The Lurking Sperm

A Review of Failures in 8879 Vasectomies Performed by One Physician

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Vasectomy techniques and failure rates vary among surgeons, and the criteria for failure are not often clearly defined. To help establish a yardstick for comparative purposes, a series of 8879 consecutive vasectomies performed with uniform technique over 24 years was reviewed. A subgroup of 5331 men who had returned for at least two postoperative semen tests—the *study* group—was used for follow-up analysis. Failures were defined as *early* or *late* and also were categorized as *overt* or *technical* according to the numbers, motility, or persistence of the remaining spermatozoa. There were 97 failures of all types, including 32 (0.60%) early and overt failures and 61 (1.14%) technical failures that involved the persistence of small numbers of spermatozoa, possibly of no significance. Four (0.08%) late overt failures were also seen; each of these was discovered as a result of a pregnancy, and each occurred at least four years after two azoospermic test results. Of the 97 failures, four were recognized as due to missed vasa deferentia, and the remainder were attributed to recanalization. Whether improved and reproducible failure rates can be consistently obtained by other techniques is not yet clear.

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MOST physicians who perform substantial numbers of vasectomies acknowledge some failures. Failures may be evident almost as soon as postvasectomy semen testing begins, or they may follow azoospermia that had been demonstrated years earlier. They may be associated with normal numbers of motile spermatozoa or, more commonly, with just an occasional nonmotile spermatocyte in an occasional high-power field. In the latter instance, these spermatozoa represent a concentration of about 100×10^6/L (J. E. Davis, MD, written communication, April 16, 1971). Edwards and Farlow[1] as well as Davis have suggested that these nonmotile spermatozoa have no clinical significance.

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Some authors report a clear relationship between technique and failure rate; their recommendations for surgical methods are based on their experience. Schmidt[2] strongly recommended the fulguration–fascial interposition method of vasectomy; he declared that it was responsible for a failure rate of 0 in his hands. Not all physicians follow Schmidt's advice. In 1986, Babayan and Krane[3] reported that of 281 urologists contacted (from the New England Section of the American Urological Association, Manchester, Mass), 116 (41%) use suture alone without cautery, and 137 (49%) do not close the fascia over the ligated stump. Babayan and Krane noted that a wide variety of methods were used; the variables included suture materials, turning back the ends of the vas deferens, excision of a section of vas deferens, the length of such an excision, and the use of clips. The authors concluded that "no statistical correlation could be drawn between those reporting recanalization and the technique each used." Philp and coworkers[4] in the United Kingdom concurred, in a review of 16 000 vasectomies performed by 19 surgeons in their clinic. It is evident that a controversy exists as to which technique of male sterilization is the most effective in reducing failures as well as which is best overall.

METHODS

A series of 8879 consecutive vasectomies performed by me between Nov 1, 1962, and June 30, 1986, was reviewed to determine failure rates and the types of failure encountered. This series is called the *total* group. Failure rates were calculated by counting the number of failures in a subgroup of 5331 men—the *study* group—who had at least two semen tests.

Procedure

Nearly all vasectomies were done as an office procedure (a few were done with the patient under general anesthesia in the hospital) using the same

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technique. With the patient under local anesthesia, a 2- to 3-cm section of vas deferens was removed bilaterally through a central incision, and the free ends were tied off with, in most cases, absorbable suture. Fulguration was not used, nor was any attempt made to separate the ends of the vas deferens in different tissue planes or to cover stumps with fascia.

Semen Testing

Semen testing commenced after three months, after which monthly tests were requested until at least two consecutive negative specimens were obtained. This constituted *proof of success.* Motility of spermatozoa was ignored in each patient's initial specimens, and only the presence or absence of spermatozoa was recorded; however, motility became important later, when an attempt was made to distinguish between *overt* and *technical* failures. Table 1 lists the categories of semen analysis results that were used.

Classification of Failures

Vasectomy failures were divided into two general categories, early and late, and both of these categories were subdivided into overt or technical failures. Essentially, *early* means within an arbitrary period of 12 months following vasectomy, and *late* is defined as failure at any time following proof of success:

Early Failures.—*Early* failures were those in which *significant numbers* of spermatozoa or any motile spermatozoa persisted continuously later than four months after vasectomy *or* those in which *any* spermatozoa remained in the ejaculate one year after vasectomy. In this study, levels of immotile spermatozoa in excess of one per high-power field (1/HPF [$>100 \times 10^6$/L]) were arbitrarily regarded as significant, and as representative of failure if they persisted. Motile spermatozoa in *any* numbers were similarly regarded. All of the former early failures were, by definition, overt; the latter were either overt or technical depending on the number of spermatozoa and motility. In all cases, sequential postvasectomy semen analyses were performed, and it was confirmed that patients were sexually active.

Late Failures.—*Late* failures were those in which spermatozoa in any numbers or condition appeared after proof of success of the vasectomy. These late failures, which are sometimes called *spontaneous recanalizations*, were either overt or technical.

Overt Failures.—*Overt* failures involved the continuous presence of significant numbers of spermatozoa or any active spermatozoa in the ejaculate of sexually active patients later than four months after vasectomy. Most patients with overt failures presented with motile spermatozoa at levels of 5/HPF to 20/HPF or with normal levels of spermatozoa (>20/HPF).

Table 1.—Categories Used for Postvasectomy Semen Analysis*

No spermatozoa seen (a "negative" test)
1 spermatocyte only in 50 high-power fields *or* an occasional spermatocyte in an occasional field ($<100 \times 10^6$/L)
1-5 spermatozoa per high-power field†
5-20 spermatozoa per high-power field
>20 spermatozoa per high-power field *or* too many to count ("normal" numbers)
Unfit to test because of decomposition or contamination

*Fifty high-power fields (magnification ×430) were examined; motility was noted when present.

†Spermatozoa concentrations of this magnitude or greater were considered significant even if they were nonmotile.

Technical Failures.—*Technical* failures were those in which *nonsignificant* numbers of spermatozoa were present one year after vasectomy or later. In this study, levels of nonmotile spermatozoa lower than 1/HPF ($<100 \times 10^6$/L) were considered nonsignificant.

In clinical terms, men whose ejaculate contained any motile spermatozoa were arbitrarily regarded as potentially fertile at the time of the test. When ejaculates contained nonmotile spermatozoa in excess of 1/HPF, potential fertility was also arbitrarily assumed, because it was unclear when these spermatozoa had most recently been viable. Similarly, it was unclear when concentrations of nonmotile spermatozoa lower than 1/HPF had been viable, but in 1971 it was decided to cease repeating vasectomies that had been classified as technical failures because of the persistence of such cells and to offer these men a cautious assurance of success.

RESULTS

Of a total of 97 failures, 36 were overt, with significant numbers of spermatozoa or any motile spermatozoa in semen tests, and 61 were technical (Table 2).

Early Overt Failures

Thirty-two men (0.60%) fell into the early overt failure group, with significant numbers of spermatozoa or any motile spermatozoa persisting in postvasectomy semen tests. (Importantly, three of these individuals had *negative* initial semen test results.) In four of the 32, one vas deferens could not be located at surgery. Of these four unlocated vasa deferentia, one was not found because of surgical inexperience, while the other three had been involved in surgery or had been affected by infection, making identification difficult. Aside from these four, I believed that a section of every vas deferens present had been excised at the time of surgery, but, because histologic confirmation was not obtained, it is possible that more failures were due to missed vasa deferentia.

Late Overt Failures

There were four late overt failures (spontaneous recanalizations) in the study group. These followed "successful" vasectomies by an average of 5.5 years (minimum, 4.5 years; maximum, 8.6 years). All of these failures were discovered because of an associated pregnancy. At the time failure was discovered, two individuals had motile spermatozoa in excess of 20/HPF in their ejaculate, and a third man had motile spermatozoa of 1/HPF to 5/HPF. The fourth patient had had a laboratory examination performed that showed a spermatozoa count of 12×10^9/L, with 50% motility. These four men decided to obtain an additional semen analysis because of the circumstance of an unexpected pregnancy.

Technical Failures

Very small numbers of nonmotile spermatozoa seen one year after vasectomy or later represented technical failure. Sixty-one patients (1.14%) were placed in this category. The significance of these numbers of spermatozoa is discussed later.

Early Technical Failures.—Fifty-nine of the 61 technical failures were in the early subgroup. Each of these failures followed directly after surgery, and each of these patients continued to show small numbers of nonmotile spermatozoa one year after vasectomy or later. Because I was uncertain about the significance of these numbers of spermatozoa, I was at first reluctant to regard these operations as successful, but after 1971, these individuals were given a cautious assurance of success. These 59 patients with technical failures had their vasectomies from one to 22 years before June 30, 1986 (mean, 14.5 years), and, at this writing, none had reported pregnancies related to failure of vasectomy.

Late Technical Failures.—The two men with late technical failures were fortuitously discovered to have a few nonmotile spermatozoa long past their first year after surgery. One individual discontinued semen tests after just one negative examination; he only returned three years later when his wife became pregnant. At that time his semen was found to be azoospermic, but another specimen, taken three months later, revealed occasional nonmotile spermato-

Table 2.—Types and Incidence of Vasectomy Failures

Failure Type/ Group*	No. of Patients	% of Study Group (n = 5331)
Early/overt	32	0.60
Early/technical	59	1.11
Late/overt (spontaneous recanalization)	4	0.075
Late/technical	2	0.038
Total	**97**	**1.82**

*Men who had at least two semen analyses after vasectomy.

zoa. While it was not possible to confirm that the patient was responsible for this pregnancy, this was, by definition, an instance of late technical failure. The other late technical failure was discovered as a result of semen tests done before a proposed vas deferens reanastomosis. In this case, occasional nonmotile spermatozoa were found some nine years after proof of success (Table 2).

Anomalies

Congenital abnormality of the vas deferens was found in 14 instances. One individual's vasa deferentia were unilaterally duplicated, while 12 men had unilateral congenital absence of the vas deferens; this was proved in ten of these 12 by subsequent azoospermia (the remaining two men did not return semen tests). One remarkable individual, tested before his proposed surgery because he was not known to have become a father, was found to possess neither spermatozoa nor palpable vasa deferentia. This was the only instance seen of congenital bilateral absence of vasa deferentia.

COMMENT

Recently reported failure rates range from 0 (Schmidt[2]) to 1.57% (of 826 procedures, performed by surgeon "P" of Philp and colleagues'[4] group). Schmidt claimed over 4600 consecutive cases without known failure.[2] Philp et al, using various techniques, reported 81 failures among 16 796 vasectomies (0.48%) that can be classified as overt—75 early and six late failures. The authors concluded that "the [early recanalization] rate was not influenced by the operative technique used, but varied markedly between individual surgeons."

Schmidt's[2] failure rate of 0 is remarkable inasmuch as the literature, to my knowledge, reveals that no others have been able to reproduce this rate of success without the excision of long sections (4 to 7 cm) of vas deferens. Denniston,[5] "using the Schmidt technique" in 2500 cases, reported a failure rate of 0.24%, but his criteria for failure or success are not clearly defined.

Failures result either because one or more vasa deferentia are left uncut at surgery or because the continuity of the vas deferens was in some way restored following its interruption. An uncut vas deferens should result in an early and overt failure, but a recanalization may occur at any time and may be of any degree of patency or duration. (It is therefore considered important to continue testing in marginal cases for a prolonged period before an outcome can be reasonably determined.) Mistaking some other structure for the vas deferens is also a possible cause of failure, as is accessory vasa deferentia.

Spontaneous recanalization of the vas deferens appeared to account for all but four failures in the study group and is reported to occur through spermatic granulomas at the vasectomy site. Esho and colleagues[6] excised tissues at these sites and injected them with radioopaque material to demonstrate this phenomenon.

Technical failures occurred nearly twice as often as overt ones. These failures, defined by small numbers of nonmotile spermatozoa persisting in the ejaculate a year after surgery or later, are easier to recognize than explain. It is possible that microfistulae span the gap between the ends of the vas deferens on at least one side, allowing the passage of small numbers of impaired spermatocytes. Such patients can be given a cautious assurance of success, however, because, at this writing, not one of the 59 men with technical failures in this series had confirmed an associated pregnancy during an average of nearly 15 years after vasectomy. Periodic—perhaps annual—semen tests can also be suggested; this may offer some additional comfort.

The 12 instances found of congenital unilateral absence of the vas deferens represented 0.135% of the total group. Deane and May[7] reported on the association of absent vas deferens with other genitourinary anomalies, such as renal agenesis, and strongly recommended follow-up studies in such instances.

The four men with late overt failure were self-selecting—they returned only because their partners were pregnant. This self-selection tends to exaggerate the failure rate, because the 3548 men who had fewer than two semen analyses after surgery presumably had no associated pregnancies and might have had a lower failure rate. In any case, the incidence of late overt failure or spontaneous recanalization (0.075%) is now mentioned to all vasectomy candidates. I also mention that if this risk is of particular concern, periodic semianalysis after a successful vasectomy may reduce the chance of an unplanned pregnancy.

That two negative and consecutive semen tests are desirable is confirmed by the three instances of early overt failure *in which the initial semen specimen was negative*. All subsequent tests of these individuals showed significant numbers of spermatozoa or the presence of motile spermatozoa. Marshall and Lyon[8] reported similar instances of intermittent reappearance of motile spermatozoa, although all of their cases resolved spontaneously.

If the 61 technical failures are excluded because they are unlikely to be associated with fertility, the combined early and late overt failure rate among the 5531 men in the study group is 0.68%. This is higher than the 0.48% average rate reported by Philp and colleagues[4] for 19 surgeons. However, the study group I used for comparisons excluded all men who failed to produce at least two semen samples; it is unclear whether Philp and associates used similar standards, so the results of the two studies may not be directly comparable.

Whether other surgical techniques can produce improved failure rates consistently and in a reproducible manner remains to be determined. In any case, failure is just one of several complications of vasectomy, and further studies are needed to determine the relationships among technique, the failure rate, and other sequelae, such as hemorrhage and sperm granuloma.

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