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Orginal Article

# SPLIT GLANS & ADVANCEMENT FLAP TO REPAIR PENILE HAIR TOURNIQUET INJURY IN CHILDREN: A CHALLENGING PROBLEM OF UNKNOWN ETIOLOGY.

**Ghulam Mujtaba Zafar[1], Muhammad Nadeem Sajjad[2], Muhammad Zaheer[3], Muhammad Hanan Yousaf[4], Fawad Humayun Akhtar [5], Muhammad Naseem Javeed[6]**

*[1,2,3,4,5,-6 -] Department of Pediatric Urology, The Children's Hospital and University of Child Health Sciences, Lahore.*

**ABSTRACT**

**Background:** Penile Hair tourniquet injury is a clinical phenomenon that involves hair or thread becoming so tightly wrapped around the coronary sulcus of the penis, causing progressive penile strangulation and compromised blood flow resulting in clinical appearance which ranges from simple oedema to necrosis of the urethra, corpora and sometimes partial or near total penile amputation It is most commonly found in boys between 0-6 years of age and almost described in circumcised boys. The patients usually present with urethra-cutaneous fistula, and most of the urination is from the fistula site. A high index of suspicion and careful inspection of the affected area are key to diagnosis. Surgical repair is challenging due to ischemic necrosis, scared tissue with compromised blood supply.

**Objective:** To find out the cause and outcome of repair by split glans & advancement flap for hair tourniquet penile injury

**Study Design**: A Retrospective Study.

**Place and duration of study**: Department of Pediatric Urology, The Children's Hospital and University of Child Health Sciences, Lahore. From Jan 2015 to December 2021

**Methodology:** This retrospective study was conducted from the medical record from Jan. 2015 to December 2021. All children with classical tourniquet injury were included, and children with iatrogenic urethral injury or UCF after hypospadias surgery were excluded. We repair the urethra in a transverse fashion & cover the repair with a full-thickness dartos-cutaneous flap advanced and fixed in split glans. SPSS version 21 was used for statistical analysis of data. Variables like age, cause, injury type, and outcome of surgical repair: measured single urinary stream from glans tip and cosmesis were noted

**Results:** A total of 30 patients were retrieved. All patients were male in the age range of 2-12 years, with a mean age of 7 years. Most children have two ends of the urethra separated apart with scarred tissue at the distal penile area and a tight band around the penis. Of 30 patients, Children with grade II injury ( presence of urethra-cutaneous fistula ) 20 and grade III injury ( subtotal amputation of corpus sporangium, hanging glans ) 10 and no patients presented with grade I ( superficial skin lesion) and IV injury (loss of glans, complete section of corpus sporangium). The success rate of fistula closure is 28 patients; two patients developed a fistula, and 26 patients were satisfied with cosmesis.

**Conclusion:** Split glans & advancement flap is a good choices for the repair of such ischemic injuries of the penis, which provides a healthy vascular cover to repair and blood supply to the glans as well. Mothers and the general population should be educated about this preventable trauma, which is caused by negligence and ignorance.

**Keywords:** Penile Hair Tournique injury (PHTI), Urethrocutaneous fistula (UCF), Balanoprepucial sulcus (BPS), Penile Strangulation Injury (PSI).

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**Corresponding Author: Muhammad Nadeem Sajjad**

**Email:mazhar20211@gmail.com**

**https://orcid.org/0009-0005-1089-6386**

**Cell no: 0343 4633359**

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## INTRODUCTION

Penile Hair Tourniquet Injury (PHTI) is a rare injury in which hair gets entangled around the coronal sulcus of a circumcised penis, giving rise to a spectrum of clinical manifestations ranging from mild swelling and redness of glans to more severe complications such as urethrocutaneous fistula, gangrenous of glans penis and even penile amputation [1]. Most children below 6 years of age have this injury, and the aetiology is unknown most of the time [2]. The constricting hair ring typically becomes lodged at the balanoprepucial sulcus (BPS), which is a deep anatomical groove that holds the hair or thread in place [3,4]. This condition is exceedingly rare in uncircumcised boys, as the prepuce covers the BPS. Most injuries are accidental, but some cases of deliberate hair tying around the penis to manage urinary incontinence and a few cases of abuse have also been reported [5, 6]. Management of PHTI requires awareness of this rare clinical entity, maintaining a high clinical index of suspicion, a meticulous inspection of the affected area with magnification, examination under general anaesthesia, and timely intervention to prevent the occurrence of severe complications [7]. Early removal of the hair coil is crucial to avoid urethral damage and glandular necrosis [8, 9]. This study aims to share our insights and expertise regarding this uncommon condition in children and report the outcomes of our surgical technique.

## METHODS & MATERIALS

30 cases of Penile Hair Tourniquet Injury who received treatment at the Pediatric Urology Department, Children's Hospital and University of Child Health Science, Lahore, starting Jan. 2017 to Dec. 2023. The Institutional Review Board approves this study under the reference **ERB-No/730/CH-UCHS**. The data was recorded on a predesigned proforma. The variables of our study were clinical presentation, grade of injury, outcome of surgical intervention and complications. Data was analyzed by SSPS 21. All patients who presented with acute conditions underwent removal of the tourniquet at the clinic or in the operating room under general anaesthesia in those children who were non-cooperative. The tourniquet removed was mostly a bunch of hair or thread. Subsequently, the children underwent re-examination at 6 to 8 weeks later and were graded on the basis of the grading system, which was proposed by Harouchi and Bashir et al., as outlined in Table 1 [10, 11].

## RESULTS

The data were statistically described by using mean value ± standard deviation for age, median (range) for the time between the onset of symptoms and presen tation and number (per cent) for categorical variables. Statistical analysis was conducted using SPSS 21. The total number of patients was 30 in our study. The mean age of patients was 4.43 years, with a standard deviation value of ± 2.5 years. The time interval between the onset of symptoms and presentation was roughly estimated to be 1-4 weeks, as the exact onset was usually unnoticed by the parents. The mean follow-up period for the patients was 22.5 ± 8.65 months, ranging from 6 to 36 months.All children included in the study had undergone previous circumcision and had normal-looking external urethral meatus at the glans. Not a single boy had any neurological diseases, but six boys had a history of nocturnal enuresis. The parents of 4 children believed that someone had tied these hairs, raising suspicion of abuse in these cases. One child had a history of a tie to control bleeding after circumcision performed by a quack (Table 2). On the day of presentation, hair coils were removed in the outdoor clinic for 22 boys (73%), while eight boys (27%) were too anxious, and a tuft of hair or thread was deeply buried, requiring removal under general anaesthesia in the operating room as a day case. No urinary diversion catheter was placed at the time of presentation. Of the total, 20 boys (66%) had partial transection of the penile urethra, while 10 boys (33%) had complete transection of the penile urethra (Table 3). Surgical repair was required for all boys, and the procedure was delayed for at least 3 months from the initial time of presentation. All patients underwent a single-stage repair, as described previously, over a silicone catheter/stent, which was kept for at least a mean period of 9±1.5 days for grade II and grade III injuries.Out of the 30 children, 28 (93%) had a satisfactory functional and cosmetic outcome, while 2 (7%) developed urethra-cutaneous fistulae that were repaired six months later. During the follow-up period of 6 to 36 months, all patients demonstrated good penile length with a wide urethral opening at the tip of the glans, which was highly satisfactory for the parents. None of the patients in our study developed anastomotic stricture. The success rate after the primary surgical intervention was 93% (Table 3). It is important to note that there were no patients with grade I and grade IV injuries in this study.

## Condition at first presentation (Figure-1)

**Table 1: Causes of Hair Tourniquet Injury**

| Causes | Number (Percentage) |
|---|---|
| Unknown | 19 (63.3%) |
| Nocturnal enuresis | 06 (16.6%) |
| Post circumcision bleeding | 01(3.3%) |
| Jealously/abuse | 04 (13.3%) |

**Table 2: Classification of degree of penile injury**

| Type | Features |
|---|---|
| Grade I | Superficial skin injury without a urethral injury. |
| Grade II | Partial transection of corpus sporangium with urethrocutaneous fistula |
| Grade III | Complete transection of corpus spongiosum and constriction of the corpus cavernosum. |
| Grade IV | Gangrenous of the glans penis with or without amputation of the glans. |

**Table 3: Causes of Hair Tourniquet Injury**

| Causes | Number (Percentage) |
|---|---|
| Unknown | 19 (63.3%) |
| Nocturnal enuresis | 06 (16.6%) |
| Post circumcision bleeding | 01(3.3%) |
| Jealously/abuse | 04 (13.3%) |

**Table 4: Classification of the degree of penile injury**

| Type | Features |
|---|---|
| Grade I | Superficial skin injury without urethral injury. |
| Grade II | Partial transection corpus sporangium with urethrocutaneous fistula. |
| Grade III | Complete transection of the corpus spongiosum and constriction of the corpus cavernosum. |
| Grade IV | Gangrenous glans with or without auto amputation. |

**Table 5.** Clinical Presentation of Penile Hair tourniquet injury.

| Grade of injury | Number | Percentage % |
|---|---|---|
| Grade 2 injury | 20 | 66.6 % |
| Grade 3 injury | 10 | 33.3% |
| Grade 1 & 4 injury | 0 | 0 |

**Table 6**. Complications after surgical intervention..

| Outcome | Grade II | Grade III | Total |
|---|---|---|---|
| Number of patients | 20 | 10 | 30 |
| Successful surgery | 19 | 9 | 28 (93%) |
| Fistula | 1 | 1 | 2 (7%) |
| Persistent constriction ring | 0 | 0 | 0% |
| Stricture | 0 | 0 | 0% |

Children with superficial skin injury were treated conservatively after the removal of the hair tourniquet with care of the local wound, utilizing antibiotics and anti-inflammatory medications. After the removal of the hair tourniquet, the decision to perform surgical intervention was delayed for at least 03 months [14]. The repair process followed general principles for these cases. In grade 2 injuries, a complete release of the constriction ring involved dorsal dissection, excision of whole fibrous/scared tissue, margin dissection of the fistula, edge trimming and transverse closure of the urethral defect using interrupted 6/0 PDS suture. The penis was degloved, the glans split on the ventral side, and a second layer of coverage with skin and subcutaneous tissue flap to the urethral suture line was performed. The flap was advanced between the open wings of the split glans. For children with grade 3 injuries, dissection around the proximal and distal ends of the urethra and corpus spongiosum was conducted, followed by direct end-to-end anastomosis of both ends of the urethra by using interrupted 6/0 PDS suture, encompassing both the spongiosum and urethra. The glans were then reunited to the corpus cavernosum with PDS 5/0. Dressings were maintained for 1 week, and the urethral catheter was removed on the 10th postoperative day, followed by The patient was followed in the outdoor clinic at 1 month, 3 months, 6 months, and then yearly. Parents were given instructions on wound care and were asked to observe the child's urinary stream. During each visit, a thorough evaluation of the wound was performed, and parents were requested to provide a video of the child's voiding to assess the urinary stream. The successful repair was determined by achieving a proper urinary flow from the external urethral meatus at the tip of the glans and attaining an excellent cosmetic appearance with no evidence of a constriction ring.

## DISCUSSION

PHTI is a clinical phenomenon involving the circumferential strangulation of the penis by the human hair or thread. The injury mechanism begins with the impairment of lymphatic flow, followed by obstruction to venous outflow, and then the impairment of arterial inflow [2]. Various terms, including constrictive band injury, hair-thread tourniquet syndrome, penile strangulation injury, and penile hair coil strangulation, have been used in the literature [ 1, 17, 21, 24 ]. PHTI is an uncommon condition and is often overlooked due to factors such as very thin hair, severe oedema and swelling of the glans penis, or a lack of awareness about this entity among primary health care providers, including paediatricians and emergency pediatric physicians [12, 22]. The acute condition of Penile Hair Tourniquet Injury (PHTI) should be treated as a surgical emergency, requiring immediate intervention. Early diagnosis of PHTI and rapid initial treatment are crucial in preventing serious complications. However, many children often present with urethrocutaneous fistula ( grade 2 ), and a few cases involve complete transection of the corpus spongiosum ( grade 3 ). Surgical repair is typically recommended for the more severe cases of penile injury, specifically grade 2 and above. The aetiology of Penile Hair Tourniquet Injury (PHTI) is often unknown, but it is commonly accidental.In some cases, there may be voluntary tying for the treatment of conditions such as nocturnal enuresis or spiritual healing. [2,5,6]. Child abuse or obsessive behaviours could be potential causes, particularly inYoung children or if there is evidence of a knot on the constrictive agent [20]. Differential diagnoses for PHTI include infection, dermatitis, insect bites, trauma, or congenital constriction bands (23). In this study, we suspected child abuse in four boys and nocturnal enuresis was reported in six children, but we could not find any reason in the remaining 19 boys. Patients with Grade II, III, and IV require surgical repair, and different approaches have been reported in the literature. Dikshit et al. described the Urethral Advancement and Glanuloplasty Incorporated Procedure (URAGPI), in which the proximal urethra was mobilized up to three times the length of the distance between the neo-meatus and corona. The advantages of URAGPI include a lower incidence of fistula and diverticula formation, as well as good cosmetic results. (13) This is similar to Koff's technique of urethral mobilization in distal hypospadias [18, 19]. The technique described by Dikshit et al., known as URAGPI, has certain disadvantages, including the potential development of chordee, glandular disruption, meatal retraction, or stenosis. We were not convinced to discard the normal distal glandular urethra, as mentioned in the above study, and to do an unnecessary dissection of the penile urethra in very young boys. We didn't mobilize the urethra; instead, we did the transverse closure of the fistula or urethra and covered the suture line with the advancement of a full-thickness skin flap along with dartos, which helps to prevent the formation of fistula and stricture. AbouZeid et al. described a delayed single-stage repair involving three layers (urethra, dartos, and skin) in 16 children with a 100 per cent success rate [14]. The choice of surgical technique mostly depends on the severity of the injury and the surgeon's preference. In a multicenter study of 25 cases, Badawy et al. described single-stage repair by spatulation and end-

to-end anastomosis of penile urethra, reinforced by a second layer vascularized dartos flap and closure of the overlying skin was done with the lower edge of the glans penis with 84% success rate and reported complications (16%) were stricture and fistula. An onlay dartos base local penile skin rotation flap was also used in children with grade III injuries [1]. Kirtane et al. described an approximation of both ends of the urethra, shaft, and glans over silastic stents without any suture with good results but in a series of only seven patients [17]. Harouchi et al. reported the largest series of 38 patients and suggested a two-stage repair for severe degrees of tourniquet injuries by reinforcing the nearly totally amputated glans with corpus cavernosum first, followed by urethroplasty later on [10]. We did successful one-stage repair in 10 children with grade III (partially amputated) injuries. Another study by J. Qamar et al. involved a simple fistula repair and advancement of the skin flap up to the glans in 12 patients, with the development of a fistula in one patient [16]. In our study, we repaired grade II and grade III injuries with urethral approximation and advancement of the skin/dartos flap into split glans wings with a 93% success rate and excellent cosmetic outcome. We found fistula formation in 2 (7%) children, which were closed successfully later on. We believe that the advancement of normally innervated skin into the glans not only prevents fistula formation but also potentially improves the vascular supply and sensations of the glans [16].

## CONCLUSION

Split glans & advancement flap is a good choices for the repair of such ischemic injuries of the penis, which provides a healthy vascular cover to repair and blood supply to the glans as well. Mothers and general pediatricians should be educated about this preventable injury, which is usually caused by alack of awareness.

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**Authors Contribution:**

**Concept & Design of Study:** Ghulam Mujtaba Zafar1
**Drafting:** Muhammad Nadeem Sajjad2
**Data Analysis:** , Muhammad Zaheer3, Muhammad Hanan Yousaf4
**Critical Review:** Fawad Humayun Akhtar,Muhammad Naseem Javeed6
**Final Approval of version:** Muhammad Nadeem Sajjad2

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