Surgical competence of Obstetrics and Gynecology residents performing microsurgical tubal anastomoses

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Received: 17 April 2006 / Accepted: 11 September 2006 / Published online: 20 December 2006
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Abstract *Objective:* To assess tubal patency rates after microsurgical tubal anastomosis in a residency program.

Study design: Retrospective cohort analysis. Primary outcome measurement was tubal patency rates.

Results: Twenty-seven of the forty-nine patients (55.1%) had bilateral tubal patency and twenty-one of the forty-nine (42.9%) had only one tube open after surgery. No statistical difference in tubal patency rate was noted between the REI staff (85.7%) and the resident (71.4%) ($p = 0.09$). No statistical difference was noted when comparing the patency rate of the residents' first procedure (68.6%) to subsequent procedures (72.8%) ($p = 0.99$).

Conclusions: These data suggest that with appropriate guidance, residents without prior experience are able to perform microsurgical procedures under direct supervision. Residents completed the procedure with patency rates similar to the REI staff. Additionally, tubal patency rates were

not significantly different in comparing the residents' first or subsequent procedures.

Keywords Surgical competence · Microsurgery · Obstetrics and Gynecology · Resident education · Tubal anastomosis · Tubal ligation

Introduction

As surgical techniques and technology has improved for sterilization procedures since the 1970s, more women have chosen to undergo surgical sterilization as a method of birth control [1]. Sterilization by tubal surgery has become the most frequent intra-abdominal procedure performed on women in North America [2]. Approximately 800,000 tubal sterilizations are performed per year and it is the most common form of contraception in women over age 30 [2]. Due to the convenience of this permanent procedure, women no longer need to be compliant with daily oral contraceptives, subjective themselves to injections of depot progesterone, use barrier methods or other less effective methods.

Women who have had surgical sterilization sometimes change their minds and desire a reversal of the procedure. The most common reason cited for a reversal is a change in marital status. The most significant independent risk factors for regret of permanent sterilization are age and marital status [3, 4]. It is estimated that up to 10% of patients with permanent sterilizations will regret their decision and subsequently approximately 1% will seek a reversal of the procedure [2].

The tubal anastomosis procedure has been performed since the early 1900s, initially with limited success. Since the 1960s, microsurgical techniques have improved resulting in improved pregnancy rates [5]. Some of the techniques

There was no financial support for this study.

This study was approved by the Department of Clinical Investigation at Tripler Army Medical Center, Honolulu, HI.

The views expressed in this manuscript are those of the authors and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the U. S. Government.

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described that have contributed to the success of tubal reversals are visualization of the tubal lumen under higher magnification to better approximate tubal lumens, atraumatic technique with careful handling of tissue, constant irrigation of tissue to prevent dissipation, pinpoint cautery, and use of minimally reactive suture material [5–7].

Animals have been widely used as a training model for teaching microsurgery. However, access to the animal laboratory is not always possible. Alternative methods and teaching tools, such as surgical guaze, surgical gloves, and medical grading tubes, are sometimes required for microsurgical training. These alternative teaching tools present an alternative for teaching microsurgical techniques; however, they do not exactly mimic human tissue [8–10].

What is the most efficient mode to demonstrate competence in microsurgery? This is an important question. With the reduction of work hours in residency programs, the ability to document surgical proficiency is crucial. However, the most appropriate method of defining surgical proficiency has yet to be described. In the past it was felt that the gynecologist could master microsurgical techniques in the laboratory prior to engaging in clinical microsurgical work [11]. Since microsurgical tubal anastomosis is not a common procedure in residency programs, it is essential that the learning of the microsurgical procedure be standardized and studied to optimize the educational experience.

Since July 2000, the tubal anastomosis procedure has been completed in a standard fashion at Tripler Army Medical Center with the same Reproductive Endocrinology and Infertility (REI) staff. During each case, the REI staff demonstrated the technique by completing the right side of the anastomosis and then under direct supervision and instruction the resident completed the left side. We sought to evaluate the ability of the obstetrics and gynecology resident to successfully complete the contra-lateral half of the procedure with direct continuous instruction from the REI staff after viewing the initial half the procedure.

Materials and methods

Protocol

This retrospective cohort analysis study was approved by the Institutional Review Board at Tripler Army Medical Center. The patients included in the study had prior tubal sterilization and were seeking fertility. All patients underwent microsurgical tubal anastomosis between July 1 2000 and January 1 2004.

Inclusion criteria included all patients undergoing bilateral microsurgical tubal anastomosis with the REI service who had a postoperative hysterosalpingogram. Standard inclusion criteria for microsurgical tubal anastomosis also included prior tubal sterilization, age 20 to 42 years, normal

day 3 FSH value (<12 mIU/mL), weight within 25% of ideal body weight, no prior tubal surgery, confirmation of proximal tubal length ≥ 1.0 cm bilaterally, and a normal male semen analysis. All procedures were performed by the same REI staff (JLF) with different residents who rotated on the infertility service.

All tubal anastomotic procedures were performed in a similar manner using the surgical microscope and microsurgical instruments. The abdomen was entered via a small Pfannenstiel incision. The uterus was elevated out of the abdomen. Tubal status did not determine resident and staff side. The REI provider (JLF) always demonstrated and performed the procedure on the right tube. The reason for this is that the microscope was positioned by the patient's feet and since most of the residents are right-handed the left side of the table offered the resident fewer obstructions. It was assumed that for the right-handed novice surgeon the left side would provide a more optimal outcome, while the experienced subspecialist should be able to get reproducible results regardless of the operating side. The proximal and distal ends of the right tube were opened and flushed with methylene blue dye to ensure patency. The mesosalpinx was approximated using 6-0 VICRYL (polyglactin 910, Ethicon Inc, Sommerville, NJ) suture in a figure of eight fashion. The tubal lumen was approximated using three or four interrupted 8-0 VICRYL sutures. The serosa was approximated with a running 6-0 VICRYL suture. Patency of the tube was ensured by flushing with methylene blue dye at the end of the procedure. The OB/GYN resident then accomplished the same procedure on the contralateral side.

The primary outcome measurement was tubal patency rate. Approximately 6 weeks following the procedure, patients underwent a hysterosalpingogram to evaluate continued tubal patency in order to establish a proper treatment regimen. The overall patency rate for the residents was compared to the patency rate of the subspecialist. The patency rate for the first procedure performed by the residents was compared to subsequent procedures. Secondary outcome measurements included age, gravidity, parity, height, weight, BMI, type of anastomosis, pre-operative proximal tubal length, and post-operative total tubal length.

Statistical analysis

All data were taken from a quality assurance database kept prospectively by the author (JLF). Statistical analysis was performed using a Wilcoxon-Mann-Whitney test for non-parametric data, *t*-test for parametric data, Fishers Exact test and a Chi-square test for rates as appropriate. An alpha error of 0.05 was considered significant for all calculations. Relative risks and 95% confidence intervals are displayed where appropriate. All data are reported as means with their associated standard deviation.

Table 1 Microsurgical tubal patency rates for the entire study population and subdivided for the REI staff and the residents

	Patency (%)	95% CI
Patency of at least one tube	48/49 (98.0%)	88.4, >99.9
Patency of both tubes	29/49 (59.2%)	45.3, 71.9
Bilateral blockage	1/49 (2.0%)	< 0.01, 11.8
Patency for REI staff	42/49 (85.7%)	73.1, 93.3
Overall patency for residents	35/49 (71.4%)	57.6, 82.3
Patency for residents' first procedure	11/16 (68.8%)	44.4, 86.3
Patency for residents' subsequent procedures	24/33 (72.8%)	55.7, 85.2

Results

There were sixty-five patients who received tubal anastomosis over the forty-two month period. Sixteen patients were excluded from the study. Fifteen patients were excluded due to not completing the postoperative hysterosalpingogram; one patient had a unilateral procedure and was excluded. The remaining forty-nine patients had a mean age of 35.1 ± 3.7 years (range 28.8 to 43.0 years), mean gravidity and parity were 2.6 ± 1.2 and 2.1 ± 1.0 , respectively. The mean height, weight, and BMI were 65.1 ± 2.6 inches, 135.9 ± 15.6 lbs, and 23.6 ± 2.6 kg/m², respectively. The mean pre-surgical tubal length was 3.5 ± 1.9 cm. The mean post-surgical tubal length was 6.2 ± 1.9 cm.

Table 1 displays the patency rates for the study participants. Forty-eight of the forty-nine patients (98%) had at least one patent tube after surgery. Twenty-nine of the forty-nine patients (59.2%) had bilateral tubal patency and twenty-one of the forty-nine (38.8%) had only one tube open after surgery. Only one patient failed to have at least one patent tube (2.0%). Tubal patency was not significantly related to any of the secondary outcome measures (age, gravidity, parity, height, weight, preoperative tubal length, and postoperative tubal length).

Figure 1 shows the comparison of the patency rates for the study. The surgeries performed by the subspecialist had a patency rate of 85.7% (42/49). The surgeries performed by the residents had a patency rate of 71.4% (35/49). No statistically significant difference in patency rates between the subspecialist and the residents was found ($p = 0.09$, RR 1.20, 95% CI 0.97–1.48). Power analysis revealed a power of 65% and the need of 114 total patients to find statistical significance.

The success rate for residents' first microsurgical tubal anastomosis was 68.6% (11/16) and the success rate for the subsequent procedures was 72.8% (24/33). No statistically significant difference in patency rates between the residents' first and subsequent procedures was found ($p = 0.99$, RR 0.95, 95% CI 0.64–1.40). Power analysis revealed a power of 6% and the need for 160,267 total patients to find statistical significance.

Fig. 1 There was no statistical difference in patency rates between the subspecialist and the residents ($p = 0.09$, OR 2.40, 95% CI 0.79–7.47). There was no statistical difference in patency rates between the residents' first and subsequent procedures ($p = 0.24$, OR 0.82, 95% CI 0.19–3.69). There was no statistical difference in patency rates when comparing the REI staff to the patency rates of the residents' first microsurgical procedure ($p = 0.13$, OR 2.73, 95% CI 0.56–12.20) and to the residents' subsequent microsurgical procedures ($p = 0.15$, OR 2.25, 95% CI 0.66–7.83)

Further analysis comparing the patency rates for the REI staff to the patency rates of the residents' first microsurgical procedure ($p = 0.15$, RR 1.25, 95% CI 0.88–1.77) and their subsequent microsurgical procedures ($p = 0.15$, RR 1.18, 95% CI 0.93–1.50) did not show a statistically significant difference.

Discussion

This retrospective study was performed to determine if residents could perform this technically difficult procedure with limited training on the specific procedure. These results suggest that physicians learn basic surgical techniques that can be applied to all surgical procedures. After immediately visualizing the procedure and with verbal instruction the resident physicians were able to produce patency results comparable to the REI subspecialist.

These data validate resident competence in learning new technically challenging procedures. Although a 13% difference in relative patency rates between the staff and residents was not statistically significant, clinically this may be a significant difference. Of note, no literature could be found within the past twenty years to reference anatomical patency rates, nor to compare the patency rates of the subspecialist or the resident with a standard. Whereas, the technique used in this study included an open procedure with 98% of patients having at least one patent tube, only an estimated reference for anatomical success could be found in the literature of 88.2% (814/922) [12]. Documented success for laparoscopic tubal anastomosis was 65.2% (15/23) [13]. With the limited number of microsurgical anastomosis being performed, it would be difficult to get the number ($n = 114$) needed to demonstrate a statistically significant difference in patency rates between the residents and the experienced

microsurgeon. In no manner do these data support the idea that residents are competent to perform the procedures alone. Nor do these data support that the competence of the residents is equal to an experienced microsurgeon.

In the past, surgical competence was defined as performing multiple procedures until proficiency was assumed. Recently this definition has been challenged. With the decrease in work hours across all residencies, there has been a reevaluation of surgical competence. Most programs still assume that a certain number of procedures need to be performed prior to saying that the resident is proficient in given procedure. With the 80-hour work limit in obstetrics and gynecology, the need to perform as many of the major procedures (hysterectomy, laparoscopy, hysteroscopy) as possible may relegate other less common procedures like the microscopic tubal anastomosis to only a comment in textbooks.

The evaluation of surgical competencies is now required as part of residency programs. Since microscopic tubal anastomosis is not a procedure that residents perform often, it is essential that the learning of the microsurgical techniques is standardized to optimize the educational benefit. These data suggest that by standardizing the technique the residents are able to reproduce the surgical technique with good outcomes.

The strengths of this study include the fact that all residents were compared to and taught by a single staff (JLF). All data was entered prospectively into a REI surgical quality assurance database by the author (JLF). All procedures were performed in a uniform manner. All patients had postoperative tubal patency confirmed by a hysterosalpingogram.

There are weaknesses of this study, which are associated to its retrospective nature. Selection bias was limited since the REI staff neither selected the resident who was operating or the side on which to operate. Recall bias is also limited since the procedures were performed in the same manner and the data immediately entered into the database. Of greater note, the study may have been underpowered to show a difference in comparing the subspecialist and the residents. The number of subjects was 49 and was 65 below the calculated 114 subjects needed to show a statistically significant difference in patency rates. This point contrasts with having an additional 160,218 additional participants in the study to show a statistical difference between the residents' first and subsequent surgical procedures.

While patency rates may not be the optimal outcome to evaluate, a main outcome of pregnancy or live birth is not practical considering that this study was designed to assess the ability of residents to perform this procedure in a training setting and to compare their outcome to that of the microsurgeon's. In addition, the military population studied is a

mobile population. It would be difficult to assess pregnancy rates for the following year after the surgery as up to 50% of the population studied may no longer be in the area.

Conclusion

In summary, these data suggest that under direct supervision, residents are able to complete a microscopic tubal anastomosis with similar patency rates to the experienced microscopic surgeon. Patency rates for the residents and staff are not statistically different based on the data and the limited number of patients. Additionally, tubal patency rates were similar whether it was the residents' first or subsequent procedures. These data suggest that with appropriate guidance and supervision, residents without prior experience are able to perform microsurgical procedures.

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