Ovarian function before and after salpingectomy in artificial reproductive technology patients

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To determine the effect of the removal of the tube on ovarian function we studied 52 artificial reproduction technology cycles in 26 women before and after undergoing laparoscopic salpingectomy for ectopic pregnancy. Ovarian response was measured by the duration and quantity of human menopausal gonadotrophins used in the cycle, the pre-ovulatory concentrations of oestradiol, the number of oocytes retrieved, and the quality of the embryos. All parameters were compared between cycles carried out before and after salpingectomy as well as between affected and unaffected sides. Our findings show no significant difference in any of the parameters studied. We conclude that laparoscopic salpingectomy does not abate ovarian response in artificial reproduction technology cycles that follow the procedure.

Key words: artificial reproduction technology/ovarian function/salpingectomy

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Introduction

The place of salpingectomy in the management of the pathological tube in a patient who will need assisted reproduction technology is still a dilemma.

It is well established that ectopic pregnancy is far more frequent in patients undergoing artificial reproduction technology for mechanical infertility than in the normal population (Herman et al., 1990; Dubuisson et al., 1991; Zouves et al., 1991). Using multivariate analysis of the risk factors for recurrent ectopic pregnancy, a scoring system has been proposed that allows a selection of information-based treatments to decrease recurrence (Pouly et al., 1991). Even though ectopic pregnancy may still occur following salpingectomy (Chang et al., 1998), for high-risk patients the authors suggested a laparoscopic ipsilateral salpingectomy with contralateral sterilization. In the presence of hydrosalpinx, in which significantly decreased pregnancy rates were reported (Singhal et al., 1991; Camus et al., 1999), some investigators recommended consideration of salpingectomy before the artificial reproduction technology cycle (Mukherjee et al., 1996; Shelton et al., 1996). Furthermore, it was suggested recently that the performance of salpingectomy before in-vitro fertilization (IVF) in all cases of severe infertility, may improve implantation and pregnancy rates (Dechaud et al., 1998; Bredkjaer et al., 1999). However, before embarking on such a radical and irreversible treatment in high-risk patients without hydrosalpinx, the short- and long-term implications of the procedure must be considered. In view of the close anatomical association of the blood supply and nervous system of these organs, potential adverse effects of the physical and functional presence or absence of the tube on ovarian function were postulated (McComb and Delbeke, 1984; Rumeu et al., 1987; Lass et al., 1998). However, current data are still inconclusive and contradictory. This study was undertaken to determine and compare ovarian response in artificial reproduction technology patients before and after salpingectomy for ectopic pregnancy.

Materials and methods

Records between October 1988 and July 1996 were found of 26 women who had artificial reproduction technology cycles before and after undergoing salpingectomy for ectopic pregnancy. All these patients met the following criteria: no previous tubal surgery; age at surgery under 40 years; and a period of 3 years between cycles. The selection of a group of women with proven fertility by previous pregnancy raised the possibility of a bias towards a more favourable sub-group. The design of the study, using women as the control for themselves, removed this problem.

Ovulation induction in all cases was accomplished with menstrual long-acting gonadotrophin-releasing hormone (GnRH) analogue/human menopausal gonadotrophin (HMG)/human chorionic gonadotrophin (HCG) protocol described previously (Herman et al., 1990). IVF was carried out in all but two cycles in which intracytoplasmic sperm injection (ICSI) was utilized.

Ovarian response was measured by the duration and quantity of HMG used in the cycle, the pre-ovulatory concentrations of oestradiol, number of oocytes retrieved and quality of embryos (Puissant et al., 1987). Ovarian response was compared between cycles before and after salpingectomy as well as between affected and unaffected sides before and after salpingectomy.

Statistical analysis

Paired t-test was used to compare ovarian response parameters; χ2 test was used to assess the differences in proportions. Values are mean ± SD; P < 0.05 was considered statistically significant.

Results

The average age of patients before salpingectomy was 31.7 ± 3.6 and 33.4 ± 2.7 years after salpingectomy (P < 0.05).
Gravidity in pre-salpingectomy cycles ranged from zero to six and parity ranged from zero to one. The main indications before the pre-salpingectomy artificial reproduction technology cycle was mechanical infertility (n = 16), male factor (n = 6), anovulation (n = 1), endometriosis (n = 1), and unexplained infertility (n = 2). There was no significant difference in semen analysis WHO criteria for each couple between cycles.

Salpingectomies were performed in all cases by laparoscopy. Additional surgery was performed in three women. Contralateral salpingectomy was performed in one case. A contralateral tubal catherization was done for two other women who had had repeated ectopic pregnancies and on laparoscopic examination had been found to have severe adhesions and/or hydrosalpinx. Informed consent involved a complete explanation of the procedure, the surgical options, and the uncertainty of subsequent ovarian response to the radical and irreversible options.

Implantation rate and clinical pregnancy rates following the post-salpingectomy cycle were 23.07 and 19.23 respectively. One woman had a repeated ectopic pregnancy (3.84%) and a laparoscopic salpingectomy was performed. In all parameters examined to evaluate ovarian performance (Table I) no significant differences were found before and after the salpingectomy. Moreover, to determine whether the lack of difference was due to a decrease in ovarian response on the affected side with a compensatory increase in response on the unaffected side, we compared the number of oocytes retrieved from the same ovary before and after surgery. Notwithstanding that the women were significantly older during the post-salpingectomy cycle, no significant difference was found (Table I).

Additionally, no significant difference was found in the distribution of embryo quality between pre- and post-salpingectomy cycles (Table II) or in the number of oocytes retrieved, between the operated and non-operated side during pre- and post-salpingectomy cycles (Table III).

**Table I. Ovarian response parameters before and after laparoscopic salpingectomy for ectopic pregnancy**

<table>
<thead>
<tr>
<th>Ovarian response parameters</th>
<th>Before</th>
<th>After</th>
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<tbody>
<tr>
<td>Days of HMG (n)</td>
<td>10.81 ± 2.45</td>
<td>10.68 ± 2.57</td>
</tr>
<tr>
<td>HMG ampoules (n)</td>
<td>36.13 ± 14.45</td>
<td>34.81 ± 12.47</td>
</tr>
<tr>
<td>Oestradiol on day 0 (pg/ml)</td>
<td>1285 ± 785</td>
<td>1151 ± 819</td>
</tr>
<tr>
<td>Oocytes retrieved from non-operated side (n = 25)</td>
<td>5.07 ± 3.08</td>
<td>4.40 ± 3.68</td>
</tr>
<tr>
<td>Oocytes retrieved from operated side (n = 27)</td>
<td>6.06 ± 3.85</td>
<td>5.31 ± 4.22</td>
</tr>
<tr>
<td>Oocytes suitable for insemination/injection (n)</td>
<td>10.81 ± 5.75</td>
<td>9.5 ± 6.98</td>
</tr>
<tr>
<td>Fertilization rate (%) (n)</td>
<td>55.5</td>
<td>59.26</td>
</tr>
<tr>
<td>Transferred embryo (n)</td>
<td>3.56 ± 0.81</td>
<td>3.37 ± 0.80</td>
</tr>
</tbody>
</table>

Values are means ± SD.

*There were no significant differences (paired t-test) except \( \chi^2 \) test for comparison of proportions (0.07).

*In one case bilateral salpingectomy was performed.

**Table II. Embryo quality before and after laparoscopic salpingectomy**

<table>
<thead>
<tr>
<th>Embryo quality (degree)</th>
<th>Before</th>
<th>After</th>
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<tbody>
<tr>
<td>1st</td>
<td>37/56 (66)</td>
<td>30/54 (55.5)</td>
</tr>
<tr>
<td>2nd</td>
<td>13/56 (23.2)</td>
<td>19/54 (35.18)</td>
</tr>
<tr>
<td>3rd and 4th</td>
<td>6/56 (10.7)</td>
<td>5/54 (9.25)</td>
</tr>
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</table>

Values in parentheses are percentages.

*a According to Puissant et al. (1987).

**Table III. Comparison of oocyte number retrieved between operated and non-operated sides before and after salpingectomy (n = 25)*

<table>
<thead>
<tr>
<th>Side of oocyte retrieval</th>
<th>Before salpingectomy</th>
<th>After salpingectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operated</td>
<td>6.06 ± 3.85</td>
<td>5.07 ± 3.08</td>
</tr>
<tr>
<td>Non-operated</td>
<td>5.31 ± 4.22</td>
<td>4.40 ± 3.68</td>
</tr>
</tbody>
</table>

Values are means ± SD.

*a In one case bilateral salpingectomy was performed.

There were no significant differences (paired t-test).

The current study demonstrates that laparoscopic salpingectomy apparently has no deleterious impact on ovarian performance in subsequent artificial reproduction technology cycles. Some studies from the 1980s, before the routine use of operative laparoscopy, reported adverse effects on ovarian function following salpingectomy. Significantly fewer follicles appeared in rat ovaries following the division of anastomotic blood vessels between the ovary and the fimbria (McComb and Delbeke, 1984), and a significantly lower number of pre-ovulatory oocytes in patients after bilateral salpingectomy was also noted (Rumeu et al., 1987). Likewise, fewer corpora lutea were seen in the ipsilateral ovary after unilateral fimbriectomy as compared with the number found in the contralateral intact ovary (McComb et al., 1981). It was reported that four of seven women who had undergone tubal ligation had oestrogen excretion concentrations at ovulation below the tenth percentile (Cattanch, 1985). Nevertheless, studying 2456 women for 2 years after tubal sterilization (DeStefano et al., 1983) it was shown that except for menstrual pain among patients who had undergone unipolar electrocoagulation procedures, there was no increase in the prevalence of adverse menstrual function after the procedure. The existence of perianexal adhesions was also found by some investigators to be associated with poor ovarian function (Mahadevan et al., 1985; Molloy et al., 1987), but others could not confirm this finding (Halme et al., 1982; Imoedeme et al., 1988).

Some recent studies of ovarian performance following salpingectomy resulted in different findings and conclusions. Lass et al. compared ovarian response in artificial reproduction technology cycles between 29 patients who had undergone unilateral salpingectomy because of ectopic pregnancy and 73 patients with no preceding tubal surgery (Lass et al., 1998). They found fewer follicles and retrieved oocytes on the operated side, but no difference in overall number of follicles and oocytes as compared to the control group. These findings introduce the possibility of a compensatory mechanism in the unaffected tube. Our study does not support such a possibility.
In a study of 26 women who underwent bilateral salpingectomy (Verhulst et al., 1994) it was found that ovarian performance subsequent to surgery was equivalent to the control group. Moreover, no difference in ovarian function was reported in five women before and after bilateral salpingectomy. This series as well as our own supports the hypothesis that tubal removal does not compromise ovarian function. A third study compared implantation and pregnancy rates in IVF patients with severe mechanical factor who underwent laparoscopic salpingectomy and those with no prior surgery (Dechaud et al., 1998). The authors found that the antecedent surgery tended to increase implantation and pregnancy rates. These findings were also confirmed by others (Bredkjaer et al., 1999).

The most important blood supply for the tube is the medial tubal artery, which originates at the same level as the median ovarian artery. Laparoscopic surgery, the predominant method for treatment of ectopic pregnancy today, in combination with early detection of ectopic pregnancy, permits resection of the unruptured tube as close as possible to its surface in the isthmic region. This minimizes the damage to the ovarian blood supply and thus may decrease the occurrence of adverse effects as reflected in our results.

Although not addressed in our study, the long-term impact of salpingectomy on ovarian function, such as timing of menopause, is an important concern. It has been shown (Siddle et al., 1987) that the mean age of ovarian failure was lower in women who had undergone hysterectomy. However, salpingectomy and hysterectomy are scarcely comparable since the latter is far more devastating to the ovarian nerve and blood supply than the laparoscopic procedure. Furthermore, the local hypertension that results from the occlusion of the ovarian ligament may have a role in deterioration of ovarian function. Clearly, more studies are needed to elucidate the long-term effects of salpingectomy on the ovary.

In conclusion, our data suggest that laparoscopic salpingectomy is a safe procedure in regard to conservation of ovarian response in subsequent artificial reproduction technology cycles. In view of the high risk of ectopic pregnancy in patients with pathological tubes who will need assisted reproduction, salpingectomy, when indicated, should not be avoided because of concern for deterioration of ovarian function.

References

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