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Association between the length of the vas deferens excised during vasectomy and the risk of postvasectomy recanalization

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Objective: To evaluate the association between the length of the vas deferens excised during vasectomy and the risk of recanalization.

Design: Nested case-control study.

Setting: Hospital-based Family Planning Clinic in Quebec City (Canada).

Patient(s): Among 870 vasectomized men, all 47 cases of spontaneous recanalization and 188 controls whose first semen analysis showed either azoospermia (controls A) or $<1 \times 10^6$/mL nonmotile sperm (controls B).

Main Outcome Measure(s): Spontaneous recanalization defined as a semen analysis showing any motile sperm 6 weeks or more after vasectomy.

Result(s): Individual vas segments excised ranged from 5 to 20 mm in 227 (97%) of the 235 participants. The mean ± SD of the average of both segments for each man was 12 ± 4 mm, identical in cases and in controls. In cases and controls A, the risk ratio (95% confidence interval [CI]) of recanalization with an average of segments of <10 mm and 10–14 mm was 0.6 (0.1–2.0) and 0.6 (0.2–1.6) when compared to 15 mm or more, respectively. In cases vs. controls B, the risk ratio of recanalization was 1.6 (0.4–7.7) and 0.6 (0.2–1.7), respectively.

Conclusion(s): In this cohort, there was no association between the length of vas segment excised and the risk of recanalization. (Fertil Steril® 2003;79:1003–7. ©2003 by American Society for Reproductive Medicine.)

Key Words: Male sterilization, vasectomy, vas occlusion, methods, recanalization

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A vas deferens segment is commonly removed during vasectomy to prevent failure. Recanalization is extremely rare with the excision of a segment of 40 mm or more (1–3). However, most surgeons remove a much shorter segment. The optimal length of a shorter segment to be excised has never been clearly established. We found only one study that specifically addressed this issue (4). Comparing the mean length of vas segments removed by each of six surgeons, Kaplan and Huether (4) observed that those excising a shorter section of vas had higher failure rates and that a difference of as little as 2 mm could play a role in the success of the surgery. They suggested a critical value of 15 mm, under which the failure rate rapidly increases.

Vasectomy failure must be distinguished from postvasectomy recanalization. Late recanalization usually detected by an unexpected pregnancy and the reappearance of sperm in the semen after a man had become azoospermic is definitely a failure of vasectomy. However, the situation is not as clear when early recanalization is suspected by the presence of motile sperm at the time of the first sperm count after vasectomy.

According to earlier studies (5–7), if motile sperm are present 3 weeks after vasectomy, a defect in the block or recanalization is almost certain. However, early recanalization does not necessarily imply that the vasectomy has failed. According to a survey of British urologists, the time interval between vasectomy and decision to repeat the intervention if semen analysis shows motile spermatozoa, varies between 2 and 24 months, with an average time interval of 6.8 months (8). Although we found

no study specifically evaluating the extent of this phenomenon, it is believed that most recanalizations eventually close or scar down (9). Nevertheless, early recanalization is a significant source of burden and anxiety for the patient.

The objective of this nested case-control study was to evaluate the association between the length of a short vas deferens segment excised and the risk of recanalization in a cohort of vasectomized men.

MATERIALS AND METHODS

In June 2001, we extracted from a computerized data bank and medical records information on 1,124 men who had a first bilateral vasectomy at the Family Planning Clinic of the Centre Hospitalier Universitaire de Québec (CHUQ), Pavillon CHUL, between January 1989 and December 1993. During this period, vas deferens occlusion was done by ligation with two tantalum clips (Hemoclip; Weck Closure Systems, Research Triangle Park, NC) followed by excision of the vas segment between the clips. A vas stump of ~2–4 mm was left beyond each clip. Starting January 1994, the occlusion technique was substantially modified. For this reason, patients vasectomized after this date were not included. One physician performed all surgeries. A first postvasectomy semen analysis was recommended 8–12 weeks after the procedure. Because the study was considered as a medical audit and no patients were contacted, data access was approved by the hospital medical director and study protocol was not submitted to the Institutional Review Board.

Among the 870 (77.4%) men who had at least one postvasectomy semen analysis recorded in the database, we selected as cases all those who had a recanalization (n = 50, 5.7%) defined as at least one semen analysis showing any number of motile sperm 6 weeks or more after vasectomy, independently of the other semen analysis results. Cases were excluded if we could not confirm the semen analysis result or find the pathology report describing the length of both vas segments removed in the hospital medical record (n = 3).

The final postvasectomy vas occlusion status of the 47 cases was determined based on the available semen analyses. Early failure was defined as the persistence of motile sperm beyond 6 months or, before 6 months, by an increasing number of motile sperm in serial semen samples (n = 13). Late failure was defined by the reappearance of motile sperm (and a pregnancy) after sterility had been established (n = 3). Transient early recanalization was assumed when azoospermia was observed in a semen analysis subsequent to the one leading to case identification (n = 30). One case was classified as indeterminate because only one semen analysis with $<1 \times 10^6$/mL motile sperm was available.

We then identified controls among those who had a confirmed success (n = 803, 92.3%) defined as either the first semen analysis with azoospermia, the first or second semen analysis with $<1 \times 10^6$/mL nonmotile sperm followed by one semen analysis with azoospermia, or the first three semen analyses with $<1 \times 10^6$/mL nonmotile sperm. Recanalization or success according to study definition was indeterminate in 17 (2.0%) patients including three whose first semen analysis performed before 6 weeks after vasectomy showed motile sperm. All three had azoospermia in a subsequent analysis.

Four controls per case were randomly selected—two were chosen among those who had a first semen analysis with azoospermia (controls A) and two among those whose first test showed $<1 \times 10^6$/mL nonmotile sperm (controls B). Controls and cases were matched for the same or nearest possible date of vasectomy to account for the potential confounding effect of the surgeon's experience. Matching was achieved on the same date, between 1 and 5 weeks, and between 6 and 19 weeks in 62%, 28%, and 10% of the controls, respectively. Six of the initially selected potential controls were excluded and replaced because we could not confirm information from the computerized database in the medical records. All cases and controls were selected without knowing the length of the vas segments excised.

The risk ratio of recanalization according to the length of the vas segment excised and its 95% confidence limits was estimated for cases vs. controls A and for cases vs. controls B, using conditional logistic regression taking into account matching (PHREG procedure in SAS for windows, version 8.0; Cary, NC). The length of the segment excised was divided in three categories corresponding to 5-mm intervals (<10, 10–14, and 15+ mm), with the last category chosen as the reference category based on Kaplan and Huether study (4). Two dummy variables were used to take this grouping into account in the regression. Risk ratio >1 indicates higher risk of recanalization. Because it was not possible to identify on which side the recanalization took place in the cases, analyses were performed using the average length of both vas segments excised, the shortest segment excised for each man, and the longest segment excised for each man.

RESULTS

The characteristics of the 47 cases, the 94 controls A, and the 94 controls B were comparable with the exception of the time between the vasectomy and first semen analysis (Table 1). Individual vas segments excised ranged from 2 to 22 mm in cases, 3 to 35 mm in controls A, and 2 to 20 in controls B; they ranged from 5 to 20 mm in 227 (97%) of the 235 men. Correlation between both segments of vas from the same man was high (0.88) and was comparable for cases (0.84), controls A (0.88), and controls B (0.90). The length of vas segments excised was similar in cases and controls (Table 2 and Fig. 1). Among cases, the mean of the average length of both vas segments excised was similar, whichever final vas occlusion status achieved—early and late failure (12 ± 5 mm) or transient recanalization (11 ± 4 mm).

TABLE 1

Characteristics of the study population.

Characteristics	Cases (n = 47)	Controls A[a] (n = 94)	Controls B[b] (n = 94)
Age (y)	35.9 ± 6.3	35.5 ± 5.7	36.7 ± 6.0
Marital status			
Single	13%	19%	11%
Married	72%	68%	69%
Divorced/Separated	13%	13%	19%
Widow	2%	0%	1%
Age of spouse (y)	32.4 ± 5.6	32.8 ± 4.4	33.5 ± 4.3
Number of children	2.3 ± 0.9	2.3 ± 0.9	2.2 ± 0.8
Age of the last born (y)	5.1 ± 6.0	3.5 ± 4.9	4.6 ± 6.1
Contraception method used			
Pill	26%	32%	19%
Barrier	43%	47%	53%
IUD	4%	1%	5%
None	26%	20%	21%
Unknown	2%	0%	1%
Time from vasectomy to 1st semen analysis (days)	95 ± 35	121 ± 58	110 ± 44

Note: Values are either means ± SD or proportion (%).

[a] Controls with azoospermia at the first semen analysis.

[b] Controls with $<1 \times 10^6$/mL nonmotile sperm at the first semen analysis.

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There was no significant association between the risk of recanalization and the average length of both vas segments excised (Table 3). Adjusting for age of the patient and delay between vasectomy and first semen analysis did not modify the association. The lack of significant difference remained after repeating the regression analyses using the shortest and the longest vas segment excised for each man (Table 3).

DISCUSSION

In this cohort of vasectomized men in whom 5- to 20-mm vas segments were routinely removed during vasectomy, the risk of recanalization was not significantly associated with shorter segments excised. These results are based on the analysis of a homogeneous cohort attended by a single physician, avoiding biases related to variations in clinical experience and technical skills of physicians. In the Kaplan and Huether study (4), the source of variation in failure rates most likely rests on other technical differences between physicians than the difference in the small length of vas segment excised.

The ligation/excision procedure performed in Kaplan and Huether's study was comparable to ours with the exception that we replaced suturing material by metal clips, which are more convenient and faster to apply. This slight difference between the two techniques may partially explain variation in the recanalization/failure risk between the studies. In our study, the recanalization risk was 5.7% and the failure risk (early and late) was 1.8%, whereas the overall undefined "unsuccessful operation" risk in Kaplan and Huether's study was 1.2%.

Although we studied a large cohort with a high risk of recanalization and we maximized power by including all cases and selecting two matched controls per case in each control group, some of the confidence intervals around the estimates of the risk of recanalization are wide. Thus, a clinically significant higher (but also lower) risk with shorter segments excised cannot be totally excluded.

Furthermore, one cannot rule out the possibility of a significant difference if the observed range of length of vas segments were larger. As suggested in previous studies, removal of a vas segment of 40 mm or more would prevent failure (1–3), and excision of 70 mm would almost guarantee prevention of recanalization by formation of a sperm granuloma (10). However, excising a segment of this length necessitates a more extensive surgical procedure than the one commonly recommended, increases the risk of surgical complications, and may preclude success of a vasovasostomy (11).

The length of the excised vas segment as measured by the histopathologist is a good estimate of the tissue gap created by excising a vas segment. There is a good correlation between the length of vas excised and both the immediate ($r = 0.65$, $P<.001$) and final ($r = 0.69$, $P<.001$) separations of the segments measured by radiography (10). In addition, the vas average shrinkage by fixation in formalin is minimal (3.4%) (4).

Previous studies have suggested that the presence of motile sperm after 3 weeks most probably indicated that a spontaneous recanalization had occurred (5–7). In our study, to completely avoid misclassification due to including as cases men with residual motile sperm, we have chosen as cases only men who had motile sperm 6 weeks after vasectomy.

TABLE 2

Length of vas segments excised in each man in cases and controls.

Length of vas segments	Cases (n = 47)	Controls A[a] (n = 94)	Controls B[b] (n = 94)
Average of both segments (mm)	12 ± 4	12 ± 4	12 ± 4
Average of both segments			
<10 mm	40%	35%	30%
10–14 mm	21%	33%	33%
15+ mm	38%	32%	37%
Shortest individual segments (mm)	11 ± 5	11 ± 4	11 ± 4
Longest individual segments (mm)	12 ± 5	13 ± 5	13 ± 4

Note: Values are either means ± SD or proportion (%).

[a] Controls with azoospermia at the first semen analysis.

[b] Controls with $<1 \times 10^6$/mL nonmotile sperm at the first semen analysis.

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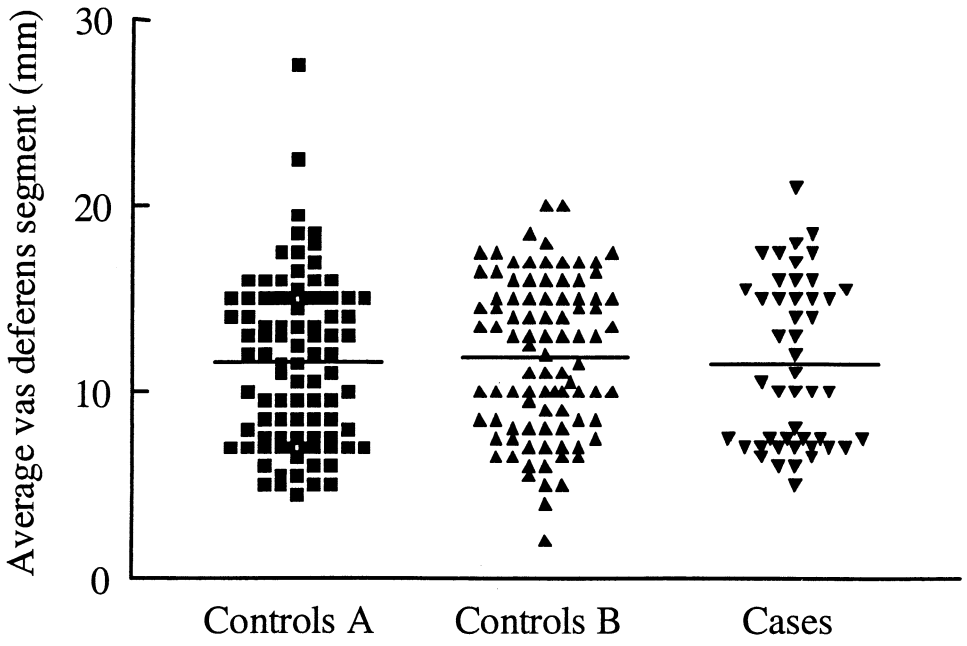
FIGURE 1

Distribution of the average length of both vas segments excised in cases and controls. *Horizontal lines* indicate the mean of the distribution.



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Although the majority of our cases with early recanalization finally had a semen analysis showing azoospermia, about one-third had persistence or increased number of motile sperm confirming vasectomy failure. Thus, the risk of failure among men with early recanalization is high and its occurrence should be minimized. Other occlusion methods,

TABLE 3

Risk ratio of postvasectomy recanalization according to the length of vas deferens segments excised.

Length of vas segments excised in each man	Risk ratio[a] (95% CI) of recanalization			
	Cases vs. controls A		Cases vs. controls B	
	Unadjusted	Adjusted[b]	Unadjusted	Adjusted[b]
Average of both segments				
<10 mm	0.6 (0.1–2.9)	0.5 (0.1–3.3)	1.6 (0.4–7.7)	1.6 (0.3–8.5)
10–14 mm	0.6 (0.2–1.6)	0.4 (0.1–1.3)	0.6 (0.2–1.7)	0.6 (0.2–1.8)
15+ mm[c]	1	1	1	1
Shortest individual segment				
<10 mm	1.0 (0.2–5.6)	0.7 (0.1–4.8)	2.8 (0.5–14.9)	3.1 (0.5–18.0)
10–14 mm	0.7 (0.2–2.0)	0.5 (0.2–1.6)	0.7 (0.2–2.2)	0.7 (0.2–2.3)
15+ mm[c]	1	1	1	1
Longest individual segment				
<10 mm	2.0 (0.3–11.5)	1.6 (0.2–10.3)	3.4 (0.7–15.7)	3.8 (0.8–19.2)
10–14 mm	0.8 (0.2–2.6)	0.5 (0.1–1.9)	1.3 (0.4–4.2)	1.4 (0.4–4.9)
15+ mm[c]	1	1	1	1

[a] Estimated with conditional logistic regression.
[b] Adjusted for age of the patient and delay between vasectomy and first semen analysis.
[c] Reference category.

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such as intraluminal vas cautery combined with separation of the vas stumps with fascial interposition, even without any excision of a vas segment, appears to be more effective than ligation and excision (12–15). However, strong evidence on the most effective vasectomy occlusion method is still lacking (16, 17) and ligation is still a very popular vas occlusion technique. It is believed to be the most common technique used worldwide (18). In 1995, about 27% of physicians performing vasectomy in the United States were using ligation with clips or suture material only, although about half of those physicians may also have been using fascial interposition (19).

This study represents one of the first that evaluates the effectiveness of excising small vas segments during vasectomy. Within the range of 5–20 mm, longer segments excised do not reduce the risk of recanalization when ligation by clips is used. Further research is needed to examine the possible role of other components of the ligation technique such as the degree of force applied on the clips or suture material, the length of the remaining stumps distal to the ligation, and the presence or quantity of fascia included in the ligation.

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