Ultrasonographic observations following unilateral and bilateral laparoscopic ovarian diathermy in infertile women with clomiphene citrate resistant polycystic ovarian syndrome (PCOS)

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ABSTRACT

Objective: To evaluate the changes in ovarian volume and the reproductive outcome after unilateral (UOD) and bilateral (BOD) laparoscopic ovarian diathermy in infertile women with Clomiphene Citrate resistant PCOS.

Material and Methods: The ovarian volume in both groups was measured by transvaginal ultrasonography preoperatively and up to 10 days after laparoscopic ovarian diathermy and examined in relation to the subsequent clinical course.

Results: Of the ten patients who underwent UOD, seven clinical pregnancies were achieved in five women. Of the ten patients who underwent BOD, seven clinical pregnancies were achieved in six women. BOD was seen to be followed by a statistically significant decrease in mean ovarian volume ten days post-operatively; whilst there were no changes in mean ovarian volume following UOD, resulting there was a decrease in ovarian volume in two women whose right ovary (ipsilateral) was diathermied and three women in the contralateral ovary.

Conclusion: Although such changes were not consistently seen following UOD, the clinical outcome was similar in both groups.

Key words: unilateral vs. bilateral laparoscopic ovarian diathermy; polycystic ovarian syndrome; ultrasound
follow up at medium-term and long-term intervals confirmed that ovarian volume decreased significantly from 11.0 cc before laparoscopic ovarian diathermy (LOD) to 8.5 cc at medium-term and remained low 8.4 cc at long-term follow up (8). The purpose of the current study was to determine the effect of laparoscopic unilateral and bilateral ovarian diathermy on ovarian volume and subsequently reproductive outcome.

**MATERIAL AND METHODS**

All the patients were recruited from the Gynecology Department or the Centre for Reproductive Medicine at St Bartholomew's and the Royal London Hospitals over a three-year period. Women with anovulatory infertility due to Clomiphene Citrate resistant PCOS were recruited to be randomly allocated according to cards numbered, one to twenty, in sealed envelopes to either unilateral (right ovary, only) (even number, n=10) or bilateral (odd number, n=10) laparoscopic ovarian diathermy after informed written consent in this study which had been approved by the East London, City & Hackney Authority (ELCHA) Research Ethics Committee. Clomiphene Citrate resistance was defined as failure to ovulate after Clomiphene Citrate administration up to a daily dose of 150 mg from cycle days 2-6 for at least three consecutive cycles. Criteria for inclusion were: 1) age between 20 and 38 years; 2) body mass index<28 Kg/m$^2$; 3) history of infertility; 4) diagnosis of PCOS using the National Institutes of Health (NIH) criteria based on (a) amenorrhea or oligomenorrhea with chronic anovulation, (b) clinical and/or biochemical evidence of hyperandrogenism (9,10), (c) ultrasonographic appearance of PCOS was defined as an increase in ovarian volume, more than ten follicles of 3-8 mm in diameter and an increase in stromal density (1). All women were normo-prolactinemic, normo-tensive, and had no evidence of any other medical disorder. Thyroid function, blood glucose and 17α-hydroxyprogesterone levels were normal between (1-10 nmol/L). All women had at least one patent Fallopian tube. After randomization, ten patients underwent unilateral laparoscopic ovarian diathermy always on the right ovary and ten had bilateral ovarian diathermy using the laparoscopic technique described (11). The procedure was always conducted by either the two authors or a senior registrar in the presence of one of the authors to ensure that the same technique was used in each patient. Laparoscopy was performed under general anesthesia with endotracheal intubation. The laparoscope was introduced subumbilically and trocars and cannulae were introduced into the iliac fossae for forceps to hold the ovarian ligament and the diathermy probe. After careful inspection of the pelvic organs, tubal patency was confirmed by transcervical injection of methylene blue dye. The ovary was lifted to the anterior wall of the uterus to minimize the likelihood of damage to neighboring viscera during unipolar diathermy (G U Turner Warwick, London, UK). The machine was set on 40 watts and diathermy applied using a specially designed probe, at four points, for 4-6 seconds at each point. Craters created were ~3-4 mm in diameter and ~8 mm in depth. The electrosurgical unit employed was the Force 2 Valleylab electrosurgical generator (Valleylab Inc, Boulder, Co, USA). The ovary was then cooled with normal saline, to minimize adhesion formation and to prevent heat trauma to adjacent viscera. The saline (300 ml) was left in the peritoneal cavity at the end of the procedure.

All patients underwent a transvaginal ultrasound examination up to 10 days prior to and ten days after surgery performed by the author (vaginal probe, 6.5 MHz transducer, Toshiba, Japan) to assess the ovarian volume and morphology and to monitor the evidence of ovulation at each visit to the clinic. Ovulation confirmed by serum progesterone levels and transvaginal ultrasonography (TVS) observations i.e. follicle collapse and elevated serum progesterone level 7 days later.

All ultrasound follow-up examinations were performed vaginally by the author to examine the uterus, ovaries and adnexal structures and, at the same time, to monitor for evidence of ovulation at each visit to the clinic using the technique described above.

Ovarian volume was calculated using this formula: Volume (ml) = length (cm) X width (cm) X depth (cm) X 0.5233.
Figure 1. Pre and postoperative (mean ±SD) ovarian volume in the right ovary following unilateral ovarian diathermy (n=10 women).

Venous blood was obtained preoperatively, post-operatively and 10 days intervals until menstruation occurred from the majority of patients. This analysis is the subject of other report (12).

The statistical analyses are expressed by mean ± SD, the differences seen being statistically significant if P <0.05, using paired Student's t-test.

RESULTS

Measurement of ovarian volume in the unilateral group (n=10) revealed that the mean pre-operative volume of the right ovary was 13.7±3.5 cc, being unchanged ten days after surgery, 13.6±4.5 cc (p= 0.98, NS). Similar results were obtained with respect to the left ovary, the mean pre-operative volume being 11.9±2.6 cc and mean post-operative volume being 10.5±3.2 cc (p= 0.21, NS).

By contrast, in the bilateral group (n=10), there was a statistically significant reduction in mean ovarian volume in both right and left ovaries. The mean pre-operative volume of the right ovary was 15.7±4.8 cc while, ten days after surgery; it was 10.1±3.2 cc (p= 0.01). Similar results were obtained for the left ovary, the mean pre-operative volume being 14.6±5.2 cc and mean post-operative 9.2±3.7 cc (p=0.01). (Tables 1-2; Figs.1- 4).

All women were followed up at regular monthly intervals for up to 18 months after surgery. The recall follow-up was at 18-48 months after UOD and BOD, the 20 women being recalled for early follicular phase hormonal tests and ultrasound. Spontaneous menstruation had occurred in a similar number of women in each group (unilateral, 50%; bilateral, 40%), there being similar observations between the unilateral and bilateral groups with respect to spontaneous ovulation (20% vs. 10%).

Table 1. Ovarian volume measurements (mean±SD) pre- and post-operatively after unilateral ovarian diathermy (n=10)

<table>
<thead>
<tr>
<th>Ovarian volume (cc)</th>
<th>Pre-operative</th>
<th>Post-operative</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ovary</td>
<td>13.7±3.5</td>
<td>13.6±4.5</td>
<td>NS</td>
</tr>
<tr>
<td>Left ovary</td>
<td>11.9±2.6</td>
<td>10.5±3.2</td>
<td>NS</td>
</tr>
</tbody>
</table>

*P value using paired Student's t-test

Table 2. Ovarian volume measurements (mean±SD) pre- and post-operatively after bilateral ovarian diathermy (n=10)

<table>
<thead>
<tr>
<th>Ovarian volume (cc)</th>
<th>Pre-operative</th>
<th>Post-operative</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ovary</td>
<td>15.7±4.8</td>
<td>10.1±3.2</td>
<td>0.01</td>
</tr>
<tr>
<td>Left ovary</td>
<td>14.6±5.2</td>
<td>9.2±3.7</td>
<td>0.01</td>
</tr>
</tbody>
</table>

*P value using paired Student's t-test
amenorrhea whilst breast feeding (20% vs. 20%), secondary amenorrhea i.e., menstruation had occurred in the past but not for at least six months (30% vs. 50%) and pregnancy (70% vs. 70%) respectively (Table 3). After ovarian diathermy seven pregnancies were achieved in five women after UOD in contrast to seven pregnancies in six women after BOD. These pregnancies were consequent to spontaneous menstruation in nine women in each group, spontaneous ovulation (in two women after UOD vs. one woman after BOD) and Clomiphene Citrate induced ovulation (four women after UOD vs. five women after BOD). Clomiphene Citrate resistance was noted to persist in four women in each group. One of these three women after UOD, responded to HMG and conceived, while the other four Clomiphene Citrate resistant women after BOD declined to have further treatment.

**Table 3.** Reproductive outcome up to 48 months after surgery in women who had undergone unilateral (n=10) and bilateral (n=10) ovarian diathermy

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Unilateral n=10 women</th>
<th>Bilateral n=10 women</th>
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<tbody>
<tr>
<td>Pregnancy</td>
<td>7*</td>
<td>7†</td>
</tr>
<tr>
<td>Live birth</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Miscarriage</td>
<td>2</td>
<td>1</td>
</tr>
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</table>

* Two women conceived twice
† One woman conceived twice

In the five women who conceived following UOD, the ovarian volume of the right ovary decreased in two women and increased in the remaining. In the contralateral ovary the ovarian volume decreased in three women and was unchanged in two. By contrast, in all six women who conceived following BOD, changes in ovarian volume were seen. The ovarian volume in the right ovary decreased in five women and increased in one woman, whilst in the contralateral ovary there was a decrease in ovarian volume in six women.

**DISCUSSION**

One of the effects of laparoscopic ovarian diathermy is reduction of ovarian volume. There are, however, very limited data from one group documenting the quantitative changes in ovarian volume following ovarian diathermy, in association with the reproductive outcome. They reported a transient increase in volume after laparoscopic ovarian diathermy due probably to inflammatory changes, but three weeks later the average volume was significantly smaller (7).

In our study, women who underwent bilateral ovarian diathermy had a statistically significant reduction in mean ovarian volume seen in both ovaries 10 days post-operatively. By contrast, women in the unilateral diathermy group did not show any change in mean ovarian volume in either
It was surprising to note a similar clinical outcome with respect to pregnancy rates in particular, in both groups. We showed that the ovarian volume decreased ten days post-operatively, in contrast to the increase in the ovarian volume seen by others one week post-operatively (7). These differences may due to study design and duration of diathermy, yet in spite of the different techniques used, the clinical outcome was similar on both studies. A recent long-term follow up at medium-term and long-term intervals confirmed that ovarian volume decreased significantly from 11.0 cc before LOD to 8.5 cc at medium-term and remained low 8.4 ml at long-term follow up (8).

More studies are needed to determine whether there is a relationship between the changes in ovarian volume and the endocrine profile after diathermy.

In conclusion we found that bilateral laparoscopic ovarian diathermy was seen to be followed by a decrease in ovarian volume ten days post-operatively in six women. This decrease was seen in two women whose right ovary was diathermied in the UOD group and three women in the contralateral ovary. The clinical outcome was similar in both groups.
REFERENCES


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