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### **Title**

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### **Permalink**

<https://escholarship.org/uc/item/7234894j>

### **Journal**

Andrologia, 53(6)

### **ISSN**

0303-4569

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### **Publication Date**

2021-07-01

### **DOI**

10.1111/and.14066

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Peer reviewed

# Challenges in completing a successful vasectomy reversal

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## Abstract

Although a wide array of interventions exist for men seeking fertility after vasectomy, up to 6% of them will elect for a vasectomy reversal. While the widespread adoption of telemedicine promises convenience and improved access, lack of ability to do a physical examination may hinder appropriate counselling. Although vasectomy reversal is successfully completed in most of the men either with a vasovasostomy or a vasoepididymostomy, there could be various reasons for the inability to successfully complete the operation. Our commentary outlines the reasons why a vasectomy reversal is not possible or successful. We also discuss a pre-operative management algorithm in men seeking vasectomy reversal to ensure appropriate counselling with a thorough pre-operative history, physical examination and on occasion, hormonal evaluation.

## KEYWORDS

male infertility, microsurgery, vasectomy reversal, vasovasostomy

## 1 | INTRODUCTION

In the United States, vasectomy is the most common cause of obstructive azoospermia, with estimates of 175,000 to 350,000 men undergoing a vasectomy each year (Namekawa et al., 2018). The joint American Society of Reproductive Medicine (ASRM) and American Urological Association (AUA) 2020 male infertility guidelines highlight that couples desiring conception after vasectomy have the option of surgical reconstruction, surgical sperm retrieval, or both reconstruction and simultaneous sperm retrieval for cryopreservation (Schlegel et al., 2020). While vasectomy reversal remains the only method to allow for natural conception, the joint ASRM and AUA 2020 male infertility guidelines fail to mention the situations where a vasectomy reversal would not be able to be performed. Additionally, several studies have demonstrated for the vasectomy reversal to be cost effective as compared with sperm retrieval for in vitro fertilisation (IVF) or intracytoplasmic sperm injection (ICSI; Shridharani & Sandlow, 2010). Approximately 20% of men who previously underwent a vasectomy express the desire to have future

children with up to 6% of men ultimately requesting a reversal procedure to either re-establish fertility potential or for treatment of post-vasectomy pain (Sharma et al., 2013).

A vasectomy reversal commonly refers to the microsurgical techniques of vasovasostomy (VV) and the considerably more technically challenging vasoepididymostomy (VE) owing to the size and fragility of epididymal tubules. While an increase in the obstructive interval is associated with higher likelihood of requiring VE, the ability to perform the VE technique is a necessary skill for any surgeon offering vasectomy reversal since epididymal obstruction can only be determined intra-operatively, via macro- and microscopic intravasal fluid examination (Scovell et al., 2015). Nevertheless, success of vasectomy reversal depends on sound clinical judgement, good microsurgical skills, and appropriate selection of operative candidates identified via a thorough pre-operative history and physical examination.

Although surgical technique remains a critical piece for success, there are a number of anatomic and functional reasons why a vasectomy reversal may be unsuccessful (Table 1).

**TABLE 1** Factors which could impact a successful vasectomy reversal

History	Physical examination
History of testosterone or anabolic steroid use	Short-testicular vas length after vasectomy
Prior infant or childhood orchidopexy with vasal damage or atrophy	Inguinal herniorrhaphies
Intratesticular obstruction suspected due to testicular or epididymal infection	Partial or total epididymectomy for management of post-vasectomy pain syndrome or epididymal cysts
Conditions including hypertension, diabetes mellitus, tuberculosis, or filariasis leading to multiple sites of vasal obstruction	Congenital unilateral or bilateral absence of vas
Multiple failed PESA (Percutaneous epididymal sperm aspiration)	Other congenital abnormalities of the mesonephric duct (vasa, epididymis, seminal vesicles)
Medical comorbidity with unacceptable risk of surgery/anaesthesia	Atrophic, soft testicles
Imaging/Hormones	Intra-operative events
Cystic ectasia of rete testis	Biopsy confirming Sertoli Cell Only syndrome
Testicular tumour	Prolene test or vasography confirms obstruction proximal to site of vasectomy
Proximal vasal or ejaculatory duct atrophy	Long vasal gap that cannot be bridged without elevating testicle to an abnormally high position
Multiple Vasographies resulting in scarring	Intraoperative nonurologic anaesthetic, cardiovascular, pulmonary or medication complications
Elevated FSH with atrophic testicles	

## 2 | ANATOMIC CHALLENGES

A patient's surgical history can shed light on whether previous iatrogenic injuries could impact vasal reconstruction. Inguinal herniorrhaphy is the most common cause of iatrogenic vasal obstruction and testicular atrophy due to a compromise of testicular blood supply. Other procedures performed in the scrotal, inguinal and pelvic areas such as orchidopexy, pelvic surgery, renal transplantation, varicocelectomy and hydrocelectomy can injure the vas as well (Shin et al., 2005). Bilateral inguinal vasal obstruction or unilateral obstruction with a poorly functioning contralateral testis is a potentially unrecognised and uncommon cause of azoospermia in the male infertility patient. Iatrogenic injuries to the vas are usually not identified at time of injury and may not come to light in infants and children until fertility problems arise much later in life. The issues surrounding iatrogenic injuries to the vas include unpredictable length of occlusion, multiple occlusion sites, long obstructive interval and severe fibrosis or obliteration.

There can also be occult abnormalities, acquired or congenital, that may not be expected or appreciated until a surgeon is evaluating the testicle, epididymis and testicular vas intra-operatively. Patients may have acquired excurrent ductal obstruction ranging from the rete testis to the retroperitoneal vas due to trauma or infections such as epididymitis and orchitis. Patients with maldevelopment of the mesonephric duct such as congenital unilateral absence of the vas deferens or segmental aplasia of the vas can have epididymal or ejaculatory duct absence or obstruction on the contralateral side (Vohra & Morgentaler, 1997). A careful review of the patient's history and physical examination can help identify factors that increase risk of unexpected findings in the operating room.

## 3 | FAILURE OF SPERMATOGENESIS

While disruption in normal anatomy can pose a surgical challenge, equally important is identifying patients where a reversal

will not improve fertility potential. Acquired testicular failure can be seen in men with history of testosterone replacement therapy (TRT) use. The average age of a man seeking vasectomy reversal is 41, and men in their 40s have a 1.5 to 2% prevalence of testosterone use in the United States (Baillargeon et al., 2018; Coward et al., 2014). Increases in systemic testosterone levels are coupled with impaired sperm production due to centrally suppressed release of gonadotropins and low-intratesticular testosterone levels. Sperm concentrations usually recover to pre-treatment levels after the cessation of TRT; however, recovery could take up to 2 years and in some cases spermatogenesis may not even recover (Liu et al., 2006). Identifying a history of testosterone or anabolic steroid use should prompt further evaluation and treatment with medications to boost intratesticular testosterone prior to proceeding with vasectomy reversal.

Idiopathic causes of non-obstructive azoospermia could be missed in the 3.5% of patients who underwent a vasectomy before having children (Sharma et al., 2013). Non-obstructive azoospermia, ranging from Sertoli cell-only syndrome to maturation arrest and hypospermatogenesis may be present in men without identifying physical characteristics. This failure of spermatogenesis could be missed in men who have not fathered children, as the diagnosis of non-obstructive azoospermia is identified during an infertility evaluation.

## 4 | HISTORY

As with any surgical procedure, success begins with accurate identification of appropriate operative candidates by completing a comprehensive medical and surgical history.

Historical elements should include timing since vasectomy, post-vasectomy complications such as infection or hematoma and other surgical history with focus on pelvic, inguinal and genitourinary procedures that could result in iatrogenic vasal injury. This focussed surgical history, which can often be obtained in person or through

telemedicine, can help shape the pre-operative discussion and highlight that there are scenarios where an obstruction may be present beyond the vasectomy site.

Moving forward with vasal reconstruction relies on the assumption that a patient only has an obstructive component to male infertility. The pre-operative evaluation should help rule out acquired testicular failure by identifying previous or current exogenous testosterone or anabolic steroid use. History taking should also incorporate fertility before vasectomy, the age of the female partner, evaluations of female infertility and family planning goals including number of children and timing as this could preclude vasal reconstruction and lead to a discussion of further workup and possibly using assisted reproductive technologies.

## 5 | PHYSICAL EXAMINATION

The physical examination can help identify both anatomic and functional concerns that could impact success of vasal reversal. A detailed examination should focus on location and length of vasal gaps, presence of sperm granuloma, epididymal abnormalities including absent portions and cysts, testicular size and consistency, as well as surgical scars in the pelvis, inguinal region and scrotum. These different components may impact counselling from need for conversion to a VE to the use of complex reconstructions such as vasal crossovers or extended mobilisation of the vas deferens to intra-operative findings that would result in inability to complete the surgery.

A careful examination of the palpable Wolffian structures will assist a surgeon in anticipating intra-operative challenges. The removal or cauterisation of a large vas segment during vasectomy requires extended mobilisation of the vasal stumps to attempt reconstruction. A short testicular vasal segment can impact intravasal fluid characteristics and increase risk of intravasal azoospermia and require a VE (Witt et al., 1994). Finding large vasal gaps or short testicular vasal remnants may indicate an inability to create a tension-free anastomosis without elevating the testicles, a scenario that should be discussed pre-operatively. Patients with pelvic, inguinal, or scrotal scars could harbour retroperitoneal, inguinal, or multiple vasal sites of obstruction requiring adjunct intra-operative manoeuvres to bypass obstructed sites or a termination of the procedure. Anticipating these challenging scenarios should impact pre-operative counselling and informed consent.

Coupled with a good history, the scrotal physical examination is essential beyond identifying factors that could impact the technical challenges of surgery. The male genital examination provides essential information for estimating presence of spermatogenesis and other contributors to infertility. Since the majority of testis volume is made up from seminiferous tubules, a small and firm testis suggests impaired sperm production. Furthermore, there may be men who are found to have a clinical varicocele and need to be counselled that fertility potential could be impaired even with a successful vasal reconstruction.

## 6 | TELEMEDICINE

Indeed, telehealth proves to be useful to broaden access to care for couples that may not have a reproductive urologist trained in microsurgery close to them. Unfortunately, telehealth is limited, in that only a thorough medical, fertility and surgical history can be obtained before vasectomy reversal without a physical examination. With the widespread adoption of telemedicine, the importance of the physical examination cannot be underestimated. Patients who have not been examined by their surgeon need to understand there is a risk that an examination on the day of surgery could reveal they have a higher risk of unsuccessful surgical attempt or in some circumstances even cancelling the surgery. While a physical examination should be performed prior to the day of surgery, geographic barriers or unprecedented events such as the COVID-19 pandemic may prevent patients from having a pre-operative visit prior to surgery. In these cases, a thorough physical examination would need to be performed on the day of surgery and appropriate expectations regarding success should be set for patients that were evaluated only with telehealth.

## 7 | HORMONAL EVALUATION

Given that undergoing a vasectomy reversal relies on the assumption that there is only an obstructive component to the patient's infertility, follicle-stimulating hormone (FSH) may be used in the pre-operative evaluation to confirm healthy spermatogenesis. While FSH does not need to be used in all men undergoing reconstruction, FSH may provide a useful biomarker in men with a history of impaired spermatogenesis. Elevated FSH greater than 7.6 IU/L in the presence of atrophic and soft testicles is highly suggestive of spermatogenic failure rather than obstructive azoospermia (Schlegel et al., 2020). Combining the history, testicular examination and FSH levels can identify failures of spermatogenesis before proceeding to a surgery resulting in a technical success without improving fertility.

When FSH is elevated, there are two key aspects of the history that should make the surgeon consider offering an in-office testicular sperm aspiration (TESA) to confirm spermatogenesis. The first is a previous history or concerns about infertility prior to vasectomy as well as the men who underwent a vasectomy prior to having children. In these scenarios, a TESA can offer reassurance that re-establishing vasal patency will return spermatozoa in the ejaculate and provide patients with a chance of natural conception.

## 8 | INTRA-OPERATIVE

Successful vasal reconstruction relies on the core surgical principle of creating a water-tight, tension-free anastomosis. The surgical microscopic minimises trauma to healthy tissues and allows the vasal mucosa to be reapproximated to restore patency and outflow of spermatozoa from the testicle. Even with a careful history and

physical examination, there are scenarios that arise intra-operatively that could preclude a successful reconstruction.

The first major intra-operative decision revolves around whether VV or VE is indicated as part of the reconstructive surgery. The macroscopic examination includes fluid opacity and viscosity, while the microscopic examination looks for the quantity and quality of the spermatozoa, including motility and sperm parts. An indurated or convoluted epididymis, as well as the presence of hydrocele, are often associated with secondary epididymal obstruction and may indicate the need for VE. The intravasal efflux with the testicular end of the vas deferens, or fluid obtained with barbotage, will inform the surgeon if secondary epididymal obstruction has ensued (Scovell et al., 2015). Obtaining creamy, toothpaste-like fluid without spermatozoa will obligate the surgeon to perform a VE. On the other hand, clear, cloudy or creamy fluid with spermatozoa or sperm parts within the vas deferens eliminates the possibility of epididymal obstruction.

For patients with a short testicular vasal segment, the surgeon should be prepared to encounter the convoluted vas as part of the vasectomy site. Given the thin muscular wall and discrepancy in the luminal size of the convoluted vas and the straight vas on the abdominal end, an anastomosis in the convoluted vas deferens may be more technically challenging than in the straight portion. However, there is evidence showing that continuing with a VV will have better success rates than VE when spermatozoa or sperm parts are seen in the intra-operative vasal fluid (Sandlow & Kolettis, 2005). In essence, while more technically challenging the decision-making is still driven by the vasal fluid seen at the time of surgery.

Some patients may have multiple sites of obstruction or obstruction proximal to the site of vasectomy that are only discovered intra-operatively. This lack of vasal patency can be identified when the surgeon is unable to flush the abdominal end of the cut vas. The location of obstruction can be estimated by passing the non-needle end of a 0 prolene suture proximally into the abdominal vas. If the suture does not pass easily, the distance to obstruction can be measured based on length of suture passed. Alternatively, an intra-operative vasography can be performed using water-soluble contrast and portable X-ray. In cases where proximal obstruction is confirmed, patients may require more challenging surgical manoeuvres including vasal crossover procedures, inguinal and/or retroperitoneal dissection, or laparoscopic mobilisation of the retroperitoneal vas deferens (Kramer & Meacham, 2006). The impact abdominal vasal length can also impact reconstruction, especially in patients requiring VE, as with a short abdominal vas it may not be possible to mobilise enough vas to successfully complete a tension-free VE. Additionally, patients with multiple obstruction sites of the vas, due to medical, idiopathic or iatrogenic conditions, will not be able to undergo a successful reversal and should consider IVF for family planning.

## 9 | CONCLUSIONS

With a wide array of post-vasectomy treatment options, it is of utmost importance that a thorough pre-operative evaluation is

completed to ensure that vasal reconstruction is the most appropriate recommendation for restoring fertility. When vasectomy reversal is planned, a focused history, physical examination and hormonal evaluation can help surgeons anticipate technical and functional challenges that could impact surgical outcomes. While the most important factor for vasectomy reversal success is patient selection and surgical technique, this article highlights all of the possible factors that can impact the success of a vasectomy reversal. With the widespread adoption of telemedicine, the importance of the physical examination should not be understated in patients seeking natural conception through vasal reconstruction.

## DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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**How to cite this article:** Andino JJ, Gonzalez DC, Dupree JM, Marks S, Ramasamy R. Challenges in completing a successful vasectomy reversal. *Andrologia*. 2021;53:e14066. <https://doi.org/10.1111/and.14066>