Transvaginal sonographic appearance of functional ovarian cysts

Mª Angela Pascual¹, Lourdes Hereter¹, Francisco Tresserra², Olga Carreras¹, Alicia Ubeda¹ and Santiago Dexeus¹

¹Department of Obstetrics and Gynaecology and ²Department of Pathology, Institut Universitari Dexeus, Paseo de la Bonanova 67–69, Barcelona 08017, Spain

To whom correspondence should be addressed

Knowledge of the nature of ovarian lesions is important in order to establish the correct treatment and, especially, to detect ovarian cysts that do not require surgical treatment. With the purpose of demonstrating the utility of transvaginal sonography with colour Doppler of ovarian functional cysts, 378 ovarian tumours were studied, comparing sonographic diagnosis with pathological findings. Sensitivity and specificity of colour Doppler transvaginal sonography to detect functional ovarian cysts were 84.6 and 99.2% respectively. Positive and negative predictive values were 98 and 93.5% respectively. In our experience, transvaginal sonography with colour Doppler is a useful technique in the diagnosis of ovarian pathology.

Key words: colour Doppler/functional ovarian cyst/transvaginal sonography

Introduction

Ovarian tumours comprise a great variety of histological types including functional ovarian cysts which do not require surgical treatment (Hall, 1983). The use of ultrasound, especially since the advent of vaginal transducers, allows the prediction of the histological type of an ovarian tumour with high degrees of both sensitivity and specificity (Coulam et al., 1982; Liukkonen et al., 1984; Reynolds et al. 1986; Baltarovich et al., 1987; Timor-Tritsch et al., 1988; Athey et al., 1989; Broussin, 1991; Sassone et al., 1991; Pascual et al., 1993a; Okai et al., 1994; Chapron et al., 1996). The aim of this study was to confirm the diagnostic value of transvaginal ultrasound in the diagnosis of functional ovarian cysts.

Materials and methods

A total of 10 173 gynaecological ultrasounds undertaken at the Gynaecological Ultrasound Unit between May 1993 and January 1995 has been reviewed. Of these, in 854 a diagnosis of some type of ovarian tumour was made. The study group included 117 patients with a diagnosis of functional ovarian cysts (13.7%). The control group included 237 patients diagnosed with benign tumour pathology and 24 patients with malignant cysts. The remaining patients had no follow-up or were treated in another centre. The diagnosis was confirmed by histopathology or by means of ultrasound (regression of the cyst after menstruation).

All patients included had spontaneous menstrual cycles and none of them was subjected to induction or prevention of ovulation.

The parameters considered were: age, size of the cyst, ultrasound pattern and vascularization; resistance index (RI) and the pulsatility index (PI) were also considered. The study included characterization of septa, papillae, diffuse internal echoes and estimation of a solid and/or heterogeneous pattern.

All the ultrasound explorations were undertaken with real-time sonography using a vaginal probe of 6 mHz, with a sweeping angle of 150° and colour Doppler (Toshiba SSA 270 A). On a few occasions ultrasound was undertaken through the suprapubic region with the help of a filled bladder and using a 3.5 mHz transducer.

The information was recorded on a database (DBASE IV) and analysed with the SPSS/PC+ version 4.0 statistical package. The diagnostic efficiency of vaginal ultrasound for the diagnosis of functional ovarian cysts was evaluated through the parameters of sensitivity, specificity, the positive predictive value and the negative predictive value with a confidence interval of 95% (Fletcher, 1989).

The results were expressed as percentages or mean values. To test differences in mean values, Student’s t-test, and the χ² test for categorical variables were used. Fisher’s Exact test was used when the expected frequencies were less than five in >20% of the total. The level of significance was set at 5%.

Results

A good level of diagnostic agreement was observed between the three operators (M.A.P., O.C. and L.H.) in the ultrasound section (Kappa index = 72.9%).

The mean age of the patients was 38.6 years (±10.16), and 11 of them were menopausal. No significant differences were seen for this parameter in patients with non-functional benign ovarian pathology (35.9 ± 11.1 years), whereas those patients with malignant ovarian cysts were significantly older (47.45 ± 12.31; *P* < 0.001).

The mean size of the functional ovarian cysts was 41.8 mm (±17.35). Significant differences were found between this group and the other two groups: for non-functional benign ovarian pathology a mean size of 62.7 mm (±69.5; *P* < 0.001) was observed; and for the group of malignant cysts the mean size was 86.9 mm (±48.6; *P* < 0.001).

Ultrasound features

The presence of diffuse internal echoes was less frequent in functional ovarian cysts in comparison with the groups with non-functional benign ovarian pathology or malignant cysts (38, 72.2, 54.2% respectively). This difference was statistically significant (*P* < 0.001).

© European Society for Human Reproduction and Embryology
The presence of intracystic septal structures was less frequent in the functional ovarian cysts (43.6%) than in those with non-functional benign ovarian pathology (58.2%) and those with malignant cysts (62.5%). Furthermore, the width of the septal structures was narrower (<3 mm) for the functional ovarian cysts than for the other groups (>3 mm; \( P < 0.05 \)).

A heterogeneous pattern was more frequent among the malignant cysts (79.2%) than among the non-functional benign ovarian cysts (42.2%), and less common among the functional ovarian cysts (7.7%). The difference in heterogeneity between the diagnostic groups was statistically significant (\( P < 0.001 \)).

The presence of papillae was frequent in the malignant cysts (58.3%), unusual in the benign cysts (8.4%) and practically absent in functional ovarian cysts (0.9%) (\( P < 0.001 \)). This same distribution was seen for the presence of a solid pattern (malignant cysts = 58.3%; benign cysts = 13.5%; functional ovarian cysts = 0.9%; \( P < 0.001 \)).

The characteristic anechogenic pattern was associated with functional ovarian cysts in approximately half of these cases, whilst this was less frequent in cases with either non-functional ovarian benign cysts (15.4%) or malignant cysts (4.2%) (\( P < 0.001 \)) (Table I).

### Colour Doppler ultrasonography

Vascular flow was obtained in 85 cases out of the 117 patients with functional ovarian cysts, 23 out of the 24 cases with malignant cysts and for 146 out of the 237 cases with benign organic cysts. The values of the RI and PI are given in Table II.

A significant difference in the RI value between functional ovarian cysts and malignant cysts (\( P < 0.05 \)) was observed, as was a difference in PI between these diseases (\( P < 0.05 \)). Furthermore, differences in these values (RI and PI) were detected between functional ovarian cysts and the benign organic cysts (\( P < 0.001 \)) (Figure 1).

Out of 117 functional ovarian cysts, 99 were detected by ultrasound and 18 were not identified as such. Two cases were diagnosed ultrasonographically as functional ovarian cysts and histologically were proved to be benign non-functional ovarian cysts. The majority of the 99 functional ovarian cysts ultrasonographically detected, regressed during the first month after the

---

**Figure 1.** Vascularization of a functional ovarian cyst with low pulsatility index (PI) and resistance index (RI) values.

**Table I.** Ultrasonographic features in each study group

<table>
<thead>
<tr>
<th></th>
<th>Age (years)</th>
<th>Tumour size</th>
<th>Ultrasonographic characteristics (%)</th>
<th>Anechogenic pattern</th>
<th>Diffuse internal echoes</th>
<th>Septa</th>
<th>Heterogenic pattern</th>
<th>Papillae</th>
<th>Solid pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional cysts</td>
<td>38.6 (±10.6)</td>
<td>41.8 (±17.3)</td>
<td>48.7</td>
<td>38.0</td>
<td>43.6</td>
<td>7.7</td>
<td>0.9</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Benign non-functional cysts</td>
<td>35.9 (±11.1)</td>
<td>62.7 (±69.5)**</td>
<td>15.6**</td>
<td>72.2**</td>
<td>58.2*</td>
<td>42.2**</td>
<td>8.4**</td>
<td>13.5**</td>
<td></td>
</tr>
<tr>
<td>Malignant cysts</td>
<td>47.4 (±12.3)**</td>
<td>86.9 (±48.6)**</td>
<td>4.2**</td>
<td>54.2**</td>
<td>62.5*</td>
<td>79.2**</td>
<td>58.4**</td>
<td>58.3**</td>
<td></td>
</tr>
</tbody>
</table>

Statistical significance when functional cysts are compared with benign non-functional and malignant cysts, \( *P < 0.05 \), \( **P < 0.001 \).
diagnosis (following menstruation), and all patients were ultrasonographically normal in the third month (Figure 2).

Colour Doppler transvaginal ultrasonography sensitivity was found to be 83.0% (74.2–89.4). The capacity of ultrasound to rule out the presence of an ovarian functional ovarian cyst (specificity) was achieved in 99.2% of cases (97.0–99.9).

The positive predictive value of the colour Doppler transvaginal ultrasound for functional ovarian cysts was seen to be 97.8% (91.4–99.6) and the negative predictive value was seen to be 93.5% (89.7–96.0).

Discussion

Functional ovarian cysts are the most common type of ovarian lesions among women in their fertile phase of life (Hall, 1983; Grimes and Hughes, 1989), and most do not require medical treatment. The presentation of luteinized unruptured follicles (LUF) was seen to vary between 6 and 47% (Marik and Hulka, 1978; de Crespigny et al., 1981; Vanrell et al., 1982) appearing as a cyst showing thin septa. It has been described that LUF can cause unexplained sterility and may also be associated with endometriosis (Brosens et al., 1978; Koninckx et al., 1978; Dmowski et al., 1980; Portuondo et al., 1981). The rate of hospitalization due to functional ovarian cysts is high. One study, undertaken in the USA, estimated this as 500 admissions per 100 000 women (Grimes and Hughes, 1989).

Out of all the women we studied, the percentage of functional ovarian cysts showing the pattern of cystic disease of the ovary was 13.7%. However, it must be remembered that the majority vanish spontaneously with menstruation and hence may escape medical attention.

In a prospective study undertaken over 10 years (Vessey et al. 1987), it was observed that, in the absence of oral contraceptives, functional ovarian cysts made up 66% of all diagnosed ovarian cysts, and three-quarters of these were fortuitously diagnosed as a result of other medical procedures.

From our results, it can be deduced that only a third of the functional ovarian cysts have diffuse internal echoes, two out of five show thin septal structures, <10% show a heterogeneous pattern, and proliferative or solid areas are indeed very rare.

When this type of cyst is associated with diffuse internal echoes (38%), it should be distinguished from an endometriotic cyst (Pascual et al., 1993a). Likewise, if its pattern is heterogeneous (7.7%) it raises the possibility of a haemorrhagic cyst, which can in turn be a functional ovarian cyst. These results are in concordance with those published by other authors (Hamilton et al., 1986; Baltarovich et al., 1987; Vessey et al., 1987; Chapron et al., 1996).

### Table II. Doppler colour features in each study group

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Flow present (%)</th>
<th>RI</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional cysts</td>
<td>117</td>
<td>85 (72.6)</td>
<td>0.57 (±0.10)</td>
<td>0.93 (±0.33)</td>
</tr>
<tr>
<td>Benign non-functional cysts</td>
<td>237</td>
<td>146 (61.6)</td>
<td>0.65 (±0.18)**</td>
<td>1.16 (±0.48)**</td>
</tr>
<tr>
<td>Malignant cysts</td>
<td>24</td>
<td>23 (95.8)</td>
<td>0.48 (±0.14)*</td>
<td>0.77 (±0.37)*</td>
</tr>
<tr>
<td>Total</td>
<td>378</td>
<td>254 (67.2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RI = resistance index.
PI = pulsatility index.

Statistical significance when functional cysts are compared with benign non-functional and malignant cysts.

*P < 0.05, **P < 0.001.
A large proportion of these cysts are vascularized (72.6%) and show low RI and PI. Hence it is of importance, and in fact absolutely necessary, to undertake the ultrasound with colour Doppler in the first phase of the cycle in order to rule out the presence of a functional type cyst. This feature is not found in polycystic ovaries in which blood flow is greater and without variations during the cycle (Zaidi et al., 1995).

The diagnostic capacity of ultrasound in the diagnosis of a functional ovarian cyst is clear, and, when the ultrasound features are depicted, in 97.8% of the cases the final diagnosis will be a functional ovarian cyst.

The results obtained allow us to determine that there are two main groups of functional ovarian cysts: the simple ultrasound cyst that corresponds to follicular persistence; and the LUF that presents with thin septal structures (43.6%), in general highly vascularized in which the spontaneous regression confirms their functional nature.

Knowledge of the ultrasound characteristics of functional ovarian cysts and their course is of great importance to the gynaecologist, so that unnecessary surgery can be avoided and that some light can be shed for patients with unexplained infertility.

Acknowledgement
The authors are grateful to J.C. Suris, M.D., for the statistical management of the data. This study was sponsored by FISS funds from Spanish Department of Public Health number 93/1052.

References


Received on December 12, 1996; accepted on March 18, 1997

Functional ovarian cyst sonography