RADIOLOGICAL AND HISTOPATHOLOGICAL CORRELATION IN PATIENTS WITH UTERINE AND EXTRAUTERINE FIBROIDS

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ABSTRACT

Leiomyomas are the most common benign uterine tumours. They are usually asymptomatic but may cause menometrorrhagia, abdominal pain and infertility. They may be single or multiple and may have variable size. When fibroids increase in size, their vascular supply becomes insufficient causing hyaline, myxoid, cystic and haemorrhagic degeneration. Differential diagnoses include adenomyosis, solid adnexal masses, and focal contraction of myometrium and leiomyosarcomas of the uterus. Our purpose was to describe USG, MR imaging findings, histological features and clinical aspects of uterine fibroids.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Radiodiagnosis and Department of Pathology, MVJ Medical College and Research Hospital from January 2014 to December 2015. Our MR protocol includes sagittal, coronal, axial T2-weighted fast spin-echo, T1-weighted axial spin echo and axial short tau inversion recovery sequence. Optional sequences include sagittal and coronal short tau inversion recovery, axial diffusion weighted sequence, axial GRE sequence and sagittal T2 weighted 3D space sequence.

RESULTS

Uterine leiomyomas typically appear as well-defined, homogeneously hypointense masses on T2-weighted images and with intermediate signal intensity on T1-weighted images. Hypercellular leiomyomas show higher signal intensity than that of non-degenerated leiomyomas on T2 weighted images. Degenerated leiomyomas show signal intensity on T2-weighted images and on T1-weighted images obtained before and after contrast administration. 75 cases of leiomyomas were detected. In our study, majority of the cases belonged to the 41-50 years age group. Intramural fibroids were seen in 45 cases, subserosal fibroids were seen in 23 and submucosal fibroids in 15 cases. Both intramural and subserosal fibroids were seen in 7 cases. Broad ligament fibroids were seen in two cases. Pathological features of hyaline degeneration were noted in 5 cases, cystic degeneration in 7 cases, and red degeneration in one case.

CONCLUSIONS

MRI is the most specific imaging modality in detection and localisation of uterine leiomyomas. Leiomyomas characterisation, often possible with MR imaging, requires knowledge of pathological features and imaging findings associated with the different kinds of degeneration. MRI is useful in planning the correct therapeutic strategy and in followup after therapy.

KEYWORDS

Magnetic Resonance Imaging, Leiomyomas, Uterine Neoplasms.

HOW TO CITE THIS ARTICLE: Kumar DR, Reddy AM, Parthiban R, et al. Radiological and histopathological correlation in patients with uterine and extrauterine fibroids. J. Evid. Based Med. Healthc. 2016; 3(68), 3721-3728.
DOI: 10.18410/jebmh/2016/797

INTRODUCTION: Fibroids are the most common pelvic tumours, occurring in up to 25% of women over the age of 35. These benign tumours are hormone dependent, responding to both oestrogen and progesterone. They are composed of smooth muscle cells arranged in a whorl-like pattern with variable amounts of intervening collagen, extracellular matrix, and fibrous tissue. They are classified according to their location: Intramural, submucosal, subserosal, and pedunculated. Leiomyomas can also occur, less commonly in the cervix and in the broad ligament. As they grow, they outgrow their blood supply and degenerate. Five types of degeneration have been described: haemorrhagic, hyaline, fatty, cystic, and sarcomatous. Sarcomatous degeneration is much less likely, occurring in less than 2% of cases.

Financial or Other, Competing Interest: None.
Submission 25-07-2016, Peer Review 04-08-2016,
Acceptance 15-08-2016, Published 25-08-2016.
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MATERIAL & METHODS: This prospective study was conducted in the Department of Radiodiagnosis and Department of Pathology, MVJ Medical College and Research Hospital from January 2014 to December 2015. Ultrasound, MR imaging findings, histological features and clinical aspects of 75 cases of uterine leiomyomas were analysed in our department, many of which have been histologically confirmed. All patients underwent ultrasound examination of the pelvis. Ultrasound examination was done using GE Voluson 730 Pro (GE Medical Systems, Austria). Patients were scanned using a curvilinear transducer (1.5-6 MHz). Fifteen patients with equivocal findings on ultrasound examination underwent MRI examination of the pelvis. The MR imaging protocol in our department to study patients with clinical suspicion or ultrasound finding of uterine leiomyomas is as follows.

MR imaging was performed with a closed-configuration 16-channel superconducting 1.5-T system (Siemens Magnetom Essenza, Siemens Healthcare, Germany) with 57.2 mT/m gradient strength and 120 T/m/s slew rate, by using an eight-channel high-resolution large flex coil with array spatial sensitivity technique parallel acquisition. The MR sequences were Localizer sequence in the three spatial planes, Axial T2-weighted fast spin-echo (FSE) sequence with time to repetition (TR)/time to echo (TE) range 4840/103, flip angle 90°, section thickness 4 mm; interslice gap 1 mm, bandwidth 19.1 kHz, field of view (FOV) 34 cm. Axial T1-weighted spin-echo (SE) sequence with time to repetition (TR)/time to echo (TE) range 610/10, section thickness 4 mm; interslice gap 1 mm, bandwidth 25 kHz, field of view (FOV) 34 cm. Axial STIR sequence with time to repetition (TR)/time to echo (TE) range 5390/33, section thickness 4 mm; interslice gap 1 mm, bandwidth 16.1 kHz, field of view (FOV) 32 cm. Sagittal T2-weighted fast spin-echo (FSE) sequence parallel to the longitudinal axis of the uterus TR/TE range 3000/124, flip angle 90°, section thickness 4 mm, interslice gap 1 mm, bandwidth 19.1 kHz, FOV 30 cm, matrix 320×224, number of averages 4, number of images 26. Coronal T2-weighted FSE sequence parallel to the longitudinal axis of the uterus with TR/TE range 3900/72, flip angle 90°, section thickness 4 mm, interslice gap 1 mm, bandwidth 19.1 kHz, FOV 32 cm, matrix 320×224, number of averages 4, number of images 26.

Optional sequences included sagittal and coronal short tau inversion recovery, axial diffusion weighted sequence, axial GRE sequence and sagittal T2 weighted 3D space sequence and DWI. DWI is a technique based on the diffusion motion of water molecules that displays information about extracellular compartment, tissue cellularity and the integrity of the cellular membranes. In the study of uterine leiomyomas, DWI could be of help in identifying hypercellular components of hypercellular leiomyomas or leiomyosarcomas, but its role in the differential diagnosis is still debatable.

RESULTS: 75 cases of leiomyomas were detected. Majority of the cases belonged to the 41-50 years age group followed by 31-40 year and 21-30 years. Least number of cases were seen in more than 50 years age group (Table 1). Intramural fibroids were seen in 45 cases, subserosal fibroids were seen in 23 cases and submucosal fibroids in 15 cases. Both intramural and subserosal fibroids were seen in 7 cases. Broad ligament fibroids were noted in two cases (Table 1).

Age Group	No. of patients
<20	-
21-30	02
31-40	49
41-50	18
>50	03

Table 1: Age Distribution of Patients

Location	Number	Clinical symptom
Intramural	45	DUB
Subserosal	23	DUB
Submucous	15	Infertility
Intramural-subserosal	07	DUB
Broad ligament	2	Mass per Abdomen

Table 2: Type of Fibroids

Majority of the intramural fibroids (38) showed homogenous hypoechogenicity on ultrasound examination. 5 cases were of mixed echogenicity and 2 cases showed hyperechogenicity. 21 subserosal fibroids showed homogenous hypoechogenicity, 2 cases were of mixed echogenicity. 9 cases of submucosal fibroids showed homogenous hypoechogenicity and 6 cases mixed echogenicity. Both the broad ligament fibroids were of mixed echogenicity (Table 3)

Echogenicity on USG	Intramural	Subserosal	Submucosal	Broad ligament fibroid
Hypoechoic	38	21	9	-
Mixed echogenic	5	2	6	2
Hyperechoic	2	-	-	-
	45	23	15	2

Table 3: Findings on USG

Signal intensity on MRI	Intramural	Subserosal	Submucosal	Broad ligament fibroid
Hypointense	5	9		-
Mixed intensity	1	2		2
Hyperintense			1	-
	6	11	1	2

Table 4: Findings on MRI Pelvis

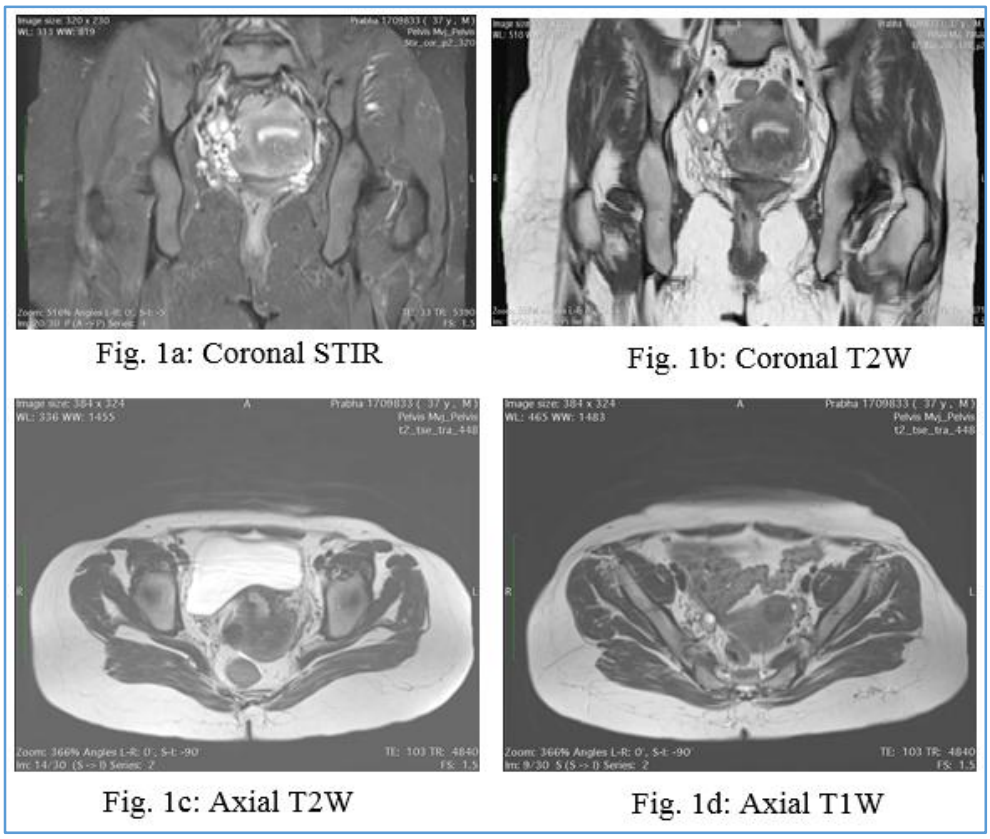

Fig. 1: Case of Subserosal Fibroid

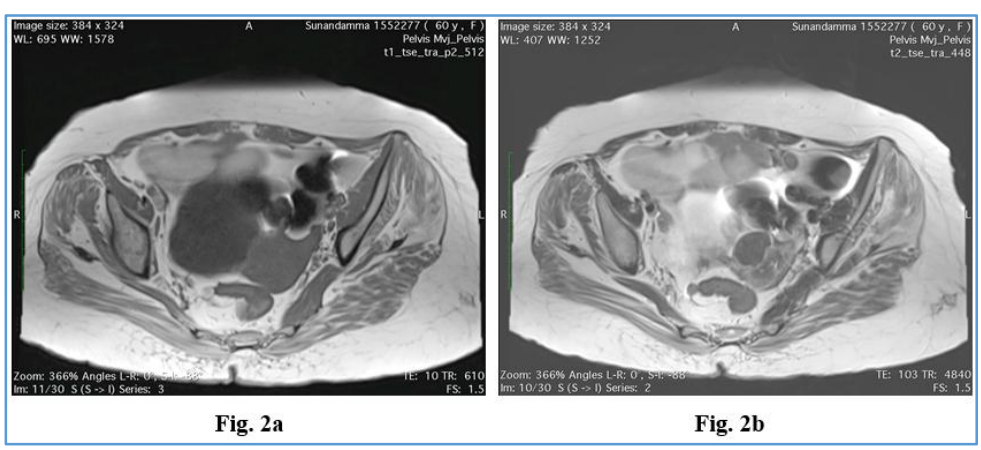

Fig. 2: Anterior Intramural Fibroid

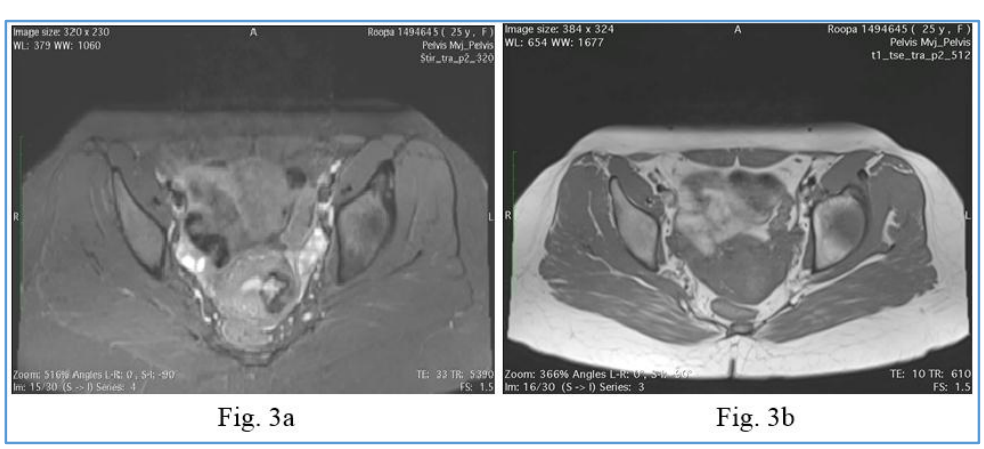

Fig. 3: Intramural Fibroid with Cystic Degeneration

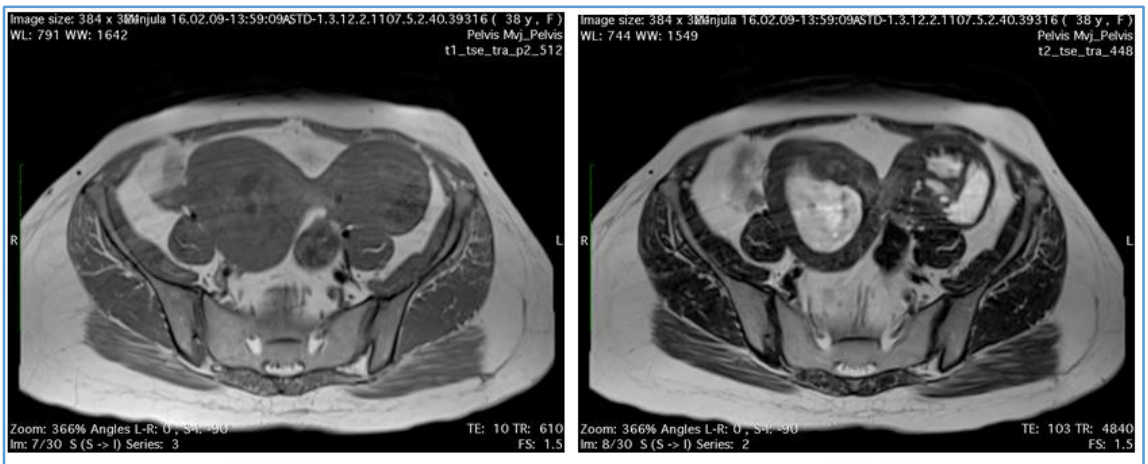

Fig. 4: Pedunculated Subserosal Fibroid

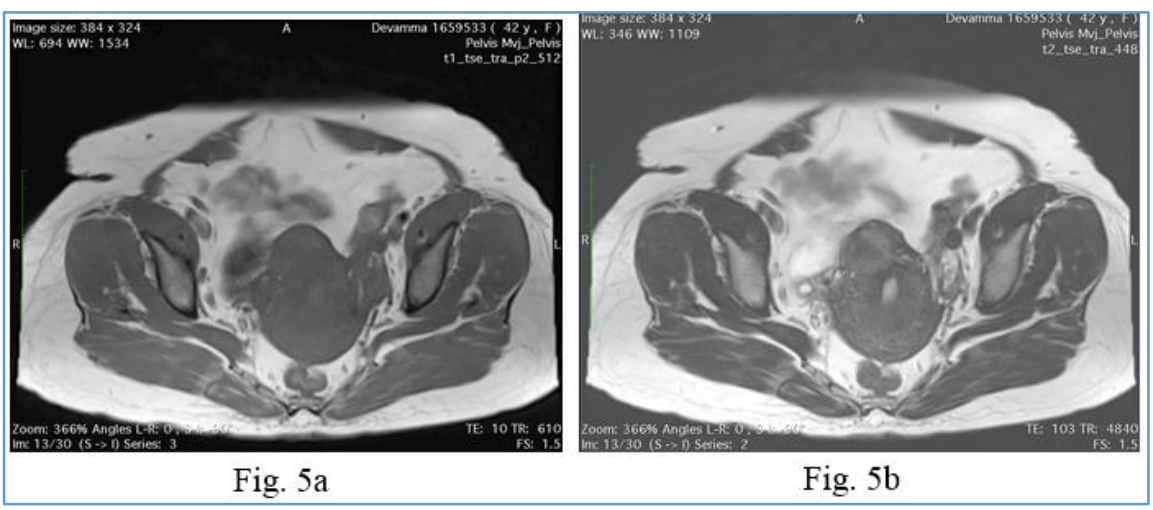

Fig. 5: Anterior wall Subserosal Fibroid

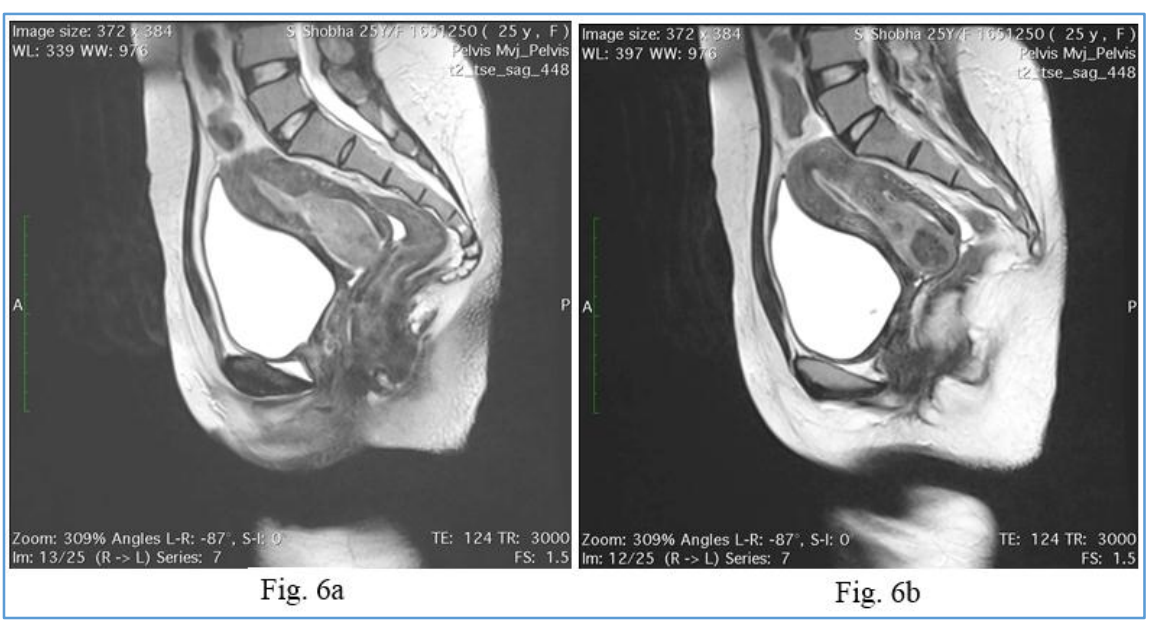

Fig. 6: Submucosal Fibroid

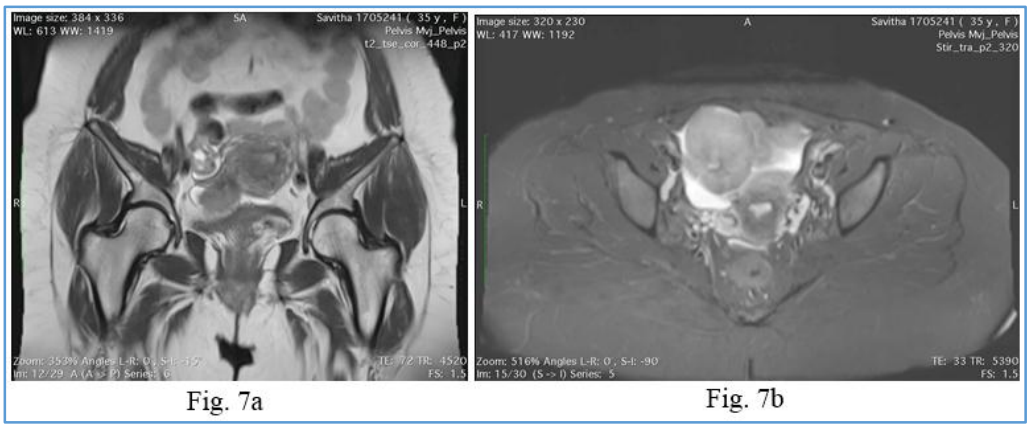

Fig. 7a Fig. 7b

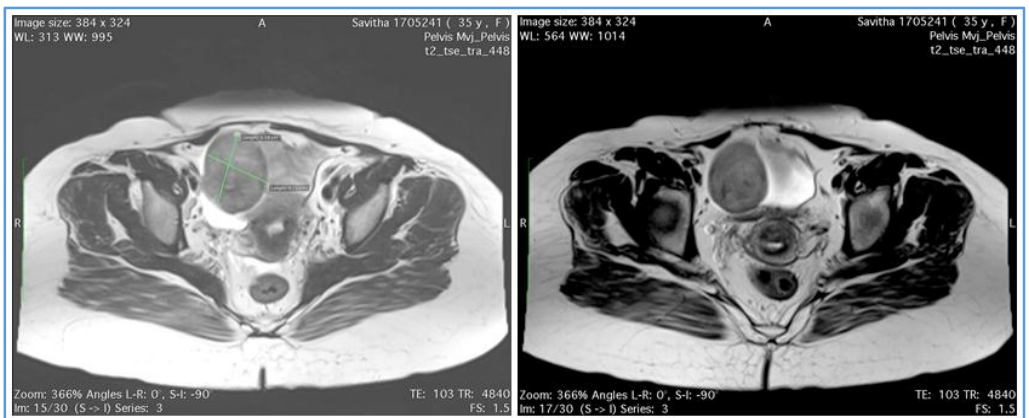

Fig. 7c Fig. 7d

Fig. 7: Shows Right Adnexal Broad Ligament Fibroid

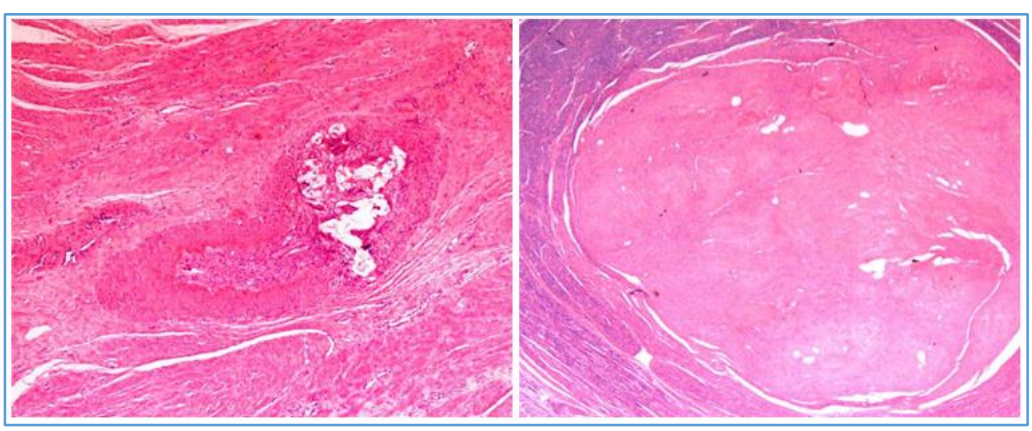

Fig. 8a & 8b: Fibroid with Hyaline Degeneration

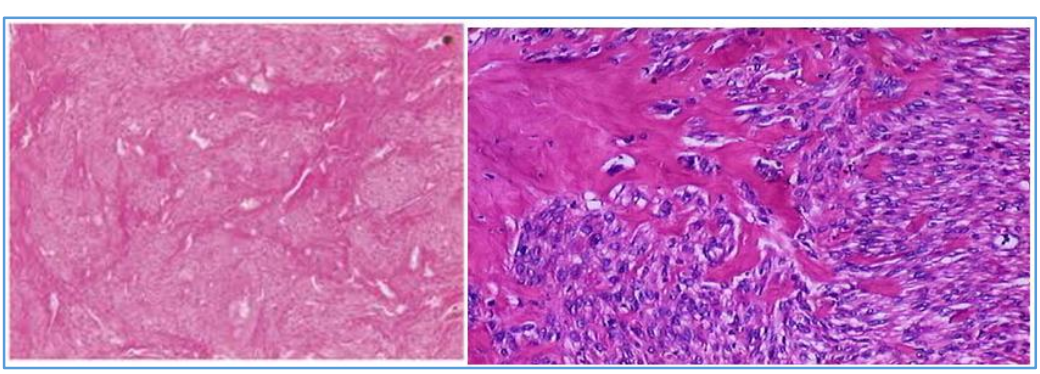

Fig. 9a & 9b: Fibroid with Cystic Degeneration

DISCUSSION: Leiomyomas represent the most common gynaecologic tumours and are observed in 20-30% of women in reproductive age.[1] They are the most common benign uterine tumours. According to their location, they are classified as submucosal, intramural or subserosal. Submucosal leiomyomas are the least common. Pedunculated submucosal leiomyomas may protrude in the cervical canal or in vagina. They are usually asymptomatic but may cause menometrorrhagia, abdominal pain and infertility. They may be single or multiple and may have variable size. When fibroids increase in size, their vascular supply becomes insufficient causing hyaline, myxoid, cystic and haemorrhagic degeneration. Differential diagnoses include adenomyosis, solid adnexal masses, focal contraction of myometrium and leiomyosarcomas of the uterus.

Bleeding is the most common symptom of leiomyomas. It may manifest as menorrhagia or metrorrhagia, and chronic bleeding causes anaemia.[2] Haemorrhage is associated with the presence of submucosal leiomyomas due to erosion of overlying endometrium, or with intramural myomas which interfere with the normal contractile activity of myometrium. Mass effect over the urinary bladder causes increased frequency, urgency and incontinence. Mass effect over the rectum causes constipation. Intramurals are the most common leiomyomas and are often asymptomatic. Subserosal leiomyomas may be pedunculated and may undergo torsion. Painful symptoms are seen in 30% of women affected by uterine leiomyomas[3] and occur in case of torsion of pedunculated subserosal lesions or in case of prolapse of pedunculated submucosal lesions.[4] Pain is also associated with acute haemorrhagic degeneration that occurs more frequently during pregnancy.[5] Infertility is caused by impairment of fallopian tubes or distortion of the endometrial cavity.

On ultrasound, a typical leiomyoma usually has a whorled appearance, with variable echogenicity depending on the extent of degeneration, fibrosis and calcification.[4] Majority of the fibroids are well defined, uniformly hypoechoic. Less than three percent of the cases are hyperechoic. Mixed echogenicity is noted in lesions which show internal cystic and hyaline degeneration. Calcification is rare. Depending on the location they may be intramural, subserosal or submucosal. Intramural is the most common location. Majority of the lesions show internal vascularity. Few lesions show posterior acoustic shadowing due to calcification. Small fibroids at the periphery of the myometrium usually cause alteration in the uterine contour. Magnetic resonance (MR) is the most specific imaging tool to identify and localise leiomyomas. At MR imaging, leiomyomas can show a typical signal, may manifest different patterns of degeneration that make their appearance widely variable. Differential diagnoses at MR imaging include adenomyosis, solid adnexal masses, focal myometrial contractions and uterine leiomyosarcomas.

Fibroids demonstrate low to intermediate signal intensity on T1-weighted images and low signal intensity on T2-weighted images. Myxoid degeneration and necrosis may be visible as high signal intensity areas on T2-weighted images. Hyalinisation is the most common type of degeneration occurring in 60% of cases. Cystic degeneration occurs in 4% of cases and is considered an extreme sequel of oedema. Cystic lesions in female pelvis most often originate in ovary. Non-ovarian cystic pelvic lesions may include peritoneal inclusion cysts, paraovarian cysts, and mucocoele of appendix, hydrosalpinx, subserosal or broad ligament leiomyomas with cystic degeneration, cystic adenomyosis, and cystic degeneration of lymph nodes, haematoma, abscess, spinal meningeal cysts and lymphocoeles. Extrauterine fibroids occur infrequently, although they are histologically benign, may mimic malignant tumours at imaging and may present a diagnostic challenge.

Occasionally, fibroids become adherent to surrounding structures like the broad ligament, omentum, develop an auxiliary blood supply and lose their original attachment to the uterus. It has also been suggested that fibroids that are adherent to the broad ligament originate from hormonally sensitive smooth muscle elements of that ligament. Clinically, these lesions may manifest as extrauterine pelvic masses that compress the urethra, bladder neck, or ureter producing symptoms of varying degrees of urinary outflow obstruction or secondary hydroureteronephrosis. The differential diagnosis for broad ligament fibroids includes masses of ovarian origin, broad ligament cyst, and lymphadenopathy. Transvaginal ultrasound may be of great help in diagnosing broad ligament fibroid because it allows clear visual separation of the uterus and ovaries from the mass. MR imaging, with its multiplanar imaging capabilities, also may be extremely useful for differentiating broad ligament fibroids from masses of ovarian or tubal origin and from broad ligament cysts. The distinctive MR imaging appearances of typical fibroids also are useful in differentiating them from solid malignant pelvic tumours.

Histopathological examination reveals that non-degenerated leiomyomas are characterised by a proliferation of smooth muscle cells, organised in bundles separated by a variable quantity of well-vascularised connective tissue. Within the stroma may be present lymphocytes and numerous mast cells. From a histological point of view, hypercellular leiomyomas are characterised by an increased cellularity, but they do not present coagulative necrosis or cellular atypia. At MR imaging, they show signal intensity higher than that of non-degenerated leiomyomas on T2 weighted images and present contrast enhancement after administration on diffusion weighted imaging (DWI) may be observed areas of restricted diffusion, which are expression of the hypercellularity of the lesion.

When leiomyomas increase in size, their vascular supply may become insufficient determining many types of degeneration: hyaline, myxoid, cystic and haemorrhagic degeneration.[6,7] The type of degeneration pattern depends on how quickly the vascular insufficiency establishes and inside the same leiomyoma different types of degeneration may coexist. Degenerated leiomyomas present variable

signal intensity on T2-weighted images and on T1-weighted images obtained before and after contrast administration.

Hyaline degeneration is the most common type of degeneration. It occurs in more than 60% of leiomyomas and may be focal or diffuse.[8] At histologic examination it is characterised by deposits of collagen fibres into areas of the leiomyoma with insufficient vascular supply. At MR imaging, their radiological appearance is quite similar to that of standard leiomyomas with low signal intensity on T2-weighted images.[9,10] Cystic degeneration may be observed in about 4% of leiomyomas and is characterised by the presence of cystic areas of variable width.[11] At MR imaging, the cystic components appear as roundish and well-defined areas, with water-like signal intensity: low signal on T1-weighted images and high signal on T2-weighted images, without contrast enhancement.[12,13]

Differential diagnoses of leiomyomas include adenomyosis, solid adnexal masses, focal contraction of myometrium and leiomyosarcomas of the uterus.**[14,15]** At MR imaging, the diffuse form looks like a thickening of the junctional zone on T2-weighted images more than 12 mm. Hypointense signals of adenomyosis on T2-weighted images is due to the hypertrophy of smooth muscle cells. Small hyperintense foci on T2-weighted images represent endometrial glands. Some of these foci may show high signal intensity on T1-weighted images due to haemorrhagic phenomena. In the focal form, adenomyosis looks like an area with ill-defined margins into the myometrium with low intensity signal on T2-weighted images, whereas leiomyomas often appear as well-defined masses.[16,17] The distinction between adenomyosis and leiomyomas is of clinical importance because leiomyomas may be treated with surgical myomectomy whereas adenomyosis may need hysterectomy.

At histological examination, adenomyosis is characterised by ectopic endometrial glands and stroma inside the myometrium associated with reactive hypertrophy of smooth muscle cells of the surrounding myometrium. Adenomyosis may be focal or diffuse. Clinically may determine dysmenorrhea and menorrhagia, symptoms similar to that of leiomyomas.[17,18] Pedunculated leiomyomas which develop into the broad ligament may enter in differential diagnosis with solid adnexal masses originated by the ovary.[18,19] In the presence of an adnexal mass, on MR imaging, the diagnosis of leiomyoma can be suggested by the demonstration of its continuity with the myometrium even if only for the presence of bridging vessels. The capability of MRI to demonstrate a normal morphology of the ovaries in presence of an enlarged and fibromatous uterus allows ruling out the diagnosis of adnexal neoplasms. The adnexal neoplasms that may show signal intensity similar to that of leiomyomas are ovarian fibromas and Brenner tumour, both characterised by abundant fibroid component. At MR imaging, the visualisation of ovarian stroma and follicles surrounding an ovarian fibroma or a Brenner tumour allows to establish the ovarian origin of the mass and to exclude the diagnosis of leiomyoma. The distinction between an ovarian mass and leiomyoma may be important in pregnant patients as a diagnosis of leiomyoma can exclude the need for surgical treatment.[20]

CONCLUSION: Owing to its excellent contrast resolution and multiplanar capabilities, MR imaging allows to identify and localise uterine leiomyomas and to distinguish them from other masses of adnexal origin. Characterisation of leiomyomas is often possible with MR imaging, but the radiologist should be aware of the pathological features and the radiological findings that characterise the different types of degeneration; however, in the presence of widespread phenomena of necrosis and haemorrhage the diagnosis is often histopathological. Nevertheless, the contribution of MR imaging is irreplaceable to choose the correct therapeutic strategy and in followup after therapy.

REFERENCES

1. Cramer SF, Patel A. The frequency of uterine leiomyomas. Am J Clin Pathol 1990;94(4):435-438.
2. Baird DD, Dunson DB, Hill MC, et al. High cumulative incidence of uterine leiomyoma in black and white women: ultrasound evidence. Am J Obstet Gynecol 2003;188(1):100–107.
3. Prayson RA, Hart WR. Pathologic considerations of uterine smooth muscle tumors. Obstet Gynecol Clin North Am 1995;22(4):637–657.
4. Mayer DP, Shipilov V. Ultrasonography and magnetic resonance imaging of uterine fibroids. Obstet Gynecol Clin North Am 1995;22(4):667-725.
5. Marshall LM, Spieglman D, Barbieri RL, et al. Variation in the incidence of uterine leiomyoma among premenopausal women by age and race. Obstet Gynecol 1997;90(6):967–793.
6. Rein MS, Barbieri RL, Friedman AJ. Progesterone: a critical role in the pathogenesis of uterine myomas. Am J Obstet Gynecol 1995;172(1 Pt 1):14–18.
7. Murase E, Siegelman ES, Outwater EK, et al. Uterine leiomyomas: histopathologic features, MR imaging findings, differential diagnosis, and treatment. Radiographics 1999;19(5):1179-1197.
8. Ueda H, Togashi K, Konishi I, et al. Unusual appearances of uterine leiomyomas: MR imaging findings and their histopathologic backgrounds. Radiographics 1999;19(Suppl 1):S131-145.
9. Atri M, Reinhold C, Mehio AR, et al. Adenomyosis: US features with histologic correlation in an in-vitro study. Radiology 2000;215(3):783-790.
10. Deshmukh SP, Gonsalves CF, Guglielmo FF, et al. Role of MR imaging of uterine leiomyomas before and after embolization. Radiographics 2012;32(6):251-281.
11. Dudiak CM, Turner DA, Patel SK, et al. Uterine leiomyomas in the infertile patient: preoperative localization with MR imaging versus US and hysterosalpingography. Radiology 1988;167(3):627-630.

12. Zawin M, McCarthy S, Scoutt LM, et al. High-field MRI and US evaluation of the pelvis in women with leiomyomas. Magn Reson Imaging 1990;8(4):371-376.
13. Hamm B, Kubik-Huch RA, Fleige B. MR imaging and CT of the female pelvis: radiologic-pathologic correlation. Eur Radiol 1999;9(1):3-15.
14. Mittl RL, Yeh IT, Kressel HY. High-signal-intensity rim surrounding uterine leiomyomas on MR images: pathologic correlation. Radiology 1991;180(1):81-83.
15. Kempson RI, Hendrickson MR. Pure mesenchymal neoplasms of the uterine corpus: selected problems. Semin Diagn Pathol 1988;5(2):172-198.
16. Mark AS, Hricak H, Heinrichs LW, et al. Adenomyosis and leiomyoma: differential diagnosis with MR imaging. Radiology 1987;163(2):527-529.
17. Weinreb JC, Barkoff ND, Megibow A, et al. The value of MR imaging in distinguishing leiomyomas from other solid pelvic masses when sonography is indeterminate. AJR Am J Roentgenol 1990;154(2):295-299.
18. Rha SE, Byun JY, Jung SE, et al. CT and MRI of uterine sarcomas and their mimickers. AJR Am J Roentgenol 2003;181(5):1369-1374.
19. Janus C, White M, Dottino P, et al. Uterine leiomyosarcoma: magnetic resonance imaging. Gynecol Oncol 1989;32(1):79-81.
20. Erdemoglu E, Kamaci M, Bayram I, et al. Primary giant leiomyoma of the ovary – case report. Eur J Gynaecol Oncol 2006;27(6):634–635.