

Laparoscopic tubal sterilization reversal and fertility outcomes

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ABSTRACT

PURPOSE: The purpose of the study was two-fold. Firstly it was to assess the suitability for tubal recanalization and factors predicting successful laparoscopic recanalization. Secondly, it was to analyze the fertility outcomes and factors affecting the pregnancy rate following laparoscopic tubal recanalization. **MATERIALS AND METHODS:** A retrospective chart review of prospectively followed-up 29 women at a tertiary care center seeking tubal sterilization reversal between May 2005 and February 2010 were included. **RESULTS:** In 14 (48.3%) women unilateral tubes were suitable and in only 3 women (10.3%) bilateral tubes were suitable. All cases with laparoscopic tubal sterilization were suitable, whereas all cases with fimbriectomy were unsuitable for recanalization. In 6 (20.7%) cases salphingostomy was performed as an alternative procedure to tubal reanastomosis. The overall pregnancy rate was 58.8%. In cases with sterilization by Pomeroy's method, 4 out of 10 (40%) conceived, whereas for laparoscopic tubal ligation cases 6 out of 7 (85.7%) conceived ($P=0.32$). None of the patients with final tubal length <5 cm conceived ($P=0.03$). Comparing the age at recanalization, in women ≤ 30 years, 71.4% conceived, as compared with 50% when age of women was more than 30 years ($P=0.37$). **CONCLUSIONS:** The important factors determining the success of recanalization are technique of sterilization and the remaining length of the tube after recanalization. The gynecologist must use an effective technique of sterilization to minimize the failure rates, but at the same time, which causes minimal trauma, and aim at preserving the length of the tube so that reversal is more likely to be successful, should the patient's circumstances change.

KEY WORDS: Fimbriectomy, pregnancy rate, sterilization reversal, tubal recanalization

INTRODUCTION

Although wide ranges of contraceptive options are available, tubal sterilization is currently the most popular form of birth control. It is an important constituent of National Family Planning Program in India. Tubal sterilization is being done from primary health center to the tertiary care centers in the government sector and also at private institutions and nursing homes. According to NFHS-3 (2005–2006), female sterilization accounted for 37.3% of all methods of family planning used in the country.^[1] This is influenced by the economic compensation being given and according to a survey data, 64% women stated, they would like to go for tubal sterilization at some time in future.^[2]

The method of tubal sterilization varies according to the expertise available from

fimbriectomy to classical Pomeroy's to laparoscopic sterilization.^[3] More than 45.5% women undergoing sterilization are between 20 and 25 years of age. Although it is done as a permanent method of sterilization, due to unforeseen circumstances, 1%–3% of these women subsequently demand reversal of sterilization.^[4] There are no studies from the country trying to look at the rate of successful recanalization procedures based on the type of sterilization performed.

Conventionally, the gold standard for recanalization has been microsurgical tubal recanalization through the laparotomy route. Minimally invasive laparoscopic microsurgery has introduced a new dimension for tubal reconstruction as the magnification obtained is similar to that obtained with an operating microscope. The major advantage is short postoperative stay

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duration with minimal tissue handling, less postoperative adhesions. With the emergence of expertise in advanced laparoscopy techniques, many western centers have demonstrated success through laparoscopy and this has been widely regarded as the alternative route to perform microsurgical reversal of a ligated tube.^[5] There are no studies from India looking at fertility outcome after laparoscopic tubal recanalization.

Objectives

1. To assess the suitability for reversal and analyze the factors predicting successful laparoscopic recanalization.
2. The safety of laparoscopic tubal sterilization reversal.
3. To assess the fertility outcome after laparoscopic sterilization reversal procedure.
4. To analyse the factors affecting pregnancy rate after a successful recanalization.

MATERIALS AND METHODS

Study setting and design

This study was carried out at a tertiary care center. The patients were referred to this clinic from the area and also adjoining states. This was a retrospective chart review of prospectively followed-up patients from the database of the institute. All the patients assessed for tubal sterilization reversal between May 2005 and February 2010 were included.

Before the operation, the patients were thoroughly interrogated, examined, and investigated. A detailed counselling of both husband and wife was done regarding the procedure of recanalization and also that the procedure will be performed only if the tubes are suitable for reanastomosis and if the available tubal length is adequate. Also, they were counseled regarding the success rate and the complications after recanalization and the alternative option of *in vitro* fertilization. Apart from routine investigations for major surgery, a baseline evaluation was done to rule out other factors contributing to infertility, including husband's semen analysis. The informed consent was taken from all the patients.

Tubal recanalization procedure

The tubal sterilization reversal procedures were performed by laparoscopy under general anesthesia. First the status of the tubes was evaluated and the suitability of the tubes for recanalization was decided (by KJK). Depending on the suitability of the tubes for recanalization, the laparoscopic tubal reanastomosis was performed either unilaterally, bilaterally, or not performed at all. End to end tubal anastomosis was performed by two-layer closure using no 7-0 prolene. First four sutures at 6, 3, 9, and 12 o'clock were taken in the muscularis layer and then the serosal

stitches were taken. Hemostasis was achieved by precise electrocoagulation by bipolar cautery and injection of diluted vasopressin to mesosalpinx. The patency was assured intraoperatively by methylene blue injection. The patients were discharged on the second day of surgery.

Postprocedure follow-up

They were asked to come for follow-up personally after 2 weeks and then subsequently every 3 months or earlier if needed. Whenever the patients failed to come for a review, they were interviewed over the telephone. All the patients were followed-up for a period of 3 years after recanalization.

After successful recanalization, the patients were advised to try for conception from the next cycle. The patients in whom recanalization procedure was not performed due to unsuitability of tubes, the option of *in-vitro* fertilization (IVF) and adoption were discussed. All the patients after recanalization were asked to achieve conception naturally or if they failed to conceive after a year they were offered intrauterine insemination.

Outcome measures

The outcome measures studied were the suitability of the tubes for the recanalization procedure analyzed for the technique of sterilization performed previously and the interval between sterilization and reversal procedures. The procedure of reanastomosis performed and the anatomical site of anastomosis was analyzed for the technique of sterilization performed initially. Also the pregnancy outcome was analyzed for the technique of sterilization initially performed, location of anastomosis, tubal length, and age of the patient.

Statistical analysis

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

RESULTS

29 women, seeking tubal sterilization reversal during the study period were included in the analysis. The mean age was 32.9 years (standard deviation [SD] 4.8; range 24-42). Of the total, 18 women (62.1%) had all vaginal deliveries, 9 (31%) had all cesarean deliveries, and 2 (6.9%) had both vaginal and cesarean deliveries. The timing of sterilization was postpartum in 10 (34.5%), interval sterilization in 9 (31%). In 8 (27.6%) women sterilization was performed along with LSCS, and in 2 (6.9%) sterilization was done along with medical termination of pregnancy. The most

common procedure of sterilization was Pomeroy's sterilization in 16 (55.2%) women, while laparoscopic tubal sterilization was performed in only seven (24.1%) women. Remaining 6 (20.7%) women had fimbriectomy as the method of sterilization performed.

Tubal recanalization

The mean interval between sterilization and recanalization was 6.10 years (SD 4.0; range 1–16). The main reason for seeking sterilization reversal was death (65.5%) or disability (6.9%) of one or more children. In the remaining 27.6%, second marriage was the reason for sterilization reversal. Assessments for suitability showed that in majority of women, that is, 14 (48.3%) unilateral tubes were suitable and in 3 women (10.3%) bilateral tubes were suitable. All cases with laparoscopic tubal sterilization had one or both tubes suitable for recanalization. In contrast, all cases with fimbriectomy as method of sterilization were unsuitable for recanalization [Figure 1]. Recanalization was done unilaterally in 14 (48.3%) cases [Table 1] and bilaterally in 3 (10.3%) cases and the procedure could not be performed in 12 (41.4%) cases. In 6 (20.7%) cases salpingostomy was performed as an alternative procedure to tubal reanastomosis [Table 2]. These were 5 cases with fimbriectomy performed as sterilization procedure and 1 case with Pomeroy's sterilization. In the remaining 6 patients with unsuitable tubes (5 had Pomeroy's sterilization and 1 had fimbriectomy), the procedure was cancelled [Figure 2]. The status of tubes in all the unsuitable cases is shown in Table 3. Thus, an effective procedure of tubal reanastomosis was performed in only 58.6% cases. The mean length achieved after recanalization in cases with Pomeroy's sterilization was 6 cm (SD 1.24), whereas that for cases with laparoscopic tubal ligation was 7.3 cm (SD 0.9). The type of anastomosis performed was isthmo-ampullary in 10 cases (58.82%), isthmo-isthmic in 4 cases (23.5%), cornuo-isthmal in 2 cases (11.7) and ampullo-ampullary in a single case. In one case with cornuo-isthmal anastomosis, medial end patency was established after hysteroscopic cannulation. In 5 cases (31.5%) with Pomeroy's sterilization, anastomosis could not be done. The type of anastomosis as subclassified according to the type of sterilization is shown in Figure 3. None of these patients had any intraoperative, anesthesia-related or postoperative complications. All the patients were discharged on the second day of surgery.

Postprocedure fertility outcome

At median follow-up of 28 months, 10 (58.8%) became pregnant. The mean interval between recanalization and pregnancy was 6.5 months (SD 4.1). Of these 4 had undergone isthmo-isthmic anastomosis and 6 had isthmo-ampullary anastomosis. Out of these 2 had ectopic pregnancies, 2 are ongoing intrauterine pregnancy and other delivered at term. In cases with sterilization by

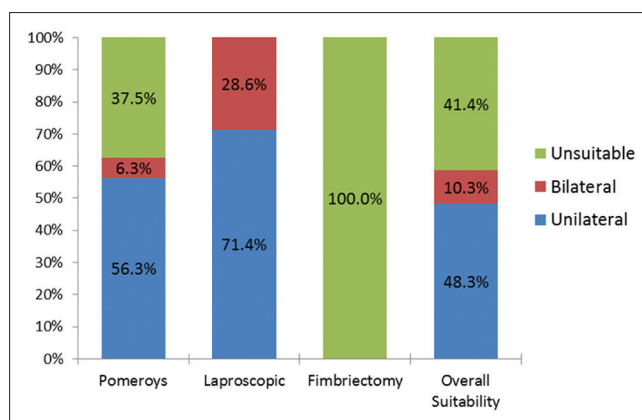


Figure 1: The suitability for reversal according to the technique of sterilization

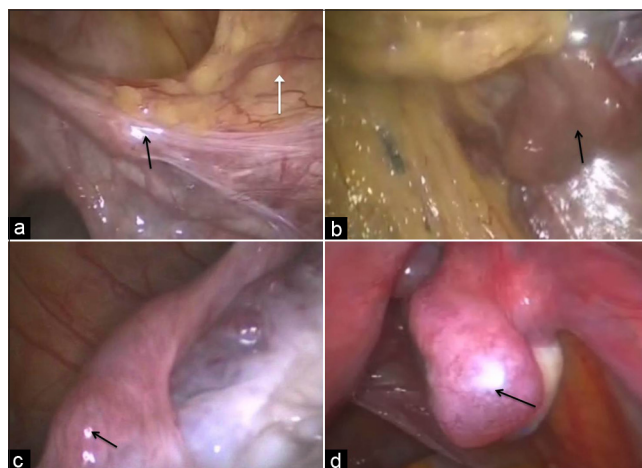


Figure 2: The status of tubes in unsuitable cases with Pomeroy's sterilization. (a, b) Status of left tube in a patient. (a) Medial end is 3–4 cm (black arrow), omental adhesions are seen laterally (white arrow); after adhesiolysis (b) only small fimbrial end, which could not be anastomosed. (c) Only long medial end seen (black arrow); lateral end and fimbria not seen. (d) Lateral end showing hydrosalpinx, fimbria not seen

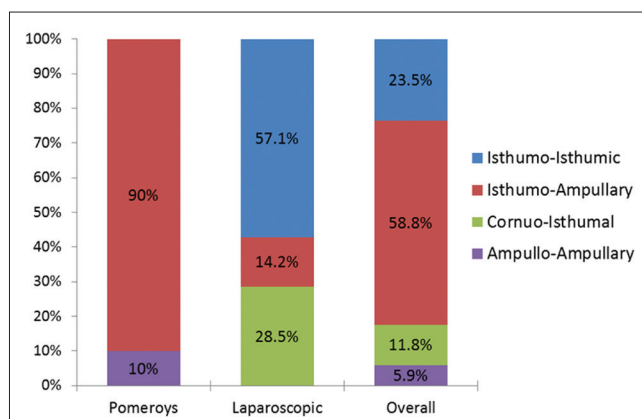


Figure 3: The type of anastomosis subclassified across the technique of sterilization

Pomeroy's method 4 out of 10 (40%) conceived, whereas for laparoscopic tubal ligation cases 6 out of 7 (85.7%) conceived ($P=0.32$). In cases where recanalization was done bilaterally, 2 (67%) conceived, whereas for unilateral recanalization

Table 1: Status of other tube in cases where procedure was done unilaterally

Status of other tube
Fibrosed tube
Partial fimbriectomy
Medial end 1 cm, lateral end only fimbria
Medial end not seen, only fimbrial end seen
Tube absent
Medial end 3 cm, lateral end only fimbria
Lateral end only fimbria with omental adhesions
Lateral end only fimbria with adhesions
Peritubal adhesions

Table 2: Status of tubes in cases where salphingostomy was performed

Status of tubes bilaterally
3–4 cm, Medial stump only
6–7 cm, Ampulla and fimbria absent
Medial 4–5 cm, only fimbria seen laterally
Only medial stump 3 cm
3–4 cm, Medial stump only
Medial 7–8 cm, fimbria absent

Table 3: Status of tubes in cases where the procedure was not done

Right tube	Left tube
Medial 2 cm, fimbriae adherent	Medial 2 cm, lateral end not seen
Fimbriectomy with dense adhesions	Fimbriectomy with dense adhesions
Length 7–8 cm, ampullae deficient, fimbriae agglutinated	Length 8 cm, ampullae dilated, fimbriae adherent
Medial 4 cm, lateral end not seen	Medial 3 cm, fimbriae close to ovary and adherent
Medial 4–5 cm, fimbriae buried in adhesion, adhesiolysis done, but fimbriae so small that cannot be anastomosed	Medial 1–2 cm, laterally only fimbriae seen
Medial 2 cm, no fimbria seen, lateral end hydrosalphix	Medial 2 cm, few fimbriae seen adherent to ovary

8 (57.8%) conceived. None of the patients with final tubal length <5 cm conceived ($P=0.03$). Comparing the age at recanalization, in women ≤ 30 years, 71.4% conceived, as compared with 50% when age of women was more than 30 years ($P=0.37$). None of the patients undergoing neosalphingostomy conceived. Two of the 12 patients, who were unsuitable for recanalization, opted for *in vitro* fertilization. One patient conceived after IVF and had twin pregnancy and delivered at term.

DISCUSSION

Although tubal sterilization is done as a permanent contraception method, few unfortunate women may seek reversal later. In the current study, the most common reason for seeking reversal was death or disability of child

(72%) followed by second marriage (28%). This is similar to previous studies from India.^[6,7] On the contrary, the most common reason for regretting sterilization in the developed countries was the desire to have children from a new husband.^[3]

In India tubal sterilization is done in private nursing homes as well as government hospitals, from remotest public health center to the tertiary care center using different techniques. There are no studies assessing the suitability for reversal, majority of the studies include only the suitable cases and follow their outcome.^[6,8] In this scenario, this study is unique, trying to compare the suitability of reversal across different procedures. In the current study, significant proportion, that is, 42% patients were unsuitable for reversal, in contrast to a study from Belgium, where only 18% of the cases were unsuitable for surgical reversal.^[9] In the current study, three-fourth patients had Pomeroy's sterilization/fimbriectomy as the technique of sterilization. The technique of fimbriectomy as described by Kroener is considered as the most effective method of sterilization with minimal failure of sterilization method.^[10] In India tubal ligations are performed as part of the national family planning program. There are medicolegal and social issues related to the failure of the procedure hence in most centers across the country, gynecologists perform fimbriectomy, or remove long segments of the tubes during Pomeroy's sterilization making them unsuitable for recanalization in future. Although laparoscopic sterilization is more conservative and an equally effective technique, most of the centers do not have the instruments and expertise to perform the above. Reversal of fimbriectomy by neosalphingostomy has been reported^[11] to result in pregnancies, but in our 6 patients in whom, salphingostomy was performed, none of the patients conceived.

The overall suitability for reversal and final mean length achieved was better for sterilization performed by laparoscopic fallope ring application (100%) as compared with Pomeroy's method (62.6%). The results are concordant with the current literature.^[6,12] Our study confirmed the importance of tubal length in terms of live birth rates. None conceived when the length was <5 cm. The literature also supports the same, and a previous study reported 100% pregnancy rate with >4 cm and 0% with <3 cm of the tubal length after tubal reversal by microsurgical technique.^[13]

The pregnancy rate was better for laparoscopic sterilization by Falope ring (85.7%), as compared with those with Pomeroy's procedure (40%). The Pomeroy's method of combined ligation and excision usually removes 3–4 cm of the isthmic or ampullary portion of the tube and can be even more at times.^[13] Such a drastic decrease in postreversal tube length is bound to manifest as poor pregnancy rate. In studies from other countries, the sterilization is routinely

performed by application of rings or clips and it is accepted that mechanical occlusion by Filshie clips should be the method of choice for tubal occlusion as it destroys a smaller part of the tube and the reversal, if performed subsequently, is more likely to succeed.^[14] The results caution us about the need to adapt appropriate procedure with minimal tissue handling during tubal sterilization. To the patient contemplating reversal, today one clip or falope ring at the mid-isthmus portion of each fallopian tube offers the best hope because the success of reversal is related, firstly, to the length of the tube remaining and, secondly, to the site of the anastomosis. "Cut and tie" surgical methods and unipolar diathermy often destroy a substantial length of the tube.^[15]

Several studies on microsurgical reversal reported delivery rates ranging from 50% to 87%. A recent study reported 40% and 53% cumulative pregnancy rates at 6 and 12 months, respectively, for open microsurgery vs 55% and 71% for laparoscopic microsurgery. Our results compare quite favourably with a pregnancy rate of 53% at a median follow-up of 28 months. The fertility outcomes after laparoscopic recanalization are comparable to other studies from our country in which reversal is done by microsurgical methods.^[6,12] The laparoscopic approach potentially involves less manipulation of intraperitoneal organs and causes less bleeding.^[16,17] These advantages may result in fewer adhesions further enhancing the pregnancy rate and is a preferred technique in many centers.

The limitations of the study are its retrospective nature, small group to arrive at a statistically significant result, and a relatively short follow-up period.

CONCLUSION

The gynecologist must use an effective technique of sterilization to minimise the failure rates, but at the same time, which causes minimal trauma, and aim at preserving the length of the tube so that reversal is more likely to be successful, should the patient's circumstances change.

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