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Clinical results of terminal salpingostomy with the use of the CO_2 laser: report of the intraabdominal laser study group

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Forty-eight women underwent terminal salpingostomies with a standard operative procedure with the use of the CO_2 laser and microsurgical techniques at five centers. Early second-look laparoscopy was performed in all patients 1 to 12 weeks after the laparotomy. The tubal patency rate at the second look was 92% for these 48 patients, with a minimum of 6 months' follow-up study in all patients. Of these patients, ten became pregnant (21%), one with an ectopic pregnancy (10%). All pregnancies occurred within 12 months of the second-look procedure. It is preliminarily concluded from this series that use of the CO_2 laser for neosalpingostomy at laparotomy with early second-look laparoscopy provides a term pregnancy rate similar to that previously achieved by nonlaser microsurgical techniques and shortens the time period between the surgical procedure and when conception would be expected to occur. Fertil Steril 45:175, 1986

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The carbon dioxide (CO_2) laser, because of certain properties of the beam, has most recently been suggested as a less traumatic way to perform reconstructive pelvic surgery.[1] The severity of preexisting disease and status of the tubal endothelium are the major determinants of success in the surgical correction of hydrosalpinges, and it is difficult for one surgeon to find groups of patients with similar tubal disease.[2] Similarly, few studies are examinations of early second-look laparoscopy after infertility surgery to evaluate results in patients receiving a standardized operative procedure. The clinical studies that have been reported for salpingostomy with the CO_2 laser have not included postoperative evaluation with early second-look laparoscopy.[3, 4]

According to the nomenclature proposed at the Ninth World Congress on Fertility and Sterility,[5]

salpingostomy refers to the repair of a totally occluded tube and can be classified as terminal, midampullary, or isthmic. Furthermore, fimbrioplasty refers to the partially occluded tube that is repaired by deagglutination and/or dilatation of fimbria, incision of the peritoneal ring, or incision of tubal wall with freeing of the fimbria. This article is a review of 48 patients who underwent terminal salpingostomy by techniques that included use of the CO_2 laser after proven distal occlusion by hysterosalpingography and laparoscopic visualization with injection of dye.

MATERIALS AND METHODS

All patients included in this report had distal fimbrial occlusion documented by hysterosalpingography and laparoscopy. Patients whose disease consisted of phimotic tube(s) secondary to peritoneal bands or with fimbrial agglutination were excluded, as were patients with associated proximal tubal disease. Patients for whom only one tube underwent a terminal salpingostomy, with a different procedure being performed on the other tube (fimbrioplasty or salpingo-oophorolysis), were not included.

All patients underwent a standard infertility workup, which included documentation of ovulation, semen analysis, postcoital testing, and hysterosalpingography. On several occasions, laparoscopic visualization of dye constituted the only preoperative evaluation of the tubal factor.

A standard CO_2 laser technique was derived from the method for salpingostomy described by Mage and Bruhat.[3] Procedures were performed with either handheld or micromanipulator direction of the CO_2 laser beam. Magnification provided in all cases by loupes or an operating microscope was followed by all surgeons. Meticulous salpingo-oophorolysis was accomplished, and hemostasis was achieved with the laser or unipolar cautery when needed. The tube was distended with dye and the dimple identified where the fimbria had scarred and obstructed. This point was then opened with the CO_2 laser with a power density of 15,000 to 20,000 W/cm^2. A quartz or pyrex rod was then inserted as a backstop and a linear incision made extending from this point. Subsequent radial incisions were then made with the focused CO_2 laser beam looking "from inside out" to determine planes of fibrosis and scarring along which to vaporize. The fimbriated ends were "flowered" back with the use of a defocused beam to evert the ampullary peritoneal edges. Power densities of 400 to 800 W/cm^2 were used to accomplish this procedure. Before the peritoneum was closed, 200 ml of 32% dextran 70 (Hyskon Division, Pharmacia, Piscataway, NJ) was poured into the abdominal cavity. Hydrotubation was performed in 15 patients on the first postoperative morning, using sterile saline without adjuvants. A similar office hydrotubation was performed after the first menstrual cycle at the first postoperative visit in selected patients. In all patients, laparoscopy scheduled in the proliferative phase of the cycle was performed 1 to 12 weeks after operation. These second-look procedures all were done by the initial surgeon with chromotubation and, when indicated, adhesiolysis. Adhesiolysis at the time of second-look laparoscopy included both CO_2 laser and nonlaser techniques. Findings and results of both the primary operation and the second-look laparoscopy were carefully recorded on special data forms and analyzed by computer. The techniques of the second-look laparoscopy were those described by Surrey and Friedman.[6]

RESULTS

The demographic makeup of the 48 patients was as follows: 39 were white, 6 were black, and 3 were Mexican-American. Twenty-nine patients had primary infertility and 19 had secondary infertility. The mean age was 28 ± 4 years.

Of these 48 women, 8 had previously undergone unilateral salpingectomy; an additional 6 underwent unilateral salpingectomy during the initial operative procedure. One patient had bilateral hydrosalpinx, of which only one was repaired. Thus 81 salpingostomies were performed in these 48 women. At the time of second-look laparoscopy, 73 of 81 tubes were patent (90%), and 44 of 48 women (92%) had at least one patent tube. All four women who did not have patency at the time of the second-look procedure had only a single remaining fallopian tube.

A total of 10 of 48 patients conceived, for an overall pregnancy rate of 21%. Nine patients had intrauterine pregnancies, and all gave birth to full-term infants or have normally progressing pregnancies. One woman had an ectopic pregnancy, for a 10% ectopic rate. Figure 1 shows a life-table analysis of pregnancies in this series, which yielded a final rate of 22%. All pregnancies occurred within 12 months of the second-look pro-

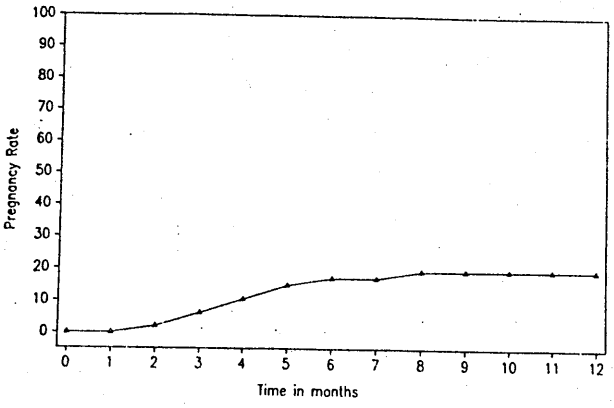

Figure 1
Duration of time from second-look laparoscopy to pregnancy in patients undergoing neosalpingostomy.

cedure. Follow-up in the nonpregnant patients ranged from 3 to 31 months, with a mean of 19.4 ± 1.2 months and a median of 19 months.

There were no surgical complications at laparotomy, but one patient developed a partial large bowel obstruction after second-look laparoscopy; it subsequently spontaneously resolved.

DISCUSSION

Modern treatment for distal tubal disease implies creation and maintenance of tubal patency, avoidance of postoperative adhesion formation, and, it is hoped, the occurrence of an intrauterine pregnancy. There has been much controversy regarding the role of the CO_2 laser for intraabdominal surgery,[7] in both experimental animals[8, 9] and clinical trials.[10, 11] The CO_2 laser offers theoretic advantages for reconstructive pelvic surgery, such as hemostatic properties, minimal tissue touching, and reduced tissue damage at the sites of beam impact. Empirically, these properties would suggest less intraabdominal adhesions and possibly better clinical results. These proposed advantages have not yet been demonstrated in the few clinical studies available for review.[12]

This article is an evaluation of the outcome of patients undergoing neosalpingostomy with the use of the CO_2 laser followed by early second-look laparoscopy. As such, the pregnancy outcome actually represents a composite of both of these procedures as well as the described adjuvant use. To accomplish this evaluation, we initiated a multicenter study group. Use of several centers allowed for more rapid collection of a large number of patients. In contrast to reports from a single surgeon, this potentially allows introduction of variability in the skill and experience of participating surgeons, in operative technique and patient management within the established protocol, and in interpretation of findings. Although we have attempted to standardize these, we acknowledge the potential for variation. Finally, attention must also be called to the potential bias created by each surgeon's reviewing the outcome of his or her own initial operative procedures. Recognizing these limitations, the observations of this group are described below.

Our term pregnancy rate of 19% of patients and ectopic rate of 10% of pregnancies is in the range reported by various authors for terminal salpingostomy both with and without use of the laser

Table 1. *Results of Terminal Salpingostomy: Recent Reports*

	Total no. of patients	Patency	Total patients with pregnancies	Term pregnancies		Ectopic pregnancies	
		%	*n*	*n*	%	*n*	%
Laser technique							
Daniell et al. (present study)	48	92	10	9	19	1	10
Mage and Bruhat (1983)[3]	38	NS[a]	15	9	24	3	20
Kelly (1983)[4]	28	NS	3	2	7	1	33
	114		28 (25%)	20	18	5	18
Nonlaser technique							
Gomel (1978)[13]	41	NS	16	11	27	5	31
DeCherney and Kase (1981)[14]	54	90	24	14	26	4	17
Harris and Daniell (1983)[2]	26	75	8	6	23	3	38
Mage and Bruhat (1983)[3]	30	NS	9	5	17	3	33
	151		57 (38%)	36	24	15	26

[a]NS, not stated.

(Table 1). Certainly the early postoperative tubal patency rate as determined by laparoscopic chromotubation is good, compared with that of other similar nonlaser studies.[12] Harris and Daniell[2] reported a mean of 20 months to conception after terminal salpingostomy. Gomel[13] observed that 60% of his patients conceived more than 1 year after terminal salpingostomy. In our series, all conceptions occurred within 12 months of the second-look procedure.

The reason for the reduction in the operation-to-conception interval with use of the CO_2 laser is uncertain. It is thought that the difference arises from the need for damaged endothelial tissue to regenerate after terminal salpingostomy.[14] Thus perhaps the regeneration process occurs more quickly after use of the CO_2 laser, although the mechanism for this is uncertain.

Based on this study and the few other evaluations of the use of the CO_2 laser for terminal salpingostomy at laparotomy, at present neither the CO_2 laser nor the nonlaser techniques demonstrate superiority in efficacy with regard to the ultimate pregnancy rate. Randomized clinical trials are required to resolve the comparative efficacy of the CO_2 laser and nonlaser techniques for neosalpingostomy at laparotomy.

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