

# Pregnancy outcome of laparoscopic tubal reanastomosis: retrospective results from a single clinical centre

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## Abstract

**Objective:** Tubal sterilization is a widespread method of contraception. Post-sterilization regret is encountered, despite careful consideration prior to the procedure. Two treatment options are available for women after having had tubal sterilization: microsurgical reversal and IVF treatment. Recent improvements in laparoscopy have allowed tubal reanastomosis to be performed. This study aimed to evaluate the reproductive outcome after laparoscopic tubal reanastomosis and surgical features of the patients.

**Methods:** From June 2007 to January 2010, 27 patients with bilateral tubal ligation who underwent laparoscopic tubal reanastomosis were evaluated retrospectively. Tubal sterilization was performed by Pomeroy's technique during caesarean section in all of the patients. Before surgery, all of the patients were evaluated for possible other causes of infertility and the results of the evaluation were normal.

**Results:** The mean age of the patients was 31.8 years (range, 27–38 years). The mean interval between sterilization and reversal was 5.1 years (range, 1–14 years). Bilateral reversal was achieved in 24 patients. The operation time ranged from 85 to 140 minutes with a mean time of 105 minutes. All of the patients were discharged on the next day. There were no postoperative complications. Overall pregnancy, intrauterine pregnancy, and ectopic pregnancy rates were 55.5% (15/27), 51.8% (14/27), and 3.7% (1/27), respectively. Of the 14 intrauterine pregnancies, one ended with abortion

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at 6 weeks' gestation (1/14). The mean interval from surgery to pregnancy was 270 days (range, 147–420 days).

**Conclusion:** Laparoscopic tubal reanastomosis has the advantages of fewer complications, less postoperative discomfort, a smaller incisional scar, a shorter recovery time, and earlier resumption of normal activities. This technique has a satisfactory pregnancy rate in selected patients who desire reversal of tubal sterilization.

## Keywords

Laparoscopy, tubal reanastomosis, infertility, microsurgery

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## Introduction

Tubal sterilization is a widespread method of contraception. The incidence of post-sterilization regret has been reported to be 3%–8%,<sup>1</sup> despite careful consideration prior to this procedure. Several characteristics of patients have been determined to be predictors of regret. According to a collaborative review of sterilization study, the cumulative probability of expressing regret following tubal sterilization increases as the time after sterilization increases.<sup>2</sup> One of the major risk factors for subsequent regret of sterilization is a young maternal age at the time of sterilization. Other potential factors are death of a child, a change in marital status, and desire to have another child because of improvement of the socio-economic condition of the family.

Two treatment options are available for women after having had tubal sterilization: microsurgical reversal and *in vitro* fertilization (IVF) treatment. The traditional treatment for tubal reversal is microsurgical tubal reanastomosis through a laparotomy. Microsurgical tubal repair, which restores tubal patency, offers couples multiple cycles in which to achieve conception naturally and the opportunity to have more than one pregnancy from a single operation.<sup>3</sup> The results of tubal reversal greatly improved after introduction of microsurgical techniques and the principle of gentle tissue

handling in the early 1970s.<sup>4</sup> Using microsurgical techniques, reported pregnancy rates vary between 57% to 84%, and the associated risk for ectopic pregnancy is 2%–7%.<sup>1</sup> Two factors that are most commonly reported to affect the pregnancy rate after tubal reversal are the woman's age at the time of the reversal and the length of the remaining fallopian tube after reversal.

Recent improvements in laparoscopic microsurgical instruments have allowed tubal reanastomosis to be performed by laparoscopy. Excellent results have been reported after laparoscopic tubal reanastomosis. Reports on the pregnancy rate after laparoscopic tubal reversal have demonstrated as favourable results as those with microsurgical reversal.<sup>5,6</sup>

Therefore, this study aimed to present the results of reproductive outcome of 27 patients who underwent laparoscopic tubal reanastomosis and to describe the surgical technique.

## Materials and methods

We retrospectively evaluated 27 patients with bilateral tubal ligation who were referred for laparoscopic tubal reanastomosis from June 2007 to January 2010. A change in marital status, loss of a child, and desire for a child with a different sex were the reasons that motivated these patients to seek tubal reversal. Tubal

sterilization was performed by Pomeroy's technique during caesarean section in all of the patients. A complete evaluation of fertility potential of each woman who requested tubal reanastomosis, including basic day 3 hormonal analysis, basal ultrasound examinations, and pelvic examinations, was performed. Semen analysis was also performed to show that the male partner was fertile. Those with male factor infertility and whose spouse was not eligible for tubal reversal were not operated on. After receiving institutional review board approval, informed consent was obtained from each participant.

### Surgical technique

The patient was placed in the lithotomy position under general anaesthesia. The bladder was emptied using a Foley catheter, and a V-care<sup>®</sup> uterine manipulator/elevator (Conmed, Utica, NY, USA) was inserted for uterine manipulation and chromopertubation. A 12-mm trocar was placed by direct puncture through an umbilical incision and adequate pneumoperitoneum was achieved with CO<sub>2</sub> gas. A straight, 10-mm, 0-degree telescope with an endoscopic camera system (Karl Storz GmbH & Co. KG, Tuttlingen, Germany) was introduced into the abdominal cavity. The surgical procedure began with a diagnostic phase to check whether laparoscopic tubal reversal was technically feasible, and to evaluate tubal length, the quality of the fimbria, and adhesions. If the tubal length was shorter than 4 cm, or extensive adhesions involving the tube or fimbriectomy were present, the procedure was interrupted. After the initial examination, three 5.5-mm trocars were inserted in the lower abdomen. One of the trocars was placed lateral to the rectus muscle on the right and a pair of trocars were placed lateral to the deep inferior epigastric vessels on the left side. Another trocar was placed in an upper position, which helped to achieve

an ergonomic position and comfort in suturing. All of the instruments used for suturing and tissue dissection, such as forceps, microscissors, graspers, and needle holders (Karl Storz endoscopy), were 5 mm in size.

Anastomosis was performed by the four-stitch technique. The main steps of the procedure were as follows. Methylene blue dye was injected through the intrauterine cannula for identifying the obstructed area, transection of the tubal stumps, and removal of scar tissue at least 5 mm away from the obstructed area to obtain normal ciliary function. This was followed by identification of the tubal opening by injection of methylene blue. The mesosalpinx was then reapproximated using 6-0 polyglactin 910 (Vicryl; Ethicon, Turkey) after tubal catheterization from the distal to the proximal ends over an 18G epidural catheter. Anastomosis of the tube (taking up the serosa and muscularis in one layer) was performed by using three more stitches with the same suture material placed at the 3-, 9-, and 12-o'clock positions. After anastomosis was complete, tubal patency was checked by identifying the flow of methylene blue dye through the fimbria.

All of the patients were discharged on the next day and they were advised to avoid pregnancy for the next 2 months. A hysterosalpingogram (HSG) was performed 1 year after surgery to assess tubal patency if pregnancy was not achieved.

All statistical analyses were performed using SPSS for Windows version 17.0 (SPSS Inc., Chicago, IL, USA). Data are expressed as means, medians, standard deviations, and percentages. We used the Student's *t*-test to compare group means and Fisher's exact test to compare proportions. A *P* value of < 0.05 was considered significant.

### Results

A total of 27 patients underwent laparoscopic tubal reanastomosis from June 2007

to January 2010. A new spouse (16 patients), loss of a child (6 patients), and desire of a child with a different sex (5 patients) were the reasons for performing tubal reversal. The mean age of the patients was 31.8 years (range, 27–38 years). All of the patients who applied for tubal reversal underwent post-partum tubal ligation. Tubal sterilization was performed by Pomeroy's technique during caesarean section, which is the most frequently used method in Turkey. The mean interval between sterilization and reversal was 5.1 years (range, 1–14 years). The patients were followed for a minimum of 36 months. The operation time ranged from 85 to 140 minutes with a mean time of 105 minutes (Table 1). Postoperative follow-up was uneventful in all patients.

Bilateral reversal was achieved in 24 patients. In three patients, only one-sided reversal could be performed because the tube was extremely short on the other side. HSGs were performed 1 year after surgery if pregnancy was not achieved. HSGs of 12 patients who could not become pregnant showed patent fallopian tubes. None of those patients could achieve spontaneous pregnancy during the course of follow-up. Overall pregnancy, intrauterine pregnancy, and ectopic pregnancy rates were 55.5% (15/27), 51.8% (14/27), and 3.7% (1/27), respectively (Table 2). Of the 14 intrauterine

pregnancies, one ended with abortion at 6 weeks' gestation (1/14). The mean interval from surgery to pregnancy was 270 days (range, 147–420 days).

Of the three patients in whom one-sided reversal was performed, only one became pregnant after 420 days. There were no significant differences in age and tubal length between patients who could become pregnant and those who could not.

## Discussion

In the last 3 decades, microsurgical tubal reanastomosis has been offered to patients with tubal ligation who desired pregnancy.<sup>7</sup> Using microsurgical techniques, reported pregnancy rates vary between 57% and 84%,<sup>8,9</sup> with a risk for ectopic pregnancy of 2% to 7%. Several factors affect the pregnancy rate of patients who have tubal reanastomosis. Age at the time of tubal reversal is the most important factor in the outcome of tubal reanastomosis. In the absence of another major cause of infertility, women who are younger than 35 years of age at the time of reversal can anticipate a cumulative intrauterine pregnancy rate of greater than 70%. In these women, most pregnancies occur within 18 months after surgery.<sup>10</sup> The remaining total tubal length appears to be one of the prognostic factors of tubal reanastomosis. Poor results have been reported when the total tubal length was shorter than 4 cm.<sup>7</sup> The method of

**Table 1.** Characteristics of the patients, tubal sterilization, and reversal procedure

Characteristics	
Reasons for desire of tubal reversal (n)	
New spouse	16
Loss of a child	6
Desire for a child with a different sex	5
Age, years (mean, range)	31.8 (27–38)
Interval between sterilization and reversal, years (mean, range)	5.1 (1–14)
Operation time, min (mean, range)	105 (85–140)

**Table 2.** Results of the reversal procedure

Successful reversal of tubes (n)	
Bilateral	24
Unilateral	3
Overall pregnancy rate (n, %)	15 (55.5)
Intrauterine pregnancy rate (n, %)	14 (51.8)
Ectopic pregnancy rate (n, %)	1 (3.7)
Interval from surgery to pregnancy, days (mean, range)	270 (147–420)

sterilization and the site of tubal anastomosis do not appear to affect the outcome.<sup>11,12</sup>

A laparoscopic approach of this procedure was introduced by Sedbon et al.<sup>13</sup> in 1989 using biological glue and an intraluminal guidewire. Since then, several techniques have been reported with different pregnancy rates (PRs). In 1993, Reich et al.<sup>14</sup> reported a series of 22 laparoscopic tubal anastomoses with the two-suture technique. The PR was 35% in their study. Yoon et al.<sup>8</sup> reported 54 cases of laparoscopic microsurgical reanastomosis. The overall PR was 77.5% and there was one case of ectopic pregnancy. However, the operative time ranged from 3–5 hours early in their series. Dubuisson's research group reported their experience with single-suture laparoscopic tubal reanastomosis in 1998. The overall intrauterine PR was 53.1%. The operative time was reduced to an average of 72 minutes.<sup>15</sup> Bissonnette et al.<sup>16</sup> reported an intrauterine PR of 65.3% in 102 patients using the one-suture technique. Yoon et al.<sup>11</sup> performed anastomosis of the tube in two layers, with four sutures in each layer. They reported an intrauterine PR of 82.8% in 202 patients. The mean operative time in their study was 140 minutes. However, Ribeiro et al.<sup>7</sup> reported a PR of 56.5% in 2003. They used conventional 5-mm laparoscopic instruments and a one-chip camera, and performed the anastomoses in a single plane, including the muscularis and serosa in one layer.

The surgeon's experience affects success of tubal reversal. Laparoscopic tubal reversal is a challenging surgery, it requires a qualified surgical skill, and is considered as an advanced laparoscopic surgery. However, surgical techniques and instruments may also play an important role. The telescopic view angle, the size of laparoscopic instruments, the type of suture material, and use of cautery may also affect the pregnancy outcomes, as well as presurgical tubal anatomy. There is no agreement on

these issues in previous published studies. Different surgical techniques and their different modifications have been described.

Sedbon et al.<sup>13</sup> first reported sutureless laparoscopic tubal deesterilization using biological glue, as mentioned above. However, although success rates similar to those of microsurgical tubal anastomosis have been reported,<sup>17</sup> this method is not widely used. When we evaluated the surgical techniques that were used in previous studies, we found that Dubuisson and Chapron<sup>15</sup> and Bissonetti et al.<sup>16</sup> preferred single-suture laparoscopic tubal reanastomosis. Yoon et al.<sup>8</sup> used two layers of four stitches followed by an intermittent serosal suture, and Ribeiro et al.<sup>7</sup> used the one-layer four-stitch technique. We adopted a single-layer surgical technique similar to Ribeiro et al.'s, but performed Yoon et al.'s surgical steps. In Yoon et al.'s method, the authors used dilute vasopressin that infiltrated into the mesosalpinx for haemostasis and hydrodissection. After they grasped the proximal stump with a fine pair of forceps, they cut it transversely. Patency was determined by tubal lavage of indigo carmine dye, which was infused through a uterine manipulator. The occluded site of the distal stump was held with forceps and cut perpendicularly at the most proximal edge. The scar tissue was resected with a microneedle electrode or microscissors until the luminal diameters were equalized. The mesosalpinx was sutured with 6-0 polydioxanone using a 5-mm microneedle holder and each suture was tied intracorporeally with three throws. They first sutured the 6-o'clock site of the proximal segment of the mucosa from the outer to inner direction. The distal tube was then sutured from the inner to outer direction, aligning the mucosa and typing with three throws, and placing the knot outside the tubal lumen. They placed the 12-o'clock suture from the distal tube to the proximal tube and cut the suture, leaving approximately 2–3 cm untied to facilitate placement

of the other sutures. The 9-o'clock and 3-o'clock sutures were placed and tied, and finally the 12-o'clock suture was tied. In their study, the muscle layer of the tube was sutured with 7-0 polydioxanone. After they completed anastomosis of the muscle layer, they checked tubal patency by identifying the flow of indigo carmine dye through the fimbriae. Finally, they approximated the serosal layer with 6-0 polydioxanone interrupted sutures. Between each suture, warm lactated Ringer's solution was used to irrigate the operative field.

Diluted vasopressin was not used in our study and we only used a microneedle electrode for haemostasis. The mucosal and muscle layers were passed together with one suture. In previous studies, suture materials of different sizes (ranging from 4-0 to 7-0) and characteristics (polyglactin, polydioxanone, etc.) were also used. We only used 6-0 polyglactin 910 in all surgical stages related to the tuba uterina. Another important point in the success of tubal reversal in laparoscopic microsurgery is the size of the instruments. Remote suturing with large instruments can make the operation difficult and can extend the operation time, even if they are in 3 mm in size. Because there are no 3-mm trocars in our hospital, conventional 5-mm laparoscopic instruments and camera systems were used in our patients. In many previous studies, 5-mm forceps and microneedle holders were used, but the pregnancy rate was not higher in studies that used instruments with a diameter of 3 mm.<sup>18</sup>

The most frequently encountered difficulty during tubal surgery is extensive separation in the mesosalpinx. We have overcome this situation by applying more sutures to reduce tissue tension. As confirmed by recently published series on laparoscopic tubal reanastomosis, favourable results were achieved regarding the PR compared with classic microsurgery by laparotomy. Our study showed an overall pregnancy rate of 55.5%, which is in

accordance with previous reports. However, our pregnancy rate was slightly below average success, although it was in the normal range. The mean operative time was 105 minutes. This finding can be explained by instrumental limitations and surgical technique and experience.

The other treatment option for women who wish to become pregnant after having had tubal sterilization is IVF. The European IVF-monitoring program showed a pregnancy rate per IVF cycle of nearly 27% in patients who were submitted to IVF in 521 Human Reproduction Centres in 18 countries in Europe.<sup>19</sup> In the United States, better results have been achieved, reaching 36.5% per IVF cycle.<sup>20</sup> This shows that pregnancy outcomes of tubal reversal are better than those that are obtained from IVF techniques. Furthermore, these procedures are associated with a significant increase in multiple pregnancy rates. Prenatal morbidity and mortality are markedly increased in pregnancies that are complicated by multiple gestations. Notably, monofoetal pregnancies resulting from IVF are associated with an elevated risk compared with non-assisted reproduction singleton pregnancies. More than 10% of monofetal births are preterm and the perinatal mortality rate is higher than that of non-assisted reproduction singleton pregnancies.<sup>21</sup> The advantage of IVF is that success or failure is recognized during the same treatment cycle. IVF allows cryopreservation of good-quality embryos, which permits another replacement cycle. This is an important aspect for women in advanced reproductive age. However, after surgery, time is required to achieve pregnancy, leading to some anxiety for couples. Therefore, treatment should be individualized based on findings resulting from investigation of couples, their wishes, and the costs involved. Tubal reversal should be considered as a first-line treatment option for young women <35 years old without other infertility factors.



This was a retrospectively designed descriptive study with relatively few patients. Therefore, the number of patients was too small to reach statistical significance for defining predictors of pregnancy outcomes in patients who underwent laparoscopic tubal reanastomosis. However, although our mean follow-up time was shorter, our success rates are consistent with the literature.

In conclusion, laparoscopic tubal reanastomosis has the advantages of fewer complications, less postoperative discomfort, a smaller incisional scar, a shorter recovery time, and earlier resumption of normal activities compared with classic microsurgery. Our study showed that the overall pregnancy rate was 55.5% and the average time to achieve pregnancy was 9 months following laparoscopic tubal reanastomosis. We consider that this technique is a good alternative to classic microsurgery in patients who desire reversal of tubal sterilization with favourable PR's.

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### Declaration of conflicting interest

The Authors declare that there is no conflict of interest.

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### References

- Gordts S, Campo R, Puttemans P, et al. Clinical factors determining pregnancy outcome after microsurgical tubal reanastomosis. *Fertil Steril* 2009; 92: 1198–1202.
- Schmidt JE, Hillis SD, Marchbanks PA, et al. Requesting information about and obtaining reversal after tubal sterilization: findings from the U.S. collaborative review of sterilization. *Fertil Steril* 2000; 74: 892–898.
- Gomel V. Reversal of tubal sterilization versus IVF in the era of assisted reproductive technology: a clinical dilemma. *Reprod Biomed Online* 2007; 15: 403–407.
- Gomel V. Salpingo-ovariolysis by laparoscopy in infertility. *Fertil Steril* 1983; 40: 607–611.
- Cha SH, Lee MH, Kim JH, et al. Fertility outcome after tubal anastomosis by laparoscopy and laparotomy. *J Am Assoc Gynecol Laparosc* 2001; 8: 348–352.
- Tan HH and Loh SF. Microsurgical reversal of sterilisation - is this still clinically relevant today? *Ann Acad Med Singapore* 2010; 39: 22–26.
- Ribeiro SC, Tormena RA, Giribela CG, et al. Laparoscopic tubal anastomosis. *Int J Gynaecol Obstet* 2004; 84: 142–146.
- Yoon TK, Sung HR, Cha SH, et al. Fertility outcome after laparoscopic microsurgical tubal anastomosis. *Fertil Steril* 1997; 67: 18–22.
- Kim SH, Shin CJ, Kim JG, et al. Microsurgical reversal of tubal sterilization: a report on 1,118 cases. *Fertil Steril* 1997; 68: 865–870.
- Gomel V and McComb PF. Microsurgery for tubal infertility. *J Reprod Med* 2006; 51: 177–184.
- Yoon TK, Sung HR, Kang HG, et al. Laparoscopic tubal anastomosis: fertility outcome in 202 cases. *Fertil Steril* 1999; 72: 1121–1126.
- Rouzi AA, Mackinnon M and McComb PF. Predictors of success of reversal of sterilization. *Fertil Steril* 1995; 64: 29–36.
- Sedbon E, Delajolineres JB, Boudouris O, et al. Tubal desterilization through exclusive laparoscopy. *Hum Reprod* 1989; 4: 158–159.
- Reich H, McGlynn F, Parente C, et al. Laparoscopic tubal anastomosis. *J Am Assoc Gynecol Laparosc* 1993; 1: 16–19.
- Dubuisson JB and Chapron C. Single suture laparoscopic tubal re-anastomosis. *Curr Opin Obstet Gynecol* 1998; 10: 307–313.

16. Bissonnette F, Lapensée L and Bouzayen R. Outpatient laparoscopic tubal anastomosis and subsequent fertility. *Fertil Steril* 1999; 72: 549–552.
17. Schepens JJ, Mol BW, Wiegerinck MA, et al. Pregnancy outcomes and prognostic factors from tubal sterilization reversal by sutureless laparoscopic re-anastomosis: a retrospective cohort study. *Hum Reprod* 2011; 26: 354–359.
18. Ai J, Zhang P, Jin L, et al. Fertility outcome analysis after modified laparoscopic microsurgical tubal anastomosis. *Front Med* 2011; 5: 310–314.
19. Nygren KG and Andersen AN; European IVF-monitoring programme (EIM). Assisted reproductive technology in Europe, 1998. Results generated from European registers by ESHRE. European society of human reproduction and embryology. *Hum Reprod* 2001; 16: 2459–2471.
20. Assisted reproductive technology in the United States: 1997 results generated from the American society for reproductive medicine/society for assisted reproductive technology registry. *Fertil Steril* 2000; 74: 641–653.
21. Rufat P, Olivennes F, de Mouzon J, et al. Task force report on the outcome of pregnancies and children conceived by in vitro fertilization (France: 1987 to 1989). *Fertil Steril* 1994; 61: 324–330.