

Original article

Inner Preputial Flap as Tunica Albuginea Replacement in The Management of Previously Untreated Fracture of The Penis

A. Bhat¹, B. Sharma¹, M. Dawan² and G. Saxena¹

¹Department of Urology and ²Department of Surgery, Sardar Patel Medical College, Bikaner (Rajasthan), India

ABSTRACT

Objectives: To assess the efficacy of an inner preputial skin flap as replacement for the tunica albuginea of the corpus cavernosum after excision of fibrous plaque.

Patients and Methods: In this retrospective study we evaluated 5 men who presented with impotence, chordee, painful erection and/or painful coitus after previously undiagnosed or untreated penile fracture. In two patients soft tissue X-rays suggested calcification of the plaque, while ultrasonography revealed extension of fibrosis in four cases. In all patients the plaque was excised and the defect in the tunica albuginea was closed with an inner preputial pedicle skin flap.

Results: The flaps had taken well in all cases at 3 months follow-up and all patients reported having normal sexual intercourse.

Conclusion: Surgical excision is the treatment of choice for management of symptomatic fibrous plaques occurring in undiagnosed, untreated or conservatively managed penile fracture. A defect of more than 1.5 cm after excision of the plaque requires tunica replacement, and an inner preputial flap is a good replacement.

Key Words: Penile fracture, complications, fibrous plaque, tunica replacement, inner preputial flap, erectile dysfunction

Corresponding Author: Dr. Amilal Bhat, C-15 Sadul Ganj Bikaner, Rajasthan, India 334003, Email: amilalbhat@rediffmail.com

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INTRODUCTION

Continuous Penile fracture is defined as a rupture of the tunica albuginea of the corpus cavernosum in an erect penis because of blunt trauma, usually during sexual intercourse or masturbation¹. Neglected or conservatively managed penile fracture may result in a fibrous plaque and calcification at the site of corporal rupture. Complications may occur in 30-50% of cases and include penile aneurysm, induration, fibrotic nodule at the rupture site, penile curvature, erectile dysfunction (ED), painful erection, painful coitus, missed urethral injury, penile abscess, corporo-urethral fistula, arterio-venous fistula and urethro-cutaneous fistula².

Fernstrom (1957) was the first to suggest surgery for complications in healed cases of penile fracture³. Three other reports added four more cases of patients who had repair of the tunica albuginea after excision of fibrous plaque in complicated cases of penile fracture⁴⁻⁶. There is no reported case where an inner preputial flap was used for tunica replacement after penile fracture. The objective of this study was to evaluate the results of a new technique, using an inner preputial flap to replace the tunica albuginea after excision of the fibrous plaque in cases of neglected or untreated penile fracture.

PATIENTS AND METHODS

The clinical records of patients who presented with complications arising from penile fracture between January 1990 and June 2008 were reviewed. Only patients who presented more than 6 months after trauma to the penis, had defects larger than 1.5 cm in diameter, had the tunica replaced by an inner preputial flap and had at least three follow-up visits were included. The records were screened for the patient's age, type and time of initial trauma, initial treatment, presenting symptoms, size of the swelling, investigations and surgery performed, post-operative complications and outcome of the surgery. Patients were evaluated for swelling, pain, ED, haematoma and signs of flap necrosis.

Surgical technique

Under spinal or general anaesthesia the penis is de-gloved via a circumcoronal incision. The plane of dissection is Buck's fascia. Care is taken to sleeve back the skin along with the dartos layer on the shaft so that the vascularity of the preputial flap is preserved [Fig. 1A]. The plaque is identified and excised to the depth of normal cavernosal tissue [Figs. 1B-C]. The tunica is re-sutured if the defect is less than 1 cm x 1.5 cm. If the defect is large, it is covered with an inner preputial flap, which is raised by dissecting the vascular pedicle off the penile shaft, up to the root of penis between the superficial and deep layers of the dartos fascia [Fig. 1D]. The pedicle is split in the midline ventrally to avoid tension on the pedicle to prevent penile torsion. The size of the defect is measured and the inner preputial skin is trimmed to the same size. No attempt is made to remove the epidermis. The flap is sutured to the tunica using interrupted Vicryl (4/0) sutures [Fig. 1E]. The penile skin is pulled up and the circumcision incision is sutured. A pressure dressing is applied after inserting a urethral catheter.

RESULTS

The mean patient age was 30.8 years (range 26 to 47 years). The mean interval between initial injury and presentation was 15.6

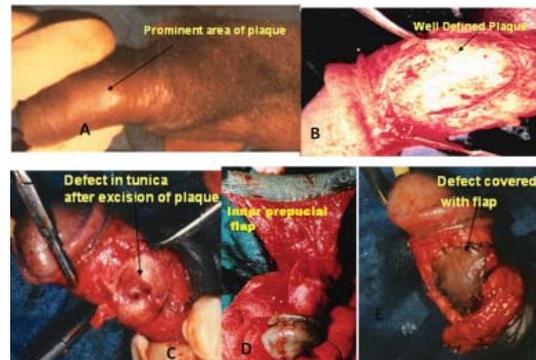


Fig. 1: A. Photograph showing prominent area of plaque. B. Operative photograph showing well defined plaque. C. Operative photograph showing excision of plaque extending into corpora. D. Operative photograph showing dissected inner preputial flap. E. Operative photograph showing preputial flap applied as replacement of tunica

months (range 6 months to 3 years). Patients presented with complaints of impotence, chordee, painful erection and/or painful coitus. On detailed interrogation four of them gave a history of trauma to the erect penis during sexual intercourse, while one fractured the penis accidentally during forcible bending and kneading. Four patients did not have any treatment at the time of the initial injury, while one was treated conservatively. One patient presented with a repeated fracture after being treated conservatively the first time. Only one of the patients had lower urinary tract obstructive symptoms. Two patients suffered from severe ED [SHIM score 1], one had mild to moderate ED [SHIM score 14] and two had mild sexual dysfunction [SHIM scores 17 & 19]. A prominent area at the site of the plaque was visible in four cases, and the plaque was palpable in all.

Hemogram and blood biochemistry were normal, and soft tissue X-ray of the penis showed calcification in two cases [Fig. 2]. Ultrasonography showed evidence of calcification and deep extension of fibrosis into the corpora in four cases. Cavernosography was done in all cases, which showed loss of distensibility at the site of the plaque in all and penile curvature in two cases. The size

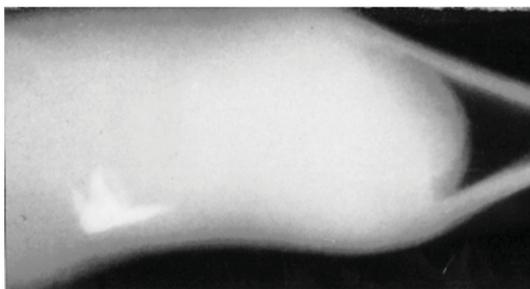


Fig. 2: Soft tissue X-ray showing calcification of penile plaque.

of the plaques varied from 1.5 x 1.5 cm to 4.5 x 3 cm. The location was mid-shaft left side in three cases, distally right side in one case and distally left side with ventral extension involving the corpus spongiosum in one case. Fibrosis was found extending deep into the corpora in three cases.

All patients had an uneventful postoperative recovery and were discharged from hospital 5-7 days after removal of the catheter. Flaps had taken well in all cases with no gap on palpation at follow-up visits. All had normal erections and sexual intercourse 6-8 weeks after surgery and during follow-up of 3-13 years. Mild ED [SHIM score 21] was found in one, whereas four had normal sexual function [SHIM score 21 to 25]. Mild chordee was found in one case, but sexual intercourse was painless. One patient with an inner preputial pedicle flap had a well defined skin patch without any pain or penile angulation, and enjoyed good sexual function through 13 years of follow-up. No other complications, such as aneurysmal dilatation or chordee were seen.

DISCUSSION

Penile fracture comprises a wide spectrum of injuries. At one end it is a minor injury creating a small tear in the tunica albuginea, which is usually sub-clinical, unnoticed and untreated. At the other end are large tears that heal with scar formation and fibrotic plaques in the tunica albuginea, which may cause penile deformity during erection. Penile curvature

during erection is usually diagnosed as Peyronie's disease, a systemic desmoplastic disease of unknown etiology. Many patients with some degree of penile curvature might have had a minor penile fracture, which was not severe enough for them to seek medical attention at that time⁷.

Diagnosis is usually clinical, but there is some role for soft tissue X-ray, cavernosography, sonography and magnetic resonance imaging (MRI) in the diagnosis of untreated or neglected penile fracture. Soft tissue radiography of the penis might show calcification, which is an indication for surgical exploration. Cavernosography may diagnose deep extension of fibrosis in the corpus cavernosum as evidenced by non-distensibility of the corpora, but the extent corporal fibrosis is better delineated by ultrasonography and MRI. A urethrogram helps delineate a suspected stricture.

Complications of the injury include coital difficulty, urethral fistula, penile plaque and ED. Fibrosis at the site of closure, ED and pain during erection can occur later on but may be unrelated to the injury⁸. The results of re-suturing of the tunica albuginea after excision of a fibrous plaque are very good, provided that fibrosis does not extend deep into the cavernous tissue and the defect is small. If fibrous tissue is found extending into the cavernous tissue, then caverno-cavernosum shunts or penile implants might be required in addition to repair of the tunica albuginea^{6,9}.

If resection of fibrous tissue produces a big gap in the tunica albuginea, then replacement graft is required to bridge the defect. Many types of tunica replacement grafts have been used to cover the defect after excision of a plaque in Peyronie's disease, i.e. dermal graft¹⁰, free fat graft¹¹, tunica vaginalis graft¹², temporalis fascia graft¹³, monofilament knitted polypropylene or lyophilized human dura¹⁴ and venous patch graft¹⁵.

Devine and Horton¹⁰ and Wild et al¹⁴ popularized the dermal graft and achieved excellent results with potency rates greater than 70% postoperatively. However, the

reported results of dermal graft vary widely having success rates between 0% and 90%^{4,10,14,16}. In one study, all 7 patients with dermal graft were impotent at one year¹⁶. In the largest series of 52 patients with dermal graft, the complications were clinically significant residual curvature [46 degrees] in 20%, impotence in 12% and painful erections in 16% of the patients. The dermis is more vascular and has higher metabolic demand and more random fiber arrangement that might contribute to its contraction when used as a free graft¹³.

The tunica vaginalis has been used as free graft with good results in 75% of patients, but 25% had impotence¹². Others have used the tunica vaginalis as flaps with satisfactory results in 58% of patients, but the remaining 42% had impotence due to chordee in 25%, glanular hypoaesthesia in 8% and venous leak in 8%¹⁷. However, tunica vaginalis lacks strength and it might result in areas of aneurysmal dilatation¹³.

Prosthetic materials have the disadvantage of promoting a capsule around the material, which may contract later, thus defeating the purpose of the procedure¹⁴. Zenteno⁴ used fascia lata graft for healed penile fracture with good results. Gelbard and Hayden reported 100% potency with temporalis fascia free graft after plaque incision at 22 months follow-up¹³. However, in fascia lata, dura mater and temporalis fascia grafts additional major surgery is required to harvest the graft.

Dermabraded flaps raised from the penile skin were used in Peyronie's disease with good results¹⁸. However, removal of the epidermis leads to potential weakness in the flap strength. Trauma to the epidermis will cause an inflammatory reaction, which may lead to fibrosis and contracture. The good long-term results of this technique were not reproducible by others¹⁹. There is a greater risk of inclusion dermoid, as multiple small segments of epidermis are left in place, despite meticulous care to removal it. Insufficient length of the vascular pedicle may produce torsion or chordee. In one study the authors compared various tunica substitutes and

found the venous patch as the most suitable¹⁹ but the disadvantages of a vein graft are that the dorsal vein may fall short of large defects and taking a saphenous vein patch requires additional surgery.

We considered the idea of using the inner preputial pedicle flap as had been used by Duckett et al²⁰ for urethroplasty in hypospadias. Fortunately most of the patients in India are uncircumcised and the preputial skin is available, but where it is not available a non-hair-bearing skin flap from the distal penile shaft without dermabrading may be used with equally good results. This flap is hairless and well vascularized, resulting in good viability and strength with low risk of graft contracture. Additional surgery is not needed for graft harvesting, since the flap is taken from the site of the original operation for fracture.

The theoretical disadvantage of the procedure is the increased risk of inclusion dermoid due to the buried epidermis²¹. There is a lower risk of inclusion dermoid with large sized flaps compared with small free skin grafts or dermabraded flaps. Microscopically, minute cysts form early in dermal grafts, which atrophy with time and do not form epidermoid inclusion cysts²². We did not encounter this complication in any of our patients in a follow-up of 1-13 years.

The skin flap can be sutured either way; keeping the skin surface towards the cavernosal tissue or facing other way. The advantage of having the epithelium towards the cavernosal side is that the suturing can be watertight, thus reducing the risk of leakage during erection. However, the disadvantage is that if a dermoid forms, it will occupy space in the corpora, which may lead to sexual dysfunction. An exteriorized epidermal surface has the advantage of being palpated easily during follow-up for any changes, enabling earlier diagnosis and management of dermoid formation. Skin edges near the pedicle are approximated with interrupted sutures avoiding the vessels, thus keeping the graft viable. The risk of fibrosis is less, as the vascular pedicle is dartos-based and is expanded repeatedly during penile erections.

CONCLUSIONS

Surgery is the treatment of choice for symptomatic fibrous plaques resulting from undiagnosed or untreated penile fracture. Plaque excision and closure of the defect with a vascularized flap is highly successful in. We have found the inner preputial skin flap to be an excellent tunica replacement. It is hairless and can be harvested from the original site of surgery. Being vascularized, it has good strength and low risk of contracture. Our good results should encourage further trials on the use of the inner preputial flap for tunica replacement.

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Editorial Comment:

This paper offers a very interesting treatment option for plaques of the tunica albuginea after penile fracture. A vascularized flap surely seems to be the best tissue to avoid shrinking and fibrosis and therefore looks very promising. The advantage of the technique is that it avoids the use of expensive alloplastic material or time consuming harvesting of vein grafts. However, the technique has limited applicability in areas where routine male circumcision is performed.

Prof. Dirk Schultheiss

Consultant Urologist and Andrologist

Chairman, History Office, European Association of Urology (EAU)

Archivist, Deutsche Gesellschaft für Urologie (DGU)

Authors' Reply:

This technique can also be used for circumcised persons by raising the circumcoronal non-hair-bearing skin for the flap. Usually the circumcoronal and distal penile area is covered by the inner preputial skin even after circumcision, which can be utilized for a vascularised flap.

Dr. Amilal Bhat