Luke Witherspoon, MD, MSc, Ryan Flannigan, MD

Fertility treatment options after vasectomy

Couples who wish to achieve a pregnancy following a vasectomy should discuss the various treatment options with their specialists and consider the differences in pregnancy rates, timing to pregnancy, cost, and invasiveness to patient and partner.

ABSTRACT: Canadian men and their female partners are increasingly turning to vasectomy as a means of birth control. Although vasectomy is thought of as a permanent form of birth control, men who wish to attain fertility after having the procedure may undergo a vasectomy reversal to achieve pregnancy with their partner or undergo sperm retrieval and in vitro fertilization/intracytoplasmic sperm injection (IVF/ICSI). Vasectomy reversal patency rates are typically 90.0% to 99.5% when gold standard surgical techniques, such as the Goldstein microdot multilayer anastomosis, are used. Cumulative pregnancy rates with IVF/ICSI range from 18.2% to 69.4%, depending on the female partner's age. However, sperm retrieval procedures and IVF/ICSI, or vasectomy reversal procedures can yield similar efficacy for appropriately selected couples.

Dr Witherspoon is a sexual medicine and infertility fellow in the Department of Urologic Sciences, University of British Columbia, and the Department of Urology, Ottawa Hospital, Ontario. Dr Flannigan is an assistant professor in the Department of Urologic Sciences, University of British Columbia, and an adjunct clinical assistant professor in the Department of Urology, Weill Cornell Medicine, New York.

This article has been peer reviewed.

Men have been having vasectomies for more than 200 years.[1] Every year, approximately 6% of men (500 000) in the United States undergo a vasectomy.[2] In Canada, approximately 15% of men have the procedure, as the shift away from female sterilization continues.[3] However, the increase in vasectomy rates has led to an increased need for fertility options following vasectomy, as approximately 7.4% of men ultimately regret having a vasectomy and pursue some type of fertility assessment.[4] Four treatment options exist: vasectomy reversal; sperm retrieval and in vitro fertilization (IVF) with intracytoplasmic sperm injection (ICSI); acquisition of a sperm donor for intrauterine insemination or IVF/ICSI; or child adoption. Approximately 60% of men who request a vasectomy reversal are in a new relationship; the rest are in the same relationship they were in when they had a vasectomy.[5] We review the considerations, prognostic factors, and outcomes associated with vasectomy reversals and sperm retrieval with IVF/ICSI as potential fertility options for couples seeking fertility after a vasectomy.

Evaluation and considerations

Both partners who are proceeding with a fertility assessment after vasectomy should have a thorough history taken and undergo a physical examination to determine if additional causes of infertility may be present. In addition, the male partner's fertility history (previous associated pregnancies and children), inguinal surgery history (specifically, hernia repairs), time since vasectomy, and erectile and ejaculatory function should be assessed. His current and recent medication use should also be fully reviewed, with a focus on the use of any anabolic steroids or testosterone supplementation. Discussion about the couple's family planning is likely warranted, and should include the number of children desired and the future desire for sterility.[6]

A focused physical examination should include an exam of the inguinal region for surgical scars, and a full assessment of the testes and scrotal contents. The entire cord structure should be palpated, with the location of the vasectomy identified. The presence of granulomas on the testis side of the vas deferens should be noted, as it may reflect a positive prognosis.[6] Most men who undergo vasectomy reversal have a history of fertility,[7] but if a man has no documented fertility prior to undergoing a vasectomy, a formal fertility workup, including hormonal profile, may be undertaken.[8]

An assessment of the female partner is also required. Although there are no clear guidelines about which women require full fertility assessments, some guidelines suggest that all women over 35 years of age should be offered an expedited fertility evaluation.[9] Prior documented fertility, especially if it was within the same relationship in which they achieved a prior pregnancy, is a positive prognostic factor for pregnancy and live births in couples undergoing vasectomy reversal.[10]

Vasectomy reversal

Compared to historical vasectomy reversals, contemporary subspecialized reproductive microsurgery has evolved significantly and refined the procedure to provide excellent outcomes for patients. Although some practitioners still perform the procedure using surgical loupes,[11,12] most specialists use an operating microscope, which allows for a precise microscopic anastomosis. Should further surgical complexity be encountered intraoperatively, use of a microscopic approach is typically necessitated for epididymal reconstruction, thereby limiting the use of loupes.[11] The need for epididymal reconstruction on at least one side occurs in approximately 30% to 60% of vasectomy reversal procedures, and is not reliably predicted preoperatively; thus, the general standard of care is to perform reversals with an operating microscope.[13,14]

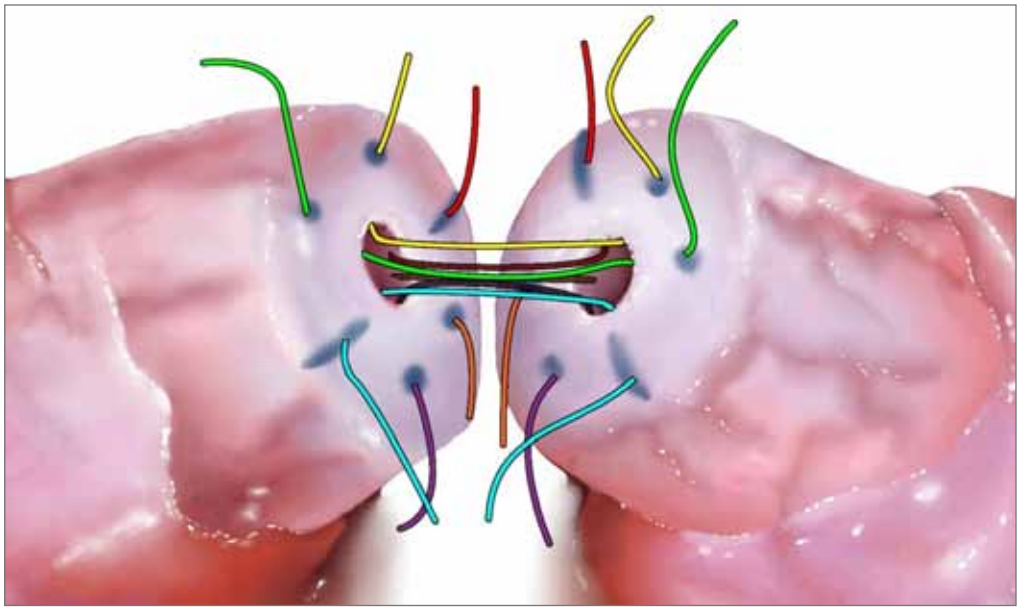

FIGURE 1. Goldstein microdot multilayer anastomosis. Six 10-0 mucosal anastamotic sutures are placed. Three additional layers of sutures are placed for a precise and watertight anastomosis.

Procedure

Vasectomy reversal procedures are typically performed through two small incisions in the scrotum, where the obstructed vas deferens is identified. The obstructed ends are then transected, and fluid is expressed from the testicular end of the vas deferens. Microscopic inspection of the fluid is vital because it dictates whether a vasovasostomy can be performed or a more complicated vasoepididymostomy must be carried out. If full sperm or sperm parts are identified, or if there is copious clear fluid, then a vasovasostomy is performed. Several techniques for performing vasectomy reversals have been described since the procedure's inception. An ongoing debate has centred on the use of either multilayered or single-layered closures for the connection between the ends of the vas deferens. Multilayer closures allow for precise mucosal approximation and ensure a leak-proof alignment. However, a potential disadvantage of this approach is that sutures are tied adjacent to the vas deferens mucosa, which may promote fibrosis and anastomotic stricture.[15] Single-layer approaches are technically easier, although there is some concern that a good mucosal approximation is less possible and may promote anastomotic misalignment or leak leading to failure.[15] A recent meta-analysis on this topic found no difference between the two techniques, although inconsistent reporting of outcome measures, exclusion of papers with highest patency rates using multilayer techniques, and suspected publication bias make meta-analyses of this topic difficult.[16] Reported patency rates following these procedures have been reported to range widely from 80.0% to 99.5% depending on the series reported.[16]

Gold standard technique

The highest reported success rate for vasovasostomy is the Goldstein microdot multilayer anastomosis (patency rate of 99.5%), where six ink dots are placed equidistantly beyond the mucosal-muscularis junction of the vas deferens **[Figure 1]**.[17] This allows for mapping of planned suture locations to ensure consistent suture spacing and to maximize lumen approximation and minimize the chance of leakage.[17] This technique has undergone continued improvement with the addition of a 15-degree angled cut of the vas deferens prior to anastomosis, contributing to a patency rate of 99.5%.[18] Furthermore, recent reports that have formalized tension-relieving suture techniques (e.g., ReVas) suggest that sperm counts and pregnancy rates improve following vasectomy reversal. The ReVas reduces anastomotic tension, a factor that may lead to anastomotic failure.[13]

Impact of time since vasectomy

Several prognostic factors for successful return of sperm, and ultimately pregnancy, have been highlighted within the fertility literature. One of the most discussed, but controversial, factors has been interval of obstruction. Early reports described reduced success with increasing time since vasectomy, particularly beyond 10 years postsurgery;[19] however, several articles have shown no differences 15 years following vasectomy.[20,21] The concept of reduced success rates following longer obstructive intervals is related to secondary obstruction of the epididymis. During the obstructive interval, the testis continues to make sperm and fluid. This results in increased epididymal tubule pressure and may lead to rupture and scarring. Thus, in the presence of an epididymal obstruction, a regular vasectomy reversal that connects the two ends of the vas deferens will not work, and an epididymal reconstruction will be necessary to achieve success. Upon intraoperative inspection of vasal fluid, epididymal obstruction can be confirmed if no sperm parts are identified, no fluid can be expressed, or thick toothpaste-like fluid is encountered.[22] Therefore, a discussion about reversal as a treatment option should be held with couples in which the male partner has had a prolonged obstructed interval, but they should be counseled on the

FIGURE 2. Longitudinal intussuscepted vasoepididymostomy (LIVE) technique for epididymal anastomosis. Two 10-0 sutures are used to anastomose the epididymal tubule to the vasal lumen. Additional 9-0 sutures are placed to secure the vas deferens to the tunical layer of the epididymis.

higher risks of needing more complicated, and possibly less efficacious, procedures such as a vasoepididymostomy.[23]

Epididymal reconstruction

The most widely used procedure for epididymal reconstruction is the longitudinal intussuscepted vasoepididymostomy (LIVE) technique **[Figure 2]**. It involves microscopic identification of an area above the suspected obstruction, where a small longitudinal incision is made into the epididymal tubule. The abdominal-oriented side of the vas deferens is then anastomosed to the tubules microscopically, typically with 10-0 and 9-0 sutures.[24] This is an intricate process and, in fact, the most technically demanding microsurgical procedure in male reproductive surgery. The success rate of LIVE depends largely on microsurgical expertise.[24] Reported patency rates of the procedure range from 48% to 92%, with a late failure rate of 0% to 4%.[24,25] Thirty-one percent of couples in which the male underwent the LIVE technique reported natural pregnancy at a median of 15.3 months; an additional 39% achieved pregnancy with IVF using ejaculated sperm.[24]

Outcomes and cost

Overall, a single vasectomy reversal procedure can provide the couple with the opportunity to have one or more children. Conventional vasectomy reversal patency rates are typically greater than 90.0% and up to 99.5% when a gold standard technique is used.[10,16,17] If epididymal reconstruction is required, determined intraoperatively, patency rates are highly variable depending on surgeon skill and technique, and range from 48% to 92%.[24,26,27] Men who undergo a vasectomy reversal can expect to have sperm return to ejaculate approximately 2 to 6 months following repair if it is successful,[28] and barring any female factor infertility concerns, pregnancy within approximately 1.0 to 1.5 years.[5,29] Pregnancy success rates can range from 42% to 94.2% depending on the female partner's age.[14,30] In British Columbia, based on the authors' current experience, the estimated cost of vasectomy reversal, anesthetic, and hospital charges ranges from $8000 to $10 000 when the procedure is performed by a reproductive microsurgeon.

In vitro fertilization and intracytoplasmic sperm injection

Sperm retrieval and IVF/ICSI

In the postvasectomy patient, sperm may be retrieved via percutaneous (i.e., percutaneous epididymal sperm aspiration; testicular sperm aspiration) or open sperm retrieval (i.e., testicular sperm extraction; microsurgical epididymal sperm aspiration) **[Figure 3]**. Retrieved sperm can then be used for IVF/ICSI. IVF/ICSI was first reported in 1992: Palermo and colleagues demonstrated that injection of a single sperm into an oocyte may result in successful fertilization, embryo development, and ultimately pregnancy and live birth following embryo transfer into the uterus.[31] This technique is not dependent on the sperm being motile or having normal acrosome function.[32] Reports of successful ICSI have been reported with as little as a single viable sperm, which makes even extremely oligozoospermic patients candidates for this technology.[33]

Outcomes and cost

According to the Canadian Fertility and Andrology Society, live birth rates per fresh IVF treatment cycle using the female partner's oocytes are 33.7% among women aged less than 35 years, 28.7% among women aged 35 to 39 years, and 21.9% among women aged 40 years and older.[34] Cumulative pregnancy rates with

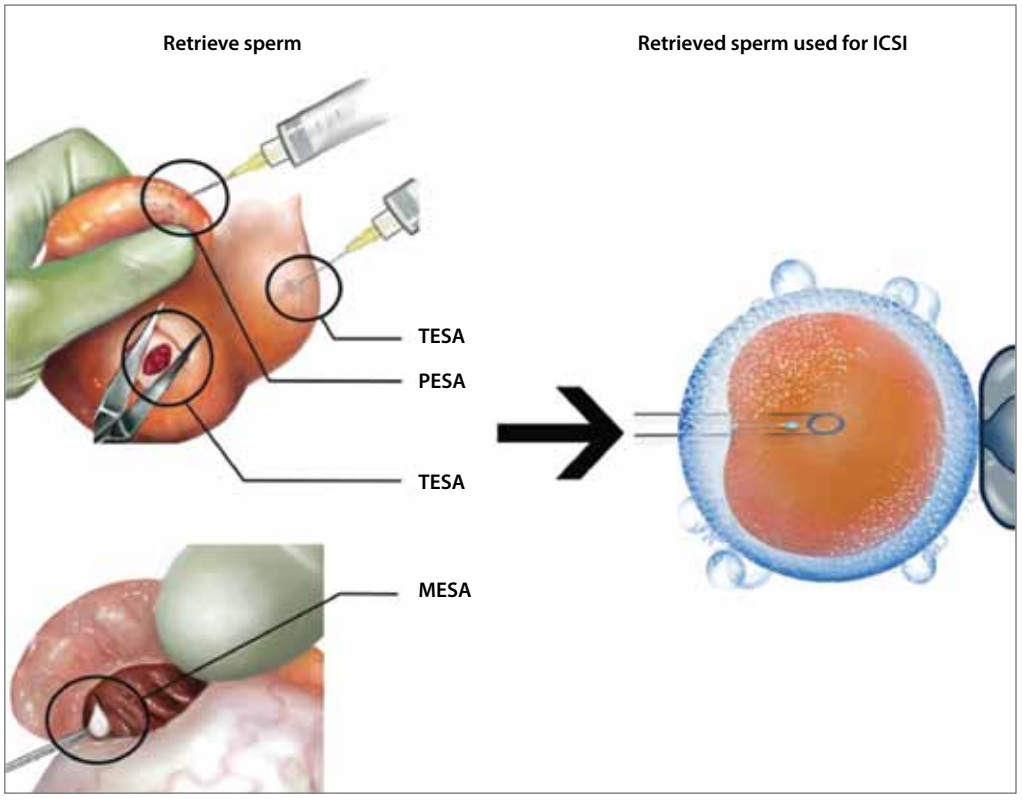

FIGURE 3. Surgical sperm retrieval option to acquire sperm for intracytoplasmic sperm injection (ICSI—intracytoplasmic sperm injection; TESA—testicular sperm aspiration; PESA—percutaneous epididymal sperm aspiration; TESE—testicular sperm extraction; MESA—microsurgical epididymal sperm aspiration).

IVF/ICSI, defined as performing one or more cycles of embryo transfer from a single egg retrieval, have higher rates of reported success. When performing between one and four embryo transfers, pregnancy rates are 46.9% to 69.4% among women aged less than 35 years, 35.5% to 62.0% among women aged 35 to 40 years, and 18.2% to 34.0% among women older than 40 years.[34]

The average duration from initiation of IVF/ICSI attempts and confirmed pregnancy is approximately 8 months.[5] In British Columbia, the cost of percutaneous sperm retrieval and a typical cycle of IVF/ICSI (egg retrieval, embryo transfer, medications, embryo freezing/storage ± genetic testing) can range from $13 000 to $22 000 depending on IVF medication insurance coverage and selection of genetic testing or screening, with additional frozen embryo transfers ranging from $1500 to $2000 per embryo.[35,36]

Impact of female age on IVF/ICSI and vasectomy reversal outcomes

The importance of female partner age has long been considered one of the deciding factors for pursuing either IVF or vasectomy reversal. It has been recommended that if the female partner is 40 years of age or older, the couple should pursue aspiration of sperm and IVF rather than undergo a vasectomy reversal and await natural conception.[37] However, this has been challenged in the last decade. Natural pregnancy rates based on maternal age have been reported to be 91% among women less than 30 years, 77% among women 31 to 35 years, and 53% among women by age 40 years.[38] Pregnancy rates among couples in which the male partner has had a vasectomy reversal and the female has no significant infertility factors are slightly higher when compared to a single IVF/ICSI cycle but are comparable to cumulative IVF/ICSI. Among female partners aged 30 to 35 years, vasectomy reversal cumulative pregnancy rates are 78.4%, whereas single-cycle IVF/ICSI pregnancy rates are 56.6%, and cumulative IVF/ICSI rates can be as high as 69.4%.[30,34] In women over 40 years of age, vasectomy reversal cumulative pregnancy rates are 42.0%, whereas single-cycle IVF/ICSI pregnancy rates are between 19.0% and 27.3% per cycle, and cumulative IVF/ICSI rates are reported to be as high as 34.0%.[30,34] Although no age-stratified studies that compare time to pregnancy between IVF/ICSI and vasectomy reversal have been reported, a study of female partners with a mean age of 34.8 years in the IVF/ICSI group and 33.8 years in the vasectomy reversal group showed a mean (standard deviation) time to pregnancy of 8.2 (13.0) months for IVF/ICSI compared to 16.3 (11.3) months for vasectomy reversal.[5]

There are multiple treatments that can produce excellent results and allow many patients to achieve pregnancy following a prior vasectomy.

Summary

Men and their female partners have several options for achieving a pregnancy following vasectomy. Counseling remains of critical importance in this patient population, given that success rates between either sperm retrieval procedures and IVF/ICSI, or vasectomy reversal procedures can yield similar efficacy for appropriately selected couples, such as those involving a female partner aged less than 40 years. However, some differences in the timing to pregnancy, cost, and invasiveness to patient and partner exist, so careful discussion about the pros and cons of each course of treatment should be undertaken with respective specialists. What can be emphasized to these patients, regardless of their choice, is that there are multiple treatments that can produce excellent results and allow many patients to achieve pregnancy following a prior vasectomy. ■

Competing interests

None declared.

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