSE with fat saturation

A true anatomical sagittal scan was first obtained by planning on the three plane survey images. If uterus was the organ of interest, then coronal and axial scans were obtained along the uterine axis and perpendicular to it. If there was no specific organ of interest or an irregular adnexal lesion, then true anatomical coronal and axial scans were obtained.

STATISTICAL ANALYSIS

Data analysis and generation of graphs was done using MS-Excel. Quantitative and qualitative data was represented in form mean (SD) and frequency (%) respectively.

RESULTS

The present study was conducted among 75 female patients who came to the Radiology Department with pelvic pathologies. The mean age of the study patients was 35.5 ± 16.0 years [Range 1.2 months-80 years]. In this study, 48 (64%) patients were in the reproductive age group i.e. 20-49 years. The most common clinical presentation was pelvic pain seen in 38 (50.7%) patients. On MRI, 46 (61.3%) patients had uterine pathology and 32 (42.7%) patients had adnexal pathology among others. Thus, most common site in our study was utero-cervical region followed by Adnexa. [Table/ Fig-1] Overall, our study showed that benign pelvic pathologies (82.6%) were more common than malignant pathologies (17.4%).

The distribution of patients according to uterine pathologies is given in [Table/Fig-2]. Out of 46 patients with uterine pathologies, benign pathologies were more common, seen in 36 (78.2%) patients than malignant pathologies in 10 (21.7%) patients.

Among the benign pathologies, congenital anomalies were the most common, noted in 17 (37.0%) patients. Most common congenital anomalies were hypoplastic uterus and uterine agenesis seen in four patients each (23.5%). In our study, total 12 patients out of 46 i.e., 26.1% had fibroids. Most common location of fibroid was intramural seen in 66.6% of patients followed by submucosal location in 16.6% patients. Based on morphology, 33.3% patients had degenerated fibroids and uncomplicated/simple fibroids were seen in 58.3% patients [Table/Fig-2]. Two patients had adenomyosis with intramural fibroid, one patient had congenital arcuate uterus with subserosal fibroid and one patient had gestational trophoblastic neoplasia with arteriovenous malformation. Among the malignant pathologies, cervical carcinoma was seen in six patients and endometrial carcinoma was noted in four patients.

Variables	Values
Age (years)	35.5±16.0 (Range 1.2 months-80 years)
Clinical presentation	
Vaginal bleeding	19 (25.3%)
Amenorrhoea	10 (13.3%)
Menstrual disturbances	26 (34.7%)
Pelvic pain	38 (50.7%)
Infertility	6 (8.0%)
Lump in abdomen	12 (16.0%)
Urinary complains	3 (4.0%)
Rectal bleeding	5 (6.7%)
Pathologies	
Vaginal pathology	10 (13.3%)
Uterine and cervical pathology	46 (61.3%)
Adnexal pathology	32 (42.7%)
Urinary bladder pathology	1 (1.3%)
Rectal pathology	5 (6.7%)
Miscellaneous pathology	5 (6.7%)

[Table/Fig-1]: Patient characteristics; the total is not 75 as some patients had more than one clinical presentation and more than one pelvic pathology.

Pathology	n (%)
Benign lesions (n=36)	
Congenital anomalies	17 (37.0%)
Hypoplastic	4 (23.5%)
Agenesis	4 (23.5%)
Arcuate	2 (11.8%)
Bicornuate	2 (11.8%)
Didelphys	2 (11.8%)
Septate	1 (5.9%)
Unicornuate	1 (5.9%)
Malformation	1 (5.9%)
Fibroid	12 (26.1%)
Classification of fibroids based on location	
Intramural	8 (66.6%)
Intramural+Sub serosal	1 (8.33%)
Submucosal	2 (16.6%)
Subserosal	1 (8.33%)
Classification of fibroids based on morphology	
Degenerated	4 (33.3%)
Degenerated+Simple	1 (8.3%)
Simple	7 (58.3%)
Arterio-Venous malformation	2 (4.3%)
Retained placenta	2 (4.3%)
Adenomyosis	4 (8.7%)
Diffuse	3 (75.0%)
Focal	1 (25.0%)
Gestational trophoblastic neoplasia	2 (4.3%)
Endometrial polyp	1 (2.17%)
Malignant lesions (n=10)	
Cervical and endometrial carcinoma	10 (21.7%)

[Table/Fig-2]: Distribution of patients according to Uterine pathologies (n=46).

In this study, benign ovarian masses were more common than malignant ovarian lesions [Table/Fig-3]. Out of 75 patients, 22 (29.3%) had benign ovarian pathologies out of which largest number of cases i.e., seven were simple cysts accounting for 31.8%.

Pathology	n (%)
Benign lesions (n=22)	
Congenital	3 (13.6%)
Simple cyst	7 (31.8%)
Complex cyst	1 (4.5%)
Haemorrhagic cyst	4 (18.2%)
Dermoid cyst	2 (9.1%)
Theca lutein cyst	1 (4.5%)
Cystadenoma	4 (18.2%)
Malignant lesions (n=4)	
Cystadenocarcinoma	2 (7.4%)
Solid malignancy	2 (7.4%)

[Table/Fig-3]: Distribution of patients according to ovarian pathologies.

Vaginal pathologies were seen in 10 (13.3%) patients. Four patients out of these had Congenital Septum+Haematocolpos and two patients had congenital hypoplastic vagina. There was one patient each of a congenital malformation, fistula, cyst and carcinoma.

Total 18 (24%) patients had pelvic malignancies. Amongst them, 6 (33.3%) patients had cervical malignancy, 4 (22.2%) patients had endometrial carcinoma, 4 (22.2%) patients had ovarian carcinoma, 3 patients (16.6%) had rectal carcinoma and one patient had vaginal malignancy.

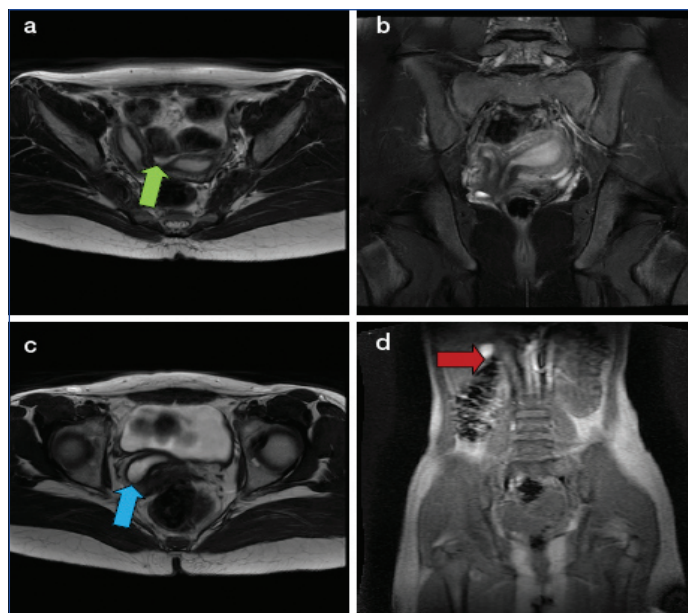
There were five patients with miscellaneous pelvic pathologies. Among these, there was one patient each of presacral teratoma, pelvic AVM's with large pelvic haematoma, perineal tear, post-hysterectomy collection in operative bed, mesenteric cyst.

DISCUSSION

The mean age of our study patients was 35.5 years. Pelvic pathology requiring imaging was more common in middle aged females. A study by Schwartz LB et al., was also conducted in similarly aged patients [6]. Most of the patients with leiomyoma and adnexal pathologies were 20-49 years (61.5%). In our study, pelvic pain was the chief presenting complaint in 50.7% of patients followed by menstrual disturbances in 34.7% and vaginal bleeding in 25.33% of patients. However, in studies by Schwartz LB et al., and Szklaruk J et al., the commonest presenting complaint was bleeding [6,7]. In general, our study showed that benign pathologies (82.6%) were more common than malignant pathologies (17.4%). These findings are consistent with study by Choudhary S et al., [8].

Among the benign pathologies, congenital anomalies were most common (37%). Type I Mullerian duct anomaly was most common finding in our study. Sagittal and axial planes were most important in diagnosing Type I Mullerian duct anomalies. Two patients had combined uterine didelphys with transvaginal septum with haematocolpos along with absent kidney on the side ipsilateral to the haematocolpos. These cases belonged to a group of rare congenital anomalies of the urogenital tract involving Mullerian ducts and Wolffian structures, and characterised by the triad of didelphys uterus, obstructed hemivagina and ipsilateral renal agenesis known as Herlyn Werner Wunderlich Syndrome [Table/Fig-4] [9]. In a study conducted by Saleem SN, uterine anomalies were identified in 0.17% fertile women and 3.5% infertile women. The prevalence of uterine anomalies in the general population was around 0.5% [10].

In patients with gynaecological complaints, leiomyoma was the most common finding. All the uncomplicated leiomyoma had low signal intensity compared to myometrium on T2WI. Fat suppressed T1W images are used to differentiate between



[Table/Fig-4]: Herlyn Werner Wunderlich Syndrome MRI T2 Axial; a,c) T2 Coronal; b) Surview images; d) reveal uterus didelphys (green arrow), Obstructed right hemivagina (blue arrow) and absent right kidney (red arrow)

red degeneration of fibroid and fatty changes, as fibroids with red degeneration maintain their hyperintense signal even on fat suppressed images. Study done by Togashi K et al., shows that leiomyoma is more common than rest of uterine pathologies [11]. Similar to our study, Murase E et al., reported in their study that leiomyoma occur most commonly in the myometrium of the uterine corpus [12].

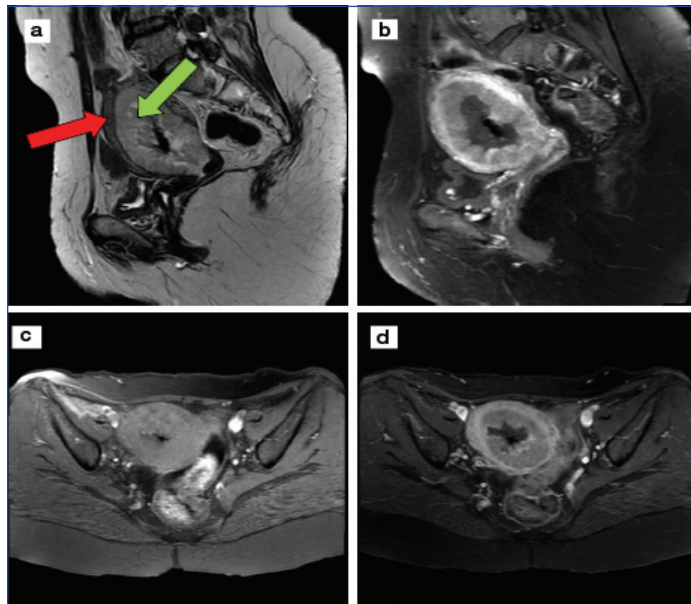
Adenomyosis was the third most common benign uterine pathology after congenital anomalies and leiomyoma. On MRI, the diffuse form of adenomyosis presented with thickening of the junctional zone. Areas of adenomyosis were seen as bright foci and cyst-like high signal intensity areas which represent heterotopic endometrial glands or haemorrhagic foci. Focal adenomyosis was seen as a hypointense focal uterine lesion abutting the junctional zone. In comparison to leiomyomas, it was less well-defined and poorly marginated. Diffuse adenomyosis was more common than the focal adenomyosis. These findings were similar to study done by Reinhold C et al., [13].

In our study, 22 patients had benign ovarian pathology, most of them were simple cysts followed by haemorrhagic cyst and benign cystic ovarian lesions. All the simple cysts appeared hypointense on T1W images and hyperintense on T2W images. All of them were incidental findings. There were two patients of dermoid cyst. According to study by Koonings PP et al., mature cystic teratoma are the most common germ cell tumours and the most common ovarian neoplasm [14]. Kurman RJ et al., reported similar findings stating that unlike other germ cell tumours of the ovary, they have a wider age distribution and may be encountered from infancy to old age [15]. In our study, the cases had unilateral tumour. However, Kurman RJ et al., reported bilateral tumour in 8% to 15% of cases [15].

Out of 75 patients included in this study, 18 patients (24%) had malignancy. Most common malignancy in our study was cervical followed by endometrial and ovarian malignancies. Cervical cancer is the second most common gynaecological malignancy worldwide and is the most common pelvic malignancy in Indian women as shown in a study by Somalwar SA et al., [16]. MR imaging has proven to be an excellent modality to evaluate tumour size, extent, and nodal involvement [17]. In this study, for one patient, the tumour was confined to the cervix and was in stage IB2. Two patients belonged to stage II out of which one was IIA and one was IIB

with parametrial invasion. One patient belonged to stage IVA. These figures correlated with the higher incidence of carcinoma cervix than carcinoma endometrium in Indian population. The national cancer registry programme stated in their 2009 report that there were 90,708 cases of carcinoma cervix in 2007 in India making carcinoma cervix the commonest malignancy affecting female genital tract [18].

Endometrial carcinomas were diagnosed as confined to the endometrium when the junctional zone appears intact. Myometrial invasion was diagnosed when junctional zone was indistinct. A smooth interface between the endometrium and myometrium was considered to represent intact myometrium. However, irregularity of interface was considered as myometrial invasion. Both T2W and postcontrast images were used for staging purpose [Table/Fig-5]. Study conducted by Lee et al showed similar findings with maximum patients in stage IB group (43%) followed by stage IA (34%) [19]. Cervical stromal invasion was not seen in any patient. Also, two patients had associated fibroids. Patients having Stage I and II Ca Endometrium were treated with radical hysterectomy with/without lymph node dissection. Advanced cases were treated with surgery as well as radiotherapy and chemotherapy.



[Table/Fig-5]: Carcinoma endometrium stage Ia MRI reveals T2 sagittal; a) T2 FAT SAT Axial; c) Postcontrast T1 axial; d) Postcontrast T1 sagittal; b) reveal endometrial lesion (green arrow) without myometrial invasion (red arrow)

In our study, 42.7% had adnexal pathology, either primary or secondary. Amongst these, two patients had hydrosalpinx and one patient had haematosalpinx. One case was diagnosed as adnexal mass lesion in present study which proved to be broad ligament fibroid after surgery and histopathology. Amongst patients with congenital adnexal pathologies, two patients had atypical MRKH syndrome with absent ovaries and one had congenital malformation. One patient was a 26-year-old female with complaints of bleeding PV and MRI revealed a large right ovarian neoplastic lesion, with possibility of germ cell tumour given, which was histopathologically proven as yolk sac tumour. Another patient was a 49-year-old female with complains of pain in abdomen and difficulty in micturition with two episodes of postmenopausal bleeding. USG revealed a solid cystic pelvi-abdominal mass. MR revealed a large solid mass with cystic and necrotic areas with the right ovary not separately seen, with moderate ascites, omental deposits s/o malignant ovarian neoplasm. MRI was extremely useful in diagnosing ovarian lesion and differentiating benign from malignant lesions. This is

in accordance to study done by Kim MY et al., of CT and MRI of ovarian tumours with emphasis on differential diagnosis [20].

Limitation(s)

As our study was conducted in a tertiary care hospital, a wide spectrum of female pelvic pathologies was available for MRI assessment including a few rare anomalies. However, the study patients were not selected randomly and therefore, the prevalence rates cannot be generalised is a limitation of our study.

CONCLUSION(S)

The study involved MRI assessment of mostly women in the reproductive age group commonly presenting with complaints such as pelvic pain and menstrual disturbances. On MRI, female pelvic pathologies were most commonly noted in the uterine and cervical region followed by adnexal region. Among other pathologies noted were in the vagina, rectum and urinary bladder. In general, our study showed that benign pathologies were more common than malignant pathologies. MRI with its various sequences, excellent soft tissue contrast and multiplanar imaging capacity is helpful in covering a wide spectrum of pelvic pathologies especially when USG findings are inconclusive. Hence, it has now become a useful adjunctive tool in the evaluation of female pelvic pathologies.

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PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Radiology, SMBT Institute of Medical Sciences and Research Centre, Dhamangoan, Nashik, Maharashtra, India.
2. Professor, Department of Radiology, SMBT Institute of Medical Sciences and Research Centre, Dhamangoan, Nashik, Maharashtra, India.
3. Assistant Professor, Department of Radiology, SMBT Institute of Medical Sciences and Research Centre, Dhamangoan, Nashik, Maharashtra, India.
4. Professor, Department of Radiology, SMBT Institute of Medical Sciences and Research Centre, Dhamangoan, Nashik, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Devendra Vikas Kulkarni,
Assistant Professor, Department of Radiology, SMBT Institute of Medical Sciences and Research Centre, Dhamangoan, Nashik, Maharashtra, India.
E-mail: devendrakulkarni2485@gmail.com

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