



Research Article

# Penile Injury: Four Years' Experience of a Single Surgeon in a Limited Resources Setting

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## Abstract

**Background:** Penile injuries (PIs) are uncommon, with the management of severe cases being difficult. This study aims to examine the causes of PIs and present experience for their management using the limited facilities available in a hospital with low-resource settings.

**Methods:** The management of PIs in a limited-resource hospital in eastern Sudan was recorded over four years. Records of 32 cases of emergency penile surgical conditions between January 2016 and March 2020 were retrospectively reviewed, and 17 cases of significant PI were included in the study and divided into pediatric and adult groups with further subdivision of each group according to the nature of the injury.

**Results:** Seventeen patients with PIs were treated during the study period. The pediatric group ( $n = 4$ ) were victims of traditional circumcision; two of them presented with glans penis (GP) amputation, one with gangrenous GP, and one with mild GP injury. The patients in the adult group were divided into three subgroups; the first group had penile fractures ( $n = 8$ ), the second group had degloving PIs ( $n = 2$ ), and the third group had penile amputation injuries ( $n = 3$ ). Management included various surgical techniques tailored to the individual patients. The outcome of the intervention was presented on a case-by-case basis.

**Conclusion:** Severe PIs should be managed using a case-by-case approach. To enhance the effectiveness of surgical interventions, the field of reconstructive penile surgery must be established and developed. Community orientation and work safety measures should be implemented to avoid PIs that may result from traditional circumcision and machinery trauma.

**Keywords:** penile injuries, glans penis, fracture, amputation, circumcision, degloving

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## 1. Introduction

Penile injuries (PIs) are uncommon and have a wide range of causes, clinical presentations, and different approaches for their classification and treatment. Moreover, there are no universal treatment guidelines, especially for severe cases [1, 2]. Iatrogenic causes, car crashes, gunshot wounds, animal bites, and self-mutilation (Klingsor syndrome) can all lead to PI [1]. Penile skin, erectile tissues, and the urethra can all be affected by PI, which can range in severity from minor injuries to more severe cases and complete emasculation [1, 3]. The history and clinical examination are typically sufficient to make the diagnosis in most cases; however, further imaging tests may be required in certain cases with suspected penile fractures or urethral injuries [3].

Even with experience and the development and advancement of surgical facilities, PI treatment and penile reconstruction remain a challenge [3, 4]. Given the importance of genitalia in forming body image issues and determining future mental image, PIs have a notable impact on the psychological, physical, functional, and emotional well-being of the patient [5]. Considering the factors that affect treatment outcome, it is essential to individualize treatment using standard creative techniques that target time-sensitive repairs and salvage viable tissues as much as possible [1, 6], seeking to maintain the penis' typical anatomical, cosmetic, and functional characteristics [3]. In this study, patients were broadly categorized into pediatric and adult groups, and each group was further subdivided depending on the cause, mechanism, and type of injury. Management was performed on a case-by-case basis while making efficient use of the available facilities with the help of experienced personnel.

## 2. Materials and Methods

The management of PIs in a limited-resource hospital in eastern Sudan was recorded over four years. Records of 32 patients with emergency penile surgical conditions admitted to the hospital between January 2016 and March 2020 were retrospectively reviewed. Only 17 cases of significant PI were included in the study. Significant PI was defined as an injury that involved disruption and/or extensive damage of skin, tunica, urethra, or loss of part of penile tissue that may compromise penile structure and function. They were divided into two main groups according to age: the pediatric group ( $n = 4$ ) with an age range of 1–2 years (median age, 1.5 years) and the adult group ( $n = 13$ ) with an age range of 23–55 years (median age, 35 years). Each group was further divided into subgroups according to the cause and nature of the injury. Informed consent was obtained from all patients at the time of presentation for imaging and publication of this study.

## 3. Results

Seventeen patients with PI were treated between January 2016 and March 2020 (Table 1). PI is diagnosed by physical examination in most cases, with accurate evaluation of the extent of injury assessed during surgical exploration. In the pediatric group, all four patients were victims of traditional circumcision. Two of them presented with glans penis (GP) amputation, none of them brought the amputated GP. Emergency reconstruction was performed under general anesthesia and tourniquet. The urethra was dissected from the corpus spongiosum, the ends of both corpora cavernosa were closed transversely, and the stump was covered by penile skin with the creation of a

new urethral meatus (Figure 1). The postoperative course was unremarkable, and the catheter was removed after 10 days. Follow-up after one month revealed good urine flow and an acceptable shape of the residual stump. The possibility of delayed phalloplasty was discussed with the parents. The third child presented three days post circumcision with gangrenous GP and penile skin (Figure 2). Debridement was performed, a catheter was inserted, antibiotics were administered, and daily dressing was applied for five days followed by referral to plastic surgery for grafting (Figure 2). The fourth child presented two weeks post circumcision with a distorted penile appearance and narrow urine stream. Examination revealed a stenosed urethral meatus with mild injury to the tip of the GP that was buried by the residual prepuce (Figure 3). Refashioning with urethral meatotomy was performed under general anesthesia (Figure 3), and the patient was discharged on the second postoperative day. Follow-up was performed one week later, and the patient was in a good condition.

The adult group was divided into three sub-groups. The first group had penile fractures ( $n = 8$ ). The primary assessment included history-taking and physical examination of the patients, all of whom reported a history of sexual intercourse as a cause of the condition. However, penile Doppler ultrasound was performed in six patients. Seven patients underwent surgical repair consisting of a sub-coronal incision with degloving and exposure of the corpora. All seven patients had a single lesion on the lateral side of the corpora cavernosa at the base of the penis (Figure 4). In all patients, the lesions were repaired using 3-0 Vicryl, the catheter was removed after 12 hr, and they were discharged after three days. All patients were also followed-up after one week, one month, and three months, and showed good healing with no

residual nodules or deviation. However, they all experienced erection that was incomplete and initially painful but improved over time. No further follow-up was performed. The eighth patient with a penile fracture was referred as per his request.

The second adult group comprised of two patients who had degloving injuries. Both patients were involved in motorcycle accidents. The first patient had partial penile degloving with the left testis being retracted out of the scrotum (Figure 5). He also had a partial tear in the suspensory ligament of the penis. The wound was washed properly and sutured covering the penile shaft with the pedicled degloved skin. The testis was repositioned in the scrotum, and the ligament was repaired by interrupted stitches (Figure 5). The postoperative course and follow-up were unremarkable. In the second case, the penis was completely degloved with the remaining pedicled skin still attached (Figure 6). The patient had complete transection of the penile urethra (AAST grade 4), and a urethral catheter was passed through both parts of the urethra (Figure 6). Subsequently, primary urethral anastomosis after urethral spatulation was performed with primary closure of the degloved penis by the skin. The patient developed a postoperative infection, which was managed using regular dressing for 10 days with antibiotics. After the infection was treated, his condition was complicated by a urethro-cutaneous fistula that was repaired successfully after three months.

The last group of adult patients had penile amputations ( $n = 3$ ). The first patient was mentally ill who presented 2 hr after self-inflicted penile amputation. Physical examination revealed complete amputation of the penis with a sharp object (Figure 7). Immediate replantation was performed using the macroscopic surgical technique (Figure

TABLE 1: Distribution of cases according to the age, cause, type of injury, time of presentation after trauma, and treatment applied.

Type of injury	Cause of injury	Age in years	Duration of injury	No	Treatment
<b>Pediatric group</b>					
GP amputation	Post circumcision	1–2	8–12 hr	2	Reconstruction of the residual stump
GP gangrene	Post circumcision	2	3 D	1	Debridement
GP injury	Post circumcision	1	14 D	1	Refashioning
<b>Adult group</b>					
Penile fracture	Sexual intercourse	23–49	4–24 hr	8	Repair of tear in 7 cases, referral of 1 case
Degloving injury	MCA	38–48	2–3 hr	2	Covering of the degloved penis, with repair of suspensory ligament in one case and urethroplasty in other one
Penile amputation	Self-inflicted	35	2 hr	1	Macroscopic replantation
	Machinery avulsion	29	20 hr	1	Closure of the wound with burying of the testis in subcutaneous thigh pouch and creation of perineal urethrostomy
	Criminal assault	55	8 hr	1	Closure of the stump with neo-urethrostomy and burying of the testis in subcutaneous thigh pouch
<b>Total</b>				<b>17</b>	

GP: glans penis; MCA: motorcycle accident; hr: hour; D: day.



**Figure 1:** (A) Dissection of the urethra from corpus spongiosum. (B) Preparation of skin flap to cover the penile stump after closure of corpora cavernosa. (C) Creation of new urethral meatus and covering of the stump.

7). On the first postoperative day, his relatives asked for a referral; thus, no further follow-up was done. The other two patients presented with a completely amputated penis. The first patient was

criminally assaulted with a sharp object leading to amputation of the penis. A very short stump was left, with complete excision of the scrotum. Only a small part of the posterior scrotum was



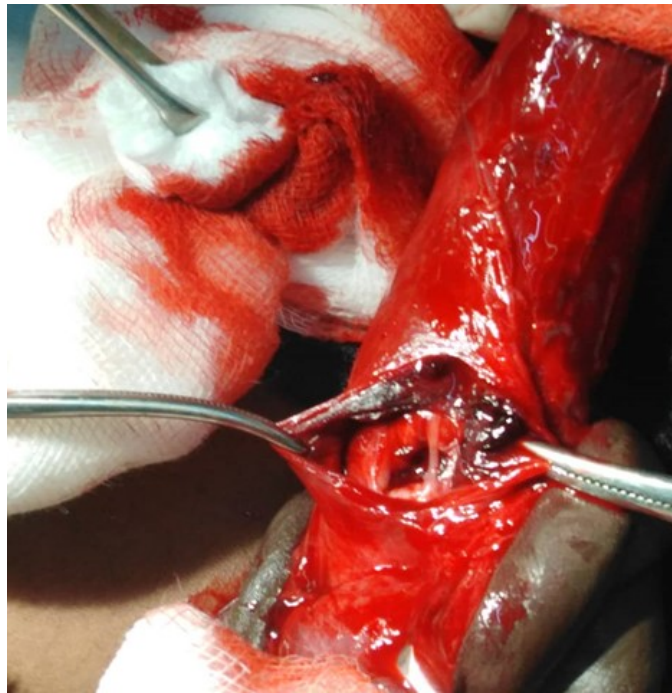
**Figure 2:** (A) Gangrenous glans penis post traditional circumcision. (B) Debridement of the gangrenous glans and necrotic penile skin with hemostasis and catheter insertion.



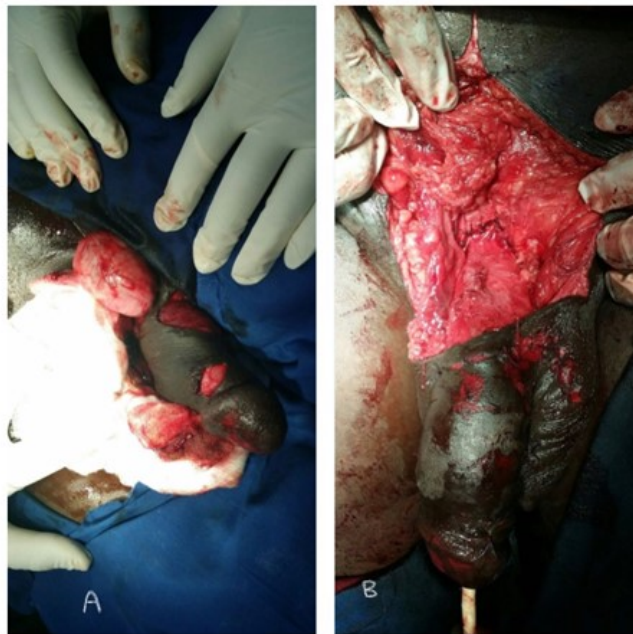
**Figure 3:** (A) Buried glans penis with mildly injured tip. (B) Refashioning of circumcision and meatotomy.

left with the testes uncovered (Figure 8). The second patient was injured by a grinding machine that entrapped his clothes by its exposed belt, leading to complete avulsion of the penis from its base, complete avulsion of scrotal skin with part of the perineal skin, and loss of most of the anterior urethra, leaving just a small stump

in the perineum (Figure 9). In the first case, the amputated part was not brought; thus, the stump was closed and covered by the residual scrotal skin. A urethrostomy was performed, and the testes were buried in a subcutaneous thigh pouch (Figure 8). The patient was discharged after one week, and the catheter was removed after three



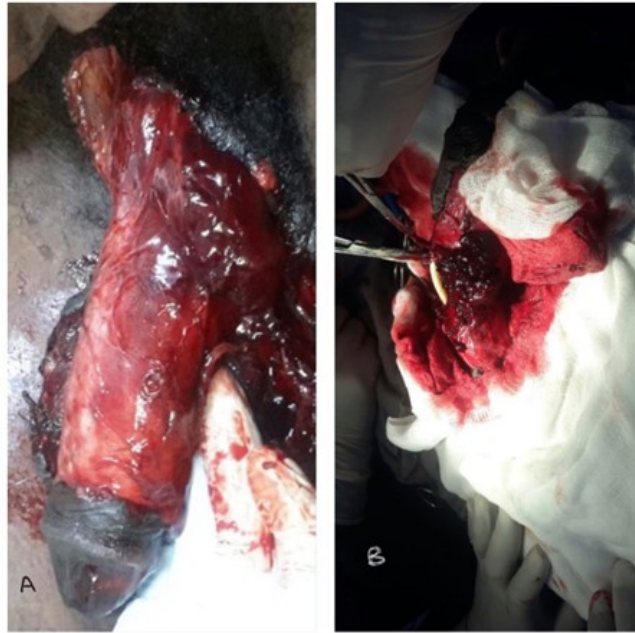
**Figure 4:** Tear in tunica albuginea at the base of the penis.



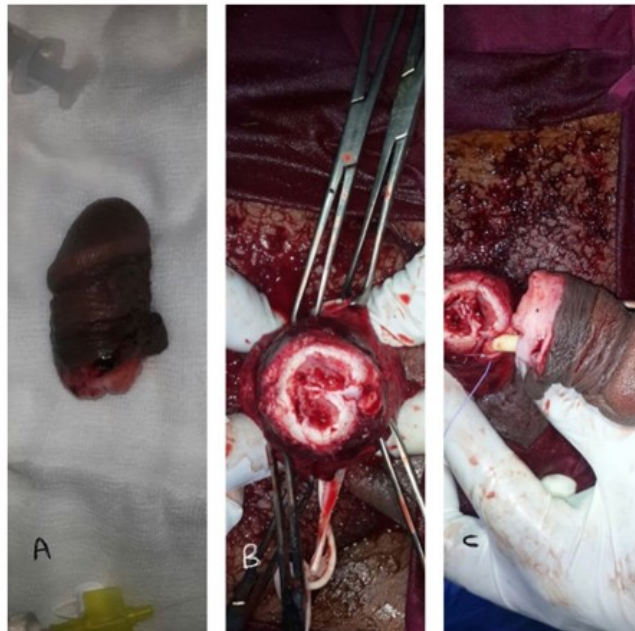
**Figure 5:** (A) Partially degloved penis with left testis extracted out of the scrotum. (B) Penile covering with testis repositioning and repair of suspensory ligament tear.

weeks. Good healing and urine flow were observed in the subsequent follow-ups for the next six months. In the second case, owing to his relatively late presentation, inappropriate transportation of the amputated part, and the situation of the

residual tissues, the option of replantation trial was excluded; thus, the wound was closed by performing a perineal urethrostomy through a pedicled skin flap harvested from the surrounding area. The testes were buried in a subcutaneous



**Figure 6:** (A) Complete penile degloving. (B) Complete penile urethral transection with catheter passed through both ends.



**Figure 7:** (A) Amputated penis with sharp object. (B) The residual penile stump. (C) Urethral anastomosis over catheter as first step of macroscopic replantation.

thigh pouch (Figure 9). The patient was discharged after 10 days, and the catheter was removed after three weeks. The patient was followed-up for the next six months and developed urethrostomy stenosis after three months, which was treated

with dilatation. The option of phalloplasty was discussed with both patients and was adopted by the second patient; therefore, he was referred abroad.



**Figure 8:** (A) Complete penile amputation with excision of the scrotum. (B) Covering of penile stump with creation of new urethral meatus and location of the testes in subcutaneous thigh pouch. (C) Final appearance after three months.



**Figure 9:** (A) Completely avulsed penis from its base. (B) Creation of perineal urethrostomy through pedicled skin flap. (C) Three weeks postoperatively before catheter removal.

## 4. Discussion

The current literature on PI is scarce compared to other conditions, as most case series include a relatively small number of patients over many years [7, 8]. This is possibly due to underreporting of the incidence because many patients do not seek medical help due to social embarrassment

or psychological reasons [3, 9]. A wide range of causes have been reported, leading to a spectrum of injury ranging from abrasions to total amputation [5]. PIs may be isolated, or they may be a part of other genital injuries [3]. Due to the diverse nature of these injuries, there is no consensus regarding their classification and no



specific treatment strategy, especially for severe cases [2, 5]. In general, primary construction is the preferred option if possible and feasible [5]. However, the treatment type and outcome are greatly influenced by the degree, nature, and mechanism of injury, time before presentation, remaining penile and local tissues, equipment used, and the experience of the treating surgeon [10, 11]. The main objective of treatment is to achieve adequate anatomical, functional, and cosmetic results [4].

In this study, the sole cause of PIs in children was circumcision. It is the most performed surgical procedure worldwide, and is done for religious, cultural, and medical reasons [12, 13], and represents the most common cause of pediatric PIs [14]. In our setting, circumcision is usually conducted by paramedical staff and sometimes by personnel outside the medical field. Traditional methods using bone cutters as clamping instruments are frequently followed, which leads to a substantial rate of injuries and morbidities, and this was the case in this study. Use of the remaining viable tissues to perform reconstruction was applied in most cases with accepted cosmetic and functional outcomes.

Penile fracture was the most frequent presentation of adult PIs in this study. It is a rupture of the tunica albuginea of the corpus cavernosum [15], commonly during sexual intercourse, and rarely due to forceful bending of the erected penis (maneuver of Taghaandan) [16], and it may be associated with penile urethral injury [17]. Given the availability, noninvasiveness, and cost-effectiveness of ultrasound, it can be used to confirm the diagnosis in equivocal cases [18]. In this study, patients with penile fractures presented with a typical clinical history, and ultrasound was used in cases of equivocal examination findings and to

confirm the diagnosis in patients for whom the condition was not certain such as for patients who denied the condition. Early repair was performed for most cases with adequate outcome.

A degloving PI is uncommon and is usually caused by industrial or agricultural machines that snag the operator's clothes, leading to degloving of the penis with or without loss of scrotal skin and penile avulsion [14, 19]. Use of degloved skin to cover the exposed area is an option when appropriate, however, when genital tissue is not available for repair, skin grafts and variety of pedicled and free flaps represent a viable option for genital reconstruction [4]. In this study, both degloving injury cases involved motorcycle accidents, and both were treated by emergency covering of the penis using the degloved skin. Despite prompt intervention, one of them was complicated by wound infection, most likely due to the associated urethral transection, which increased the risk of infection.

Penile amputation represents the most challenging modality of PIs. Treatment options include primary replantation, phallic reconstruction, or closure of the penile stump with urinary diversion [1, 2]. Moreover, the testes are initially placed in subcutaneous thigh pouches if the scrotal skin is also jeopardized [4]. Replantation could be achieved by a macroscopic technique which relies on corporal sinusoidal blood flow within the replanted part, with the corpus spongiosum playing a role in arterial supply and venous return [10]. Yang *et al.* introduced a method of venous bloodletting that involves piercing the edematous implanted part with some squeezing, allowing venous blood to be removed, thus reducing venous edema which develops within 12 hr after macroscopic replantation. This method has good outcome [11]. In general, the macroscopic technique has a relatively

low success rate with a high rate of complications, ranging from loss of sensation to necrosis to complete loss of the implanted part [10, 11]. The other penile replantation method is microsurgical anastomosis, which was first attempted in 1977 [11], and includes anastomosis of the dorsal penile artery and vein with other structures, leading to a higher chance of graft survival and a lower rate of complications. This method also allows for a longer ischemia time before surgery that may reach up to 16 hr [20]. If replantation is not feasible or possible, other treatment options include phalloplasty or penile transplantation. Over 20 different types of flaps are used for phallic reconstruction [4], of which the radial artery forearm free flap described by Chang and Hwang is the most used and preferred method for total phalloplasty [6, 21]. This complicated multistage procedure carries a high rate of donor site and flap complications [4, 6]. Given the inability of conventional phalloplasty to completely restore penile function, penile transplantation comes to the forefront of genitourinary reconstruction [22]. The first successful penile transplantation was conducted in South Africa in 2014 [6]. Although the procedure has highly controversial biotechnical issues and may have a psychological impact on the patient and his partner, the future is promising [22]. In our setting, there is a lack of equipment and experience that may be needed for the management of severe PI cases. The author was the only urologist responsible for treating such cases, and access to the nearest more specialized center is difficult in most situations. Therefore, treatment priority was to stop the bleeding, cover the tissues as appropriate, and maintain patent urine flow. This may be the reason for potentially unsatisfactory outcomes for the patient and the medical team.

## 5. Conclusion

The goal of PI treatment is to achieve maximum restoration of normal penile appearance and function. Patients with severe PI should be treated on a case-by-case basis, making maximum use of residual tissues and available facilities and skills. There is a need to improve training in this field, as expertise in the use of flaps for neophallus has not yet been developed. Community awareness regarding the risk of traditional circumcision should be developed to prevent the avoidable disastrous complications of this procedure. Finally, occupational safety rules should be applied when machines are operated.

## Declarations

## Acknowledgments

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## Ethical Considerations

The study was approved by the medical ethics committee of the University of Gadarif, Faculty of Medicine, Sudan (reference: GU/FM/REC/Q2.6.22.2). Informed written consent for anonymized information to be published was provided by all patients (or their parents or legal guardian in the case of children under 18).

## Competing Interests

The author declares that he has no competing interests.

## Availability of Data and Material

The datasets used and/or analyzed during this study are available from the corresponding author upon reasonable request.

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## Abbreviations and Symbols

PI: Penile injury

GP: Glans penis

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