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REVIEW

Long-term patency and pregnancy after vasovasostomy: A comprehensive review

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Summary

***Background:** Vasovasostomy (VV) is often pursued by men seeking natural conception after vasectomy. Microsurgical VV is associated with high patency rates (~95%) and moderate pregnancy rates (~40%), according to existing literature. However, long-term outcome data remain limited. This review evaluates patency and pregnancy rates at ≥ 12 months following microsurgical VV.*
***Materials and methods:** A comprehensive literature search was conducted via PubMed using the terms "vasovasostomy," "patency rate," and "pregnancy rate." Studies were included if they reported patency or pregnancy outcomes ≥ 12 months post-VV. Data were categorized and analyzed using MedCalc, applying the Freeman-Tukey transformation for normalization.*
***Results:** Only four clinical studies reported long-term patency data, and six studies reported long-term pregnancy rates following microsurgical VV. Patency rates ranged from 77% to 99%, with a mean follow-up of 25 months. Patency was defined as the presence of any sperm in the ejaculate in five studies, and as > 1 million non-immotile sperm/mL in one study. Using the > 1 million sperm definition, the patency rate was 77% at 12 months, but decreased to 33% when defined as ≥ 30% motile sperm in the ejaculate. Pregnancy rates across the six studies ranged from 28% to 54%, with a mean follow-up of 21 months.*
***Conclusions:** Long-term patency and pregnancy rates following VV vary widely due to inconsistent definitions and limited follow-up data. These findings underscore the need for standardized outcome measures and longitudinal follow-up to better understand factors influencing long-term success after VV.*

KEY WORDS: *Vasovasostomy; Patency rate; Pregnancy rate; Male infertility.*

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INTRODUCTION

Long-term data following microsurgical vasectomy reversal is essential for counseling men considering permanent sterilization and those seeking fertility restoration. Although vasectomy is intended to be irreversible, a significant percentage of patients eventually seek reversal, most commonly to restore fertility. Microsurgical *vasovasostomy* (VV) remains the standard of care for re-establishing patency of vas deferens and recovering sperm in the ejaculate. Reported short-term outcomes are favorable, with patency rates ranging from approximately 75% to 90% within the first 12 months, and pregnancy rates around 40-50% within the first postoperative year (1, 2). These early series underscore the overall effectiveness of microsurgical VV, however, they offer rather limited information about durability beyond the first postoperative year. For many couples, restored semen parameters may support a stepwise shift from IVF-dependent conception toward IUI-based fertility, representing a meaningful upgrade in patient ability to conceive naturally or with minimal assistance.

Despite encouraging early results, long-term patency following VV remains poorly defined, with data beyond 12 months often limited. Moreover, definitions of patency rate also vary widely, from mere presence of any sperm in the ejaculate to threshold levels based on vague sperm concentration or motility. Importantly, many of the patency rates that have been reported in the literature, more particularly the rates cited as "*successful*", are based on minimal or clinically insignificant criteria that do not correlate with true fertility potential. These thresholds are frequently set well below clinically meaningful benchmarks for natural conception or intrauterine insemination, including a *total motile sperm count* (TMSC) of 20 million/mL for natural conception or 9 million/mL post-wash for intrauterine insemination (3, 4). Consequently, patency defined by these thresholds may substantially overestimate the likelihood of achieving pregnancy.

The variability in thresholds and lengths of follow-up complicates inter-study comparisons and patient counseling about the likelihood of achieving pregnancy. To address this gap, the current study critically re-evaluates published clinical outcomes of VV, with an emphasis on long-term patency and pregnancy rates, while also highlighting the heterogeneity in the definitions of outcomes and length of follow-up.

Materials and methods

This systematic review was conducted according to the guidance outlined in the Cochrane Handbook for Systematic Reviews of Interventions (5). The manuscript is reported following the *Preferred Reporting Items for Systematic Reviews and Meta-analyses* (PRISMA) guidelines (Figure 1).

A comprehensive literature review of English-language clinical studies on VV was performed using a *PubMed* search with the terms "*vasovasostomy*," "*patency rate*," and "*pregnancy rate*" from 1947 through September 2025. Only studies published in English were included. After initial screening based on abstracts, full-text articles were retrieved and manually reviewed. Two independent reviewers (FL, MAC) screened the titles and abstracts of all articles retrieved from the PubMed search to assess eligibility for inclusion. Full-text articles were then reviewed for final inclusion. Any discrepancies between reviewers were resolved through discussion and consensus. Studies were included if they reported patency or pregnancy outcomes at ≥ 12 months post-VV. Articles were excluded if they lacked long-term follow-up data, did not report relevant outcomes, or were not in English. The patency and pregnancy data were then categorized separately, followed by meta-analyses conducted with MedCalc, utilizing the Freeman-Tukey transformation for data normalization.

The methodological quality of each included study was assessed using the *Newcastle-Ottawa Scale* (NOS) for observational research. The NOS evaluates studies across three domains: Selection (0-4 points), comparability (0-2 points), and outcome (0-3 points), for a total possible score of 9.

Two independent reviewers performed scoring, and discrepancies were resolved by consensus. A summary of NOS scores for all included studies is provided in Table 1.

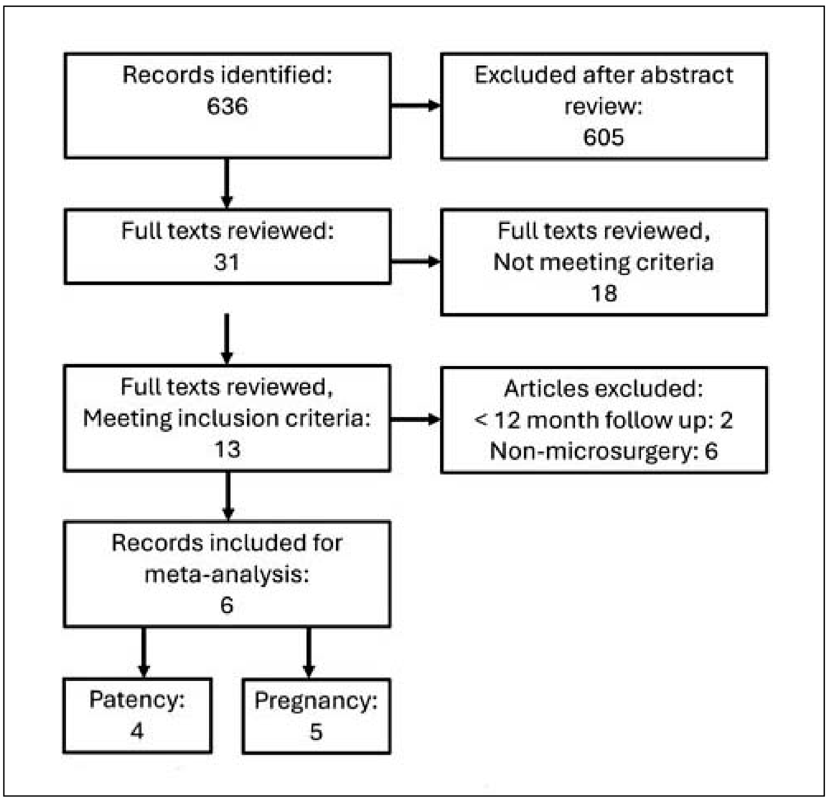


Figure 1.
Flowchart of study selection.

Table 1.
Summary of NOS scores for all included studies.

Study (Year)	Selection* (0-4)	Comparability** (0-2)	Outcome*** (0-3)	Total (0-9)
Wang et al. (2019) (5)	3	0	3	6
Cosentino et al. (2018) (1)	3	0	2	5
Majzoub et al. (2017) (6)	3	0	2	5
Safarinejad et al. (2013) (10)	3	0	3	6
Sandlow et al. (2005) (7)	3	0	2	5
Nalesnik et al. (2003) (8)	3	0	3	6
Kolettis et al. (2002) (11)	3	0	3	6
Goldstein et al. (1998) (9)	3	0	3	6

* *Selection (0-4): Assesses the clarity and appropriateness of the study population, including cohort representativeness and accurate description of the vasovasostomy technique.*
** *Comparability (0-2): Evaluates whether the study accounted for major confounding factors such as obstructive interval or female partner age. None of the included studies controlled for these variables, resulting in comparability scores of 0.*
*** *Outcome (study specific) (0-3): Measures the objectivity and reliability of outcome assessment (e.g., semen analysis or documented pregnancy), the adequacy of follow up duration (≥ 12 months), and the completeness of follow up.*

Table 2.
Characteristics of included studies.

Study (Year)	N	Mean patient age (years)	Mean obstructive interval (years)	Surgical technique (N)	Mean Follow up time (months)	Patency definition	Short-term measures	Long-term measures
Wang (2019) (5)	23	41	12.1	One-layer	24-31	Sperm in ejaculate	15/23 (65%) at 1 mo	22/23 (96%) at 24 mo
Wang (2019) (5)	19	40	10.8	Double-layer	24-31	Sperm in ejaculate	Not reported	18/19 (95%) at 24 mo
Cosentino (2018) (1)	156	41.6	7.2	Mixed	12	1 mil sperm/mL	116/156 (74%) at 1 mo	79/102 (77%) at 12 mo
						> 30% motility	31/156 (20%) at 1 mo	33/102 (33%) at 12 mo
Majzoub (2017) (6)	139	Unspecified	9.5	Mixed	18	Sperm in ejaculate	91.8% at 1.5 mo	Not reported
						Pregnancy	Not reported	49.6% at 18 mo
Safarinejad (2013) (10)	136	37	6.4	Double-layer	24	1 mil sperm/mL	92/112 (82%) at 6 mo	Not reported
						Pregnancy	Not reported	29/112 (28%) at 24 mo
Sandlow (2005) (7)	48	39	10	Mixed	Every 3 mo	Sperm in ejaculate	Range unspecified	
						Pregnancy	Not reported	15/31 (48%) at 12 mo
Nalesnik (2003) (8)	73	39	7.4	Mixed	48-120	Sperm in ejaculate	Not reported	83% at 48 mo
						Pregnancy	Not reported	33/73 (45%) at 48 mo
Kolettis (2002) (11)	70	44.5	14.5	Mixed	12	Pregnancy	Not reported	26/70 (37%) at 12 mo
Goldstein (1998) (9)	194	Unspecified	7	Microdot	17	Sperm in ejaculate	Not reported	193/194 (99%) at 17 mo
						Pregnancy	Not reported	105/194 (54%) at 17 mo

RESULTS

Characteristics of included studies

In this review, there were a total of eight studies published between 1998 and 2019 (1, 5-11). Of these, four studies reported long-term patency outcomes following VV, and six studies reported long-term pregnancy outcomes, with follow-up periods ranging from 12 to 120 months (Table 2).

Using the NOS, overall study quality was moderate to high. Most studies scored well in the selection and outcome domains, reflecting appropriate patient inclusion criteria and adequate follow up. However, comparability scores were generally limited due to the lack of control groups and inconsistent adjustment for confounders such as female partner fertility or obstructive interval.

Patency outcomes

There were multiple definitions of patency across the included studies. Patency was defined as the presence of any sperm in the ejaculate post-surgery in five studies (6-10) and as ≥ 1 million sperm per milliliter in one study (1), which also used ≥ 30% motility as a stricter secondary criterion. In that study, the patency rate was 77% at 12 months when defined as > 1 million sperm/mL but decreased to 33% when defined as ≥ 30% motile sperm in the total sperm count. Reported long-term patency rates across studies ranged from 77% to 99%, with follow-up durations ranging from 12 to 31 months and mean follow-up times averaging 25 months (Table 2).

Mo: months

A meta-analysis of the four studies, assuming random effects, calculated a pooled patency rate of 90.3 % (I^2 = 94.69%, $p < 0.0001$), reflecting the most recent patency data reported in each study, which ranged from 12 to 31 months of follow-up (Figure 2a).

This finding demonstrates that roughly 9 of 10 men experienced a sustained return of sperm following VV. The high I^2 value reflects significant heterogeneity between studies, likely resulting from differences in surgical technique, patency definitions, and follow-up duration.

Despite this variability, the pooled data demonstrate that vasovasostomy consistently achieves high long-term patency rates, confirming its strong effectiveness in restoring sperm flow after vasectomy reversal.

Pregnancy outcomes

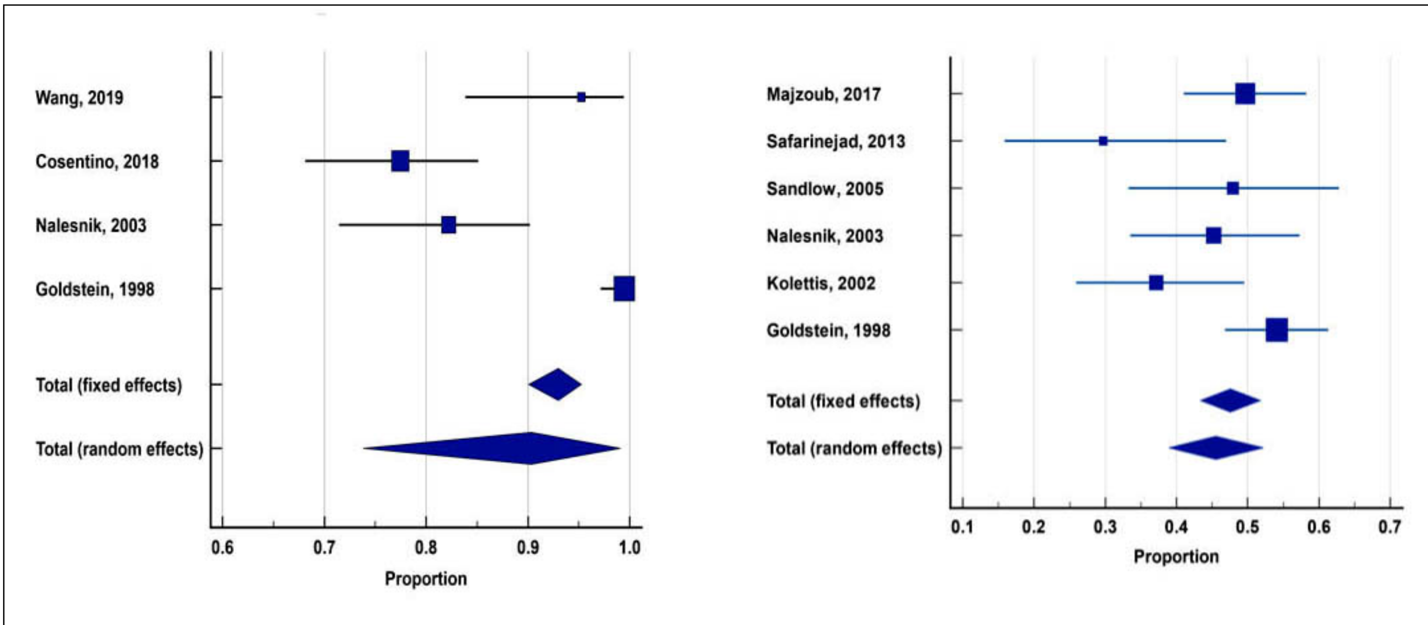
Long-term pregnancy outcomes were available from six studies (6-11) with follow-up periods ranging from 12 to 48 months. Reported pregnancy rates varied from 28% to 54%, with follow-up durations ranging from 12 to 48 months and a mean follow-up of approximately 21 months. The lowest reported pregnancy rate was 28% at 24 months, while the highest was 54% at 17 months.

The meta-analysis, also assuming random effects, calculated a pooled pregnancy rate of 45.5 % (I^2 = 57.09%, $p < 0.0001$) (Figure 2b). This indicates that nearly half of couples achieved natural conception following VV. Compared with the patency analysis, the lower I^2 value indicates greater consistency among studies, though variations in reporting standards, patient selection, and female partner fertility continue to contribute to outcome variability.

DISCUSSION

This meta-analysis provides a consolidated assessment of the long-term outcomes of VV, focusing on patency and pregnancy rates beyond 12 months post-procedure.

Figure 2.
Forest plot of patency data (a) and pregnancy data (b).



Across the included studies, The pooled long-term patency rate approached 90% at up to 31 months, while the pooled pregnancy rate was approximately 45%, indicating that VV remains a highly effective means of restoring fertility after vasectomy, even at a mean of 21 months follow up. These values are consistent with the historically reported short-term patency rates of 85-95% and pregnancy rates of 30-60% within the first year, suggesting that once patency is achieved, it is generally durable over 12-48 months (9, 11).

Interpretation of long-term outcomes is complicated by substantial heterogeneity in definitions, follow-up durations, and reporting standards across studies. Patency was variably defined as the presence of any sperm in the ejaculate, ≥ 1 million sperm/mL, or ≥ 30% motile sperm in the total sperm count (1, 5, 8-10). These differences significantly influenced the reported success rates. Cosentino et al observed that at 12 months, patency was 77% when defined as ≥ 1 million sperm/mL but decreased to 33% when ≥ 30% motility was required (1). Such variation underscores the need for standardized definitions of patency and clinically relevant fertility thresholds.

Despite the heterogeneity, most studies demonstrated stable or even improved patency with continued follow-up. Wang et al. reported an increase in patency from 65% at one month to 96% at 24 months in the one-layer cohort, reflecting delayed return of sperm due to gradual resolution of intraluminal debris or inflammation (5). Similarly, Nalesnik et al. reported sustained patency of 83% at 48 months, suggesting long-term anastomotic durability (8).

The choice of surgical technique likely contributes to the variability observed across studies. Double-layer microsurgical VV, which involves precise mucosa-to-mucosa alignment with interrupted sutures followed by a seromuscular layer, was historically associated with higher patency compared to single-layer repairs. This was demonstrated by *Wang et al.*, who reported 95% patency at 24 months with double-layer VV *versus* 96% with one-layer, though the sample sizes were small (5). Prior experimental and clinical data support the superiority of double-layer repairs in maintaining luminal continuity and preventing leakage (2). However, the marginal difference in Wang's series suggests that surgeon experience and tension-free approximation may be more critical determinants of success than suture layering alone (5). Notably, *Goldstein et al.* introduced the microdot 4 layers technique, emphasizing meticulous alignment of the vasal mucosa under high magnification, achieving 99% patency and 54% pregnancy at a mean of 17 months (9). These results remain a benchmark for microsurgical VV and highlight how advancements in optical magnification and microsurgical training have optimized outcomes. However, *Herrel et al.* pooled analysis showed similar patency rates regardless of the microsurgical technique used for vasovasotomy (12).

Although patency is essential for fertility, pregnancy rates are far more difficult to interpret because they depend heavily on female-factor fertility and other variables beyond restoration of ductal continuity. The pooled pregnancy rate of 45.5% in this analysis is consistent with prior large series, suggesting that approximately half of couples achieve natural conception following successful VV (7, 11). However, the gap between patency and pregnancy rates reflects the multifactorial nature of post-reversal fertility. Key determinants include female partner age, duration of the obstructive interval, and pre-existing fertility factors.

Kolettis et al. demonstrated that pregnancy rates declined sharply when the obstructive interval exceeded 15 years, likely due to secondary epididymal obstruction and reduced sperm motility (11). With *Safarinejad et al.*, the mean interval was 6.4 years, the pregnancy rate reached 28%; lower than the overall pooled rate, highlighting the heterogeneity of pregnancy outcomes across studies (10). Additionally, some men with restored patency fail to achieve conception due to anti-sperm antibodies or compromised sperm motility resulting from epididymal damage during the obstructive period (13, 14).

The high heterogeneity observed in the pooled analysis (I^2 = 94.69% for patency and 57.09% for pregnancy) appears to reflect differences in study design, surgical technique, patient selection, and follow-up methods rather than random error. Many studies lacked standardized follow-up intervals, with some reporting semen analyses every few months and others relying on retrospective chart review (7). Furthermore, differences in inclusion criteria such as whether patients with previous reversals were excluded also contribute to inconsistency.

To facilitate better cross-study comparison, future research should employ standardized endpoints: defining patency as ≥ 1 million motile sperm/mL at a fixed time point (e.g., 12 months), reporting cumulative pregnancy rates stratified by obstructive interval and female age, and distinguishing between early and late patency failures. The development of a consensus reporting framework, similar to the WHO guidelines for semen analysis, would be particularly beneficial.

In clinical practice, thorough pre-operative counseling is essential to set realistic expectations after VV. Patients should understand that most successful VV procedures achieve patency within the first few months, and outcomes during the first year are particularly critical. However, long-term patency data remain limited, making early follow-up and semen analysis at 3 and 6 months important for monitoring. Given that patency often occurs within the first year, discussing sperm freezing as a contingency for future conception may be prudent. Counseling should also address that achieving patency does not guarantee pregnancy, as factors such as female partner fertility, duration of obstruction, and sperm quality can influence outcomes

Several limitations warrant mention. First, reproductive outcomes, such as live birth data, were not provided. Second, only a small number of studies met inclusion criteria for ≥ 12-month follow-up, and most were retrospective in nature, potentially introducing selection bias toward studies with favorable outcomes. Third, heterogeneity in definitions and reporting precluded subgroup analyses by age, obstructive interval, or technique. Fourth, most studies did not control for female partner age or fertility status, limiting interpretation of pregnancy outcomes. Finally, publication bias cannot be excluded, as negative or short-term studies are less likely to be reported.

Conclusions

This meta-analysis demonstrates that microsurgical VV achieves consistently high long-term patency rates, with a pooled patency of approximately 90% by 12-31 months of follow up, and results in natural pregnancy in nearly half of couples within 24 months. Standardized reporting of patency and pregnancy outcomes, incorporating time-stratified analyses and female partner variables, will be essential to refine prognostic counseling and optimize long-term reproductive outcomes.

Declarations

Ethical approval and consent for participate: *Not applicable. This study is a systematic review of previously published literature and does not involve human or animal participants.*

Consent for publication: *Not applicable.*

Availability of data and material: *All data generated or analyzed during this study are included in this published article.*

Competing interests: *The authors declare that they have no competing interests.*

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Authors' contributions: *RG, study concept, data analysis and interpretation, manuscript original drafting; MH, study concept, data analysis and interpretation, manuscript original drafting; FL, literature search and data extraction; MAC, literature search, data extraction, and manuscript editing; KT, data analysis; MM, study supervision and final manuscript review. All the authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.*

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References

1. Cosentino M, Peraza MF, Vives A, et al. Factors predicting success after microsurgical vasovasostomy. Int Urol Nephrol. 2018; 50:625-32.

2. Belker AM, Thomas AJ, Fuchs EF, et al. Results of 1,469 microsurgical vasectomy reversals by the Vasovasostomy Study Group. J Urol. 1991; 145:505-11.

3. Keihani S, Verrilli LE, Zhang C, et al. Semen parameter thresholds and time-to-conception in subfertile couples: how high is high enough? Hum Reprod. 2021; 36:2121-33.

4. Muthigi A, Jahandideh S, Bishop LA, et al. Clarifying the relationship between total motile sperm counts and intrauterine insemination pregnancy rates. Fertil Steril. 2021; 115:1454-60.

5. Wang B, Liu Z, Jiang H. Comparison of low-power magnification one-layer vasovasostomy with stent and microscopic two-layer vasovasostomy for vasectomy reversal. Int J Impot Res. 2020; 32:617-22.

6. Majzoub A, Tadros NN, Polackwich AS, et al. Vasectomy reversal semen analysis: new reference ranges predict pregnancy. Fertil Steril. 2017; 107:911-5.

7. Sandlow JI, Kolettis PN. Vasovasostomy in the convoluted vas deferens: indications and outcomes. J Urol. 2005; 173:540-2.

8. Nalesnik JG, Sabanegh ES. Vasovasostomy: multiple children and Long-term pregnancy rates. Current Surgery. 2003; 60:348-50.

9. Goldstein M, Shihua PL, Matthews GJ. Microsurgical vasovasostomy: the microdot technique of precision suture placement J Urol 1998; 159:188-90.

10. Safarinejad MR, Lashkari MH, Asgari SA, et al. Comparison of *macroscopic one-layer over number 1 nylon suture vasovasostomy with the standard two-layer microsurgical procedure. Human Fertility 2013; 16:194-9.*

11. Kolettis PN, Sabanegh ES, D'amico AM, et al. Outcomes for vasectomy reversal performed after obstructive intervals of at least 10 years. Urology. 2002; 60:885-8.

12. Herrel LA, Goodman M, Goldstein M, Hsiao W. Outcomes of Microsurgical Vasovasostomy for Vasectomy Reversal: A Meta-analysis and Systematic Review. Urology. 2015; 85:819-25.

13. Silber SJ. Microscopic Vasectomy Reversal. Fertil Steril. 1977; 28:1191-1202.

14. Matthews GJ, Schlegel PN, Goldstein M. Patency following Microsurgical Vasoepididymostomy and vasovasostomy: temporal considerations. J Urol. 1995; 154:2070-2073.

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