



Original article

Comparison of the outcome of *in vitro* fertilization after laparoscopic laser ablation surgery versus laparoscopic cystectomy for endometrioma

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ABSTRACT

Objective: To compare the influence of laparoscopic ablation surgery or cystectomy for endometrioma on the ovaries with respect to the results of *in vitro* fertilization (IVF).

Materials and Methods: Fifteen patients who had not achieved spontaneous pregnancy following KTP laser ablation surgery for ovarian endometrioma and who wanted to undergo IVF formed the ablation group. Another 12 infertile women who failed to achieve spontaneous pregnancy following laparoscopic cystectomy for ovarian endometrioma and underwent IVF formed the cystectomy group. Both groups of patients were reviewed retrospectively.

Results: The fertilization rate was significantly lower in the ablation group compared with the cystectomy group. The percentage of good-quality embryos and the implantation rate were also lower, although not significantly, in the ablation group than the cystectomy group. Even though the number of embryos transferred was higher, the pregnancy rate was lower in the ablation group.

Conclusion: These results suggest that the quality of oocytes may be lower in the ablation group than the cystectomy group.

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Introduction

Endometriosis is a major cause of female infertility. It affects 2.5–22% of all women of reproductive age and is detected in 20–68% of women with infertility.^{1–4} In addition, endometriomas are found in 17–44% of women with endometriosis.^{5–7} Several effective treatments have been reported for infertility associated with endometriosis, including controlled ovarian stimulation plus intrauterine insemination, assisted reproductive technology, and surgical procedures.^{8,9} There have been a number of reports on surgical treatment including laparoscopic surgery, which has become a more common treatment.

Several laparoscopic techniques for ovarian endometrioma have been described; chief methods are cyst stripping (cystectomy) and cyst wall ablation or vaporization. The two main risks associated with the surgical treatment of endometrioma are possible excessive

resection or destruction of the normal ovarian cortex along with the endometrioma and the risk of incomplete resection with subsequent early recurrence.^{8–10} Therefore, the surgical technique must be selected carefully with due consideration of these risks.

According to the Cochrane Review, ablation or vaporization surgery is associated with a lower spontaneous pregnancy rate and higher recurrence rate than cystectomy.¹¹ Carmona et al.¹⁰ compared recurrences rate and reported that the ablation group had a higher recurrence rate than the cystectomy group at 12 months, although the rates were similar at 60 months. The aim of the current study was to compare the outcome of *in vitro* fertilization (IVF) after laparoscopic laser ablation surgery or cystectomy for endometrioma. This is the first study to compare the detailed results of IVF after these two procedures for endometrioma.

Materials and methods

Fifteen infertile women who had laparoscopic ablation surgery with a KTP laser for ovarian endometrioma and failed to achieve spontaneous pregnancy postoperatively underwent IVF between

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March 1997 and September 2011, and were reviewed retrospectively as the ablation group. Another 12 infertile women who failed to achieve spontaneous pregnancy following laparoscopic cystectomy for ovarian endometrioma and underwent IVF formed the cystectomy group. The size of the endometriomas ranged from 2 to 7 cm. No abnormalities of the uterine endometrium were observed by transvaginal ultrasonography. All of the patients underwent IVF for the first time. Patients were excluded if they had other obvious causes of infertility, such as anovulation or male factors. Laparoscopic ablation of endometrioma was performed under general anesthesia. Our procedure involved opening and draining the endometrioma, followed by adhesiolysis and destruction of the cyst wall using the KTP laser. All sites of superficial active endometriosis involving the ovarian surface and the pelvic peritoneum were also ablated. Laparoscopic cystectomy was performed by drainage of the endometrioma, followed by adhesiolysis and dissection of the cyst pseudocapsule from the underlying stroma by gentle traction and countertraction in the correct plane. Careful bipolar coagulation of the ovarian stroma was performed when necessary.

A standard long downregulation IVF protocol was used in both groups. Buserelin was started for downregulation on Day 20–22 of the menstrual cycle. Next, recombinant follicle-stimulating hormone (FSH) or human menopausal gonadotropin (hMG) was administered for controlled ovarian stimulation. When the largest one to three follicles reached a mean diameter of 18–20 mm, human chorionic gonadotropin (hCG) was administered. Oocyte retrieval was performed 35 hours later, and the oocytes were fertilized on the same day. Embryo transfer was done at 48 or 120 hours after oocyte retrieval. Since April 2008, the transfer of a single embryo has been standard.

The fertilization rate was calculated as the number of fertilized embryos divided by the number of retrieved oocytes (%), the good-quality embryo rate was calculated as the number of good-quality embryos divided by the number of fertilized embryos (%), and the implantation rate was calculated as the number of gestational sacs divided by the number of transferred embryos (%). Clinical pregnancy was defined as the detection of an intrauterine gestational sac on ultrasound. The pregnancy rate was calculated as the number of pregnancies divided by the number of patients. Recurrence of endometrioma was confirmed by ultrasound detection of a thick-walled cyst >1 cm in diameter that contained low-echogenic fluid.

Data were expressed as the mean \pm standard deviation or as percentages. Statistical analysis was performed by using Statistical Package for Social Science version 15.0 (SPSS Inc., Chicago, IL). Statistically significant differences were determined with Yates corrected χ^2 test or the Mann-Whitney *U*-test as appropriate, and $p < 0.05$ was taken to indicate statistical significance.

Results

Patient characteristics are listed in Table 1. The two groups were comparable in terms of age, Day 3 FSH levels, endometrioma size, the bilateral endometrioma rate, the average revised American Society for Reproductive Medicine (rASRM) score, and the interval between surgery and oocyte retrieval. However, the body mass index was significantly lower in the ablation group.

Ovarian stimulation parameters are shown in Table 2. No significant differences were found between the two groups with regard to the total dose of FSH and the number of oocytes retrieved, but the fertilization rate was significantly lower in the ablation group than the cystectomy group. The good-quality embryo rate, the implantation rate, and the pregnancy rate were also lower in the ablation group, without a significant difference, although the

Table 1
Patient characteristics.

	Ablation group (<i>n</i> = 15)	Cystectomy group (<i>n</i> = 12)	<i>p</i>
Age	31.33 \pm 3.83	34.50 \pm 3.58	NS
Day 3 FSH (IU/L)	8.08 \pm 3.28	8.77 \pm 2.44	NS
Body mass index (kg/m ²)	19.39 \pm 1.54	21.12 \pm 1.64	<0.05
Cyst size (cm)	3.53 \pm 1.32	4.48 \pm 1.50	NS
rASRM score	41.47 \pm 34.76	57.43 \pm 32.95	NS
Bilateral endometrioma (%)	26.67 (4/15)	25.00 (3/12)	NS
Interval between surgery and oocyte retrieval (mo)	11.67 \pm 6.96	19.42 \pm 20.52	NS
Recurrence rate	33.3 (5/15)	41.7 (5/12)	NS

FSH = follicle-stimulating hormone; NS = not significant; rASRM = revised American Society for Reproductive Medicine.

number of embryos transferred was higher in the ablation group than the cystectomy group.

Discussion

Some investigators have reported that ablation does not damage the ovaries with respect to the pregnancy rate and follicular response.^{9,12–15} Donnez et al.⁹ compared an ablation group with a tubal factor group and concluded that ablation surgery does not impair ovarian function. However, there have been no reports with detailed IVF data that compared ablation and cystectomy.

In the current study, we retrospectively investigated the outcome of IVF following laparoscopic ablation surgery or cystectomy for endometrioma of the ovaries. This study was not randomized and the sample size was small because we carefully selected the patients (as described in the Materials and methods section). All data were obtained from the first IVF cycle because patients who underwent multiple cycles without achieving pregnancy were more likely to receive high-dose gonadotropins, have fewer oocytes retrieved, and have lower quality embryos. Therefore, it would be impossible to correctly assess the influence of each surgical procedure if all IVF cycles were included.

This study showed that the fertilization rate was significantly lower in the ablation group compared with the cystectomy group. The percentage of good-quality embryos and the implantation rate were also lower, although not significantly, in the ablation group than the cystectomy group. Moreover, although the number of embryos transferred was higher, the pregnancy rate was lower in the ablation group. These results suggest that the oocytes retrieved were of lower quality in the ablation group compared with the cystectomy group. The possible lower quality of oocytes in the ablation group might be explained by several factors. First, diffusion of heat during ablation surgery may impair oocyte quality. Roman et al.¹⁶ performed complete vaporization of the inner surface of cysts with plasma energy before cystectomy, and then carried out a histologic evaluation of the depth of necrosis and the effectiveness of endometrial ablation. They suggested that plasma energy ablation was feasible, but they noted some cases of necrosis

Table 2
Ovarian stimulation parameters and outcome of IVF.

	Ablation group (<i>n</i> = 15)	Cystectomy group (<i>n</i> = 12)	<i>p</i>
Total FSH dose (IU)	2616.67	2604.17	NS
No. of oocytes retrieved	9.53 (143/15)	7.25 (87/12)	NS
Fertilization rate (%)	56.64 (81/143)	73.56 (64/87)	<0.05
Rate of good-quality embryos (%)	29.63 (24/81)	40.63 (26/64)	NS
No. of embryos transferred	1.88 (30/16)	1.07 (16/15)	<0.05
Implantation rate (%)	23.33 (7/30)	50.00 (8/16)	NS
Pregnancy rate (%)	33.33 (5/15)	58.33 (7/12)	NS

FSH = follicle-stimulating hormone; IVF = *in vitro* fertilization; NS = not significant.

affecting the underlying normal ovarian parenchyma. KTP laser therapy may also damage the underlying ovarian parenchyma and oocytes, although we could not find any reports that compared plasma energy ablation with KTP laser ablation. In contrast, cystectomy would be less likely to damage the ovarian parenchyma by diffusion of heat compared with ablation surgery. Second, the interval between operation and oocyte retrieval was longer in the cystectomy group (19.42 months) than the ablation group (11.67 months). There was no significance, probably due to the small sample size. However, the difference of 8 months may be a good span for the ovaries to recover postoperatively in the cystectomy group. This difference might have a positive effect on the oocyte quality of cystectomy group.

Our findings suggest that oocyte quality was worse in the ablation group than the cystectomy group. If oocyte quality is reduced after ablation compared with cystectomy, this could be one reason for the lower spontaneous pregnancy rate after ablation surgery that was demonstrated in the Cochrane Review.¹¹

In the future, a prospective study should be done to compare the outcome of IVF after laparoscopic ablation surgery versus cystectomy for endometrioma.

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