

The Success of Laser Laparoscopy in the Treatment of Endometriosis: A Two-Step Analysis

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ABSTRACT

Background and Objectives: The most advantageous treatment for nonextensive endometriosis has long been the subject of debate. In recent years, the ability to detect atypical presentations has allowed the gynecological surgeon to treat this disease more readily. The treatment in the past has only been concerned with the singular treatment being applied at the time, not on the effects that previous treatments have had. The purpose of the current study was to see whether previous unsuccessful treatment modalities affected subsequent laser laparoscopy treatment of endometriosis.

Methods: Patients who were previously treated for their endometriosis (minimal and mild) underwent treatment of their disease by laser laparoscopy and the results were analyzed by χ^2 (chi-square) analysis.

Results: Those patients previously treated with laser laparoscopy and laparotomy demonstrated poorer results than those previously treated with expectant, medical, or cautery. The sum of the original treatments plus the second treatment of laser laparoscopy was equal in all groups.

Conclusions: If endometriosis is diagnosed at the time of laparoscopy and is easily amenable to treatment, it behooves the physician to treat it at the time of surgery.

Key Words: Endometriosis, Laser, Laparoscopy.

INTRODUCTION

Determining the optimum treatment for patients with endometriosis has been fraught with conflicting ideas for many years. Since the initial reports of this entity by Von Rokitansky,¹ Cullen,^{2,3} and Sampson,^{4,5} diagnosis and treatment have changed dramatically. For many years, diagnosis was based on findings secondary to surgery for marked symptomatology of the disease or as an ancillary finding during a surgical procedure necessitated by other unrelated problems. With the advent and popularization of laparoscopy, the diagnosis of endometriosis has been simplified in regards to both infertility and the diagnosis of symptoms secondary to the disease. Within the past few years, the ability to detect atypical presentations of endometriosis has allowed the gynecological surgeon to treat even subtle degrees of this entity successfully. For the patient with uncomfortable symptomatology, recent advances have allowed endoscopic treatment of this problem, either conservatively by irradiating or debulking the disease or radically by procedures such as a salpingo-oophorectomy, a laparoscopic-assisted hysterectomy, or both. For the patient desirous of maintaining her fertility potential, treatments have varied including expectant management,⁶⁻¹¹ medical management,^{9,11-13} laparoscopic cautery,¹⁴⁻¹⁸ laparoscopic utilization of the argon beam coagulator,^{19,20} laparotomy,^{7,8,21-23} and laser laparoscopy.²⁴⁻³⁰

Several of these studies have retrospectively compared the efficacy of various treatments and demonstrated no statistical improvement in a couple's fertility potential in regards to expectant treatment, medical therapy, or laparoscopic cautery techniques. A study of 1268 patients comparing 5 treatment modalities for the treatment of mild and moderate endometriosis in infertile patients was published in 1991.²⁹ The study compared an ongoing surgical treatment (laser laparoscopic ablation of endometriosis) with retrospective data about other treatments. The results demonstrated that treatment by laser laparoscopy was comparable to laparotomy in improved fertility rates, and both treatments were superior to expectant, medical, and laparoscopic cautery treatments. Age of disease, length of infertility, and the amount of disease present appear to be important prognostic factors.

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Previously published works on treatment of this problem have only addressed the singular treatment at the time of the respective study; they have not been concerned with the possibility that previous treatment may have affected subsequent successes, nor have these studies offered a different prognosis of success based on previous outcome. We explored how previous unsuccessful treatment modalities (two-step treatment) have affected subsequent laser laparoscopy successes in infertile women.

METHODS

Patient Population

The subjects were from the group of patients that had been studied using the standard singular treatment regimen.³⁰ In that series, patients with minimal and mild endometriosis and no other factors contributing to their infertility were exposed to different treatment modalities without taking into account previous treatment courses and outcomes. Patients who were treated with expectant therapy (expectant) had a 57% subsequent pregnancy rate; those treated medically (medical) had a 39% successful pregnancy rate. The patients treated by laparoscopic cautery (cautery) of the endometriosis became pregnant 47% of the time, whereas the patient group treated by extirpation of the endometriosis by laparotomy (laparotomy) had an 84% pregnancy rate. Those that were treated by laser fulguration of their endometriosis during laparoscopy (laser laparoscopy) had a pregnancy rate of 81%.

Statistical Analysis

To analyze the results between different treatment groups, we used χ^2 analysis (chi-square analysis). A fundamental assumption in the use of χ^2 analysis is that each observation is independent of all other observations, ie, the experiment consists of a number of identical independent trials. Our groups in this study are defined in such a way that our samples have this property. The χ^2 test for independence in a contingency table, which we used, is an approximate test that is useful when the sample size is initially large.

The work was divided into three distinct studies.

Study I

Two hundred fifteen (215) consecutive infertile patients were included who had been treated previously for endometriosis without any other predisposing factors

explaining their infertility. They had not become pregnant with their previous treatment. Of these patients, 57 had been treated previously with expectant management, 45 patients had been treated medically with danazol, 34 patients had been treated with laparoscopic treatment with cautery, 25 patients had been treated with laparotomy with excision of the endometriosis, and 54 patients had been treated with laparoscopy using laser ablation of the endometriosis. After at least 18 months (18 months to five years) post-treatment without achieving a pregnancy, patients were treated by laser laparoscopy.

Study II

This second study was a two-step treatment involving those patients who were successful in achieving pregnancy after their initial treatment of the disease (treatment included expectant, medical, laparoscopic cautery, laparotomy, or laparoscopic laser treatment). The patient numbers in each group were added to those individuals who were not successful in each group but who became pregnant after treatment of their endometriosis by laser laparoscopy. These groups' successes (pregnancies) were then compared with each other to see whether a statistical difference (χ^2 analysis) occurred between the different treatment groups, those that had successes and those whose failures were treated by laser laparoscopy and afterwards they had success.

Study III

This study consisted of an analysis among groups that failed with one treatment (expectant, medical, laparoscopic cautery, and laparotomy), and then these failed patients were treated with laser laparoscopy. These groups were then compared by χ^2 analysis with those treated with laser laparoscopy only.

RESULTS

Study I

A χ^2 analysis of study I demonstrated that no difference existed in successful pregnancy rates among those patients who had originally been treated with expectant, medical, or laparoscopic cautery and subsequently were treated with laser treatment. A difference did, however, occur between those who failed treatment in the groups with laparotomy and laser laparoscopy versus the other groups (expectant, medical, and laparoscopic cautery treatment) (**Table 1**).

This means that a patient who had expectant, medical, or laparoscopic cautery in her first treatment of endometriosis and failed would subsequently have the same chance of success with laser laparoscopy no matter which of the three treatments she had undergone prior to the laser surgery. If the patient, however, had failed with her first treatment of laser laparoscopy or laparotomy for the endometriosis, then the success of subsequent laser laparoscopic treatment was less than the other treatments (Table 1).

Study II

No statistical differences in the total successful outcome occurred among the 5 groups treated by the two-step method. This means that no matter which of the treatment choices was performed first, by the addition of laser laparoscopy to the failures, the total pregnancy rates within each group were similar (Table 2).

Study III

No difference in the pregnancy rates occurred between: (1) the group that failed expectantly and was then treat-

Table 1.
Results of Treating Mild and Moderate Endometriosis in Patients with No Other Predisposing Fertility.

Conditions	Number of Patients	Number of Pregnancies	Number of Non-Pregnancies
L _e	57	45	12
L _m	45	34	11
L _c	34	27	7
L _p	25	13	12
L _l	54	32	22

- L_e Patients failed expectantly, then treated with laser.
- L_m Patients failed medically, then treated with laser.
- L_c Patients failed cautery, then treated with laser.
- L_p Patients failed laparotomy, then treated with laser.
- L_l Patients failed in laser, then treated with laser.

Comparisons between two treatment conditions as follows:

- 1.1 L_e vs. L_m 1.4 L_e vs. L_l 1.7 L_m vs. L_l 1.10 L_p vs. L_l
- 1.2 L_e vs. L_c 1.5 L_m vs. L_c 1.8 L_c vs. L_p
- 1.3 L_e vs. L_p 1.6 L_m vs. L_p 1.9 L_c vs. L_l

Results of Comparisons Between Treatment Conditions by χ^2 Analysis at 5% Level of Significance.

Condition 1	Pregnancy Rate	Condition 2	Pregnancy Rate	χ^2 df=1	χ^2 $\alpha=.05$, df=1	Difference
L _e	79%	L _m	76%	0.18	3.84	No
L _e	79%	L _c	79%	0.00	3.84	No
L _m	76%	L _c	79%	0.14	3.84	No
L _m	76%	L _l	59%	2.93	3.84	No
L _p	52%	L _l	59%	0.29	3.84	No
L _e	79%	L _p	52%	6.15	3.84	Yes
L _e	79%	L _l	59%	5.14	3.84	Yes
L _m	76%	L _p	52%	4.08	3.84	Yes
L _c	79%	L _p	52%	4.84	3.84	Yes
L _c	79%	L _l	59%	3.84	3.84	Yes

Table 2.
Results of Treating Mild and Moderate Endometriosis in Patients with No Other Predisposing Fertility.

Conditions	Number of Pregnancies	Number of Patients	Number of Non-Pregnancies
EL	133	121	12
ML	98	87	11
CL	64	57	7
PL	156	144	12
LL	309	287	22

EL Group first treated expectantly, then the nonpregnancies treated with laser.
 ML Group first treated medically, then the nonpregnancies treated with laser.
 CL Group first treated with cautery, then the nonpregnancies treated with laser.
 PL Group first treated with laparotomy, then the nonpregnancies treated with laser.
 LL Group first treated with laser, then the nonpregnancies treated with laser again.

Comparisons between two treatment conditions as follows:

- 2.1 EL vs. ML 2.4 EL vs. LL 2.7 ML vs. LL 2.10 PL vs. LL
- 2.2 EL vs. CL 2.5 ML vs. CL 2.8 CL vs. PL
- 2.3 EL vs. PL 2.6 ML vs. PL 2.9 CL vs. LL

Results of Comparisons Between Treatment Conditions by χ^2 Analysis at 5% Level of Significance.

Condition 1	Pregnancy Rate	Condition 2	Pregnancy Rate	χ^2 df=1	χ^2 $\alpha=.05$, df=1	Difference
EL	91%	ML	89%	0.29	3.84	No
EL	91%	CL	89%	0.16	3.84	No
EL	91%	PL	92%	0.19	3.84	No
EL	91%	LL	93%	0.50	3.84	No
ML	89%	CL	89%	0.00	3.84	No
ML	89%	PL	92%	0.89	3.84	No
ML	89%	LL	93%	1.74	3.84	No
CL	89%	PL	92%	0.64	3.84	No
CL	89%	LL	93%	0.33	3.84	No
PL	92%	LL	93%	0.05	3.84	No

ed with laser laparoscopy versus a group treated with laser laparoscopy only; (2) the group that failed with medical treatment and was treated with laser laparoscopy versus a group treated with laser laparoscopy; and (3) the group that failed with treatment from laparoscopic cautery and was then treated with laser laparoscopy versus a group treated with laser laparoscopy. A significant difference, however, occurred in rates between the group that failed by laparotomy treatment and then was treated with laser laparoscopy versus a group treated with laser laparoscopy only (**Table 3**).

This means that if a patient is attempting to achieve a pregnancy and had endometriosis and she failed treatment (expectant, medical, or laparoscopic cautery), the chance that she will become pregnant with subsequent laser laparoscopy therapy will be comparable to those patients who never had treatment before and were then treated with laser laparoscopy. If, however, the individual had had previous surgery by laparotomy to remove her endometriosis and she then failed to become pregnant, then her success rate with laser laparoscopy is less than if she had undergone the procedure initially.

Table 3.
Results of Treating Mild Endometriosis in Patients with No Other Predisposing Fertility.

Conditions	Number of Patients	Number of Pregnancies	Number of Non-Pregnancies
L _e	57	45	12
L _m	45	34	11
L _c	34	27	7
L _p	25	13	12
L	120	99	21

L_e Patients failed expectantly, then treated with laser laparoscopy.
 L_m Patients failed medically, then treated with laser laparoscopy.
 L_c Patients failed cautery, then treated with laser laparoscopy.
 L_p Patients failed laparotomy, then treated with laser laparoscopy.
 L Patients treated with laser laparoscopy only.

Comparisons between two treatments with laser laparoscopy only.

3.1 L_e vs. L

3.2 L_m vs. L

3.3 L_c vs. L

3.4 L_e vs. L

Results of Comparisons Between Treatment Conditions by χ^2 Analysis at 5% Level of Significance.

Condition 1	Pregnancy Rate	Condition 2	Pregnancy Rate	χ^2 df=1	χ^2 $\alpha=.05$, df=1	Difference
L _e	79%	L	83%	0.33	3.84	No
L _m	76%	L	83%	1.04	3.84	No
L _c	79%	L	83%	0.16	3.84	No
L _p	52%	L	83%	10.90	3.84	Yes

DISCUSSION

For many years, determining the ideal treatment for patients with endometriosis has been difficult at best, as many conflicting ideas have been published in the literature. Since the early part of the twentieth century, diagnosis and treatment have changed dramatically. For many years, diagnosis was based on findings at laparotomy secondary to surgery for marked symptomatology of the disease or an ancillary finding during surgery necessitated by other unrelated problems. With the advent and popularization of laparoscopy, the diagnosis of endometriosis has been simplified for both patients with infertility and the diagnosis and symptomatology secondary to the disease. Although known for many years, treating gynecologists only recently have recognized that endometriosis can have atypical presentations; this has allowed the gynecological surgeon to treat even

subtle degrees of this entity more successfully.³¹⁻³⁵ For the patient with uncomfortable symptomatology, recent advances have allowed endoscopic treatment of this problem both conservatively and radically. For patients who are desirous of enhancing their fertility potential, many treatments are available. However, the optimal treatment to be performed by the gynecologist is often questionable. This study took into account previous treatment modalities, both successful and unsuccessful, that were done prior to treatment to see whether these were factors in either changing or predicting, or changing and predicting, the outcome of these patients desiring pregnancy.

The results of these studies suggest that variations in treatment can be performed affording the patient good results. If one interlaces all three of the studies together, a trend in the treatment process can be appreciated. If a

couple has infertility with a diagnosis of minimal or mild endometriosis and no other problems exist that are attributable to the infertility, then the type of primary treatment of the disease can be important. If the individuals had been treated for their endometriosis by either expectant, medical, or cautery treatment and they did not become pregnant, then if they were treated by laser laparoscopy, when compared with each other, they then all had the same chance of becoming pregnant again. The success was similar, also, if they were then compared with a primary treatment course with laser laparoscopy. If the successes with their primary treatment were added to the treatment successes achieved by treating the failures of each group by laser laparoscopy, then no difference existed among the groups. Therefore, it is possible to treat an individual with a more simple course of treatment that is less efficacious but has fewer risks and side effects; if no pregnancy is achieved, one can then treat with laser laparoscopy, and the same overall number of successful pregnancies would be achieved. The reasons for not treating a patient immediately with what one considers the best therapy are age, which may play a role in a woman's fertility, and the additive time necessary to achieve a pregnancy in some patients. In our study, medical treatment consisted of danazol, because GnRh agonists were not readily available at the time of the initial study. Studies have shown that danazol and GnRh agonists are similar in their effectiveness for treating endometriosis.^{31,36-38}

In previous studies,³⁰ it was demonstrated that a statistically significant better success was achieved with treatment of endometriosis by laser laparoscopy and laparotomy compared with that of expectant, medical, or laparoscopic cautery therapy for the disease. Obviously, those individuals who were not successful in becoming pregnant after their first treatment of endometriosis by laser laparoscopy or laparotomy, perhaps, went through a weeding out process; the majority of these patients were successful after the treatment, and the patients that did not become pregnant may not have specific problems contributing to their infertility that can be quantified, and therefore they are not understood at this time. If, however, the successes of the initial treatment were added to the successes of the patients who originally failed to become pregnant and were then treated with laser laparoscopy, then no difference exists in total pregnancy rates between this group and the other groups tested.

Although minimal and mild disease has been shown to alter the monthly fecundability of couples,³⁹ only lately have studies demonstrated that treatment can be beneficial. Recently a randomized study⁴⁰ suggested that the treatment of mild or moderate endometriosis by laparoscopic means was superior to diagnosing and not treating the endometriosis at the time of laparoscopy. The question by many practitioners is that (1) if the treatment at the time of diagnosis is equal to or better than other treatment modalities, and (2) if the time requirements to do this are not great, and (3) if the risks to the patient are minimal, why then should the disease not be treated? Why should a physician leave disease and subsequently have to treat it by medicines that may prove uncomfortable to the patient or not even be as beneficial? Some may postulate that if the patient is not attempting pregnancy and is not symptomatic, no reason to treat exists at all. It has been seen that over time the disease has the ability to progress and cause symptoms. By treating minimal or mild endometriosis at the time of its diagnosis, one may prevent problems in the future by performing a relatively safe and quick procedure.

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