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Role of Ultrasound Imaging in the Differential Diagnosis of Benign and Malignant Ovarian Cancer

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Abstract: *The problem of diagnosing and treating tumors and tumor-like formations of the ovaries is complex and extremely urgent not only in connection with the increase in the frequency of the disease but also the severity of the disorders of the reproductive and other body systems caused by them. The identification of a unilocular solid cyst had a positive predictive value for malignancy of 37.1%, while the identification of a multilocular solid cyst had a positive predictive value for malignancy of 43.0% from IOTA framework. Mucinous cystadenocarcinoma was commonly unilateral and involve the presence of irregular thick septa or solid papillary projections that are usually detected within cysts. Therefore, in order to create an easy and simple classification facilitating the differentiation of benign and malignant masses, familiarity with the pattern recognition approach to ultrasound is required.*

Keywords: *breast, ultrasound, cancer, lymphadenopathy, ovarian*

I. Introduction

Ultrasound imaging remains the study of choice in the initial evaluation of suspect adnexal masses because it is relatively inexpensive, noninvasive, and widely available. Early and correct diagnosis of ovarian masses has a great impact on the ultimate survival. The present study was done to know the role of color Doppler studies in the characterization of ovarian masses and to evaluate its efficacy in diagnosis and differentiation of these neoplasms when used along with grayscale (B-mode) ultrasonography (US). Transabdominal US, endovaginal US, or both should be performed for the evaluation of adnexal masses. Endovaginal US has allowed markedly improved resolution for uterine and adnexal imaging and is essential for imaging adnexal masses whose nature is not apparent at transabdominal US [1]. Morphologic features including thick, irregular walls and septa, papillary projections, and solid, moderately echogenic loculi have been described as suggestive of malignant tumor. Color Doppler US of ovarian masses helps identify vascularized tissue and can assist in differentiating solid tumor tissue from nonvascularized structures [2,3]. Benign lesions tend to initiate new tumor blood vessel formation peripherally from preexisting host vessels, whereas malignant tumors tend to initiate new tumor blood vessel formation centrally. Two indexes have been used in analyzing Doppler waveforms: the

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pulsatility index and the resistive index. Both increase with increasing distal vascular resistance, and the two indexes have a high correlation. However, resistive indexes less than 0.4–0.8 and pulsatility indexes less than 1.0 are generally considered to be suspicious for malignancy. The use of a combination of morphologic analysis with the endovaginal US and pulsed Doppler waveform analysis with color Doppler US may help overcome problems [4, 5]. The various categories of ovarian masses according to the US features defined in the IOTA (Internet of Things Agent) framework are reviewed in this article.

II. Experimental, Materials and Methods

We examined 35 patients' data who had been admitted to the Department of Gynecology, 1st Republic Scientific Cancer Centre, Tashkent, Uzbekistan. All patients were diagnosed with a different type of ovarian mass and had undergone US imaging.

III. Result and Discussion

Most unilocular cyst such as follicular cyst and the benign serous tumors can demonstrate anechoic features (Figure 1). Since blood clots, fat, and sebaceous materials can be occasionally mistaken for solid components within a cyst, it is necessary to understand the typical US features of a "complex" cyst, which is defined as

cyst containing any kind of nonviable components.

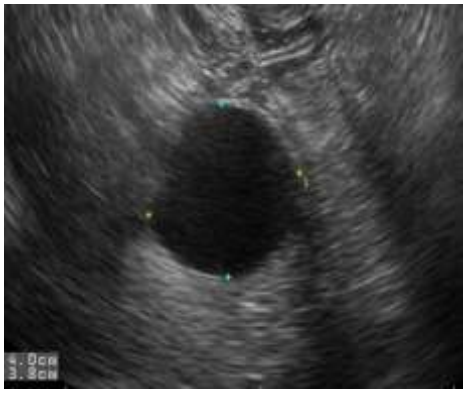

Figure 1. Transvaginal ultrasonography shows a well defined anechoic mass without a solid component.

Hemorrhagic corpus luteal cyst can be caused by bleeding to corpus luteum. In the acute stage, a hemorrhagic cyst may contain clotted blood, which manifests in US as intensely echogenic, avascular, homogeneous, or heterogeneous material.

It can occasionally appear to have a bizarre contour compared to the lobulated contour found in malignancies (Figure 2).

Figure 2. Transvaginal ultrasonography (US) shows a rectangular hypoechoic lesion in the cystic mass.

Over time, the clot may retract and liquefy, resulting in an undulating and concave surface. In a later stage, resolved clots with fibrin strands result in a pattern that referred to with a variety of terms, including "cobweb," "honeycomb," "reticular," "lacy," "fishnet," and "sponge" (Figure 3).

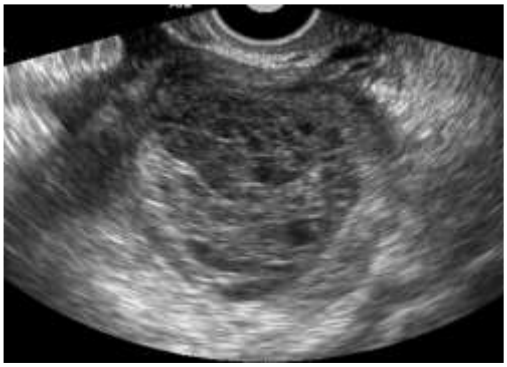

Figure 3. Transvaginal ultrasonography shows a round complex echoic ovarian mass.

Endometrioma occurs in the ovary where ectopic endometrial tissue is implanted [6, 7]. The characteristic US features of endometrioma are homogeneously diffuse low-level echoes in the cyst, compromising the so-called ground-glass appearance, which is indicative of chronic repetitive hemorrhages within the cyst (Figure 4). However, less than 15% of endometrioma have atypical findings, such as fluid-fluid level, hyperechoic mural irregularity, heterogeneity, or calcification (Figure 5). In addition, endometrioma in postmenopausal patients are less likely to exhibit the typical "ground-glass" pattern of echogenicity, and malignant transformations to endometrioid or clear cell carcinoma have been reported in older patients (Figure 6).

Figure 4. Transvaginal ultrasonography reveals homogeneously diffuse low echoes in thecystic mass, which is known as “ground-glass” appearance.

Mature cystic teratoma often referred to as dermoid or dermoid cyst, typically shows focal high echogenic nodules, heterogeneous internal echoes in the cyst with acoustic shadows, and multiple hyperechoic fine lines and dots, which are due to reflection by clumps of hair, sebum, or fat component within the mass. The hyperechoic area is not usually as intensely echogenic as calcification and may be confused with the echo of adjacent bowel gas.

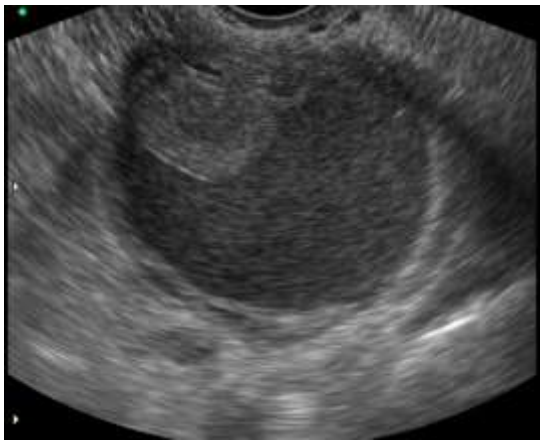

Figure 5. Transvaginal ultrasonography (US) reveals a well defined round lesion within a homogeneously hypoechoic cyst.

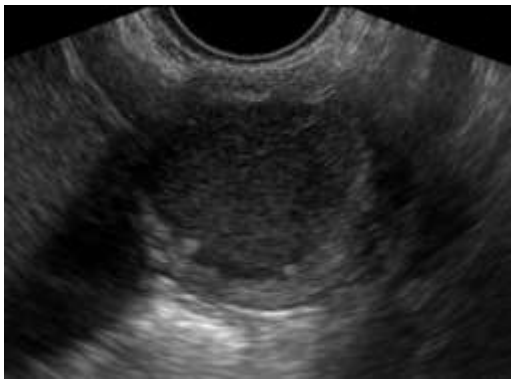

Figure 6. Transvaginal ultrasonography shows several small polypoid lesions that have diffuse internal low echoes along the wall of the cystic mass.

Most serous cystadenocarcinoma, endometrioid adenocarcinoma, clear cell carcinoma, serous borderline malignancies, and cystadenofibroma are categorized as unilocular solid cyst [8, 9]. According to a study using IOTA framework, the identification of a unilocular solid cyst has a positive predictive value for malignancy of 37.1%. In order to create an easy and simple classification facilitating the differentiation of benign and malignant masses, familiarity with the pattern recognition approach to US is required. Using the categories of unilocular cyst, unilocular solid cyst, multilocular cyst, multilocular solid cyst, and solid tumor, it is possible to recognize typical cases of each category . This results in confident and specific diagnoses of hemorrhagic corpus luteal cyst, cystic teratoma, endometrioma, tubo-ovarian abscess, benign or malignant epithelial tumor, sex cord stromal tumor, rare malignant germ cell tumor, and metastatic tumor.

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