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CLINICAL ARTICLE

The value of ultrasonographic tubo-ovarian abscess morphology in predicting whether patients will require surgical treatment

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ABSTRACT

Objective: To determine if the ultrasonographic morphology of a tubo-ovarian abscess (TOA) could be used to predict if a patient will require surgical treatment. *Method:* A retrospective cohort study reviewed medical records from patients diagnosed with TOA via ultrasonography between January 2009 and January 2014 at a tertiary referral center in Turkey. Patients with pelvic inflammatory disease and an inflammatory adnexal mass, identified during sonographic examination, were included in the study. Ultrasonographic morphology, demographic characteristics, and clinical and laboratory findings were compared between patients who required surgical treatment and those who did not. *Results:* Records were included from 164 patients; medical therapy was successful in 121 (73.8%) patients and 43 (26.2%) required surgical treatment. TOA morphology was identified, using ultrasonography, as unilocular cystic, complex multicystic mass, or pyosalpinx in 56 (34.1%), 73 (44.5%), and 35 (21.3%) patients, respectively. No correlation was present between ultrasonographic TOA morphology and patients requiring surgical treatment (all $P>0.05$). Multivariate analyses demonstrated that an abscess larger than 6.5 cm in size ($P=0.027$), fever at admission ($P<0.001$), and parity greater than two ($P=0.026$) were independent predictors of patients requiring surgical treatment for TOA. *Conclusion:* Although increased TOA size, fever at admission, and parity were associated with increased odds of patients with TOA requiring surgical treatment, ultrasonographic TOA morphology was not.

1. Introduction

During the clinical course of pelvic inflammatory disease (PID), nearly 15% of women develop a tubo-ovarian abscess (TOA) [1]. A TOA is an inflammatory mass that forms during infection of the adnexa and, sometimes, other adjacent organs [2–4]. TOA is a serious complication of PID that can threaten both patients' fertility and lives; consequently, prompt diagnosis and treatment are crucial. Whereas PID is classically diagnosed based on clinical and laboratory findings, imaging is necessary to diagnose TOA and ultrasonography is the most commonly applied diagnostic imaging modality for diagnosing a TOA. Ultrasonography is inexpensive, non-invasive, widely available, and has demonstrated high specificity (93%) and sensitivity (98.6%) in diagnosing TOA [1]. The ultrasonographic morphology of a TOA can demonstrate a unilocular cystic structure, a complex multicystic structure with thick walls and septation (tubo-ovarian complex), or a pyosalpinx, a fluid-filled sausage-shaped cystic structure with incomplete septation [5].

Although first-line medical treatment for TOA is the aggressive use of intravenous broad-spectrum antibiotics, such treatment is ineffective and surgery is required for approximately 25% of patients [6]; however, few data exist on associations between clinical and biochemical variables, and whether a patient with a TOA will require surgery. Although increased age, a high white blood cell (WBC) count, and a cyst larger than 6 cm in size are thought to be associated with increased risk for surgical treatment [7,8], whether TOA ultrasonographic morphology is associated with the effectiveness of antibiotic therapy is unknown. It is thought that antibiotic penetration into infected tissue could differ based on abscess morphology. For example, it could be the case that the thin wall of a pyosalpinx is easily penetrated by antibiotics, whereas a tubo-ovarian complex, with thick walls and septae, could be less permeable for antibiotics. Consequently, the aim of the present study was to determine if the ultrasonographic morphology of a TOA is associated with whether a patient will require surgical treatment.

2. Materials and methods

In the present retrospective cohort study, medical records were reviewed for patients diagnosed with a TOA who were hospitalized between January 2009 and January 2014 at a tertiary referral center in Turkey. Patients with a pelvic ultrasonography-identified tubo-ovarian inflammatory mass fulfilling the US Centers for Disease Control and Prevention criteria for PID [9] were included in the present study;

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patients were only excluded if the patient records included incomplete data. The institutional review board approved the study protocol and written informed consent for future data use was obtained from all participants at the time of treatment.

Data retrieved from patient records included demographic characteristics; menopausal status; the presence of diabetes mellitus; history and current use of an intrauterine device; history of curettage; history of pelvic surgery including cesarean section, salpingo-oophorectomy, ovarian cystectomy, myomectomy, and tubal ligation; laboratory and pelvic ultrasonography findings; treatment modality; and duration of hospitalization. Association between patients requiring surgical treatment and ultrasonographic TOA morphology, demographic characteristics, and clinical and laboratory findings were investigated. Patients were grouped according to whether medical treatment was successful or if surgery was required, and based on ultrasonographic morphology (unilocular cyst, complex multicystic mass, or pyosalpinx [cyst with incomplete septation]); examples of ultrasonographic morphology findings are presented in Fig. 1.

All patients underwent an ultrasonography examination using a 6–10-MHz transvaginal probe (Logiq P5; GE Healthcare Inc, Milwaukee, Wisconsin, USA), with all examinations performed by one sonographer who was not blinded to patient diagnoses. Patients were examined in the lithotomic position, and the uterus and bilateral adnexa were evaluated. The maximum diameter of each inflammatory mass was considered the TOA size. In patients with a bilateral TOA, the maximum diameter of the largest mass was considered to be the TOA size.

All patients diagnosed with a TOA were admitted to the hospital's gynecology department. Upon admission, all patients underwent routine physical and pelvic examinations, and venous blood samples were taken for laboratory testing. The serum WBC count, erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) level were measured on the first day of medical treatment, before being measured every other day. Initially, all patients were treated with broad-spectrum antibiotics (clindamycin–gentamycin or ceftriaxone–metronidazole [10]). Parenteral antibiotic treatment continued for 10 days, based on recommendations for PID treatment [11] and clinical experience treating patients unable to complete follow–up or tolerate oral medication. Patients in the present study were predominantly of low socioeconomic status and, based on clinical experience at the study institution, were hypothesized to potentially experience difficulties regularly complying with the oral-medication dosing schedule.

Patients who did not experience clinical improvement after 72 hours of antibiotic therapy [12], had positive peritoneal signs, or had a suspected ruptured TOA had medical treatment withdrawn and underwent surgery. Surgical treatment included ultrasonography-guided transvaginal abscess drainage, uni-/bi-lateral salpingectomy/salpingo-oophorectomy via laparoscopy or laparotomy, or total abdominal hysterectomy combined with uni-/bi-lateral salpingectomy/salpingo-oophorectomy. CT-guided abscess drainage was not available at the study institution. Eligible patients underwent ultrasonography-guided transvaginal abscess drainage. In the lithotomic position, a 16G aspiration needle attached to a 6–10-MHz transvaginal probe (Logiq P5; GE Healthcare, Inc, Milwaukee, Wisconsin, USA) was inserted into the abscess and purulent material was aspirated. Patients with a ruptured TOA, multilocular abscess, or an abscess that was difficult to access using ultrasonography-guided transvaginal drainage underwent laparoscopy or laparotomy.

Data were analyzed using SPSS version 11.5 (SPSS Inc, Chicago, IL, USA) and the normality of the data was analyzed using the Kolmogorov–Smirnov test. Differences in normally distributed continuous data were analyzed using the independent samples *t* test, and data without a normal distribution were analyzed using the Mann–Whitney *U* test. The χ^2 test was used to evaluate categorical data. A one-way ANOVA test with Bonferroni correction was used to make comparisons between the three TOA morphology groups in terms of continuous data with a normal distribution. The Kruskal–Wallis test and one-way ANOVA were used in the analysis of continuous data that was not normally distributed. Binary and multiple logistic regression analyses were used to evaluate the effect of variables on the odds of a patient with TOA requiring surgical treatment. Variables were included in the multiple logistic regression analyses if $P<0.25$ for comparisons between patients treated successfully or unsuccessfully with medical treatment, and if there was no correlation with other variables. A receiver operating characteristic curve was used to evaluate the optimal TOA-size

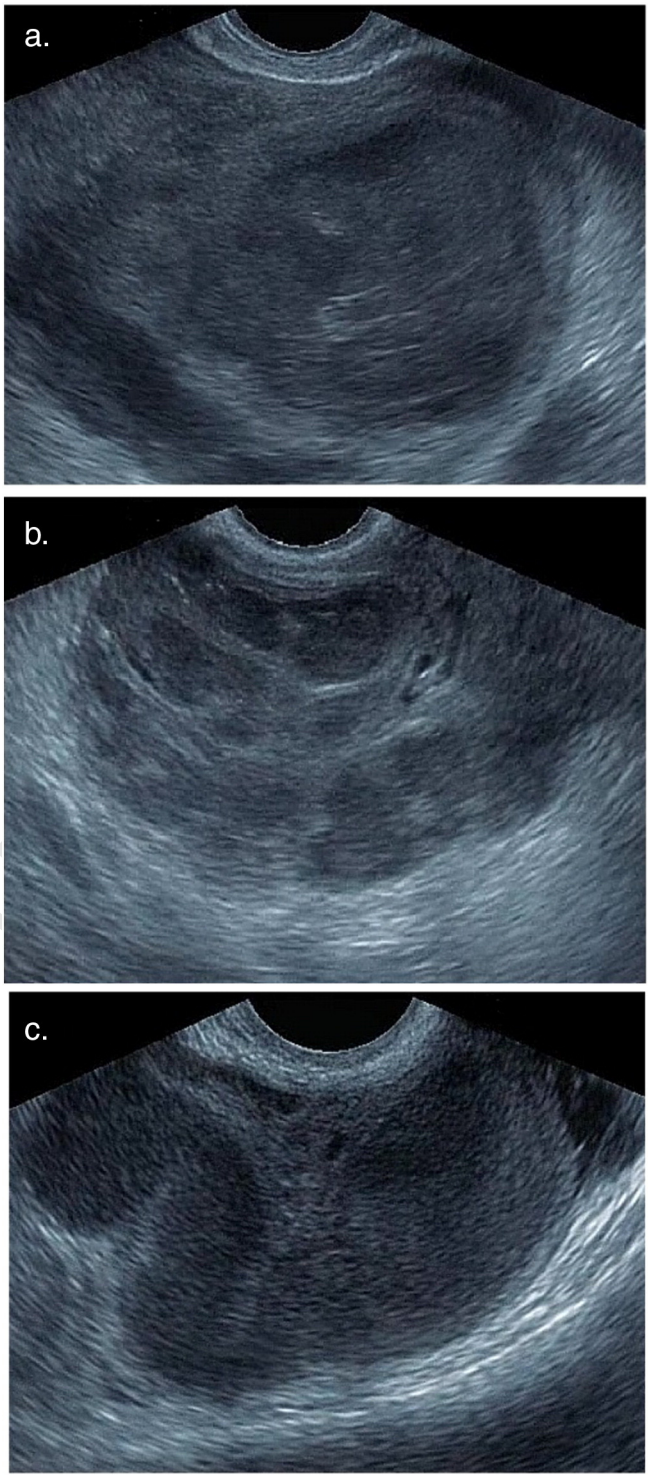

Fig. 1. Examples of tubo-ovarian abscess ultrasonographic morphology. Unilocular cystic structure (a). Complex multicystic structure with thick walls and septation (b). Pyosalpinx (cystic structure with incomplete septation) (c).

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