

Severe Penile Injuries in Children and Adolescents: Reconstruction Modalities and Outcomes

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OBJECTIVE	To review our experience with severe penile trauma, mechanism of injury, and their treatment modalities in 16 children younger than 18 years. Management of penile trauma poses diverse challenges to the reconstructive urologist, as injuries vary from abrasions to total emasculation.
METHODS	Analysis of 16 patients with severe penile injuries referred to us between 2002 and 2011 was undertaken. The median age at surgery was 13 years (range, 5-17). Etiology of penile trauma and choice of treatment were evaluated. The management included a wide variety of surgical techniques that were tailored to the individual patient. Results were analyzed to define etiology, that is, mechanism of penile injury and to estimate modalities of surgical management and postoperative outcomes. Also, postoperative questionnaire was used, which included questions on functioning and esthetical appearance of participating patients and overall satisfaction.
RESULTS	The causes of penile injury in these series were traffic accidents (2), iatrogenic trauma (5), self-amputation (1), electrocution (1), burns (3), dog bite (2), zipper injury (1), and mother's hair strangulation (1). The mean follow-up was 46 months (range, 14-122), and examinations were uneventful, except for 2 fistulae formation after neophallic urethral reconstruction.
CONCLUSION	The main goal of reconstructive surgery is to have a penis with normal appearance and functions. Severe penile injuries should be treated on a case-by-case basis using the most propitious techniques. UROLOGY 83: 465-470, 2014. © 2014 Elsevier Inc.

Severe trauma of the external male genitalia is rare because of the location and mobility of the penis and scrotum and includes injury of 2 or more penile entities (penile skin, corpora cavernosa, urethra, and glans). Underlying causes include iatrogenic injury, motor vehicle accidents, child abuse, animal bites, gunshot wounds, and self-mutilation.¹⁻⁸ Reports of trauma to the external genitalia in pediatric population are sporadic and often raise a suspicion of sexual abuse. It is not surprising that most previous reports of the pediatric penile injuries were based on a small number of cases.⁹⁻¹⁵ The type and extension of nonsexual pediatric penile trauma vary in severity from small to more serious injuries and total emasculation. Owing to their rarity and disparity there is no universal therapeutic strategy in their management. The treatment often requires standard urologic care mixed with ingenuity and innovations. Superficial wounds can initially be treated with wound dressing or

suturing, after exploration. More extensive injuries require evaluation of both the urethra and corpora cavernosa and can be treated by local, free transfer flaps, and different grafts. The last resort, penile amputation, partial or total, requires complex reconstructive techniques, including phalloplasty.¹⁶⁻¹⁸

In the present treatise, we reviewed 16 patients who underwent single or multiple surgical procedures because of severe penile injury. We hypothesized that it is very important to delineate the mechanism of injury and treatment modalities used in the management of severe penile trauma in children and adolescents and to evaluate postoperative outcomes according to the choice of their treatment.

MATERIALS AND METHODS

We retrospectively analyzed 16 patients aged from 5 to 17 years (mean, 13 years) treated for severe penile injury from March 2002 to July 2011. All injuries were classified into 3 groups: complete avulsion, penetrating injury, and amputation. Of the 16 patients, 6 patients (37.5%) were primarily treated at our department, whereas 10 (62.5%) were referred from other centers 3 months to 5 years after injury. In the first group, there were different etiologies as follows: burns (2), traffic accident (2), dog bite (1), and zipper sliders (1). Causes of penile trauma in the second group differed, and some patients were particularly

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Table 1. Treatment according to causes and type of penile injury

No.	Age (y)	Cause	Type	Treatment (Single/Multiple)	Follow-up (mo)
1	6	Burns	Skin loss	FTSG (single)	22
2	16	Iatrogenic – curvature repair	Semi-amputation	Phalloplasty (multiple)	68
3	14	Burns	Skin loss-trapped penis	Penile lengthening FTSG (multiple)	75
4	8	Electric burns	Amputation	Total phalloplasty (multiple)	72
5	13	Mother's hair strangulation	Corporeal and urethral injury	Urethroplasty with corporoplasty (single)	89
6	17	Motorcycle injury	Avulsion	Primary repair (single)	21
7	15	Dog bite	Skin avulsion Corporeal injury	Corporoplasty skin reconstruction (single)	122
8	16	Dog bite	Penetrating skin and urethral injury	Urethroplasty and skin reconstruction (single)	27
9	13	Zipper avulsion	Skin avulsion	Primary skin reconstruction (single)	47
10	9	Iatrogenic – epispadias repair	Amputation	Total phalloplasty (multiple)	94
11	12	Iatrogenic – circumcision	Glans semi-amputation	Buccal mucosa graft glanuloplasty (single)	33
12	16	Self-amputation	Total amputation	Total phalloplasty (multiple)	38
13	9	Traffic injury	Skin avulsion	FTSG (single)	45
14	11	Iatrogenic – epispadias repair	Penile loss	Total phalloplasty (multiple)	66
15	16	Iatrogenic – circumcision	Glans injury	Glans reconstruction with preputial flap (single)	14
16	5	Burns	Penile skin loss	Penile skin reconstruction with scrotal flaps (single)	23

FTSG, full thickness skin graft.

unusual: one boy presented with penile amputation caused by electrocution while urinating over a high-voltage electric-current wire. Another boy had a penetrating trauma caused by strangulation with the mother's hair. Iatrogenic injuries in 5 cases were severe and proved to be devastating for the patient. One adolescent who underwent ventral penile curvature repair had lost the pendular part of the corpora cavernosa, urethra, and glans. In 2 others, several surgical attempts for correction of epispadias-exstrophy complex after primary Cantwell-Ransley epispadias repair were performed elsewhere and resulted in total penile loss. These patients underwent total phalloplasty using musculocutaneous latissimus dorsi free flap. Because most patients had combined injuries of 2 or more penile entities (penile skin, corpora cavernosa, urethra, and glans), management was individualized and based on the availability of viable penile tissue. In cases with severe defects, additional grafts were used for complete reconstruction (Table 1).

In cases with skin avulsion, the treatment was based, in principle, on mobilization of remaining healthy genital skin and creation of island flaps whenever possible. In cases with genital burns and completely destroyed genital skin, full thickness skin grafts were used for covering the penile shaft. Pharmacologic erection by Prostaglandin E1 was used in all cases for precise measurement of the flaps and grafts in maximally stretched/erect penis. Postoperatively, in cases with skin avulsion and island flaps covering, compressive dressings were applied for 2 weeks, to prevent swelling and ensure good adhesion of the skin to the penile body. In other cases with graft reconstruction, the dressing was left on standard 5 days.

Urethral reconstruction was performed in both cases with urethral injury using available remaining flaps. In the patient with penetrating strangulation injury with mother's hair, urethroplasty was performed using penile skin flap (Fig. 1). In the adolescent who had a penetrating injury caused by a dog bite, remaining urethral plate was mobilized and tubularized to create

a new urethra (Fig. 2). In both cases, well-vascularized subcutaneous flaps were used to cover the newly formed urethra and to prevent postoperative fistula formation. The urethral stent was placed into the neourethra to enable drainage of urethral secretions during nocturnal ejaculations. Suprapubic tube was used in all cases involving urethral reconstruction.

A partially lost glans after circumcision was reconstructed using buccal mucosa grafts, whereas total glanular reconstruction was achieved using an inner preputial skin flap over the tips of the corpora cavernosa. Glans corona was created using Norfolk technique.¹⁹

Total phalloplasty was performed using musculocutaneous latissimus dorsi free transfer flap using a similar technique to that described previously.²⁰ Latissimus dorsi musculocutaneous flap was harvested with thoracodorsal artery, vein, and nerve. The flap was transferred to the pubic region and anastomosed to the femoral artery, saphenous vein, and ilioinguinal nerve. The remnants of corporal bodies were incorporated into the neophallus. Six months later, urethroplasty with an inlay of buccal mucosa grafts was performed. The graft was tubularized 6 weeks after the initial procedure. An inflatable prosthesis was implanted in 2 patients. Corporeal remnants were recruited as support for the proximal cylinders. Cylinders were covered with vascular graft socks that imitated tunica albuginea (Fig. 3).

In addition, a postoperative questionnaire was used, which included questions about functioning and esthetical appearance. Patients and parents were asked about voiding, the quality of erection and penile sensation, and overall satisfaction with appearance of new genitalia and measured on a 3-point scale (1-dissatisfied, 2-somewhat satisfied, and 3-completely satisfied).

RESULTS

Postoperative period ranged between 14 and 122 months (mean, 46). All included patients were evaluated at 3, 6,

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