ULTRASONOGRAPHIC EVALUATION OF PELVIC INFLAMMATORY DISEASE

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**Synopsis** The relative frequencies of various sonographic patterns and features of pelvic inflammatory disease (PID) were examined in retrospective analyses of sonograms in 36 proven cases. The original sonographic reports correctly predicted PID in 34/36 patients (sensitivity = 94.4%). Two cases were found to be tubo-ovarian abscess although at first they were reported to be ovarian neoplasia. The most frequent finding was dilatation of the fallopian tube (72.2%). String sign within the dilated tube that would reflect increased interface within the endosalpinx was found in 50.0%, fluid collection in the Douglas' pouch in 47.2%, which was confirmed by the culdocentesis and aspiration in 16 cases, and/or tumor formation at the adnexal region in 38.9%. These findings were characteristic but not specific in PID. Careful sonographic scrutinization should improve the diagnostic accuracy of PID in patients with low abdominal pain, high temperature and low back pain.

**Key words:** Ultrasound • Pelvic inflammatory disease

**Introduction**

Pelvic inflammatory disease (PID) has been diagnosed by physical findings, bimanual examination, culdocentesis, laparoscope and laparotomy. With improvement in the resolution of ultrasonographic equipment, the usefulness of ultrasonography in diagnosing of PID has become apparent. We retrospectively evaluated sonograms of a large series of patients with PID, noted the relative frequencies of the various sonographic patterns and discussed the utility of ultrasound in routine gynecologic examinations.

**Subjects and Methods**

Ultrasonograms of 36 patients, diagnosed as cases of PID, were retrospectively evaluated. Three of the 36 cases were secondary to non-gynecologic disease; namely, 2 were complications of appendicitis and 1 was status after surgery for a cholelithiasis. PID was diagnosed by serial ultrasound examinations showing improvement with antibiotic therapy (47.2%), culdocentesis (44.4%) and laparotomy (8.3%). The medical history and clinical setting were those of PID, in all cases. All but the 13 years old girl were sexually active ages of these 36 women ranged from 13 to 43 years, the mean being 28.5 years. The chief complaints were low abdominal pain (83.3%), elevated temperature (22.2%), low back pain (8.3%) and atypical genital bleeding (5.6%). Intrauterine devices were being used by 2 patients. Ultrasonic studies were done according to the following ultrasonographic findings: Dilatation of the fallopian tube, fluid collection in the Douglas' pouch, and tumor formation at the adnexal region. The equipment used in this study was Aloka SSD-256 (3.5MHz).

**Results**

The original sonographic examinations correctly predicted PID for 34/36 patients (sensitivity = 94.4%). Two false negative cases had been diagnosed as an ovarian neoplasm. Dilatation of the fallopian tube with string sign was frequently observed (Fig. 1a) and sometimes a club-like shape was recognized (Fig. 1b). Fluid collected in the Douglas' pouch as shown in Fig. 2. Tumor formation at the adnexal region presented various sonographic patterns that were cystic with septum (Fig. 3a), polycystic (Fig. 3b), cystic with internal echo, as debris (Fig. 3c) and solid (Fig. 3d). Table 1 is a summary of ultrasonographic findings. Dilatation of the fallopian tube was evident in 26 patients (72.2%), 18 (50.0%) showed string sign within the dilated tube, a finding which reflected an increased
interface within the endosalpinx. Fluid collection in the Douglas' pouch was observed in 17 (47.2%) and culdocentesis was performed. Pus or inflammatory exudate was removed from 16 patients. One resulted in a dry tap. Tumor formation at the adnexal region was present in 14 (38.9%). All had at least one and more of these

<table>
<thead>
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<th>Ultrasonographic findings</th>
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<td>Dilatation of the fallopian tube</td>
<td>26(72.2%)</td>
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<tr>
<td>String sign</td>
<td>18(50.0%)</td>
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<tr>
<td>Fluid collection in Douglas' pouch</td>
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</tr>
<tr>
<td>Tumor formation at the adnexal region</td>
<td>14(38.9%)</td>
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Fig. 1a. Dilatation of fallopian tube (arrow heads) with string sign (arrows). (U: Uterus, BL: Bladder)

Fig. 2. Fluid collection in Douglas' pouch (arrows). (U: Uterus, BL: Bladder)

Fig. 1b. Club-like shaped dilatation of fallopian tube (arrows). (U: Uterus)

Fig. 3a. Cystic tumor formation with septum (arrows). (BL: Bladder)
abnormalities.

Discussion

Sample\(^a\) reported that there might be loss of definition between the uterus, adnexa and pelvic side walls in ultrasonograms of PID patients. Bowie\(^b\) termed this finding "indefinite uterus". Swayne et al.\(^1\) described that this finding accounted for only 6.2% of those with PID and the sonographic abnormalities were chiefly related to the uterus and depicted an early endometritis. Moreover, this finding is often recognized in cases of non-inflammatory disease, such as endometriosis, myoma uteri and ovarian tumor\(^g\).

In our retrospective study, dilatation of the fallopian tube was most frequently observed (72.2%). Obstruction of the fallopian tube during the acute phase leads to a pyosalpinx. Sonographically, a pyosalpinx is tubular or fusiform with a low-level echo\(^d\). Moreover, we observed the string sign within the dilated fallopian tubes (50.0%). This sign seems to reflect the increased interface within the endosalpinx secondary to the purulent exudate. Berland et al.\(^2\) stated that fluid collection in the intrapelvic cavity was indicative of a peritonitis. We performed culdocentesis in all patients with fluid collection in the Douglas’ pouch, as seen on the ultrasonogram. Pus or inflammatory exudate was removed from 16 patients and the clinical features remarkably improved. Therefore, culdocentesis is considered to be an effective treatment for PID. Mass formation at the adnexal region was also recognized (41.7%), but the internal architecture varied. Cystic tumor with solid part\(^h\), cystic tumor with an internal echo, as a debris\(^i\), a small
round tumor with an irregular surface and multilocular cyst with irregular surface have been reported. These sonographic patterns derive from the inflammatory exudate and adhesions, and many different pathologic entities of the PID spectrum produce these patterns, ranging from acute salpingitis to most forms of chronic disease.

Although dilatation of the fallopian tube, fluid collection in the Douglas' pouch and tumor formation at the adnexal region are characteristic ultrasonographic findings of PID, these observations are not specific. It is sometimes difficult to distinguish these findings from hematoma, ectopic pregnancy and ovarian neoplasm. We attempted to calculate sensitivity on the basis of 36 proven cases, and obtained the value of 94.4%. In 2 false negative cases, we sonographically diagnosed tubo-ovarian abscess as an ovarian neoplasm. Therefore, in addition to the conventional diagnostic tools, careful attention to the sonographic criteria discussed above should assist and improve the diagnostic accuracy of PID.

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References