



MRI EVALUATION OF DISORDERS OF FEMALE PELVIS: A STUDY IN RURAL TELANGANA

Radio-Diagnosis

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ABSTRACT

Background:- The female pelvic disorders or abnormalities includes various different pelvic disease conditions originating from uterus, ovaries, adnexae, anorectal region, pelvic sidewalls and bony pelvis, and other related structures in the pelvis cavity including urinary bladder, presacral space as well as anterior lower abdominal wall or hypogastrium. Primarily disorders of female pelvis are investigated in an imaging department by transabdominal and/or transvaginal ultrasonography (USG) followed by colour Doppler, and CT wherever necessary. MRI forms a valuable non-invasive diagnostic tool for evaluation of disorders related to pelvic pathologies in female. MRI of the female pelvis done for any disease process provides a unique display of pelvic anatomy, uterine zonal anatomy, junctional zone in uterus, as well as pelvic visceral –organ related pathologies like ovaries & adnexa, either in localized or diffuse form or might be multifocal or multicentric. The anatomical and spatial resolution, and delineation of pathologies related to uterus provided by MRI especially helps in clear diagnosis of conditions like adenomyomatosis, fibroids and its types 1, 2, 7. **Methods:** This retrospective study of 42 cases of female pelvic disorders which we evaluated on state-of-the-art 1.5 Tesla MRI scanner. The study was done in the Department of Radio-diagnosis, Dr. Patnam Mahender Reddy Institute of Medical Sciences and Hospital, Chevella (Rangareddy, Telangana state, India) in the month of June 2023 to November 2023, over a total period of six months. The age group of patients included ranged from 14 years to 70 years, including female patients of reproductive age group and also post-menopausal age group. The abnormal female pelvic pathologies were ascertained clinically by the presence of history of lower abdominal and/or pelvic pain, spasmodic dysmenorrhea, irregular menses, primary or secondary infertility, white or abnormal or foul-smelling PV discharge, lump in lower abdomen or pelvic region, palpable mass on per-vaginal examination, presence of hernial swellings in lower abdomen, discharge from perineum or natal cleft region, and abdominal surgical scar-site local signs and symptoms. **Results & Conclusion:-** In this study of MR evaluation of female pelvic disorders, we came across altogether different & diverse case spectrum of abnormal female pelvis involving uterus, ovaries, adnexae, pelvic bony wall, sacrococcygeal region, anorectal region & lower abdominal wall; which form the female pelvic cavity. Mostly uterine and ovarian disorders predominated the study results. The various disorders involving uterus like fibroids, adenomyosis, congenital uterine anomalies, cervical cysts, cervical malignancies were diagnosed on MR imaging. So also, different ovarian disorders like simple functional ovarian cysts, cystadenomas, dermoid cysts, endometriosis, polycystic ovaries and pelvic inflammatory disease were diagnosed confidently on MRI evaluation. Unusual presentations like abdominal surgical scar endometriosis, hernial mesh repair-site infection, sacrococcygeal teratoma (extra-pelvic type 1), bilateral sacral insufficiency fractures in elderly postmenopausal women, sacro-ileitis and perianal sinus tracks were also seen in female patients evaluated for pelvic pain and discomfort.

KEYWORDS

Magnetic Resonance Imaging, Ovarian Cyst, Uterine Fibroid, Adenomyomatosis, Ovarian Cystadenoma

INTRODUCTION

Abnormal pelvic pathology includes various different abnormal conditions originating from uterus, ovaries, adnexa and other related structures in the pelvis cavity including urinary bladder, anorectal region, presacral space as well as anterior abdominal wall. Primary investigation of abnormal female pelvis is by ultrasonography (USG) with colour Doppler¹. To obtain more morphological details and lesion characterization CT with contrast study is often used. MR imaging with ultrafast sequences is being increasingly used worldwide for pelvic imaging in females. This is more so because of excellent soft tissue delineation of anatomical planes between and within the visceral organs like uterus, fallopian tubes, uterine ligaments, ovaries, ovarian ligaments and pedicle, pelvic side wall, musculature and bony pelvis, nodal structures, anorectal region, pelvic floor musculature, urinary bladder and urethra, ischioanal and perianal fossa fat, vaginal vault & canal and pelvic small bowel loops by MRI evaluation¹. MRI also helps in pre-surgical evaluation, local staging of uterine or cervical or ovarian malignancies because of the better depiction of soft tissue anatomical planes around the lesion and organ involved; apart from its anatomic localization, especially when biopsy or FNAC is being contemplated for tissue diagnosis, and later whenever surgical resection is indicated depending upon the local staging of tumour, surgical resectability of the tumour or non-malignant lesion¹.

MRI thus forms a valuable non-invasive diagnostic tool for evaluation of disorders related to pelvic pathologies in female⁹. MRI of the female pelvis done for any disease process provides a unique display of pelvic anatomy, uterine zonal anatomy, junctional zone in uterus, as well as pelvic visceral –organ related pathologies, either localized or diffuse or multicentric⁷. The anatomical and spatial resolution, and delineation of pathologies related to uterus provided by MRI especially helps in clear diagnosis of conditions like adenomyomatosis, fibroids and its types^{2,7}. Though the endometrial and cervical malignancies are easily detected by MRI, specific tissue diagnosis is not possible. However, MRI is quite helpful in early diagnosis and locoregional staging of these common malignancies in middle-aged and elderly women. Here

it definitely scores over clinical evaluation, USG with Doppler and CT, due to high spatial resolution especially with sequences with short TR and TE.^{2,7} Similarly, it is quite helpful in detection and staging/grading of severity of uterine congenital anomalies, fibroids, adenomyomatosis of uterus, uterine and cervical as well as vaginal neoplasms, different forms of ovarian cysts, dermoids, ovarian neoplasms, and polycystic ovaries⁹. It also helps in differentiation of tumor from adjoining normal tissues due to greater tissue contrast inherent to MRI⁷.

Tissue characterization like fat, fluid -serous or mucinous, fibrous or myomatous or endometrial in origin e.g. can be done easily by MRI based on signal characteristics on T1, T2 and STIR sequences, in-phase and out-phase imaging⁹. Laparoscopy can be obviated in certain cases of uterine developmental anomalies due to its non-invasive nature⁹. MRI can help in critical planning of follow-up treatment in cases of recurrent disease versus post-radiation fibrosis, especially in utero-cervical malignancies treated by chemo-radiation⁹.

The abnormal female pelvic pathologies were ascertained clinically by the presence of clinical history or signs and symptoms of lower abdominal and/or pelvic pain, spasmodic dysmenorrhea, irregular menses, primary or secondary infertility, white or abnormal or foul smelling PV discharge, something protruding out of vagina, lump in lower abdomen or pelvic region, palpable mass on per-vaginal examination, presence of hernial swellings in lower abdomen, discharge from perineum or natal cleft region, and surgical scar-site local signs and symptoms like discharge, redness and soreness^{1,2,3,4,5}.

Most of the twelve cases in previous article published by same corresponding author in IJSR September 2023 issue related to case series on abnormal female pelvis evaluated by MR imaging are again showcased here in addition to thirty more cases of female pelvic disorders which presented later in months of August, September, October and November of year 2023¹. So, you will find repetition of some case details and corresponding images which represent rarity of

such presentations and add value and quality to the information provided in this original article¹.

MATERIALS AND METHODS

This retrospective cross-sectional study was conducted in Department of Radiodiagnosis and Imaging, Dr Patnam Mahender Reddy Institute of Medical Sciences and Hospital, Chevella, Rangareddy district-501503, Telangana state (India) during six months period from June to November 2023. The study was conducted on 1.5 T MRI scanner of SIEMENS make and model SEMPRA (Siemens Medical Systems, Erlangen, Germany) having 60 cm magnet bore and 160 cm system length; using phased array body coils with various standard MRI protocols & sequences meant for an ideal pelvic imaging protocol including T1, T2 WI with fat suppression wherever required, in all three planes along with STIR coronal and sagittal images and axial DWI with ADC as well as T1 Dixon imaging.

All age groups were included in this retrospective study and we had 42 female patients referred for MRI pelvis evaluation with age-group of 14 to 70 years and most common presenting complaints were lump in lower abdomen, pain in abdomen, abdominal scar-related local complaints like swelling and discharge, spasmodic dysmenorrhea, irregular menses, primary or secondary infertility, white or abnormal or foul smelling PV discharge, something protruding out of vagina, lump in lower abdomen or pelvic region, palpable mass on per-vaginal examination, presence of hernial swellings in lower abdomen and discharge from perineum or natal cleft region.

Patient-related demographic details including name, age, sex, address, marital status, occupational history, past history, history of labour and previous child births, any history of abortion or miscarriage or still birth, previous surgical history, any Caesarean section, dietary habits, presenting clinical signs and symptoms as well as details of laboratory investigations, ultrasound reports, previous CT and/ or MR reports, histopathological or cytology reports like PAP smear were taken into consideration.

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. TVS was also performed wherever necessary. MRI evaluation of the cases of abnormal female pelvis was done after taking proper history and ruling out any contraindications for MRI study (like patients were asked for any cardiac pacemaker, cochlear implants, aneurysm clips, recent orthopaedic implants). Patients with severe claustrophobia were excluded so also infants, neonates and pregnant women were excluded from study. All metallic objects were removed by the patients before subjecting to MRI. Patient was imaged in supine position with phased-array pelvic /body coil, with larger FOV, obtaining coronal localizer 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), followed by T1 Dixon dual echo fat-only and water-only sequences. 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 the site involved like uterus or ovaries or adnexae, location and 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^{1,2,3,4,5,6}. Of course, we did require contrast evaluation in two of our cases. The results of MRI evaluation of each case were also tabulated along with the above mentioned, patient-related demographics, clinical, laboratory findings and previous imaging details for proper methodical assessment of each case study and statistical analysis was done by using simple percentage method to know disease burden of pelvic pathologies in the females evaluated by MRI.

Image Interpretation By Radiologist

The MR images were interpreted by the Radiologist with 15 years experience in cross-sectional imaging on a standard iMac Apple

system on Osirix software, in all three imaging planes, in required image format and windowing. The lesion was first identified and its location, site, size, signal characteristics, tissue MR characterisation was done along with the extent of lesion, number, multiplicity if any, if lesion is bilateral like in ovaries or fallopian tubes, was assessed along with any contiguous spread or involvement like in inflammatory lesion or a malignant lesion with any adherence or tethering to adjoining organs. Fat content in lesion was assessed by fat suppressed sequences. Locoregional nodal enlargement was noted in pelvic cavity. Any post-contrast enhancement was detected with vascular status of lesion, The lesion proximity to any major vessel was also noted. Pelvic side-wall musculature, bony pelvis including sacrum presacral space, coccygeal region, iliac bones, pubis and also anorectal region, ischiorectal fossa was assessed along with detailed evaluation of uterus, cervix, vaginal canal, adnexa, tubes, ovaries, vascular pedicle, peritoneal pouches, urinary bladder and urethra. Overall detailed assessment was done with suspected malignancies with regards to pelvic sidewall invasion, bony invasion, tethering or invasion to urinary bladder or rectum with nodal staging after contrast study post-gadolinium. This was done to assess surgical resectability and feasibility. Ovarian volumes were measured in cases suspected to have PCOS. A checklist regarding these intricate details was prepared beforehand and checked accordingly.

RESULTS

We found diverse disease spectrum with disorders involving uterus, ovaries, anorectal region, pelvic side walls as well as abdominopelvic walls; ranging from congenital anomalies to inflammatory conditions of pelvic viscera to benign uterine. Ovarian and abdominopelvic wall tumors as well as malignancies involving cervix. The age group of females included in our study ranged from all age groups, from 14 years to 70 years, with 09 cases out of 42 from 14 – 25 years age-group, 15 cases from age group of 26 – 45 years and last age group of 46 and above till 70 years having 13 cases.

The broad division of conditions which we found with good degree of confidence with plain MRI multiparametric studies, with need of contrast only in two situations (endometrial polyp and cervical malignancy for enhancement characterization of lesion) are as follows: -

- a) Uterine conditions: - 18 (42.9%)
- b) Ovarian disorders: - 15 (35.7%)
- c) Miscellaneous conditions: - 09 (21.4%).

So, we can see that uterine and ovarian disorders comprised the major chunk of the patients; almost 78.6% of total cases, rest 21.4% cases were miscellaneous conditions related to adnexae, pelvic side walls, abdominal wall, anorectal and sacrococcygeal regions. These findings correlate well with findings of study done by D V Kulkarni et al in Nashik city.

The details of conditions or female pelvic disorders in our study are: -

A) Uterine disorders- total 18 conditions out of 42 cases.

- 1) Uterine fibroids (leiomyomas)- 07 (16.7% out of total cases)
- 2) Adenomyomatosis of uterus- 03 (7.1%)
- 3) Uterine congenital anomalies- 03 (7.1%)
- 4) Cervical cancer- 023 (4.7%)
- 5) Abnormally thin uterine LSCS scar- 01
- 6) Benign endometrial polyp- 01
- 7) Asherman's syndrome with PID- 01

B) Ovarian disorders: - total 15 out of 42 cases.

Some overlap of conditions is seen in some cases involving multiple sites, but the major presentation has been classified here.

- I) Simple functional cysts of ovary- 07 (16.7%)
- II) Ovarian cystadenomas- 04 (9.5%)
- III) Ovarian dermoid- 02 (4.7%)
- IV) Ovarian endometriosis- 01
- V) Polycystic ovarian morphology (PCOS)- 02 (4.7%)

C) Miscellaneous conditions: - total 09 cases out of 42 cases.

- a) Bony pelvis disorders- 04 (9.5%)
- b) Inflammatory conditions including anorectal region: - 03 (7.1%)
- c) Abdomino-pelvic wall abnormalities: - 02 (4.7%)
- d) Pelvic wall tumors (sacrococcygeal teratoma): - 01.

DISCUSSION

The tumors or tumor-like conditions which we came across were 25 cases out of total 42 cases, almost comprising 60 % of total cases. The benign tumors or tumor like conditions (23 cases- 55 % cases of total cases approximately) - which we came across were: - Functional ovarian cysts (07), Ovarian cystadenomas (04), uterine leiomyomas (07), scar endometriotic cyst (01), ovarian dermoid cysts (02), sacrococcygeal cystic teratoma (01) and large cervical Nabothian cyst masquerading like cervical mass (01). The other two cases (4.7% cases of total) had cervical malignancy, one already proven and under chemoradiation and other undiagnosed large cervical malignancy extending into proximal half vaginal canal & fornices.

The major findings in our study according to the age-group; showed trend of tumorous conditions like fibroids, adenomyosis, ovarian cystadenomas and teratoma, dermoid in middle aged and elderly post-menopausal women, whereas common pelvic non-tumorous conditions like polycystic ovaries, pelvic inflammatory pathologies, Nabothian cysts with cervicitis, endometriosis of ovaries and functional ovarian cysts were seen in young age group of 14 to 25 years, though few benign serous cystadenomas were also seen. There was also notably presence of congenital uterine anomalies presenting with infertility in this young age-group of 14 to 25 years. Cervical malignancies of course were found in elderly postmenopausal women, one of them already diagnosed and undergoing palliative radiotherapy and chemotherapy. Rare conditions like pelvic pain having sacral insufficiency fractures due to osteopenic conditions like osteomalacia was seen in three elderly women in post-menopausal age group, whereas SI joint arthritis was seen in a young married woman having PID as well as chronic cervicitis and Asherman's syndrome.

The ovarian conditions like simple functional cysts and their benign characterization by MRI [Figure 1] regarding the site, size, extent and status of any solid septae, papillary projections, nature of fluid in cysts was well assessed by MRI with its tissue characterization and morphological soft tissue inherent contrast resolution capabilities. [Figures 2 and 3]. Other ovarian tumors like dermoid cysts with typical fat [Figure 4] or fat-fluid levels [Figure 5] also could be ascertained by fat suppressing sequences. Polycystic ovarian morphology with raised ovarian volumes above 9 cc, were seen in young unmarried females with history of delayed and irregular menses. [Figure 6]. Similarly ovarian endometriosis was detected with typical small chocolate cysts in right ovary with T2 shading. [Figure 7]

The things to be highlighted are the clear depiction of uterine dividing septum and cornua of uterus in case of uterine congenital anomalies, morphology of uterine fundus and cervical as well as vaginal status. Other things are: - anatomical and morphological delineation of pathological focal lesions like uterine fibroids [Figures 8], ovarian cystadenomas, adenomyomatosis of uterus [Figure 9], ovarian dermoids, sacrococcygeal teratoma, abdominal surgical scar site-endometriotic cyst with adherent adenomyotic uterus [Figure 10] cervical stenosis in case of treated cervical malignancy [Figure 11], cervical solid mass in other, confusing case of large Nabothian cyst in one young woman and ovarian endometriosis, wherein the lesion characteristics of benign versus malignant nature could be picked up confidently based upon wall, septae or invasive features. Local pelvic wall invasion could be assessed easily in solid large cervical malignancy presenting with foul-smelling vaginal discharge [Figure 12 and 13].

The uterine benign leiomyomas (fibroids) most of which presented in middle aged and elderly post-menopausal women had either single or few or multiple small or larger fibroids, most of which were intramural, few being subserosal type and only one condition had submucous fibroid in a large uterus with bosselated appearance. This case had adenomyotic features as well with wide ill-defined junctional zones of uterus. Similarly, the three congenital uterine anomalies which we found were: - 1) Septate uterus with bicornis, bicollis features and single vagina [Figure 14] 2) Subseptate uterus [Figure 15] 3) Arcuate uterus – all in young married women with history of infertility.

The contrast MRI evaluation helped in assessing benignity of small 4 mm endometrial polyp which shows mild enhancement [Figure 16- first image], whereas in the situation of malignant cervical mass, the parametrial involvement and nature of associated sessile as well as pedunculated endometrial polyps [Figures 16- second image] could be well ascertained, suggesting local endometrial spread of disease. It

had local invasion of right obturator internus with tethering of cervical mass to urinary bladder and to minimal extent to rectum. Bony invasion was absent. Though final confirmation would be by histopathological study of surgically resected or biopsied specimen, the situation of nature and possible course of management could be established in these two cases needing contrast study. So also, lymph nodal (loco-regional) status involving common iliac nodes was given in the imaging findings.

The decision of surgical management to resect scar site endometriosis along lower anterior abdominal wall with adherent adenomyotic uterus was taken and operated upon based on MRI findings as shown in the case with Figure no.10. Similarly, the case of infection of hernial mesh repair site in lower abdomen post-LSCS status with intrapelvic right para-uterine collection was treated aggressively with surgical debridement and hysterectomy of adenomyotic uterus in that case at later date.

The other miscellaneous conditions like sacral insufficiency fractures secondary to osteomalacia [Figure 17], sacro-iliac joint arthritis, Large Nabothian cervical cyst with associated polycystic ovaries [Figure 6 again], Asherman's syndrome, perianal sinus track [Figure 18], sacrococcygeal teratoma with late presentation in elderly woman [Figure 19], pelvic inflammatory disease with enlarged ovaries, fluid in POD and thick endometrium, hydrosalpinges were well detected and characterized by multiplanar capabilities of MRI with its inherent tissue characterization. The status and thickness of LSCS uterine scar in a multiparous woman with lower pelvic pain and PV discharge having thinned out LSCS scar with scar niche formation on endometrial side was found out easily by MRI [Figure 20].

The condition mentioned as Asherman's syndrome had features of endometrial mucosal irregularity with associated PID features on MRI and right sacro-iliac joint arthritis. Most probably previous dilatation & curettage is suggested as etiology. In another scenario of an elderly woman with perianal discharge, had blind perianal intersphincteric sinus, with 7.6 cms long blind ending sinus track, as shown in Figure 18. A case of sacrococcygeal teratoma with cystic features (type 3 extra-pelvic tumor) was seen in a middle-aged adult woman with clinical presentation of pilonidal sinus which on imaging showed cystic midline lesion with altered fluid contents along natal cleft jutting out from sacrococcygeal bony junction into subcutaneous planes in midline as shown in Figure 19. Due to sitting posture adopted naturally there was some focal rupture with fluid extravasation, like in a pilonidal sinus.

The various inflammatory conditions of pelvis found were about 06 cases (14.2% out of total 42 cases) which included: - pelvic inflammatory disease (PID) [02 cases], cervical large Nabothian cyst with chronic cervicitis [01], perianal blind intersphincteric sinus [01], and sacro-iliac joint arthritis with PID & Asherman's syndrome [01].

The bony pelvic abnormalities were 04 cases out of 42, (9.5% cases of total): - 03 having bilateral sacral insufficiency fractures and one had right SI joint arthritis as mentioned above.

These diverse pelvic conditions are well documented in texts of Radiology and imaging, the various types of lesions or pathological conditions ranging from inflammatory, developmental, benign tumours, malignant tumors and tumor mimics as well as bony pelvic pathologies, anorectal perineal fistulae or sinuses, sacrococcygeal teratoma, etc. just to enumerate^{13,14,15}. These literatures form the basic understanding of Radiology residents during post-graduation. The article by Reham M A Sayed¹² also depicts the common pelvic gynecological neoplasm and malignancies and there imaging characteristics.

SUMMARY AND CONCLUSIONS

MRI of female pelvic abnormalities is an important pre-management, presurgical imaging tool as well as a complimentary diagnostic tool along with preliminary screening with transabdominal and transvaginal sonography coupled with pelvic colour Doppler as well as plain and/o contrast-enhanced CT whenever and wherever necessary, for overall evidence-based diagnostic evaluation of diverse spectrum of abnormal female pelvis. This is proved beyond doubt from the forty cases who underwent preliminary USG followed by MR imaging, revealing variety of presentations of uterine disorders, ovarian disorders as well as diseases of bony pelvis, abdomino-pelvic wall,

anorectal region, cervical malignancies, mature teratomas (fat-filled and cystic variants), PIDs, with benign tumours and tumour-like conditions forming almost 60% of total cases. Rest were inflammatory conditions (06 cases) like PID, perianal sinus track, SI joint arthritis, chronic cervicitis and abdominal hernial mesh repair site infection as well as bony pelvis abnormalities (04 cases), including sacral ala insufficiency or stress fractures secondary to osteomalacia. Remaining two conditions were cervical malignancies, one of which undergoing chemoradiation had pyometra collection in uterus with severe cervical stenosis. Few rare situations like C-section scar related abnormalities like scar endometriosis with adherent adenomyotic uterus, abnormal thinned out C-section uterine scar with scar niche formation and infection of hernial repair mesh site which are well dealt in the article¹ by Dr Vyankatesh Aironi et al with relevant images depicting the clinical and imaging findings.

The clinical decision of surgical versus conservative management is possible by better characterisation of lesions like uterine fibroids, adenomyomatosis of uterus with excessive PV bleeding or abdominal pain (spasmodic dysmenorrhoea). Same thing applies to ovarian large serous and mucinous cystadenomas, which we found in four cases (03-serous, 01- mucinous) diagnosed on basis of fluid signal and lesion, wall, septal characteristics on MRI. Adherence of scar-endometriotic cysts of lower abdominal wall at the previous LSCS surgical scar to the intrapelvic adenomyotic diseased uterus was detected on MRI rather than on ultrasound study, and this was helpful in the consequent surgical treatment of that particular case. Similar dilemma was solved in case of the hernial mesh-repair site infection in the lower abdomino-pelvic wall showing intrapelvic extension of collection on MRI along with recurrent large omental paraumbilical hernia, just cranial to infection site. Imaging helped the clinician to plan the surgical management in two-stage operation along with subsequent hysterectomy.

Basic advantage of multiparametric MR imaging including T2WI, T1WI, STIR, DWI, ADC, T1 Dixon, T1 fat-suppressed sequences in three planes, is the clear delineation of anatomical as well as pathological planes, the internal tissues within the lesion, the lesion itself, the extensions and invasion by direct spread or tethering (as in case of cervical malignancies); thereby helping in pre-surgical road-mapping of treatment by referring clinician or medical conservative management wherever required as per the clinical condition and laboratory, histopathological findings. Main advantage to repeat again is better characterization of benign nature of ovarian cysts and uterine fibroids, the benignity of ovarian cysts ascertained by MRI based on fluid signal characteristics and cyst morphology related to wall, nodularity, internal septae, their thickness with just plain study, as use of contrast was obviated.

The tissue characterisation of fat and fat-fluid level by STIR or fat-suppressed sequences in MRI help in diagnosis of benign fat-containing dermoid cysts in ovary. Similarly, fat is ruled out in cystic variant of mature teratoma in sacrococcygeal region (extra-pelvic type 1 lesion). MR signal characteristics (T2 bright, T1 dark) of large Nabothian cyst in cervix straddling across the cervix and simple ovarian functional cysts with thin smooth walls is quite typical. Bone signal abnormalities of bone marrow oedema and arthritis are well demonstrated on STIR sequences as in case of sacral stress fractures and sacro-iliac joint arthritis. MR fistulogram sequences (T2WI, STIR) in three planes demonstrate the perianal sinus or fistula tracks better than USG as the extent, length, the type of sinus or fistula-in-ano, the internal mucosal opening as well as its extension into supralelevator space or limited to infralevator compartment all can be well appreciated on MRI. All in all, soft tissues (visceral organs) as well as bony pelvis, side wall musculature, abdomino-pelvic wall, adnexae can be comfortably and confidently assessed by MR imaging, with of course the exception of bowel wall. Here too rectal and mesorectum is well studied by MRI coupled with CECT, but that is altogether a separate topic out of scope of this article^{13,14,15}.

In short, excellent soft tissue contrast resolution, detection of fluid signals, non-invasive nature, lack of ionizing radiation, multiplanar imaging capabilities provided by MRI as a diagnostic tool in evaluation of female pelvic pathologies are well established beyond doubt since the inception of MRI⁸. Due to increasing field strengths of magnets, widespread availability of superconducting magnets in developed as well as developing countries, reduction in overall scanning times, increased digitization of images with improved image

quality; MRI has become imaging tool of choice in this category of diseases originating from female pelvis. Ultrafast MRI too is emerging tool to reduce scan acquisition times thereby improving patient compliance¹⁰.

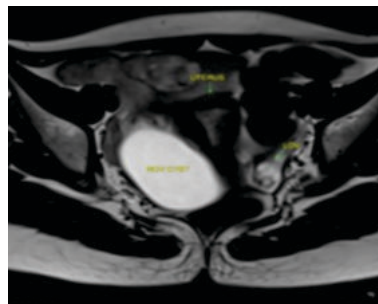


Figure 1: - Simple right ovarian functional cyst (T2WI) in young unmarried female.

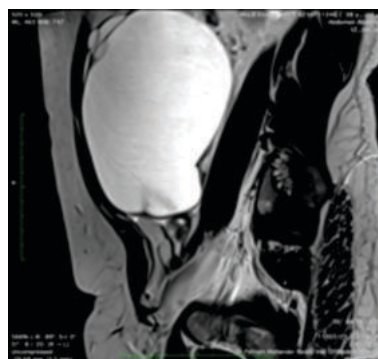


Figure 2: - Serous cystadenoma (T2WI) from right ovary in 28-year-old woman.

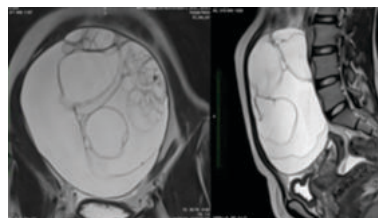


Figure 3: - Mucinous cystadenoma (T2WI Cor and Sag) from right ovary in middle aged adult woman.

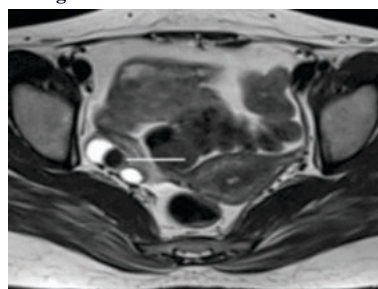


Figure 4: - Small 14 x 13 mm right fat-containing dermoid cyst in right ovary in young woman.

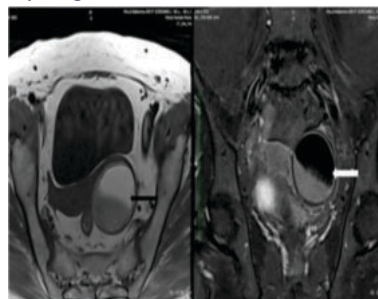


Figure 5: - Large left ovarian dermoid with fat-fluid level on T1WI and STIR Cor images in a post-menopausal woman.

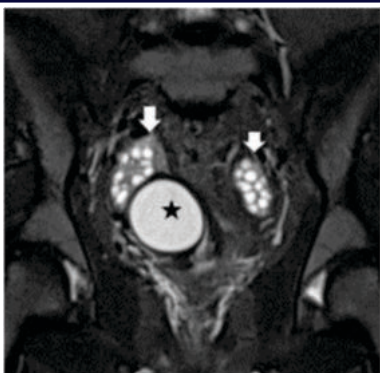


Figure 6: - Large Nabothian cyst (marked with black star) with polycystic ovaries (PCOS) in 22-year woman. [STIR Coronal]

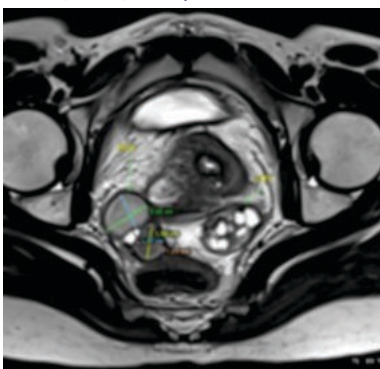


Figure 7: - Endometriosis of ovaries (T2WI) in unmarried 22-year staff nurse.

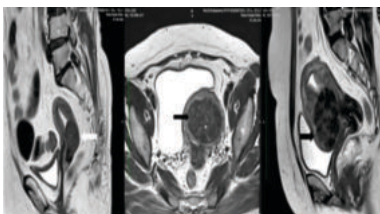


Figure 8: - Three different cases of uterine fibroids in intramural location in different middle-aged adult women

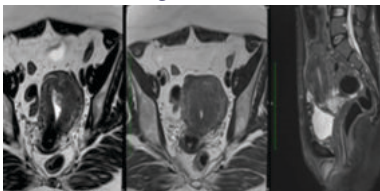


Figure 9:- First two images (T2WI) show same patient with adenomyosis of uterus with third image showing another case of adenomyomatosis uterus on STIR sagittal image

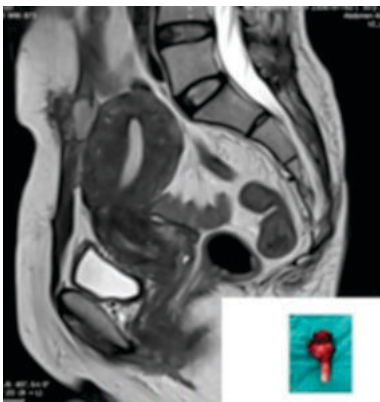


Figure 10: - Abdominal incisional scar site endometriosis with adenomyotic adherent bulky uterus showing wide ill-defined

junctional zone and multiple tiny myometrial cysts (endometrial rests)- Post-surgical specimen; Image courtesy: Dr D Venkateshwar Reddy, General Surgeon.

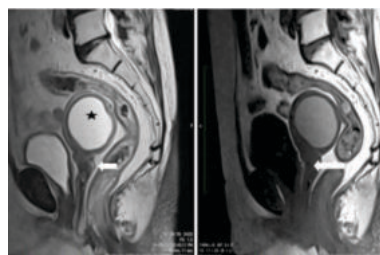


Figure 11:- 58-year-old woman of carcinoma cervix after completion of palliative radiation and chemotherapy showing tight cervical stenosis without any obvious residual mass but showing resultant pyometra of 70 cc volume. [T2WI and T1WI sagittal images)

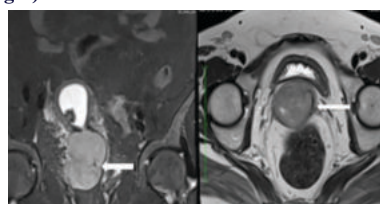


Figure 12:- Large cervical malignancy (58-year woman) extending into proximal half vaginal canal and fornices with pyometra of 30 cc volume and small endometrial deposit seen as a polyp.

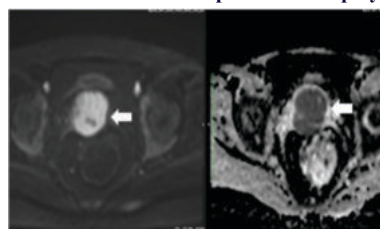


Figure 13: - Same case of large solid Cervical carcinoma showing restricted diffusion (DWI first image & ADC second axial image)

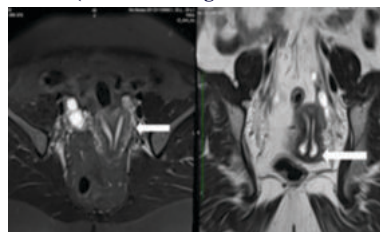


Figure 14: - Septate (bicornis, bicollis) uterus with single vaginal canal in a young woman with infertility. [STIR axial and T2 Coronal]

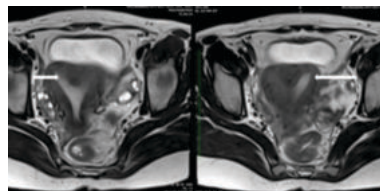


Figure 15: - Subseptate uterus (T2WI) in a 28-year-old married woman with secondary infertility.

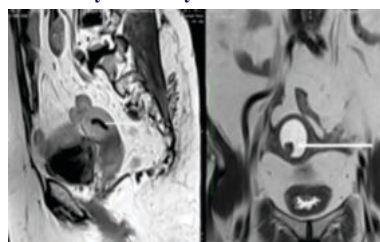


Figure 16: - First image on post-contrast T1WI sag showing

benign mildly enhancing endometrial polyp, whereas second image shows large pedunculated polyp (there was another sessile polyp- not shown here) in case of large cervical malignancy, representing malignant endometrial polyp/deposit.

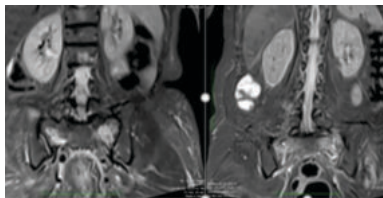


Figure 17: - Bilateral sacral insufficiency fractures in two different post-menopausal elderly women secondary to osteomalacia (STIR Coronals).

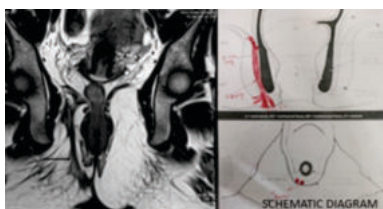


Figure 18: - Blind infralevator intersphincteric 8.5 cms long tracks (T2WI Cor) extending from 7 o'clock position external perianal skin opening into anal canal wall just below right levator ani muscle without any obvious internal mucosal opening into anal canal.

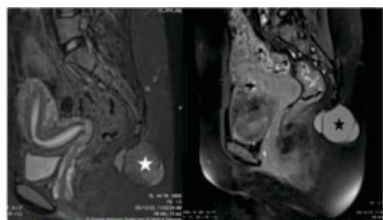


Figure 19: - Middle aged adult woman presenting with discharge from natal cleft, suspected pilonidal sinus showing extra-pelvic type 1 sacrococcygeal teratoma with predominant cystic fluid components (STIR Sag and T1 FS sagittal images)

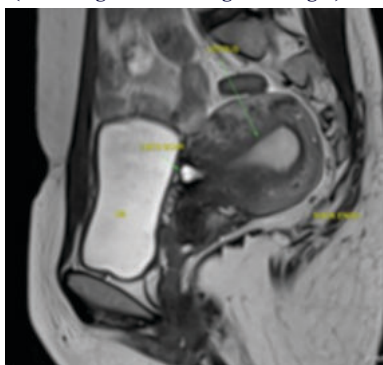


Figure 20: - 38-year-old woman with thinned out LSCS uterine scar with scar niche formation.

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