

## Sexual Function/Infertility

# The Utility of Sperm Cryopreservation at the Time of Vasectomy Reversal



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### Abbreviations and Acronyms

BMI = body mass index  
ICSI = intracytoplasmic sperm injection  
IVF = in vitro fertilization  
TESE = testicular sperm extraction  
VE = vasoepididymostomy  
VR = vasectomy reversal  
VV = vasovasostomy

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**Purpose:** We retrospectively evaluated the utility of sperm cryopreservation at the time of vasectomy reversal.

**Materials and Methods:** From April 2016 through December 2018 a total of 26 men underwent vasectomy reversal. Sperm cryopreservation is routinely offered at the time of vasectomy reversal at our institution. We sought to assess utilization of cryopreserved sperm by those men with early or late vasectomy reversal failure.

**Results:** Of 26 patients presenting for vasectomy reversal 22 (85%) elected to cryopreserve sperm. Sperm were obtained for freezing from the vasal (7 patients) or epididymal fluid (3), or via testicular biopsy (12). Three patients were lost to followup postoperatively. Of the 23 who presented for post-procedure followup 19 either had semen analyses with motile sperm or a live birth (83% success rate). There were 4 early failures and 2 late failures; all patients with failures had elected to cryopreserve sperm at the time of initial reversal. Three of the 6 individuals (50%) with vasectomy reversal failure elected to use cryopreserved sperm for in vitro fertilization/intracytoplasmic sperm injection, with 2 of these (67%) resulting in live births.

**Conclusions:** Of those patients who experienced vasectomy reversal failure 50% elected to use cryopreserved sperm that had been procured at the time of initial reversal. Given the potential for early or late failure, cryopreservation of sperm at the time of vasectomy reversal should be routinely offered as a means of avoiding the added expense and potential morbidity of future surgical sperm retrieval.

**Key Words:** vasovasostomy, cryopreservation, spermatozoa

In the United States there are an estimated 175,000 to 350,000 vasectomies performed annually.<sup>1</sup> Of these men approximately 6% will later request a reversal procedure.<sup>2</sup> In some populations nearly 1 in 10 men presenting for infertility evaluation have a history of vasectomy.<sup>3</sup> For these couples options include adoption, donor sperm insemination, vasectomy reversal or surgical sperm retrieval with in vitro fertilization using intracytoplasmic sperm injection.<sup>4</sup>

Since first being introduced in the early 1990s, ICSI has revolutionized the treatment of male factor infertility. By injecting a single spermatozoon into the

cytoplasm of an oocyte, nearly all barriers to fertilization are removed.<sup>5</sup> This technique permits fertilization regardless of sperm source and characteristics, meaning that for those patients with abnormal semen parameters or obstructive azoospermia surgically retrieved testicular and epididymal sperm may be used instead of ejaculated sperm.<sup>5</sup>

While sperm retrieval with IVF/ICSI is a potential reproductive option for post-vasectomy patients who desire biological offspring, vasectomy reversal has typically been heralded as an effective and more economical option. In a recent meta-analysis the

mean post-vasovasostomy patency and pregnancy rates were found to be as high as 89% and 73%, respectively.<sup>2</sup> A previous analysis found the average patency rate after VR to be 81% and the average live birth rate to be 44%.<sup>6</sup> When comparing reversal outcomes to IVF/ICSI, the average live birth rate was the same (44%). A direct comparison of costs, however, reveals that vasectomy reversal is more cost-effective than sperm retrieval with IVF/ICSI.<sup>6,7</sup> In 1 study there was a nearly threefold decrease in cost per delivery with VR vs sperm retrieval with IVF/ICSI.<sup>7</sup>

Given that VR is an effective and economical method for restoring fertility, it is expected that many post-vasectomy patients will choose this option vs sperm retrieval with IVF/ICSI. However, the question of whether patients should cryopreserve sperm at the time of vasectomy reversal remains controversial. In 1 survey of practicing urologists only 11% of respondents routinely recommended cryopreservation; however, among fellowship trained infertility specialists this number more than doubled (24%).<sup>8</sup> The rationale for cryopreservation at the time of VR is that sperm can be collected and saved as a “backup” for later use in IVF/ICSI in the event that the post-operative ejaculate remains azoospermic or severely oligospermic. By obtaining sperm at the time of VR, patients are spared a later sperm retrieval procedure. Given the inherent possibility of either early or late failure after VR, some groups have advocated for routine sperm cryopreservation for all patients at the time of surgery.<sup>9</sup> Others have advocated for cryopreservation only in those cases where one or both sides require a potentially less successful vasoepididymostomy procedure.<sup>10,11</sup> Still others have advocated against routine cryopreservation given its poor cost-effectiveness in some studies.<sup>4</sup>

In our practice we routinely offer sperm cryopreservation to all patients at the time of vasectomy reversal. The goal of this study was to retrospectively review the vasectomy reversal procedures performed at our institution and assess the utility of concomitantly cryopreserving sperm at the time of the procedure.

## MATERIALS AND METHODS

Between April 2016 and December 2018 a total of 26 men underwent vasectomy reversal at our institution. All patients had a history of vasectomy for the purposes of

surgical sterilization; they did not have any other medical history that was suggestive of another etiology of obstructive azoospermia (ie no history epididymitis, iatrogenic injury etc). The medical records were then retrospectively reviewed. All surgeries were performed at a single ambulatory surgery center by one of 2 fellowship trained reproductive urologists. Of these patients 19 underwent bilateral VV, 6 underwent unilateral VV, and 1 underwent a combined unilateral VV and unilateral VE procedure. The decision regarding which procedure to perform was made intraoperatively, depending on the quality of vasal fluid aspirated from the testicular end of the vas deferens as well as the length of the vasal defect. If clear fluid and/or sperm could be expressed from the vas deferens, a VV was performed. If thick, pasty fluid without sperm was found, a vasoepididymostomy was performed. If the vasal defect was too great that a tension-free anastomosis could not be technically achieved, a unilateral procedure was performed. All VV procedures were done using a microsurgical technique with either a modified 1 or 2-layer anastomosis. The singular vasoepididymostomy procedure was performed using a microscopic end-to-side technique.

All patients were offered sperm cryopreservation at the time of vasectomy reversal. They were extensively counseled about the costs and risks associated with an additional sperm retrieval procedure. For those patients electing cryopreservation sperm aspirated from vasal and/or epididymal fluid were examined microscopically by our andrology laboratory at the time of surgery. If sperm suitable for ICSI were found in the vasal or epididymal fluid, they were preferentially cryopreserved. If adequate sperm were not found, a concomitant testicular sperm extraction was performed. If indicated, a TESE was performed by making a small incision in the tunica albuginea of 1 testis. Seminiferous tubules were extruded, excised and examined microscopically by our andrology laboratory; if suitable for ICSI, the testicular sperm were cryopreserved.

After the procedure all patients were instructed to follow up with a semen analysis at 4 to 6 weeks post-operatively, and then every 3 months or until conception. These semen analyses were reviewed to assess for patency after reversal. For the purposes of this study patency was defined as the presence of motile sperm in the ejaculate. A successful procedure was defined as either the presence of motile sperm on a postoperative semen analysis or a live birth. An early failure was defined as the absence of motile sperm on any postoperative semen analyses. A late failure was defined as the progression to either azoospermia or nonmotile sperm in men previously demonstrating motile sperm on earlier postoperative semen analyses.

**Table 1. Demographics**

	All VR	Bilat VV	Unilat VV	Unilat VV+ Unilat VE
No. pts	26	19	6	1
Mean yrs age (range)	Mean 40.6 (range 32–50)	Mean 40.2 (range 32–47)	Mean 41.5 (range 33–50)	43.0
Mean kg/m <sup>2</sup> BMI (range)	Mean 27.7 (range 22–40)	Mean 28.3 (range 22–40)	Mean 26.6 (range 23–30)	24.0
Mean yrs obstructed interval (range)	Mean 8.4 (range 1–18)	Mean 8.2 (range 1–18)	Mean 8.5 (range 4–15)	11.0
No. pts electing sperm cryopreservation at VR (%)	22 (85)	16 (84)	5 (83)	1 (100)

**Table 2.** Postoperative failures

	Early Failure		Late Failure		All Failures	
No. pts	4		2		6	
Mean yrs age (range)	40.0	(32–50)	39.5	(34–45)	39.8	(32–50)
Mean kg/m <sup>2</sup> BMI (range)	26.9	(22.4–34.0)	27.1	(27.0–27.1)	26.9	(22.4–34.0)
Mean yrs obstructed interval (range)	10.3	(4–15)	14.5	(11–18)	11.6	(4–18)
No. pts electing sperm cryopreservation at VR (%)	4 (100)		2 (100)		6 (100)	
No. pts using cryopreserved sperm for IVF/ICSI (%)	2 (50)		1 (50)		3 (50)	

## RESULTS

Our study included 26 men between the ages of 32 and 50 at the time of vasectomy reversal (mean 40.6 years, table 1). The obstructed interval between vasectomy and reversal ranged from 1 to 18 years (average 8.4). The average age of the female partners was 34 years (range 23 to 43).

Of these 26 men 22 elected to cryopreserve sperm (85%). Sperm were obtained for freezing from vasal fluid in 32% of cases (7 patients) and epididymal fluid in 14% of cases (3). A total of 12 patients (55%) underwent a TESE procedure. No significant postoperative complications were reported from either the vasectomy reversal or TESE procedure for any patients. Of those patients electing cryopreservation an average of 4.7 vials of sperm were obtained at the time of surgery (range 2 to 10). All cryopreserved specimens were deemed suitable for ICSI before freezing.

Of the 26 patients 3 were lost to followup postoperatively and excluded from further analysis. The remaining 23 patients were followed for unequal periods ranging from 37 to 804 days, with an average followup period of 164 days. Of these 23 patients 19 either had postoperative semen analyses with motile sperm or a live birth (83% initial success rate). There were 4 early failures and 2 late failures; all patients with failed procedures elected to cryopreserve sperm at the time of initial reversal (table 2). In comparing successful vs failed procedures there was no difference in patient age, BMI or obstructed interval, although the difference in obstructed interval did approach statistical significance ( $p=0.06$ , tables 3 and 4). Accounting for the late failure rate, the overall success rate was 74%. The 2 late failures occurred at 105 days and 418 days postoperatively. Three of the 6 men with vasectomy reversal failures (50%) used cryopreserved sperm for IVF/ICSI. Two of these patients experienced

an early failure and used cryopreserved epididymal sperm or TESE sperm for IVF/ICSI; the final patient experienced a late failure and used cryopreserved TESE sperm for IVF/ICSI. Two of these 3 IVF/ICSI cycles (67%) resulted in live births (see figure).

Of the 17 patients with postoperative followup and a successful reversal 6 (35%) ultimately used IVF/ICSI in an attempt to conceive (table 3). Although all of these patients with successful vasectomy reversal used ejaculated sperm for IVF/ICSI, 100% had previously elected to cryopreserve sperm and had additional frozen sperm available for use if needed.

Overall, of the 23 patients presenting for postoperative followup 10 (43%) used IVF/ICSI after their reversal procedure in an attempt to conceive. Of these patients 100% had elected to cryopreserve sperm at the time of their reversal procedure.

## DISCUSSION

The operative success rate reported in our study is comparable to other published series. Of the 23 patients presenting for followup 19 (83%) had a postoperative semen analysis with motile sperm or a live birth. This is similar to the 88% patency rate after either unilateral or bilateral vasovasostomy reported by Glazier et al<sup>9</sup> and the 86% patency rate after vasovasostomy reported by the Vasovasostomy Study Group.<sup>12</sup>

In our study there were 4 early failures and 2 late failures. The late failure rate observed in our study (2 of 23 cases, 9%) is again comparable to other published series. As reported by Matthews et al, the late failure rate after 100 consecutive vasovasostomy procedures by a single surgeon was 12%.<sup>11</sup> Similarly in a recent systematic review the late failure rate after vasovasostomy ranged from 0% to 12%, with mean time to late failure of

**Table 3.** Successful reversals

	Bilat VV		Unilat VV		VV+VE	All Successful Reversals	
No. successful reversal/total No. (%)	12/16	(75)	5/6	(83)	0/1 (0)	17/23	(74)
Mean yrs age (range)	42.3	(36–47)	39.8	(33–48)	Not applicable	41.6	(33–48)
Mean kg/m <sup>2</sup> BMI (range)	28.8	(22.9–40.0)	26.5	(23.0–30.4)	Not applicable	28.1	(22.9–40.0)
Mean yrs obstructed interval (range)	6.8	(1–13)	7.2	(4–10)	Not applicable	6.9	(1–13)
No. pts with successful reversal who elected sperm cryopreservation/total No. (%)	11/12	(92)	4/5	(80)	Not applicable	15/17	(88)
No. pts with successful reversal undergoing IVF or ICSI/total No. (%)	4/12	(33)	2/5	(40)	Not applicable	6/17	(35)

Includes 23 patients presenting with postoperative followup or history of a live birth; excludes both early and late failures.

**Table 4.** Comparative data for postoperative failures and successful reversals

	All Failures		All Successful Reversals		p Value
No. pts	6		17		
Mean yrs age (range)	39.8	(32–50)	41.6	(33–48)	0.60
Mean kg/m <sup>2</sup> BMI (range)	26.9	(22.4–34.0)	28.1	(22.9–40.0)	0.58
Mean yrs obstructed interval (range)	11.6	(4–18)	6.9	(1–13)	0.06

9.7 to 13.6 months.<sup>13</sup> Our 2 reported late failures occurred at 3.5 and 13.9 months. While our followup interval ranged from 1 to 26.8 months, the average length of followup was only 5.5 months; therefore, it is possible that additional late failures were not captured secondary to inadequate followup.

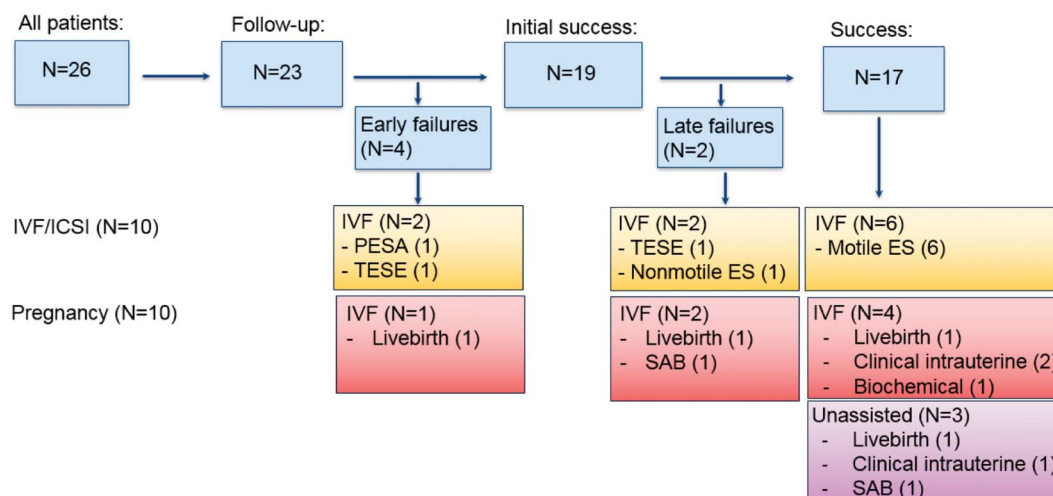
Of the 26 consecutive patients presenting for vasectomy reversal 22 (85%) elected to cryopreserve sperm. This is higher than in previous reports. In a study by Glazier et al only 64% of men undergoing vasectomy reversal agreed to intraoperative sperm banking.<sup>9</sup> Another study published during the same year found that only 46% of men undergoing VR underwent intraoperative sperm retrieval.<sup>10</sup>

Overall, of the 22 patients who elected to cryopreserve sperm intraoperatively 3 (14%) later used it for IVF/ICSI. This is slightly greater than the 8% utilization rate previously reported by Schrepferman et al.<sup>10</sup> All of these patients experienced either an early or a late failure. Of the 6 patients who experienced a reconstructive failure 3 (50%) went on to use cryopreserved sperm for IVF/ICSI. Two of these patients (67%) had pregnancies resulting in live births.

Interestingly of the 23 patients presenting for followup 10 (43%) underwent IVF/ICSI after vasectomy reversal. This is greater than a previous study that indicated assisted reproductive techniques were only used in 25% of patients after vasovasostomy.<sup>11</sup> Specifically of the 17 patients with a successful reversal 6

(35%) later used IVF/ICSI. While these patients with a history of a successful reversal all used ejaculated sperm, they all had cryopreserved sperm available for use if needed. Given that nearly half of all patients presenting for vasectomy reversal will undergo IVF/ICSI postoperatively—including over a third of patients with a successful reversal—this further strengthens the argument for routine intraoperative sperm cryopreservation. Harvesting sperm intraoperatively did not cause any additional morbidity or complications. However, it prevented 50% of patients with reconstructive failures from undergoing additional sperm retrieval procedures and acted as an insurance policy for the 6 of 17 patients with successful reversals who elected to undergo IVF/ICSI postoperatively.

The high utilization of IVF/ICSI in our study may be related to broader national trends of couples delaying childbearing, leading to a greater need for assisted reproductive techniques to achieve a pregnancy. As we know, fertility declines over time for both men and women, although the risk of infertility (inability to achieve a pregnancy after 12 months of attempted conception) has a stronger correlation with maternal age.<sup>14</sup> For women fertility declines after age 32; in our cohort the average female partner age was 34 years, which may have contributed to the difficulties in achieving a pregnancy after a successful VR. These national trends toward greater maternal age and assisted



Outcomes of patients undergoing vasectomy reversal. PESA, percutaneous epididymal sperm aspiration. ES, ejaculated sperm used for IVF/ICSI. SAB, spontaneous abortion.

reproductive technique utilization further support the argument that patients should be offered sperm cryopreservation at the time of vasectomy reversal.

Our study has several limitations. As a retrospective review, it is prone to the biases inherently associated with this study design. Our study size was also limited compared to other similar published works. As previously mentioned, the followup interval was variable and averaged 5.5 months, which may have been insufficient to capture all late failures. Additionally this followup interval may have been inadequate to identify all unassisted pregnancies. In some studies only about half of all unassisted pregnancies after vasovasostomy occurred by 12 months, and some were observed up to 5 years after the procedure.<sup>11</sup> Conversely those patients with a successful reversal procedure and/or successful pregnancy may not have seen any reason to present for routine postoperative followup. Finally, it is important to consider that this study was performed at a large, high volume infertility center with on-site andrology laboratory support and its conclusions may not be applicable to all practice settings.

Our study does not directly address the question of cost-effectiveness. As previously mentioned, prior studies have argued against routine sperm cryopreservation at the time of VR because of the associated costs; rather, these authors advocate for deferring surgical sperm retrieval until the reversal surgery has been deemed a failure and the female partner is ready to proceed with IVF/ICSI.<sup>4</sup> Given that there is significant institutional variability in both facility and surgeon fees, it is difficult to say with confidence that one method is truly more cost-effective than the other. Additionally it is impossible to assign a monetary value to the

subjective benefit of avoiding a later surgical sperm retrieval procedure. At our center there is no additional cost for obtaining and cryopreserving sperm at the time of VR, which likely contributes to the higher rates of sperm cryopreservation seen in our study compared to other centers. At the time of publication current fees (including surgery center costs, anesthesia, and andrology laboratory fees for sperm evaluation and cryopreservation) are \$12,500 for a vasectomy reversal with sperm cryopreservation and \$4,000 for TESE alone. It is important that each center have a thorough, transparent discussion with patients regarding the costs of both possible clinical scenarios prior to vasectomy reversal surgery.

## CONCLUSIONS

Compared to prior studies, our vasectomy reversal cohort demonstrated a greater percentage of elective intraoperative sperm cryopreservation (85%) as well as a greater use of postoperative IVF/ICSI (43%). Of those patients who experienced vasectomy reversal failure 50% elected to use cryopreserved sperm that had been procured at the time of initial reversal for IVF/ICSI; two-thirds of these couples (67%) had pregnancies resulting in live births. Given these findings, cryopreservation of sperm at the time of vasectomy reversal should be routinely offered as a means of avoiding the added expense and potential morbidity of future surgical sperm retrieval in the event of a reconstructive failure. The decision to proceed with sperm cryopreservation should be made after a thorough discussion with the patient regarding the risks, benefits and costs.

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