

Tubo-ovarian abscesses: Spectrum of sonographic findings with surgical and pathological correlations

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Summary

Objective: Pelvic inflammatory disease (PID) is a serious condition that can lead to abscess formation. The purpose of this study was to identify the different sonographic markers on gray scale and color Doppler sonography in tubo-ovarian abscesses.

Material and Methods: The study group consisted of 25 women in whom the presence of tubo-ovarian abscess was confirmed by surgery and histopathology and their ultrasound records were analyzed retrospectively.

Results: Presence of a mass was found in all cases. The maximum diameter of the mass was 5 cm in two cases and between 5 cm and 10 cm in 23 cases. The mass was demonstrated at the anatomic position of the ovary in 21 cases (84%) and at the cul-de-sac in four cases (16%). The mass was a simple cyst in two cases (8%), in four cases it was cystic with diaphragms (16%), in four cases it was a thickened tube-shaped structure with multiple internal echoes (16%) and in 15 cases it was a mixture of cystic and solid elements (60%). Pyosalpinges with fluid-fluid levels were found in two cases. Fluid in the cul-de-sac was observed at a rate of 48%. Color Doppler sonography demonstrated abundant blood flow in the borders and the septa of the tuboovarian abscesses in 90% of the studied cases.

Conclusion: The ultrasonographic findings of tubo-ovarian abscesses are not specific. The presence of a mass at the anatomic position of the ovary or at the cul-de-sac in combination with an increased number of white blood cells, elevated erythrocyte sedimentation rate and clinical findings are helpful for a correct diagnosis. Also, the color Doppler flow can further characterize the nature of the pelvic mass by detecting a significant rich blood flow in most cases of tuboovarian abscesses.

Key words: Ultrasound; Abdominal; Transvaginal; Tubo-ovarian abscess; Pelvic inflammatory disease; Color Doppler.

Introduction

Pelvic inflammatory disease (PID) is a common and serious condition that can lead to abscess formation or pelvic fluid accumulation [1]. Even more importantly, among women of reproductive age it can cause infertility and ectopic pregnancy. Moreover, if this condition is left untreated or the treatment is delayed it could lead to chronic pelvic pain [2, 3]. Tubo-ovarian abscess is the most serious sequel of PID and has been referred to as the last stage in the progression of upper genital tract infection [4]. It has been reported to occur in as many as 34% of patients hospitalized with salpingitis [4].

Laparoscopy has been used successfully in the diagnosis and treatment of tubo-ovarian abscess and pyosalpinx to preserve the ovaries and tubes [5]. However, laparoscopy is an invasive method, which is expensive and might lead to complications [3]. In comparison with laparoscopy, clinical examination and current laboratory tests are insufficient for diagnosis of tubo-ovarian abscesses [2, 5]. Spiros *et al.*, found that in severe PID transabdominal ultrasound confirmed the diagnosis in 94% in comparison with laparoscopy [6]. Moreover, transvaginal ultrasound increases the diagnostic power in

various stages of tubo-ovarian inflammation not seen with the transabdominal approach [2]. However, transvaginal findings are often subtle, and interpretation of the findings requires a high level of expertise [3]. The use of power Doppler strengthened the sonographic diagnosis of acute PID by showing increased vascularization consistent with hyperemia due to inflammation [3].

The purpose of this study was to identify retrospectively the different sonographic markers on gray scale and color Doppler sonography in a series of surgically and pathologically proven cases of tubo-ovarian abscesses in order to achieve correct preoperative diagnosis of this life-threatening condition.

Patients and Methods

The study group consisted of 25 women who presented for severe PID to the Emergency Department of "G. Gennimatas" General State Hospital, Athens, and "G. Chatzikosta" General State Hospital, Ioannina, for the years 2000 and 2001. The patients underwent surgical intervention and the presence of a tubo-ovarian abscess was confirmed at surgery and by histopathological study. The ultrasound records were analyzed retrospectively and the sonographic features recognized prior to surgery were compared with the surgical and pathological findings of the tubo-ovarian abscess after excision. The patient's bladder was full for the transabdominal sonography studies.

Patients examined by transvaginal ultrasonography were instructed to partially void their bladder. Two of the 25 patients included in this study underwent only transabdominal ultrasound examination, while 23 patients underwent transvaginal ultrasound examination. Cul-de-sac fluid, size, number and texture of ovarian masses and presence of fallopian tube or fluid-filled tubes were examined.

The mean age of patients was 44 years (range 33-73 years). Six patients (24%) were using an intrauterine contraceptive device and six patients (24%) had a history of previous PID. Two patients suffered from multiple sclerosis (8%) and two from thrombocytopenia (8%). Regarding the fertility of the studied patients, eight of them were nulliparous (32%).

Results

The presence of a mass was found in all the studied cases. The maximum diameter of the mass was 5 cm in two cases and between 5 and 10 cm in 23 cases. The mass was demonstrated by ultrasound scan at the anatomic position of the ovary in 21 cases (84%) and at the cul-de-sac in four cases (16%). The mass was a simple cyst in two cases (8%) (Figures 1a and 1b), in four cases it was cystic with diaphragms (16%) (Figures 2a, 2b, 2c), in four cases it was a thickened tube-shaped structure with multiple internal echoes (16%) (Figures 3a, 3b, 3c) and in 15 cases it was a mixture of cystic and solid elements (60%) (Figures 4, 5). In two cases the lesion was bilateral (bilateral pyosalpinges). Pyosalpinges with fluid-fluid levels were found in two cases (8%) (Figures 7a, 7b).

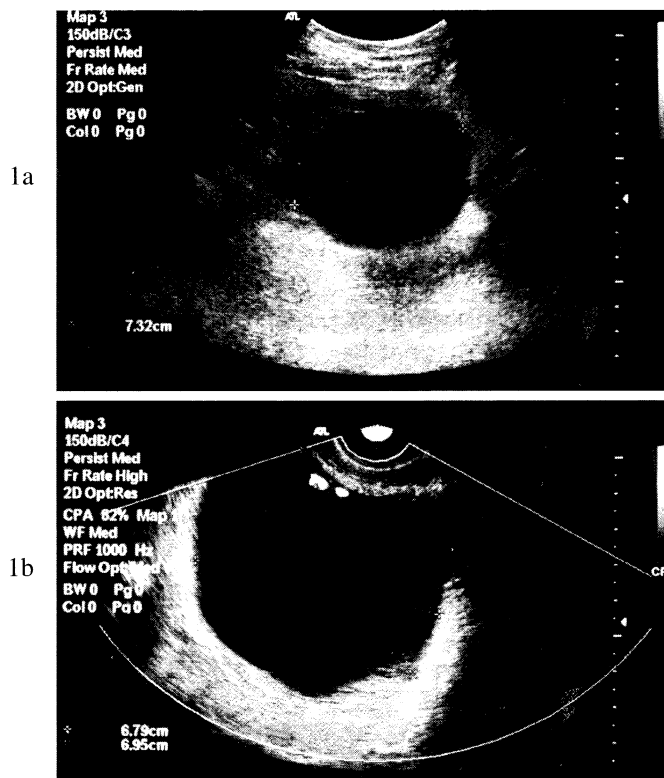


Figure 1. — Cystic appearance of the abscess. **1a.** Abdominal ultrasonography. **1b.** Transvaginal ultrasonography in the same patient.

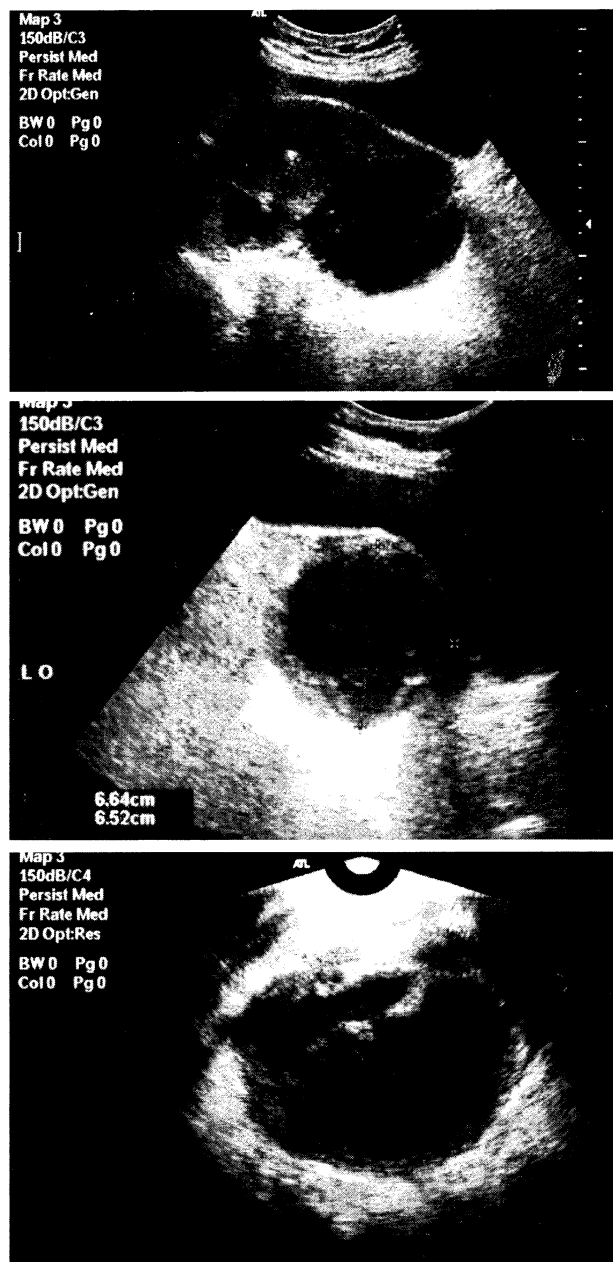


Figure 2. — **2a.** Abdominal ultrasonographic appearance of a tubo-ovarian abscess on the left, with the presence of fluid in the cul-de-sac. **2b.** The tubo-ovarian abscess is imaged with irregular internal confines and diaphragms. **2c.** The same case with transvaginal ultrasonography.

Fluid in the cul-de-sac was observed in 12 out of the 25 studied cases (48%). The vascularity of the masses was estimated in 20 patients by color Doppler flow (80%). In 18 patients (90%) abundant blood flow was seen from the borders and the septa of the tubo-ovarian abscesses (Figure 6), while in two patients no blood flow was found (10%).

All patients had fever (above 38°C) on admission and all presented with lower abdominal pain. During pelvic examination all the patients had painful movement of the cervix. Palpable and painful adnexa were found in 17

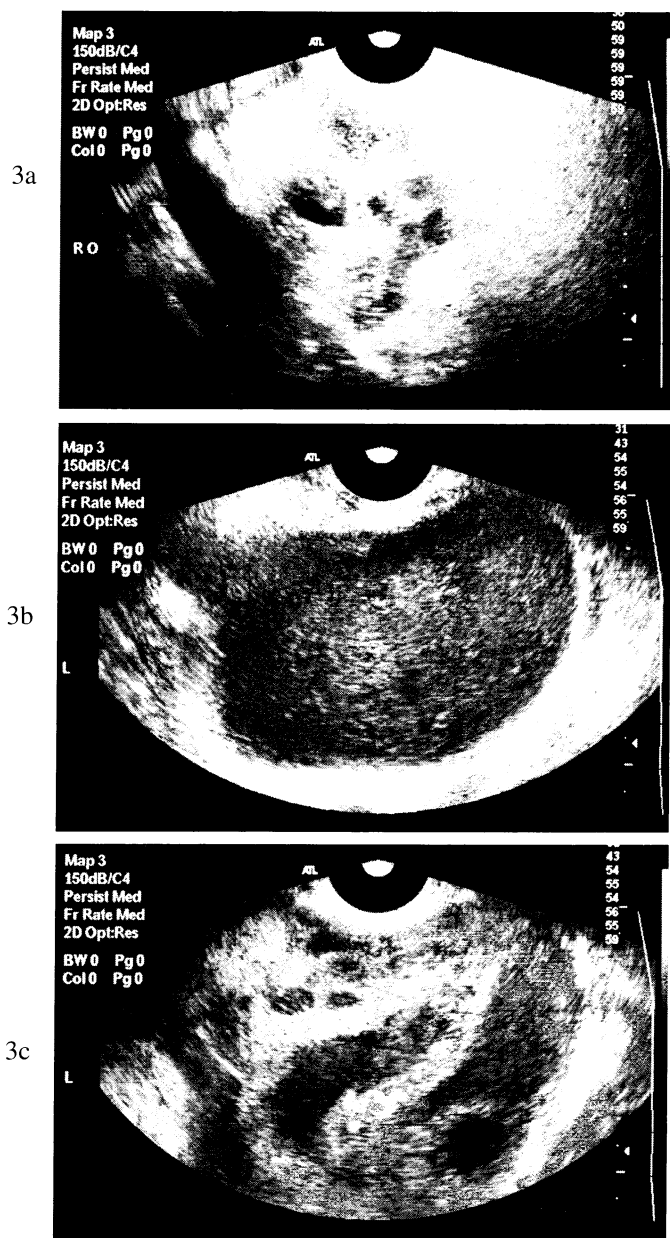


Figure 3. — Extended pelvic inflammation threatening for the life of a patient with a ruptured tubo-ovarian abscess. Image with transvaginal ultrasonography. **3a.** Ambiguous appearance of the right ovary and presence of pyosalpinx. **3b & 3c.** Pyosalpinx on the left. In Figure **3c** inflammatory elements can be seen around the left fallopian tube.

patients, while in four patients a mass was palpable in the cul-de-sac. In four patients the estimation of the adnexa was not possible because of abdominal rigidity. The haematological examination revealed leukocytosis fluctuating from 16,500/mm³ to 23,000/mm³ with increased levels of polymorphonuclear leukocytes in all the patients. Also the erythrocyte sedimentation rate was elevated (above 87 mm/h). Ruptured tubo-ovarian abscesses at the time of operation were found in four patients (16%). One case of ruptured tubo-ovarian

abscess occurred after transvaginal ultrasound-guided oocyte retrieval for IVF treatment and transcervical embryo transfer in a 38-year-old patient who had undergone aspiration of bilateral hydrosalpinges at the time of oocyte retrieval. This case has been previously discussed by Varras *et al.* [7] regarding the complications after IVF treatment.

Discussion

Pelvic inflammatory disease (PID), is a serious disease that can lead to abscess formation or pelvic fluid accumulation [1]. Abdominal pain was the major complaint in more than 90% of cases of tubo-ovarian abscesses reported in the literature [4, 8-11], while elevated temperature has been reported in 60% to 80% of the cases and leukocytosis in 66% to 80% of the cases [4, 8, 10-12]. The clinical significance of this lies in the fact that many patients harboring tubo-ovarian abscesses may present with a normal temperature and white blood counts [4]. In general, the presenting clinical findings for patients with uncomplicated salpingitis (no inflammatory mass) and those with tubo-ovarian abscess are similar; the differentiation requires determination of the presence of an inflammatory adnexal mass [4].

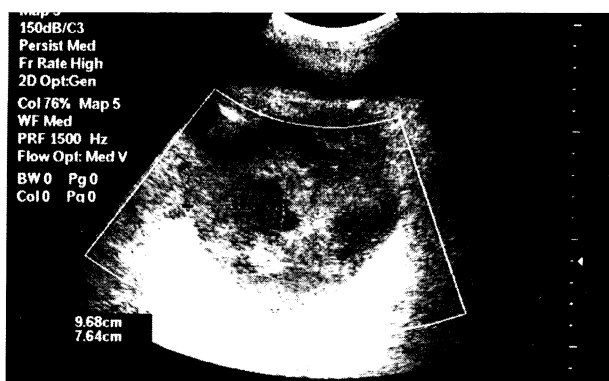


Fig. 4

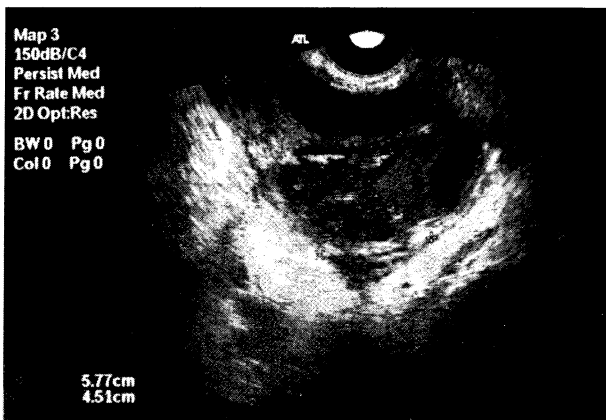


Fig. 5

Figures 4, 5. — Two cases of tubo-ovarian abscesses: Ultrasonographic appearance of masses with cystic and solid elements.

Figure 4. — Abdominal ultrasonography.

Figure 5. — Transvaginal ultrasonography.

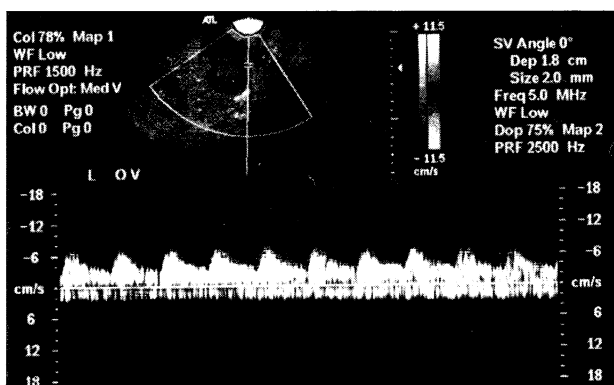


Figure 6. — In the study with color Doppler flow in the transvaginal ultrasonography rich blood flow is observed around the abscess.

Ultrasonography is a noninvasive method and should be used whenever suspicion of a tubo-ovarian abscess arises. A number of studies have examined the accuracy of ultrasound scans in the diagnosis of pelvic abscesses. Taylor *et al.*, reported that 32 out of 33 pelvic abscesses (97%) were correctly identified before the surgery by ultrasonographic examination [13]. Also, Landers and Sweet in 1983 reported the findings of 31 surgically con-

firmed cases of tubo-ovarian abscesses: Twenty-nine cases (94%) were reported as complex adnexal masses or cystic-type masses with multiple internal echoes and the remaining two cases (6%) were simple cystic masses [14]. In addition, Lande *et al.*, examined the relative merits and disadvantages of transvaginal sonography in comparison to conventional transabdominal ultrasound in 12 patients with a final diagnosis of tubo-ovarian abscess and in one patient with pelvic inflammatory disease and pus in the cul-de-sac [15]. Five of 12 patients had non-specific complex adnexal cysts that were difficult to characterize with transabdominal sonography because of an associated bowel ileus. Transvaginal sonography in these patients revealed distinct fluid-filled tube-shaped, structures with a characteristic appearance of pyosalpinx. In one patient, a large right adnexal echogenic collection identified with transvaginal sonography was not identified with transabdominal sonography because of superimposed bowel loops with similar echogenicities. In two patients, echogenic lesions initially considered either a dermoid or a partially calcified pedunculated uterine fibroid were shown with transvaginal sonography to be distended fluid-filled tubes with associated thickening of echogenic peritubal fascia. In two patients, complex masses had a similar appearance with both techniques, while two patients with bilateral complex adnexal masses were identified with transabdominal sonography. Transvaginal sonography was not diagnostic because of adhesions, pelvic distortion and a limited field of view. In one case with a final diagnosis of pelvic inflammatory disease and pus in the cul-de-sac the findings at transabdominal sonography were normal, while transvaginal sonography revealed complex cul-de-sac fluid with echoes and septations [15]. In our study, a pelvic mass was found by ultrasonography in all cases. It was a simple cyst in two cases (8%), cyst with diaphragms in four cases (16%), a thickened tube-shaped structure with multiple internal echoes in four cases (16%) and a mixture of cystic and solid elements in 15 cases (60%). Pyosalpinges with fluid-fluid levels were found in two cases, while fluid in the cul-de-sac was observed in about half of the cases (48%). Also, in one of the four cases with ruptured tubo-ovarian abscesses at operation, the tubo-ovarian abscess occurred after transvaginal ultrasound-guided oocyte retrieval for IVF treatment and transcervical embryo transfer in a 38-year-old patient who had undergone aspiration of bilateral hydrosalpinges at the time of oocyte retrieval [7]. This case indicates reactivation of latent pelvic infection after transvaginal drainage of hydrosalpinges at the time of oocyte retrieval as a route of PID related to transvaginal ultrasound-directed follicle aspiration-transcervical embryo transfer [7]. In this patient, despite her medical history of previous PID, no prophylactic antibiotics were given by her physicians in the IVF unit [7]. Prophylactic antibiotic therapy is strongly advised when using the vaginal route of ovum aspiration and the transcervical embryo transfer especially in patients with a history of salpingitis, endometriosis, pelvic adhesion, hydrosalpinx, or pelvic surgery [7].

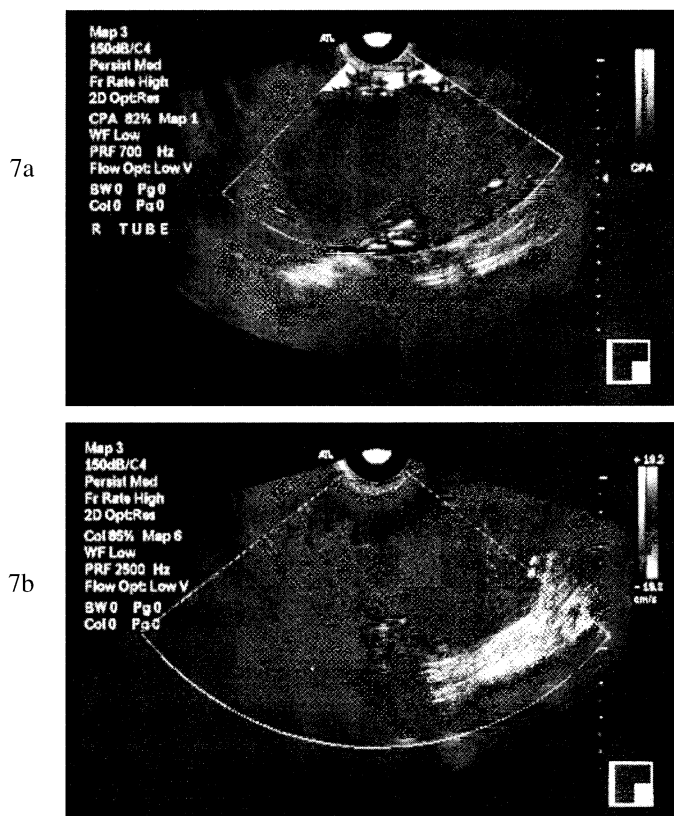


Figure 7. — **7a.** Demonstration of pyosalpinx on the right with fluid-fluid levels. Also, increased vascularity can be seen. **7b.** The right ovary has an ambiguous appearance. The internal pelvic vessels and a small amount of fluid around the ovary are demonstrated.

The application of ultrasonography to the diagnosis of tubal and ovarian abnormalities has been broadened through the use of Doppler sonography, which can further characterize the nature of these lesions. Zalel *et al.*, reported the results of color Doppler ultrasonographic examination in six cases, which surgically proved to be tubo-ovarian abscesses: In the periphery of the tubo-ovarian abscess, an abundant flow with reduced resistance to flow was seen with a mean RI of 0.448 (range, 0.4-0.53) [16]. These results are in accordance with the study of Kupesic *et al.*, in which the mean RI in the tubo-ovarian group (74 cases) was 0.53 [17]. Likewise, Tepper *et al.*, noticed that fallopian arterial resistance seemed to decrease with the severity of the pelvic inflammatory disease [18] and Tinkanen and Kujansuu, found a low resistance blood flow ($RI < 0.5$) at the margin of the infectious complex in patients with the acute phase of the disease [19]. In our study the blood flow in the periphery of the tubo-ovarian abscesses was estimated in 20 out of the 25 studied cases (80%) and was found to be rich in 18 cases (90%). Our results suggest that in cases of tubo-ovarian abscesses the rich blood supply detected by Doppler sonography can further characterize the nature of these masses. However, we should have in mind that, in cases with low RI the possibility of tubal or ovarian malignancy must be taken into consideration. The clinical condition of the patient with tubo-ovarian abscess such as high fever, leukocytosis and elevated erythrocyte sedimentation rate is helpful for the differential diagnosis. However, as we mentioned above, many patients harboring tubo-ovarian abscess may present with a normal temperature and white blood count. Therefore, following up these patients, if they are not operated on, is needed to reduce the possibility of misdiagnosing a malignant lesion [16].

In conclusion, the ultrasonographic findings of tubo-ovarian abscesses are not specific. The presence of a mass at the anatomic position of the ovary or the cul-de-sac in combination with an increased number of white blood cells, elevated erythrocyte sedimentation rate and clinical findings are helpful for a correct diagnosis. In addition, in cases with pelvic masses suggestive of tubal or ovarian lesions, color Doppler flow can further characterize the nature of the masses by detecting a significant rich blood flow in most cases of tubo-ovarian abscesses. However, in cases with low RI the possibility of tubal or ovarian malignancy should be taken into consideration. For patients where the tubo-ovarian abscesses are managed conservatively, follow-up is needed, in order to reduce the possibility of misdiagnosing a malignant lesion.

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