

ORIGINAL RESEARCH

Microsurgical vasectomy reversal: experience of a single center

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Abstract

Background: Vasectomy reversal (VR) is the only technique that allows men previously submitted to a vasectomy to conceive by natural pregnancy. We report our experience with microsurgical VR and identify predictive factors of natural pregnancy. **Methods:** We retrospectively reviewed all patients submitted to VR by a single surgeon from 2008 to 2021 at our single center. Patency and pregnancy rates were evaluated. The main outcomes after surgery were the patency and natural pregnancy rates. Secondary outcomes were the identification of predictive factors of success and patient satisfaction with the natural pregnancy. **Results:** Forty VRs were performed with a patency rate of 97.1% and, among those who became patent, pregnancy occurred in 13 of 31 couples by natural conception (41.9%). Two-layer anastomosis was significantly associated with a successful procedure (Odds Ratio of 12.428; $p = 0.045$). We did not identify a significant association between any of the other variables and a successful outcome. Even without a successful surgery, most of the patients were very satisfied with the results and would do the procedure again. **Conclusions:** VR is a useful technique for men previously submitted to a vasectomy and who pretend to have children by natural conception. Two-layer anastomosis is significantly associated with a successful surgery.

Keywords

Vasopididymostomy; Vasovasostomy; Vasectomy reversal; Patency rate; Pregnancy rate

Reversión microquirúrgica de vasectomía: experiencia de un centro

Resumen

Antecedentes: La reversión de la vasectomía (RV) es la única manera de permitir a los hombres, después de la vasectomía, concebir por embarazo natural. Presentamos nuestra experiencia en la RV microquirúrgica y buscamos identificar los factores predictores del éxito. **Métodos:** Revisión retrospectiva de todos los pacientes sometidos a RV por un cirujano entre 2008 y 2021 en el nuestro centro. Se analizaron las tasas de permeabilidad y embarazo. El objetivo principal fue la tasa de permeabilidad y embarazo natural. El objetivo secundario fue identificar factores predictivos del éxito y la satisfacción del paciente con la tasa de embarazo natural. **Resultados:** Se realizaron 40 RV con una tasa de permeabilidad del 97.1%. De las que se quedaron patentes, el embarazo ocurrió en 12 de 31 parejas por concepción natural (41.9%). La anastomosis de doble capas se asoció significativamente al éxito del procedimiento (Odds ratio 12.428; $p = 0.045$). No identificamos una asociación significativa de ninguna de las otras variables al éxito del resultado. Incluso sin una cirugía exitosa, la mayoría de los pacientes volverían a realizar el procedimiento y se quedarán muy satisfechos con el resultado. **Conclusiones:** La RV es una técnica útil después de la vasectomía en los casos de hombres que desean tener hijos por concepción natural. La anastomosis de doble capas se asocia significativamente al éxito de la cirugía.

Palabras Clave

Vasopididimostomía; Vasovasostomía; Reversión de vasectomía; Tasa de permeabilidad; Tasa de embarazo

1. Introduction

Vasectomy is the most effective method of male contraception and is widely accepted [1]. Despite being considered a permanent sterilization method, up to 6% of patients request vasectomy reversal (VR) due to changes in marital status or reproductive purposes [2]. Men who pretend to restore fertility after vasectomy can do sperm retrieval with *in vitro* fertilization/intracytoplasmic sperm injection (IVF/ICSI) or undergo VR. VR is the only way to enable a natural conception and it also allows multiple gestations in the future. It can be performed by vasovasostomy (VV) or vasoepididymostomy (VE) [3, 4]. In the last few years, the success of the procedure, when evaluated by patency and pregnancy rates, has been reported at 87% (range 80–98%) and 49% (range: 22–68%), respectively [5]. Age of couples, history of previous fertility, time between vasectomy and VR, surgical technique and type of anastomosis, presence of granuloma, intraoperative aspect of vasal fluid and sperm count in postoperative ejaculate have been cited as possible factors that may influence the success rates of VR [3, 6].

We pretend to report our experience with microsurgical VR and identify predictive factors of natural pregnancy.

2. Materials and methods

We retrospectively reviewed all the patients submitted to VR in our single center from 2008 to 2021. All VR were performed for fertility restoration and were done by a single urologist. Data collected included the age of the couple and their previous fertility histories. The obstructive interval (OI) was defined as the length of time between vasectomy and the reconstructive surgery. All female partners were submitted to previous gynaecological evaluation.

The surgical procedure was executed using an operative microscope under general anaesthesia. The modified VV was performed using a one- or two-layer anastomotic technique according to the choice of the surgeon. A two-layer microsurgical VV was realized using interrupted 9/0 or 10/0 nylon to approximate the mucosal layers and interrupted 9-zero nylon to approximate the muscular and adventitial layers. A modified one-layer microsurgical VV was undertaken using 5 to 8 interrupted full thickness 9/0 nylon sutures through the vasal mucosa, muscularis and adventitia. VE was performed when no fluid at the testicular end was observed after inserting a 24-gauge angiocatheter sheath into the lumen and barbotaged with 0.1 mL of saline solution. When VE was carried out an end-to-side intussusception technique was the technique of choice, in which two 10/0 nylon sutures were used to pull an epididymal tubule into the lumen of the vas. The type of surgical approach, the anastomotic technique, the presence of vasal granuloma and the gross appearance of the intraoperative vas fluid were recorded.

For the first nineteen procedures, patients were hospitalized for at least one night. Currently, patients are discharged on the same day. After surgery, all patients are requested to wear a scrotal supporter and avoid heavy work or sports for 6 weeks. No intercourse or ejaculation is allowed for 4 weeks postoperatively. Sperm analyses (SA) were obtained at least 6

weeks after surgery. Any adverse events were registered.

The main outcomes after surgery were the patency and pregnancy rates. Patency was defined as the presence of sperm in the ejaculate in at least one SA. Pregnancy was defined as a natural conception after the surgery. The outcomes were collected either at follow-up visits or via telephone interviews. The rate of natural pregnancy was considered the outcome of success and it was compared in terms of age of the patient and his partner, OI, type of anastomosis, presence of granuloma, surgical technique, aspect of vasal fluid and sperm count in postoperative SA. Univariate and multivariate analyses was performed to identify predictive factors of success.

Additionally, to evaluate the satisfaction with the procedure, all patients were contacted by telephone and asked two questions: “Would you do the procedure again? Yes or no” and “What is your opinion of the procedure: unsatisfied, satisfied or very satisfied”.

Statistical analyses were performed using IBM SPSS Statistics software (version 25, IBM Corp., Armonk, NY, USA). Categorical variables are presented as frequencies and percentages, and continuous variables as means and standard deviations, or medians and interquartile ranges for variables with skewed distributions. Pearson’s chi-squared or Fisher’s Exact test were used to test for associations in categorical variables. All reported *p*-values are two-tailed and a value < 0.05 was considered as statistically significant.

3. Results

In the last 14 years, a total of 40 VR were performed at our single center by a single surgeon. Baseline characteristics of patients undergoing VR are summarized in Table 1. The mean age of patients was 46.86 ± 7.51 years while the mean age of female partner was 34.74 ± 5.80 years. Most men had fathered at least one child before vasectomy (83.8%, $n = 31$). As for the partners, only 31.4% had children of previous relationships ($n = 11$). The mean duration of OI was 8.73 ± 4.50 years. On medical evaluation, the presence of unilateral or bilateral granuloma was observed in 57.1% ($n = 16$). Two patients reported a previous history of failed VV (4.35%), one in the previous year and the other 7 years leading up to this second attempt. Intraoperatively, in 83.3% of the cases the fluid was watery and opalescent ($n = 25$) and in 16.7% was dense and creamy ($n = 5$). Bilateral VV was the surgical technique of choice in 85% ($n = 34$). One patient underwent unilateral VV due to the presence of unilateral/single testicle. It was necessary to perform VE in 6 patients (15%) and bilateral in 3 of these patients (7.5%). The presence of dense and creamy fluid was not considered an indication to perform VE. In half of the cases the anastomosis was performed in one-layer, and in the other half in two-layers. Sixteen patients underwent surgery and were discharged from the hospital on the same day (40%). The mean duration of the procedure was 180.42 ± 4.5 minutes. When the one-layer technique was performed, the mean time of surgery decreased from 211.00 ± 56.1 to 144.88 ± 34.6 minutes. Adverse events were reported in 3 patients (7.8%), all with acute scrotal pain relieved with oral analgesia. No patients had chronic scrotal pain.

The patency and pregnancy rates are described in Table 2.

TABLE 1. Baseline characteristics in patients undergoing VR among all patients analysed.

Variables	No. (%)
Mean age of the patient (yr), n = 40	46.86 (SD ± 7.51)
Mean age of partner (yr), n = 39	34.74 (SD ± 5.80)
Patients with history of previous children, n = 37	31 (83.8)
Partners with history of previous children, n = 35	11 (31.4)
Mean obstructed interval (yr), n = 40	8.73 (SD ± 4.50)
Previous failure vasal obstruction, n = 40	2 (5.0)
Presence of granuloma, n = 28	
No	12 (42.9)
Yes (unilateral or bilateral)	16 (57.1)
Vasal fluid appearance, n = 30	
Watery and opalescent	25 (83.3)
Dense and creamy	5 (16.7)
Surgical technique, n = 40	
Vasovasostomy bilateral ¹	34 (85.0)
Vasoepididymostomy unilateral or bilateral	6 (15.0)
Type of anastomosis, n = 40	
1-layer anastomosis	20 (50)
2-layer anastomosis	20 (50)
Outpatient procedure, n = 40	16 (40)
Mean of operative time (minutes), n = 40	180.42 (SD ± 4.5)
1-layer anastomosis	144.88 (SD ± 34.6)
2-layer anastomosis	211.00 (SD ± 56.1)
Adverse events, n = 39	3 (7.7)

¹One patient was submitted to unilateral VV because he only had one testicle. All means represented with standard deviation (SD). VR: vasectomy reversal.

TABLE 2. Patency and pregnancy rate in patients undergoing VR among all patients analysed.

Variables	No. (%)
Patency, n = 35	34 (97.1)
Sperm count in postoperative SA (million/cc), n = 34	
Median of all patients (min–max)	22.0 (0.4–192.5)
>15 M per mL	19 (55.9)
≤15 M per mL	15 (44.1)
≤5 M per mL	5 (14.7)
Natural pregnancy, n = 31	13 (41.9%)

VR: vasectomy reversal; SA: sperm analyses.

Thirty-five patients did a postoperative SA and the patency rate after vasectomy reversal was 97.1% (34/35). Five patients without postoperative SA were excluded due to loss of follow-up. The only case without spermatozoa was a second attempt of VV. Normal semen parameters, according to World Health Organization (WHO) criteria, were observed in 19 of 34 patients (55.9%).

Among those who became patent, pregnancy occurred in 13 of 31 couples by natural conception (41.9%). Two of these couples had a miscarriage and twelve had a least one healthy delivery. We excluded 3 patients because they used a contraceptive method after the surgery.

The two-layer anastomosis was significantly associated with the probability of having a natural pregnancy ($p = 0.003$). We could not identify statistical significance between a successful outcome and the age of the patient or of his partner, OI, history of previous fertility, presence of granuloma, gross appearance of vasal fluid, need to perform VE and sperm count in postoperative SA. The association between preoperative, intraoperative and postoperative factors and the success of VR are reported in Table 3. On multivariate analysis, considering variables OI, age of the patient and his partner and the need to perform VE, the two-layer anastomosis was a significant positive predictive factor to natural pregnancy rate with an Odds Ratio of 12.428 (Interval Confidence (IC) 1.059–145.888, $p = 0.045$).

To assess the patient's global satisfaction with the procedure, regarding outcomes and adverse effects, all patients were contacted by telephone prior to 31 January 2022 and were asked two questions. Thirty of the 31 patients answered "yes" to the question "Would you do the procedure again?" (96.8%). Most of them were very satisfied with the procedure (66.7%, $n = 20$) and only one was unsatisfied (3.3%, $n = 1$) (Table 4).

4. Discussion

The popularity of vasectomy is increasing and is becoming the preferred method of male contraception [4]. However, up to 6% of these men, due to paternity desire to become a father with a new partner, choose to undergo a VR [2]. Nowadays, it is possible to offer men who pretend to conceive after vasectomy the possibility of VR or assisted reproduction techniques (ART) [7]. VR is the only way to achieve natural conception and multiple pregnancies over time without the need of further medical treatment and avoiding the risks and costs associated with advanced ART. IVF/ICSI are more expensive procedures, with risks either to the female (such as ovarian hyperstimulation syndrome) and to the child (such as higher rates of birth defects, multiple gestations, prematurity and low birth weight). However, ART can be considered a primary treatment in the presence of female infertility factors, such as advanced age or tubal disease [3, 4].

The results of the VV Study Group were published in 1991 and this continues to be one of the most cited articles when discussing the outcomes of VR [8]. Data from large prospective groups is still lacking. The definition of surgical success and patency is still unclear [9]. Until today, the articles reported variable patency rates, ranging from 80 to 98% [5]. There is no standard definition for patency after VR [10, 11]. Some authors considered the presence of any spermatozoid (motile

or nonmotile) in the postoperative SA whereas others refer to the presence of motile spermatozoid only or only spermatozoid with tails. Due to variations in the definition, some discordance exists in patency outcomes between different reports [11]. In our series of 35 patients who had a postoperative SA, it was possible to achieve patency in 34 patients (97.1%). We had a higher patency rate because we considered the presence of at least one spermatozoid on postoperative SA. The median sperm count in the postoperative SA was approximately 22.0 million/mL and 55.9% of the patients had normal values in SA after VR, according to the WHO.

Regarding the pregnancy rate, the literature reports rates between 22 and 68% for men submitted to VR [5]. Natural pregnancy was reported in 13 of 31 men who became patent (41.9%). Similarly to the patency rate, the definition of pregnancy rate is controversial. Bolduc *et al.* [6], in their retrospective analyses of 747 modified one-layer VV procedures, used the same definition of pregnancy rate that we applied and reported pregnancy rates of 33% and 53% at 1 and 2 years of follow-up. Gerald *et al.* [12] demonstrated 52 of 98 patients submitted to VV with motile sperm postoperative achieved successful pregnancies (53%).

The VR techniques include both VV or VE. The absence of fluid or the presence of creamy toothpaste-like fluid from proximal vas deferens were the criteria used to perform VE [13]. Gerald *et al.* [12] compared 100 patients submitted to VV and 100 patients submitted to VE by the same surgeon and reported that the patency rates following VV (99%) were greater than those following VE (65%, $p < 0.001$). Although the return of motile sperm to ejaculate in VE appears later than VV, no differences were observed in patency rate comparing different VE anastomosis techniques [11]. The need to perform VE is greater in men over 50 years old and is associated with OI and the need to repeat VR [12]. In our study, only men who underwent VV had natural pregnancy. The absence of vasal fluid intraoperatively was the criteria used by the surgeon to perform VE. We had a few cases of VE, but in our report the surgical technique did not seem to interfere with the outcomes ($p = 0.06$).

Many studies have tried to identify intraoperative predictive findings for patency and pregnancy outcomes after VR. However, most of them had small samples and were underpowered [14]. The identification of these factors may help select the best candidates to undergo primary ART techniques instead of surgical reconstruction [10]. Silber *et al.* [15] reported in a study with 4010 cases of microsurgical VR, that intraoperative vasal fluid quality, presence of granuloma, OI and surgeon experience were the main predictors of patency. The OI is one of the most important factors that influence the success of VR [1, 6, 7]. The VV Study Group showed an inverse correlation between the patency and pregnancy rates and the OI. In their study of 1469 men who underwent VR, if the OI was less than 3 years, the patency rate was 97% and pregnancy rate 76%. For OI, 3 to 8 years, 9 to 14 years and 15 years or more, patency and pregnancy rates were 88% and 53%, 79% and 44% and 71% and 30% respectively [8]. In our study, the mean OI was 8.73 ± 4.50 years and most of the patients with natural pregnancy had 8 years or less between vasectomy and VR (53.8%). The patency and pregnancy rates seemed to

TABLE 3. Significant associations between preoperative, intraoperative and postoperative factors and natural pregnancy.

Possible predictors	Success (n = 12) No. (%)	Failure (n = 18) No. (%)	<i>p</i>
Age of the patients			
≤35 yr	5/13 (38.5)	2/18 (11.1)	0.10
>35 yr	8/13 (61.5)	16/18 (88.9)	
Patients with history of previous children			
No	1/10 (10.0)	3/18 (16.7)	1.00
Yes	9/10 (90.0)	15/18 (83.3)	
Age of the partner			
≤35 yr	8/12 (66.7)	7/18 (38.9)	0.14
>35 yr	4/12 (33.3)	11/18 (61.1)	
Partners with history of previous children			
No	4/9 (44.4)	13/18 (72.2)	0.22
Yes	5/9 (55.6)	5/18 (27.8)	
Time of obstruction			
≤8 yr	7/13 (53.8)	7/18 (38.9)	0.41
>8 yr	6/13 (46.2)	11/18 (61.1)	
Presence of granuloma			
No	2/7 (28.6)	7/13 (53.8)	0.37
Yes	5/7 (71.4)	6/13 (46.2)	
Appearance vasal fluid:			
Vasal fluid watery and opalescent	6/7 (85.7)	12/14 (85.7)	1.00
Vasal fluid dense and creamy	1/7 (14.3)	2/14 (14.3)	
Type of anastomosis			
1-layer anastomosis	1/13 (7.7)	11/18 (61.1)	0.003
2-layer anastomosis	12/13 (92.3)	7/18 (38.9)	
Sperm count in SA			
≤15 M per mL	5/13 (38.5)	10/18 (55.6)	0.35
≤5 M per mL	2/13 (15.4)	3/18 (16.7)	
“Would you do the procedure again?”			
Yes	8/8 (100)	15/16 (93.8)	1.00
No	0/8 (0)	1/16 (6.3)	
“What is your opinion of the procedure?”			
Unsatisfied	0/8 (0)	0/15 (0)	1.00
Satisfied	2/8 (25.0)	4/15 (26.7)	
Very satisfied	6/8 (75.0)	11/15 (73.3)	

SA: sperm analyses. Significant differences between frequencies of categorical variables were assessed by Chi-squares test with significance assessed as $p < 0.05$.

TABLE 4. Answers to the two questions realized of all patients analysed.

	No. (%)
“Would you do the procedure again?” n = 31	
Yes	30 (96.8)
No	1 (3.2)
“What is your opinion of the procedure?”, n = 30	
Unsatisfied, no. (%)	1 (3.3)
Satisfied	9 (30.0)
Very satisfied	20 (66.7)

decrease with OI, although it was statistically not significant ($p = 0.48$).

The age of the partner is another factor with great importance on pregnancy rates [3, 15]. The mean females age in our study was 34.74 ± 5.80 years, and 66.7% of women who achieved a natural pregnancy had 35 years or less. Gerrard *et al.* [16] evaluated retrospectively 294 couples who underwent VR and reported lower pregnancy rates in females aged 40 years or older. Similar results were described by Silber *et al.* [15] He found better pregnancy rates in female partners 40 or older when submitted to VR, when compared to IVF/ICSI (less 20% per cycle). In our study, the age of the couple and the history of previous fertility were not predictive factors of a natural pregnancy.

Although the presence of granuloma and the gross appearance of vasal fluid were more frequent in our patients, it did not provide a significant impact in the success of the procedure ($p = 0.28$ and $p = 1.00$). The VV Study Group showed that the presence or absence of sperm granuloma did not affect the patency or pregnancy in VV. On the other hand, creamy fluid was associated with lower patency and pregnant rates compared with watery or opalescent fluids [8]. However, other studies reported different outcomes regarding the presence of granuloma [9]. Therefore, consensus regarding the impact of these factors on successful surgery is still lacking.

In our study, 38.5% of patients in the success group had a sperm count lower than 15 million/mL. With a sperm count of 5 million/mL or less, 15.4% of the couples had a successful pregnancy. These findings are in line with the results reported by other groups [15, 17].

Repeat VR had worse patency and pregnancy rates compared to first recanalization [8]. We had 2 cases of failure of previous reconstruction and in one it was not possible to perform a tension-free VR. In this case, both patients were referred to ART.

Regarding the anastomosis technique, one- or two-layer have been employed. Although specific recommendations to choose one or another remain controversial, studies have failed to show different results in restoring the continuity of the lumens [1, 18]. Two-layer anastomosis was applied in 92.3% of men who achieved fatherhood and was superior to one-layer technique (Odds Ratio of 12.428; $p = 0.045$). Our results differ from previous studies' results. Fischer *et al.* [1] reported that both anastomoses have equivalent patency (88% and 90% for modified one- and two-layer VV, respectively). The VV Study

Group found no difference between the patency rate with one- or two-layer anastomosis [8]. Two-layer technique may be better in cases of different lumens of vasa or when the proximal end of proposed anastomosis is in the convoluted portion of vas deferens [1]. The second layer with the suture of the serosa may reduce the tension of anastomosis and allow a theoretically leak-proof anastomosis [6, 19]. Furthermore, performing two-layer anastomosis may be important to improve the skills in microsurgery, as it is more challenging and precise, and this training is useful when it is necessary to perform VE. However, more studies are needed to determine the best anastomosis technique and its indications.

Even in the cases without a successful surgery, most of the patients were eager to repeat the procedure again and were very satisfied with the results. Howard identified that the main reasons who prompt men willing to restore their fertility to seek for VR are the sense of disadvantage for being infertile and the desire for remarriage [20].

To our knowledge, this study represents the largest cohort in our country of VR performed by a single surgeon. However, it has limitations. First of all, this was a retrospective study with a reduced number of patients. Additionally, follow-up with SA after the procedure was not standardized, as a significant number of patients were referred to our center solely for surgery and contact was lost after the procedure. Due to the relatively small number of events, our statistical power was too limited to identify associations with natural pregnancy. Also, we did not take in consideration other pathologies of the couple that may have worsened the prognosis. In our center, an embryologist is not present in the operating room to observe the seminal fluid or to perform cryopreservation if necessary. Further studies are needed to evaluate the rate of late failures and the respective predictors.

5. Conclusions

This is the largest national cohort regarding the outcomes of VR. In our study, we report a patency rate of 97.1% and natural pregnancy rate of 41.9%. We believe that VR is a useful technique to restore fertility in men previously submitted to a vasectomy who wish to have children by natural conception. A significant association was found between the two-layer anastomosis technique and a successful surgery.

ABBREVIATIONS

ART, assisted reproduction techniques; IVF/ICSI, *in vitro* fertilization/intracytoplasmic sperm injection; OI, obstructive interval; SA, sperm analysis; VE, vasoepididymostomy; VR, vasectomy reversal; VV, vasovasostomy; WHO, World Health Organization.

AVAILABILITY OF DATA AND MATERIALS

The data are contained within this article.

AUTHOR CONTRIBUTIONS

DA and VO—designed the research study. DA, JD, SB and VO—performed the research. DA, AG and TG—analyzes the data. DA, JD and VO—wrote the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was granted by the Ethics Committee of Hospital Center Vila Nova de Gaia and Espinho, Portugal (approval number: UIEC-2024-532412653673b72bce9ddc). Informed consent was waived by the Ethics Committee of Hospital Center Vila Nova de Gaia and Espinho in view of the retrospective nature of the study.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- [1] Fischer MA, Grantmyre JE. Comparison of modified one- and two-layer microsurgical vasovasostomy. *BJU International*. 2000; 85: 1085–1088.
- [2] Sandlow JI, Nagler HM. Vasectomy and vasectomy reversal: important issues. Preface. *Urologic Clinics of North America*. 2009; 36: xiii–xxiv.
- [3] Schwarzer JU, Steinfatt H. Current status of vasectomy reversal. *Nature Reviews Urology*. 2013; 10: 195–205.
- [4] Baker K, Sabanegh E. Obstructive azoospermia: reconstructive techniques and results. *Clinics*. 2013; 68: 61–73.
- [5] Namekawa T, Imamoto T, Kato M, Komiya A, Ichikawa T. Vasovasotomy and vasoepididymostomy: review of the procedures, outcomes, and predictors of patency and pregnancy over the last decade. *Reproductive Medicine and Biology*. 2018; 17: 343–355.
- [6] Bolduc S, Fischer MA, Deceuninck G, Thabet M. Factors predicting overall success: a review of 747 microsurgical vasovasostomies. *Canadian Urological Association Journal*. 2013; 1: 388.
- [7] Kirby EW, Hockenberry M, Lipshultz LI. Vasectomy reversal: decision making and technical innovations. *Translational Andrology and Urology*. 2017; 6: 753–760.
- [8] Belker AM, Thomas AJ, Fuchs EF, Konnak JW, Sharlip ID. Results of 1469 microsurgical vasectomy reversals by the vasovasostomy study group. *Journal of Urology*. 1991; 145: 505–511.
- [9] Cosentino M, Peraza MF, Vives A, Sanchez J, Moreno D, Perona J, *et al.* Factors predicting success after microsurgical vasovasostomy. *International Urology and Nephrology*. 2018; 50: 625–632.
- [10] Herrel LA, Goodman M, Goldstein M, Hsiao W. Outcomes of microsurgical vasovasostomy for vasectomy reversal: a meta-analysis and systematic review. *Urology*. 2015; 85: 819–825.
- [11] Farber NJ, Flannigan R, Li P, Li PS, Goldstein M. The kinetics of sperm return and late failure following vasovasostomy or vasoepididymostomy: a systematic review. *Journal of Urology*. 2019; 201: 241–250.
- [12] Matthews GJ, Schlegel PN, Goldstein M. Patency following microsurgical vasoepididymostomy and vasovasostomy: temporal considerations. *Journal of Urology*. 1995; 154: 2070–2073.
- [13] Fuchs ME, Anderson RE, Ostrowski KA, Brant WO, Fuchs EF. Pre-operative risk factors associated with need for vasoepididymostomy at the time of vasectomy reversal. *Andrology*. 2016; 4: 160–162.
- [14] Ramasamy R, Mata DA, Jain L, Perkins AR, Marks SH, Lipshultz LI. Microscopic visualization of intravasal spermatozoa is positively associated with patency after bilateral microsurgical vasovasostomy. *Andrology*. 2015; 3: 532–535.
- [15] Silber SJ, Grotjan HE. Microscopic vasectomy reversal 30 years later: a summary of 4010 cases by the same surgeon. *Journal of Andrology*. 2004; 25: 845–859.
- [16] Gerrard ER Jr, Sandlow JI, Oster RA, Burns JR, Box LC, Kolettis PN. Effect of female partner age on pregnancy rates after vasectomy reversal. *Fertility and Sterility*. 2007; 87: 1340–1344.
- [17] Majzoub A, Tadros NN, Polackwich AS, Sharma R, Agarwal A, Sabanegh E. Vasectomy reversal semen analysis: new reference ranges predict pregnancy. *Fertility and Sterility*. 2017; 107: 911–915.
- [18] Elzanaty S, Dohle GR. Vasovasostomy and predictors of vasal patency: a systematic review. *Scandinavian Journal of Urology and Nephrology*. 2012; 46: 241–246.
- [19] Li B, Chen G, Wang X. Treatment of failed vasectomy reversal using a microsurgical two-layer anastomosis technique. *Translational Andrology and Urology*. 2013; 2: 94–98.
- [20] Howard G. Who asks for vasectomy reversal and why? *The BMJ*. 1982; 285: 490–492.

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