

The role of tubal reconstructive surgery in the era of assisted reproductive technologies

The Practice Committee of the American Society for Reproductive Medicine

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Tubal reconstructive surgery has fewer indications in the era of assisted reproductive technologies than in the past, but is still appropriate and effective treatment for properly selected individuals. (Fertil Steril® 2008;90:S250–3. ©2008 by American Society for Reproductive Medicine.)

Disease or damage of the fallopian tube accounts for 25% to 35% of reported cases of infertility. Decreased fecundity may be attributed to impaired ovum transport due to fimbrial damage and/or adnexal adhesions. Risk for ectopic pregnancy also is increased due to embryo transport abnormalities. The factors responsible for tubal disease are diverse and include infection, pelvic surgery, and endometriosis, but, in some cases, the specific cause is unknown.

Treatments for infertility associated with tubal damage include reconstructive surgery or in vitro fertilization (IVF). Over the last decade, success rates achieved with IVF have increased progressively while those for tubal surgery have remained relatively stable. Therefore, a review of the role of reconstructive surgery in the treatment of tubal disease is timely. The purpose of this review is to assist clinicians in the appropriate selection of treatments for infertility due to a tubal factor.

PATIENT SCREENING AND SELECTION

Infertile couples considering surgery require a basic infertility evaluation to exclude complex ovulatory disorders, semen abnormalities, and other major reproductive problems. In general, IVF is the better choice of treatment when there are other coexisting infertility factors.

Hysterosalpingography (HSG) is a useful initial procedure for the evaluation of tubal factor, but does have limitations. Compared with laparoscopy, the gold standard method for assessing tubal patency, HSG has only moderate sensitivity (i.e., ability to detect patency when the tubes are open) but relatively high specificity (i.e., accuracy when patency is detected) in a typical infertile population (1, 2). The clinical implications are that when the HSG indicates obstruction, there is still a relatively high probability that the tube is actually open, but when HSG demonstrates patency, there is little chance the tube is actually occluded. The relatively poor sensitivity of HSG as a test of tubal patency results from the difference in test accuracy in diagnosing proximal and distal

occlusion. The diagnosis of distal tubal obstruction is generally accurate, but apparent proximal tubal occlusions are often an artifact of catheter placement or the result of uterine contractions that transiently occlude the interstitial segment of the tubes. Therefore, the HSG diagnosis of proximal tubal obstruction must be confirmed, ideally by performing either fluoroscopic or hysteroscopic selective tubal catheterization, except perhaps when HSG reveals clear evidence of salpingitis isthmica nodosa.

The pathogenesis of tubal injury must be considered in estimating the prognosis for successful surgery. Outcomes of tubal surgery may differ depending on whether tubal damage results from an intrinsic or extrinsic insult, i.e., occlusion resulting from ascending infection or salpingitis isthmica nodosa or from adhesions related to endometriosis, previous surgery, or inflammatory bowel disease. Because operative success is dependent on the location, type, and extent of tubal injury, laparoscopy may be necessary to stage pelvic disease accurately (3). When tubal damage is suspected, but has not been documented previously, serologic testing for antibodies against *Chlamydia trachomatis* may be helpful (4).

MEASURES OF OUTCOME

It is difficult to compare success rates achieved with IVF and reconstructive tubal surgery. IVF success rates are expressed per cycle initiated or per embryo transfer. In contrast, pregnancy rates after surgery are time dependent and are generally expressed as cumulative pregnancy rates per unit of time, after a varying interval of follow-up, typically, one to four years. For most infertile couples, a lengthy postoperative trial at conception is unwise and impractical. Therefore, the use of surgical success rates after a limited postoperative period (one to two years) or fecundability (probability of conceiving per month) are better outcome measures for treatment comparisons (5).

Surgical repair for intrinsic tubal damage results in modest pregnancy rates (10% to 60%) and ectopic pregnancy rates as high as 21% (6). After surgery, cycle fecundability ranges from less than 1% per month in cases of severe tubal disease to 5% to 8% per month for limited pelvic disease (7). Other causes of tubal injury are associated with more favorable

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results. After reversal of elective sterilization procedures, reported cumulative pregnancy rates have ranged from 40% to 80% (8). Cycle fecundability after sterilization reversal ranges between 8% and 10%, with an overall risk for ectopic pregnancy risk of less than 10%.

MATERNAL AGE

Fecundability in women declines with advancing age (9). Evidence from studies of donor oocyte IVF cycles in older women indicates that age-related changes in the oocyte are the primary mechanism responsible.

Pregnancy rates decrease for both IVF and tubal surgery with advancing maternal age. Surgical procedures associated with low fecundability are inadvisable in older women with declining reproductive potential. Therefore, IVF is the treatment of choice in older women with significant tubal damage. Surgery is an option for couples with ethical, religious, or financial concerns that may preclude IVF.

ECONOMIC COSTS AND OUTCOMES

Medical outcomes and economic costs of health care interventions can be compared using cost-effectiveness analyses (10). Both direct costs (i.e., costs of the service) and indirect costs (i.e., costs of successful or adverse outcomes, complications, work related expenses, etc.) are important variables for analysis. The major indirect costs for IVF include the costs related to the potential morbidity of follicular aspiration, ovarian hyperstimulation, multiple pregnancy, and related perinatal complications. The major indirect costs of surgery include the costs of procedure-related morbidity, lost wages during the postoperative period, and those relating to ectopic pregnancy. IVF is at least as, and possibly more, cost-effective than surgery for tubal disease that requires laparotomy (11). Whether IVF is also more cost-effective than surgery for disease that can be treated endoscopically is less certain. Although comprehensive analyses of cost-effectiveness have not been performed for all categories of tubal surgery, a review of the actual direct costs and potential indirect costs for specific treatments can assist in counseling patients.

MAKING THE DECISION

Because IVF has not been compared with tubal reconstructive surgery in randomized trials, selecting the best therapeutic option for an individual patient is often difficult and must be individualized. The following hypothetical cases illustrate some of the important factors that should be considered carefully in the selection of patients for tubal surgery.

Case #1

A 25-year-old woman with a history of pelvic inflammatory disease has an HSG that reveals hydrosalpinges measuring 2 cm in diameter. Evaluation excludes any other coexisting male or female infertility factors.

Comment In women with distal tubal occlusive disease, monthly fecundability decreases as the severity of hydrosalpinges increases (≥ 2 cm) and maternal age increases.

Although most cases of distal occlusion result from ascending infection, the extent of endosalpingeal damage and associated pelvic adhesions varies widely. The type and extent of preexisting pelvic disease, the thickness of the tubal wall, and the macroscopic appearance of the tubal epithelium all influence the surgical success of neosalpingostomy (3, 12). A preoperative HSG is informative, but laparoscopy generally is necessary for accurate staging into general categories (mild, moderate, and severe disease) (13, 14).

For mild distal disease (25% of total cases), live birth rates after surgical treatment range from 39% to 59% with an ectopic rate of 4% to 10% (3, 12, 13). In contrast, the outcome for severe disease (greater than 30% of cases) is uniformly poor (less than 15% pregnancy rate). Postoperative fecundability is low (1% to 2% per month), reflecting the slow process of tubal epithelial regeneration (12, 13).

The role of surgery in the treatment of infertility related to significant distal tubal disease in women of advanced maternal age is limited. In women aged 35 years or older, IVF is the superior option because pregnancy and fecundability rates after surgery are low. In younger women with relatively mild disease, surgery is a legitimate option, but IVF should be considered seriously for those with other coexisting infertility factors. The risk of ectopic pregnancy following reconstructive surgery (4% to 10%), is comparable to that associated with IVF in patients with tubal disease (1% to 13%) (3, 15–19). Because the presence of hydrosalpinges can adversely affect IVF success rates, proximal tubal occlusion or salpingectomy may be advisable prior to IVF (13, 20).

The best option for the woman described in this case is IVF, with or without preliminary bilateral salpingectomy for hydrosalpinges. However, at age 25 and with no other infertility factors, surgery is reasonable when IVF is not feasible or is rejected.

Case #2

A 32-year-old woman who previously underwent a sterilization procedure by application of surgical clips is considering her reproductive options. Her new male partner has normal semen parameters.

Comment Factors that should be discussed with couples contemplating a sterilization reversal include maternal age, number of children desired, risk of multiple pregnancy with IVF, presence or absence of other infertility factors, procedure costs, and risks of ectopic pregnancy. Microsurgical tubal anastomosis and IVF are both proven options. Microsurgical repair yields cumulative pregnancy rates ranging from 40% to 80% and monthly fecundability of 8% to 10% (4, 8). The risk of ectopic pregnancy is generally less than 10%. Most procedures are performed by laparotomy, but laparoscopic and robotic procedures are also possible. Prognostic

factors include the type of sterilization procedure performed, the site of anastomosis, and postoperative tubal length (21). Tubal occlusion with rings or clips, isthmo-isthmic anastomosis, and tubal length greater than 5 cm are associated with a greater likelihood of achieving pregnancy after sterilization reversal.

Tubal anastomosis is appealing to couples who either desire sterilization reversal or who are not comfortable with IVF. The need for major surgery and future contraception are recognized disadvantages of tubal anastomosis. In women under age 35, microsurgery is a legitimate alternative to IVF, but tubal anastomosis in older women is more controversial. Although intrauterine pregnancy rates greater than 40% have been reported in women over 40 years of age (22), other experienced surgeons have observed lower success rates (15%) in this age category (23). IVF with intracytoplasmic sperm injection also is preferred for couples with coexisting severe male factor infertility. The best option for the woman in this case depends on the couple's reproductive goals and personal preferences.

Case #3

A 35-year-old ovulatory woman has an HSG that demonstrates bilateral proximal tubal occlusion. Her male partner has normal semen parameters.

Comment True proximal tubal occlusion can be caused by intraluminal debris, adhesions, infection, or chronic inflammation. The use of a single test to diagnose proximal tubal occlusion is discouraged. As described earlier, a falsely positive finding of occlusion of the fallopian tubes may result from either transient uterine contractions or other technical factors. Selective fluoroscopic salpingography or hysteroscopically directed tubal catheterization improves diagnostic accuracy and can differentiate true from false tubal blockage related to spasm, intraluminal debris, or minimal scarring (24–26); tubal patency can be achieved in over 80% of cases. When tubal disease is more severe, e.g., salpingitis isthmica nodosa, fluoroscopic or hysteroscopic recanalization is more challenging technically and less often successful (25, 26), and IVF generally is the better treatment option.

Microsurgical repair of proximal tubal occlusion is another option. Experienced surgeons have reported live birth rates as high as 57% and ectopic pregnancy rates between 5% and 12% following a segmental resection and anastomosis procedure (27, 28). Microsurgery may be a reasonable alternative to IVF when attempts at proximal tubal recanalization are unsuccessful in younger women, but the relatively low monthly fecundability (3% to 4%), costs, morbidity, and longer convalescence associated with laparotomy make IVF the preferred choice in older women.

When distal tubal disease is excluded by laparoscopy, cumulative pregnancy rates greater than 50% have been observed one year after proximal tubal recanalization, yielding an estimated monthly fecundability of 5% to 6% (24). In

unselected cases, cumulative pregnancy rates are lower (30%) after varying intervals of follow-up (25). In cases of proximal tubal occlusion without coexisting distal disease or pelvic adhesions, selective salpingography or hysteroscopically directed tubal recanalization represents a legitimate alternative to IVF, but significant bipolar tubal disease is treated most effectively with IVF (29).

The best option for the woman described in this case hinges on whether she has true proximal tubal occlusion. IVF is the preferred treatment for patients in whom tubal patency cannot be confirmed or re-established. Segmental resection and anastomosis are performed best by experienced microsurgeons.

SUMMARY

- Hysterosalpingography is a useful initial test for the evaluation of tubal patency, but laparoscopy may be necessary to stage pelvic disease accurately.
- The risks for ectopic pregnancy after reconstructive surgery (4% to 10%) and IVF (1% to 13%) are significant and comparable.
- Maternal age, number of children desired, coexisting infertility factors, risks for ectopic and multiple pregnancy, and treatment costs are the key variables to consider when advising couples on the relative advantages and disadvantages of surgical tubal reconstruction and IVF.
- IVF is the treatment of choice for older, reproductive-aged women with significant tubal pathology.
- IVF is the preferred treatment option for women with both proximal and distal tubal disease.
- The extent of tubal disease and pelvic pathology are important factors in determining the prognosis for success after surgical repair.
- Pregnancy outcomes after reversal of tubal sterilization relate to the type of sterilization procedure performed, the site of anastomosis, and postoperative tubal length.
- Selective salpingography or hysteroscopically directed procedures for tubal recanalization are useful methods to confirm the diagnosis of true proximal tubal occlusion.

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