

ORIGINAL RESEARCH

Examining Postoperative Outcomes after Employing a Surgical Algorithm for Management of Peyronie's Disease: A Single-Institution Retrospective Review

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ABSTRACT

Aim. Surgery remains the gold standard treatment for men with stable Peyronie's disease (PD). In an attempt to guide operative selection, we report our series of penile-straightening procedures for PD, using a surgical algorithm that recommended tunica albuginea plication (TAP), partial plaque excision and grafting (PEG) or inflatable penile prosthesis (IPP) placement. With this study, we attempt to further refine surgical approach, define realistic surgical outcomes, and help establish reasonable postoperative expectations for treatment of PD.

Methods. We retrospectively reviewed all patients who underwent surgery for PD at our institution between 2007 and 2013. Work-up involved a history, physical exam, and a duplex ultrasound. Several questionnaires were employed to assess bother and distress associated with PD. Objective outcomes and patient satisfaction were assessed postoperatively. Primary outcomes include postoperative patient satisfaction with rigidity, curvature, and ability to engage in intercourse. Secondary outcomes include comparing emotional, relationship, and psychological distress to severity of disease.

Results. A total of 390 patients underwent penile-straightening procedures for correction of PD. Of these patients, 29%, (n = 114) underwent TAP, 41% (n = 159) PEG, and 30% (N = 114) IPP. Mean follow-up was 17 months. The three surgical modalities showed no significant difference in satisfaction with penile rigidity, presence of bothersome residual curve, or ability to engage in intercourse. Preoperatively, 80% of men reported a negative effect of PD on their emotional status. Postoperatively, 88.4% of men were able to engage in penetrative intercourse, while only 70% were satisfied with rigidity and 84.9% were satisfied with curvature correction.

Conclusion. Patient experience with postsurgical rigidity, ability to engage in intercourse, and residual bothersome curve was not statistically different across the three groups, supporting the use of this surgical algorithm. The majority of patients with PD experience some degree of emotional and psychological distress, which may compromise patient satisfaction. **Papagiannopoulos D, Yura E, and Levine L. Examining postoperative outcomes after employing a surgical algorithm for management of Peyronie's disease: A single-institution retrospective review. J Sex Med 2015;12:1474–1480.**

Key Words. Peyronie's Disease; Surgical Algorithms; Tunica Albuginea Plication; Grafting; Penile Prosthesis

Introduction

Peyronie's disease (PD) presents with a fibrotic plaque within the tunica albuginea of the penis leading to penile shortening, curvature, and in many cases, sexual dysfunction [1]. Apart from

being physically debilitating, PD can have severe effects on a man's mood and psychological well-being. Quality of life tends to be affected, which can have significant emotional and psychological reverberations [2,3]. The disease can cause strain on relationships and depression, with a prevalence

near 50% in some cohorts [4,5]. The high prevalence of mood disturbances adds to the complexity and challenges of treating this debilitating disorder and likely affects patient satisfaction with treatment outcomes.

Surgery remains the gold standard for treatment in men with stable PD. Surgical indications include stable disease, compromised ability to engage in sexual intercourse because of deformity and/or poor rigidity, failure of nonsurgical therapies, extensive calcification, or patient preference for rapid correction [6]. Numerous surgical approaches are available and can be categorized into three main groups: tunica placcation; plaque incision or partial excision, and grafting; and penile prosthesis placement with straightening maneuvers [6]. Important factors that contribute to surgical planning include degree of curvature, presence of a hinge effect, penile length, and erectile function [7]. To help guide intervention, surgical algorithms that take these preoperative factors into account have been introduced [7,8]. The surgical algorithm used in this study was published in 1997 as a means to regain a functionally straight penis (defined as <20 degrees), maximize sexual functioning while minimizing side effects [7–10].

Aim

We employ a previously published surgical algorithm and report our findings in hopes of, first, further defining outcomes, refining surgical approach, and helping establish realistic postoperative expectations. Second, we attempt to quantify preoperative emotional distress and its effect on postoperative satisfaction.

Methods

Patient Population

This is a retrospective study of a large surgical experience by a single surgeon at a high-volume center. Patients who underwent penile-straightening procedures for PD between 2007 and 2013 are included.

Preoperative Evaluation

A full history was conducted with specific focus on known and possible risk factors. These include a history of diabetes, hypertension, hyperlipidemia, and tobacco use. Duration of PD symptoms, pre-disease sexual functioning, and changes to penile

length, rigidity, and erection quality were noted. During initial evaluation, patients were asked to estimate their curvature in degrees. They were then asked to rate erectile rigidity on a scale from 0 to 10. A score of 7 is defined as a “stufferable” erection or rigidity capable of penetration with manual assistance. Several surveys were employed to assess bother and distress associated with PD. Included were two questions from our previously published questionnaire (Peyronie Disease Intake Questionnaire, PDIQ) that directly asked whether PD affects a patient's emotional status or sexual relationships (Appendix 1) [11]. These screening questions were first described by Smith et al. [4]. Also included, when made available, was the recently validated Peyronie's Disease Questionnaire (PDQ), which categorizes PD symptoms into pain, bother, or psychological and physical symptom domains [12–14]. A physical exam was performed, including stretched flaccid penile length, and identification of the plaque location. One evaluator measured the penis consistently, from pubic bone to corona. Patients then underwent a dynamic duplex ultrasound (DDU) with vasoactive pharmacologic injection to determine the presence of a calcified plaque, preoperative erection quality, degree of curvature, and document any hinge effect. The pharmacologic agent was redosed as needed for up to three injections to obtain an erection as strong as that achieved at home. The ultrasonographer and patient graded the rigidity (0–10), and the patient was asked to compare firmness with his typical erections at home (better, worse, same). Peak systolic flow was measured 10–20 minutes after injection, at the time of maximal rigidity.

Surgical Algorithm

In this cohort, surgical intervention was not offered before 1 year from the onset of symptoms, and not until the deformity was stable for at least 6 months. Guiding criteria include penile curvature, presence of a hinge effect, and erection quality. Patients who had satisfactory rigidity at home with or without oral phosphodiesterase-5 inhibitors (PDE5is), a penile curvature less than 60 degrees, and no hinge effect were recommended to undergo a tunica albuginea plication (TAP). Those with satisfactory erections, but with a penile curvature of greater than 60 degrees and/or a destabilizing hinge effect were recommended to undergo partial plaque excision and grafting (PEG). Those patients with unsatisfactory erections were recommended to undergo placement of an inflatable penile

prosthesis (IPP) with straightening maneuvers. A satisfactory erection was defined as having the ability to achieve penetration without manual assistance, at least an 8/10. A few patients refused plication because of fear of additional penile length loss or outright declined IPP. As a result, there was some deviation from the protocol (2–3% per group).

Intraoperative Assessment

The goal of surgery was to make the patient functionally straight, defined as a curve less than 20 degrees. With that in mind, if after PEG, there was a residual curve >20 degrees, then TAP was performed. Typically one to two plications were performed to achieve maximal straightness. Plications were most commonly used in PEG patients who had a complex or “double curve,” where there is more than one vertex. Similarly, penile modeling was performed on all patients who had a curve >20 degrees after IPP placement. If the curve remained >20 degrees after several attempts to model, the surgeons would consider incision with or without grafting.

Postoperative Rehabilitation

All TAP and PEG patients were encouraged to perform massage and stretch exercises starting 2 weeks postoperatively, to be continued for 4 weeks. These patients were also recommended to perform traction therapy, beginning 3–4 weeks postoperatively. They were instructed to wear the device 3 hours/day or longer, and no more than 2 hours/session, for a total of 3 months.

Statistic Analysis

Descriptive statistics were used to define patient characteristics and univariate analysis was performed with a two-tailed *t*-test to determine

whether a statistically significant difference was present in the clinical characteristics between those patients undergoing each surgical modality. $P < 0.05$ was considered significant. Statistic analysis was performed using StatPlus software (Version 5.8; Analyst Soft Inc., Walnut, CA, USA).

Main Outcome Measures

Primary outcomes include postoperative patient satisfaction with rigidity, curvature and ability to engage in intercourse after surgical intervention based on our algorithm. Secondary outcomes include quantifying preoperative relationship, emotional, and psychological distress associated with PD using two screening questions (PDIQ) and the PDQ.

Results

Patients (Table 1)

A total of 390 patients with PD underwent penile-straightening procedures at our institution between 2007 and 2013. All were included in the preoperative assessment, however only those patients with at least a 3-month follow-up were included in the postoperative analysis ($n = 297$). The mean age was 55.7 years (range 25–79 years, standard deviation [SD] 8.65 years). Of these patients, 29% ($n = 114$) received TAP, 41% ($n = 159$) received PEG, and 30% ($n = 117$) received IPP. For optimal penile straightening, 50% ($n = 80$) of those undergoing PEG also had a secondary TAP procedure; 13% of those undergoing IPP ($n = 15$) were also simultaneously treated with plaque incision and grafting.

There was a significantly higher incidence of diabetes mellitus and hypertension within the IPP

Table 1 Patient information

	TAP	PEG	IPP	Overall			
Number of patients	114 (29%)	159 (41%)	117 (30%)	390	—	—	—
Secondary procedure	—	80 (50%)*	15 (13%)†	—	—	—	—
—	—	—	—	—	Pa	Pb	Pc
Mean age (SD)	54.6 (9.8)	54.4 (7.7)	58.6 (8.0)	55.7 (8.7)	NS	$P < 0.01$	$P < 0.01$
Comorbidities	%	%	%	%	Pa	Pb	Pc
Diabetes mellitus	8.7	8.9	32.8	15.9	NS	$P < 0.01$	$P < 0.01$
Hypertension	32.5	27.8	61.5	39.3	NS	$P < 0.01$	$P < 0.01$
Dyslipidemia	47.4	35.2	52.1	44.0	$P < 0.05$	NS	$P < 0.01$
History of smoking	38.6	38.0	47.9	41.1	NS	NS	NS
Hypogonadism	17.5	21.5	23.1	20.8	NS	NS	NS

*Secondary TAP.

†Secondary PEG.

NS = not significant; Pa = comparing TAP and PEG; Pb = comparing TAP and IPP; Pc = PEG and IPP; PEG = partial plaque excision and grafting; SD = standard deviation; TAP = tunica albuginea plication.

Table 2 Preoperative sexual function

Subjective erectile quality (0–10)			
Groups	n	Mean	SD
TAP	104	7.7	1.6
PEG	128	8.4	1.2
IPP	84	5.5	2.3
Overall	316	7.4	—
PDE5i use			
Groups	n	%	
TAP	23/114	20.1	
PEG	13/158	8.0	
IPP	45/117	38.5	
Overall	81/389	29.1	

IPP = inflatable penile prosthesis; PDE5i = phosphodiesterase-5 inhibitor; PEG = partial plaque excision and grafting; SD = standard deviation; TAP = tunica albuginea placcation.

group (32.8% and 61.5%, respectively) compared with those treated with TAP (8.7% and 32.5%), and PEG (8.9% and 27.8% respectively, $P < 0.01$). There was no significant difference in the incidence of smoking or hypogonadism (defined as total morning testosterone < 300 ng/dL) between the various surgical procedures.

Preoperative Erectile Quality (Tables 2 and 3)

As expected, subjective erectile quality and PDE5i use was significantly different between groups (Table 2). Preoperatively, 312 patients had a documented DDU at our institution (Table 3). Some patients came to us with a previously performed DDU, or failed intracorporal injection therapy because of severe erectile dysfunction (ED).

Survey Results

The PDIQ screening questions suggested that 80% of patients found that PD had a negative effect on their emotional status, and there was no statistic variation between surgical groups. Significantly more men who underwent PEG and IPP reported a negative effect on their relationship status when compared with those who ultimately underwent TAP (76%, 72.9%, and 57.3% for PEG, IPP, and TAP respectively, $P < 0.05$).

In the PDQ assessment, only the Psychosocial and Physical Symptoms domain demonstrated a statistically significant difference between treatment modalities, with patients undergoing TAP (13.7/24, SD 4.2) and IPP (13.9/24, SD 6.6), compared with PEG patients (10/24, SD 3.0) ($P < 0.05$). There was no significant difference between the

Pain (overall mean score 6.2/30, SD 5) and Bother domains (overall mean score of 9.7/16, SD 3).

Postoperative Outcomes (Tables 4 and 5)

Only patients with at least a 3-month follow-up were included in the postoperative analysis ($n = 297$). Mean follow-up time was 17 months (range of 3–85 months). There was no significant difference in penile rigidity, ability to engage in intercourse, or residual bothersome curve (Table 4).

When comparing patients treated with PEG alone vs. PEG with secondary TAP procedure, there was no significant difference between groups with regard to gain of penile length ($P = 0.60$), satisfaction with penile rigidity ($P = 0.19$), ability to engage in sexual intercourse ($P = 0.65$), and residual bothersome curvature ($P = 0.86$).

In this cohort, the curvature correction was durable through the follow-up period. Approximately 1.5% of patients required reoperation. A summary of postoperative complications is found in Table 5.

Table 3 Duplex ultrasound findings

Duplex ultrasound rigidity (0–10)			
Groups	n	Mean rigidity (0–10)	SD
TAP	102	8.21	1.7
PEG	117	8.78	1.2
IPP	65	6.9	1.8
Overall	284	8.14	—
Hinge effect on duplex ultrasound			
Groups	n	%	
TAP	34/102	33.3	
PEG	75/117	64.1	
IPP	25/65	38.5	
Overall	134/238	56.3	
Calcification on duplex ultrasound			
Groups	n	%	
TAP	16/102	15.7	
PEG	48/117	41	
IPP	19/65	29	
Overall	83/284	29.2	
Mean total curvature (degrees)			
Groups	n	Mean curvature (degrees)	SD
TAP	106	59	21
PEG	141	79	25
IPP	65	63.5	32
Overall	312	69	—

IPP = inflatable penile prosthesis; PDE5i = phosphodiesterase-5 inhibitor; PEG = partial plaque excision and grafting; SD = standard deviation; TAP = tunica albuginea placcation.

Table 4 Postoperative outcomes

Mean change in stretched flaccid penile length (cm)					
Groups	n	Mean (cm)	SD (cm)	P value	
TAP	68	0.44	1.3	TAP vs. PEG	$P < 0.01$
PEG	113	0.96	1.1	—	
Overall	181	0.77	—	—	
Patient reported satisfaction with penile rigidity					
Groups	n	%		P value	
TAP	45/68	66.2		TAP vs. PEG	NS
PEG	84/116	72.4		—	
Overall	129/184	70.1		—	
Patient reported ability to engage in sexual intercourse					
Groups	n	%		P value	
TAP	60/64	93.8		TAP vs. PEG	NS
PEG	80/96	83.3		TAP vs. IPP	NS
IPP	61/66	92.4		PEG vs. IPP	NS
Overall	201/226	88.9		—	—
Patient reported residual bothersome curvature					
Groups	n	%		P value	
TAP	12/69	17.4		TAP vs. PEG	NS
PEG	19/103	18.4		TAP vs. IPP	NS
IPP	6/62	9.7		PEG vs. IPP	NS
Overall	37/233	15.9		—	—

IPP = inflatable penile prosthesis; PEG = partial plaque excision and grafting; SD = standard deviation; TAP = tunica albuginea placcation.

Discussion

As expected with implementation of our algorithm, erectile function varied significantly across all three groups. All groups reported a significant reduction in erectile quality when comparing pre-disease erections to preoperative rigidity. Venooclusive dysfunction and impaired cavernosal inflow may be contributors to onset of ED [15,16]. As previously discussed, however, a significant proportion of these men may develop anxiety, loss of confidence, and in some cases clinical depression. These psychosocial effects likely contribute to ED, and in many to a negative self-perception.

Based on our preoperative questionnaires, up to 80% of all men reported a negative effect of PD on their emotional status and 69% of men experienced a negative effect on their relationships. This high prevalence of mood disequilibrium is comparable with the findings reported by Smith et al. [4]. When looking at the PDQ, bother domain scores were the same across all surgical groups. This is consistent with previous findings that there is no correlation between severity of curvature and patient bother [5]. In the future, the PDQ may prove to be useful in

the postoperative setting to assess surgical treatment outcomes.

After a comprehensive preoperative evaluation, the aforementioned surgical algorithm was employed to help guide patients to an intervention [3,8]. Regardless of surgical modality employed, important postoperative end points were statistically equivalent. There was no significant difference in satisfaction with penile rigidity, presence of bothersome penile curve, or ability to engage in intercourse among the three groups (Table 4).

In the current study, 70.1% of patients were satisfied with their penile rigidity (excluding IPP patients), and 84.9% were satisfied with curvature correction. However, 88.9% were able to engage in penetrative sexual intercourse with or without PDE-5 inhibitors. There appears to be some discrepancy between a patient’s postoperative satisfaction and sexual functioning. This fact is echoed in the literature. Using validated instruments, Nelson et al. determined that many PD patients do not psychologically adjust to their diagnosis. As such, they may continue to experience a significant psychological impact even after “successful” intervention [5]. A related survey-based study noted that many men with PD had a disabling preoccupation with penile appearance and deformity, with 48% stating that they worried about it frequently or all the time [17]. In validating the PDQ, Hellstrom and colleagues determined that the perception of a functional and esthetic sexual abnormality is perhaps the most troubling aspect of PD for patients [12]. It is imperative to counsel patients that pharmacotherapy or surgery aim to restore sexual functioning, but will likely not restore pre-disease penile length, rigidity, and shape. Surgeons should consider preoperative psychological referral

Table 5 Postoperative complications

Postoperative complications		
TAP	PEG	IPP
Hematoma: 1	Subgraft hematoma: 15	Device failure: 12
Wound infection: 1	Abscess: 1	Device infection: 4
Seroma: 1	Revision: 2	Erosion: 3
—	—	Hernia: 1
Reoperation with new surgical modality:		
Initial TAP	Initial PEG	Initial IPP
IPP placement: 2	TAP: 1	PEG: 1
—	IPP placement: 2	—

IPP = inflatable penile prosthesis; PEG = partial plaque excision and grafting; TAP = tunica albuginea placcation.

to facilitate counseling and help manage many of the psychosocial issues that patients experience [4,18].

The mean follow-up was only 17 months, attributed in part to the relatively short 6-year study period, and that enrollment included patients who had surgery as recently as 2013. Also, in many cases, patients were referred from out-of-state and followed up with their preestablished urologist. The relatively short follow-up duration limits our ability to predict long-term success and patient satisfaction within this cohort. Several studies with long-term (>5 years) follow-up suggest progressive worsening of ED and shape with time. In regards to ED, Kalsi et al. did note a 15% incidence of sexual dysfunction soon after grafting surgery, which increased to 22.5% after 5 years [19]. Long-term follow-up at our institution shows similar rates of ED for grafted patients, determined to be 21% at a mean follow-up of 58 months [20]. At long-term follow-up, penile shortening was reported between 35% and 40% of patients who underwent grafting procedures, which also may be progressive in nature [19,21]. In regards to penile curvature following grafting, persistent minor curvature (i.e., <20 degrees) is reported in 9–20% of patients [19–21], while only 6% experienced a significant recurrence at long-term follow-up [21]. Long-term plication results, with a mean follow-up of 72 months, quote rigidity adequate for coitus in 90% and 7% had a residual curve [20]. All in all, there appears to be a low curvature recurrence rate, mild progression of ED, and perhaps shortening in long-term follow-up studies.

Other than a relatively short follow-up period for this contemporary study, there were several limitations. First, it is a retrospective review, although patients were prospectively assigned to a surgical procedure based upon our surgical algorithm. In addition, patient preference led to a certain degree of variability from the algorithm, albeit small. Some feared length loss with TAP and others refused prosthesis placement. For patients who declined an IPP, reconstruction without an implant was offered. However, patients were made to understand that a subsequent IPP might be needed. This occurred in four cases. As a minority of patients completed both psychosocial surveys, we acknowledge limitations to drawing definitive conclusions. However, we did appreciate striking effects on emotional well-being and relationships across the entire surgical cohort, regardless of the type of surgical procedure.

Conclusions

This contemporary single-center retrospective analysis suggests that adhering to a previously published surgical algorithm resulted in satisfactory outcomes in a complicated patient population. In fact, postsurgical satisfaction with penile rigidity, correction of deformity, and resumption of sexual intercourse was statistically equivalent when comparing TAP, PEG, and IPP cohorts. Patients should be counseled that the goal of surgery is to make them functionally straight and capable of penetrative intercourse. Given the serious emotional and psychological distress caused by PD, we suggest that those who appear unwilling to recognize the limitations of surgery should undergo psychological counseling before surgery.

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Conflict of Interest: Dimitri Papagiannopoulos: No conflicts. Emily Yura: No conflicts. Laurence Levine: Consultant and speaker for Coloplast, American Medical Systems, and Auxilium; speaker for Abbvie; and officer for Absorption Pharmaceuticals.

Statement of Authorship

Category 1

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Category 3

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Appendix 1 (PDIQ) [4,11]

1. Do you feel the presence of Peyronie's disease has affected your emotional status?
2. Has the presence of Peyronie's disease affected your relationship with your sexual partner?