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Original Article

Preoperative Factors Influencing Postoperative Results after Vasovasostomy

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Purpose: The purpose of this study is to evaluate the preoperative factors that influenced postoperative sperm concentration after vasovasostomy.

Materials and Methods: We retrospectively reviewed 97 consecutive single-layer vasovasostomy procedures performed by a single surgeon between March 2003 and September 2010. The patients were stratified into three groups based on sperm concentration at 1 month follow-up: group I-azoospermia, group II-oligospermia, and group III-normal. We evaluated the preoperative factors that may have influenced sperm concentration at postoperative 1 month. Patients with serial semen analysis were divided into four groups according to the change in postoperative sperm concentration at the 6-month visit: group II-N-from oligospermia to normal, group II-O-from oligospermia to oligospermia, group III-O-from normal to oligospermia, group III-N-from normal to normal. We compared the pregnancy rate among the four groups.

Results: The mean obstructive interval was 9.69 years in group I, 6.02 years in group II, and 7.82 years in group III. There were significant differences found among the groups ($p=0.035$). There was significantly different change in sperm concentration, sperm motility, and sperm morphology between each of the groups. A total of 32 patients underwent serial semen analyses at 1 month, 3 months, and 6 months after vasovasostomy. There was no significant difference in patient age, obstructive interval, or follicle-stimulating hormone among the groups. The natural pregnancy rate in group II-O was lower than that in group II-N, and in group III-O was lower than that in group III-N. However, there was no significant difference among each of the groups.

Conclusions: The sperm concentration after vasovasostomy was significantly related to the obstructive interval between vasectomy and reversal.

Key Words: Vasovasostomy, Sperm count, Factor

INTRODUCTION

As many as 50 million men worldwide have relied on vasectomy for family planning.[1] It is estimated that between 2% and 6% of these men who undergo vasectomy will ultimately seek vasectomy reversal.[2] The number of

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vasectomy reversals is continually increasing, most likely because of the popularity and ease of vasectomy as a means of sterilization and the trend towards rising rates of divorce and remarriage.[3]

Modern microsurgical techniques, as popularized by Silber,[4] remain the standard with which all other methods of vasectomy reversal are compared. Patency is over 80% in most microsurgical series, with patency approaching 100% in some reports.[5-10] However, prediction of the patency of vasovasostomy is based on preoperative and intraoperative factors as well as semen analysis. The purpose of this study was to evaluate the change in sperm concentration and the preoperative factors that may have influenced postoperative sperm concentration after vasovasostomy.

MATERIALS AND METHODS

1. Patients

We retrospectively reviewed 97 consecutive vasovasostomy procedures performed by a single surgeon between March 2003 and September 2010. All of the operations were performed using a single-layer microsurgical technique with 6 full thickness 8-0 Nylon sutures. The criteria for inclusion in the study were a minimum of 1 month and 6 months of follow-up with semen analysis (performed according to World Health Organization [WHO] methods).[11] Patients were excluded if they did not provide a semen analysis.

2. Groups

The patients were divided into 3 groups: group I-postoperative sperm concentration (azoospermia) at 1 month follow-up, group II-postoperative sperm concentration or total sperm number (oligospermia) at 1 month follow-up, group III-postoperative sperm concentration or total sperm number (normal) at 1 month follow-up. A total of 32 patients underwent serial semen analysis at 1 month, 3 months, and 6 months after vasovasostomy.

The sperm count was defined as follows (WHO, 2010):

- Azoospermia: 0 spermatozoa/ml
- Oligospermia: $<15\times10^6$ spermatozoa/ml or $<39\times10^6$ spermatozoa/ejaculate
- Normal: $\geq15\times10^6$ spermatozoa/ml or $\geq39\times10^6$ spermatozoa/ejaculate

The 32 patients with serial semen analyses were divided into 4 groups according to differences in the change in postoperative sperm concentration at the 6-month visit. Group II and group III were stratified into four groups (group II-N, group II-O, group III-O, and group III-N) by sperm concentration at the 6-month follow up. Group II-N patients changed from oligospermia at 1 month follow up to a normal sperm concentration; in group II-O, the patients had persistent oligospermia; in group III-O, the sperm count changed from a normal sperm concentration to oligospermia at 6 months' follow up; and in group III-N, the sperm concentration did not change from a normal sperm count to normal at 6 months' follow up, respectively. We evaluated the preoperative factors which were correlated with the change in sperm concentration. The preoperative factors were patient age, obstructive interval, hormonal values (follicle-stimulating hormone [FSH], luteinizing hormone, testosterone), and testis volume. Also, we compared the pregnancy rates among the groups.

3. Statistics

Statistical analyses were performed with chi-squared tests and ANOVA. p values <0.05 were considered statistically significant for all analyses. All statistical calculations were performed using SPSS program version 15.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

The clinical characteristics of the patients were stratified into three groups, each based upon the sperm concentration at 1 month follow up with semen analysis after vasovasostomy (Table 1). Mean obstructive interval was 9.69 years in group I, 6.02 years in group II, and 7.82 years in group III. There were significant differences among the groups ($p=0.035$). A total of 32 patients underwent serial semen analyses at 1 month, 3 months, and 6 months after vasovasostomy.

The three groups were stratified by postoperative serial semen analysis (Table 2). The sperm concentration changed to azoospermia in 4 (16.7%), oligospermia in 13 (54.2%), and normal in 7 (29.2%) in group II and azoospermia in 0 (0%), oligospermia in 6 (46.2%), and normal in 7 (53.8%)

Table 1. Patient's clinical characteristics

	Group I (n=13)	Group II (n=49)	Group III (n=35)	p value
Mean age (yr)	41.15±8.15	38.71±5.20	40.69±5.46	0.199
No. of patients with follow-up†	6	24	13	-
Obstructive interval (yr)	9.69±5.17	6.02±4.45	7.82±5.22	0.035*
FSH (mIU/ml)	7.1 2±10.03	4.55±2.38	4.44±1.49	0.117
LH (mIU/ml)	4.59±3.13	4.69±1.80	4.45±1.83	0.871
Testosterone (ng/ml)	5.84±3.50	5.09±1.90	4.91±1.73	0.422
Testis volume (ml)	11.92±2.23	11.72±1.93	11.72±1.93	0.114

Values are mean±standard deviation. Group I: sperm concentration (0 spermatozoa/ml) at 1 month follow up, Group II: sperm concentration ($<15\times10^6$ spermatozoa/ml) or total sperm number ($<39\times10^6$ spermatozoa/ejaculate) at 1 month follow up, Group III: sperm concentration ($\geq15\times10^6$ spermatozoa/ml) or total sperm number ($\geq39\times10^6$ spermatozoa/ejaculate) at 1 month follow up.
FSH: follicle-stimulating hormone, LH: luteinizing hormone.
One-way ANOVA was used. Significant at $p<0.05$ (*$p<0.05$). †3 months and 6 months of follow-up with semen analysis.

Table 2. Sperm count in 3 groups at 6 months of follow-up after vasovasostomy

	Group I* (n=6/13)	Group II* (n=24/49)	Group III* (n=13/35)
Azoospermia†	5	4	0
Oligospermia‡	1	13	6
Normal§	0	7	7

Pearson's chi-squared test was used. There was a significant difference among each group (p=0.001).
*Patients at 6 months of follow-up with semen analysis, †Sperm concentration (0 spermatozoa/ml), ‡sperm concentration ($<15\times10^6$ spermatozoa/ml) or total sperm number ($<39\times10^6$ spermatozoa/ejaculate), §sperm concentration ($\geq15\times10^6$ spermatozoa/ml) or total sperm number ($\geq39\times10^6$ spermatozoa/ejaculate).

Table 3. Preoperative factors influencing the change in sperm concentration on serial analysis

	Group II-N (n=8)	Group II-O (n=13)	Group III-O (n=6)	Group III-N (n=5)	p value
Mean age (yr)	37.44±5.65	41.92±3.81	41.83±5.81	42.40±5.22	0.157
Obstructive interval (yr)	5.67±4.82	6.92±5.76	9.17±5.07	7.80±3.19	0.619
FSH (mIU/ml)	3.28±0.88	5.95±3.79	3.90±1.34	3.67±0.25	0.139
LH (mIU/ml)	3.68±2.14	5.94±1.85	3.73±0.82	3.73±0.82	0.061
Testosterone (ng/ml)	5.25±1.99	4.44±1.65	3.75±1.30	5.28±2.23	0.376
Testis volume (ml)	13.67±2.42	11.25±1.76	13.33±2.85	11.80±2.04	0.097

Values are mean±standard deviation. Group II-N: Oligospermia (at 1 month follow up) → normal (at 6 months' follow up), Group II-O: Oligospermia (at 1 month follow up) → oligospermia (at 6 months' follow up), Group III-O: normal (at 1 month follow up) → oligospermia (at 6 months' follow up), Group III-N: normal (at 1 month follow up) → normal (at 6 months' follow up).
One-way ANOVA was used. Significant at $p<0.05$.

at 6 months' follow up in group III, respectively. There were significant differences among the groups (p=0.001). Also, sperm motility and sperm morphology were changed significantly among the groups at serial follow up (Fig. 1).

There was no significant difference in patient age or FSH among the groups (Table 3). The natural pregnancy rate in group II-O (22.2%) was lower than in group II-N (37.5%), and in group III-O (33.3%) was lower than in group III-N (50.0%). However, these differences were not significant.

DISCUSSION

After microsurgical vasovasostomy, sperm return to the

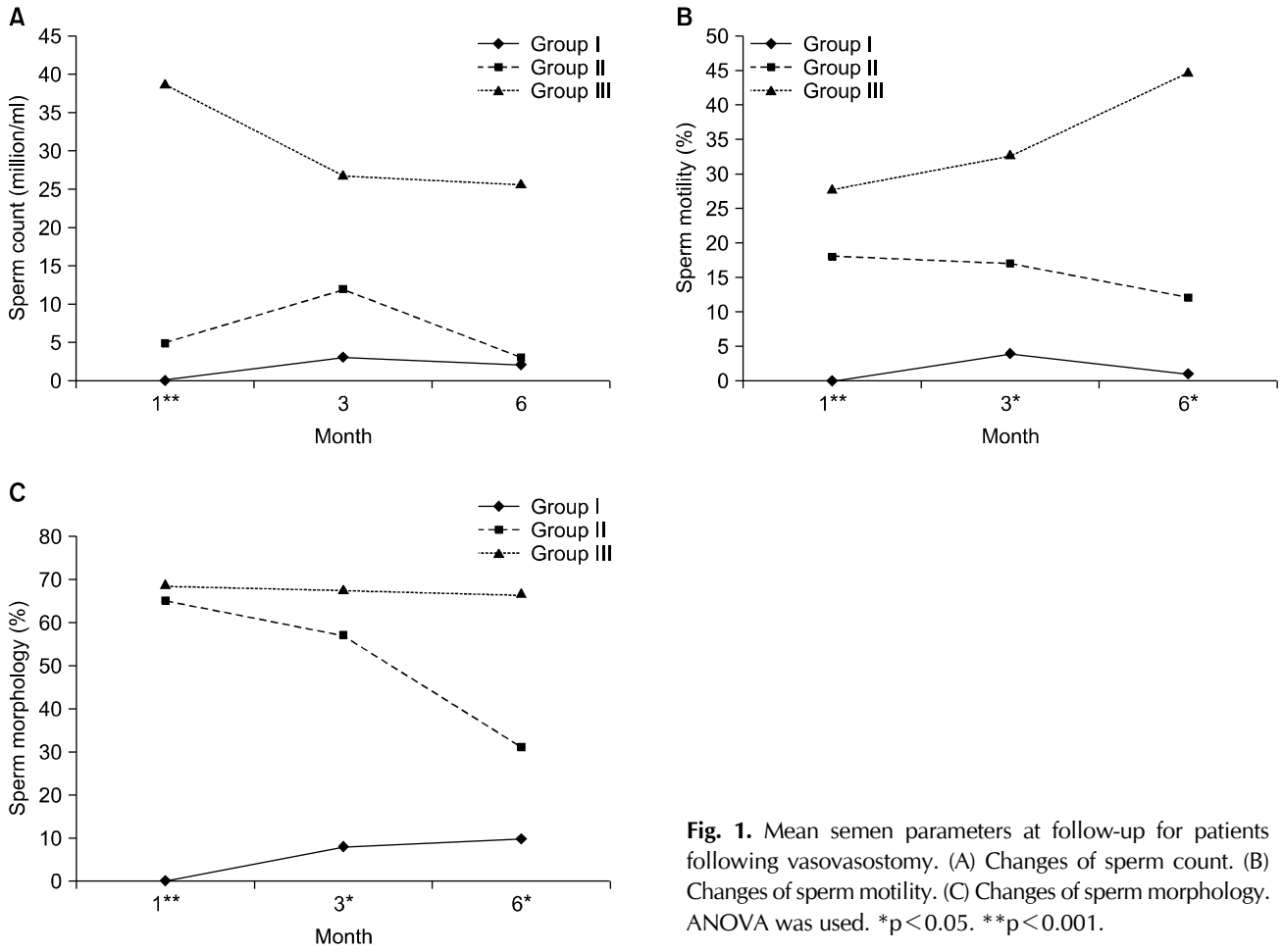

Fig. 1. Mean semen parameters at follow-up for patients following vasovasostomy. (A) Changes of sperm count. (B) Changes of sperm motility. (C) Changes of sperm morphology. ANOVA was used. *$p<0.05$. **$p<0.001$.

semen in 85% to 90% of men, and 50% to 70% of their partners achieve pregnancy.[12] The prognosis for success after microsurgical vasectomy reversal declines progressively as the interval between vasectomy and its reversal increases. A large study conducted by the Vasovasostomy Study Group observed that both patency rates (return of sperm to the semen) and pregnancy rates after vasovasostomy decrease as the time since vasectomy increases.[6] Others have found no relationship between patency rates and the interval between vasectomy and reversal, but have observed significantly lower pregnancy rates when reversal was performed 15 years or more after vasectomy.[2] The inverse relationship between success rates and the interval of obstruction may reflect progressive testicular damage.[13]

The age of the female partner has important prognostic value,[14] and success rates are higher in men having proven fertility with the same female partner than in men having a different partner.[15,16] Success rates after bilateral vasovasostomy also relate directly to the quality of sperm observed in the vasal fluid at the time of vasectomy reversal.[6]

In our study, the overall postoperative vas patency rates of our patient collective were 86.4% at 1 month follow up and 86.1% at 6 months' follow up. The mean obstructive interval was 9.69 years in group I (azoospermia at 1 month follow up), 6.02 years in group II (oligospermia at 1 month follow up), and 7.82 years in group III (normal at 1 month follow up). The obstructive interval in the patency cases (group II, III) was distinctively lower than in the non-patency case (group I). In particular, we applied new semen analysis methods instead of the previous WHO methods.[11] In other words, the definition of the normal sperm count in the previous study was $\geq 20\times10^6$ spermatozoa/ml or 40×10^6 spermatozoa/ejaculate, but the normal sperm count was $\geq 15\times10^6$ spermatozoa/ml or $\geq 40\times10^6$ spermatozoa/ejaculate in our study.

After either vasovasostomy or vasoepididymostomy, semen analyses should be obtained approximately every 2 to 3 months until the sperm concentration and motility return to normal or until a pregnancy occurs. Once the sperm concentration and motility normalize, subsequent semen analyses may be obtained at approximately 4-month intervals until pregnancy occurs.

In our study, postoperative semen analyses were performed at 1 month, 3 months, and 6 months after vasovasostomy and the azoospermia rates were 13.4% at 1 month follow up and 13.9% at 6 months' follow up. The sperm motility and sperm morphology were changed significantly between the groups at serial follow ups. In our opinion, this result occurred by obstruction of the anastomotic site of the vasovasosotomy. Careful monitoring of the semen quality after surgery ensures that those who may again become obstructed due to scar formation at the anastomotic site are identified promptly; the incidence of postoperative re-obstruction ranges between 3% and 12% after vasovasostomy and is approximately 21% after vasoepididymostomy.[17,18] When sperm do not return to the semen by 6 months after vasovasostomy, the procedure has failed.[19]

In previous studies, the vasovasostomy patency rate and perioperative factors that influenced patency were the main concerns. In our study, a change in sperm concentration on postoperative serial semen analyses and preoperative factors that influenced the change in the sperm count were the main concerns. Particularly, oligospermia at 1 month follow up changed to a normal sperm count (group II-N, n=8) or remained with persistent oligospermia (group II-O, n=13) at 6 months' follow up, and a normal sperm count at 1 month follow up was changed to oligospermia (group III-O, n=6) or remained at persistent normal (group III-N, n=5). There was no significant difference in the patient age or FSH between the groups. The natural pregnancy rate in group II-O was lower than in group II-N, and in group III-O was lower than in group III-N. However, these differences did not reach statistical significance.

When we evaluated a change in serial sperm concentration, the reason we excluded the groups with azoospermia at 1 month or 6 months' follow up was that the anastomotic site of these groups was obstructed or may have become obstructed.

The limitation of our study was that there was a relatively low number of patients with serial postoperative semen analyses.

CONCLUSIONS

The sperm concentration after vasovasostomy was significantly influenced by the obstructive interval between vasectomy and reversal. In our study, patient age and FSH did not influence the change in postoperative sperm concentration. The natural pregnancy rates were lower in the oligospermia groups than the normal groups at serial follow up. Although this finding did not reach statistical significance, it may be helpful to keep in mind when clinicians counsel patients who have oligospermia at 1 month follow up about postoperative outcomes.

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