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Dealing with fertility problems after vasectomy reversal

For many years, vasectomy has been considered irreversible. The author describes his advanced microsurgical technique that restores fertility in a majority of patients.

One of the most popular methods of birth control in the U.S. today, vasectomy has generally been considered permanent. A more accurate concept of vasectomy and its effects on the epididymis has helped us develop new microsurgical techniques that now make the procedure reversible for the majority of patients. This does not just mean "patency" with a few dead sperm getting through, but rather the production of normal semen and fertility as proven by the partner's pregnancy.

One of the three major aspects to the problem of reversibility is obtaining an accurate reanastomosis of the vas deferens. A sloppy anastomosis results in a strictured fistulous connection and poor results in terms of pregnancy. Now, with advanced microsurgical technique, we should be able to achieve reliable reanastomosis of the vas deferens in most cases.

Another aspect of the problem involves the pressure-induced effects of vasectomy itself on the male reproductive system. The pressure buildup in the epididymis that inevitably occurs after vasectomy usually is relieved once the vas is accurately reanastomosed; but permanent damage may result from epididymal ruptures, which makes the recovery of fertility unlikely even with a sophisticated vasovasostomy.

The third aspect—and the most challenging—is the intricate microsurgical technique required for vasoepididymal anastomosis. This technique can restore fertility even when there is secondary epididymal obstruction.

Why spontaneous recanalization?

After vasectomy the two ends of the vas deferens often reunite spontaneously, making some patients fertile again. It is odd, therefore, that we seem to have such difficulty in achieving this intentionally. With standard ligature techniques of vasectomy, there is about 1% risk of such recanalization. With the cautery technique, such recanalization is much less likely.

In order to explain the poor results with conventional vasovasostomy techniques (no pregnancy despite the presence of sperm in the ejaculate), we must

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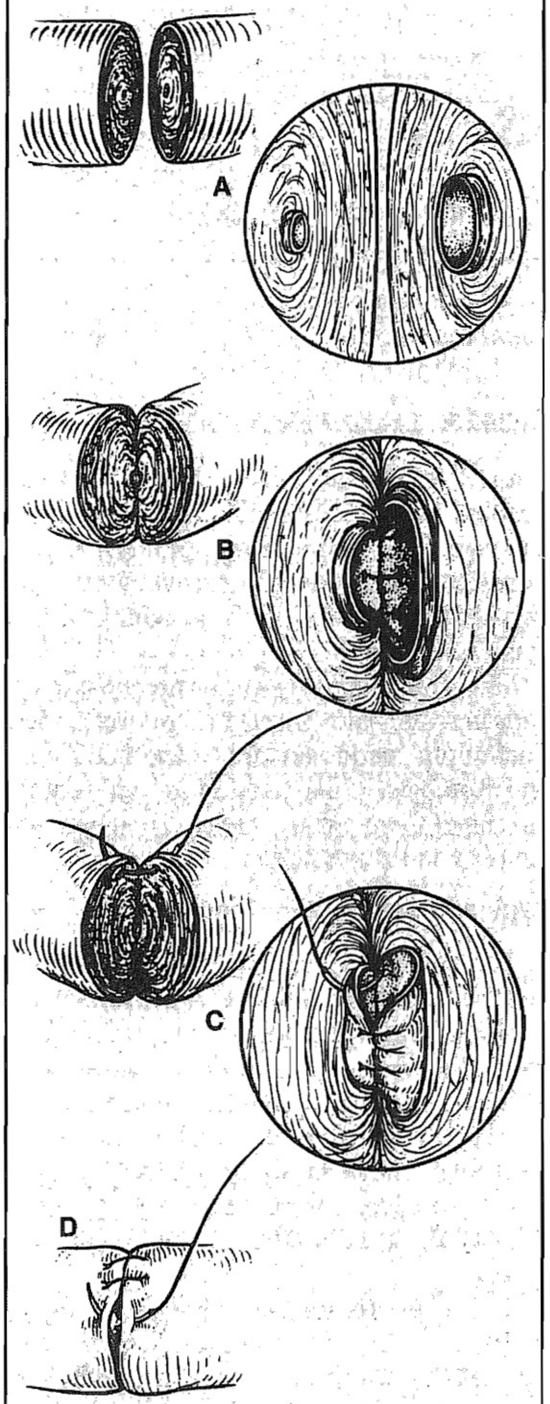
Fig. 1. This is a diagrammatic overview of the microsurgical two-layer technique for vasovasostomy.



understand how a spontaneous reanastomosis occurs. After vasectomy, fluid pressure builds up on the proximal side of the vas ligature. In many cases, there is a vasal rupture at the vasectomy site and leakage of sperm. A sperm granuloma forms between the two ends of the vas deferens with multiple, fistulous tracts. In most cases, this granuloma eventually fibroses so that there is no communication with the other side, but occasionally a channel remains open and sperm can wander through this maze. Very rarely, the channel will stay open and even allow the patient to be fertile.

Usually, however, the channel will be too small to allow passage of sperm, and the patient will be oligospermic with mostly nonmotile sperm. Eventually most granulomas will scar down completely so that the patient becomes azoospermic again.

It is possible for the same phenomenon to occur after vasovasostomy. If the two ends of the vas are sutured in any way at all, some sperm probably would be recovered in the ejaculate; however, most patients would be infertile with low sperm counts. Because of the capacity of spermatozoa to grind their way through, it is very easy to obtain sperm in the ejaculate after even a crude vasovasostomy technique. The incidence of fertility is going to be low, however, unless a proper anastomosis is made for easy passage of sperm.

Conventional methods of vasectomy reversal

Reanastomosis of the vas usually has involved the use of some sort of splint placed almost blindly into the lumen of the vas deferens, after which the muscularis is sutured with three to eight stitches of 4-0 or 7-0 suture material. I consider this kind of approach crude and leading to

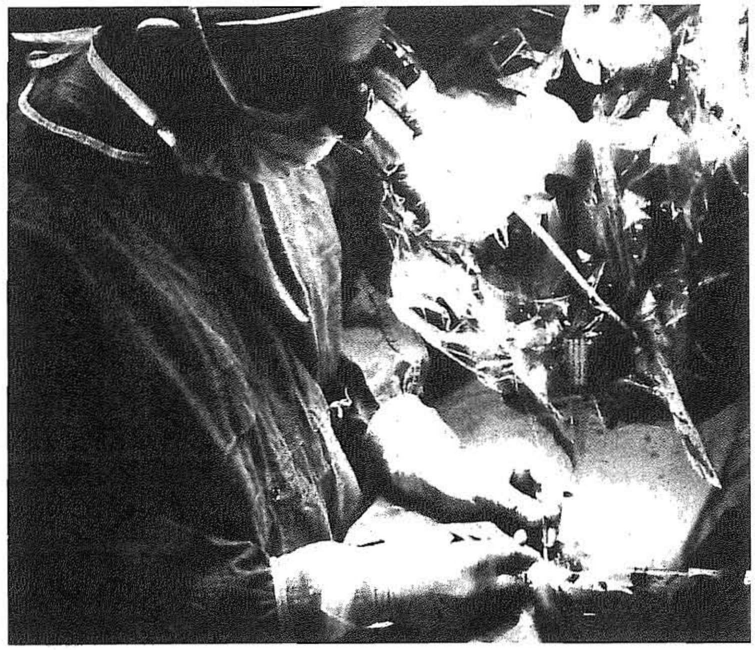


Fig. 2. The microscopic arrangement should allow surgeon and assistant to have the same field of view.

sperm leakage, granuloma formation, and a poor reconnection of the inner lumen of the vas.

Most such traditional methods have resulted in a 30% to 85% incidence of sperm in the ejaculate, with a 5% to 30% pregnancy rate. However, the clinical literature has provided no solid information on actual sperm counts at various intervals postvasovasostomy or on any characteristics of patients' original vasectomies that might correlate with vasovasostomy results. Therefore, in an effort to study systematically what has at best been a problem considered only haphazardly, we have very carefully measured multiple preoperative parameters and obtained detailed monthly postoperative follow-up. Furthermore, the microscopic reliability of our anastomosis has allowed us to consider more systematically factors other than technique that may also affect recovery of fertility after vasovasostomy.

Microscopic techniques

I shall first describe the microsurgical technique we used in our series of over 650 patients (Figs. 1, 2). I shall then discuss success rates and my views on other factors that influence the return of fertility after vasectomy reversal.

We use ×16 to ×25 magnification to do the anastomosis (Figs. 3, 4). I have the assistant hold the anterior wall of the vas deferens with a jeweler's forceps, and I insert my own jeweler's forceps into the

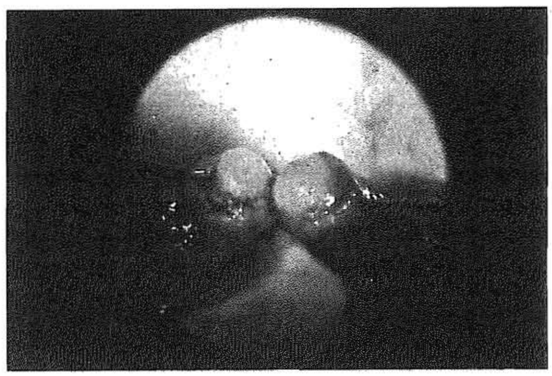


Fig. 3. Under ×16 magnification, the different-sized vas lumens can be appreciated.

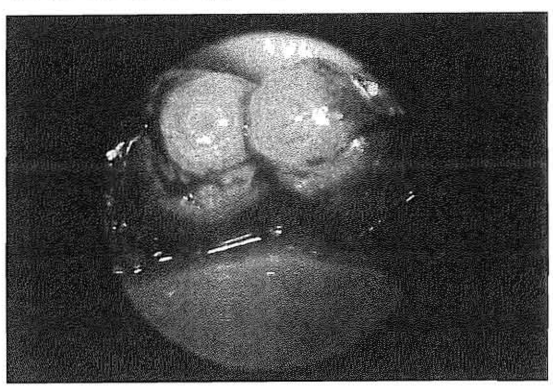


Fig. 4. The inner mucosal anastomosis can be performed very accurately under ×25 magnification.

lumen (0.3 mm) and allow the forceps to open it (Fig. 5). I then place the first mucosal suture anteriorly, including the elastic layer directly under the mucosa (Fig. 6). I pull the suture through and then place it into the mucosa of the lumen of the other side (Fig. 7). I perform an instrument tie and cut the suture (Fig. 8).

It may now be difficult to visualize the lumen unless the assistant again holds the wall of the vas deferens, rotating it toward him (Fig. 9). I again insert my jeweler's forceps into the lumen and place the next anterior suture adjoining the first one. After placing three mucosal sutures anteriorly, I rotate the entire clamp and vas 180° so that the posterior wall of the vas deferens is seen in the anterior position (Figs. 10, 11).

Now we can view the anterior row of sutures from the inside to determine whether we have achieved accurate mucosal alignment. If accurate mucosa-to-mucosa approximation has not been achieved, we perform the anastomosis again. If the sutures are properly spaced, the shrunken lumen of the distal side should match precisely the dilated lumen of the testicular side. The smaller lumen dilates easily to the diameter of the larger. Thus, the sixth or seventh mucosal suture usually closes a very small remaining gap. There should be no tearing or inaccuracy in lining up these margins. When the mucosal layer is completed, we should have a watertight and leakproof connection of the mucosal lining. Only then do I suture the outer muscularis.

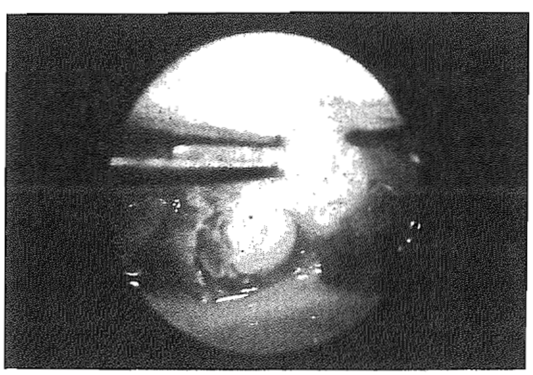


Fig. 5. Jeweler's microforceps is inserted into the lumen and serves as a counterpress for placing the needle and suture.

When some surgeons begin to work with the microscope, they try simply to do a one-layer anastomosis. The major advantage of a two-layer technique is a more accurate mucosal approximation with minimal risk of stricture or leakage. Contrary to a first impression, it is actually *easier* to perform an accurate anastomosis using two layers. If, instead of suturing the mucosal layer separately, the surgeon uses full-thickness stitches that cross the muscularis and mucosa in one large bite, he pulls so much muscle into the anastomosis that the next stitch is very difficult to place accurately and it becomes increasingly difficult to see the mucosal edge of the lumen for subsequent stitches.

In addition, with a through-and-through stitch there is almost always a muscle bridge between the two mucosal edges. This allows sperm to leak and granulomas to form. Finally, it is very difficult to match the shrunken lumen to the dilated lumen with full-thickness stitches. I have found that separate suturing of the mucosal layer permits a precise, leakproof connection.

Suturing the muscularis accurately gives strength and support to the anastomosis and allows normal conduction of peristalsis, which is necessary for the propulsion of sperm from the epididymis into the ejaculate. However, the muscularis closure should not be thought of as mak-

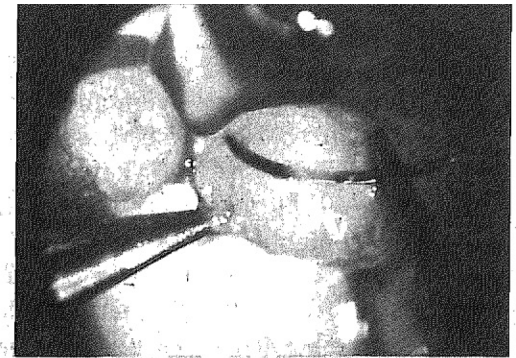


Fig. 6. The first mucosal suture is being placed. (Since this photograph was taken, more delicate microneedles have become available.)

Fig. 7. The needle is then placed inside to outside in the mucosa of the other side. Note that the vasectomy in this case extended to convoluted portion, and this has no deleterious effect on the accuracy of the anastomosis.

Fig. 8. The first 35-μ mucosal suture has been placed, but not yet tied down.

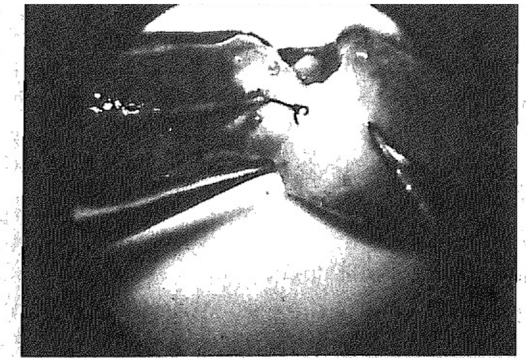


Fig. 9. After the first knot has been tied, the vas is rotated toward the assistant to expose the lumen again.

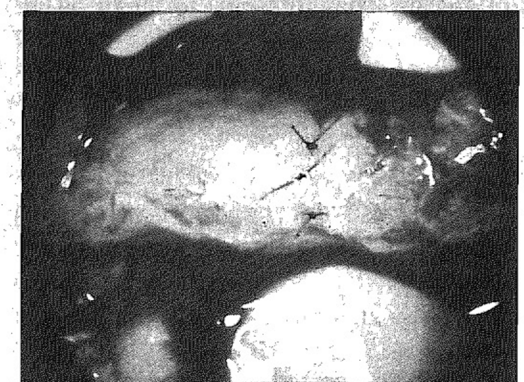


Fig. 10. The first three anterior mucosal sutures have been placed and tied. The vas will now be rotated so that the posterior three mucosal sutures can be placed.

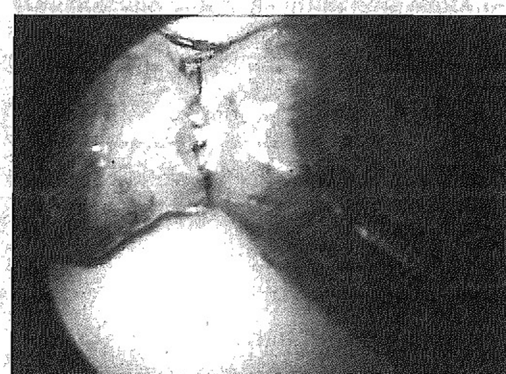


Fig. 11. The first three mucosal sutures from inside after the vas has been rotated.

ing the anastomosis leakproof. This must be accomplished by the mucosal layer. If the muscularis stitches are mistakenly relied upon to make the anastomosis leakproof, then sperm will leak easily into this muscularis and prompt a granulomatous response with stricture formation.

Ironically, the same mechanism that allows sperm granulomas to form after the crudest efforts at vasovasostomy is often responsible for failure to obtain an adequate anastomosis. Neither the length of vas deferens missing nor the site of the vasectomy affects the technical success of the operation or the fertility rate. The major factor that affects fertility is a microscopically accurate, stricture-free anastomosis.

The two-layer microscopic technique

We have now used the two-layer technique on approximately 650 patients and have carefully studied them both preoperatively and postoperatively in an effort to determine the factors that affect recovery of fertility. The overall pregnancy rate at one-and-a-half years of follow-up is 76%. Sperm counts generally do not return to normal until three to eight months after surgery. Very few patients become pregnant before six months have passed and most of the pregnancies have occurred between six months and two years; with longer follow-up, it is possible that the pregnancy rate will increase even more. Pregnancy correlated very well with the quality of the sperm. The sperm count and motility tend to improve continually over the first two years of follow-up.

Reversing conventional vasovasostomy failures

Other accomplished urologists, using conventional techniques, had previously operated on more than 100 of our patients. Their lack of success was evident in the patients' oligospermia or azoospermia and failure to impregnate their spouses. Many of the operations were originally considered successful because sperm were present in the ejaculate. But the wives did not become pregnant, and the patients had poor semen analyses with low numerical counts and poor motility. Many had changed from having some sperm in the ejaculate immediately after the operation to being completely azoospermic. When we reoperated upon these men, we noted severe obstruction at the site of the former anastomosis. Of the patients with oligospermia and poor motility, almost all recovered normal sperm counts with normal motility and morphology after reoperation using microscopic technique. Of the patients in this group who were azoospermic, almost 90% had normal sperm counts after reoperation. We found these cases interesting because they involved the convoluted portion of the vas or the epididymis.

Those patients who did not develop normal semen analyses after microscopic reanastomosis almost always had very poor, if any, sperm in the vas fluid on the testicular side of the obstruction. However, we could expect patients who had reasonable amounts of sperm in the vas fluid to develop normal sperm counts after vasectomy re-reversal. This group of re-reversal patients demonstrates the importance of performing a good microscopic anastomosis.

Correlating sperm count with time since vasectomy

We found that of the patients who had had vasectomies no more than ten years earlier, 91% had normal sperm counts within six months and 94% had some sperm in the ejaculate. Of patients who had had vasectomies more than ten years previously, only 50% had normal sperm counts. All patients who had had vasectomies within two years of the reversal operation had normal sperm counts postoperatively. It is interesting to note, however, that only 2% of patients who had had vasectomies within five years had no sperm in the vas fluid on either side at the time of the vasovasostomy. Of those who had had vasectomies between five and ten years earlier and had had sperm in the vas fluid at the time of surgery, 98% developed normal sperm counts. Only half of the patients who had had vasectomies more than ten years earlier had any sperm in the vas fluid at the time of surgery.

From the statistics cited above, I believe it is clear that patients who have had obstructions for a long time have less chance of restored fertility after reconstruction of the vas deferens. The success rate of vasovasostomies in patients who have had vasectomies recently, no matter how crude the technique, will be higher than in patients who had had vasectomies more than ten years earlier. In our series, nearly every anastomosis was patent because the patients who had no sperm after the operation were those who had no sperm on the testicular side of the obstruction before the operation. A patient who had sperm in the vas fluid before surgery had a 95% chance of eventually achieving a normal sperm count after surgery.

The significance of sperm granulomas

The quality of sperm in the vas fluid was improved in patients who had sperm granulomas at the site of the vasectomy. We noted sperm granulomas at the vasectomy site in 32% of the patients. We could relate no particular symptoms of discomfort with the sperm granulomas. Of these patients, 92% had morphologically normal sperm in the vas fluid; the other 8% had some degenerate forms in addition to morphologically normal sperm. In those patients with sperm granulomas, we found that all vasa had good quality sperm. Of the patients with sperm granulomas, none had poor quality sperm in the vas fluid, even when the vasectomy had been performed more than ten years earlier. No matter when the vasectomy had been performed, we found that patients with sperm granulomas had very high quality of sperm in the vas fluid at the time of surgery.

Of patients with no sperm granulomas, only 7% had morphologically normal sperm in the vas fluid and 22% had morphologically normal sperm and degenerated sperm. In this group, 26% had no sperm in the vas fluid and 45% had only degenerated sperm heads. In vasa with sperm granulomas, the internal diameter of the testicular-side lumen of the vas deferens was almost always 0.75 mm or less. In patients without sperm granulomas, the internal diameter of the testicular-side lumen was usually 1 mm or greater. We concluded, therefore, that patients who had sperm granulomas had less vasal dilation on the testicular side of the obstruction.

Patients with unilateral sperm granulomas had better quality sperm on the side with the sperm granulomas than on the opposite side. The benefit to the sperm output in the vas fluid on the side with a sperm granuloma did not extend to the side without a granuloma. These data again favor our theory that failure to become fertile after an accurate anatomic reconnection of the vas deferens is a result of the high pressure created by vasectomy. This intravasal pressure appears to be lower in patients with sperm granulomas. A sperm granuloma indicates persistent leakage of sperm at the vasectomy site and somewhat alleviates the high intravasal and epididymal pressure after vasectomy.

Summary

We believe the return of fertility after vasovasostomy is influenced by a very careful microscopic technique for reconnection, by the length of time the vas deferens had been obstructed, and by whether there is a sperm granuloma at the vasectomy site. We know how important is an accurate microsurgical technique, because we have reoperated on patients whose first operations had failed to restore fertility. The majority of these patients became fertile after a proper microscopic reanastomosis. After a prolonged period, however, the effects of intravasal pressure created by the vasectomy may preclude fertility even when an accurate vasovasostomy has been done. The epididymis can withstand some increased intravasal pressure. However, a sperm granuloma at the vasectomy site, which relieves this high pressure even more, appears to protect the epididymis between the time of vasectomy and vasectomy reversal. □

REFERENCES
1. Derrick, FC Jr, Yarbrough W, D'Agostino J: Vasovasostomy: results of questionnaire of members of the American Urological Association. J Urol 110:556, 1973 **2.** Silber SJ: Microscopic technique for reversal of vasectomy. Surg Gynecol Obstet 143:630, 1976 **3.** Silber SJ: Perfect anatomical reconstruction of vas deferens with a new microscopic surgical technique. Fertil Steril 28:72, 1977 **4.** Silber SJ: Successful auto-transplantation of an intra-abdominal testicle to the scrotum using microvascular anastomosis. J Urol 115:452, 1976 **5.** Silber SJ: Microscopic vasectomy reversal. Fertil Steril 28:1191, 1977 **6.** Silber SJ: Vasectomy and vasectomy reversal. Fertil Steril 29:125, 1978 **7.** Bedford JM: Adaptations of the male reproductive tract and the fate of spermatozoa following vasectomy in the rabbit, rhesus monkey, hamster, and rat. Biol Reprod 14:118, 1976 **8.** Friend DS, Galle J, Silber SJ: Fine structure of human sperm, vas deferens, epithelium and testicular biopsy specimens at the time of vasectomy reversal. Anatomic Record 184:584, 1976 **9.** Pardanani DS, Patil NG, Pawar HN: Some gross observations of the epididymides following vasectomy: a clinical study. Fertil Steril 27:267, 1976