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RESEARCH ARTICLE

Application of seminal vesiculoscopy on the treatment of seminal vesiculitis

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Abstract

***Objective*:** The development of seminal vesicle technology has greatly improved the efficiency of diagnosis and treatment of seminal vesiculitis, but its long-term efficacy and postoperative complications still need to be evaluated further.

***Patients and methods*:** Ninety-eight patients with seminal vesiculitis were randomly assigned to a traditional medical treatment control group ($n = 49$) and a seminal vesiculoscopy group ($n = 49$). The clinical efficacy of the two groups of patients, including blood sperm and pain, was evaluated 1 month after surgery. The maximum urine flow rate (MFR) and the average urine flow rate (AFR) were measured.

***Results*:** Compared with traditional medicine, seminal vesicle endoscopy has a higher clinical effect on seminal vesiculitis. Seminal vesicle therapy was more effective in reducing blood cells in patient's semen and improving the patient's urinary function. The seminal vesicle volume and seminal fructose were significantly improved.

***Conclusions*:** The efficacy of seminal vesiculoscopy for seminal vesiculitis is better than traditional medicine.

Keywords: *seminal vesiculoscopy*; *seminal vesiculitis*; *hematospermia*; *traditional medicine*

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Seminal vesiculitis (SV) and ejaculatory duct obstruction (EDO) are common clinical urogenital diseases (1). The etiology of SV is very complex (2). A range of benign and malignant diseases such as infection, inflammation, obstruction, tumor, trauma, iatrogenic injury, and some systemic diseases may cause SV (3). Hematospermia is a common clinical manifestation of SV (4). In addition, perineal and lower abdominal discomfort, urethral burning, frequent urination, urgency, dysuria, loss of libido, and sexual dysfunction may also be caused by SV (5). The condition of most SV patients was relieved by anti-infection and symptomatic treatment (6). However, some patients did not respond well to drug treatment, resulting in prolonged SV disease course and refractory blood sperm (7). Therefore, various invasive and non-invasive instruments for further observation and treatment of SV are clinically necessary.

As an emerging endoscopic technique, transurethral seminal vesiculoscopy has been widely used in the treatment and diagnosis of male reproductive system diseases (8). The seminal vesicle can examine the ejaculatory ducts and seminal vesicles under direct vision (9). Seminal vesiculoscopy is emerging as an alternative method for the diagnosis and treatment of seminal vesicles and seminal tract disorders due to the relative simplicity of the procedure and the preservation of the normal anatomy of the seminal vesicles (10). Several studies have shown that eminal vesiculoscopy can achieve good results in the treatment of recurrent hemospermia and concluded that eminal vesiculoscopy is an effective and safe method for the treatment of spermatic disorders (11). However, seminal vesiculoscopy also has its limitations. Certain abnormal anatomical conditions, such as inflammation of the ejaculatory duct region, congenital or acquired cystic lesions, or other factors, may result in narrowing or atresia of the ejaculatory duct opening and failure of the seminal vesiculoscopy procedure (12). In addition, seminal vesiculoscopy may lead to complications such as epididymal or orchitis, urinary tract infection, retrograde ejaculation, and persistent hematuria (13).

Fully evaluating the efficacy and risk factors of SV is of great significance for the clinical treatment of SV and similar diseases. The purpose of this work is to study the clinical effect of seminal vesiculoscopy in the treatment of SV. Our study shows that transurethral seminal vesiculoscopy is effective for SV. Transurethral seminal vesiculoscopy significantly improves the cure rate of SV and can minimize the risk of surgery and reduce the pain of patients.

Methods

Participants

Ninety-eight patients were randomized into the control group and the seminal vesiculoscopy group, with 49 patients each between January 2019 and March 2021. The study was approved by the Cangzhou People's Hospital.

Inclusion criteria include the following: patients should meet the diagnostic criteria for SV; the age range is from 18 to 65 years old; patients willing to sign an informed consent.

Exclusion criteria include patients with prostate disease, chronic prostatitis, chronic pelvic pain syndrome, seminal vesicle tuberculosis, seminal vesicle tumor, and blood system diseases; with a history of minimally invasive surgery on seminal vesicles; and with a urinary tract stricture.

Diagnostic criteria for SV

1) The semen ejaculated during sexual intercourse, nocturnal emission, or masturbation is bloody, which may be accompanied by deep pain in the perineum or pain and discomfort in the perineum, lower abdomen, and rectum; 2) There were obvious pathological changes in the seminal vesicles by digital rectal examination; 3) Laboratory examination of semen in a large number of white blood cells (WBCs) and red blood cells (RBCs); 4) The obvious pathological changes of seminal vesicles were found by B-ultrasound and seminal vesicle angiography; 5) Bacteria or microorganisms can be found in semen culture. Patients with items 1 and 3 and one or more other items can be diagnosed as SV.

Intervention

Control group

The following drug intervention was taken: Levofloxacin tablets (Daiichi Sankyo Pharmaceutical (Beijing) Co., Ltd., H20040091, 0.5 g/tablet) orally, 1 tablet/time, 1 time/day; Ningmitai capsules (Guiyang Xintian Pharmaceutical Co., Ltd., Chinese medicine Zhunzi Z20025442, 0.38 g/capsule) orally, 3 capsules/time, 3 times/day. Patients were asked to continue taking these drugs for 30 days.

Seminal vesicle group

The patient received epidural anesthesia. A 4.5-/6.5-Fr pediatric ureteroscope (Germany) was placed transurethral into the mons sperm and the bladder in the lithotomy position. The patient's ureter and bladder were probed for abnormal bleeding. The speculum is withdrawn to the fin to explore the prostate and other conditions. The irrigation device is used to perform low-pressure flushing under the ureteroscope to confirm the location of the prostatic sac and the opening of the sac. The speculum is inserted from the opening of the ejaculatory duct. A zebra wire was used for the guidance of seminal vesicles. The ureteroscope is inserted into the seminal vesicle through the ejaculatory duct through the opening of the ejaculatory duct. An ureteroscope is used to probe the prostatic sac under the guidance of a guide wire to observe whether there is an abnormal opening of the ejaculatory duct, and then the ureteroscope enters the seminal vesicle through the abnormal opening if the opening of the ejaculatory duct cannot be confirmed. In the case where the opening of the ejaculatory duct has not yet been explored, the syringe is used to withdraw the lateral wall of the patient's prostatic sac to observe the location of the translucent thin wall in the prostatic sac lumen. A guide wire is used to break the wall and enter the seminal vesicle. Seminal vesicle obstruction, inflammatory changes, bleeding spots, and severity were observed after seminal vesicle placement. Damage to the vas deferens should be avoided during lens placement. Di lasers are used to break up stones in patients with combined vas deferens. Levofloxacin injection was used to cleanse the interior of the seminal vesicles until the fluid was clear. Conventional antibiotics were used for 1 week. The patient was forbidden to have sex for 1 month after surgery. Patients were asked to maintain a stable mood, eat a light diet, and exercise moderately.

The patients in both groups underwent reexamination 1 month after the operation and began to ejaculate.

Curative effect

The clinical efficacy of the two groups of patients was evaluated 1 month after surgery, and the specific efficacy criteria were as follows: 1) Recovery: no gross blood semen was seen in 10 consecutive ejaculations, no RBCs and WBCs were found in the semen routine, and the patient had no discomfort. 2) Effectual: 10 consecutive ejaculation occasional blood sperm (<2 times), and the RBCs and WBCs of the semen were significantly reduced, <10 /HP. 3) Effective: 10 consecutive discharges of semen were seen with the naked eye (<5 times), the symptoms were relieved, and the RBCs and WBCs of the semen routine examination were reduced by at least 1 grade compared with those before treatment. 4) Ineffective: gross blood sperm (>5 times)

is common in 10 consecutive ejaculation discharges. The symptoms were not significantly improved compared with those before treatment, and the number of RBCs and WBCs in routine semen examination had not changed significantly compared with that before treatment.

Detection indicator

The following indicators were detected before treatment and 1 month after treatment: the number of RBCs and WBCs was counted under the high magnification microscope of semen. The content of refined fructose was determined by the resorcinol method. The seminal vesicle Magnetic Resonance Imaging (MRI) was detected in the natural state, and the seminal vesicle volume was calculated. The maximum urine flow rate (MFR) and the average urine flow rate (AFR) were measured using a multi-function uroflowmeter.

Statistical analysis

The SPSS 22.0 statistical software was used for analysis. The comparison between preoperative and postoperative was performed by paired *t* test, and *P* values less than 0.05 were considered statistically significant.

Results

Baseline characteristics of the study participants

A total of 98 patients with SV who were admitted to the Department of Urology from January 2019 to March 2021 were selected as the research subjects and were divided into traditional medicine group (control) and the seminal vesiculoscopy group (SV) according to different treatment methods, with 49 subjects in each group. There were no significant differences in baseline data between the two groups of patients, including patient age, disease duration, semen volume, sperm concentration, and related symptoms (Table 1). In addition, operation time, hospitalization time, and the proportion of seminal vesicle cysts and stones complicated by SV found during the operation of seminal vesicle surgery patients were shown in Table 1.

Comparison of clinical efficacy between two groups

As shown in Table 2, in the control group, there were nine cases of recovery (18.4%), 12 cases of effectual (24.5%), 13 cases of effective (26.5%), and 15 cases of ineffective (30.6%). However, in the SV group, 18 cases were recovered (36.7%), 14 cases were effectual (28.6%), 13 cases (26.5%) were effective, and four cases were ineffective (8.2%). The total effective rate of the traditional medicine group was significantly lower than that of the SV group, and the difference was statistically significant ($P < 0.05$).

Table 1. Demographic and clinical characteristics of the study participants

Clinical features	Study group		*P*
	Control (*n* = 49)	SV (*n* = 49)	
Age (years)	38.5 ± 8.9	39.3 ± 9.2	0.382
Duration of seminal vesiculitis (months)	5.7 ± 2.1	6.2 ± 1.9	0.174
Semen volume (mL)	3.14 ± 1.07	3.42 ± 1.14	0.293
Sperm concentration ($\times 10^6$/mL)	29.38 ± 16.28	27.15 ± 18.41	0.148
Chronic hepatitis B	3 (6.1%)	2 (4.1%)	0.999
Hypertension	6 (12.2%)	8 (16.3%)	0.774
Diabetes mellitus	2 (4.1%)	1 (2.1%)	0.999
Complication			
Pain	34 (69.4%)	40 (81.6%)	0.239
Sexual dysfunction	25 (51.1%)	27 (55.1%)	0.839
Scrotum discomfort	14 (28.6%)	11 (22.4%)	0.644
Sterility	4 (8.2%)	6 (12.2%)	0.741
Surgery features			
Operation time (min)	-	43.6 ± 11.5	-
Hospital stays (days)	-	4.2 ± 2.6	-
Seminal vesicle cyst	-	3 (6.1%)	-
Seminal vesicle stone	-	9 (18.4%)	-

Values were expressed as *n* (percentage, %) or mean ± SD. *P* values were derived from Fisher's exact test or Mann–Whitney test.

Table 2. Comparison of clinical effectiveness in the treatment of seminal vesiculitis between the two groups

Clinical effectiveness	Study group		*P*
	Control (*n* = 49)	SV (*n* = 49)	
Recovery	9 (18.4%)	18 (36.7%)	**0.023**
Effectual	12 (24.5%)	14 (28.6%)	
Effective	13 (26.5%)	13 (26.5%)	
Ineffective	15 (30.6%)	4 (8.2%)	

Values were expressed as *n* (percentage, %). *P* value was derived from Chi-square test.

Comparison of the number of WBCs and RBCs in the semen between the two groups before and after treatment

Then, we counted the number of RBCs (Fig. 1a) and WBCs (Fig. 1b) in the semen of the two groups of patients before treatment and 1 month after treatment. Our results indicated that there were no significant differences in WBC and RBC counts in the semen between the two groups before treatment. After 1 month of different treatments, WBC and RBC counts decreased in both groups, but the decrease was more pronounced in the SV group (Fig. 1).

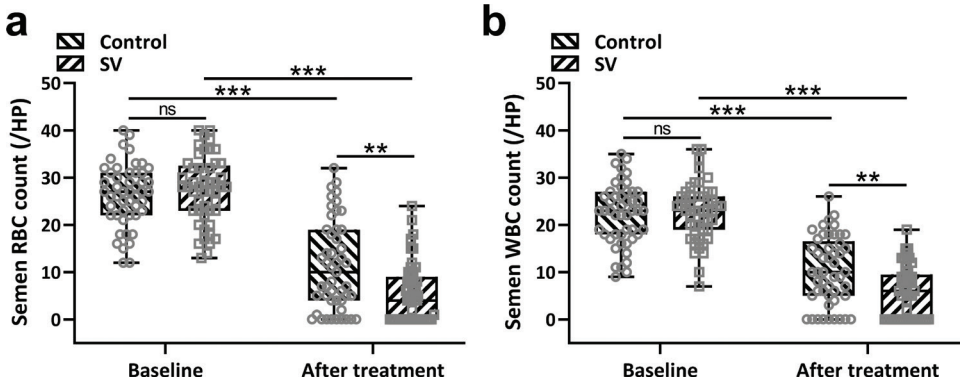

Fig. 1. Comparisons of red blood cell count (a) and white blood cell count (b) in semen between the two groups before and after treatment. $N = 49$ for each group. Data were shown with box plot. $^{**}P < 0.01$, $^{***}P < 0.001$, and ns means no significance. Two-way ANOVA followed Turkey's multiple comparisons test.

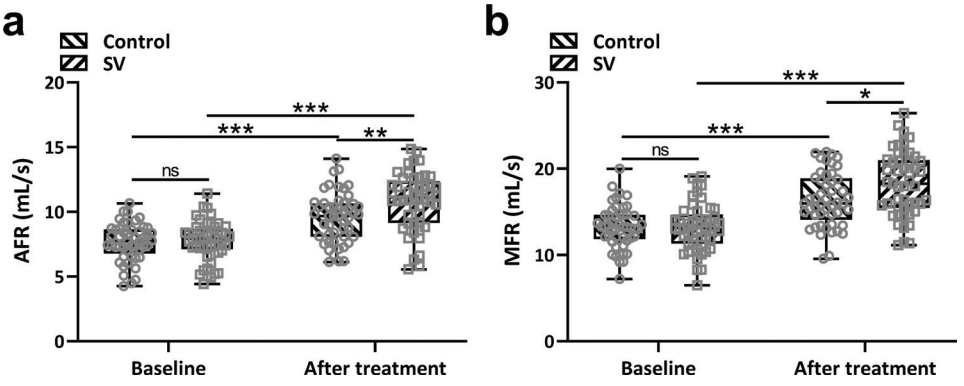

Fig. 2. Comparisons of average flow rate (a) and maximum flow rate (b) between the two groups before and after treatment. $N = 49$ for each group. Data were shown with box plot. $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$, and ns means no significance. Two-way ANOVA followed Turkey's multiple comparisons test.

Comparisons of average flow rate and maximum flow rate between the two groups before and after treatment

Subsequently, we used a multi-function uroflowmeter to measure the average flow rate (AFR, Fig. 2a) and maximum flow rate (MFR, Fig. 2b) of the two groups before treatment and 1 month after treatment. Our results indicated that there was no significant difference in the urinary flow rate between the two groups before treatment. After different treatments, the urinary flow rate increased in both groups after 1 month, but the improvement was more obvious in the SV group (Fig. 2).

Comparisons of semen fructose concentration and seminal vesicle volume between the two groups before and after treatment

Fructose in seminal plasma is produced by enzymatic conversion of blood sugar and secreted by seminal vesicles, which is the energy source for sperm activity. The concentration of semen fructose is usually used as an indirect measure of testosterone activity in clinical practice. Therefore, we examined semen fructose concentration and seminal vesicle volume in both groups. Our results indicated that there was no significant difference in the concentration of semen fructose between the two groups before treatment. After different treatments, the concentration of semen fructose in both groups increased after 1 month; however, the increase was more obvious in the SV group (Fig. 3a). Seminal vesicle hematoma and inflammation caused by SV increase the volume of the seminal vesicles. Our results showed that there was no significant difference in the volume of seminal vesicles between the two groups before treatment. After different treatments, the volume of seminal vesicles decreased in both groups after 1 month, but the reduction was more obvious in the seminal vesicle group (Fig. 3b).

Discussion

Seminal vesicles are paired glands that produce and act as a reservoir for semen (14). About 70% of the fluid in the seminal vesicles ends up as semen, and the fluid secreted

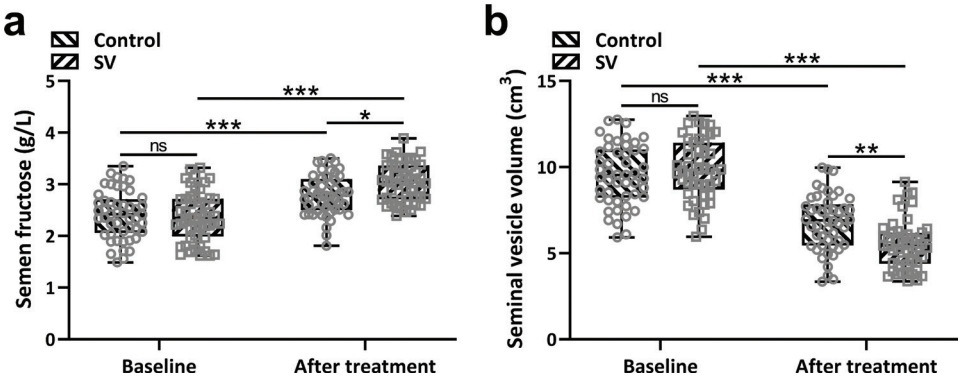

Fig. 3. Comparisons of semen fructose concentration (a) and seminal vesicle volume (b) between the two groups before and after treatment. $N = 49$ for each group. Data were shown with box plot. $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$, and ns means no significance. Two-way ANOVA followed Turkey's multiple comparisons test.

by the seminal vesicles has many components that are important for semen function and sperm survival (15). A range of benign and malignant diseases can affect the function of the seminal vesicles, such as stones, cysts, infections, abscesses, and tumors (16). Physical examination of the seminal vesicles can be difficult, but seminal vesicle lesions can occasionally be palpated during the digital rectal examination (17). Fructose levels in semen analysis can be used to assess seminal vesicle function (18). Hematospermia is one of the most common manifestations of SV. Hemospermia is the presence of blood in the semen. The incidence of hematocrit is unknown because most men do not routinely test semen (19). The age range of patients with hemospermia is usually between 30 and 40 years (20). Certain medications can also be used to treat symptoms of blood sperm (21). For example, finasteride can be used to control hematospermia due to benign prostatic hyperplasia (22). Patients with hemospermia caused by bacterial infection or sexually transmitted diseases should be tested for urinary tract secretions and treated with antibiotics in a timely manner (23). Common pathogens that cause hemospermia include mycoplasma, chlamydia, gonococcus, and herpes simplex. Seminal vesicle puncture, ultrasound-guided drug injection, and other methods can be used to treat hematospermia patients whose symptoms have not subsided after conservative treatment (24).

With the development of minimally invasive technology, more and more patients hope to receive minimally invasive techniques such as endoscopy, laparoscopy, or robotic surgery for disease diagnosis and treatment. Transurethral seminal vesicle microscopy has developed rapidly as a new endoscopic technique (25). Seminal vesiculoscopy has its unique advantages in the treatment of SV, especially for blood sperm caused by minimal lesions (26). There are few postoperative complications after seminal vesicle endoscopy, and the curative effect is remarkable (8). Transurethral seminal vesicle microscopy is emerging as an alternative method for the diagnosis and treatment of seminal vesicle and seminal tract disorders. Several studies have shown that transurethral vesicle microscopy can achieve good results in the treatment of recurrent hemospermia and concluded that transurethral vesicle microscopy is an effective and safe method for the treatment of spermatic diseases (27). In 2002, Yang et al. used seminal vesicle endoscopy for the first time in the examination and treatment of seminal vesicle diseases, and they reported the safety of this method (28). Liao et al. reported that the treatment efficiency of seminal vesicles was 93.0% in a study of 271 patients with refractory hematospermia, and they did not find significant postoperative complications in these patients (29). In another large-scale seminal vesiculoscopy treatment study, the effective rate was 94.4% 3 months after seminal vesiculoscopy in 324 patients. The recurrence rate at 12 months after surgery was 3% (8). Therefore, seminal vesicle microscopy has shown satisfactory results in the diagnosis and treatment of SV.

Seminal vesiculoscopy also has its limitations. For example, poor semen excretion can cause chronic inflammation, and in severe cases, even stones in the ejaculatory duct or prostate area. In this case, it is difficult to insert the endoscope through the natural orifice. The outer layer of the ejaculatory duct is longitudinal smooth muscle, which rapidly thins proximally until it disappears. Therefore, the ejaculatory duct does not have the peristaltic and contractile functions of the sphincter. The presence of a tapered structure between the ejaculatory duct and the prostatic urethra makes it difficult to prevent urinary reflux. Animal studies have shown that the relationship between the seminal vesicle and the ejaculatory duct is similar to that between the bladder and the urethra (30). If the opening of the ejaculatory duct is too large during the operation, it may cause urine reflux; if the opening is too small, it may lead to postoperative stenosis or even occlusion. In addition, inappropriate seminal vesiculoscopy may lead to complications such as epididymal or orchitis, urinary

tract infection, retrograde ejaculation, and persistent hematuria. The urethroseminar technique still has its limitations, and a unified surgical standard should be developed as soon as possible. Further research in this area is needed to understand the anatomical and functional abnormalities of the seminal vesicles and to enhance their surgical efficacy.

In this study, we investigated the clinical efficacy of seminal vesiculoscopy in the treatment of SV. We demonstrate that seminal vesicle therapy is more effective in relieving patients' symptoms than traditional antibiotic drug regimens. Compared with drug therapy, seminal vesicle therapy significantly reduced the number of blood cells in the patient's semen and improved the patient's urinary function. The fructose in seminal plasma is produced by enzymatic conversion of blood sugar and secreted by the seminal vesicles. It is the energy source for sperm activity. The concentration of seminal fructose is usually used as an indirect measure of testosterone activity in clinical practice. We report that seminal vesiculoscopy treatment can more significantly increase the concentration of seminal fructose. Of course, there are some limitations to our study. We assessed seminal vesicle function in patients using only blood cells and fructose in semen. We plan to assess seminal vesicle function in patients with additional physiological indicators and imaging means in our future studies.

Conclusion

In conclusion, we report the clinical efficacy of seminal vesiculoscopy in the treatment of SV in this study. We report that transurethral seminal vesiculoscopy is effective in the treatment of seminal vesicles and significantly improves the cure rate of SV compared with traditional drug therapy. Transurethral seminal vesiculoscopy can reduce the risk of surgery and relieve the pain of patients on the basis of curing the disease. The results of this study are conducive to the rational allocation of medical resources.

Conflict of interest and funding

The authors declare that they have no competing interests. The authors have not received any funding or benefits from industry or elsewhere to conduct this study.

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