

Original Article | **Non-Tensile Tunica Albuginea Plication for the Correction of Penile Curvature**

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ABSTRACT

Objective: To evaluate the efficacy of non-tensile tunica albuginea plication (NTTAP) using non-absorbable sutures for the correction of congenital and acquired penile curvature and to determine the key points for a successful outcome of this procedure.

Patients and Methods: From June 2004 to July 2007, 43 patients with penile curvature (35 congenital and 8 secondary to Peyronie's disease) underwent surgical correction by NTTAP. The indications were difficult or impossible vaginal penetration, and a cosmetically unacceptable penis. For tunica albuginea plication (TAP) we applied the 16 dot procedure using non-absorbable sutures (Tycron® 2/0 polyester fiber).

Results: After a mean follow-up period of 18 months, successful results with respect to penile straightening, normal erection, penetration and sensation, confirmed both subjectively and objectively, were achieved in all patients. Post-operative penile shortening of less than 1.5 cm was present in 50% of the cases, but did not affect intercourse. Post-operative complications were mild and reversible; they consisted of penile skin necrosis after circumcising incisions and post-operative pain upon nocturnal erection that subsided after a few weeks with the frequent use of ice compresses. The overall satisfaction rate was nearly 100% (35/43 very satisfied and 8/43 satisfied).

Conclusion: NTTAP is a simple and effective method for the correction of congenital and acquired penile curvature. The key points for successful outcomes are: clear identification of the line of maximum curvature, adequate pre-operative evaluation, counseling of the patient to set appropriate expectations, and careful discussion of the location of the suture sites. There is no need for mobilization of the urethra or neurovascular bundle, which adds a great advantage to this easy and simple technique. Cutting through the tunica albuginea, which may prevent post-operative erectile dysfunction, is not necessary. A disadvantage of this procedure is that it cannot correct hour-glass deformity.

Keywords : Plication procedure, Peyronie's disease, penile curvature

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INTRODUCTION

Penile curvature can be either congenital or secondary to Peyronie's disease (PD). Patients with penile curvature may complain of painful erection, discomfort during intercourse, difficult or impossible penetration and/or erectile dysfunction (ED) which may be either organic or secondary to psychological troubles caused by the deformity¹.

The true prevalence of congenital penile curvature (CPC) is difficult to determine due to the fact that patients with CPC do not seek medical advice except at an older age when they become sexually active. In the only study that reviewed the incidence of true CPC, 3 out of 500 patients had true CPC². Unfortunately, most studies reporting techniques for surgical correction mix acquired curvature with CPC.

Peyronie's disease, named after a physician of Louis XV, Francois Gigot de la Peyronie³, is characterized by the formation of fibrous plaques in the cavernous body causing penile curvature which may be severe enough to preclude vaginal penetration. Correction of CPC and penile curvature secondary to Peyronie's disease is a challenge for the practising urologist. There is a variety of non-surgical treatments, including intralesional injection and traction therapy which may be considered particularly in patients with unstable disease, or who are not interested in surgery. Surgical options for the correction of such deformities include wedge resection/plication operations, plaque excision/incision with grafting procedures and the placement of a penile prosthesis⁴.

Nesbit was the first to describe the method of corporeal plication, but he recommended the use of non-absorbable sutures, as absorbable sutures had caused a recurrence of penile curvature⁵. Corporeal plication as a valid treatment of PD was then popularized by Essed and Schroeder⁶ as well as by Ebbehøj and Metz⁷. In 1998, Baskin and Lue⁸ described the technique of multiple parallel plications for correction of penile curvature in 10 young patients. Four years later, Gholami and Lue⁹ modified the procedure using a 16 or 24-dot minimal-tension technique.

In this study, we evaluated our early experience with non-tensile plication of the tunica albuginea, its efficacy and patient satisfaction after this surgical procedure.

PATIENTS AND METHODS

From June 2004 to July 2007, 43 patients with a mean age of 33 (range 18 – 55) years underwent surgical correction of congenital or acquired penile curvature (35 CPC and 8 PD) by using the non-tensile plication technique.

Indications for surgery included a penile curvature of more than 45 degrees, difficulty or inability to achieve vaginal penetration, cosmetic reasons or psychological troubles. In addition, requirements in patients with PD included stable disease for at least 6 months,

stretched penile length >12 cm, and sexual potency or ED responding to oral medication. The stretched penile length was measured on the dorsal surface from the pubic bone (after depressing the prepubic fat pad) to the tip with the patient in the supine position. Patients with a penile length < 12 cm were counseled thoroughly regarding possible shortening of the penis after the procedure, and they were offered alternative surgical procedures. Patients with a hinge effect, hour-glass deformity or a short penile length and those not responding to oral pharmacotherapy were excluded from the study.

Overall, 30/35 patients with CPC were complaining of a poor self-image due to their penile curvature, while the remaining 5 were complaining of difficulty with intercourse. In the 34 patients with CPC 34 had a ventral penile curvature, and one had a left lateral curvature.

The patients with PD complained of discomfort during sexual intercourse and/or the inability to perform sexual intercourse caused by the curvature. All patients with PD were examined pre-operatively for the site, size, and number of plaques. All 8 patients had preserved sexual potency in spite of the existing disease. Three patients had a dorsal curvature, while 4 had a lateral curvature and one presented with ventral curvature.

The medical condition of our patients was assessed thoroughly, including history of trauma, medication and previous penile surgery. The condition was discussed with the patients and the surgical procedure was clearly explained with regard to the expected post-operative penile length and the possible penile shortening. The patients were informed about the fact that they might feel some soft knots underneath the penile skin which will be permanent but mostly not painful and about the possibility of pain during normal physiological nocturnal erections and the expected duration of these symptoms, as well as about how to manage this complication. They were informed about the expected post-operative penile numbness which may last for a few months, and they were assured that this

Table 1: Patient characteristics and results of surgery

Preoperative data	
Number of patients	43
Age (years) (mean, range)	33 (18-55)
Follow-up (months) (mean, range)	19.7 (3-29)
Number of patients with ventral curvature	36
Patients with dorsal curvature	3
Patients with lateral curvature	5 (3 left and 2 right)
Penile curvature	
mean (range)	52.5° (20°-90°)
<30° (lateral curvature)	4
40°-60°	35
>60°	4
Postoperative results	
Straightening	42 (98%)
Residual curvature <15°	1 (2%)
Early complications	
Wound infection	1 (2%)
Hematoma (self limiting)	6 (14%)
Penile skin necrosis	8 (19%)
Urethral injury	0
Late complications	
Penile shortening (1-1.4 cm)	21 (49%)
Palpable knots	30 (70%)
Penile paresthesia	5 (12%)
Pain on erection	14 (33%)
Erectile dysfunction (de novo)	0
Satisfaction grades	
Very satisfied	35 (81%)
Satisfied	8 (19%)
Dissatisfied	0

is a self-limiting complaint. Patients worried about their erectile function were assured that this type of surgery does not usually affect erectile function unlike the grafting procedures in which there is a reported higher risk.

Pre-operatively penile doppler was done in all patients with PD to assess calcification and blood flow parameters, and to measure the pre-operative deformity during the erect phase.

In all patients 30 mg of papaverine or 20 µgm of prostaglandin E1 (PGE1) was injected intracorporeally in order to induce

erection, and a photo was taken to document the pre-operative angulation. In this study we encountered ventral, lateral, dorsal and combined curvatures (e.g. ventrolateral) (Table 1).

All operations were done under spinal anesthesia with the patient in the supine position. First we injected 60 mg of papaverine intracorporeally 2-3 minutes before scrubbing in order to induce full erection.

The operative procedure performed in this study was the one described by Gholami and Lue⁹ with the only difference that we used spinal anesthesia.



Fig. 1A: Ventral penile curvature, dissected deep dorsal vein.



Fig. 1B: Knots tied down away from the tunica while straightening the penile shaft.



Fig. 2A: Dorsal penile curvature, midline ventral incision and marking dots (16 dots).



Fig. 2B: Dorsal penile curvature, tying the knots down to straighten the penile shaft.

For ventral curvature and ventrolateral curvature a circumcising incision was done, the penile layers were dissected down to Buck's fascia which was incised in the midline. The neurovascular bundle was seen but not dissected; a surgical hemostat was used to create the spaces of the knots in between the dorsal vein and the dorsal artery. In 4 cases we had to resect the deep dorsal vein from its bed to have a space to put the sutures (Fig.

1A). The center of maximum curvature was marked using a surgical marking pen, the dots were placed horizontally on both sides of the dorsal vein and medial to the dorsal artery of the penis. Four dots were placed on each side of the vein, both above and below the marked central line. Then non-absorbable braided sutures (2/0 polyester fiber - Tycron®) were placed taking the full thickness of the tunica albuginea (Fig. 1B). Four pairs of sutures

were taken (one for each 4 dots). A single surgical knot was placed and clamped with rubber-shod clamps in a non-tensile fashion making sure that the knot was tied away from the tunica even during tumescence (Fig. 1B). When all plication sutures had been placed, all members of the surgical team examined the erect penis for its straightness. Once the previously made surgical knots were approved by all, we tied 5 more knots with minimal tension so that the suture material was not causing any strangulation of the tunica albuginea.

For dorsal curvature, a midline ventral longitudinal penile incision was made down to the dorsal fascia. The corpus spongiosum was identified and 1 cm of the corpus cavernosum was dissected on both sides of the spongiosum to clear the tunica albuginea. The marking dots were placed both above and below the center of the maximum curvature and the sutures were placed 2-3 mm lateral to the corpus spongiosum (Fig. 2 A, B).

For lateral curvature, we also used a circumcising incision. Dissection of the neurovascular bundles started just laterally to the corpus spongiosum up to the dorsal aspect of the penis. It is not mandatory to dissect the neurovascular bundle bilaterally, as our aim was to expose the tunica albuginea on the convex side of the penis and to ensure that suture placement will not injure the nerve fibers.

The penile length was measured with a measuring tape immediately before the plication procedure and after achieving a straight penile shaft to record the degree of penile shortening. At the end of the procedure, usually the penis was still rigid, so corporeal blood aspiration was done using a 19 gauge scalp vein needle with intermittent 500 µgm phenyl-epinephrine injection every 3-5 minutes until complete detumescence. The injection site was thoroughly closed with 5-0 polypropylene (Prolene®) or polyglycolide-trimethylene carbonate (Maxon®) sutures to avoid hematoma formation. The penile layers were approximated and the penile skin was

closed using 4-0 polyglactin 910 (Vicryl®) sutures.

A coban (3M) or elastoplast dressing was used to cover the penis and the patient was transferred from the operating room to the surgical ward and advised to apply ice compresses on his penis starting from 6 hours post-operatively, especially during the first night. The patients were discharged from hospital 6-8 hours post-operatively. They were seen on the second post-operative day to renew the dressing and then followed up on a regular basis. All patients were advised to refrain from any sexual activity for at least 4-6 weeks post-operatively.

The patients were reassessed every 3 months post-operatively for 1 year, then every 6 months thereafter with regard to any complications encountered and their satisfaction with the operation..

RESULTS

The patients were evaluated post-operatively every week up to 4 weeks to ensure a smooth healing process and to detect complications. Early post-operative complications included nocturnal pain in 20%, post-operative skin necrosis after the circumcising incision in 19% and self-limiting hematoma in 26% of our patients. Superficial wound infection was encountered in one patient who did not comply with the dressing schedule and antibiotic regimen.

Six and 12 weeks post-operatively, the patients were assessed with regard to straightness, palpable knots, paresthesia and painful erection and the occurrence of de novo ED. The results are shown in Table 1.

35 (81%) patients were very satisfied with the results of the operation, 8 (19%) were satisfied; none was dissatisfied. 42 (98%) patients reported complete penile straightness, while one patient reported a residual curvature <15 degrees which was not a major concern for him.

DISCUSSION

The ultimate goal for surgical correction of CPC and penile curvature secondary to PD is to enable the patient to perform satisfactory intercourse with a straight penis. At the same time the procedure should ensure the avoidance of excessive penile shortening, ED, or damage to adjacent structures, such as the neurovascular bundle or the urethra.

Many surgical procedures have been described to correct penile curvature. Lengthening procedures have been developed to avoid penile shortening; however, they carry a significant risk of ED or worsening of erectile function. Moreover, penile shortening may still occur after these procedures¹⁰.

Plication surgery was introduced by Nesbit in 1965⁵, while the tunica plication method of Essed and Schroeder⁶ and its modifications have been used as minimally invasive procedures since 1985.

Despite reported satisfactory results of the Nesbit procedure, the incidence of complications was high. Overcorrection, penile shortening, suture granuloma, penile bulging, hypoesthesia of the glans and penile shaft and ED were the most commonly reported complications^{5,7}. Andrews et al.¹¹ noted that 16% of failures of the Nesbit procedure were secondary to suture breakage. Nesbit, however, did not abandon the procedure but recommended the use of non-absorbable sutures.

The non-tensile plication method was used in our study. From our point of view it is the least invasive procedure of all plication techniques previously described because there is no need for tunica excision or incision as described by Nesbit⁵ and Essed and Schroeder⁶, no need for dissection of the neurovascular bundle, no need for urethral mobilization, and minimal injury to the

sensory nerves. Different incisions can be used to perform this technique, such as a circumcising incision for ventral curvatures, a lateral incision for some lateral curvatures and a ventral incision for dorsal curvatures. However, we still prefer to approach all lateral curvatures via a circumcising incision as this decreases the incidence of nerve injury and allows a better surgical field.

Gholami et al.⁹ managed 132 cases of NTTAP using local anesthesia. In our study we used spinal anesthesia for all patients as we believe that it may be more convenient for both the surgeon and patients. Moreover, even with spinal anesthesia, the patients can be discharged the same day of the operation, in addition to the benefit of limited need for post-operative analgesia. We did not encounter any complication from using spinal anesthesia in our series.

As in all plication procedures one of the most frequently reported disadvantages is penile shortening. In the current study 50% of the patients reported penile shortening <1.5 cm. However, most of our patients had CPC with a long penile shaft, hence shortening did not affect their penile length image. On the other hand, our patients' satisfaction with the post-operative results was also favored by pre-operative counseling and explanation of the expected shortening usually associated with the procedure. The incidence of penile shortening in our study is slightly higher than that reported by Gholami et al.⁹ and Hassan et al.¹² who reported shortening in 38% of their patients. However, in both studies the majority of the patients had PD rather than CPC. Patients with PD who are usually older in age are more concerned about penile straightening than they are about penile shortening.

The rates of excellent penile straightening (100%) and preservation of erectile function (100%) in our study are in accordance with other studies¹³⁻¹⁶.

In our study no case of recurrence has been reported to date. However, with a longer follow-up this may change. Penile paresthesia which was temporary and may be secondary to tissue edema was reported in 5 (13%) of our patients. In recent studies it was noted that 40% of the patients will have mild changes in their sexual sensitivity following any penile surgery, particularly when a degloving incision is used^{4,7,15-17}. In our study, the percentage of penile numbness was less, which may be due to our non-diabetic and younger cohort of patients. In addition, one of the main advantages of this procedure is avoiding injury of the sensory nerves of the penis as much as possible.

Painful erection was reported by 14 patients (33%) and was mainly present during nocturnal erection. It was managed by ice pack compresses that are proven to be effective in alleviating painful episodes in 95% of the patients. Diurnal painful erection which was managed conservatively was mainly seen in smokers. Pain was gradually subsiding until it disappeared after one month. Pre-operative counseling of the patients regarding the incidence of pain during erection, how long it may last, and how to manage this pain post-operatively is of utmost importance to alleviate these post-operative painful episodes.

Penile skin necrosis was encountered in 8 of our patients (19%). We attributed this relatively high complication rate to the use of much pressure during penile dressing leading to venous outflow impedance, particularly in our first 10 cases. All those patients were managed with frequent light dressing until regeneration of the penile skin.

Palpable knots underneath the skin were encountered in 30 patients (70%). However, as the patients had previously been informed about this possibility, none of them was bothered. Similar results were reported by Gholami et al.⁹, while in the study carried out

by Hassan et al.¹² 12% of the patients were bothered by these suture knots, which may be due to the fact that they had used monofilament nylon instead of the multifilament braided sutures (Tycron® 2/0) used in our study.

All our patients received intracorporeal injection of 60 mg papaverine at the time of scrubbing to induce erection. We consider this method much better than saline infusion because the compression on the proximal ends of the corpora cavernosa needed to induce erection with saline infusion often masks the full proximal extent of the curvature. In addition, with papaverine injection a uniform erection throughout the procedure is achieved, thus facilitating readjustments of the sutures and the degree of tension exerted on them preventing under- or over-correction of the curvature. However, when the response to papaverine was inadequate we used saline infusion to properly assess the deformity.

Using paired parallel sutures through the whole thickness of the tunica, we had the advantage of distributing the force needed to straighten the penis along the whole shaft (length) of the penis. This also allowed us to secure the plication sutures with minimal tension on the tunica thus minimizing the incidence of suture breakdown against the tunica reported in other series^{11,14}.

As no validated questionnaire for patient satisfaction has been standardized yet, our patients' satisfaction was based on their judgment regarding the degree of straightness, penile length, rigidity and complications encountered. The satisfaction rate of nearly 100% (very satisfied 81%, satisfied 19%) reported in our study is similar to the 97% satisfaction rate reported by Lee et al.¹⁷ with the same procedure.

In conclusion, penile plication has not only a high surgical success rate both cosmetically and functionally, but also a high patient satisfaction rate. The minimal

tension approach (16 dots procedure) has the following advantages: 1) minimal risk of ED or neurovascular bundle damage, 2) precise placement of the sutures because the papaverine-induced erection allows suture adjustments until the penis is straight, and 3) it is a one-day procedure and does not require long hospitalization. The disadvantages are: 1) penile shortening as in all other plication procedures, 2) palpable nodules from the permanent sutures, and 3) no possibility for correction of hour-glass deformity. Pre-operative counseling usually minimizes the patient's concern regarding penile length and nodules. In general the stretched flaccid length of the penis is the expected length after the plication surgery and this should be demonstrated to the patient prior to the operation.

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