Microsurgical Reversal of Tubal Sterilization: Factors Affecting Pregnancy Rate, With Long-Term Follow-Up

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Among 48 women with long-term follow-up after microsurgical reversal of tubal sterilization, the pregnancy rate correlated closely to the length of tube on the longest side. Aside from an accurate anastomosis, no other factor significantly affected pregnancy rate. *(Obstet Gynecol 64:679, 1984)*

There have been many papers reporting improved pregnancy rates after microsurgery for reversal of female sterilization.[1–7] However, in most series the factors that might lead to a greater chance of normal intrauterine pregnancy (and therefore how patient selection might have affected the success rate) are not clear. In 1979 the authors proposed that the most significant factor affecting the likelihood of pregnancy may be the total length of tube on the longest side, assuming a technically accurate microsurgical anastomosis.[8] The anatomic site of anastomosis, the length of the isthmus or the ampulla, and the duration of time since the sterilization had no significant impact on the likelihood of pregnancy. Similar findings have been noted by others.[6,9]

Presented is four to seven years of follow-up on the authors' first 48 consecutive patients who underwent microsurgical reversal of sterilization. From the start of the series, no preconditions for patient selection were made, except that fimbriectomy patients were excluded from surgery.

Materials and Methods

Forty-eight women underwent microsurgical reversal of their tubal sterilization. Total tubal length, ampullary length, and isthmic length were measured at the completion of each procedure. When tubal length on each side differed, the patient was classified according to the longest side. No patient was turned down because of "short tubes," adhesions, or anticipated operative difficulty. Only patients known to have had fimbriectomy were excluded. Most patients had undergone laparoscopic monopolar cauterization, several had undergone either Irving or Pomeroy procedures, and a few had had Fallope ring sterilization. Two patients were undergoing rereversal because of failure of a previous attempt at tubal reversal elsewhere. Several patients had been turned down for surgery elsewhere because of short tubes, short ampulla, age, or apparent difficulty. To assure that no preselection could take place, none of the patients were subjected to laparoscopy. This was truly an unselected, unbiased series.

The first 14 patients had a hysterosalpingogram performed between six weeks and six months postoperatively, revealing patent oviducts in all. Thereafter, hysterosalpingograms were not performed unless the patient failed to conceive after several years.

Microsurgical techniques that were used have been described by the authors.[4] However, there have been a few subsequent modifications. Heparinized saline is now routinely used for irrigation to limit the formation of fibrinous adhesions. Pitressin is routinely injected into the cornual stump to minimize operative bleeding when a cornual anastomosis is being performed. With ampullary-cornual anastomosis, the ampullary end is now more carefully tailored to an opening equivalent in size to the cornual lumen (Figures 1 and 2).

For all anastomoses, 9-0 monofilament nylon interrupted sutures were used for the mucosa. For the serosa, 7-0 monofilament nylon interrupted sutures were used. The first suture was placed posteriorly at the 6 o'clock position, and subsequent sutures at 4 and 8 o'clock. Then three more mucosal sutures were placed anteriorly to complete the accurate mucosa-to-mucosa alignment. Hemostasis was obtained with meticulous bipolar cautery using microforceps. Adhe-

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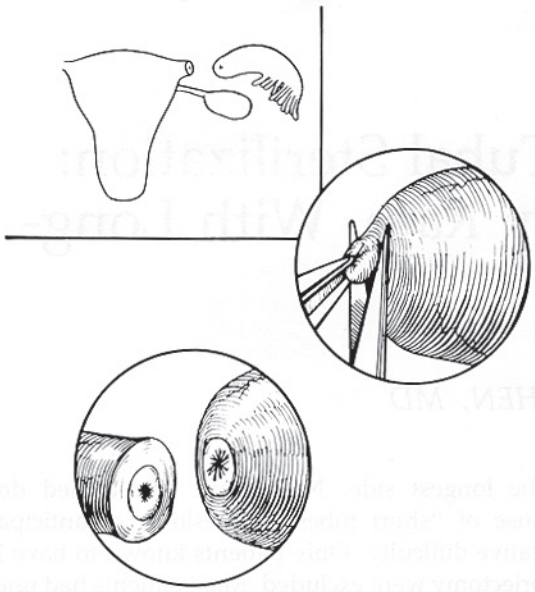

Figure 1. This diagram demonstrates the technique of making a small window in the ampullary stump (ampullary-isthmic or ampullary-cornual anastomosis), which allows for a smooth transition at the anastomosis site.

sions were cut with a monopolar microelectrode. Ampullary-isthmic and ampullary-cornual anastomoses were most commonly required. Ampullary-ampullary anastomoses were the least commonly required. Isthmic-isthmic anastomoses were technically the easiest because there is no discrepancy in lumen diameter.

As the early series progressed, it was found that unless the ampullary lumen was properly tailored to match the tiny cornual lumen, there was a high risk of ectopic pregnancy. Therefore, the ampullary-cornual anastomosis was modified by making only a 2-mm opening in the proximal stump of the ampulla and

Table 1. Relationship of Successful Pregnancy Rate to Total Tubal Length

	< 3 cm	3–4 cm	> 4–5 cm	> 5 cm
Pregnant*	2 (18%)	8 (57%)	9 (82%)	12 (100%)
Not pregnant	9	6	2	0
Mean time until pregnancy occurred	33 mo	10 mo	10 mo	5 mo

* Pregnancy means term pregnancy with live birth.

suturing this to the cornual lumen. This modification resulted in a smoother transition at the anastomotic site. Two cases of ectopic pregnancy occurred with ampullary-cornual anastomosis before this modification. These two ectopic pregnancies (5%) are not included in the tables as "pregnancy." Only normal term pregnancies with live birth were tabulated as pregnancy.

Results

The relationship of pregnancy rate to total tubal length is summarized in Table 1. The chances for a normal pregnancy were directly proportional to the length of the tube on the longest side. When the total tubal length on the longest side was greater than 5 cm, all 12 patients (100%) achieved normal intrauterine pregnancy. When the total tubal length was less than 3 cm, only 18% of patients achieved pregnancy. When tubal length was between 3 and 4 cm, 57% achieved a normal pregnancy; and when tubal length was between 4 and 5 cm, 82% achieved pregnancy. Furthermore, the mean time to pregnancy was inversely proportional to total tubal length on the longest side.

There was no statistically significant difference in pregnancy rate or mean time to pregnancy in relation-

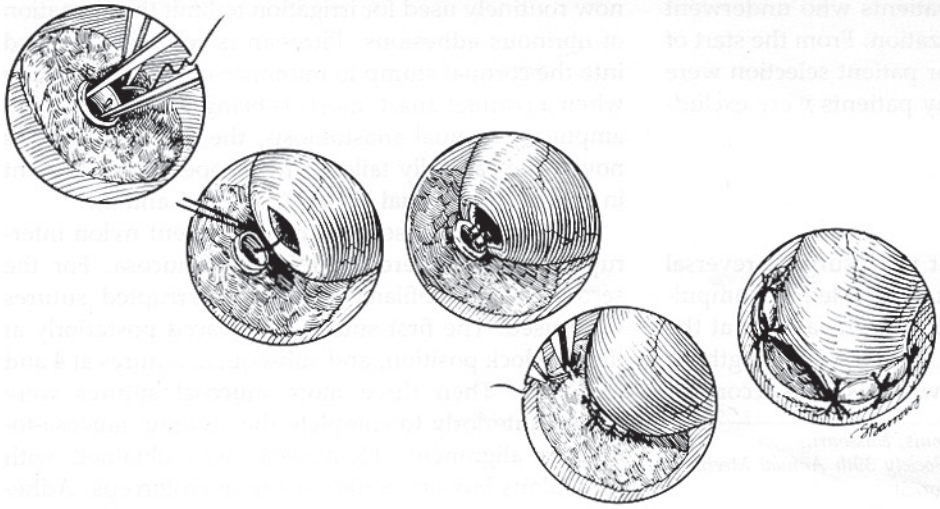

Figure 2. Outline of the technique for ampullary-cornual anastomosis.

Table 2. Relationship of Successful Pregnancy Rate to the Length of Ampullary Portion of Tubule

	0–1 cm	> 1–2 cm	> 2–3 cm	> 3 cm
Pregnant*	0	3	9	19
Not pregnant	2	3	7	5

* Pregnancy means term pregnancy with live birth.

ship to age from age 21 to 36; the duration of time since sterilization also had no significant effect on the likelihood of achieving a pregnancy.

There were two miscarriages and two ectopic pregnancies. These were not included as pregnancies in any of the tables.

Between 1 and 3 cm of ampullary length, no significant difference in pregnancy rate related to ampullary length was found (Table 2). When there was greater than 3 cm of ampulla, the pregnancy rate was higher, but most of these 24 patients with greater than 3 cm of ampulla also had greater than 4 cm of total tubal length. Thus, the incidence of pregnancy seemed to be related more to total tubal length than to ampullary length.

Discussion

The length of tube destroyed or damaged by the sterilization procedure has a great bearing on the subsequent pregnancy rate after an anatomically accurate microsurgical reanastomosis. Destruction of a large length of tube can interfere seriously with pregnancy, despite a good anastomosis.[4] The single factor that seems to influence success is total tubal length, so long as fimbria and 1 cm of ampulla are intact.

Although age is generally recognized to have a negative effect on fertility of the woman in large population studies, it did not have nearly as great an effect on pregnancy rate in the current series as tubal length. In addition, the duration of time since the sterilization has no influence on success or failure, because there are no pressure complications as in the male.[10–13]

The clinical finding of the critical importance of total tubal length was preceded by numerous experimental studies in rabbits with similar results.[14–16] Nonetheless, because of the complex nutritive contribution of the ampullary region of the oviduct during the first two days after fertilization and the required hold up of the egg in this region before transfer into the uterus at 48 to 72 hours, it would be natural to fear that any deviation from the normal anatomic arrangment could prevent a normal pregnancy from occurring.[17–21] But it appears from this clinical series that the various regions of the fallopian tube may possibly be remarkably adaptive, and the chances for normal pregnancy are not severely affected by such anatomic alterations, so long as total tubal length is preserved.

This observation causes speculation as to whether or not the critical problem with short tubes after sterilization reversal is not an alteration in function of the uterotubal junction, the ampullary-isthmic junction, the ampulla, or the isthmus, but rather simply the ability of the fimbriated end of the tube to reach the entire ovarian surface for ovum pick-up. The oviduct assumes a relatively long, curved course from the uterotubal junction to the fimbria, and at least in animals it is assumed that at the time of ovulation it is drawn forward pulling the fimbriated end over the entire surface of the ovary, where cilial beating toward the ostium of the oviduct pulls the egg into the ampulla.[17,22]

Normally the oviduct is between 8 and 12 cm long, making it quite easy for the fimbriated end to reach any area on the ovarian surface. However, when the oviduct is shortened to less than 3 cm, it appears (from observations at the time of surgery) very difficult for the fimbriated end to reach all of the ovarian surface (Figures 3 and 4). When the oviduct is between 3 and 5 cm long, the fimbria can reach portions of the ovarian surface but cannot completely surround it. When the oviduct is greater than 5 cm, however, the fimbriated end appears to have no difficulty reaching any area of the ovarian surface. The anatomic relationship of the fimbria to the ovarian surface appears from direct observation at the time of surgery to be determined by the length of the oviduct. Thus, despite the complexity of oviductal functions, it appears that as long as there is 1 cm or more of ampulla with fimbria present, the only factor significantly affecting pregnancy (other than an accurate anastomosis) is tubal length.

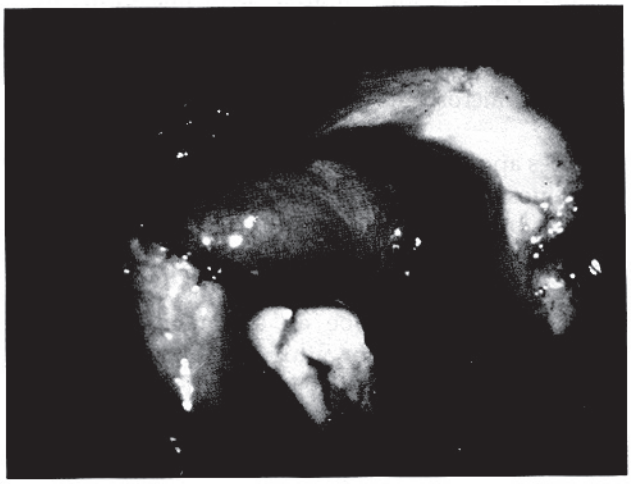

Figure 3. A completed tubal anastomosis with a short tube barely allows the fimbriated end to reach any of the ovarian surface.

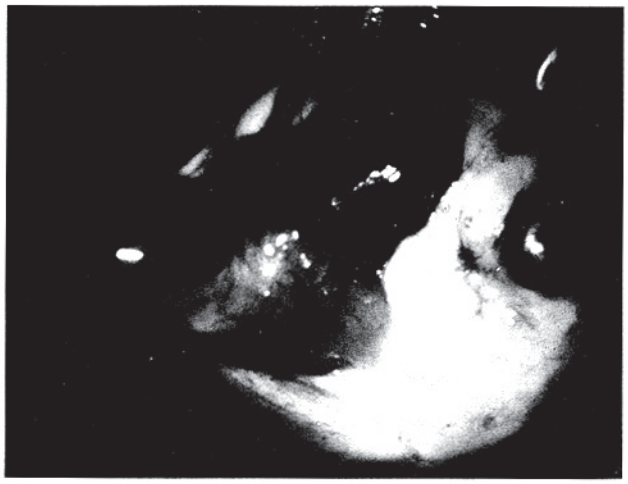

Figure 4. The short tube cannot reach the ovulatory follicle.

It should be apparent how difficult it is to compare the pregnancy rate of one series against the pregnancy rate of another series. If patients with short tubes are eliminated from a series (as most series do), pregnancy rates should be very high. However, if patients with short tubes are not eliminated, then pregnancy rate may depend upon the particular patient population and what type of sterilization procedure was being used in that region. When the Fallope ring or bipolar cautery is used, the pregnancy rate with sterilization reversal should be extraordinarily high. However, if aggressive monopolar cautery is used to destroy most of the tube, leaving only 2 to 3 cm, then the pregnancy rate, despite very accurate microsurgery, should be low. The overall term pregnancy rate in the current unselected series was 65%. This correlates remarkably with that of Winston[5]—another completely unselected series. If patients with less than 4 cm had been excluded, the pregnancy rate would be 91%. It is only by analyzing patients carefully according to the tubal length remaining after their sterilization procedure that one series can be compared with another and the results of microsurgery can be compared with macrosurgery.

It does appear that the reliability of the microsurgical anastomosis makes it the appropriate technical approach to reversal of tubal sterilization. However, even with the most accurate microsurgical technique, tubal length will ultimately determine the prognosis for pregnancy. This may be an argument in cases of bilaterally short tubes for autotransplantation of a tube from one side to the other, in order to construct one long tube.

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