Single-Port Laparoscopic Tubal Anastomosis

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ABSTRACT

Introduction: With the recent advances in assisted reproductive technologies, most reproductive surgeries for tubal infertility have been replaced by in vitro fertilization. Yet, considering the potential in vitro fertilization–related risks and drawbacks, tubal reversal surgery still plays an important role for those who desire fertility after sterilization.

Case Description: We present a case of successful single-port laparoscopic tubal anastomosis (LTA) on a woman who desired reversal of sterilization after two cesarean deliveries. A singleton intrauterine pregnancy was confirmed 9 weeks after reversal. To our knowledge, this is the first reported case of a successful single-port LTA done with a conventional laparoscopic technique using conventional instruments and sutures.

Discussion: Single-port LTA may be a feasible option that is both cost-effective and has cosmetic benefit. Further studies on feasibility, pregnancy rate, and patient satisfaction are needed. In addition, its benefits over conventional multiport laparoscopy are to be determined.

Key Words: Tubal reversal surgery, Single-port laparoscopic tubal anastomosis, Laparoscopic tubal anastomosis, Sterilization.

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INTRODUCTION

Sterilization is considered to be the most widely used contraceptive method in the world.[1] Studies have shown that as many as 20% of patients regret their decision, and 1% to 5% of patients eventually request tubal reversal.[2,3] There are only two options available for those who desire fertility after sterilization: in vitro fertilization (IVF) and tubal reversal surgery. With the availability of and advancements in IVF treatment, there has been much debate on the role of reproductive surgery as the primary treatment for infertility. Yet, considering the potential IVF-related risks and drawbacks, tubal anastomosis still plays an important role in the treatment of women who desire fertility after sterilization.

Since the concept of microsurgery was hypothesized in the late 1970s,[4] tubal anastomosis has been performed via laparotomy using the microscope. In 1989, Sedbon et al published the first case of laparoscopic tubal anastomosis (LTA).[5] Thereafter, studies have reported the feasibility of laparoscopic microsurgery with successful results, leading to the commencement of minimally invasive surgery.[6,7] Recently, the robotic technique has been successfully implemented to facilitate the performance of LTA.[8,9] In addition, single-port laparoscopy has been introduced as a new trend in minimally invasive gynecologic surgery; however, the feasibility of such a technique, including LTA, is yet to be confirmed in laparoscopic microsurgery.

We present a case of successful single-port LTA performed with the conventional laparoscopic technique using conventional instruments and sutures, which is to our knowledge the first case ever reported in the literature.

CASE REPORT

Patient

The patient was a 36-year-old woman with two children delivered by lower-segment cesarean birth in 2001 and 2004. According to the surgery report, both fallopian tubes had been sterilized during her second surgery using the modified Pomeroy method.

The preoperative evaluation was performed per protocol. The hysterosalpingography revealed an approximately 3-cm length of the proximal segments on the left tube and 2-cm length on the right. Ultrasonographic findings showed complete obliteration caused by dense adhesion between the uterus and the anterior pelvic wall. The examination also revealed adhesion between the left adnexa and the uterus. However, the right adnexa were mobile and the pouch of Douglas was free from adhesion. Semen analysis results were within the normal range.

Single-Port Laparoscopy

The patient was placed under general anesthesia in the lithotomy position with the arms tucked to each side. Standard draping of the operative field, as for conventional laparoscopic surgery, was used. Nelaton catheterization was done, and a uterine manipulator (Umi, Catheter Research, Inc., Indianapolis, Indiana) with a channel for injection of indigo carmine was inserted.

A 2-cm-long incision was made longitudinally at the umbilicus. The deepest edge of the umbilicus on either side was grasped and elevated with a Kocher clamp to facilitate further downward dissection into the fascia. Subsequently, the fascia was incised and the peritoneal cavity was entered under direct vision. 2–0 VICRYL (polyglactin 910) sutures (Ethicon, Inc., Cincinnati, Ohio) were placed and tagged on either side of the fascia to facilitate accurate alignment of the abdominal wall layers during the closure. A SILS flexible port (Covidien, Mansfield, Massachusetts) was inserted through the incision to accommodate three 5-mm cannulas and an insufflation inlet.

After an adequate pneumoperitoneum was achieved, a 5-mm 30° laparoscope was introduced to assess pelvic status and feasibility before beginning the main surgery. The operating table was set to place the patient in the Trendelenburg position to allow the small bowel and sigmoid colon to be displaced out of the pelvis. On visualization, the fimbria of the left tube was completely embedded in the dense adhesion around the left adnexa and was declared inoperable (**Figure 1**). Furthermore, the entire anterior surface of the uterus was adhered and fixed to the anterior pelvic wall by thick adhesion from the previous surgeries (**Figure 2**).

Laparoscopic Tubal Anastomosis

After the cornus of the inoperable left tube was occluded using electrocautery, tubal anastomosis was performed on the right tube in the following fashion. Although there are instruments specially designed for the use in single-port laparoscopy, only conventional instruments for microlaparoscopy and standard sutures were used for the anastomosis. All of the sutures described were tied with the intracorporeal knot-tying technique with 3 or 4 throws.

Figure 1. The left tube was inoperable because of adhesion around the fimbria.

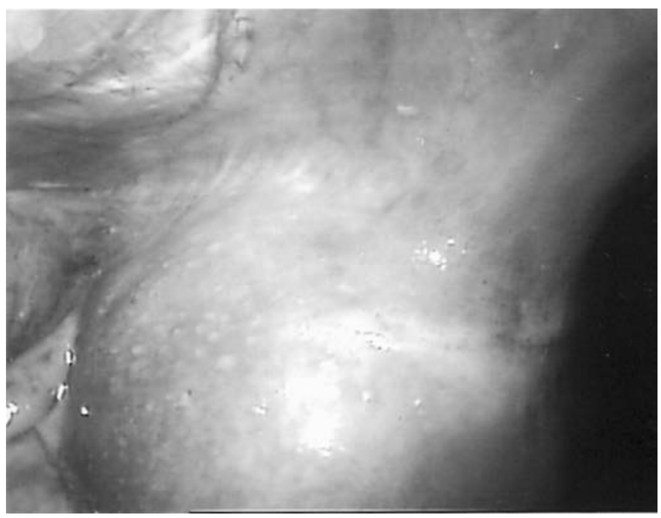

Figure 2. Dense adhesion was noted between the anterior pelvic wall and the uterus.

The procedure was started with the subserosal infiltration of diluted vasopressin (10 U in 100 mL of normal saline solution) in the mesosalpinx for subsequent dissection of both the proximal and distal tubal ends and hemostasis (**Figure 3**). Microscissors were used to incise the serosal covering of the proximal and distal anastomosis site. The mesosalpingeal scar

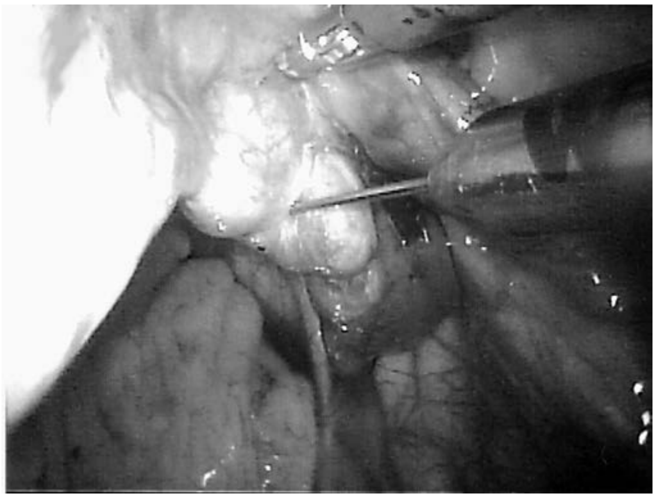

Figure 3. The mesosalpinx was infiltrated with dilute vasopressin.

tissue was then excised with a monopolar microneedle electrode. The muscularis-mucosal portion of the proximal stump was transected using microscissors, at the point of occlusion to open the tubal end. Subsequently, the tubal patency was confirmed by injecting indigo carmine dye through the manipulator. The occluded site of the distal tube was drawn up with microforceps and cut using microscissors to the diameter matching that of the proximal tube. After transection, the length of the proximal and distal tubes was about 2 cm and 4 cm, respectively.

To facilitate subsequent suturing with fine sutures and to obtain proper alignment of the two tubal segments, the defect of the mesosalpinx was approximated with two interrupted 6–0 PDS (polydioxanone) stitches. Each suture was tied intracorporeally with 3 throws with 5-mm microneedle holders (Jarit, Hawthorne, NY) and 3-mm microforceps (Storz, Tuttlingen, Germany). The muscularis-mucosal layers were sutured with 4 interrupted 7–0 PDS sutures. The first suture was placed at 6 o'clock of the proximal segment from the outside to the inside direction. Subsequently, the corresponding site of the distal segment was sutured from the inside to the outside direction so that the knot could lie on the outside of the lumen (**Figure 4**). The second suture was placed at 12 o'clock from the distal to the proximal segment direction. The suture was cut, leaving 3 cm, and left untied (**Figure 5**). The third and fourth stitches were placed at 3 o'clock and 9 o'clock, respectively, and finally the 12 o'clock suture was tied. The lumen was accurately aligned without angulation or rotation of the distal segment along its longitudinal axis. On confirmation of the tubal patency by chromopertubation (**Figure 6**), the serosal layer was closed with 3 interrupted 6–0 PDS sutures (**Figure 7**).

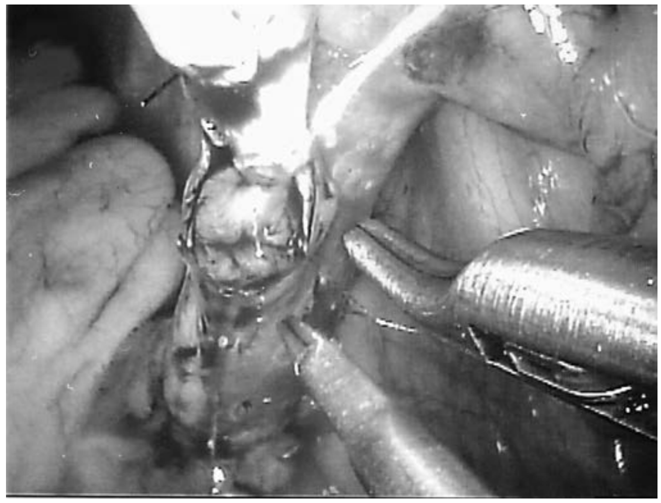

Figure 4. The first interrupted 7–0 PDS suture was placed at 6 o'clock in the muscularis-mucosal layers. Intracorporeal knot-tying was done using conventional rigid instruments.

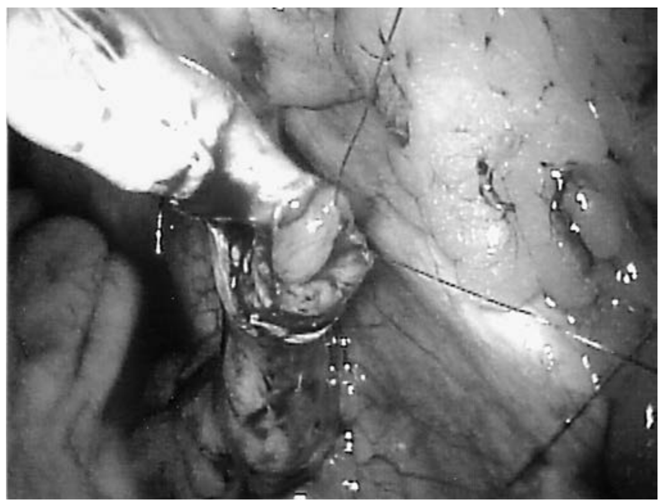

Figure 5. The second suture, at 12 o'clock, was cut and left untied until the third and fourth stitches were placed.

The pelvic cavity was thoroughly examined for any debris and irrigated with warm lactated Ringer solution before removal of the umbilical port and laparoscopic instruments were used. The operating table placement was returned to the supine position for umbilical wound closure. The fascial defect was closed with 4 interrupted 2–0 VICRYL sutures. The skin was reapproximated with 4 interrupted subcuticular 3–0 VICRYL sutures and covered with SteriStrips (Nexcare/3M, Maplewood, MN). The bladder was catheterized at the end of the procedure. Blood loss was minimal and the total operating time was 67 minutes.

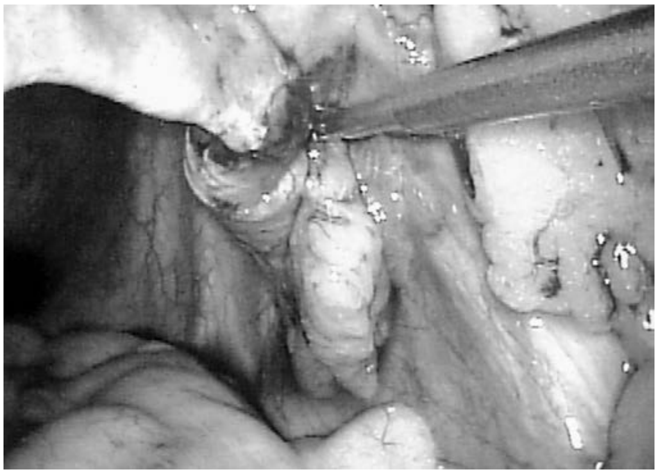

Figure 6. Tubal patency was ensured after 4 interrupted 7–0 PDS sutures were placed in the muscularis-mucosal layers.

Figure 7. Finally, the serosal layer was closed with 3 interrupted 6–0 PDS sutures.

Postoperative Care and Results

Ambulation and oral intake were allowed as soon as possible, and self-voiding was advised within 4 hours postoperatively. The patient was discharged without complication the day after surgery.

A singleton intrauterine pregnancy was confirmed on transvaginal ultrasonography 9 weeks after tubal reversal.

DISCUSSION

Although there has been no randomized controlled trial comparing IVF with tubal anastomosis,[10] most reproductive surgeries for tubal infertility have been replaced by IVF. However, the IVF procedure has known concerns including multiple pregnancies, ovarian hyperstimulation,[11,12] an associated higher incidence of preterm birth, low birth weight, intrauterine growth restriction, and congenital malformations.[13] Therefore, there may still be a continuing role for tubal reversal surgery for those who desire fertility after sterilization. Furthermore, current efforts to avoid multiple births by transferring fewer embryos may further limit the live birth rate associated with IVF, making the higher success rate of tubal anastomosis even more attractive.[14,15] In a study of 163 women, Boeckxstaens et al reported cumulative delivery rates of 52.4% and 72.2% after IVF and LTA, respectively, for patients younger than 37 years. No significant difference was found for older patients.[16] Tubal reversal surgery is also cost-effective because it offers multiple cycles to achieve natural conception and thus provides patients with an opportunity to have more than one pregnancy from a single surgery.

Traditionally, tubal anastomosis has been performed via laparotomy using microsurgery, and the cumulative pregnancy rate after the procedure is known to be 60% to 80%.[17] Despite the high success rate and prevalence of its technique, tubal reversal via laparotomy has known disadvantages over the laparoscopic approach, such as longer hospital stay, more postoperative pain, and a higher risk of postoperative adhesion.

Enabled by the improvements in laparoscopic instruments and techniques, minimally invasive surgery attracted much attention to remedy the challenges of traditional laparotomy, and the feasibility of laparoscopic microsurgery was confirmed in the late 1990s.[6] Since then, LTA has been successfully attempted without having to compromise the pregnancy rate while addressing the shortcomings of laparotomy.[7] One recent trend is the oversimplification to circumvent the technical difficulties inherent in laparoscopic microsurgery techniques.[8] Many studies have reported such tendencies, such as gluing cut segments instead of using stitches, using a guide or a stent to facilitate suturing, and placing various numbers of stitches (1, 2, or 3) in the mucosa-muscularis layer. Nevertheless, the best pregnancy rate of 80.5% was reported with a two-layer anastomosis technique, during which 4 stitches were placed in the mucosa-muscularis layer in compliance with the principles of microsurgery.[7] This two-layer, 4-stitch technique, however, requires extremely precise microsurgical suturing techniques and has been successfully performed by only a few experts.

Recently, robotic technology has been increasingly adopted in gynecologic surgeries. Its unique features such as tremor filtration, motion downscaling, 3-D visualization, and instruments with multiple degrees of freedom have been successfully implemented to overcome the technical difficulties inherent in LTA.[8,9] An alternative and new approach in minimally invasive surgery is a single-port laparoscopy. Studies have already shown its feasibility in various gynecologic surgeries.[18,19] By accomplishing surgeries through a single hole placed in the umbilicus, the body's natural embryonic orifice, this technique allows for virtually scarless surgery, and hence better cosmetic results. Technically, however, it has its own disadvantages: the single port only allows for a parallel placement of instruments; a smaller and angled scope is needed to avoid crowding between instruments; and thus fine movements such as intracorporeal knot-tying may be more difficult than when done during conventional laparoscopy. Although flexible instruments and barbed sutures have been developed to circumvent such difficulties inherent to the single-entry technique, the feasibility of single-port laparoscopy is yet to be confirmed in laparoscopic microsurgery, such as LTA.

We successfully performed a single-port LTA. Consequently and as of this writing, our patient is now pregnant with a single intrauterine fetus. This report demonstrates that LTA can be performed successfully via a cosmetically beneficial single-port entry technique without using specialized flexible instruments and sutures. Furthermore, we were able to duplicate the exact same steps that we perform during a conventional LTA to preserve the high pregnancy rate.[7] To our knowledge, this is the first reported case of successful single-port LTA performed with the conventional laparoscopic technique using conventional instruments and sutures, without simplifying the needed steps.

In conclusion, single-port LTA may be a feasible option that is cost-effective and has cosmetic benefit. However, further studies on feasibility, pregnancy rate, and patient satisfaction are needed. In addition, its benefits over conventional multiport laparoscopy have yet to be determined.

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