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Comet Tail Artifact on Pelvic Ultrasound Associated with Borderline Serous Tumor of the Ovary

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Abstract

The "comet tail" is an ultrasound artifact that appears as a dense tapering tail of echoes just distal to a strongly reflective surface. [1] The radiologic significance of this reverberation artifact has been described in clinical settings where underlying microcalcifications indicate the presence of endocrine, respiratory and abdominal pathology. [2] However, its relevance in pelvic pathology is unclear. We describe a patient with a borderline papillary serous lesion found on her fallopian tubes following a bilateral salpingectomy, who was later found to have a borderline serous tumor of her left ovary on re-operation following multiple pelvic ultrasounds describing comet tail artifacts within her left ovary in the setting of no other pelvic pathology. The clinical significance of reverberation artifact on ultrasound in diagnosing ovarian pathology is discussed.

Keywords

Borderline serous tumor; Reverberation artifact; Psammoma bodies; Pelvic ultrasound

Case Report

A 34-year-oldfemale was referred to gynecologic oncology for a borderline papillary serous lesion of the left fallopian tube found after bilateral salpingectomy for infertility treatment. Her ovaries were noted to be grossly normal during that procedure. Her family history was notable for her maternal grandmother who had ovarian cancer at age 38 and breast cancer at age 53. She was counseled on her options of surgical versus surveillance and elected surveillance as she was undergoing fertility treatment. She conceived 1 month following her initial visit. A pelvic MRI at 8 months of pregnancy was unremarkable. Pelvic ultrasound 8 months after her term vaginal delivery was done, and compared to the previous MRI,and showed overall normal uterine and adnexal anatomy. However, multiple echogenic foci were seen within the left ovary, described as demonstrating a "ring down" artifact (figure 1). She had a repeat pelvic ultrasound 6 weeks later which was notable for re-demonstration of multiple echogenic foci and ring down artifact in the left ovary (figure 2). Due to concern over the re-demonstration of the foci and ring down artifact, laparoscopic left oophorectomy was performed 3 weeks later. Intra-operative findings included normal appearing abdominal organs and a cobble-stone appearance of the uterus and ovaries. Pelvic washings were positive for atypical cells and psammoma bodies and final pathology of the left ovary showed a small focus of serous borderline tumor with psammoma bodies. A retrospective

radiologic inquiry later suggested that the described ring down artifact was actually consistent with comet tail artifact.

Discussion

Serous borderline neoplasm (SBN) is the most common subtype of borderline tumors, accounting for 65% of borderline ovarian neoplasms. [3] The mean age of presentation is 35-40 years of age. Although late recurrences are not uncommon, the ten-year survival is excellent at 95-100%. [3] Patients with peritoneal spreador lymph node involvement are at increased risk of recurrence and progression to low-grade invasive serous carcinoma. [3]

On gross pathology, SBN tends to develop within a cyst with fine papillary projections that usually arise on the internal surface of the cyst. [5-7] Endosalpingosis and inclusion cysts are associated with SBN in 40% of patients and 40% of patients will have peritoneal implants which tend to be firm, fibrotic and calcified. [7] While coarse implants with an abundance of psammoma bodies are more characteristic of low-grade invasive serous carcinoma, they can be seen in patients with a diagnosis of SBN, such as our patient. [5] Psammoma bodies are round collections of calcium thought to arise from infarcted and calcified papillary tips in papillary histopathology. The key microscopic feature of SBN is serous epithelial proliferation into tufts with branch-like configuration into papillae. [7,8] The complexity of the tufting may lead to a cribiform pattern. [5,7] It is controversial whether highly complex cribiform lesions behave more like low-grade invasive carcinoma rather than a borderline tumor. Approximately 10% of the complex SBN can have areas of microinvasion. If the microinvasive component measures greater than 5 mm, the neoplasm is classified as a low-grade serous carcinoma arising from a SBN. [5,6]

The radiologic characteristics of the microscopic architecture of these lesions have been described in context of macroscopic pathology such as cystic tumors. [9] However, if there are no associated macroscopic features defining a lesion, the radiologic characteristics of microscopic feature predominate. On ultrasound, papillary projections display multiple echogenic foci or bands, depending on where the tufts accumulate. [5] This is likely secondary to the calcified tips and psammoma bodies.

Traditionally, “comet tail” artifacts are seen on ultrasound appearing as dense tapering tails of echoes, which look like closely spaced bands, just distal to a strongly reflective surface, such as calcium deposits. [1] They are usually seen in a relatively echo-free background and the tails are generally short, less than 2 cm. [10] Acommon clinical setting in which the comet tail artifact has been seen is in the gallbladder where the presence of cholesterol crystals in the luminal wall cause reverberation. [2,10]Ring-down artifact is another reverberation artifact used specifically in the context of reverberation caused by small gas or fluid bubbles. Comet tails and ring-down artifact are sometimes used interchangeably, due to their similar appearance on ultrasound. [1] The echogenic finding on ultrasound of our patient was initially described as a ring-down artifact, but, on retrospective review, was more correctly a comet tail artifact. Despite the similar appearance, the physical basis and mechanism that produce these two artifacts are different. Unlike comet tails, which are from reverberation echoes caused by reflective surfaces, ring-down artifact is the appearance of solid streaks or a series of parallel bands radiating away from gas or fluid collections. [11]Ring down artifact has been described on imaging of patients with pulmonary parenchymal thickening sometimes associated with pneumonia and interstitial fibrosis. [12]

In female pelvic imaging, reverberation artifacts, including comet tails and ring down artifact, have unclear significance. Echogenic foci of the ovary seen on ultrasound have been described in the literature and may be found in a variety of clinical ovarian pathology including dermoid and inclusion cysts, hemosiderin (iron-containing cellular components) and benign calcifications. [13,14] However, they may be considered clinically important because of their association with microcalcification in certain types of malignancies involving the ovary, as well as other organ systems. [13] Tiny flecks of calcium that appear as bright echogenicities have been described with primary serous carcinoma of the peritoneum, papillary carcinoma of the thyroid, and liver metastasis from mucin-producing tumors of the gastrointestinal tract. [13,14]Research is mixed about whether peripheral echogenic foci involving the ovary represent psammomatous calcifications, which are commonly associated with ovarian epithelial neoplasms, or if they are part benign inclusion cysts. [13,14] This is due to the relatively high prevalence of echogenic foci (54%) in benign ovaries of patients undergoing oophorectomy for non-ovarian indications. [16] However, none of these studies looked at the clinic significance of echogenic foci in the ovary in patients at high risk for ovarian neoplasia.

The patient described above exhibited extensive ovarian endosalpingosis with psammoma bodies on the serosal surface and parenchyma. Extensive calcifications from psammoma bodies may have resulted in the comet tail artifact seen on her imaging. While the clinical significance of ovarian echogenic foci, as well as reverberation artifact on pelvic ultrasound remains vague, the finding of comet tails on imaging in our patient resulted in early detection of and intervention for ovarian pathology.

Conclusion

In conclusion, when reverberation artifacts, such as comet tails, are seen in the ovary on pelvic ultrasound, it may be attributed to microscopic features of concerning pathology in certain patients. This clinical case suggests that reverberation artifact on ultrasound in high-risk patients, such as patients previously diagnosed with SBN, those with adnexal masses concerning for malignancy and BRCA patients undergoing surveillance, should warrant further evaluation. Awareness of the pathologic features of epithelial carcinomas of mullerian origin and the characteristic appearance or micro-pathology on ultrasound may assist in earlier diagnosis and treatment.

Figures

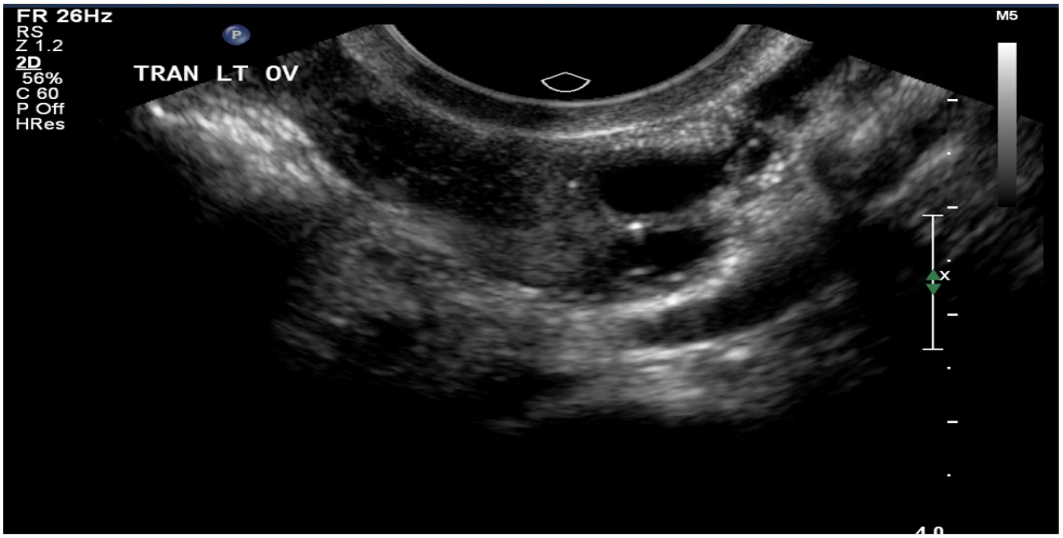

Figure 1: Echogenic foci at the tip of arrows represent comet tail artifacts

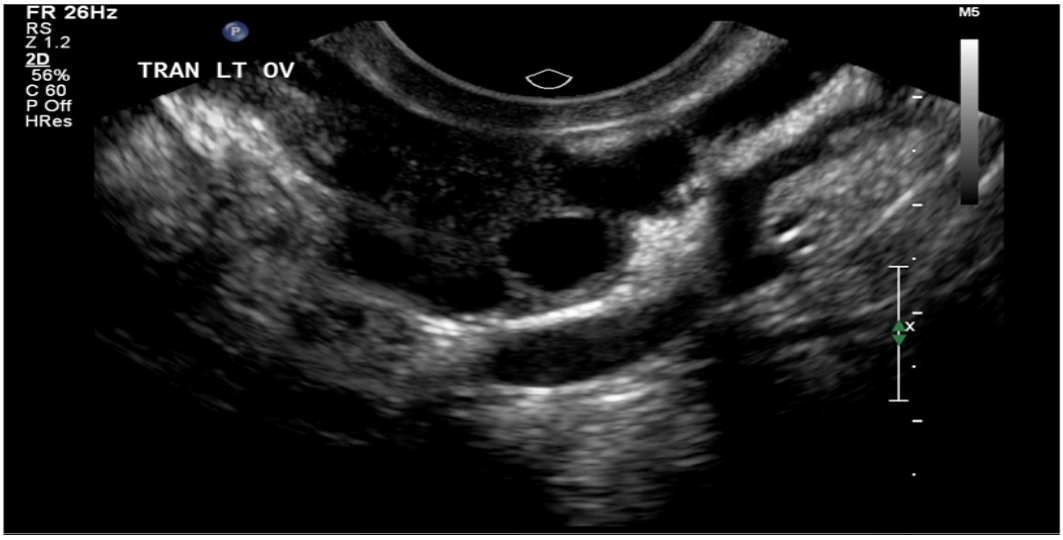

Figure 2: Ovarian follicles in the left ovary with peripheral comet tail artifact.

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