Sonographic Whirlpool Sign in Ovarian Torsion

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Objective. To describe an additional maneuver during sonography for ovarian torsion and to assess its diagnostic value. Methods. During a period of about 2 years 6 months, 21 patients with acute or intermittent lower abdominal pain who had an ovarian mass and an extraovarian mass suggestive of a twisted vascular pedicle on sonography were studied. The gray scale features of the ovarian mass were recorded. The presence of a twisted vascular pedicle was evaluated. Its location and gray scale features were noted. The probe was moved to and fro along the axis of the pedicle, and the presence of a whirlpool sign was evaluated. The same procedure was repeated on a color Doppler study. Results. A twisted pedicle with a whirlpool sign was seen in all 21 patients. Ovarian torsion was confirmed in all 20 patients who underwent surgery. The last patient was pregnant and did well with conservative treatment. Hemorrhagic infarction or early hemorrhage of the ovary or ovarian mass was seen in all 8 patients who did not show flow in the twisted pedicle on the color Doppler study and in 2 patients who showed flow in the artery in the proximal part of the pedicle. Of the 6 patients who showed flow in the artery alone, the ovary was removed in 4, and all had hemorrhagic infarction or early hemorrhage. The ovary was viable in all 5 patients in whom flow was seen in both the artery and vein. Conclusions. A positive whirlpool sign in the twisted vascular pedicle of the ovary is the most definitive sign of ovarian torsion. Absence of blood flow in the twisted pedicle and visualization of the flow in the artery alone are predictive of nonviability of the ovary. Key words: color Doppler study; ovarian torsion; sonography; twisted pedicle; whirlpool sign.

Adnexal torsion is reported to be the fifth most common gynecologic emergency condition encountered, with a prevalence of 2.7%. Prompt diagnosis and surgery may prevent irreversible adnexal damage. However, the diagnosis of adnexal torsion poses a difficult challenge because the clinical symptoms are often misleading. The possibility of ovarian torsion should be considered when an ovarian mass is discovered in the appropriate clinical setting. Variable sonographic and color Doppler findings have been described in ovarian torsion. The purpose of this study was to describe an additional maneuver during sonography and to assess its diagnostic value in ovarian torsion.

Materials and Methods

The patients selected for study were female patients with acute or intermittent lower abdominal pain who had an ovarian mass and an extraovarian mass suggestive of a twisted vascular pedicle on sonography. The clinical
symptoms, history of associated pregnancy, and laboratory findings were obtained from the patients’ records. They were investigated with gray scale and color Doppler sonography. Transabdominal scans were performed with HDI 5000 equipment (Philips Medical Systems, Bothell, WA) using convex 2- to 5- and 4- to 7-MHz probes and linear 5- to 12-MHz probes. The gray scale features of the ovarian mass were recorded. The extraovarian mass representing the twisted vascular pedicle was evaluated. Its location and gray scale features were noted, and an additional maneuver was carried out. The probe was moved to and fro along the axis of this pedicle, and the presence of a “whirlpool” sign was evaluated. The whirlpool sign was visible as a clockwise or counterclockwise wrapping of the hypoechoic vessels around the central axis (Video 1). The same procedure was repeated on a color Doppler study. The visualized ovarian artery and vein were observed to be winding around the central axis (Video 2). If the whirlpool sign was present on gray scale sonography, torsion of the ovary was diagnosed; torsion was excluded if the whirlpool sign was not seen. If the whirlpool sign of visible vessels was seen on the color Doppler study, the adnexal structure was considered potentially viable, and that was indicated in the report. The findings were correlated with the surgical and pathologic findings of the affected ovaries and tumors.

Results

During a period of about 2 years 6 months, there were 21 patients with lower abdominal pain who had an ovarian mass and an extraovarian mass suggestive of a twisted vascular pedicle on sonography. Fourteen of them had acute severe pain, and 7 had intermittent pain. The immediate duration of the pain ranged from 8 to 72 hours. A palpable pelvic mass was reported in 10 patients, and it was found to be tender in 5. Ten patients were unmarried, and 11 were married. The age of the patients ranged from 7 to 69 years. One patient was pregnant at 23 weeks’ gestation. An ovarian mass was seen on sonography in all the patients. It was tender in 5 patients. There was free fluid in the pelvis of 5 patients. Features of cystic teratoma were present in 6 patients, namely, a cystic mass with solid areas containing fat, hair, or calcification. The ovarian mass in others appeared as a unilocular cyst in 3 patients, a multiseptated cyst in 3, solid and cystic in 2, and solid in 2. There was an enlarged ovary with peripheral cysts suggestive of ovarian torsion in 5. In 2 patients with cystic masses, the wall was thick, suggestive of torsion.

Figure 1. A and B, Two types of target appearances of the twisted vascular pedicle (arrows). BL indicates urinary bladder; and CYST, ovarian cyst.
A round mass, suggestive of a twisted pedicle, was seen in all 21 patients. It was located between the ovarian mass and the side wall of the pelvis in 15, between the ovarian mass and the fundus of the uterus in 4, and between the ovarian mass and the urinary bladder in 2. In 13 patients, the appearance of the twisted pedicle was as a hypoechoic mass with a target appearance, either with or without a central echogenic dot (Figure 1). It appeared echogenic in 3 patients, with a string of hypoechoic beads surrounding it, suggestive of dilated veins (Figure 2). It had the appearance of a snail shell (Figure 3A) in 2 patients. In 2 patients, it appeared as a large hypoechoic mass (Figure 4), and in another patient, it appeared as an echogenic mass (Figure 5A and Table 1). In all of them, the whirlpool sign (Video 1) was seen when the transducer was moved to and fro along the central axis of the twisted pedicle. In the whirlpool sign, the hypoechoic band in the twisted pedicle, representing the vessels, was seen wrapping around the central axis. On the color Doppler study, the visualized ovarian artery and vein were seen winding around the central axis in 5 patients (Figure 3B and Video 2). The artery alone was seen in 6 patients. No flow was seen in the vessels (Figure 5B) of the pedicle in 8 patients. In 2 patients, the artery alone was seen in the proximal part of the pedicle, and it too was absent in the distal part (Figure 6 and Table 2).

Figure 2. Twisted vascular pedicle showing the circular string-of-beads appearance of dilated veins (arrows). BL-indicates urinary bladder; and CYST, ovarian cyst.

Figure 3. A, Snail shell appearance of the twisted pedicle (arrows). BL indicates urinary bladder; and CYST, ovarian cyst. B, Color Doppler study of the twisted artery and vein.
Twenty patients underwent surgery 4 to 36 hours after the scans. An ovarian mass with torsion of its pedicle was found in all of them. The ovary had features of gangrene or impending gangrene in all 8 patients in whom flow was not seen in the vessels of the pedicle and in 1 of the 2 patients in whom there was flow only in the proximal part of the pedicle. In the second patient, the pedicle was gangrenous, and the cystic teratoma had ruptured, with leakage of fluid into the peritoneal cavity. In all these patients, the ovarian mass or the ovary was excised. Among the 6 patients in whom the artery alone was seen, 4 had impending gangrene, and the ovary was removed. In the fifth, the ovary was enlarged and appeared viable. Because the appearance of the ovary improved after untwisting, it was not removed. The last patient of this group was pregnant and was treated conservatively. Because she showed improvement, she did not undergo surgery. In 4 of 5 patients in whom blood flow was observed in the artery and vein in the pedicle, a tumor was also present replacing the ovary, and they were removed. In 1 patient, there was normal ovarian tissue along with a cystic teratoma. The ovary was swollen but appeared viable. On untwisting, the ovary improved; hence, only the tumor was removed. Pathologic diagnosis of the ovarian masses in the 19 patients in whom the ovarian mass was removed included teratoma in 6, serous cystadenoma in 4, mucinous cystadenoma in 2, a luteal cyst in 3, fibroma in 1, and hemorrhagic necrosis of the ovary in 2. In 1 patient, the pathologic diagnosis was not possible because of the advanced gangrene (Table 3). There was hemorrhagic infarction in all 8 patients in whom there was no flow within the twisted vascular pedicle, in the 2 patients in whom blood flow was seen only in the proximal part of the pedicle, and in 1 of the 4 patients in whom only the artery but not the vein was visualized. In the remaining 3 patients of the last group, there was early hemorrhage.

Figure 4. Twisted pedicle appearing as a large hypoechoic mass (arrows). The rings are not obvious.

Figure 5. A, Twisted pedicle appearing as a large echogenic mass (arrows). B, Color Doppler study of the pedicle showing absent flow.
Discussion

Ovarian torsion is caused by rotation of the ovary or adnexa with the vascular pedicle on its axis, resulting in arterial, venous, or lymphatic obstruction. It is an acute condition that requires prompt surgical intervention to save the ovary. The sonographic appearances of ovarian torsion vary according to the duration and degree of torsion (complete or incomplete) and the presence or absence of an ovarian mass.2,3 Twisted adnexal masses are often midline, positioned cranial to the uterine fundus. Helpful sonographic findings that have been described include the appearance of a cystic, solid, or complex mass, with or without pelvic fluid, thickening of the wall, and cystic hemorrhage. Detection rates of only 46% to 74% have been reported because these findings are nonspecific for ovarian torsion. It is difficult to distinguish these findings from those of other diseases, such as hemorrhagic cysts, endometriosis, ovarian masses, pelvic inflammatory disease, and ectopic pregnancy.1,4,5 Previous reports suggested that the presence of a unilateral enlarged ovary with multiple peripherally located follicles might be a specific finding for ovarian torsion, with a detection rate of 64%, but this feature was not always observed.5–7 In this series, 1 of these gray scale features of torsion was seen in only 7 patients. There have been few reports of an enlarged ovary with absent or markedly diminished ovarian blood flow on transvaginal and color Doppler sonography as a specific finding for the early diagnosis of ovarian torsion.8,9 Other studies showed the presence of normal arterial flow in 3 confirmed cases of ovarian torsion, which suggested venous thrombosis without arterial occlusion and a dual blood supply to the ovary as possible explanations for the occurrence.2,10 These different results indicated that, in partial or early torsion, both arterial and venous flow could be maintained with viable ovarian tissue.

A study by Lee et al11 shifted the focus to the observation of the pedicle instead of the ovary or the mass. They described a twisted vascular pedicle in 88% of ovarian torsion cases, which is greater than the previously described sonographic findings of the twisted ovary or the ovarian mass. The twisted vascular pedicle corresponds to the broad ligament, fallopian tube, and adnexal and ovarian branches of the uterine artery and vein.11 Lee et al11 reported that a false-positive diagnosis could be made in cases of ovarian tumor-associated salpingitis, endometriosis, or hemorrhagic cyst–associated edema because these conditions could have findings similar to those of a twisted vascular pedicle.

Table 1. Gray Scale Appearance of Twisted Pedicles

<table>
<thead>
<tr>
<th>Appearance of the Pedicle</th>
<th>No. of Patients</th>
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<tbody>
<tr>
<td>Target appearance</td>
<td>13</td>
</tr>
<tr>
<td>Dilated veins</td>
<td>3</td>
</tr>
<tr>
<td>Snail shell appearance</td>
<td>2</td>
</tr>
<tr>
<td>Large hypoechoic mass</td>
<td>2</td>
</tr>
<tr>
<td>Large echogenic mass</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
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Figure 6. Color Doppler study of the pedicle showing the twisted artery alone in the proximal part (A) and no flow in distal part (B). BL indicates urinary bladder, and C, ovarian cyst.
Here, we have described an additional maneuver, wherein during sonography the probe is moved to and fro along the central axis of the twisted pedicle. On gray scale sonography, the whirlpool sign is seen as a hypoechoic band representing the vessels wrapping around the central axis. This is similar to the whirlpool sign described with caudal movement of the probe in malrotation of the midgut with volvulus.12,13 The diagnosis of ovarian torsion is made only when this whirlpool sign is seen. The diagnosis was surgically confirmed in all 20 patients who underwent surgery. This sign is important because the cross section of the twisted pedicle has 4 different appearances, some of them mimicking other conditions. Blood flow in the twisted vessels is not seen in all patients. The cross section of a twisted pedicle can have an appearance of a target, a snail shell, and large echogenic or hypoechoic masses without any obvious layers produced by twisted vessels. However, the whirlpool sign was seen in all of them. It is the most definitive prospective feature in aiding the diagnosis of torsion of the ovary, even though the number of patients is small.

In ovarian torsion, if the viability of the ovary can be predicted preoperatively, an attempt can be made to untwist the pedicle and retain the ovary to conserve ovarian function and fertility. Recent reports have suggested that documentation of intraovarian venous flow is important in establishing the viability of the affected ovary.3 Lee et al11 performed a color Doppler study on the twisted vascular pedicle instead of the ovarian parenchyma to assess the viability of the ovary in torsion. All the patients who failed to show blood flow within the twisted vascular pedicle showed hemorrhagic infarction and necrosis of the adnexal structures. Lee et al11 also reported 94% predictability of the viability of the ovary when arterial and venous flow was seen in the twisted pedicle. In our series, a color Doppler study of the twisted pedicle was performed. Hemorrhagic infarction of the ovary or a mass was present in all the patients in whom no blood flow was seen in the pedicle. In those in whom blood flow was seen in the artery alone and in whom the ovary was removed, either hemorrhagic infarction or early hemorrhage was observed. The ovary or the mass was viable in all the patients who showed flow in both the artery and the vein. The movement of the probe during the color Doppler study also highlighted the whirlpool sign of wrapping of the visualized vessels around the central axis.

In conclusion, the positive whirlpool sign in the twisted vascular pedicle is the most definitive sign of ovarian torsion. Absence of blood flow in the twisted pedicle and visualization of flow in the artery alone are predictive of nonviability of the ovary.

References


