CURRENT SURGICAL MANAGEMENT OF SEVERE PEYRONIE’S DISEASE

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Summary.- OBJECTIVES: To report the principles of penile re-sculpturing of different deformities caused by M. Peyronie: restoration of penile length, girth and shape with or without penile prosthesis implantation.

METHODS: In the period between February 2007 and March 2009, we performed grafting surgery for M. Peyronie in 98 patients aged between 24 and 72 years (mean 52 years). Penile deformities were different: dorsal curvature in 54 (55%), lateral in 7 (7%), ventral in 11 (11%), and combined curvature in 21 (21%); associated corporal narrowing was present in 24 patients (24%). Four (4%) patients presented isolated penile shortening without other deformity. Isolated diffuse corporal narrowing without shortening was found in two (2%) patients. Severity of curvature ranges from 60 to 90 degrees, mean 72. Thirty one (31%) patients had associated ED. Surgical options for severe Peyronie’s disease were: single grafting in 26 pts (26%), complex grafting including circular tunical incision in 36 pts (36%), and in patients with ED the same procedures combined with penile prosthesis implantation (37 pts, 38%). Surgical correction was based on measurement of the tunical defect and precise calculation of graft size and shape. Penile straightening and lengthening was achieved by equalizing of shortened penile side/s with the longest one (convex) and grafting. Penile width is reestablished with additional longitudinal incision/s and grafting; graft width is determined by measurement of difference in circumference between normal and narrowed part of the corpora. We used Intexen LP (AMS) as a grafting material in all cases.

RESULTS: The mean follow-up was 15 months (6-25). Mean penile length gain without prosthesis was 2.8cm (1.5-4.2) and with prosthesis 3.2cm (2-4.5cm). Insufficient straightening was in 5 patients (>15 degree) where Neuro Vascular Bundle (NVB) was limiting factor. Twenty four patients reported hypoesthesia and reduced orgasmic sensitivity that recovered spontaneously after 3-6 months. De-novo ED occurred in 6 pts and progression of disease in 6 patients. Infection occurred only in one patient with penile prosthesis implantation. Overall patients’ satisfaction was 95%.

CONCLUSIONS: Complete tunical reconstruction in IPP can be performed as a safe procedure by transversal, longitudinal and circular grafting with or without simultaneous penile prosthesis implantation. Maximum penile length, girth and shape restoration can be achieved using geometrical calculation, regardless of type of deformity.
**Resumen.** OBJETIVO: Informar sobre los principios de la cirugía reconstructiva de diferentes deformidades del pene causadas por la enfermedad de Peyronie: restauración de la longitud, perímetro y forma con o sin implante de prótesis de pene.

MÉTODOS: En el periodo comprendido entre febrero 2007 y marzo de 2009, se realizó cirugía con parche por enfermedad de Peyronie en 98 pacientes con edades comprendidas entre 24 y 72 años (media 52 años). Las deformidades en el pene eran diferentes: curvatura dorsal en 54 (55%) pacientes, lateral en 7 (7%), ventral en 11 (11%), y curvatura combinada en 21 (21%). 24 pacientes presentaban estrechamiento en el cuerpo cavernoso (reloj de arena) (24%). Cuatro (4%) pacientes presentaban acortamiento de pene aislado, sin otras deformidades, y en dos (2%) pacientes se encontró un estrechamiento cavernoso difuso aislado sin acortamiento. La gravedad de la curvatura varió de 60º- 90º, media 72. Treinta y un (31%) pacientes padecían disfunción eréctil asociada. Las opciones quirúrgicas para los casos graves de enfermedad de Peyronie fueron: injerto simple en 26 (26%) pacientes, injertos complejos incluyendo incisión circular de la túnica albugínea en 36 (36%), y los mismos procedimientos en pacientes con disfunción eréctil combinados con implante de prótesis de pene en 37 pacientes (38%). La corrección quirúrgica se basó en la medición del defecto de la túnica y el cálculo preciso del tamaño del injerto y la forma. El enderezamiento y alargamiento del pene se logró, mediante la nivelación del lado/s acortados del pene con el más largo (convexo) y el injerto. El ancho del pene se restablece con incisión/es longitudinal/es adicionales e injertos; el ancho del injerto se determina mediante la medición de la diferencia en la circunferencia entre las partes normal y reducida del cuerpo cavernoso. En todos los casos, se utilizó InteXen LP (AMS) como material de injerto.

RESULTADOS: El seguimiento medio fue de 15 meses (6-25). El incremento de longitud del pene fue de 2,8 cm sin prótesis (1,5-4,2 cm) y 3,2 cm (2,4-5,5 cm) con prótesis. En 5 pacientes (<15 grados), la corrección de la curvatura fue insuficiente, debido a que el haz neurovascular fue un factor limitante. Veinticuatro pacientes informaron de hipoestesia y sensibilidad orgásmica reducida que se recuperó espontáneamente al cabo de 3-6 meses. Seis pacientes presentaron una disfunción eréctil de novo y 6 pacientes progresión de la enfermedad. Sólo un paciente con implante de prótesis de pene sufrió infección. El índice de satisfacción general de los pacientes fue del 95%.

CONCLUSIONES: La reconstrucción de la túnica albugínea completa en la enfermedad de Peyronie puede realizarse como un procedimiento seguro por medio de injertos transversales, longitudinales y circulares con o sin implante simultáneo de prótesis de pene. Se puede lograr, mediante el cálculo geométrico, la longitud máxima del pene, el grosor y la recuperación de la forma, independientemente del tipo de deformidad.

**INTRODUCTION**

Peyronie’s disease is characterized by different penile deformities caused by albuginea fibrosis and shrinkage. The disease is almost always associated with penile shortening. It has major influence on quality of life and is often associated with serious psychological consequences. Incidence is 3-10% among the male population; it can be commonly found in man between 40 and 70 years; however it can also affect young population under 30 years (1,2). Peyronie’s disease is commonly associated with erectile dysfunction, ranging from 20 to 54% according to Usta et al (3).

The indication for surgery begins with having the stable disease. The concept of stable stable disease has not been clearly defined, but is generally accepted to be at least one year of disease and at least six months where there has been no change in the deformity and that pain has resolved. Progression of disease is uncertain, and there is no reliable parameter to predict it. The surgical candidate should also describe a compromise or inability to engage in coitus secondary to deformity or inadequate rigidity. In addition, a patient who has medical treatment failure and has extensive plaque calcification is a proper candidate for surgery. Lastly, the patient who wants the most rapid and reliable results should select a surgical approach.

Surgical treatment must be individualized, aiming not only at restoring penile function, but also restoring as much as possible the previous shape of the penis. Different techniques have been proposed in the past and different grafts materials were suggested to cover tunical defect, but at present time, none of them present the gold standard.

Our goal is to present personal experience in surgical treatment of severe Peyronie’s disease based on geometrical principle, i.e. complete restoration of penile length, girth and shape, with or without implantation of penile prosthesis.
MATERIALS AND METHODS

Between February 2007 and March 2009 we performed surgery on 98 patients with severe M. Peyronie based on geometrical measurement, using porcine acellular collagen matrix graft (Intexen LP, AMS) for albugineaal reconstruction. Mean patients’ age was 52 years (24 to 72). Penile deformities were: dorsal in 54 (55%), lateral in 7 (7%), ventral in 11 (11%), and combined curvature in 21 (21%); corporal narrowing in 24 (27%). Curvature on more than one site was presented in 15 (16%) patients. Four (4%) patients had only penile shortening without other deformity. Isolated diffuse corporal narrowing was in two (2%) patients. Severity of curvature ranged from 60 to 90 degrees, mean 72. Thirty one (31%) patients had associated ED (Table 1).

The indication for surgery was a severe penile deformity that made sexual intercourse difficult or impossible with symptoms for more than 12 months, and stable disease for more than six months.

Preoperative evaluation included complete clinical history as well as assessment of co-morbidities. Penile deformity, erection and rigidity assessment was performed subjectively using IIEF5 test (5) and objectively using intracavernous injection (ICI) of alprostadil (10-20ug). All patients that had severe to moderate ED (37 pts), based on IIEF5 score results (5-11) and ICI test were candidates for surgery with penile prosthesis implantation. Patients, whose IIEF5 test score was between 24 and 25 with normal ICI test, were considered for surgery without penile prosthesis implantation (54pts). We used also color doppler ultra-sound (DUS) for vascular assessment (arterial insufficiency and/or veno-occlusive dysfunction) as well as detection and localization of collateral vessels between dorsal and cavernous arteries.

Surgical alternatives

Operative techniques are selected according to the geometrically determined tunical defect after incision/s. The aim of surgery was restoration of a penile shape in a mean of straightening, lengthening and widening in order to satisfy patients expectations as much as possible.

After penile degloving, NVB is extensively mobilized starting paraurethrally in order to achieve sufficient length after albugineaal straightening and lengthening. Urethra was also mobilized in cases with ventral or lateral curvature. When NVB is involved by the plaque, it could be difficult to find proper plane of dissection and special care was taken not to injure its elements. Its elasticity was usually decreased and presented a limiting factor for proper penile lengthening in some patients. Full artificial erection is induced by PGE1 or intracavernous injection of saline after tourniquet placement for estimation of deformity. We applied several surgical techniques depending on found deformity: single grafting in 59 pts (60%), complex grafting including circular tunical incision in 39 pts (40%); simultaneous penile prosthesis implantation was implantation was done in 37 pts (38%) with ED.

Single graft procedure

Indication for this type of surgery is a penile curvature located one point. The width of tunical defect, i.e. graft is equal to the difference between longer convex and shorter concave side; their lengths were determined by measuring the distance between two circular lines marked perpendicularly to the proximal and distal normal, uninvolved parts of the albuginea. Level of transversal tunical incision is at the intersection points of proximal and distal axes marked on lateral corporal sides (Figure 1A). Incision should pass half of circumference with relaxing "Y" extensions at the edges to enable straight contour after graf-
ting. This way, the linear incision is transformed into quadrangular or hexagonal defect. Albuginea is undermined by mobilization of cavernosal tissue together with septum for 2-3 cm proximally and distally in order to allow its stretching and better redistribution under the graft (Figure 1B-D). In the case of calcified plaque, it is carefully excised, preserving uninvolved thin layer of tunica.

The shape of tunical defect, i.e. graft was quadrangular or hexagonal, depending on a degree of curvature and length of “Y” extensions. When hexagonal, the maximum graft width corresponds to the point of maximum curvature. Graft length was calculated by subtraction of un-incised part of albuginea from circumference. For ventral curvature, circular incision corporal goes over ventral and lateral sides with Y extensions dorsally (Figure 2A-D). For isolated lateral curvature incision starts under urethra, goes over affected side up to dorsal groove (Figure 3A-D).

Porcine collagen dermal acellular matrix (Intexen LP, AMS) was used as a grafting material in all cases. It is dehydrated and should be soaked into saline for 5 min before usage. Graft shape was created according to the described calculation. It is sutured to the albuginea using 4-0 PDS watertight running suture, turning smooth surface of the graft inside. Graft is also tacked to the septum using several mattress sutures to prevent bulging and to enable its better contact with cavernosal tissue in early postoperative period. Penile straightening and lengthening was estimated in artificial erection with saline (Figure 1D, 2D, 3D).

**Complex grafting**

This kind of grafting was indicated in cases with complex penile deformity: curvatures at more than one point, curvatures in more than one plane (i.e., dorsolateral, ventrolateral), curvature combined with penile narrowing, apical location of the plaque (floppy glans) and isolated corporal shortening or shrinkage.

In cases where curvature was in the same plane with two points of bending (at the same or at the opposite sides of the penis - S shaped penis) it is grafted on both places using described geometrical principle (Figure 4A, B). Proximal graft width is calculated as a difference between convex and concave side of proximal and middle normal part of the penis, and distal graft width as a difference between convex and concave side of middle and distal normal part of the penis.

When the curvature was combined, i.e. at one point in more than one plane, another principle was used. Normal proximal and distal parts are marked with two perpendicular circular lines and distances between them measured at several points all around circumference parallel to the longitudinal albuginal fibers. The longest, convex length is determined and the goal was to lengthen all shortened parts of albuginea to the same degree. The point of maximal shrinkage was on the dorso- or ventro-lateral side, where the graft was widest, too. Graft shape was irregular hexagonal.

When penile curvature was combined with penile narrowing, transversal grafting (described) was combined with proximal and distal longitudinal incision with Y relaxation at the ends and grafting. This way simultaneous penile widening was achieved. Longitudinal graft width is determined as a difference between normal and narrowed corporal circumference. The length of graft is corresponds to the length of the narrowing. Grafts are sutured to each other using 4-0 Prolene running suture, to avoid postoperative dehiscence (Figure 5A-C).

If plaque is located under the glans at the top of the corpora cavernosa, total penile disassembly was performed to enables approach to the tips of deformed corpora. Restoration of the tips of corporal bodies is done longitudinal or/and transversal incision, cavernosal tissue undermining and grafting using the same geometrical principle for restoration of penile length/girth (Figure 6A-E).

**Penile Prosthesis Implantation**

Patients with Peyronie’s disease and ED non-responsive to conservative treatment were candidates for penile prosthesis implantation. The patients first underwent reconstruction of penile length, girth and shape using described principles and then penile prosthesis implantation on a standard way (Figure 7A-D). In patients with diffuse disease and significant penile shortening albuginea was circularly incised, cavernosal tissue undermining and grafted (Figure 8A,B).

In our opinion, two complete circular incisions on two different levels are better than one, to avoid overstrecthing of cavernosal tissue, which occurs if only one circular incision is used (Figure 9A-F). Two or three pieces inflatable or malleable penile prosthesis is implanted, with the size compatible to the lengthened penis. Penile lengthening was always limited by the length and elasticity of NVB, as the urethra and cavernosal tissue stretches easily.
FIGURE 1. Simple grafting - dorsal curvature:
A). Geometrical measurement of tunical defect. Point of maximum curvature at intersection of two lines parallel to penile axis. Determination of the width of the graft, by measuring the difference in length of the shorter and longer side outside of affected corpora. Length of the graft is equivalent to the length of the circular incision, with a forked ends close to the urethra.

FIGURE 1B). Tunical defect is created, and erectile tissue is undermined.

FIGURE 1C). Grafting with Intexen LP.

FIGURE 1D). Complete lengthening and straightening in full erection.
FIGURE 2. Single grafting - ventral curvature: A) Severe ventral curvature.

FIGURE 2B). Hexagonal graft shape.

FIGURE 2C). Ventral grafting.

FIGURE 2D). Erection shows penile straightening and lengthening.

For isolated corporal narrowing two longitudinal lateral grafts are used for girth enhancement. (Figure 10A-C).
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FIGURE 3A. Single grafting - lateral curvature:

A) Lateral curvature.

B) Mobilization of urethra and NVB.

C) Grafting of one corpora cavernosa affected with a disease.

D) Complete penile straightening in full erection.

TABLE II. RESULTS OF CORPORAL RECONSTRUCTION BY GRAFTING PROCEDURE USING GEOMETRICAL PRINCIPLE, WITH OR WITHOUT PROSTHESIS

<table>
<thead>
<tr>
<th>Type of procedure</th>
<th>Nº. of pts</th>
<th>Follow-up</th>
<th>Length gain</th>
<th>Re-curvature &lt;15degree</th>
<th>De novo ED</th>
<th>Progression of disease</th>
<th>Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single grafting</td>
<td>59 pts. (60%)</td>
<td>6-25 meses</td>
<td>2.8cm (rango)</td>
<td>2 pts (2%)</td>
<td>2 pts (2%)</td>
<td>2 pt (2%)</td>
<td>/</td>
</tr>
<tr>
<td>Complex grafting</td>
<td>39 pts (40%)</td>
<td>(medio 15 meses)</td>
<td>1.5-4.2cm</td>
<td>3 pts (3%)</td>
<td>4 pts (4%)</td>
<td>4 pts (4%)</td>
<td>/</td>
</tr>
<tr>
<td>Grafting with penile prosthesis</td>
<td>37 pts (38%)</td>
<td></td>
<td>3.2cm (rango)</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>1 pt (1%)</td>
</tr>
<tr>
<td>Total</td>
<td>98</td>
<td>/</td>
<td>/</td>
<td>5 pts (5%)</td>
<td>6 pts (6%)</td>
<td>6 pts (6%)</td>
<td>1 pt (1%)</td>
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</tbody>
</table>
TABLE III. PATIENTS AND PARTNERS SATISFACTION.

<table>
<thead>
<tr>
<th>Degree of satisfaction</th>
<th>Patients satisfaction with sexual life</th>
<th>Partners satisfaction with sexual life</th>
<th>Patients overall satisfaction with surgical outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without prosthesis</td>
<td>With prosthesis</td>
<td>Without prosthesis</td>
</tr>
<tr>
<td>Very satisfied</td>
<td>36 pts (59%)</td>
<td>27 pts (74%)</td>
<td>32 pts (53%)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>20 pts (33%)</td>
<td>9 pts (24%)</td>
<td>24 pts (40%)</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>5 pts (8%)</td>
<td>1 pts (2%)</td>
<td>5 pts (7%)</td>
</tr>
</tbody>
</table>

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Postoperative physiotherapy

Daily PDE5 inhibitors are prescribed for 3-4 weeks starting 2-3 days after surgery in order to induce erections and increase penile blood flow. Patients are advised to use of penile stretching device approximately 2-3 weeks postoperatively and vacuum device 1-2 weeks later to prevent graft shrinkage and consequent penile shortening and re-curvature. Physiotherapy was applied for 4-6 months after surgery.

We also advised using of vacuum device in patients with penile prosthesis implantation.

RESULTS

Follow-up was from 6 to 25 months (mean 15 months). There were no intra-operative complications. Patients were re-assessed at 1 week, 1, 3, 6 and 12 months after surgery. Mean penile length gain without prosthesis was 2.8cm (1.5-4.2) and with...
prosthesis 3.2cm (2.5-4.5cm). In all cases of corporal narrowing, normal pre-disease penile girth was re-established. Re-curvature occurred in 5% of the patients (5 pts), but within a low range of curvature (<15°) and none of them required reoperation. Twenty four patients (24%) reported transient hypoesthesia and reduced orgasmic sensitivity that recovered spontaneously after 3-6 months. Postoperative Doppler ultrasound in patients without penile implant (61 patients, 62%) showed the same or improved values of PSV
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and EDV (Table II). The patient’s sexual activity erectile function was evaluated using IIEF5 test (4). In patients that underwent surgery without penile prosthesis implantation (61 pts), postoperatively IIEF5 test score

FIGURE 7B). Complex geometrical measurement in full erection.

FIGURE 7C). Complete sculpturing of the penis by several longitudinal and transversal grafts.

FIGURE 7D). Implantation of malleable prosthesis.
was 22-24 (no ED), in 54 patients (89%), while IIEF5 test score was 19-21 (mild) in 7 patients (11%). 54 patients had normal sexual intercourse 3-6 months after surgery, and 7 patients (11%) with IIEF5 test score 19-21 postoperatively used PDE5 inhibitors. De-novo ED occurred in 6 pts and progression of disease in 6 patients. The patients’ overall satisfaction with outcome of surgical procedure was: 5% not satisfied, 31% satisfied, 64% very satisfied. In cases with penile prosthesis implantation, satisfaction with sexual life of the patients (98%) and their partners (100%) was greater than without prosthesis (92%, 93%) (Table III).

Sexual intercourse was restored in all patients with penile implants that resulted in improved satisfaction and self esteem. Infection occurred in one patient with severe diabetes, 10 months after surgery. This case was resolved successfully three months later with re-implantation of the penile prosthesis.

DISCUSSION

The quest for the treatment of severe Peyronie’s disease constitutes a great challenge. Preoperative informed consent is critical for preparing the men with Peyronie’s disease for surgery. Many of these men are depressed, have marked reduction of self esteem, and often times have unattainable expectations re-
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1. **Current surgical management** of severe Peyronie’s disease is crucial in managing the outcomes from surgical reconstruction (4). Therefore, a detailed discussion on severity of curvature should be initiated with accepted goal of making the patient “functionally straight”, which we define as a curvature of less than 15 degrees. Informed consent also involves loss of penile length, diminished rigidity, sexual sensation and problems with orgasm and ejaculation. Patient must be informed that, in some cases, progression of disease is unavoidable, and there is no exact parameter to predict it. Progression usually appears after several months or within 2 or 3 years.

The variety of techniques showed that no consensus exists as to any single procedure that meets the needs of most patients. Albugineal grafting bares different potential risks and complications, including: ED, progression of disease, diminished orgasmic sensitivity, penile shortening, residual or recurrent curving.

Different grafts are used in the surgery of IPP, including autologous (dermis, vein, temporalis facia, tunica vaginalis, buccal mucosa) and non-autologous (processed human cadaveric: pericardium, dermis, fascia lata, dura mater; and processed animal grafts – xenografts: bovine pericardium, porcine small intestine submucosa, porcine acelular dermal matrix). The disadvantages of autologous grafting are: increased surgical time, increased morbidity and scar at the harvest site, the amount of tissue may be insufficient, especially for vein and penile crura autografts. In the past, personal experience with human cadaveric pericardium, bovin pericardium and a porcine small intestinal submucosa, showed many shortcomings. Postoperative outcomes are not solely dependent on type of graft used, but also on type of surgical technique used. However, there is no ideal graft available, but advance in quality of grafting materials is evident. In last two years, we solely used porcine acelular dermal collagen matrix (Intexen LP, AMS). This type of graft showed to be the most suitable for substitution of great tunical defects. It is readily in various sizes, has good tensile strength with thickness and consistency is similar to tunica albuginea; it provides excellent stability of grafted corporal bodies. It don’t produce inflammatory reaction and is very resistant to infection. Contracture of this graft is small if postoperative physiotherapy is applied properly. Holes, where were hair follicles, provide quick incorporation of blood vessels into the graft which induces creation of new fibrous tissue.

The majority of procedures that are using empirical grafting with small grafts result in residual curvature, sometimes even penile shortening instead of penile lengthening (6-8) (Table IV). Our technique is based geometrical calculation of place of incision and graft shape and size. (9-11) We introduced several modifications and additions to this technique with the goal to achieve restoration of pre-disease penile shape and size: hexagonal instead of rectangular shape of transversal graft to avoid dog ears at the

![Figure 9A](image1.png)

**Figure 9A.** Corporal lengthening - one circular incision, grafting and inflatable prosthesis implantation: A). Corporal lengthening with one circular incision, grafting and implantation of inflatable prosthesis (AMS 700 MS LGX).

![Figure 9B](image2.png)

**Figure 9B.** Arrow shows joining of circular graft.
lateral ends of sutured grafts and improve contour; correction of corporal narrowing in all cases with longitudinal grafting, for establishing normal corporal girth; double grafting in cases where two points of bending are present; avoiding postoperative graft bulging by its tacking to the septum.

The technique is based on tunical incisions irrespective of the plaque characteristics and localization. It may be used to correct all types of deformities. The dissection of the neurovascular bundle was standardized for all cases, using lateral approach. Complete preservation of the NVB is the most important. Its dissection may be limited or extensive, allowing maximum elongation according to the severity of Peyronie’s disease. The risk of lesion to the collaterals of the dorsal arteries is minimized with lesser dissection. Preoperative DUS can define the sites of these collaterals, when present. Information on penile arterial anatomy may be very useful to the surgeon in selecting the type of surgical technique to be used. Knowledge of the existence of significant collateral branches is important. Patient must be informed before making decision about two different types of surgery. If collateral arteries are to be destroyed, we strongly advice patient to accept restoration of corporal shaft, using grafts, with simultaneous implantation of penile prosthesis, due to ED. Otherwise, if we preserve these collaterals, plication procedures are performed with a consequence of penile shortening. Schaeffer et al report 44% of arterial anomalies, and 10% of distal collaterals between dorsal and cavernosal arteries (12). Kendirci et al correlated vascular status to the type of penile deformity, demonstrating a relationship between type of curvature and penile hemodynamic (13). Color Doppler ultrasound provides essential data for vascular assessment, arterial insufficiency or/and veno-oclusive dysfunction. Values of peak systolic velocity (PSV), greater than 40 cm/sec, and resistive index (RI), greater than 0.9, are considered good parameters for grafting procedure without penile prosthesis implantation. End diastolic velocity (EDV) values less than 5 cm/s indicate veno-oclusive dysfunction. EDV values greater than 5 cm/s are considered normal. During or shortly after DUS, penile rigidity is objectively compared to self-reported rigidity. If the rigidity is lower with the intra corporal injection test (ICI), both crura penis are pressed over the pubic bone to obtain maximum rigidity in order to assess actual penile deformity, while the other hand assess axial rigidity by pressing on the glans to mimic an attempt of penetration.

Midline dissection of NVB, that some authors use, is not suitable for correction of severe cases (14). Creation of full erection is of great importance for the

<table>
<thead>
<tr>
<th>Number of patients</th>
<th>Follow-up</th>
<th>Type of graft</th>
<th>De novo ED</th>
<th>Diminished orgasmic sensitivity</th>
<th>Curve recurrence</th>
<th>No change in biothesiometry</th>
<th>Not reported</th>
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</thead>
<tbody>
<tr>
<td>111</td>
<td>&gt;5y</td>
<td>human pericardium</td>
<td>24%</td>
<td>31%</td>
<td>Not reported</td>
<td>8%</td>
<td>Not reported</td>
</tr>
<tr>
<td>162</td>
<td>&gt;5y</td>
<td>SIS</td>
<td>21%</td>
<td>Not reported</td>
<td>12%</td>
<td>35%</td>
<td>41%</td>
</tr>
<tr>
<td>40</td>
<td>&gt;5y</td>
<td>vein</td>
<td>22.5%</td>
<td>Not reported</td>
<td>50</td>
<td>100%</td>
<td>60%</td>
</tr>
<tr>
<td>50</td>
<td>&gt;5y</td>
<td>vein</td>
<td>22%</td>
<td>Not reported</td>
<td>50</td>
<td>100%</td>
<td>60%</td>
</tr>
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</table>

| TABLE IV. PUBLISHED DATA OF MEDIUM TERM RESULTS OF GRAFTING Procedure. |
|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 111                    | >5y                    | human pericardium      | 24%                    | Not reported            | 8%                    | Not reported            | 31%                      |
accurate application of geometrical principles, and determination of appropriate tunical incision sites. The basic principle for corporal lengthening is equalizing shorter side with longer side. The difference between those two sides defines the width of the defect. Complete penile straightening is checked by penis traction after final tunical and septal incisions, and tunical dissection from the erectile tissue of corpora cavernosa. Its structure is similar to urethral spongiosum and although very elastic, it was also mobilized in order to enable penile straightening and prevent graft bulging. If NVB is limiting factor for penile straightening, its dissection may be extended. Urethra is never limiting factor for lengthening due to its elasticity. Only one incision and graft is used when the penis is curved at one point. If there are two points of bending, two incisions and grafts are necessary to straighten the penis. Complementary plication is avoided whenever possible, because it compromises advantages of geometrical principle in complete restoration of straightening, lengthening and widening of the penis. In all cases where implantation of penile prosthesis is indicated, restoration of penile shape by grafting is done first. In cases with isolated shortening of the penis, complete circular incision and grafting provides real corporal lengthening. Presented technique is effective for correcting all types of penile deformities regardless of plaque characteristics.

Postoperative penile pain is a common complaint and corresponds to sensory nerve recovery after operative stretching of the neurovascular bundles. Reassurance and analgesics prove to be, in most cases, temporary phenomenon.

Postoperative physiotherapy is started on a 2nd or 3rd postoperative day with PDE5 inhibitors (for 3-4 weeks) and continued with stretching (2-3 weeks postoperatively) and vacuum (1-2 weeks later) devices to prevent graft shrinkage and enable healing in both flaccid and erect state (15). They should be used during whole healing period – for 4-6 months (16, 17).

CONCLUSIONS

Surgical treatment of severe Peyronie’s disease based on geometrical principle is effective for extensive penile shaft reconstruction with correcting severe penile shortening and narrowing, resulting in maximum penile length gain and girth restoration regardless of plaque characteristics. Penile shape and size restoration is very important for self-esteem and patient satisfaction.

REFERENCES AND RECOMMENDED READINGS

(*of special interest, **of outstanding interest)