

EFFECTIVENESS AND COMPLICATIONS ASSOCIATED WITH 2 VASECTOMY OCCLUSION TECHNIQUES

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ABSTRACT

Purpose: We compared the effectiveness and complications associated with 2 common vasectomy occlusion techniques, namely clipping and excision of a small vas segment and thermal cautery with fascial interposition and an open testicular end.

Materials and Methods: We retrospectively reviewed the computerized records of 3,761 men who underwent initial vasectomy at a single university hospital family planning clinic and at 2 private clinics in the Quebec City, Canada area, including concurrent and historical controls. All procedures were performed by 1 surgeon, who used the scalpel-free technique to expose the vas.

Results: The risk of vas occlusion failure in men with at least 1 semen analysis was much greater in the clipping and excision group than in the cautery, interposition and open testicular end group (126 of 1,453 or 8.7% versus 3 of 1,165 or 0.3%, OR 37, 95% CI 12 to 116). Medical consultations for hematoma or infection were more frequent in the cautery group (28 of 1,721 cases or 1.6% versus 10 of 2,040 or 0.5%, OR 3.4, 95% CI 1.6 to 6.9). Consultations for noninfectious pain were similar for the 2 techniques (71 of 1,721 cases or 4.1% versus 72 of 2,040 or 3.5%, OR 1.2, 95% CI 0.8 to 1.6).

Conclusions: Cautery and interposition with an open testicular end are much more effective than clipping and excision. The effectiveness and morbidity associated with the components of the cautery, interposition and open testicular end technique need further evaluation.

KEY WORDS: testis; vasectomy; sterilization, sexual; infertility, male

Vasectomy is performed in 2 distinct steps, namely exposing the vas deferens out of the scrotum and occluding the vas. To expose the vas the scalpel-free technique is being increasingly adopted by physicians who perform vasectomy.¹ Controlled trials have shown that the scalpel-free technique is the safest method of exposing the vas.^{2,3}

To occlude the vas various methods are available. Ligation and excision of a small vas segment is believed to be the most common method used world wide.⁴ This technique may also still be significantly performed in United States.¹ Although it is the simplest method, it is considered the least effective.⁵ To increase occlusion effectiveness cautery of the vas lumen and/or fascial interposition have been recommended.^{5,6} However, the best evidence of the superiority of these combined techniques over vas ligation and excision is currently based on a few retrospective case series with historical controls.^{7–11} Most of these studies did not mention the objective criteria used to assess occlusion failure based on the number of semen analyses, sperm number and motility, and the period between vasectomy and testing. Leaving the testicular end of the vas unclosed (open-ended vasectomy) has also been suggested to decrease post-vasectomy orchiepididymitis and painful granuloma.^{10,12} We compared the effectiveness and complication risk of 2 commonly used vasectomy occlusion techniques in a large cohort of men with vasectomy using combined concurrent and historical controls.

MATERIALS AND METHODS

The computerized records of all 3,768 men who underwent initial vasectomy at 1 university hospital family planning clinic and 2 private clinics in the Quebec City, Canada area were reviewed. All vasectomies were performed by a single physician using the scalpel-free technique to expose the vas deferens out of the scrotum. Of these men 7 (0.2%) were excluded from analysis because technical difficulty made it impossible to expose the vas. The study was approved by the hospital ethics review board.

The technique of ligation with tantalum clips using 1 on each stump of each vas, resulting in a closed testicular end, and excision of an approximately 1 cm. segment of vas between the clips (clipping and excision) was performed in 2,040 men between July 1996 and October 1999 at the private clinics. This technique is similar to the standard ligation method except suture material was replaced by metal clips, which are more convenient and rapid to apply.

Thermal cautery of 1 cm. of the lumen of the abdominal end and fascial interposition over the abdominal end with the testicular end left open¹⁰ was done in 1,086 men between July 1996 and November 2000 at the family planning clinic and in 635 between October 1999 and November 2000 at the private clinics. Between July 1996 and February 1997 a vas segment of approximately 1 cm. was cut in 151 patients. Otherwise no segment was excised using the cautery, interposition and open testicular end technique.

At vasectomy all patients were provided with a semen sampling container and instructed to provide the hospital laboratory with a sample within 1 hour of collection 2 to 3 months after vasectomy. However, because no reminders were mailed, the timing of semen analyses varied according to patient compliance. A single analysis of centrifuged semen

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TABLE 1. *Vas occlusion effectiveness according to the occlusion technique*

Outcome	Clipping	Cautery
No. pts.	2,040	1,721
No. no semen analysis (%)	587 (29)	556 (32)
No. at least 1 semen analysis (%):	1,453 (71)	1,165 (68)
Confirmed success	1,207 (83.1)	1,115 (95.7)
Probable success	113 (7.8)	41 (3.5)
Indeterminate*	7 (0.5)	6 (0.5)
Possible failure	23 (1.6)	2 (0.2)
Confirmed failure	103 (7.1)	1 (0.1)

All failures chi-square test $p < 0.00001$.

* No further test after $1 \times 10^9/l$. or greater motile sperm less than 91 days after vasectomy in 3 patients in clipping group and last test with $1 \times 10^9/l$. or greater nonmotile sperm and no further test in 4 in clipping and 6 in cautery group.

showing azoospermia confirmed procedure success. If any sperm were found, semen analyses were requested at 6-week intervals until the success or failure of vas occlusion. Success or failure was established according to certain criteria, including confirmed success—a last test showing azoospermia, probable success—a last test with less than $1 \times 10^9/l$. nonmotile sperm, possible failure—a last test showing any motile sperm or the last 2 tests with $1 \times 10^9/l$. or greater nonmotile sperm with the last test done more than 91 days after vasectomy and not classified as a confirmed failure, and confirmed failure—3 tests showing any motile sperm or 2 tests with $1 \times 10^9/l$. or greater sperm with any motility and the last test done more than 91 days after vasectomy or the last test done more than 182 days after vasectomy showing $1 \times 10^9/l$. or greater sperm with any motility and indeterminate—not otherwise classified. Failure criteria were established before data analysis based on the criteria used in clinical practice at the study sites.

All patients presenting due to a medical problem after vasectomy were recorded in the computerized database. Complications were based on the diagnosis of the attending physician and were classified as surgical (hematoma with or without infection and infection, defined as any antibiotics prescribed), noninfectious pain (painful granuloma, vasitis/orchepididymitis and pain with no specific diagnosis) and other (hemospermia, sexual dysfunction, pain localized at the wound or isolated scrotal ecchymosis).

The source medical records of all confirmed/possible failures, select successes and all reported complications were verified. Data obtained up to February 2001, that is 4 months after the last procedure, were included in analysis. The chi-square test was used to compare categorical data. The OR with the 95% CI was calculated by logistic regression. All analyses were performed with commercially available statistical software.

RESULTS

Sociodemographic characteristics and compliance were similar in the 2 groups. Median time to the first semen analysis was longer in the clipping and excision group than in the cautery, interposition and open testicular end group (112 versus 105 days). In men with at least 1 semen analysis available the risk of confirmed or possible failure was higher in the clipping than in the cautery group (8.7% versus 0.3%, OR 37, 95% CI 12 to 116, $p < 0.0001$, table 1). Restricting analysis to those with confirmed status yielded similar results (7.6% versus 0.1%, OR 93, 95% CI 13 to 669, $p < 0.0001$). Results were comparable after adjusting estimates by logistic regression for patient age and the interval between vasectomy and the first semen analysis. There was no confirmed or possible failure of the cautery and interposition technique after 1998.

Table 2 shows that at the first semen analysis the distribution of men according to the presence of sperm differed in the clipping and cautery groups ($p < 0.0001$). The proportion of men with motile sperm was higher in the former than in

the latter group (12.8% versus 0.3%). With respect to nonmotile sperm the proportion of patients with only nonmotile sperm at the first test was also higher in the clipping group (22.8% versus 17.0%). In that group 9 of the 301 men (3%) with fewer than $1 \times 10^9/l$. nonmotile sperm and 7 of 30 (23.3%) with $1 \times 10^9/l$. or more nonmotile sperm had a final status of possible or confirmed failure according to study criteria compared with 0 of 178 and 1 of 20 (5%) in the cautery group, respectively.

Medical consultations for surgical complications, including hematoma and infection (any prescription of antibiotics) were more common in the cautery than in the clipping group (1.6% versus 0.5%, OR 3.4, 95% CI 1.6 to 6.9, $p = 0.0005$, table 3). Most hematomas were small and none was aspirated or surgically drained. The risk of noninfectious complications (pain) after vasectomy, including painful granuloma at the surgical site, noninfectious vasitis/orchepididymitis and pain with no specific diagnosis, was similar for cautery and clipping (4.1% and 3.5%, respectively, OR 1.2, 95% CI 0.8 to 1.6, $p = 0.34$). Results were similar after adjusting for patient age and followup.

DISCUSSION

Our study shows that thermal cautery combined with fascial interposition on the abdominal end is much more occlusive than ligation with clips and excision of a small vas segment. To our knowledge we report the first study combining concurrent and historical controls to compare 2 vasectomy occlusion techniques. Although data analysis was retrospective, each patient record was prospectively and meticulously entered in a computerized data bank and objective criteria for effectiveness and complications were established before data analysis.

The low risk of occlusion failure after cautery and interposition with an open testicular end was comparable to that previously reported in large case series using the same¹⁰ or a similar⁹ technique. On the other hand, the risk of clipping and excision was surprisingly higher than that usually reported for ligation and excision of a small vas segment (1% to

TABLE 2. *Results of the first post-vasectomy semen analysis according to the occlusion technique*

Semen Analysis Results	Clipping	Cautery
No. pts.	1,453	1,165
No. azoospermia (%)	936 (64.4)	963 (82.7)
No. only nonmotile sperm (%):*	331 (22.8)	198 (17)
Rare	301	178
Numerous	30	20
No. motile + nonmotile sperm (%):*	186 (12.8)	4 (0.3)
Rare	39	0
Numerous	109	1
Very numerous	38	3

First semen analysis results divided in 3 ordinal categories and occlusion techniques chi-square test $p < 0.0001$.

* Rare—less than 1×10^9 , numerous 1×10^9 or greater to 19×10^9 and very numerous 20×10^9 or greater sperm per l.

TABLE 3. *Post-vasectomy complications according to the occlusion technique*

Post-Vasectomy Complications	Clipping	Cautery
No. pts.	2,040	1,721
No. surgical (%):	10 (0.5)	28 (1.6)*
Hematoma	5	19
Hematoma + infection	0	7
Infection	5	2
No. noninfectious pain (%):†	72 (3.5)	71 (4.1)‡
Vasitis/orchiepididymitis	43	47
Painful granuloma	20	14
Pain with no diagnosis	11	12
No. other (%)	2 (0.1)	5 (0.3)

* Chi-square test $p = 0.0005$.

† Few patients had more than 1 complication of this type and each patient was counted only once regardless of the number of occurrences.

‡ Chi-square test $p = 0.34$.

5%).⁵ In fact, the risk of occlusion failure with this technique may be higher than previously believed. In 2 recent prospective followup studies of suture ligation the risk of persistent sperm suggestive of occlusion failure was 8% to 13%.^{13,14}

Furthermore, based on the results of the initial semen analysis failure to occlude adequately the vas by ligation and excision of a small vas segment could be as high as 19%. It was suggested that the presence of motile sperm after 3 weeks most probably indicates spontaneous recanalization.^{15,16} Of the patients 13% had motile sperm at the first semen analysis a median of 16 weeks after vasectomy. In addition, the proportion of men with nonmotile sperm at the initial test was 6% higher in the clipping and excision group than in the cautery, interposition and open testicular end group. This proportion would have been similar in the 2 groups if nonmotile sperm represent residual sperm from the distal vas deferens, as is commonly believed.^{17,18} The most probable explanation for the discrepancy in the groups is that in the clipping group about a fourth of the men with nonmotile sperm at the first semen analysis experienced early micro recanalization, which eventually closed in most of them.¹⁹ The higher proportion of patients in the clipping and excision group with nonmotile sperm at the first semen analysis with a final status of possible or confirmed failure supports this explanation. To our knowledge we report the first study suggesting that the significance of nonmotile sperm after vasectomy may vary according to the occlusion technique performed.

The cautery and interposition technique with an open testicular end is technically more difficult to perform and master than clipping and excision. It can explain the higher risk of surgical complications of the former method. However, the number needed to harm (88) is rather large and most hematomas, which were the most common surgical complication in that group, were small and did not require drainage. Thus, the clinical significance of this finding must be balanced against the much higher effectiveness of the cautery, interposition and open testicular end technique.

The value of leaving the testicular end open remains uncertain. In 2 comparative studies with historical controls there was a decrease in noninfectious epididymitis and painful granuloma after open-ended vasectomy.^{10,12} As in an earlier series in the same setting and population,²⁰ in the current study the frequency of reported noninfectious post-vasectomy pain was not decreased by open-ended vasectomy. The risk of post-vasectomy complications was probably underestimated in this study because we relied only on patient initiated consultations. However, this bias should have affected each group of this homogeneous population equally. Further studies with systematic followup in men with vasectomy are needed to assess the benefit of open-ended vasectomy, if any.

CONCLUSIONS

Thermal cautery combined with fascial interposition on the abdominal end is preferable to ligation and excision of a small segment for occluding the vas deferens. The relative contribution of each component of the cautery, interposition and open testicular end method to effectiveness and morbidity needs further evaluation.

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EDITORIAL COMMENT

These authors from Quebec reviewed the results of 3,761 vasectomies performed using an open or closed ended approach. The open-ended approach allowed sperm to leak out of the testicular cut end of the vas and prevented recanalization by fascial interposition and/or cautery of the abdominal cut end of the vas. The classic closed ended approach used clips and excision of the intervening segment of vas to avoid spontaneous recanalization and avoided vasectomy failure by preventing sperm leakage from the sealed testicular end of the cut vas. The logic of the open-ended approach is that sperm leakage from the testicular end of the cut vas would allow a small sperm granuloma to form and, as a pressure release mechanism, prevent secondary epididymal blowouts and inspissation. Thus, open-ended vasectomy could theoretically make vasectomy reversal by vasovasostomy more successful and even prevent the occasional congestive epididymal tenderness seen after vasectomy.

This approach of open-ended vasectomy was first recommended in 1977 by Silber^{1,2} and in 1979 by Shapiro and Silber.³ Silber showed conclusively that in the presence of sperm granuloma at the vasectomy site normal motile sperm were always found at vasovasostomy and there was no increased epididymal pressure, dilatation, blowouts or inspissation. Therefore, there was no secondary epididymal obstruction. In the absence of sperm granuloma at the vasectomy site secondary epididymal blockage was found in 84% of vasovasostomy cases, thus, requiring vasoepididymostomy. Furthermore, Shapiro and Silber reported that there was less pain with open-ended vasectomy and rare failures as long as fascial interposition or 1.5 cm. cautery of the abdominal cut end was done. In almost 100% of such patients who later requested vasovasostomy the procedure were successful without the need for more complex vasoepididymostomy.

The original studies of Silber in the 1970s of this sperm granuloma phenomenon as well as the original studies recommending an operating microscope and microsurgical technique for vasectomy reversal were originally greeted by many academic urologists with execration. Subsequent studies showed that the presence of sperm granuloma at the vasectomy site did not increase the incidence of anti-sperm antibodies and in any event anti-sperm antibodies had no correlation with pregnancy after vasectomy reversal or any autoimmune disease. Nevertheless, it was considered immoral to perform open-ended vasectomy.^{4,5}

At first the recommendation of Silber that microsurgery increased the success of vasectomy reversal was dismissed as unnecessary and at most loupes were used. After it was apparent that the vasovasostomy technique of Silber provided superior results academic urologists who endorsed it (Vasovasostomy Study Group) never credited his articles in their subsequent reports.⁵⁻⁹

Several infertility leaders in the urological community did their best to exclude Silber from AUA and American Fertility Society courses. They viewed his microsurgical technique and the recommendation to perform vasoepididymostomy (specific tubule) when

secondary epididymal blockage was present to be a major threat to their status quo. Nevertheless, his work gained solid acceptance throughout the community of reproductive scientists.

Now that the original studies of Silber on microsurgery for vasectomy reversal and specific tubule vasoepididymostomy has been validated, it is ironic that his original articles are still not often referenced.^{10,11} For example, in a recent series Fuchs and Burt reported high success rates with microsurgical vasectomy reversal as long as microsurgical vasoepididymostomy was performed when secondary epididymal obstruction was detected.¹² However, there were no references to any of the original studies of Silber of "epididymal extravasation following vasectomy as a cause for failure of vasectomy reversal"¹¹ or "microscopic vasoepididymostomy: specific microanastomosis to the epididymal tubule."¹⁰ Even the original observation in 1989 that the pregnancy rate after vasoepididymostomy was related to the age of the wife¹³ was never credited properly.

Now it is remarkable that the current review from Canada validating the benefits of open-ended vasectomy fails to make any reference to any of the classic series of Silber or of Shapiro and Silber of open-ended vasectomy, or of sperm granuloma and the reversibility of vasectomy.¹⁻³ Nevertheless, after 23 years of avoidance it is finally time for urologists to address with their patients who request vasectomy the benefit of leaving the testicular cut end of the vas unoccluded and protecting against unwanted recanalization by fascial interposition or by 1.5 cm. cautery of the abdominal cut end of the vas. With such an approach reversibility is simpler and easier if the patient should later desire the restoration of fertility.

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