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Pitfall in Differentiation of Hemorrhagic Vs. Fatty Lesions in Female Pelvis Using Fat Saturated Sequences With Inversion Recovery – Role of T1 FATSAT Sequence – A Case Report with Radiological Review

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Abstract: *T1 hyperintense structure in female pelvis can be either a hemorrhagic lesion or fat containing lesion. FATSAT technique is integral part of workup of any T1 hyperintense structures in female pelvis for differentiation of hemorrhagic lesion and fat containing mature ovarian teratoma for tissue characterization.*
We present a case of hematometra with blood in bilateral fallopian tubes due to cervical stenosis.
The hemorrhagic content appear hyperintense on both T1WI and T2WI. An unexpected signal decrease in FATSAT T2WI inversion recovery sequence (STIR) was encountered. Suppression of signal in tissue with similar T1 relaxation time as fat can lead to diagnostic pitfall in T1WI and T2WI STIR pulse sequence. Also loss of signal on T2WI can be due to T2 "shading" in T1 bright ovarian endometrioma. Hence, fat specific spectral fat saturation on T1WI (FATSAT T1) is strongly recommended for tissue characterization in gynaecological diseases. This sequence is useful in cases of ovarian endometrioma and hematometra.

Keywords: *MRI, hematometra, endometrioma, STIR, T1 FATSAT, female pelvis*

I. Case Report

A 38 years old female patient presented to department of Radio-diagnosis with history of primary amenorrhea. She was married since last 18 years. She gave history of lower backache with severe lower abdominal pain cyclically since her puberty. There was no history of dyspareunia. She complained of lumpish feeling in lower abdomen. Her secondary sexual characteristics and breast development was normal. On clinical examination, there was tender firm lump in hypogastric region in midline just above pubic symphysis. On per vaginal and per speculum examination, vagina was seen. However, normal cervix was not well visualized.

USG Abdomen and Pelvis revealed enlarged and bulky anteverted uterus. Uterine cavity showed a hypoechoic fluid collection with multiple internal echoes measuring approx. 9.4 (length) x 6.1 (anteroposterior) x 6 (transverse) cm extending in cervical canal (Figure 1a and 1b). Myometrium appeared stretched. Vaginal echo complex was seen. Right ovary appeared bulky and showed a simple anechoic cyst (Figure 2a). A dilated tubular, tortuous anechoic lesion measuring approx. 4.4 x 2.6 cm was noted in left adnexa showing internal echoes. Another dilated tubular, tortuous measuring approx. 1.6 x 0.6 cm was noted in right adnexa just medial to right ovary showing multiple internal echoes – likely to be dilated fallopian tubes filled with blood (Figure 2b).

MRI Pelvis showed enlarged and bulky uterus. A large fluid collection measuring approx. 9.6 cms (CC) x 6.3 cms (AP) x 6.4 cms (Trans) was noted in uterine cavity and cervical canal causing stretching and thinning of myometrium. It was hyperintense on T1WI, intermediate signal on T2WI and nullified on STIR images (Figure 3a, 3b and 4a). It appeared hyperintense on T1 FATSAT images (Figure 4b). A diagnosis of hematometra and hematotrachelos was made. Vagina appeared small in size.

A dilated tubular, tortuous lesion measuring approx. 4.4 x 2.6 cm was noted in left adnexa showing similar characteristics as fluid in uterine cavity - blood in left fallopian tube.

A dilated tubular, tortuous measuring approx. 1.6 x 0.6 cm was noted in right adnexa just medial to right ovary showing similar characteristics as fluid in uterine cavity - blood in right fallopian tube (Figure 5a and 5b).

Right ovary showed a large well defined cyst measuring approx. 4.8 x 3.8 cm appearing hypointense on T1WI, hyperintense on T2WI and STIR – suggestive of a functional cyst.

Other pelvic organs were normal. Laparotomy confirmed hematometra due to cervical stenosis with blood in both fallopian tubes with endometriosis, and bilateral chocolate cysts – most likely due to retrograde menstruation. Our patient underwent total hysterectomy with bilateral salpingo-oophrectomy, as reconstruction

surgery was thought to be unsuitable because of advanced age and associated morbidity and extensive pelvic endometriosis.

II. Figures

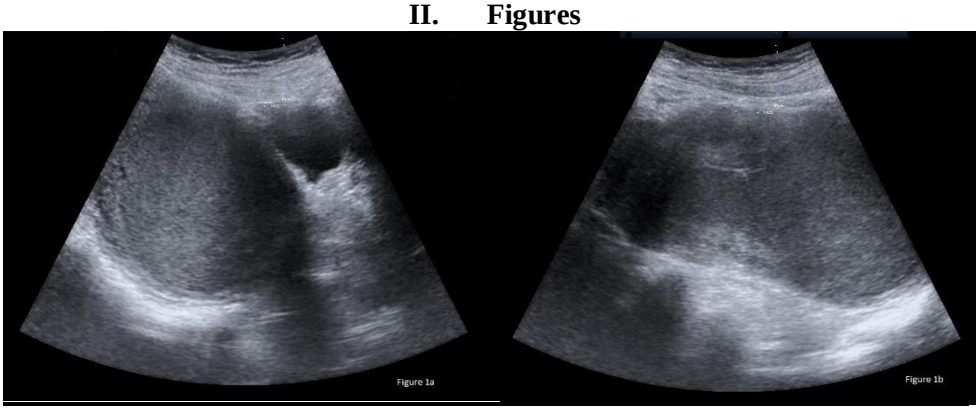

Figure 1a and 1b: USG longitudinal section in mid sagittal plane showing enlarged and bulky uterus due to hematometra with stretched myometrium and small cervix.

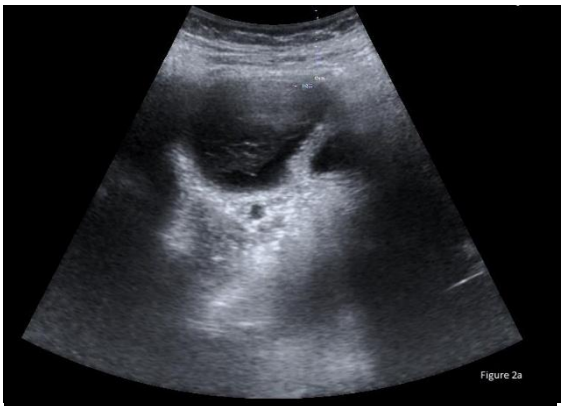

Figure 2a: USG right adnexa showing right ovarian cyst with fine septations.

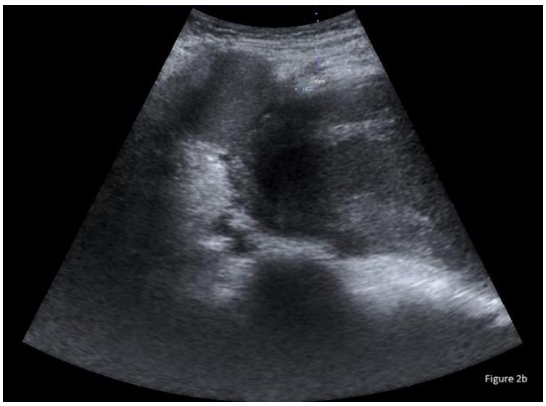

Figure 2b: USG left adnexa showing dilated fallopian tube filled with blood along with hematometra.

Figure 3a: MRI – showing hematometra appearing hyperintense on coronal T1WI.

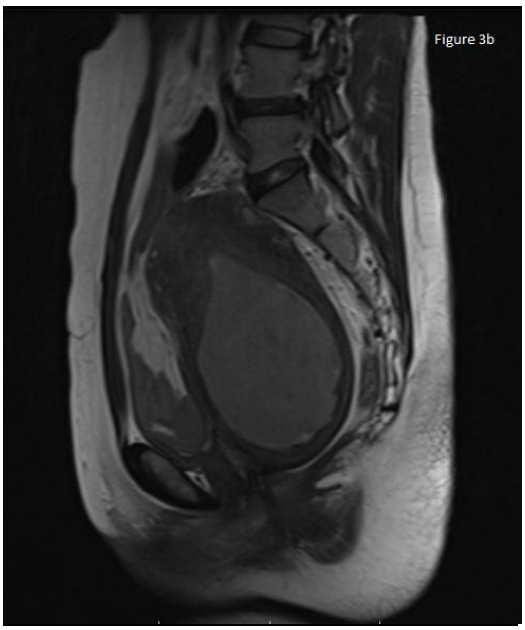

Figure 3b: MRI Sagittal T2WI showing hematometra of intermediate signal intensity.

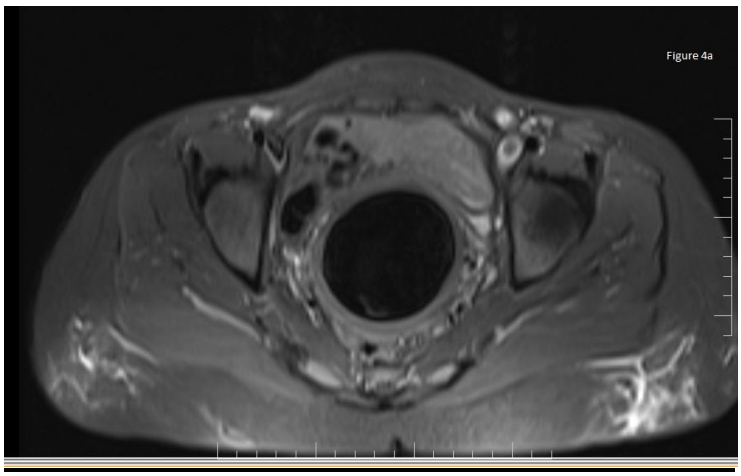

Figure 4a: MRI – showing hematometra nullified on axial STIR.

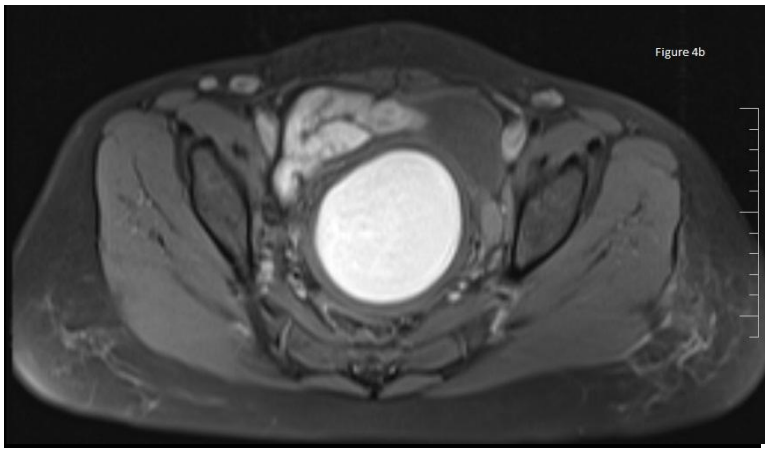

Figure 4b: MRI – showing hematometra appearing hyperintense on axial T1 FATSAT.

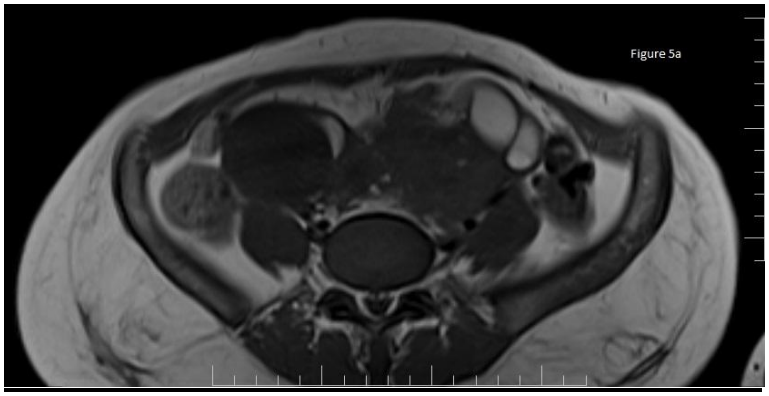

Figure 5a: MRI – showing bilateral dilated fallopian tubes due to blood appearing hyperintense on Axial T1WI.

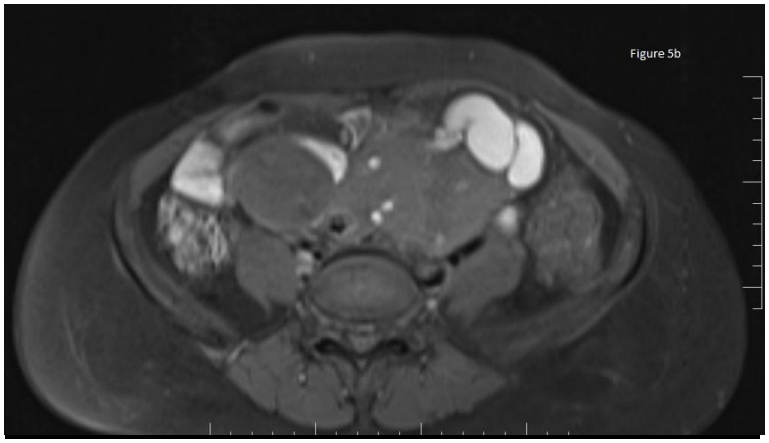

Figure 5b: MRI – showing bilateral dilated fallopian tubes due to blood appearing hyperintense on axial T1 FATSAT.

III. Discussion

STIR (Short time inversion recovery) is commonly used pulse sequence to detect broad range of pathologic conditions. It suppresses signal from fat and also includes addition T1WI, T2WI and proton density weighted contrast to facilitate lesion conspicuity. [1]

Fat suppression with STIR sequence is due to short T1 relaxation rate and hence, is not tissue specific. Signal from any tissue with short T1 (similar to that of fat) will also be nullified on STIR. Signal from tissues that accumulate paramagnetic contrast agent can also be suppressed with STIR sequence when an appropriate degree of T1 shortening results. STIR sequence relies on relatively short T1 relaxation time of adipose tissue to achieve fat suppression. It is different from frequency selective fat suppression technique in which signal from fat protons is selectively nullified on basis of intrinsic chemical shift differences between lipid and water protons. As STIR sequence can suppress signal from any tissue or fluid or short T1 relaxation time like fat. This

technique of fat suppression is non-selective. [1] Many biological tissues and fluid with short T1 values can be suppressed by STIR sequence. They are blood breakdown products (especially methhemoglobin), proteinaceous fluid and mucoid material, para magnetic substances like melanin, copper and manganese. Methhemoglobin is common in hemorrhagic ovarian cyst, endometriomas, neoplasms that have bled and hematometra. Proteinaceous fluid and mucoid material have T1 similar to adipose tissue; can be suppressed by STIR sequence. Melanoma because of presence of melanin blood products and certain hepatomas that contain copper may show signal suppression with STIR sequence. [2]

Any tissue in which a contrast agent accumulates show T1 shortening and hence can be nullified by STIR. Hence, STIR sequence should be used before administration of gadolinium chelates.

After gadolinium administration, an alternative fat suppressed technique which is independent of T1 relaxation time should be used to produce image on which enhanced tissue becomes conspicuous.

Use of STIR may result in decreased conspicuity of pathological condition or misinterpretation of signal suppression as constituting fat. [3] STIR sequence uses an initial RF pulse to invert spins in longitudinal plane. After a short time delay (inversion time – T1), initial RF pulse is followed by conventional spin echo or rare sequence. To achieve a fat suppression T1 should be selected such that longitudinal magnetization of fat spins zero when a subsequent 90 degree pulse is applied. The T1 that will negate signal from fat = 0.69 times T1 relaxation time of fat, provided that selected IR is significantly greater than T1. [1]

MRI is accurate in identifying hemorrhagic cysts and endometriomas as compared to TVS. MRI characteristics depend on the age and amount of hemorrhagic component. It shows high signal on T1WI and intermediate signal on T2WI. And frequently reveals fluid-fluid level. They tend to have thicker walls than simple cyst and may exhibit wall enhancement on post contrast on T1WI with fat suppression which help in differentiating from dermoid cyst in whom fat will be nullified. [4]

Endometriosis is ectopic presence of functional endometrial glands and stroma outside the uterus. Endometriomas are high signal on T1WI and of intermediate to low signal intensity on T2WI. Relatively low signal intensity on T2WI is called T2 shading and is due to methhemoglobin, protein and iron due to repeated resource of haemorrhage. [4] Multiplanar capability of MR imaging can diagnose dilated fallopian tube folded upon itself to form sausage like C or S shaped cystic mass. Hematosalpinx can be correctly diagnosed on MRI appearing hyperintense on T1WI, intermediate to high signal on T2WI and remaining hyperintense on T1 FATSAT.

A mullerian duct anomaly should be considered in differential of cyclical abdominal pain who respond poorly to analgesics. Mullerian duct malformation like imperforate anus, hymen, transverse vaginal septum and cervical atresia need surgical intervention. Creation of new vagina / cervix needs complex surgery associated with high morbidity and limited success, ultimately requiring surgery. [5]

IV. Conclusion

Signal suppression by STIR is not tissue specific as it is based on T1 relaxation. For effective characterization of tissue, a selective fat suppressed technique should be used whenever a tissue is isointense to fat on multiple pulse sequence. Also STIR sequence should be used before administration of contrast that cause T1 shortening.

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