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ORIGINAL ARTICLE

Laparoscopic microsurgical tubal re-anastomosis: the two-stitch technique

M. Turan Çetin · Oktay Kadayıfçı

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Abstract The objective of this study was to determine the effectiveness of the two-stitch unilateral laparoscopic sterilization reversal. Thirty-three patients who had undergone unilateral laparoscopic sterilization reversal between December 2001 and October 2006 were examined. Twenty patients (60.6%) who had had laparoscopic unilateral tubal sterilization reversal achieved an ongoing pregnancy within 1 year of the operation. In vitro fertilization (IVF) was recommended to the other 13 patients, including one patient (3%) who had an ectopic pregnancy. In conclusion, in our study, the pregnancy rate after unilateral two-stitch laparoscopic tubal reversal was 60.6%. In this IVF era, tubal anastomosis will become more popular, causing fewer women to resort to IVF and experience a completely natural conception, making surgery complementary to ART. The number of surgeons skilled in laparoscopic tubal surgery must, therefore, be increased.

Keywords Laparoscopy · Tubal sterilization · Reversal · Unilateral · Pregnancy rate

Introduction

Family planning is one of the main concerns in terms of public health care either in developed or developing countries. Tubal sterilization is still one of the most prevailing contraceptive alternatives used worldwide [1].

Approximately 138 million women of reproductive age have had tubal sterilization, and there is evidence that increasingly younger women are being sterilized [2]. Tubal sterilization was performed on many young women in Turkey during their third Cesarean section. In our clinic, we perform tubal sterilization according to a scoring system [3], because this system decreases the number of women who desire the reversal of tubal sterilization. It is estimated that 2–13% of women develop post-sterilization regret, leading in 1–3% to an operative reversal procedure [4]. The indications for reversal of sterilization are generally a change in marital status and death of children and, rarely, a desire for more children or children of different gender, wish to regain fertility, and religious and psychological factors.

Sterilization reversal was first performed laparotomically [5, 6]. Recent advances in microsurgical techniques for tubal anastomosis using a higher magnification and an atraumatic technique have resulted in a pregnancy rate of 54.8–94.1% [5–7]. Laparoscopic tubal re-anastomosis was first reported by Sedbon et al. in 1989 [8]. Since then, the development of high-quality endoscopic magnifying cameras and delicate instruments has paved the way to a laparoscopic approach. This method became widely used in the reversal of sterilization. Laparoscopic tubal re-anastomosis yields a high success rate in skilled hands [4]. As a result of this new technique, laparoscopic tubal reversal has now become the first-line surgical procedure to replace lost fertility due to tubal sterilization. To assess the effectiveness of the unilateral two-suture technique by laparoscopy, we describe our results of laparoscopic unilateral tubal re-anastomosis in 33 women.

M. T. Çetin (✉) · O. Kadayıfçı
Department of Obstetrics and Gynecology, Faculty of Medicine,
Cukurova University,
Adana, Turkey
e-mail: info@tupbebekmerkezi.net

Material and method

This article reports on 33 women who underwent the unilateral laparoscopic two-stitch technique for tubal sterilization reversal between December 2001 and October 2006. The study was approved by the university's ethics committee, and an informed consent form was signed by all patients.

Before the sterilization was reversed, a spermogram was performed on male patients and routine infertility diagnostic procedures were performed on female patients (gynecological examination, ovarian reserve test, hysteroscopy, laparoscopy during reversal) during the follicular phase of the women's cycle to rule out the presence of infertility causes other than that of sterilized tubes. In addition to that, blood tests were performed to screen for human immunodeficiency virus (HIV), hepatitis B and hepatitis C, and fasting glucose, and complete blood count (CBC) and a chest X-ray were performed. Six patients were not included in the study because the requirements for tubal reversal were not met during the laparoscopy performed on 39 women. The healthiest looking tube carrying the requirements for anastomosis was chosen for unilateral reversal of the sterilization. The criteria for anastomosis were an isthmic segment of a minimum length of 2–3 cm, starting from the cornual end, the presence of both parts of the ampullar and fimbrial ends of the fallopian tube, a length of tube of more than 4 cm remaining after the operation, and healthy looking fimbria.

The patient was placed in the lithotomy position under general anesthesia. A uterine manipulator was inserted for manipulation and chromotubation. The laparoscopic procedure began with the diagnostic phase, with the insertion of a supra-pubic trocar in the left lower quadrant. If the decision was made to perform laparoscopic tubal anastomosis, one additional 5 mm trocar was placed in the right lower quadrant. The surgical procedure involved transection of the tubal stumps and removal of scar tissue, approximation of the mesosalpinx, anastomosis of the muscle and mucosa, and approximation of the serosal layer.

The proximal stump was grasped with fine forceps and cut with scissors. Proximal tubal patency was determined with methylene blue dye infused through the uterine manipulator. The occluded site of the distal stump was grasped with fine forceps and cut at the most proximal edge.

The proximal and distal ends of the tube were approximated by passing 5/0 Vicryl sutures through the mesosalpinx with a 5 mm needle holder. The mucosal and muscle layer of the tube was sutured with 6/ 0 Vicryl at the 6 o'clock and 12 o'clock positions. The sutures were cut. After each suture, warm lactated Ringer's solution was used to irrigate the operative field. Two or more 5/0 Vicryl sutures were applied to the serosa layer and mesosalpinx, according to the size of the defect. After the anastomosis had been completed, tubal patency was checked by identifying the flow of methylene blue dye. Antibiotics, pain killers and folic acid were prescribed after a mean hospitalization time of 8 h. All patients came to the clinic for a control 5 days after the operation. One month of sexual abstinence was recommended. In vitro fertilization (IVF) was recommended to the patients if pregnancy had not occurred by the time of the 1-year follow-up examination.

Results

The indication for reversal was divorce and subsequent remarriage in 28 cases, while death of a child was the indication in five cases. In most cases there had been a sterilization interval of more than 3 years. The most common type of sterilization was the Pomeroy procedure during C-section, as sterilization after a third cesarean section is very common in Turkey. The majority of patients were below the age of 35 years and the oldest patients were 38 years old.

The demographic data of the patients are shown in Table 1.

The mean operation time was 85 min (range 50–160 min). Isthmico-isthmic anastomosis was performed in six cases, and isthmico-ampullary anastomosis was performed in 27 cases. The mean hospitalization stay was 8 h (range 7–24 h). Twenty (60.6%) patients had an ongoing pregnancy, while one (3%) patient with an isthmic-isthmic anastomosis had an ectopic pregnancy in the de-sterilized tube 3 months after de-sterilization. The mean interval to pregnancy after surgery was 7.35 months (range 3.5–12 months). IVF was recommended to the 13 patients who had not achieved an ongoing pregnancy by the time of the 1-year follow-up examination, and follow-up was stopped (Table 2).

Table 1 The demographic data of the patients

Age	No. of patients
Equal to or less than 35 years (range 24–35 years)	23
Above 35 years (range 36–38 years)	10
Indication for reversal	
Change in marital status	28
Death of a child	5
Sterilization interval	
Less than 3 years	2
Above or equal to 3 years	31
Type of sterilization	
Pomeroy during C-section	25
L/S Yoon ring	3
L/S cautery	5

Table 2 The results of the operations

Parameter	Result
Mean operation time (min)	85 (range 50–160)
Place of anastomosis	
Isthmico-isthmic	6
Isthmico-ampullary	27
Mean pregnancy interval after operation (months)	7.35 (range 3.5–12)
Mean length of hospitalization (hours)	8 (range 7–24)
Pregnancy rate after operation (%)	60.6
Ectopic pregnancy rate after operation (%)	3

Discussion

Garcia [9], Gomel [5] and Winston [6] pioneered microsurgical re-anastomosis of the fallopian tube. The results of microsurgical anastomosis were superior to those of conventional macroscopic reversal.

In 1989 Sedbon et al. [8] reported the first case of unilateral sterilization reversal via laparoscopy, using biological glue as a tissue adhesive and an intraluminal guide wire. After initial enthusiasm, subsequent results were disappointing.

The one-stitch technique [10], two-stitch technique [11], three-stitch technique [12] and four-stitch technique [13] were later performed. Dubuisson and Chapron reported their experiences with single-suture laparoscopic tubal anastomosis. The overall intrauterine pregnancy rate was 53.1% [14]. Using the one-suture technique with vasopressin injection they were able to reduce the operating time to an average of 72 min, as vasopressin is used because it reduces bleeding and allows better visualization [14, 21]. We did not need or use vasopressin in our study, because fine capillary bleeding ceases spontaneously in the presence of a pneumoperitoneum created by carbon dioxide gas. Almost all patients could be discharged on the day of the operation and had no post-operative complications and good fertility outcomes. Reich et al. [15] reported a series of 22 laparoscopic tubal anastomoses with a two-suture technique to approximate the muscularis and endosalpinx of each tubal segment at the 6 o'clock and 12 o'clock positions, respectively. The intrauterine pregnancy rate (35%) was also disappointing in this small series. In our study, we used the two-puncture and two-stitch technique, and our intrauterine ongoing pregnancy rate was 60.6%, with only one ectopic pregnancy (3%), and the mean interval to pregnancy after surgery was 7.35 months, with a range of 3.5 months to 12 months. The one-stitch technique used by Bissonnette et al. resulted in an ongoing pregnancy rate of 65.3%, with an interval from surgery to pregnancy of 5.5 months [29]. The three-stitch technique was used by Çetin et al. in a preliminary study of eight patients, with a pregnancy rate of 50% [17]. Yoon et al. [13] reported 54 cases of four-stitch laparoscopic microsurgical tubal anastomosis. The procedure was identical to microsurgical tubal anastomosis by laparotomy. The overall intrauterine pregnancy rate was 77.5%, and there was only one ectopic pregnancy.

In their 1997 study, Yoon et al. used 6/0 Vicryl sutures on the mesosalpinx and 7/0 or 8/0 Vicryl on the mucosa muscularis layer. In their robotically assisted study, Degueldre et al [26] used 6/0 Prolene sutures for the mesosalpinx and 8/0 Prolene sutures for the mucosa muscularis. The sutures used by Bissonnette et al. [29] were 5/0 Vicryl for the mesosalpinx and 6/0 for the muscularis. The sutures which were used in our study were the same as the ones used by Bissonnette. The use of 5/0 and 6/0 Vicryl sutures was preferred, as they are absorbable and cheaper.

Pregnancy is the only indicator of successful reversal of sterilization.

In order for successful pregnancy rates to be obtained, before the reversal of sterilization, other infertility factors such as male factors and peritoneal factors must be investigated; the patient's general situation (e.g., ovarian reserve) and the length and quality of the remaining tube must be evaluated. Ovarian reserve is a particularly important factor. All our patients and their husbands were examined, but no cause of infertility other than tubal ligation was found.

Many investigators reported that patients above 37 years of age had decreased fecundity [7]; however, Vasquez and co-workers [17] included patients older than 40 years. In our study, age was not a limiting factor. We did not exclude patients according to age; however, most of our patients were younger than 35 years of age.

Another aspect that influences pregnancy rate is the length of the remaining tube. It was reported that, if the remaining tube is >6 cm, the pregnancy rate is significantly increased [18]. In our study, we did not perform laparoscopic tubal sterilization reversal if the remaining tube was shorter than 4 cm and if the isthmic segment starting from the cornual end was shorter than 3 cm. The presence of healthy ampullar and fimbrial ends of the fallopian tube was also a prerequisite. It has been reported that the type of sterilization, such as ligation, Yoon's rings, clips and electrocoagulation, affects the reversal success. The length of damaged tubes is 5–7 mm with clips, 15–20 mm with bipolar and thermocoagulation, 25–50 mm with Yoon ring and above 50 mm with unipolar coagulation [19]. The damage to the tubes must, therefore, be minimal during sterilization for reversal to be successful. In our series, 25 patients had their tubes ligated during a laparotomy for Cesarean section with Pomeroy tubal sterilization, three underwent ligation with Yoon rings and five by electrocautery.

We performed isthmico-isthmic anastomosis in six cases and isthmico-ampullary anastomosis in 27 cases. In the literature, isthmico-isthmic anastomosis is the most successful as regards pregnancy rate [18, 20]. In our study; however, one isthmico-isthmic anastomosis resulted in a tubal ectopic pregnancy, in the tube that had been operated on, 3 months after the operation, and IVF was then recommended to the patient.

We performed reversal in one tube in all our patients. In the study [21] by Yoon et al., it was reported that there was a statistically significant difference in the pregnancy rate between patients who underwent bilateral anastomosis and those who underwent unilateral anastomosis; however, Isaacs et al. and Çetin et al. reported that the pregnancy rates in unilateral or bilateral anastomosis were not different [16, 22]. In addition to that, the patient receives less anesthesia and the surgical team's performance is better during a unilateral anastomosis because of the shortened operation time (success is higher with shorter operation times). Because of these factors we prefer performing unilateral anastomoses even in cases where both tubes appear healthy.

In eight patients undergoing the three-suture technique of Çetin et al. , the mean operation time was 117 min. The mean operation time was 85 min in our series. It is well known that success increases as the learning curve is followed [31]; therefore, our reduced operation time was mainly due to the increased number of cases. The fact that one less stitch was involved only contributed to it slightly. In the study by Yoon et al. [21], the bilateral anastomosis time was initially 240 min, but it later decreased to 120 min. In our study, there were no major or minor complications during or after laparoscopy.

Stadtmauer and Sauer [23] reported preliminary results after using titanium staples. The future of laparoscopic tubal anastomosis may be similar to that of bowel surgery with a stapler. It is possible that tubal staplers will be used and both resection and anastomosis will be performed with the stapler. Laser or robotic techniques have been previously used in animal models to facilitate tubal anastomosis by laparoscopy [24, 25]. Nowadays, the robot which has three-dimentional vision, allows the surgeon to perform ultra-precise manipulations with intra-abdominal articulated instruments. Degueldre et al. performed robotically assisted, laparoscopic, microsurgical, tubal re-anastomosis on eight patients, with an average operation time of 140 min; however, larger series are needed to assess post-operative pregnancy rates [26]. Rodgers et al. compared 26 cases of robotic reversal with 41 cases of mini-laparotomic reversal and concluded that hospitalization times, pregnancy, and ectopic pregnancy rates were not significantly different but that the robotic technique was more costly [27].

In 2005, Wiegerinck et al. performed a retrospective cohort study in which consecutive women who had undergone sutureless re-anastomosis by laparoscopy were compared with women who had undergone microsurgical re-anastomosis by laparotomy. The simplified stitchless laparoscopic procedure for reversal of tubal sterilization with the use of a tubal splint, clip fixation of the muscularis and fibrin glue resulted in a promising pregnancy rate that was similar to that obtained with the microsurgical re-anastomosis by laparotomy [4].

The laparoscopic approach to tubal anastomosis has the advantages of less post-operative discomfort, fewer complications, a smaller incisional scar, shorter recovery time and earlier resumption of normal activities. This could be particularly beneficial for a patient who has had a previous laparotomy or Cesarean section, because this approach allows her to avoid a second laparotomy. Laparoscopic tubal re-anastomosis is a good alternative to classical microsurgery in patients who desire the reversal of tubal sterilization, and it may be considered to be the procedure of choice for surgeons who have extensive experience with tubal anastomosis by laparotomy and advanced laparoscopic techniques [16]. Surgery and ART are complementary approaches that can be used singly or in combination to improve the outcome for couples with tubal infertility [30].

In women older than 40 years, tubal surgery should be offered as an alternative to IVF, as it offers them the opportunity to have an entirely natural pregnancy. In a study, the live birth rate following surgical reversal of sterilization in women aged 40 years or older was 40% [28], while Dubuisson et al. reported it to be 51.4% in a study done in 1995 [32].

In conclusion, laparoscopic tubal sterilization reversal, which is a minimal access surgery, can nowadays be performed successfully and is a highly cost-effective strategy for the previously fertile woman, causing fewer patients to resort to IVF. The sterilization technique must be carefully chosen, so as to cause minimal damage to the tubes to ensure eventual successful sterilization reversal. The number of surgeons skilled in laparoscopic tubal surgery must, therefore, be increased.

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