Techniques in urology – Tension-relieving microdot vasovasostomies and longitudinal intussuscepted vasoepididymostomy vasectomy reversals

A first report

Abdullah Alhamam[1,2,3], Kiera Liblik[4], Luke Witherspoon[5], Adam Dorner[6], Ryan Flannigan[1,2,7]

[1]Department of Urologic Sciences, University of British Columbia, Vancouver, BC, Canada; [2]Vancouver Prostate Center, Vancouver, BC, Canada; [3]Department of Urology, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia; [4]School of Medicine Queen's University, Kingston, ON, Canada; [5]Department of Urology, University of Ottawa, Ottawa, ON, Canada; [6]Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada; [7]Department of Urology, Weill Cornell Medicine, New York, NY, United States

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ABSTRACT

INTRODUCTION: Tension and malalignment of vasectomy reversal (VR) anastomoses are hypothesized to contribute to failure. We report VR outcomes using a novel technique introducing a tension-reliving hitch in the multilayer microdot vasovasostomy (VV) and longitudinal intussuscepted vasoepididymostomy (LIVE; VE).

METHODS: All VR patients between May 2019 and September 2023 from a single surgeon were reviewed. Patients were included if they underwent a VR with at least one semen analysis within six months of surgery and a minimum of six months of followup after the surgery to deem a failure. The primary outcome was patency, which was defined as 1) any sperm in the ejaculate; and 2) functionally as at least two million motile sperm. Late failure was defined as an azoospermic semen analysis result after previously documented presence of sperm.

RESULTS: A total of 159 patients were evaluated, of which 136 patients met the inclusion criteria. The patency rate among all VRs was 97.7 %, with an overall functional patency rate of 93.1%. One hundred and one patients underwent bilateral VVs, with a 99% patency rate and 95.5% functional patency rate. Twenty-three patients underwent a mixed VV/VE, with a patency rate of 100% and a functional patency rate of 88.8%. Finally, 12 patients underwent bilateral VE, with a patency rate of 83.3% and a functional patency rate of 77.7%. Among these patients, four VV patients were identified to have a late failure.

CONCLUSIONS: The combination of tension-relieving stitches for VVs and VEs, along with attention to symmetrical and precise stitch placement, results in high patency rates.

INTRODUCTION

Vasectomy reversal (VR) is achieved via vasovasostomy (VV) or vasoepididymostomy (VE). The definition of patency is heterogeneous. Several studies have defined patency as the presence of motile sperm, with patency ranging from 84–88%.[1-3] Other studies have described patency as any sperm in the ejaculate, with a success rate ranging from 89–98%.[4,5]

Epididymal obstruction following vasectomy necessitates the use of a VE anastomosis. A meta-analysis involving 42 studies of bilateral vasoepididymostomies revealed an overall mean patency rate of 64.1%.[6]

One of the post-reversal risks is late failure, which is defined as the onset of azoospermia or having nonmotile sperm after previously demonstrating motile sperm.[7]

We hypothesized that high patency rates could be achieved by adding tension-relieving sutures to the vasal adventitia and precisely placing 10-0 and 9-0 sutures to form the anastomosis. This study reports our technical patency and late failure rates.

METHODS

After clinical research ethics board approval, a retrospective review was performed on all VRs conducted between May 2018 and September 2023. Two independent reviewers were used for chart review and data extraction.

KEY MESSAGES

- IVasectomy reversals commonly require vasoepididymostomy anastomoses with longer intervals of obstruction; however, 15% of individual will still require a vasoepididymostomy with obstructive intervals <5 years.
- Using a microdot surgical technique to promote symmetrical and precise stitch placement in addition to tension-relieving hitch stitches results in high patency rates.
- Longitudinal intussuscepted vasoepididymostomy technique with three tension-relieving sutures promotes high patency rates.
- More work is required to define standardized patency and late failure definitions.

Surgical technique

Depending on the microscopic examination of the testicular vasal fluid, if the microscopic fluid examination revealed motile sperm, non-motile sperm, sperm with short tails, or sperm heads, the surgical team proceeded with VV, as previously reported.[8] The microdot two-layer anastomotic technique was used as described by Goldstein,[9] with minor modifications. Transection of the vas deferens deviates from Goldstein's reports, where we use a 15-blade scalpel due to a lack of availability of the described beaver blade in Canada. We use six interrupted 10-0 Nylon sutures for the mucosal layer and 12 interrupted 9-0 Nylon sutures for the muscularis, with small modifications to 9-0 placement. We systematize 9-0 placement by placing the 9-0 sutures superficial to the 10-0 sutures. The 9-0 sutures placed between the 10-0s were intended to be precise in depth and distance between the suture placement's entrance and exit sites (Figure 1). A single 5-0 Prolene stitch was added through the vasal adventitia to achieve a tension-free anastomosis (Figure 1).

If no sperm or sperm parts were detected, or no sperm were seen even after gentle barbotage or in the presence of copious clear fluid, a VE was performed. The longitudinal intussuscepted vasoepididymostomy (LIVE) technique was used. The abdominal vas was tunneled through the tunica vaginalis and secured by three 5-0 prolene 'hitch stitches.' After confirmation of sperm through puncture of an epididymal tubule, an anastomotic site was chosen proximally toward the testis. Three 9-0 Nylon sutures were placed between the vasal muscularis and the tunica vaginalis posteriorly. Two parallel, double-arm 10-0 sutures were placed in the chosen epididymal tubule oriented longitudinal to the vas deferens; however, the needles were only partially pulled through. A small incision was made between the two needles with a triangular ophthalmic Beaver Mini-Blade. Once the epididymal fluid released from the tubule, confirming that it had been cut, both needles were pulled through, and all four needles placed through the vasal lumen from inside to out for the respective positions. Six to ten 9-0 sutures were applied between the epididymal tunica and the vasal muscularis to reduce the tension over the anastomoses and create a watertight connection (Figure 2).

Followup

Patients performed a first semen analysis 6–8 weeks postoperatively, then every 2–3 months until normalization of semen analysis parameters or pregnancy is achieved.

Inclusion criteria

Patients who pursued a VR for fertility purposes were included. Patients needed at least one semen analysis within six months of surgery and a minimum of six months of followup.

Outcomes

Patency rate after VR was defined as any sperm in the ejaculate. We also included a second functional definition of patency, which is at least two million total motile sperm (TMS), which is reported to be the lowest threshold for intrauterine insemination.[10] Secondary outcomes included late failure rate, which was defined as the development of azoospermia after the previously documented presence of sperm following VR.

RESULTS

A total of 159 patients underwent VR, and 136 met the criteria. The mean time since vasectomy was eight years (standard deviation [SD] 5.50). The mean patient age was 41 (SD 6.17), and the mean partner's age was 34 years (SD 4.63). Table 1 reports patient characteristics.

The overall patency rate for all vasectomies (VVs, VEs, and mixed VV/VE) was 97.7% for finding sperm and 93.1% for at least two million TMS. A total of 101

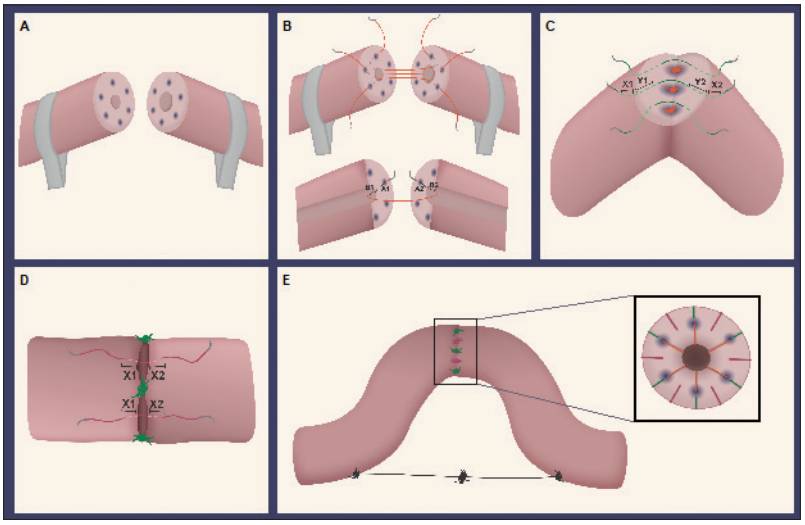

Figure 1. Overview of W technique. (A) Six equally spaced microdots are added with a fine tip micro pen for precise and consistent targets to place the 10-0 sutures. (B) Double arm 10-0 Nylon sutures are placed inside-to-out for the inner mucosal layer (orange). (C) 9-0 Nylon suture are placed through the muscularis layer superficial to 10-0 suture (green); here, y1 and y2 represent symmetry of suture depth between each side and x1 and x2 demonstrate symmetry of suture bite width relative to the muscularis edge to optimize alignment of the vasal tubes. (D) Remaining 9-0 Nylon placement for muscularis layer between the 10-0's and 9-0's previously placed; again, x1 and x2 represent symmetry of suture bite size from the edge of the vasal tube to complete the watertight anastomosis. (E) A single 5-0 Prolene is placed through the vasal adventitia to create a gentle arc for tension-relief on the anastomosis during the postoperative recovery period once gravity pulls the testicle down with the vas deferens being the shortest structure in the spermatic cord after vasectomy reversal (black).

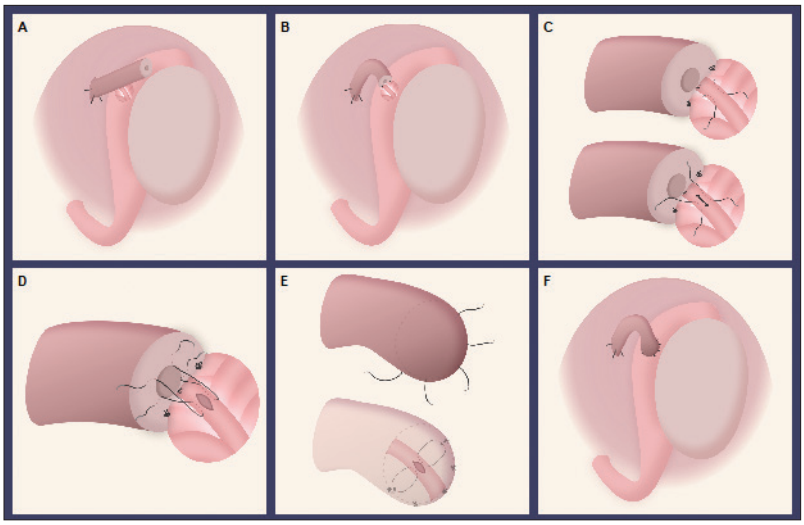

Figure 2. Overview of LIVE with hitch stitches. (A) The abdominal vas is tunnelled through the tunica vaginalis and secured by 3 stitches with 5-0 prolene. (B) After identifying the suitable epididymal tube, three 9-0 Nylon sutures are placed through the vasal muscularis layer and the tunica vaginalis. (C) Two parallel double-armed 10-0 Nylon sutures are placed in the epididymal tubule but not fully pulled through, then a small incision between the two needles is made equal to the distance of the entrance and exit sites of the 10-0 suture. (D) Both arms of the 10-0 sutures placed through the vasal mucosa from inside to out. (E) Six to ten 9-0 Nylon sutures are placed between the vasal muscularis and the tunica vaginalis. (F) Demonstrates the final picture of the tension relieving anastomosis.

patients had bilateral VVs; patency rate was 99% for any sperm and 95.5% for at least two million TMS. The postoperative semen analysis for the singular failure reported abundant sperm heads, which was the same finding during microscopic fluid examination intraoperatively. In this case, the anastomosis was found to be patent on one of the two sides during revision surgery where bilateral VEs were successfully performed.

Of note, the sperm heads were shrivelled in appearance and without short tails. After this early failure, we performed VVs with a minimum criterion of sperm heads with short tails. Following this decision-making, 76 VVs were performed, with patency rates of 100% for any sperm and 97.3% for more than two million TMS. A total of four patients had a late failure following VV.

Twelve patients underwent bilateral VEs, with an 83.3% patency rate for any sperm and 77.7% for at least two million TMS. Twenty-three patients underwent mixed VV/VE anastomoses. The patency rate for any sperm was 100% and 88.8% for a minimum of two million TMS (Figure 3). Anastomotic requirements with respect to bilateral VV, bilateral VE, or mixed VV/VE as a function of obstructive interval are summarized in Figure 4.

DISCUSSION

This study describes the outcomes of VVs, VEs, and mixed VV/VE with addition of tension-relieving sutures and attention to the symmetry of suture placement. The reported results were among the highest published in the literature. Our techniques aimed to build upon previous advancements from others in the field.

Use of a multilayer microscopic approach with the placement of microdots for systematizing precise equispaced sutures was introduced by Goldstein and led to a substantial improvement in patency rates among VVs (reported as 99.5%).[9] More recently, in an attempt to reduce the anastomotic tension, Savage et al reported the reinforcing vasal suture (ReVas) technique, where they applied 5–10 interrupted sutures or one running suture through the vasal adventitia using a 9-0 nylon. In their study, a 93% success rate, defined as >0 sperm/ml at any point, was reported.[11]

We conceptually combined the microdot multilayer approach with a tension-relieving approach inspired by the ReVas technique; however, instead of using numerous 9-0 nylon sutures, we aimed to reduce the number of stitches, improving time efficiency and establishing a gentle arc surrounding the site of anastomosis for VVs rather than a tight arc seen with the ReVas. We applied a similar approach for VEs, where we used three 5-0 prolene sutures to secure the vasal adventitia to the tunica vaginalis, leaving enough length for the vas to have a gentle arc at the site of VE anastomosis.

We captured the frequency of anastomotic subtypes based on obstructive intervals. We found that obstructive intervals >16 years have a 54–83% chance of hav-

Table 1. Patient demographics and medical history

Patient demographics	
Total number of patients (n)	159
Number of patients meeting inclusion criteria (n)	136
Mean patient age, years (SD)	41 (6.17)
Mean vasectomy interval (SD)	8 (5.50)
Smoking history, years	13
TRT, n	7
Comorbidities, n	
Gastroenterology	
GERD	1
Eosinophilic esophagitis	1
Crohn's disease	1
Liver disease	2
Respiratory	
Asthma	7
Eosinophilic pneumonitis	1
Endocrine	
Hypothyroidism	2
Diabetes mellitus	1
Rheumatology	
Rheumatoid arthritis	1
Gout	2
Psoriasis	1
Psychiatry	
Anxiety	3
ADHD	2
PTSD	2
Depression	1
Neurology	
MS	1
Ménière's disease	2

ADHD: attention deficit hyperactivity disorder; GERD: gastroesophageal reflux disease; MS: multiple sclerosis; PTSD: post-traumatic stress disorder; STI: sexually transmitted infection; TRT: testosterone replacement therapy.

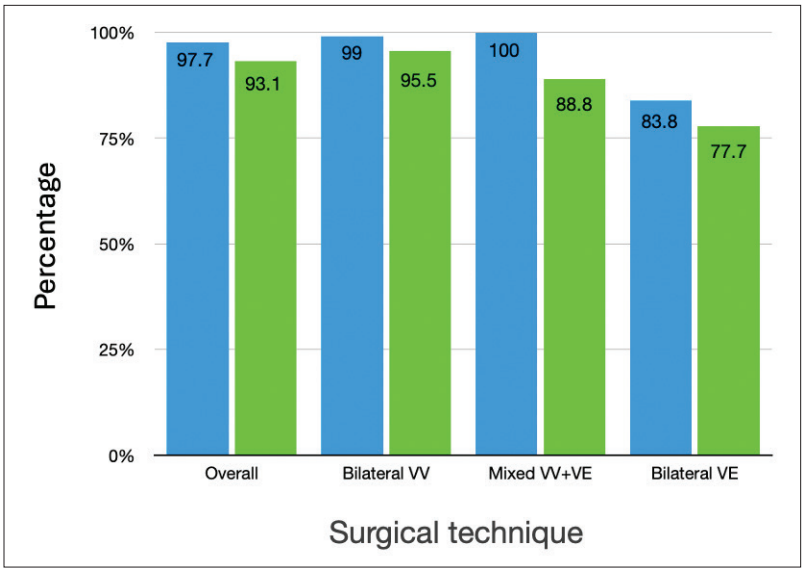

Figure 3. Patency rates following vasectomy reversal. Blue bars indicate rate of presence of any sperm, green bars represent rate of >2 million motile sperm following reversal procedure. VE: vasoepididymostomy; VV: vasovasostomy.

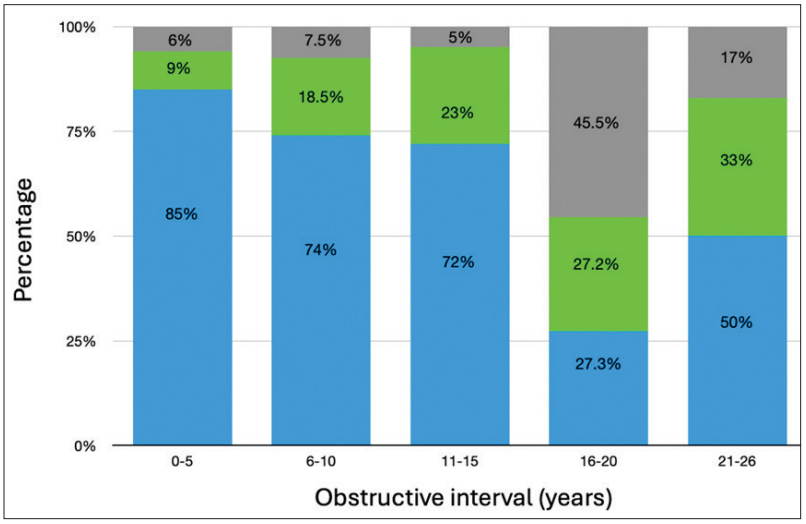

Figure 4. Type of anastomotic connections as a function of the number of years since vasectomy. Blue bars indicate bilateral vasovasostomy (VV) anastomosis; grey bars indicate bilateral vasoepididymostomy (VE); and green bars indicate mixed VV-VE anastomosis.

ing at least one anastomosis being a VV, suggesting that epididymal obstruction is not linear as statistically depicted in previous studies.[3] Similarly, at least one of the anastomotic sides will require a VE in 15% of cases with 0–5 year obstructive intervals and 26% for 6–10 year obstructive intervals.

This study has several limitations; 23 participants were ultimately lost to followup and there was a limited number of patients included. The study lacks a control group and live birth data.

CONCLUSIONS

Tension-free anastomosis and precise, symmetrical suture placement are essential for successful anastomoses. We report a technique that achieves high patency rates.

COMPETING INTERESTS: Dr. Flannigan has received educational and research grants from Boston Scientific and Coloplast and speaking honorarium from Ferring; is the principal investigator in two clinical trials using Sustained Therapeutics medication; and is co-founder of the digital health company, Teumo Health Technology Inc. The remaining authors do not report any competing personal or financial interests related to this work.

This paper has been peer reviewed.

REFERENCES

1. Yang G, Walsh TJ, Shefi S, Turek PJ. The kinetics of the return of motile sperm to the ejaculate after vasectomy reversal. *J Urol* 2007;177:2272-6. https://doi.org/10.1016/j.juro.2007.01.158
2. Sandlow JI, Kolettis PN. Vasovasostomy in the convoluted vas deferens: Indications and outcomes. *J Urol*. Feb 2005;173:540-2. https://doi.org/10.1097/01.ju.0000149981.89230.50
3. Mui P, Perkins A, Burrows PJ, et al. The need for epididymovasostomy at vasectomy reversal plateaus in older vasectomies: A study of 1229 cases. *Andrology* 2014;2:25-9. https://doi.org/10.1111/j.2047-2927.2013.00143.x
4. Kavoussi PK. Validation of robot-assisted vasectomy reversal. *Asian J Androl* 2015;17:245-7. https://doi.org/10.4103/1008-682X.142141
5. Patel SR, Sigman M. Comparison of outcomes of vasovasostomy performed in the convoluted and straight vas deferens. *J Urol* 2008;179:256-9. https://doi.org/10.1016/j.juro.2007.08.169
6. Yoon YE, Lee HH, Park SY, et al. The role of vasoepididymostomy for treatment of obstructive azoospermia in the era of in vitro fertilization: A systematic review and meta-analysis. *Asian J Androl* 2018;21:67-73. https://doi.org/10.4103/aja.aja_59_18
7. Matthews GJ, Schlegel PN, Goldstein M. Patency following microsurgical vasoepididymostomy and vasovasostomy: Temporal considerations. *J Urol* 1995;154:2070-3.
8. Kolettis PN, Burns JR, Nangia AK, et al. Outcomes for vasovasostomy performed when only sperm parts are present in the vasal fluid. *J Androl* 2006;27:565-7. https://doi.org/10.2164/jandrol.05190
9. Goldstein M, Li PS, Matthews GJ. Microsurgical vasovasostomy: The microdot technique of precision suture placement. *J Urol* 1998;159:188-90. https://doi.org/10.1016/s0022-5347(01)64053-9
10. Cao S, Zhao C, Zhang J, et al. A minimum number of motile spermatozoa are required for successful fertilisation through artificial intrauterine insemination with husband's spermatozoa. *Andrologia* 2014;46:529-34. https://doi.org/10.1111/and.12109
11. Savage J, Manka M, Rindels T, et al. Reinforcing vasal suture technique improves sperm concentration and pregnancy rates in men undergoing vasovasostomy for vasectomy reversal. *Transl Androl Urol* 2020;9:73-81. https://doi.org/10.21037/tau.2019.09.4

CORRESPONDENCE: Dr. Ryan Flannigan, Department of Urologic Sciences, University of British Columbia, Vancouver, BC, Canada; ryan.flannigan@ubc.ca