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ORIGINAL ARTICLE

Effects of patients' understanding and choice of surgical types on postoperative outcomes of Peyronie's disease: a single-center retrospective study of 108 patients

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Surgical correction can be considered for treating patients with a chronic phase of Peyronie's disease (PD) and persistent penile curvature. In clinical practice, some patients pay too much attention to surgical complications and refuse the recommended feasible surgical types. Meanwhile, they require operations according to their preferences. This study aimed to evaluate the effects of patients' own choice of surgical type on postoperative satisfaction. This retrospective study analyzed data from 108 patients with PD who underwent surgical correction according to doctors' recommendations or patients' own demands. The objective and subjective surgical outcomes were assessed. Patients' understanding of the disease was analyzed using a questionnaire survey. Objective measurements of surgical outcomes, including penile straightening, penile length, and sexual function, in patients who received the recommended surgery, were similar to those in patients who did not accept the recommended surgery. However, subjective evaluations, including erectile pain, discomfort because of nodules on the penis, and decreased sensitivity in the penis, were more obvious in patients who did not follow doctors' recommendations. In addition, a questionnaire survey showed that understanding PD and the purpose of surgery of patients who did not follow doctors' advice were inappropriate, as they did not conform to the principle of treatment. The present study showed that surgical correction seemed to be an objectively effective option in the management of patients in the stable chronic phase of PD. Low patient satisfaction might be related to patients' lack of correct understanding of the disease and its treatment strategy as well as unrealistic expectations.

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INTRODUCTION

Peyronie's disease (PD) is a two-phase pathological condition of the penis characterized by collagen deposition that creates an inelastic fibrous plaque in the tunica albuginea.¹ PD has a significant negative impact on quality of life and psychosocial burden in up to 81% of patients due to its symptoms, including palpable penile plaque, penile pain on erection, deformity and/or penile curvature during erection, and difficulty with coitus.^{1–3} The natural history of PD is usually progressive, and spontaneous regression of PD is rare.⁴

Many treatment approaches and their clinical outcomes have been described in the literature, including several oral, intralesional, mechanical, topical, and surgical therapies.^{5,6} However, medical treatments appear to be moderately efficacious for symptomatic men in the acute phase of PD or for men in the chronic phase of PD who are not ready to consider surgical therapy. If it is very bothersome with penile deformity, surgical correction can be considered, as it remains the gold standard for treating PD in the chronic phase.^{6,7} Surgical approaches can be divided into three main categories: (i) plication procedures,

(ii) incision or partial plaque excision and grafting techniques, and (iii) correction of penile curvature with simultaneous penile prosthesis (PP) implantation. The most frequently reported complications of surgical correction are incomplete straightening, curvature recurrence, penile shortening, and erectile dysfunction (ED) using either plication procedures or grafting techniques.⁸

In our clinical practice, appropriate surgical techniques are recommended to patients according to principles of surgical management of PD. Patients with ED who did not respond to phosphodiesterase type 5 inhibitors (PED5is) often receive correction of penile curvature with simultaneous PP implantation according to the doctor's recommendation or refuse surgery because they were older and had a low sexual desire or because of economic reasons. However, some patients who have adequate erectile rigidity for intercourse with or without pharmacotherapy pay too much attention to surgical complications that they do not accept the recommended type of surgical techniques. The main manifestation is that some patients refuse plication procedures and demand grafting techniques because

of an overconcern about penis size. Some patients with a shorter penis require a plication procedure to preserve erectile function. After the operation, contrary to patients who received PP implantation and were generally satisfied with the postoperative results, some of the patients who received plication procedures or grafting techniques according to the patient's choice regret the choice before the operation or have the greatest dissatisfaction with the surgery. To improve the satisfaction of patients after receiving plication procedures or grafting techniques and provide guidance for clinical practice in the future, we retrospectively evaluated the effects of the patient's own choice on postoperative satisfaction and tried to explore the reasons for patient dissatisfaction.

PATIENTS AND METHODS

The protocol and written informed consent used in this study were reviewed and approved by the Institutional Research Ethics Committee of the Ninth People's Hospital, School of Medicine, Shanghai Jiaotong University (No. SH9H-2019-T52-2), Shanghai, China. Clinical data from patients with PD collected between 2010 and 2015 were analyzed retrospectively. The inclusion criteria were as follows: (1) patients who had stable PD for at least one year; (2) persistent penile curvature without an hourglass or hinge effect that severely precluded intercourse; (3) PD patients who received surgical management by either a plication procedure or a grafting technique following the doctor's recommendation or according to the patient's own demands; and (4) patients who were followed up for at least one year after surgical correction.

All patients underwent evaluation for history and physical examination preoperatively. The angle and degree of penile curvature during maximum erection were documented by autophotography using the Kelami technique.⁹ If it was unable to obtain a photograph for the patient, artificial erection was induced by intracavernosal injection of papaverine (30 mg). The International Index of Erectile Function-erectile function domain (IIEF-EF) score was used to evaluate erectile function, and a score below 26 was used to indicate ED.¹⁰

Patient counseling specifically addressed anesthesia type, duration of the surgery, probability of correcting the curvature, possibility of erectile pain, possibility of penile shortening after the plication procedure, possibility of penile shortening or lengthening after the vein grafting procedure, possibility of loss of erectile rigidity, possibility of loss of penile sensation, possibility of *de novo* postoperative ED, and possible palpable penile nodules. After detailed and frank preoperative consultation, a 16-dot plication procedure was recommended to patients who had adequate erectile rigidity for coital activity with or without pharmacotherapy, angle of penile curvature $<60^\circ$ without indentation, stretched length more than 10 cm, and anticipated loss of length $<20\%$ of erected or stretched length.⁸ The great saphenous vein grafting procedure was recommended to patients who had adequate erectile rigidity for coital activity with or without pharmacotherapy, more severe curves greater than 60° , complex deformity, stretched length <10 cm, and anticipated loss of length more than 20% .⁸ The plication procedure or grafting procedure was performed according to the technique described by previous studies^{11,12} according to the patient's choice.

After surgery, patients were recommended to abstain from all forms of sexual intercourse for two months. Although penile traction therapy or vacuum device was not used, patients were recommended to take a low dose of PED5i daily for 2 weeks after surgery and maintain it for two months to promote nocturnal erections and prevent graft contracture.¹³⁻¹⁵ At follow-up, erectile function was assessed using the IIEF-EF questionnaire at 3 months, 6 months, and 1 year postoperatively. To assess patient satisfaction with surgery outcomes,

a questionnaire survey was conducted at 3 months, 6 months, and 1 year postoperatively.

Statistical analyses

All statistical analyses were performed using SPSS 20.0 software (SPSS Inc., Chicago, IL, USA). Baseline and follow-up continuous variables are presented as the mean \pm standard deviation (s.d.) for those with a normal distribution and as the median (interquartile range [IQR]) for those with a nonnormal distribution. To compare demographic characteristics and therapeutic outcomes, Student's *t*-test was used if the data were normally distributed. Otherwise, the Mann-Whitney U test was used. Baseline and follow-up categorical variables are presented as *n* (%) and tested using the Chi-square (χ^2) test. A *P* < 0.05 was considered statistically significant.

RESULTS

During this study period, 108 PD patients met the inclusion criteria. Among them, 32 patients received a 16-dot plication procedure, and 24 patients received a grafting procedure according to the doctor's recommendation (defined as Group 1). In addition, 30 and 22 patients underwent the 16-dot plication procedure and grafting procedure, respectively, according to the patient's own demand (defined as Group 2). Age varied between 33 years and 61 years, and the baseline demographics and disease characteristics did not show any significant differences between the two groups (Table 1).

Surgery-related complications, including penile hematoma, glandular ischemia, and wound infection, were not observed in any case. At 1-year follow-up, there were no significant differences between the two groups in complete penile straightening using either plication procedures or grafting techniques. Although slight residual curvature ($<20^\circ$) was observed in the remaining cases, they did not receive further treatment because they had no complaints about sexual intercourse. Postoperative curvature recurrence did not occur in any patient who underwent a plication procedure or a grafting procedure (Table 2 and 3).

At the 1-year follow-up, no significant differences were observed between the two groups in objective measurement of penile stretched length using either plication procedures or grafting techniques. Although there were no significant differences, more patients in Group 2 had complaints of penile shortening after either plication procedures or grafting techniques than patients in Group 1, even they could not state the actual loss of penile length. Moreover, complaints of patients with affected sexual activity by the loss of penile length were significantly higher in Group 2 than in Group 1 after either plication procedures or grafting techniques (Table 2-4).

There were no significant differences between the two groups in the postoperative IIEF-EF score in patients who received the 16-dot plication procedure. Moreover, IIEF-EF score was maintained in all patients who received the 16-dot plication procedure and slightly improved in ED patients. However, the IIEF-EF score was decreased in ED patients who underwent the grafting procedure, and new-onset ED was observed in 42.1% and 42.9% of patients in Group 1 and Group 2, respectively. However, all patients achieved adequate erectile capacity after receiving PED5i. They were able to have successful sexual intercourse (Table 2-4).

After surgery with a 16-dot plication procedure or a grafting procedure, all patients had pain during erections. The pain lasted up to three months in most patients. Regardless of the type of surgery, the degree and duration of pain were more profound in Group 2 than in Group 1, although differences between the two groups were not

Table 1: Clinical and demographic features of Peyronie's disease patients

Clinical and demographic feature	Group 1 (n=56)	Group 2 (n=52)	P (statistical method)
Age (year), mean±s.d.	47.9±6.8	48.2±7.0	0.788 (t-test)
Disease duration (month), mean±s.d.	19.1±1.5	19.2±1.0	0.684 (t-test)
Site of the penile deformity, n (%)			
Dorsal	26 (46.4)	23 (44.2)	NA
Ventral	3 (5.4)	3 (5.8)	NA
Lateral	8 (14.3)	7 (13.5)	NA
Ventrolateral	2 (3.6)	2 (3.8)	NA
Dorsolateral	17 (30.4)	17 (32.7)	NA
Angle of penile curvature (°), mean±s.d.	48.4±13.7	49.8±14.2	0.614 (t-test)
Cases with ED, n (%)	17 (30.4)	16 (30.8)	0.963 (Chi-square test)
IIEF-EF score in patients with ED, mean±s.d.	19.8±4.9	19.1±4.3	0.680 (t-test)

ED: erectile dysfunction; IIEF-EF: International Index of Erectile Function-erectile function domain; NA: not available; s.d.: standard deviation

Table 2: Surgical outcomes of 16-dot plication procedure after 1 year of follow-up

Surgical outcome	Group 1 (n=32)	Group 2 (n=30)	P (statistical method)
Complete straightening, n (%)	29 (90.6)	27 (90.0)	0.934 (Chi-square test)
Onset of penile shortening, n (%)	19 (59.4)	17 (56.7)	0.829 (Chi-square test)
Postoperative penile shortening (cm), mean±s.d.	-0.8±0.7	-0.7±0.7	0.871 (t-test)
Onset of penile shortening, <1.0, n (%)	8 (25.0)	3 (10.0)	NA
Onset of penile shortening, 1.0–2.0, n (%)	10 (31.2)	14 (46.7)	NA
Onset of penile shortening, >2.0, n (%)	1 (3.1)	0 (0)	NA
Postoperative curvature recurrence, n (%)	0 (0)	0 (0)	NA
Patients with ED at first visit, n (%)	12 (37.5)	8 (26.7)	0.362 (Chi-square test)
Preoperative IIEF-EF score in patients with ED, mean±s.d.	20.8±4.2	19.8±4.6	0.621 (t-test)
Postoperative IIEF-EF score in patients with ED, mean±s.d.	21.8±5.3	21.0±5.8	0.744 (t-test)
Improvement in IIEF-EF score in patients with ED, mean±s.d.	1.1±1.4	1.2±1.8	0.819 (t-test)
Improvement in IIEF-EF score in all patients, n (%)	15 (46.9)	13 (43.3)	0.779 (Chi-square test)
Improvement in IIEF-EF score in all patients, mean±s.d.	0.8±1.0	0.7±1.1	0.585 (t-test)

ED: erectile dysfunction; IIEF-EF: International Index of Erectile Function-erectile function domain; NA: not available; s.d.: standard deviation

Table 3: Surgical outcomes of grafting procedure after 1 year of follow-up

Surgical outcome	Group 1 (n=24)	Group 2 (n=22)	P (statistical method)
Complete straightening, n (%)	22 (91.7)	20 (90.9)	0.909 (Chi-square test)
Onset of penile shortening, n (%)	6 (25.0)	5 (22.7)	0.857 (Chi-square test)
Postoperative penile shortening (cm), mean±s.d.	-0.2±0.4	-0.1±0.2	0.608 (t-test)
Onset of shortening, <1.0, n (%)	5 (20.8)	5 (22.7)	NA
Onset of shortening, 1.0–2.0, n (%)	1 (4.2)	0 (0)	NA
Postoperative curvature recurrence, n (%)	0 (0)	0 (0)	NA
Patients with ED at first visit, n (%)	5 (20.8)	8 (36.4)	0.243 (Chi-square test)
Preoperative IIEF-EF score in patients with ED, mean±s.d.	19.4±4.6	20.5±4.3	0.671 (t-test)
Postoperative IIEF-EF score in patients with ED, mean±s.d.	16.2±4.4	17.4±3.6	0.611 (t-test)
Decrease in IIEF-EF score in patients with ED, mean±s.d.	-3.6±0.4	-3.1±0.8	0.858 (t-test)
Decrease in IIEF-EF score in all patients, n (%)	13 (54.2)	14 (63.6)	0.515 (Chi-square test)
Decrease in IIEF-EF score in all patients, mean±s.d.	-1.1±1.1	-1.4±1.2	0.476 (t-test)
New onset of ED patients, n (%)	8 (42.1)	6 (42.9)	0.966 (Chi-square test)
Decrease in IIEF-EF score in new onset of ED patients, mean±s.d.	-3.0±0.0	-3.17±0.41	0.264 (t-test)

ED: erectile dysfunction; IIEF-EF: International Index of Erectile Function-erectile function domain; NA: not available; s.d.: standard deviation

statistically significant. In addition, although all patients felt nodules on the penis, only patients in Group 2 felt significant discomfort because of nodules. Similarly, decreased sensitivity in the penis was more often noticed and more obvious in patients in Group 2. Regarding overall patient satisfaction, a significantly higher proportion of patients in Group 1 were satisfied after either plication procedures or grafting techniques and willing to recommend surgery to other patients than patients in Group 2 (Table 4).

When asked about the patient's understanding of PD, the purpose of treatment, and the basis of the decision on the type of surgery, answers were significantly different between the two groups regardless of the type of surgery (Table 5).

DISCUSSION

PD can cause a significant impact on the quality of life of patients and their partners. Despite advances in the medical treatment of



Table 4: Questionnaire survey of subjective surgical outcomes

Question	Response	Receiving 16-dot plication procedure in Group 1, n/total (%)	Receiving grafting procedure in Group 1, n/total (%)	Receiving 16-dot plication procedure in Group 2, n/total (%)	Receiving grafting procedure in Group 2, n/total (%)
1. After the surgery, are your erections straight?	Yes	29/32 (90.6)	22/24 (91.7)	27/30 (90.0)	20/22 (90.9)
A. If the answer is no, do curvatures influence your sexual intercourse?	Yes	0/32 (0)	0/24 (0)	0/30 (0)	0/22 (0)
2. After the surgery, did you notice that the erect penis is shorter?	Yes	15/32 (46.9)	6/24 (25.0)	19/30 (63.3)	8/22 (36.4)
A. If the answer is yes, is this discomfort important?	Yes	2/15 (13.3)	2/6 (33.3)	10/19 (52.6)*	5/8 (62.5)†
3. After the surgery, did the rigidity of your erections improve, worsen, or are they the same?					
A. Improved	Yes	15/32 (46.9)	0/24 (0)	13/30 (43.3)	0/22 (0)
B. Worsened	Yes	0/32 (0)	13/24 (54.2)	0/30 (0)	14/22 (63.6)
C. Equal	Yes	17/32 (53.1)	11/24 (45.8)	17/30 (56.7)	8/22 (36.4)
4. After the surgery, could you have sexual relations?	Yes	32/32 (100)	24/24 (100)	30/30 (100)	22/22 (100)
5. After the surgery, do you use any method to improve erections?	Yes	5/32 (15.6)	8/24 (33.3)	4/30 (13.3)	9/22 (40.9)
A. If yes, which one?					
a. PDE5i	Yes	5/5 (100)	8/8 (100)	4/4 (100)	9/9 (100)
b. Vasoactive drugs	Yes	0/5 (0)	0/8 (0)	0/4 (0)	0/9 (0)
c. Vacuum therapy	Yes	0/5 (0)	0/8 (0)	0/4 (0)	0/9 (0)
6. After the surgery, do you have pain during erections?	Yes	32/32 (100)	24/24 (100)	30/30 (100)	22/22 (100)
A. If the answer is yes, how long did the pain last?					
a. Within 3 months	Yes	28/32 (87.5)	21/24 (87.5)	22/30 (73.3)	16/22 (72.7)
b. 3–6 months	Yes	3/32 (9.4)	2/24 (8.3)	4/30 (13.3)	3/22 (13.6)
c. 6–12 months	Yes	1/32 (3.1)	1/24 (4.2)	4/30 (13.3)	3/22 (13.6)
B. If the answer is yes, is this pain important?	Yes	4/32 (12.5)	2/24 (8.3)	11/30 (36.7)*	10/22 (45.5)**
7. After the surgery, do you suffer pain during intercourse?	Yes	4/32 (12.5)	2/24 (8.3)	11/30 (36.7)*	10/22 (45.5)**
8. After the surgery, do you feel nodules on the penis?	Yes	32/32 (100)	24/24 (100)	30/30 (100)	22/22 (100)
A. If the answer is yes, is this discomfort important?	Yes	0/32 (0)	0/32 (0)	12/30 (40.0)**	8/22 (36.4)**
9. After the surgery, did you notice decreased sensitivity in the penis?	Yes	2/32 (6.2)	5/24 (20.8)	8/30 (26.7)*	10/22 (45.5)†
A. If the answer is yes, is this discomfort important?	Yes	0/2 (0)	0/5 (0)	4/8 (50.0)**	6/10 (60.0)**
10. In general, are you satisfied with the surgery?	Yes	30/32 (93.8)	20/24 (83.3)	19/30 (63.3)**	14/22 (63.6)†
11. Would you recommend the surgery to other patients?	Yes	31/32 (96.9)	22/24 (91.7)	18/30 (60.0)**	12/22 (54.6)**

P*<0.05; *P*<0.01, when patients who receive 16-dot plication procedure in Group 2 compared to those in Group 1; †*P*<0.05; ††*P*<0.01, when patients who receive grafting procedure in Group 2 compared to those in Group 1. PDE5i: phosphodiesterase type 5 inhibitor

Table 5: Questionnaire survey on patients' understanding of Peyronie's disease

Question	Response	Group 2 (total=56), n (%)	Group 1 (total=52), n (%)
1. Did you know about PD and its treatment strategies before you visit a doctor?	Yes	16 (28.6)	32 (61.5)**
2. How did you learn about PD and its treatment strategies before the surgery?			
A. Popular science knowledge from websites or magazines	Yes	12 (21.4)	20 (38.5)*
B. From professional medical books	Yes	4 (7.1)	12 (23.1)*
C. From doctors	Yes	40 (71.4)	20 (38.5)**
3. What is the purpose of your surgery?			
A. To recover a normal cosmetic appearance of penis, whether the sexual ability preserved was not important	Yes	6 (10.7)	5 (9.6)
B. To recover a normal sexual ability and slight deformity of penis was acceptable	Yes	26 (46.4)	3 (5.8)**
C. Both sexual ability and cosmetic appearance must be repaired	Yes	14 (25.0)	35 (67.3)**
D. Just excise the plaque radically and did not care about the functional and cosmetic outcomes	Yes	10 (17.9)	9 (17.3)
4. What was the basis for your decision on the type of surgery?			
A. Just follow the doctor's advice	Yes	20 (35.7)	5 (9.6)**
B. I made the decision by myself based on my own knowledge	Yes	2 (3.6)	30 (57.7)**
C. My wife or my parents helped me to make the decision	Yes	5 (8.9)	6 (11.5)
D. Made the decision after a detailed, frank preoperative counseling with the doctor	Yes	29 (51.8)	11 (21.2)**

P*<0.05; *P*<0.01, when Group 2 compared to Group 1. PD: Peyronie's disease

PD, surgery remains the gold standard once the deformity has stabilized in the chronic phase. Surgical correction of PD should be considered according to the severity of penile deformity, erectile function, penile length, and difficulty in penetration, among others.⁸ In clinical practice, some patients do not accept the recommended type of surgical techniques due to excessive concern about surgical

complications. In the present retrospective study, we found that surgical management by either a plication procedure or a grafting technique had excellent objective results in patients regardless of whether they followed the doctor's recommendation. However, more patients who did not follow the doctor's recommendation showed lower satisfaction.



Nesbit procedures and penile plication are the most common surgical techniques for correcting mild-to-moderate penile curvatures without indentation or deformity in hourglass or hinge effects.¹⁶ Tunica albuginea plication, especially Lue's 16- or 24-dot minimal tension plication as a less invasive approach,¹¹ does not require tunica incision or neurovascular bundle mobilization, which is beneficial for preserving erectile capacity and reducing surgical complications. The success rate of complete penile straightening in our patients was similar to that in other published studies. In a series of 116 PD patients, Gholami and Lue¹¹ reported a satisfaction rate of 96% and a completely straight penis rate of 93%. The rate of recurrent curvature was 15%. In our study, recurrence of penile curvature did not occur in any patient at the 1-year follow-up. In addition, although slight residual curvature (<20°) was observed in some cases, they did not receive further treatment because they did not have complaints about sexual intercourse.

Incision or partial plaque excision and grafting techniques are recommended for patients with adequate rigidity, severe curves, complex deformity, and/or narrowing with an hourglass or hinge effect. Many different types of autograft, allograft, xenograft, and synthetic materials have been used in grafting surgical procedures with various outcomes.^{17,18} Venous patch grafts for PD have gained wide popularity because of their physiological characteristics without the risk of rejection or shrinkage. In addition, endothelial coating of the vein can easily contact the cavernosal tissue and regain blood supply.^{19,20} Previous studies have reported high rates of penile straightening (82% to 96%) and high patient satisfaction (92%).^{21,22} In our study, until the 1-year follow-up, recurrence of penile curvature was not found in any patient, while complete penile straightening was observed in 91.7% of patients who followed the doctor's recommendation and 90.9% of patients who did not follow the doctor's recommendation after a grafting procedure. The remaining patients with slight residual curvature (<20°) did not receive further treatment because they had no complaints about sexual intercourse.

According to the literature, the plication procedure usually does not affect erectile function.^{11,23} The postoperative ED rate after surgery with venous patch grafts ranges from 0% to 50%.¹⁷ In the present study, the postoperative IIEF-EF score and sexual function were maintained in all patients who received a 16-dot plication procedure. Moreover, patients who had difficulty intercourse because of penile curvature seemed to attain a benefit in sexual activity after curvature correction. However, for those who received a venous grafting surgical procedure, 54.2% of patients who followed the doctor's recommendation and 63.6% of those who did not follow the doctor's recommendation reported varying degrees of decreased erectile rigidity. Therefore, preoperative evaluation of erectile capacity is critical for choosing venous patch grafting procedures.

Concerns over penile size and a desire for a longer penis are common in the male population even if penile length is normal.²⁴ One consequence of PD is penile shortening, which can cause significant personal distress. Additional loss of penile length may occur after surgical management. This is a great concern for patients. Previous studies have demonstrated that penile shortening occurs in 41%–100% and 0%–40% of patients following various plication procedures and incision or partial plaque excision with grafting techniques, respectively.^{18,25–27} Although penile shortening rarely results in intercourse difficulty,²⁸ patients often perceive that the loss of length is greater than the actual loss.²⁹ In our study, objective measurement of stretched penile length showed that the proportion of patients with shortening penile length and the degree of penile

length loss were similar between patients who followed the doctor's recommendation and those who did not follow regardless of the type of surgery. However, more patients who did not follow the doctor's recommendation had complaints of penile shortening and subsequent adverse effects on sexual activity, although they did not state an actual loss of penile length. These results indicate that penile shortening must be clearly explained to patients before surgery. It is recommended to measure and document penile length perioperatively regardless of what technique will be used.^{26,29} Interestingly, regardless of the type of surgery, subjective dissatisfaction of patients who did not follow the doctor's advice was also shown in other aspects, including pain, discomfort because of nodules, and decreased sensitivity in the penis.

To clarify the reasons for such dissatisfaction of patients who did not follow the doctor's recommendation, we conducted a questionnaire survey. When patients were asked about their understanding of PD before visiting a doctor, the percentage of patients who did not follow the doctor's recommendation and knew the disease was higher than that in patients who followed the doctor's recommendation. Patients who followed the doctor's advice mainly learned from their doctors about treatment strategies for the disease. In contrast, patients who did not follow doctors' advice mainly obtained information from professional books or popular science resources on websites and magazines. With the development of Internet technology and the spread of popular science knowledge as well as easier access to professional books, many patients use these routes to obtain disease-related knowledge. In our study, up to 61.5% of patients who did not follow the doctor's advice had thoroughly researched PD with a powerful knowledge base from which they drew reference. However, the purpose of their surgical treatment choice was inappropriate, as it did not conform to the principle of treatment. For example, they require that their sexual ability and cosmetic appearance be restored to the pre-morbid state or expect simple removal of the plaque. This phenomenon indicates that it is impossible for patients to attain comprehensive medical knowledge on their own. We think that patients' dissatisfaction is related to their incomplete understanding of the disease and unrealistic expectations. When treatment outcomes do not meet their expectations, they will feel dissatisfied and frustrated even if the patient is treated according to their own requirements. Therefore, patients should have a detailed, frank preoperative counseling with the doctor as much as possible. However, it is a challenge to persuade patients who have formed a fixed concept of the disease. Fortunately, a pilot study demonstrated that seeing an accurate virtual three-dimensional (3D) reconstruction of the penile curvature of patients with PD using photogrammetry software is very useful for both patients and surgeons during preoperative counseling and surgical planning.³⁰ Taken together, the evidence suggests that patient satisfaction could be improved not only through a detailed and frank consultation before the operation, continuing until patients have a correct understanding of the disease and knowledge of the advantages and disadvantages of different treatment strategies, but also through the use of a new objective method such as a virtual 3D model to visualize the expected postoperative esthetic results.

This study has several important limitations. First, it had a retrospective design, with the bias inherent to such a design. In addition, only the IIEF-EF questionnaire, a subjective tool, was used to evaluate erectile function in the present study. Although the IIEF-EF questionnaire is an applicable and amenable tool for evaluating erectile function, it might be influenced by some pre- and postoperative factors, such as depression after clinical diagnosis, surgical decision, stress, pain at the surgical site, and the resulting compromise of libido. Therefore, objective assessments such as nocturnal penile tumescence

tests, video-provoked erectile response measurements, and penile Doppler ultrasound might be needed to provide more data about erectile function. In addition, the follow-up period was too short after the surgery. The results after PD graft surgery published by the same unit have shown that even though short-term results are encouraging, the patient satisfaction rate is decreased considerably over the number of postoperative years.^{31,32} Therefore, patients who are dissatisfied with surgical outcomes in the short-term follow-up may be more dissatisfied after a long-term follow-up. Further studies are needed to clarify whether patients' understanding and preferences for surgical types can influence the long-term postoperative outcomes of PD. Finally, because there was no standard questionnaire to evaluate PD patients' understanding of the disease or the purpose of surgery, we prepared a questionnaire. However, due to lack of professionalism, the assessment might be biased.

CONCLUSIONS

The present study showed that 16-dot plication and great saphenous vein grafting procedures could be objectively effective options in the surgical management of patients in the stable chronic phase of PD. Low patient satisfaction might be related to patients' lack of correct understanding of the disease and its treatment strategy as well as unrealistic expectations. In order to improve patient satisfaction, detailed and frank consultations should be conducted before the operation until patients have a correct understanding of the disease and knowledge about the advantages and disadvantages of different types of surgery. In addition, using a new objective method such as an accurate virtual 3D model may improve patient satisfaction by increasing patients' understanding of the severity of the disease and possible esthetic results after surgery.

AUTHOR CONTRIBUTIONS

DCZ, JWJ, WJL, and ZW designed the study, collected the clinical data, performed the statistical analysis, and drafted the manuscript. DCZ, JHG, MKX, WJL, and ZW participated in the operation. DCZ, JWJ, JHG, MKX, WJL, and ZW revised the article. All authors read and approved the final manuscript.

COMPETING INTERESTS

All authors declared no competing interests.

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