Male Reproduction Tract: Erection Abnormality

Geng-Long Hsu, Hsu's Andrology and National Taiwan University, Taipei, Taiwan

Glossary

Acquired penile deviation A condition that penile curvature results from external tethering force to penile shaft or internal fibrosis of the fibroskeleton of the penis. This term is diverted from the congenital penile deviation which develops without fibrosis within the penis.

Congenital penile deviation A status that penile curvature develops along with penile growing up at adolescence. It is always seen without remarked cause after adult life.

Erectile dysfunction A condition of inability either to attain or maintain a rigid erection for satisfactory coitus. The etiologies vary from iatrogenic to natural course including arteiogenic, neurogenic, psychogenic, pharmacologic, endocrinologic, cavernosal, and venogenic contributions.

Full erection A situation to describe a human penis attaining a complete erection. Both girth widening and length elongation are seen in addition to a rigid erection which is sustainable to buckling pressure.

Hourglass deformity A condition that a penile narrowing portion occurs in the middle penile shaft is so severe that an erectile penis looks like an hour glass.

Partial erection A situation that a penis fails to attain a complete erection resulting from internal penile structure dysfunction or external tethering limitation to the corpora cavernosa.

Penile dysmorphology A situation of the penis with a deformed shape when erection. A convertible term is a penile curvature which is a result of area differences between the convex and concave surfaces of the corpora cavernosa if bisected. It could be categorized as dorsal, ventral, left lateral, right lateral and combined types.

Peyronie's disease A chronic inflammation of the tunica albuginea of the corpora cavernosa in the human penis and also named as induratio penis plastica. It may involve the cavernosal sinusoidal trabeculae along the intracavernosal pillars while fibrotic scar initiated from the tunica albuginea. A painful erection is pronounced at earliest 3 months followed by penile deformity. Spontaneous subside may happen, however surgical intervention may require if deformity persists and interfere normal coitus.

Priapism A condition that persistent penile erection ensues despite no sexual arousal or even painful feeling which always results in detumescence.

Veno-occlusive erectile dysfunction A situation of penile venous leakage which is named to describe an inability of penile erection related veins being sealed off and consequently, fail to limit sinusoidal blood draining from the corpora cavernosa to systemic circulation in each erection bout.

Soft glans syndrome A situation complained by many males who acknowledge their glans penis is too weak to coitus. It is a general term that male subjectively feels one's glans penis being too soft. It may be inadvertently ascribed resulting from excessive drainage of penile erection related veins.

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Erection Norm in Human Penis

Anatomy Reason for Penile Erectile Function and Morphology

The human penis appears to be the most peculiar organ which owns its magic extensibility resulting from the hydraulic system which, consequently, attracts most attentions in the entire human body. Albeit human penis has been in its current anatomical form for 3000 centuries, its anatomy and the erection process are still not thoroughly depicted despite extensive studies had been made. Humans penis possess an os analogue associated with some proportionally large and extraordinarily extensible corpora cavernosa which are the ideal milieu to apply Pascal's law in the entire human body if no venous leakage exists. The law depicts that pressure applied to any part of the enclosed fluid transmitted undiminished to every portion of the fluid and to the walls of the containing vessel. The erectile capability of the human penis ensues then and largely depends on sinusoids in the corpus spongiosum, the glans penis within which a distal ligament, and the corpora cavernosa, which are also responsible for erectile rigidity and erectile penile shape. It seems that the human corpora cavernosa are destined to be vulnerable to erectile dysfunction if rigidity is essential for coitus, defined as inability either to attain or maintain a rigid erection for satisfactory coitus.

Penile fibroskeleton is a determinant structure for penile morphology (Fig. 1). Recent studies substantiate a model of the tunica albuginea of the corpora cavernosa as a bi-layered structure with a 360° complete inner circular layer and a 300° incomplete outer longitudinal coat spanning from the bulbospongiosus and ischiocavernosus proximally and extending continuously into the distal ligament within the glans penis. The above two muscles, the entire outer tunica and distal ligament of the penis could be collectively categorized as skeletal components. The inner layer contains and supports the sinusoids via intracavernous pillars, the erection-related veins, and artery which could collectively be allocated as the smooth muscle components. The delicate interplay between the vascular structures and tunica albuginea results in an erection process which is a mechanical phenomenon. The tunica outer layer plays a pivotal role in penile morphology and erection rigidity. The intracavernosal pillar is distributed between 2 or 10 to 6 O'clock positions (Fig. 1) in the penile pendulous portion and is commensurately abundant distally until the distal ligament meet. An abundant elastic component is characteristic for extraordinary extensibility evidenced by the flattened status (Figure, right lower) while presents markedly wavy appearance (Figure, left lower) which correspond to being stretched (erection) and tension free status (flaccid) respectively. Thus penile elongation and girth expansion occur predominantly between the retrocoronal level and penile base, we, thereafter, can acknowledge why and how the flaccid penile shape is not a matter of concern, and only erectile penile morphology is significant because satisfactory coitus requires healthy erectile function which depends upon the sinusoidal expansion. An anatomy concept is interestingly for acknowledging penile rigid erection and morphology.

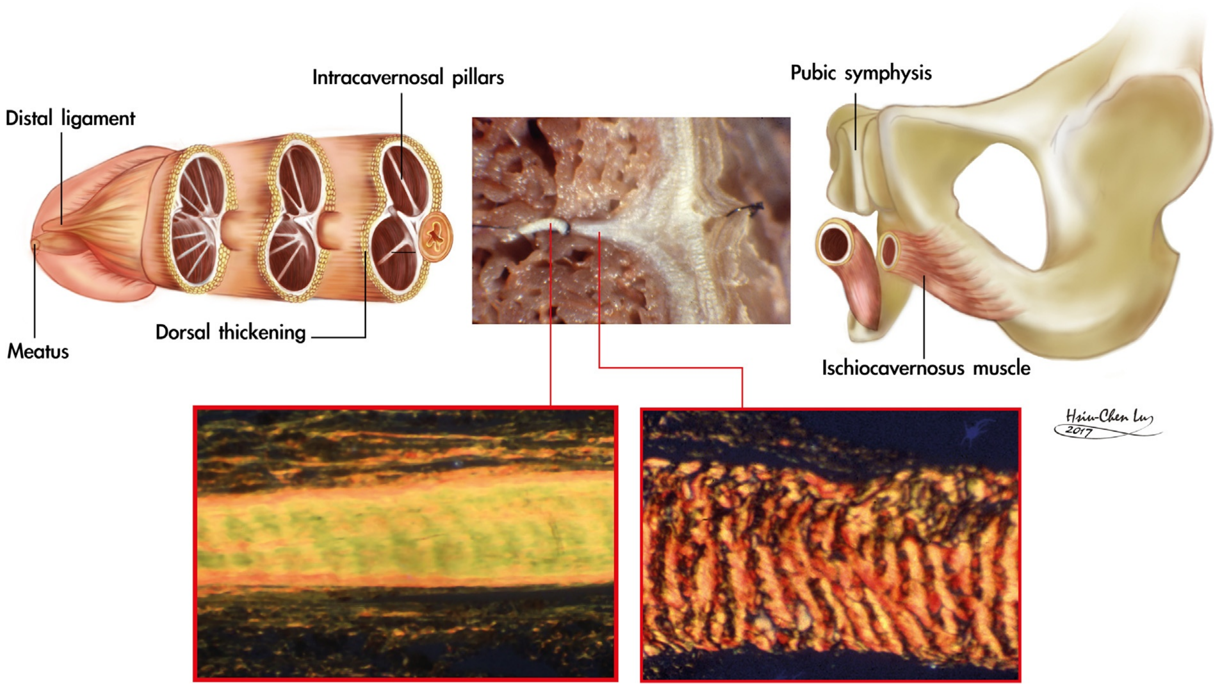

Fig. 1 Extensibility of the fibroskeleton in the human penis. A. The tunica albuginea of the corpora cavernosa is the principal structure of the fibroskeleton in the human penis. It is a bi-layered structure in which a 360 degrees complete inner circular layer, together with the intracavernosal pillars, contains and supports the sinusoids. The extensibility of the intracavernosal pillars (upper middle) is located from 2 or 10 to 6 O'clock positions to enhances the penile rigidity when erection. It can be stretched to a thinner and green appearance (Lower, left) while the collagen type 1 act as a steel-like supporter and the intertwined collagen type 3 shows off, which mimics the erection status. In contrast, simulating a flaccid status (lower, right), its pronounced wavy appearance results from elastic fiber relaxed and the collagen type 1 stands out. (Picrosirius red, 25 $\times$).

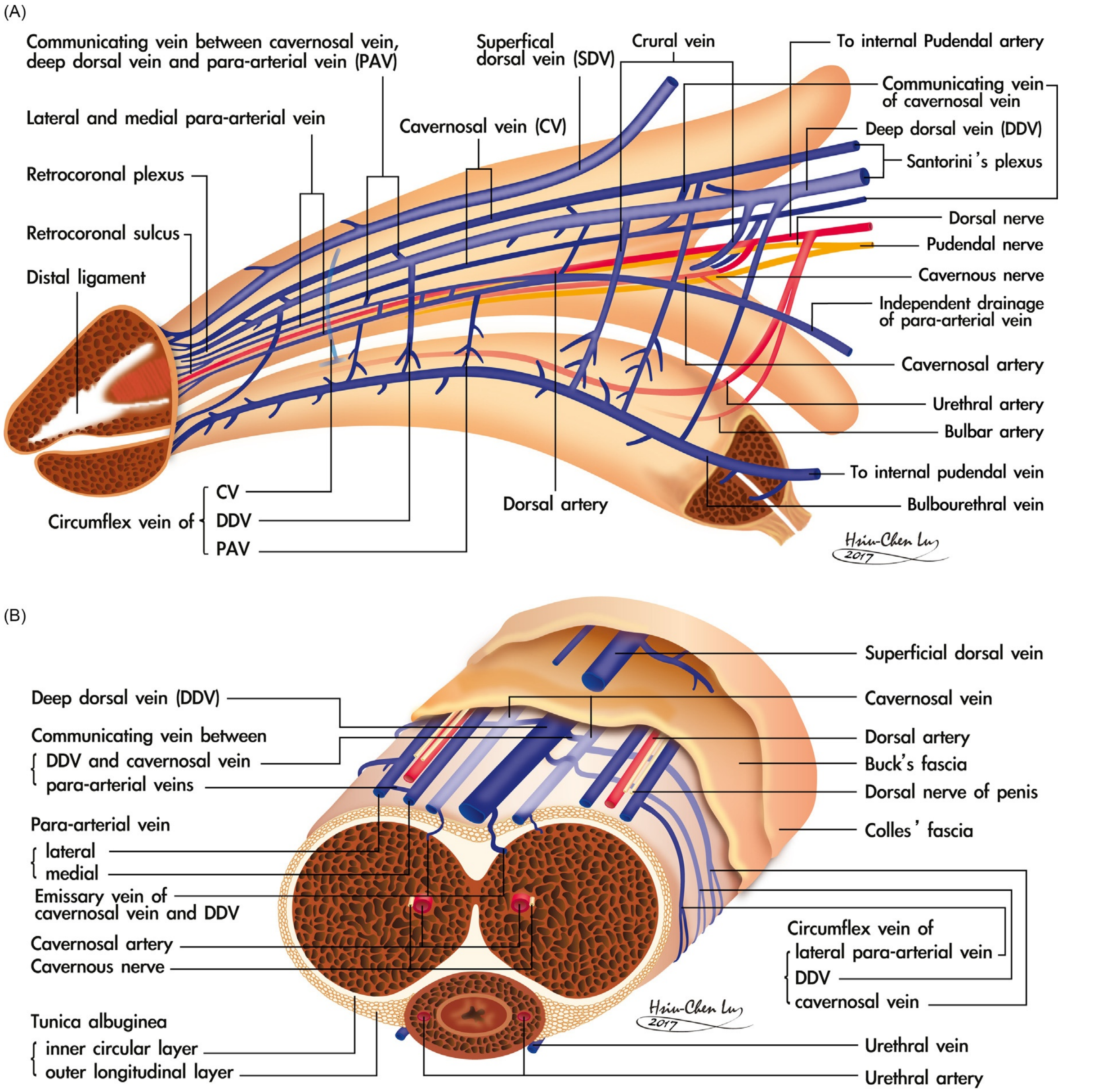

Fig. 2 Illustration of new penile vascular anatomy. (A) Lateral view: The glans penis is supported by a stout distal ligament (the *os penis* analogue) centrally just above the urethra. The DDV is consistently in the median position and receives blood of the emissary veins from the corpora cavernosa and of the circumflex vein from the corpus spongiosum. The DDV is sandwiched between the cavernosal veins (CV), but these lie at a deeper position. Bilaterally, each dorsal artery is respectively sandwiched by its corresponding medial and lateral para-arterial veins (PAVs). The pudendal artery and nerve are distributed in a similar manner but are relatively simple. (B) Cross section of the mid-penis. The corpora cavernosa is full with cavernosal sinusoids which are specific from that of the corpus spongiosum and glans penis. Note that the number of veins is seven (a larger count than the traditionally described singular vein), although it drops to four at the level of the penile hilum because each pair of the veins merges. The erection-related vasculature is arrayed in an imaginary arc on the dorsal aspect of the tunica albuginea. Thus, the penile vascular system still complies with the general rule in the body that the number of veins is normally higher than the number of arteries. Note the membranous urethra just connect the proximal end of the corpus spongiosum.

Although a rigid erection of the corpora cavernosa is initiated by either central or local sexual stimuli, a local penile response is a common endpoint. Therefore, we focus on the corpora cavernosa whereby a function speaks volume. Apart from the regular vascular system for nutrition via the capillaries, there is a system for erectile function in which sinusoids shunt directly from arterial to venous channels bypassing the capillaries. The main source of blood supply to the cavernosal sinusoids originates from the internal pudendal artery (Fig. 2) which is the end branch of the internal iliac artery, although accessory contributions may arise from the external iliac, obturator, vesical, and femoral arteries. The internal pudendal artery gives the first branch as the bulbourethral artery which supplies the sinusoids of the corpora spongiosum. The corpora cavernosa are primarily supplied by the cavernosal artery which is the second branch of the internal pudendal artery and most distally the dorsal artery which supplies the glans and the corpus spongiosum.

The sinusoidal blood drains directly to subtunica venous plexus, subsequently passing through the tunica albuginea via the emissary veins, and then to the deep dorsal veins, cavernosal veins and para-arterial veins independently, which are collectively called erection related veins because they drain the sinusoidal blood separately. This new understanding of penile venous anatomy is highly significant. Not only do we consider the traditional deep dorsal vein significant, but also the cavernosal vein, which distributes through the entire penile length and so does the para-arterial veins. The deep dorsal vein that lies consistently in the median position receives blood from the circumflex veins of the corpus spongiosum and from the emissary veins of the corpora cavernosa. Emissary veins (Fig. 2) run between the inner and outer layers of the tunica for a short distance, often piercing the outer layer bundles in an oblique manner. Therefore, and significantly, these emissary veins can be easily occluded by the shearing action elicited by the inner circular and outer longitudinal layers of the collagen bundles in the tunica albuginea.

The deep dorsal vein is sandwiched by cavernosal veins that are coalesced to one at the penile base. Bilaterally each dorsal artery is sandwiched by the medial and lateral para-arterial vein respectively. Veins from the glans penis form a retrocoronal plexus that drains predominantly into the deep dorsal vein, the cavernosal veins, the para-arterial veins, the urethral veins and the corpus spongiosum respectively. The deep dorsal vein courses proximally in the midline between the paired corpora cavernosa and empties into the periprostatic plexus. The superficial dorsal vein drains the skin and the subcutaneous tissue superficial to Buck's fascia and may have direct shunts to the corpora cavernosa. This, in turn, drains into the superficial external pudendal vein. If and only if the erectile function of corpora cavernosa is healthy, the penis not only expands in its girth but also increases in its length.

Erection Norm in Human Penis

Erection is a seamless interplay between psychologic, endocrinologic, vascular, neurologic, pharmacologic, and systemic metabolic health of the entire body. Implies a healthy erectile function depends upon the integral health of all systemic systems. However, it is not uncommon to encounter a disabled male with healthy erectile function, that is, the penile erectile function is free from disability in man suffered from spinal cord trauma. Whenever a sexual arousal ensues either from brain origin or from peripheral stimulation, a normal erection shall be subjected to a penis with healthy erectile function and ideal penile morphology. The former one is rudimentary while the latter issue is appropriate to engage in genital coitus. Therefore, we focus on the penis itself in this session. Although without a functional brain, it might be difficult to perceive sexual pleasure, in contrary, however, without a functional penis, the central order or coordination finds no effectors.

Regarding penile morphology, erection angle matters to fulfill natural coitus. Albeit sexual behavior is so individualized that there is no uniform, however, the missionary position is widely regarded as the most popular one which allows couple for close body contact and eye contact with kissing and talking throughout. Therefore, the erection angle may matter albeit it may not be a critical issue. This is the reason why there is a limited publication on penile erection angle which is more or less in normal distribution from o to 180 degrees (Table 1). Implies a mean may be in 90 degrees, however, clinically 120° may be more appropriate for coitus, otherwise, either a dorsal or ventral curvature should be considered. A severe ventral curvature is extraordinary awkward to do genital intercourse. Theoretically, most males are not in an ideal penile morphology. Erection angle may not be practical because it is simply a two-dimensional consideration.

Erection Dysmorphology

Penile Dysmorphology

An ideal penile shape is attractive to every male; however, it is very rare to encounter a perfectly ideal penile morphology in general population. Thus there is more or less a penile dysmorphology which is somewhat diverted from a geometrically neutral shape. The curvature is a result of area differences (two dimensions) between the convex and concave surfaces of the corpora cavernosa if bisected. How much is the area difference in the penis with dysmorphology? Given a dysmorphological penis can be fixed to a perfect shape, an excision of excessive tunica or a patch to the shortage tunica is the policy of reconstruction. Excision or patching surgery results in postoperative penile shortage or elongation respectively. In order to predict how much is the area difference (Fig. 3), via a calculus or geometry method, we develop a formula which is $\pi r^2 \theta / 45^\circ$ (Fig. 3A), where r is the penile radius in

Table 1 Demography of penile erection angle

Angle (degree)	*Percent of population (%)*
0–30	5
30–60	30
60–85	31
85–95	10
95–120	20
120–180	5

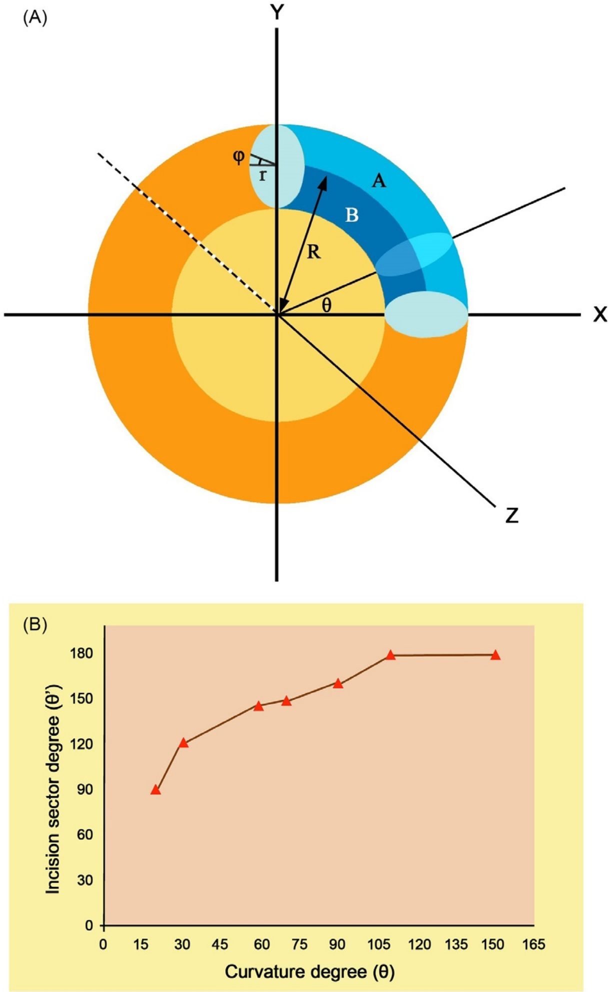

Fig. 3 Schematic illustration of discrepancy amount causing penile curvature. (A) A formula derived from calculus which is identical to that from geometry. Suppose that the center of a pipe revolves about the *Z*-axis by radius *R* as illustrated in the figure. Let S_1 and S_2 denote the outer and inner surfaces of the pipe, respectively. The difference in area between S_1 and S_2 is $S_1 - S_2 = \int_0^{\pi} 2\pi(R + r\sin\varphi) \cdot rd\varphi - \int_0^{\pi} 2\pi(R - r\sin\varphi) \cdot rd\varphi = 8\pi r^2$. Consequently, we can determine the difference in area for any degree, θ, and ΔS, which is independent of *R*, but dependent on the pipe radius, *r*, and θ: $\Delta S = \frac{S_1 - S_2}{360^\circ} \times \theta = \frac{\pi r^2 \theta}{45^\circ}$. (B) The relationship of the tunical incision sector and penile curvature degree. The incision sector (θ') and the curvature degrees (θ) is derived from goniometry. Seven curved penises of human cadavers with varied deviations of 20, 30, 60, 70, 90, 110, and 150 degrees respectively were collected. An 1–0 silk suture was put at the 12 o'clock position to serve as a guide of keeping the central line. The tunica was stepwise cut along the most curvilinear line until the penile shaft was straight. Subsequently, a curve of continuous parameters was then made with interpolation. The length of the patched veins required, consequently, was $2\pi r\theta'/\theta$. Note that a curved penis less than 110 degrees accounts for only approximation. Reproduction from Hsu, G. L. et al. (2006). Formulas for determining the dimensions of venous graft required for penile curvature correction. *International Journal of Andrology 29*(5), 515–520.

centimeters, and θ is the deviation of the curvature in degrees. Clinically, *r* can be calculated from half of the measures between the 3 and 9 o'clock positions in centimeters when the penis is artificially erected, and θ is the estimated deviation angle in each patient. Once the two-dimensional amount is determined, the second one from goniometry, $2\pi r\theta'/\theta$ (Fig. 3B), is good to predict the length (one dimension) of area difference resulting in dysmorphology. An engineering measurement can then be attainable.

Penile morphology is paramount in performing genital coitus. It is not uncommon to encounter tortured minds in many patients who had suffered from penile deformity resulting from acquired Peyronie's disease, congenital penile deviation and a variety of injury. Although the traditional anatomical paradigm of the tunica albuginea of corpora cavernosa has consistently overlooked the outer longitudinal layer which is the determined tissue of making penile morphology, the penile dysmorphology must suffer victims along with human history. The penile dysmorphology can be categorized to lateral, ventral and dorsal curvature in prevalent order, it can then be further assorted into left lateral, ventral, left ventrolateral, right lateral, left dorsolateral, right ventrolateral, dorsal and right dorsolateral curvature (Table 2). Thus left lateral deviation stands out followed by ventral, right lateral and dorsal curvature which is comparatively uncommon regardless it is resulting from acquired or congenital.

Table 2 The distribution of penile deformity

Direction of cure	*Number (%)*
Left lateral	54 (42.2)
Left ventrolateral	23 (18.0)
Left dorsolateral	5 (3.9)
Ventral	26 (20.3)
Dorsal	3 (2.3)
Right lateral	11 (8.6)
Right ventrolateral	4 (3.1)
Right dorsolateral	2 (1.6)
Total	128 (100)

Penile Morphological Reconstruction

In general, the effectiveness of either medical intervention or natural morphology restoration is unpredictable although several clinical trials have been launched. Clinically varied surgical methods have been introduced in an attempt to establish an ideal penile shape in addition to erectile function restoration. The first corporoplasty was debuted in 1965. This surgical solution is followed by modified tunical excision, tunical patches and tunical plication in an attempt to make an ideal penile shape. Tunical fashion is deemed required but the plication procedure. As a rule, there is not necessary to receive corporoplasty surgery until a satisfactory coitus is severely interfered by penile dysmorphology when erection. Subsequently, tunical plication was popular owing to simplicity and reproducibility. However, postoperative outcomes were not beyond controversy and so does reliability because erectile dysfunction may result from tunical defect and dysmorphology resumption. Penile corporoplasty for mature Peyronie's disease might be a good option for this complicated disease entity. A postoperative penile shortage should be avoided by all means, which is a problem that can be solved through grafting (Fig. 4). Therefore graft surgery may be recommendable although technically challenging. Many kinds of resources have advocated, among them autologous venous material might be the material of choice for covering a corporotomy defect because it's functional and histological compatibility. Likewise, similar procedures are feasible to

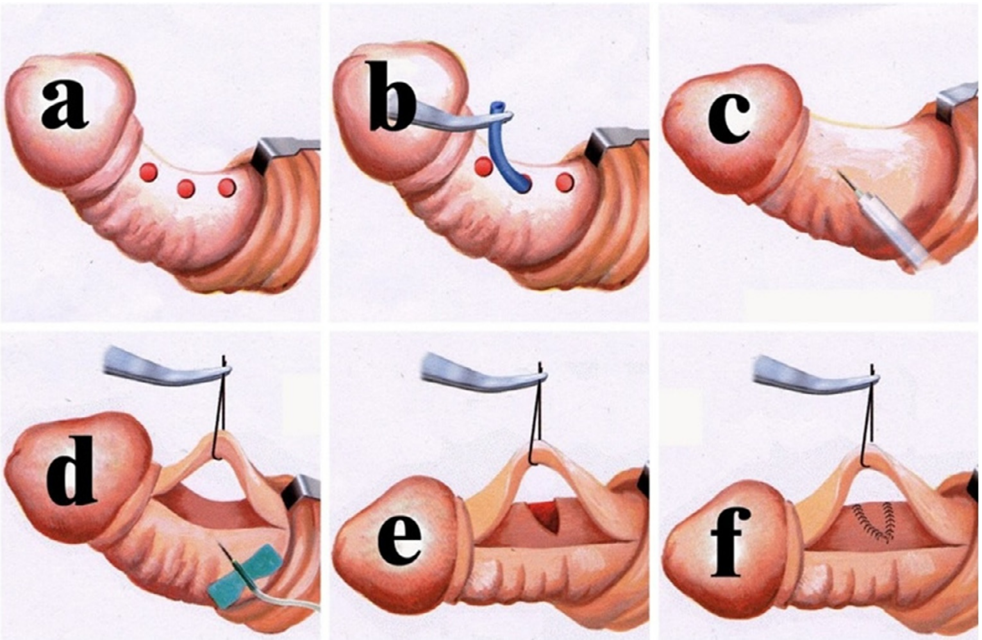

Fig. 4 Schematic illustration of penile autologous patched surgery. (A) A retrocoronal circumferential incision is made and the prepuce is degloved. The major branch of the deep dorsal vein is readily identified with a milking manipulation. Making an appropriate opening at the exits of the emissary veins, rather than making a complete opening on Buck's fascia, is done in order to perform the pull-through maneuver of the deep dorsal and cavernosal veins. (B) Completing the pull-through maneuver requires the surgeon to make 4–5 openings. The deep dorsal vein is stripped and doubly ligated with each emissary vein. This is preserved for patch material. (C) The hydro-dissection technique is used to facilitate the intact separation, the isolation, and the tag of the neurovascular bundle. (D) An artificial erection is generated, with normal saline via a 21G or 19G scalp needle, in order to determine where the depression center is, which is feasible for an incision. Using formulas for determining the dimensions of venous graft required for penile curvature correction. (E) An incision is made with a new, sharp surgical scalpel when the neurovascular bundle is well- protected until the penis is straightened. (F) The autologous venous grafting is fashioned to the tunical defect with a running suture of 6–0 nylon. It is then enforced at each centimeter. Eventually, an artificial small intestine submucosa has used to cover the patched area to enhance the tenacity which is sustainable to intracavernous pressure.

patients with congenital penile curvature undergoing penile corporoplasty. For anatomical consideration the deep dorsal vein and cavernosal veins were recommended although a controversy was addressed on its sufficiency, it appeared unequivocally sufficient after a scientific formula was developed, however (Fig. 3). This surgical intervention has become routine works in our practice since then. Relevant surgical solutions have been extended to use the autologous venous wall acting as the tunical inner layer (Fig. 4) and meanwhile, the porcine small intestinal submucosa functioning as the tunical outer longitudinal layer, which can achieve a prospective outcome. Of course, this challenging surgery warrants further research.

Erectile Abnormality

Pathophysiology of Erectile Dysfunction

The human erectile mechanism is an intricate interplay of hormonal, vascular, neurological, sinusoidal, pharmacological, and psychological factors, the relative influence of each respective component remains, however, somewhat unclear. What leads to an adequate erection is likely still not completely understood, with the current consensus remaining multifaceted and complex. There must be freed from a psychological disturbance, an intact neurological deficit, an imbalance hormonal profile, an adverse drug influence, a systemic disease, a dysfunctional artery and a fibrotic intracavernous tissue. Implies functional penis requires penile arterial sufficiency, normal sinusoidal tissue, and functional veins. Although there is no agreement on what would be the major contributor, there is a bias towards endothelial function due to the dramatic effects demonstrated by phosphodiesterase-5-inhibitors on erectile function.

Contrary to this, however, are recent hemodynamic studies on fresh and defrosted human cadavers whereby rigid erections were unexceptionally reproduced despite the lack of endothelial extensibility. Constant low perfusion rate was used to mimic arterial inflow, and the staged removal of erection related veins produced increasingly more rigid erections. Could it signify that those veins may, in fact, be the predominant factor that underlies erectile rigidity? Certainly, and in the light of our increased understanding of the penile vasculature, it would at least warrant re-evaluation of the role of the venous contributor for erectile dysfunction.

On penile tissue as the integral organ, the corpora cavernosa, skeletal muscle components unite smooth muscle components to meet the requirements for the erection and only allow vascular and nervous tissue to communicate with the systemic circulation system. Their anatomical relation is seems like a cluster of grape when the emissary vein is regarded as the grape trunk and each sinusoid as a fruit (Fig. 2). The rigid erection of the corpora cavernosa overall depends on cooperation among healthy sinusoids, a normal tunica, functional arteries, and competent erection related veins. Thereafter vascular dysfunction is an important cause of male erectile dysfunction. It can be classified as veno-occlusive dysfunction, arterial insufficiency, or mixed. Accordingly, the best option for restoring penile erectile function may be competence of penile erection related veins, restoration of penile arterial function and sinusoid rejuvenation.

Arterial Insufficiency

Penile arterial supply is the initial contribution of erectile function. In 1923, it was Leriche who recognized a connection between arterial insufficiency and loss of erectile function when he observed that endarterectomy of an occluded bifurcation of aorta did improve blood flow in the lower extremities and simultaneously marked the improvement of erectile capability. A dramatic enhancement of the cavernosal arterial flow is the primary initial process in obtaining a sinusoidal expansion in the paired corpora cavernosa, which is a result of smooth muscle relaxation. Any arterial lesion that compromises arterial inflow to the penis can lead to erectile dysfunction; this is particularly true for lesions in specific arteries such as the cavernosal and dorsal artery.

It is commonly agreed that the prevalence of the arterial disease increases with age and subsequently is a major cause of organic erectile dysfunction in men over the age of 50. Consensus shows that erectile dysfunction seems to be a bellwether for a development of coronary artery disease in asymptomatic men, and both diseases share the same medical conditions and risk factors such as diabetes mellitus, hypertension, hypercholesterolemia, hyperlipidemia and smoking habit etc. Of course, erectile dysfunction can be due to atherosclerotic or traumatic arterial occlusive disease. Furthermore, in arteriogenic erectile dysfunction, the corpora cavernosa shows lower oxygen tension, which, in turn, may result in a decreased volume of sinusoidal smooth muscle and subsequent venous leakage, ensues. In an experimental animal model, rabbits with iatrogenic iliac atherosclerotic disease demonstrated alterations in their downstream penile arteries and a reduction in cavernosal smooth muscle content. The pathogenesis of erectile dysfunction in these patients is likely to be related to endothelial dysfunction. These alterations were associated with decreased nitric oxide synthase (NOS)- and NO-mediated relaxation of sinusoidal tissues in the corpora cavernosa. In those whose erectile dysfunction is owing to traumatic stenosis of pudendal or cavernous arteries has been noted in young men with long-distance cyclists or pelvic trauma, the ultimate goal of the arterial reconstruction is to provide an alternative arterial pathway to bypass arterial lesions that cause obstruction in the hypogastric-cavernous arterial bed, and offers an option for potential cure.

Veno-Occlusive Dysfunction

This may be specific to excessive venous drainage. Early detumescence and insufficient rigidity are the common symptoms. In 1873, the Italian Francesco Parona injected varicosity dorsal penile vein of an impotent young patient with hypertonic saline in order to cause sclerosis and subsequently reduce the excessive venous outflow. Subsequently, the concept that erectile disorders might be treated surgically by occluding venous channels from the penis was materialized as early as the turn of the 20th century such as

Henry Raymond, James Duncan, Joe Wooten and Frank Lydston in 1895, 1895, 1902, and 1908 respectively. Exemplified in 1902, Joe Wooten suggested, as a justification for this type of surgery, the hypothesis of atonic impotence, claiming that it is the result of the loss of smooth muscle tonicity in the corpora cavernosa, resulting in dilated veins and sinusoids at that level. Later in 1908, Frank Lydston published his results on 100 venous ligation procedures reporting that 50% of his patients were definitely cured and that the rest had improved their sexual function. Lydston claimed, as an explanation for these good results that he ligated not only the superficial dorsal vein but also the deep dorsal vein of the penis, as well as collateral veins, courting penile tumescence, along with a sensation of enlargement of the penis which boosted the psychological confidence of patients in the effectiveness of this technique.

Beginning in the 1930's Oswald Swinney Lowsley combined simple dorsal vein plication with a surgically more advanced perineal crural technique in which he plicated the bulbocavernosus and ischiocavernosus muscles with several mattress sutures. After his initial report in 1935, he could follow-up 273 patients of the more than 1000 patients operated upon in his later publication from 1953. Afterward, as urologists embraced different techniques of vascular surgery and transplantation, attempts to resolve erectile dysfunction were directed towards the possibility of producing a greater blood supply through arterial revascularization techniques and meanwhile limiting venous drainage through venous ligation. These techniques of venous surgery disappeared from medical literature until in the 1980's the rebirth of venous surgery took place as a result of the new field of investigation of erectile physiology.

Unfortunately, a severe restraint of penile venous surgery for treating erectile dysfunction has been recommended since 1996 thus far. Every treatment modality must be somewhat effective; otherwise, repeated experiments would not be performed on the human body. This principle is applicable to all methods of penile venous surgery. It justly deserved to be condemned and abandoned if its erection restoration outcome is disappointing and it is seemingly unavoidable on adverse side effects, such as irreversible deformity and permanent penile numbness. Despite these drawbacks, our method of penile venous stripping with venous ligation is performed at the exits of emissary just closest to the outer tunica has been developed with the inspiration of patients' positive response in tandem with the advances of penile tunical and venous anatomy associated with the erection mechanism since 1986. We applied a refined penile venous stripping in many thousands of patients under acupuncture-assisted local anesthesia on an outpatient basis. It ultimately won the USPTO (The United States Patent and Trademark Office) patent on August 14, 2012. Although currently, we recommend penile venous stripping to patients who are nonresponders to phosphodiesterase-5 (PDE-5) inhibitors, we always fail to decline patients who are recommended by operated patients.

The problem is how to identify those offensives veins? Recently, computerized tomography-cavernosography is advised to be most advanced, however, after our chronic observation; it appears that the penile venous anatomy per se is only demonstrable via a pilot set of cavernosography and the veno-occlusive dysfunction physiology is appropriately documented via pharmaco-cavernosography (cavernosograms after working of intracavernously injected vaso-active agent such as prostaglandin E1). Those offensive veins can be enhanced visible once via squeezing manipulation after larger veins are shuttled down. Totally the ligation sites up to 132 positions. Albeit it seems technical challenging, this innovative method turns the venous surgery for treating erectile dysfunction from one that has been abandoned to a curable option because its prototype has been sustainable since 1986.

The current consensus of most urologists is that ED is due to the cavernosal factor, an inability to achieve a rigid erection is attributed to the loss of smooth muscle relaxation and fibrous compliance. We observed in our study, however, that reaching a rigid erection was actually a hemodynamic phenomenon, in which Pascal's law could be applied to be performed. We then shifted our focus to fresh cadavers with inspiration drawn from the trauma history gained during World War II by Newman HF. It was discovered then that the corpora cavernosa was easily accessible for the purpose of blood transfusion in emergency situations where no peripheral vein was available. Amazingly, a rigid erection ensured regardless of the absence of vital signs in a wounded soldier when the transfusion speed exceeded 25 mL/min. After penile venous stripping, the induction flow was notably less than prior to removal. The maintenance flow of most subjects was also much lower than the normal arterial in attaining a sufficient erection, thereafter, the role of venous surgery in treating erectile dysfunction deserves reevaluated? Although venous surgery for erection dysfunction has been criticized for not being durable, the recurrence of sexual inadequacy on operated patients, however, has not been supported by any evidence of regeneration of the venous vasculature. Accordingly our chronological research and clinical application for over three decades, we found that not only the veno- occlusive dysfunction is the predominant cause of erectile dysfunction, but also the penile venous stripping is categorically a viable option at a negligible complication at an ambulatory basis. In contrast, an obstructive penile venous drainage is also a severe medical problem. It is renowned as a condition of priapism which the penile venous drainage is significantly hindered resulting from sickle cell anemia or straddle injury, which will be illustrated more.

Clinical Relevance Erection Abnormality

Disease of Venous Drainage Blockage

In a normal situation, the penile detumescence occurs when cavernous blood dissipates via erection related veins after an erection bout. A priapism develops resulting from persistent, over 6 h, a penile erection occurs if venous drainage is compromised despite no sexual desire or even painful suffering. It may be induced by drug, trauma or disease such as leukemia and sickle cell anemia. It is commonly classified into ischemic, nonischemic and recurrent ischemic types. The most common one is ischemic priapism which happens when blood does not adequately drain away from the corpora cavernosa. The penile erection veins are not completely blocked in the nonischemic priapism which is typically resulting from a shunt formed between the corpus spongiosum and an artery or disruption of the nerve of parasympathetic nervous system.

Medical history and physical examination is the first impression of the priapism and then is further documented by sonography and cavernosal blood gas analysis. The most common cause of ischemic priapism is sickle cell disease followed by medication such as selective serotonin reuptake inhibitor, cocaine, and cannabis, intracavernous injection agent including papaverine and prostaglandin etc. Ischemic priapism is typically advised with a nerve block for pain relief followed by aspiration of blood from the corpus cavernosum. A cavernosal measurement is an advice by cold normal saline irrigation or phenylephrine injection if no obvious effectiveness, whereas nonischemic priapism is often treated with cold packs and compression. Shunting surgery may be required if usual measures are not effective. Priapism may lead to permanent fibrosis of the corpora cavernosa so severe that it sustains an erectile dysfunction or penile dysmorphology.

Disease of Penile Excessive Venous Drainage

Excessive penile venous drainage appears to be the most popular etiology resulting in erectile dysfunction. Penile veno-occlusive dysfunction is newly termed instead of venogenic erectile dysfunction or penile venous leakage, new treatment modality is limited but the first line usage of phospho-di-esterase-5 inhibitor. In young males younger than 40 years, it is unexceptionally noted to have excessive venous drainage veins once psychological influence is ruled out. Unfortunately, they are always refractory to phospho-di-esterase-5 inhibitors. Their symptoms include insufficient rigidity, early detumescence, loss of morning erection, position dependent impotence, soft glans syndrome and gradual onset of early ejaculation.

Since 1986 we have successfully treated many hundreds of young males who suffer from venous leakage, this denotes that venogenic erectile dysfunction is real and the current medical community should reevaluate this disease rather than just ignore this disease entity. The corpora cavernosa is nutritious with blood and susceptible to the rapid development of the venous drainage speed to override the penile arterial supply. Therefore it is understandable to acknowledge the controversial disease.

Disease of Penile Arterial Insufficiency

A functional penile artery is a prerequisite for erectile function. Similar to other kinds of cardiovascular disease, arterial vasculogenic causes of erectile dysfunction increase with age and are most prevalent in those with risk factors for atherosclerosis such as diabetes, hypertension, hyperlipidemia, smoking, and obesity. Traumatic events, which occur more often in younger men, are due to pelvic and/or perineal trauma. Arterial insufficiency can be detected using color Doppler ultrasonography, if the peak systolic velocity is less than 25 cm/s. Angiography, while being the benchmark for all arterial investigations, is reserved with the aim of concurrent arterial revascularization or angioplasty if a penile arterial stenosis is suspected. Recently a penile arterial stent is revisited with a controversial result.

Diseases of Corporeal Fibrosis

Corporal fibrosis usually occurs after Peyronie’s disease, refractory low-flow priapism, the chronic intracavernous injection of vasoactive drugs, explantation of an infected penile prosthesis and severe penile trauma etc. Peyronie’s disease is a connective tissue disorder which involves the tunica albuginea. It is commonly ascribed to repeated microtrauma on the tunica albuginea and sinusoidal tissues, which extends to involve the corporeal body. Specifically, scar tissue tethers sensation nerve will cause pain which may last for the first 3 months and then reach a mature stage in 1 year. It always present with erection dysfunction, loss of girth and penile length, penile dysmorphology and even hourglass deformity. A variety of treatments have been used, but none have been especially effective. Tunical patch surgery may be required if it is refractory.

Further Reading

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