Floating Debris Sign: A Helpful Diagnostic MRI Sign of Fat Free Mature Cystic Teratoma - A Case Report and Review of the Literature

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Received: 16 October 2023

Accepted: 4 January 2024

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DOI 10.5001/omj.2026.13

Abstract

Ovarian teratoma is a type of germ cell tumor derived from one or more of the three germ cell layers, it can be Mature Cystic Teratoma (MCT) commonly referred to as dermoid cyst or immature teratoma. Most MCT can be differentiated from immature teratoma through magnetic resonance imaging (MRI) due to their fat content showing typical features that are identified by fat suppression sequences. We present a case of fat-free ovarian dermoid cyst in a 21-year-old female with abdominal mass that was diagnosed with bilateral MCT on pathology although the diagnosis on MRI was not straightforward due to lack of fat within one of the masses. We describe additional MRI clues to the diagnosis of fat-free dermoid cyst in our case aiming for better characterization in similar cases in the future.

Keywords: Mature Cystic Treating; MRI; Floating Debris; Ovarian Tumor.

Introduction

Ovarian teratoma is the commonest germ cell tumor representing 20% of all ovarian neoplasms. Ovarian teratomas are further sub-categories as: mature cystic teratomas, immature teratomas, monodermal teratomas and fetiform teratomas.[1] The most common is MCT. Clinically patients with teratoma can be asymptomatic or have minimal symptoms such as lower abdominal pain, pelvic mass or the patient may present with a picture of cystic teratoma complicated by ovarian torsion.[2]

MCT can be easily identified through radiological imaging. The preferred initial radiological investigation is Ultrasound (US) which shows a heterogeneous appearance characterized by echogenic sebaceous material and calcifications demonstrating acoustic shadowing.

Computed Tomography (CT) and MRI have high sensitivity in diagnosing MCT through the detection of fat within the mass as well as calcifications. On MRI, the fat demonstrates high signal intensity on T1-weighted images with signal drop on fat-saturated T1-weighted images.[1]

While immature teratoma has nonspecific appearance in the US, mainly showing heterogeneous components, partially solid with calcifications. On CT and MR, immature teratoma demonstrates large irregular solid components with coarse calcification with no suppression on fat-suppression sequence.[3]

Case Report

A 21-year-old young unmarried lady with no known medical background presented in 2010 with a pelvic mass. She noticed abdominal distention 3 weeks ago, associated with mild lower abdominal pain and no constitutional symptoms. She has no menstrual abnormality. On abdominal examination, mass was palpable 20 weeks gravid uterine size, non-tender and non-mobile. Tumor markers were all within normal levels except Cancer Antigen-125 (CA-125) which was mildly raised at 146 (provide units and normal range).

MRI showed a well-defined oval cystic mass, related to the left ovary, measuring 13.3 x 11.4 x 9.5 cm, which is predominantly hyperintense on T1 and T2 weighted images, showing no suppression on fat-suppression sequences, denoting the presence of high proteinaceous content or blood. It contains innumerable variably-sized and shaped floating debris distributed throughout the cystic mass, most of them are hypointense on both T1 and T2 weighted images, and the large ones are hyperintense on T2 and isointense on T1 weighted images. No abnormal enhancement seen in the post contrast study. Those findings were favored to represent a teratodermoid tumor, likely benign in origin. In addition, the MRI also demonstrated another well-defined small right heterogeneous ovarian lesion, measuring 2.5 cm in diameter, which is predominantly hyperintense on T2 and T1 weighted images, showing signal drop-out on the fat-suppression sequences, denoting the presence of fat, suggestive of a dermoid cyst. The uterus appeared normal.

The patient underwent laparotomy, left salpingo-oophorectomy, right ovarian cystectomy with peritoneal biopsies.

Histological examination showed a large 14 x 10 x 6 cm left ovarian cystic mass weighing 820 g. The cyst was filled with thick creamy keratinous material and scanty hair. No other solid areas were identified. The right ovarian cyst measuring 2.5 x 2.0 x 2.0 cm was containing friable cheesy material and hair.

On microscopy, the cysts showed fibrous walls lined partly by squamous epithelium and partially by respiratory-type epithelium. The epithelium exhibits areas of ulceration with subjacent granulation tissue and a lympho-histiocytic cell infiltrate. The wall contains smooth muscle fibers, scattered lymphocytes and pigment epithelium. Scanty glial tissue was seen.

The ovarian stroma showed a follicular cyst. No immature elements were present, and sections from the fallopian tube showed unremarkable morphology.

In 2018 patient had multiple visits to emergency with lower abdominal pain, MRI was done three times; in 2018, 2019 and 2022 showing three subjacent fat containing cystic masses in the right ovary which were gradually increasing in size, last sizes noted up to 4.4 x 3.6 x 3.5 cm, 2.5 x 2.4 x 1.8 cm and 2.5 x 2.4 x 1.8 cm, respectively suggestive of subjacent dermoid cysts. Based on those findings, she was planned for surgery in 2022 but she lost follow up.

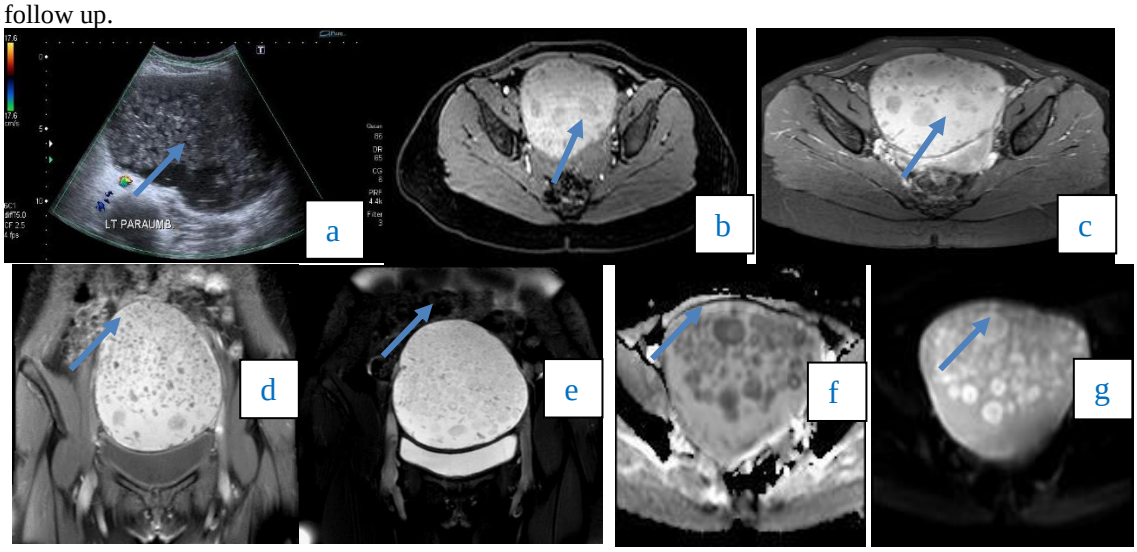

Figure 1: Grey scale Ultrasound image (a) showing a large complex (cystic and solid), avascular left adnexal mass with multiple internal echogenic foci. MRI axial T1WI pre (b) and post contrast (c) showing a non-enhancing predominantly high T1 signal lesion with innumerable variably-sized and shaped floating debris contents which are hypointense on both T1 and T2-WI. Coronal T2WI (d) and T2 fat suppression (e) shows predominantly high T2 signal with no suppression on fat suppressed sequence. There is no diffusion restriction in DWI (f) and ADC map (g).

Discussion

The fatty component of MCT is the primary diagnostic feature identified through MRI, however, studies shown that small percentage of MCT can present with minimal or no fat in the cyst. In one case series study done in Japan by Yamashita et al. which included 78 cases, 12 of them had no fat component on pathology review and 5 of those showed no fat suppression on MRI. In this case series they suggested the use of gradient-echo MR imaging.[4]

Another study in Saudi Arabia of a 19-year-old female with fat free MCT showed that there are atypical areas of fat within the mass, like fat in the wall which is described in their study. However, no other signs were mentioned to reach the diagnosis by imaging.[5] In our case, we emphasize the use of an additional sign which can help in diagnosing fat free MCT. This sign is the presence of non-enhancing variable-sized and variable-shaped floating debris at different levels within the cystic mass. In the literature, it is referred to as a floating balls sign. Floating ball sign is a known pathognomonic sign of MCT which appears as floating globules within the cyst independent of gravity, usually this sign appear to be hypointense on T1-weighted and hyperintense on T2[1] in contrast to its appearance in our case.

A case by Kawamato et al presented a similar finding of floating spherical shaped debris in MCT that has no fat on pathological examination. In their case, the MRI sagittal T1-weighted images demonstrated an area at the outer portion of the spherical structure of slightly hyperintense signal relative to the surrounding fluid, but not as hyperintense as subcutaneous fat. The center of the spherical structure was relatively hypointense compared with the outer portion. There was a fluid debris level in the dependent portion of the cystic mass. On sagittal and coronal T2-weighted images, the outer portion of the spherical structure was hypointense, and the center relatively hyperintense[6]

Also Esphidola et al described a similar finding in their case of multiple small floating spheres within a large cyst on MRI, the oval formations showed intermediate signal intensity on T1- and T2-weighted images, with no evidence of signal loss in fat-saturated sequences.[7]

Both cases matched the findings in our case with a slight difference in the shapes of the floating materials. In our case, it is more heterogeneous with linear, oval and spherical shaped floating debris that were hypointense on both T1 and T2 weighted images and the large ones are hyperintense on T2 and isointense on T1 weighted images. The second difference is the distribution of the debris which is throughout in our case while it was more in the independent half of the cyst in the previously published cases.

A retrospective study was done by Şahin et al regarding the utility of floating balls sign in diagnosing MCT. The study included 112 MCT with floating ball sign in which only one lesion had floating balls sign and was fat free in both radiology and pathology results. The study result showed that this sign has a rather high incidence rate of 25%, is more associated with large MCT and can be seen in both benign and malignant MCT.[8]

Conclusion

In conclusion, the atypical presentation of fat free MCT should be recognized by radiologists including the presence of floating debris sign without fat suppression of the lesion on Pelvis MRI. Although rare, the presence of this sign does not exclude the possibility of malignant degeneration into squamous cell carcinoma and therefore assessment for enhancing soft tissue components is important.

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