REVIEW ARTICLE

Vasovasostomy and predictors of vasal patency: A systematic review

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Abstract

About 3–6% of vasectomized men requested vasectomy reversal, for various reasons. Vasal patency (VP) is an important surrogate outcome of vasectomy reversal. This article reviews the impact of surgical skills, surgical approaches, intraoperative vasal fluid characteristics and the length of obstructive interval on VP. Based on the best available evidence, the rate of patency is related to the operative frequency of the surgeons, with better results obtained by surgeons who perform the operations at least 10 times annually. Microsurgical vasovasostomy is the preferred technique for durable good results. One-layer vasovasostomy and two-layer vasovasostomy seem to be equal with regard to VP. The rate of patency following vasovasostomy in the convoluted vas and vasovasostomy in the straight vas is comparable. The patency rate is high in men with clear intraoperative vasal fluid in at least one vas. VP is still high among patients with a long obstructive interval. In conclusion, surgical skills and intraoperative vasal fluid characteristics are the most important predictors of VP. Postoperative semen quality and the age of the female partner determine the chance of spontaneous conception in these couples.

Key Words: surgical skills, vasal patency, vasectomy reversal, vasovasostomy

Introduction

Vasectomy is the most effective permanent method of male contraception [1], with some 175 000–345 000 men in the USA [2] and 28 519 in central Europe [3] undergoing the procedure annually.

The popularity of vasectomy as a method of birth control combined with the increasing frequency of divorces has inevitably resulted in a growing number of men requesting vasectomy reversal [4,5]. Other reasons for vasectomy reversal include the death of children, a wish for further children within the same relationship and altered financial circumstances [6]. The incidence rate of vasectomy reversal is 3–6% of all vasectomized men [3].

Vasal patency (VP), defined as the return of sperm (motile or immotile) in the ejaculate after the vasovasostomy procedure, is considered the best parameter for comparing the outcome of various surgical techniques. This review discusses the impact of surgical skills, surgical approaches, intraoperative vasal fluid characteristics and the length of obstructive interval on VP based on new findings in the recent literature.

A PubMed® and EBSCOhost® search was performed for articles published between January 2000 and April 2011, querying the key words vasectomy reversal, vasovasostomy, vasal patency, surgical skills, one-layer vasovasostomy, two-layer vasovasostomy, intraoperative vasal fluid characteristics and obstructive interval. Sixteen articles reporting on VP after vasovasostomy were collected. Only articles published in English reporting on patency after vasovasostomy for vasectomy reversal were included in the review, with no restriction regarding the period of follow-up. Studies with individual case reports and with patients who had a previous vasovasostomy were excluded. Of the 16 articles, 15 publications from seven different countries met the inclusion criteria. All were retrospective studies. To the authors’
knowledge no prospective or randomized trials have been published so far.

Surgical skills

The first successful vasovasostomy for vasectomy reversal was reported by Quinby in 1919. The anastomosis was performed over a strand of silkworm gut that was later removed [7]. Since then, the procedure has been undertaken by both urological surgeons and general surgeons with great variation with regard to VP.

In an attempt to assess the current practice of vasectomy reversal, Wood et al. distributed 130 questionnaires (to 35 urological surgeons and 95 general surgeons); the response rate was 74% (26 and 71, respectively), and only 24 urological surgeons and 14 general surgeons actually performed the vasovasostomy. There was no significant difference between urological surgeons and general surgeons regarding the use of microsurgery or the mode of anastomosis. According to the survey, vasovasostomies undertaken by urological surgeons were associated with significantly higher rates of patency compared with vasovasostomies performed by general surgeons (76% vs 52%, respectively; \( p = 0.02 \)). The number of general surgeons performing stent-assisted vasovasostomies was significantly higher than the number of urological surgeons (8.0 vs 3.0, respectively; \( p = 0.01 \)) [8]. A lower rate of VP was previously observed in association with stent-assisted vasovasostomy [9].

The success rate of surgical procedures is related to the number of procedures per surgeon: vasovasostomies performed by surgeons with more than 15 operations annually resulted in significantly higher rates of VP compared with vasovasostomies performed by surgeons who performed fewer than six procedures annually (87% vs 56%, respectively; \( p = 0.03 \)) [8]. However, there was no information regarding patency following vasovasostomies by surgeons who performed seven to 15 procedures annually: the number of surgeons in these groups was relatively low. In another questionnaire-based survey carried out to assess the difference in success rates between general and academic urological surgeons, Crain et al. invited 1508 practicing urological surgeons to participate in their study; the response rate was 41% (\( n = 622 \)), and only 367 (59%) performed the vasovasostomy. Of those, only 29 (8.0%) were fellowship trained urological surgeons; 86 (23%) were academic urological surgeons and 252 (69%) were urological surgeons working in a general hospital or private institution. The study reported a significant variation between the number of vasovasostomies performed annually and the level of training or practice setting, with fellowship trained and academic urological surgeons performing significantly more vasovasostomies than the community urological surgeons (26, 12 and seven, respectively; \( p < 0.001 \)), with an overall average of 10 procedures annually. The authors did not find a significant difference between the three groups of urological surgeons with regard to VP (79%, 69% and 71%, respectively; \( p = 0.05 \)), with an overall average rate of 71% [10].

In summary, trained urological surgeons are to perform vasovasostomy more often, with better results in term of VP. The rate of patency is related to the operative frequency of the surgeons, with better results obtained by surgeons who undertake at least 10 procedures annually.

Surgical approaches

Technique of surgery

Since the introduction of microsurgical vasovasostomy by Silber [11], the technique has been popularized such that many surgeons using the technique believe it to be the procedure of choice for vasectomy reversal [12–14]. However, some surgeons still believe that careful macrosurgical vasovasostomy is a simple, less expensive and quicker alternative.

Gopi and Townell studied 70 men who underwent vasovasostomies using the macrosurgical approach with no loupe magnification. The procedures were done by the same surgeon using a one-layer approach and 6-0 Prolene with an average operating time of 75 min. The overall reported rate of patency was 90%. The authors postulated that the macrosurgical technique in the hands of an experienced surgeon produces good results and should be considered as an effective means of vasectomy reversal [15].

Hsieh et al. evaluated the rate of VP between 28 men who underwent macrosurgical vasovasostomies with loupe magnification with an average operating time of 150 min (group 1) and 35 men who underwent microsurgical vasovasostomies with an average operating time of 208 min (group 2). The rate of patency was 89% (25/28) in group 1 and 91% (32/35) in group 2. The difference was not statistically significant (\( p = 0.06 \)). The authors recommended the macrosurgical technique as the best choice for simple vasectomy reversal [16]. Jee and Hong reported higher rate of VP among 25 men who underwent microsurgical vasovasostomies with an average operating time of 106 min compared with 25 men with macrosurgical vasovasostomies with loupe magnification and an average operating time of 78 min [96% (24/25) vs 72% (18/25), respectively; \( p = 0.02 \)] [17].
In both studies there was no difference between groups with regard to patient’s age or length of obstructive interval, the procedures were performed by one surgeon who had good experience in both techniques and there were no reported operation-related complications. It is difficult to explain the difference between the two studies; one important factor that could have been helpful, the intraoperative vasal fluid characteristics, was missing.

In summary, no clear difference between macro-surgical and microsurgical vasovasostomy regarding VP is reported. Both techniques seem to be effective means of vasectomy reversal when performed by an experienced surgeon.

Method of anastomosis

While most current descriptions of vasovasostomy show two-layer vasovasostomy as standard [18,19], many practising surgeons prefer one-layer vasovasostomy [20]. On the one hand, two-layer vasovasostomy has the advantage of proper mucosal approximation between the two ends of the vas. It is speculated that this ensures a leak-proof alignment; however, a potential disadvantage of two-layer vasovasostomy is that knots of suture are left just outside the mucosa, which may promote fibrosis and lead to an anastomotic stricture. Moreover, the permucosal sutures may cause the formation of a suture granuloma and fibrosis of the lumen. On the other hand, one-layer vasovasostomy has the advantage that fewer sutures pass through the lumen, which theoretically lowers the risk of suture granuloma and subsequent stricture. A theoretical disadvantage of one-layer vasovasostomy is that the mucosal approximation may not be as reliable as in two-layer vasovasostomy. In general, one-layer vasovasostomy is easier and quicker to perform than two-layer vasovasostomy.

To date, only one study comparing one-layer vasovasostomy and two-layer vasovasostomy has been found. In this study, Fischer and Grantmyre compared VP between 17 men who underwent one-layer microsurgical vasovasostomies (group 1) and 23 men who underwent two-layer microsurgical vasovasostomies (group 2). The procedures were performed by one experienced surgeon. The patients in the two groups had identical characteristics except for the length of obstructive interval, which was longer in group 1 than in group 2 (65 months vs 35 months, respectively). The study reported an equal rate of patency in the two groups (88% vs 90%, respectively). Sperm concentration in group 1 was significantly higher than in group 2 (49 × 10⁶/ml vs 27 × 10⁶/ml, respectively); the authors attributed this to the short period of follow-up, which was 10 weeks [21]. Sperm characteristics have been shown to improve over time following vasovasostomy [22]. Moreover, one can assume that the two groups of patients were different with regard to the quality of semen before vasectomy.

In summary, the study shows that one-layer vasovasostomy and two-layer vasovasostomy have equivalent patency. However, it is difficult to draw a true conclusion based on one study with low numbers of men. Therefore, more randomized comparative studies are recommended.

Site of anastomosis

Vasovasostomy in the convoluted vas (the portion of the vas with a tortuous course) is known to be technically more difficult than vasovasostomy in the straight vas (the portion of the vas with a straight course). This is assumed to be due to the thin muscular wall and the discrepancy between the lumen size of the testicular and abdominal ends in the convoluted vas.

Witt et al. observed an inverse relationship between the length of the postvasectomy testicular vas (from the cauda of the epididymis to the site of vasectomy) and the intraoperative vasal fluid characteristics. Thus, testicular vas longer than 2.7 cm predicted the presence of sperm in the intraoperative vasal fluid in 94% of patients, whereas testicular vas shorter than 2.7 cm predicted the absence of sperm in the intraoperative vasal fluid in 85% of patients [23]. This observation raises the question of whether vasovasostomy in the convoluted vas may be less successful than vasovasostomy in the straight vas.

In this regard, Sandlow and Kolettis examined the indication of vasovasostomies in the convoluted vas in 48 patients. Of those, 42 men underwent bilateral microsurgical vasovasostomies and six men underwent unilateral microsurgical vasovasostomies. The authors had access to patency data from 43 patients who were followed up for 1 year. The reported rate of patency was 88% (38/43) [24]. However, the procedures were carried out by two different surgeons and the study did not include a group of patients with vasovasostomies in the straight vas. Patel and Sigman evaluated VP in 64 patients who underwent bilateral vasovasostomies in the convoluted vas and 42 men who underwent bilateral microsurgical vasovasostomies in the straight vas. The procedures were carried out by the same surgeon using two-layer anastomosis with 9–0 Nylon and the patients in the two groups were similar with regard to age and length of obstructive interval. The study reported a non-significant difference between the two groups with regard to VP (98% vs 97%, respectively) [25].
In summary, vasovasostomy in the convoluted vas has a similar rate of patency to vasovasostomy in the straight vas.

**Intraoperative vasal fluid characteristics**

The decision to perform vasovasostomy depends mainly on the macroscopic and microscopic characteristics of the intraoperative vasal fluid. If spermatozoa are present, then vasovasostomy should be performed. If spermatozoa are absent and the vasal fluid is clear and copious, most surgeons would still perform vasovasostomy [26].

Kolettis et al. investigated VP among 22 men with no spermatozoa detected in the intraoperative vasal fluid who received bilateral microsurgical one-layer vasovasostomies using 9–0 Nylon and were followed up for at least 6 months. The study reported positive VP in 12 men (55%). Of those, eight (67%) had clear fluid on at least one side. For the other four men with reported patency, two had bilateral creamy fluid, one had unilateral opalescent fluid and one was unknown [27]. The authors concluded that patency is possible after vasovasostomy in the setting of intraoperative vasal fluid azoospermia, although it seems to be reduced.

Sigman studied a total of 71 patients who underwent bilateral microsurgical two-layer vasovasostomies using 9–0 Nylon. All patients had bilateral clear and copious intraoperative vasal fluid. Of those, 59 (84%) had positive patency. Among those, intraoperative vasal fluid contained spermatozoa in 27 (group 1), parts of spermatozoa (head or short tails) in 26 (group 2) and no spermatozoa in six men (group 3). The patients did not differ significantly with regard to age or length of obstructive interval. The study showed insignificant difference between the three groups with regard to VP (100%, 98% and 100%, respectively). The postoperative median concentration of spermatozoa was $57 \times 10^6$/ml, $42 \times 10^6$/ml and $44 \times 10^6$/ml, respectively; the difference was not statistically significant ($p = 0.20$). Unfortunately, no information about the intraoperative vasal fluid characteristics among the patients who did not achieve VP was given. The authors concluded that VP did not vary significantly as a function of intraoperative vasal spermatozoa quality [28]. However, the follow-up period was not defined in this study. Kolettis et al. reported insignificant differences in VP for patients with parts of spermatozoa detected bilaterally, 17/22 (77%), and patients with parts of spermatozoa on one side and contralateral intraoperative vasal fluid azoospermia, 9/12 (75%) [29]. Although VP was relatively low in this study compared to the previous study, it still indicates that intraoperative vasal spermatozoa quality insignificantly affects the patency.

In summary, clear and copious intraoperative vasal fluid in at least one vas is associated with higher rates of patency. Intraoperative vasal fluid spermatozoa quality does not correlate with VP.

**Length of obstructive interval**

Silber was the first to demonstrate an inverse relationship between the length of obstructive interval (defined as the time between vasectomy and vasectomy reversal) and VP following vasovasostomy [26]. Since then, the impact of the obstructive interval on patency has been debated by many authors.

In a series of 217 vasovasostomies, Dohle and Smit compared the rate of patency between two groups of men who underwent bilateral microsurgical one-layer vasovasostomies with a variable length of obstructive interval who were followed up for 6 months. The authors reported a higher patency rate when the interval was less than 5 years compared with an obstructive interval of more than 10 years (89% vs 75%, respectively) [30]; however, the number of men in each group was not clearly defined. In accordance with these results, Kolettis et al. demonstrated 79% patency rate in 37 out of 47 men who underwent bilateral one-layer or two-layer microsurgical vasovasostomy after an obstructive interval of at least 10 years who were followed up for 12 months [31]. However, the study did not include patients with a shorter obstructive interval.

In disagreement with previous reports, Boorjian showed that VP did not change significantly with increasing length of obstructive interval, with 91% patency rate reported at less than 5 years, 88% at 5–10 years, 91% at 10–15 years and 89% at more than 15 years among 159 men who underwent microsurgical two-layer vasovasostomies with a follow-up period of at least 6 months [32]. Moreover, Yang et al. followed up 80 patients for more than 2 years following microsurgical two-layer vasovasostomies after different periods of obstructive interval and demonstrated an insignificant difference in the rates of VP at the end of the study [100% (0–8 years), 91% (9–16 years) and 88% (≥16 years)] [33]; however, the number of men in each group was not given in these two studies. Furthermore, Magheli et al. did not find significant difference in the rates of patency after different obstructive intervals among 242 patients who underwent bilateral microsurgical two-layer vasovasostomies and were followed up for at least 3 months [99% (<5 years, $n = 81$), 98% (5–10 years, $n = 87$), 95% (11–15 years, $n = 53$) and 97% (>15 years, $n = 21$)], with an overall patency rate of
97% [34]. The procedures were performed by the same experienced surgeons in all studies. In comparison to the study by Dohle and Smit, as well as the study by Kolettis et al., the last three studies were based on significantly higher numbers of patients (mean 481 vs 264) and a longer follow-up period (mean 18 vs 9 months).

In summary, vasovasostomy after a long obstructive interval can still result in high rates of patency. The length of obstructive interval, therefore, may not be a significant prognostic factor for VP after vasovasostomy.

Conclusions

Based on the best available evidence, trained urological surgeons are both likely to undertake vasovasostomy and to do so more often. The rate of VP is related to the operative frequency of the surgeons, with better results obtained by surgeons undertaking at least 10 procedures annually. No clear difference in the rate of patency is reported comparing macrosurgical and microsurgical techniques. One-layer vasovasostomy and two-layer vasovasostomy seem to be equal with regard to VP. Vasovasostomy in the convoluted vas and vasovasostomy in the straight vas appear to have equal patency. VP is higher in men with clear intraoperative fluid in at least one vas. VP may still be high in patients with a long obstructive interval.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References


