



A single center retrospective review of hair tourniquet syndrome and a proposed treatment algorithm



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ABSTRACT

Introduction: Hair tourniquet syndrome (HTS) is a rare disorder characterized by a hair becoming tightly wound around an appendage. There is little known about the epidemiology, optimal treatment, or indications for surgical intervention in HTS. We hypothesized that HTS could be readily diagnosed and treated in the pediatric emergency department and we sought out factors predictive of surgical intervention.

Methods: We performed a single center retrospective review of all patients who presented with a hair tourniquet from May 2004 till March 2014.

Results: Eighty-one patients were diagnosed with HTS, ranging in age from 2 weeks to 22 years. Of these patients, 69 were located on the toes, 5 on fingers, and 7 on genitalia. The average ages for each location were statistically different ($p < 0.0001$). Ninety-four percent of patients were successfully treated by nonoperative means. Cellulitis was found in two patients. Tissue necrosis occurred in one patient.

Conclusion: HTS is an uncommon disorder and location differs with age. Chemical depilatory agents should be a first line treatment for this condition in most patients. If chemical tourniquet release fails, then the patient should undergo mechanical tourniquet release. If edema, erythema and pain fail to resolve after tourniquet release, then persistent hair tourniquet should be investigated.

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Although rare, hair tourniquet syndrome (HTS) has been recognized since the 17th century. HTS is characterized by a hair or fiber becoming tightly wrapped around an appendage such as a toe [1], finger [2], uvula [3], tongue [4] or a genital structure [5–7] causing strangulation and compromised blood flow [8] (Figs. 1 and 2). It is most commonly found in the pediatric population, with only rare reports of affected adult patients [9]. Diagnosis may be difficult, and careful inspection of the affected area with magnification is recommended. Management includes unwrapping, cutting or dissolving the offending fiber. We hypothesized that HTS could be readily treated in the emergency department. We set out to determine characteristics that would predict the need for surgical intervention as well as determine the potential complications of HTS.

1. Materials and methods

A single center retrospective study was performed in a major metropolitan children's hospital after obtaining approval from our institutional review board. The data comprised all pediatric patients treated for HTS at our facility from May 2004 till March 2014. The information reviewed from these charts included: emergency department, inpatient, and operative records, surgical notes and pathology reports. For each patient, we identified their age of presentation, location of

hair tourniquet, method of treatment, need for surgical intervention, and presence of tissue necrosis or infection, and follow-up after tourniquet release.

2. Results

Over the 10 years, 81 patients were diagnosed and treated for HTS at our institution. Fifty-two percent were female and forty-eight percent were male. The ages ranged from 2 weeks of age to 22 years. Sixty-nine of these hair tourniquets were located on toes, 5 on fingers, and 7 on genitalia (4 male genitalia, 3 female genitalia). The average ages of patients presenting with toe, finger, or genital hair tourniquets were: 0.4 years, 1.6 years, and 6.4 years, respectively. The average ages of presentation were each significantly different depending on the site affected ($p < 0.0001$). There was no statistical difference found when comparing patient age or location of the HTS versus a need for surgical intervention. Furthermore, boys and girls had similar chances of HTS (Table 1).

Fifty of the 78 children (64%) eligible for chemical lysis of the tourniquet had successful resolution with either 1 (40 of 78, 51%) or 2 depilatory treatments (10 of 78, 13%). Further attempts with chemical application were never successful. The 3 female patients with genital HTS (cases where chemical depilatory contact with mucous membrane would be contraindicated) and the 28 treatment failures underwent release of HTS by mechanical means. Only 5 of these 31 (16% constituting 6% of the total cohort) required operative intervention.

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Fig. 1. Hair tourniquet located on the toe of an infant.

Wound complications were extremely uncommon in patients with HTS; with only 2 patients (2.5%) developing cellulitis associated with HTS of the toes. These patients were diagnosed clinically and treated with oral antibiotics. A different patient was incorrectly diagnosed with cellulitis two days after an attempted hair tourniquet release on a toe. After a week of antibiotic therapy and no resolution of the erythema the patient was found to have a persistent hair tourniquet. This patient was taken to the operating theater and underwent an examination under anesthesia and mechanical tourniquet release with complete resolution and no further complications. There were no other missed diagnoses of a hair tourniquet.

Of the 81 patients in our study, one patient developed tissue necrosis and dry gangrene of the affected toe. This patient presented to another hospital after several days of pain and swelling and was found to have superficial tissue necrosis and ischemia. The patient was transferred to our facility where they were taken to the operative theater and successfully underwent debridement of the necrotic skin from the digit and did well after surgery with intensive wound care.

3. Discussion

HTS is a rare disorder. Relatively little is known about this condition including the epidemiology, natural history, or complications associated with the development of this disorder. What is known about this disorder originates from mainly isolated case reports and small case series.

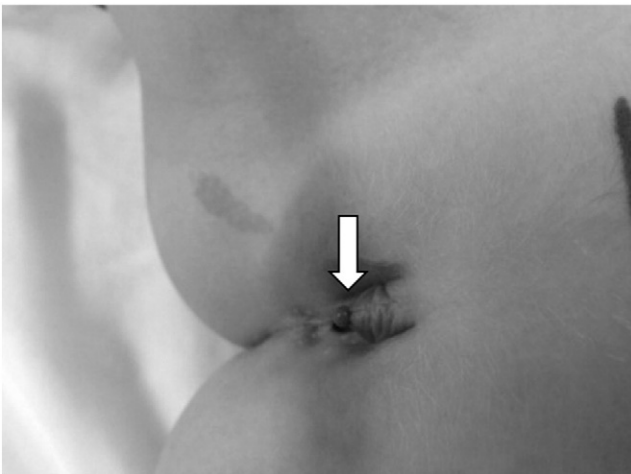


Fig. 2. Hair tourniquet located on the clitoris of a child with associated engorgement and swelling (arrow).

Table 1
Summary of results.

Patient characteristics and statistics	
Total no. of patients	81
Female:male ratio	52%:48%
Age range	2 weeks to 22 years
Average age (age range)	
Toe tourniquet	0.4 years (0.12 years–1.46 years)
Finger tourniquet	1.6 years (0.04 years–7.44 years)
Genital tourniquet	6.4 years (1.87 years–22.8 years)
Age versus location	$p < 0.0001^*$
Age versus need for surgical intervention	$p = 0.5893$
Location versus need for surgical intervention	$p = 0.1565$
Gender versus development of hair tourniquets	$p = 0.8748$

* Denotes statistical significance.

To our knowledge this is the largest single center review of HTS. A meta-analysis by Mat Saad et al. [10] compiled patients from a variety of publications, identifying 210 reported cases. Of these cases they found that 44.2% of cases of HTS involved the penis, 40.4% involved the toes, 8.57% involved fingers, and 6.83% involved other sites such as female external genitalia [10]. There are two possible sources of the discrepancy between the findings of our study and those of Mat Saad. First, the prior study included all reported occurrences of HTS from infancy to those in the elderly. Our study on the other hand only included patients with HTS that presented to a pediatric hospital. The second source of discrepancy rests in a reporting bias. One of the case series that their meta-analysis was based upon solely reported penile hair tourniquets that presented to two different institutions [11]. This reporting bias would lead to the perceived increased incidence of HTS located on the genitalia as opposed to those located on the toes.

Our study contributes several key points to be highlighted. First, in contrast to other studies or reported cases, our primary modality for treatment of HTS was a chemical depilatory agent (e.g. Nair[®]) and we experienced resolution in approximately two thirds of cases of hair tourniquet. Our institutional practice includes storage of a bottle of the chemical depilatory agent in the emergency department from which individual aliquots of the lotion can be dispensed. The chemical depilatory agent is applied for three minutes then the lotion is washed away. A second application is undertaken 10 to 15 minutes afterwards if necessary.

The mechanism of action of chemical depilatory agents is via breakage of the disulfide bonds in hair. This leads to a weakening of the hair fibers and eventual dissolution. This treatment has the benefit of being relatively painless as there is no need for blind dorsal longitudinal incisions for tourniquet release and no need for anesthesia [12]. The contraindication to the use of a chemical depilatory agent for treatment of HTS is their location in proximity to mucous membranes. One downside to the use of chemical tourniquet release is that the depilatory agents can cause chemical skin irritation if applied for too great an amount of time.

As a result of our experience with chemical depilatory agents in the treatment of HTS, we have proposed a treatment algorithm that accounts for both chemical depilatory agents as well as the need for mechanical tourniquet release (Fig. 3). The algorithm we have proposed is based upon the location of the tourniquet and presence or absence of tissue necrosis or ischemia. In all cases of hair tourniquet, if there are signs of tissue necrosis or ischemia then the patient should undergo immediate mechanical release of the tourniquet. For those hair tourniquets located on digits without signs of ischemia, two attempts at chemical depilatory release of the hair tourniquet should be attempted. If release is achieved then the patient should be closely followed and observed. If tourniquet release cannot be achieved after two attempts of chemical depilatory agents then mechanical release should be undertaken.

In contrast to hair tourniquets located on the digits, the management of hair tourniquets of the genitalia varies slightly. As in digits, if there are signs of tissue ischemia or necrosis then mechanical tourniquet release should be undertaken. The difference in treatment between digital and genital hair tourniquets thus arises because of anatomic differences and

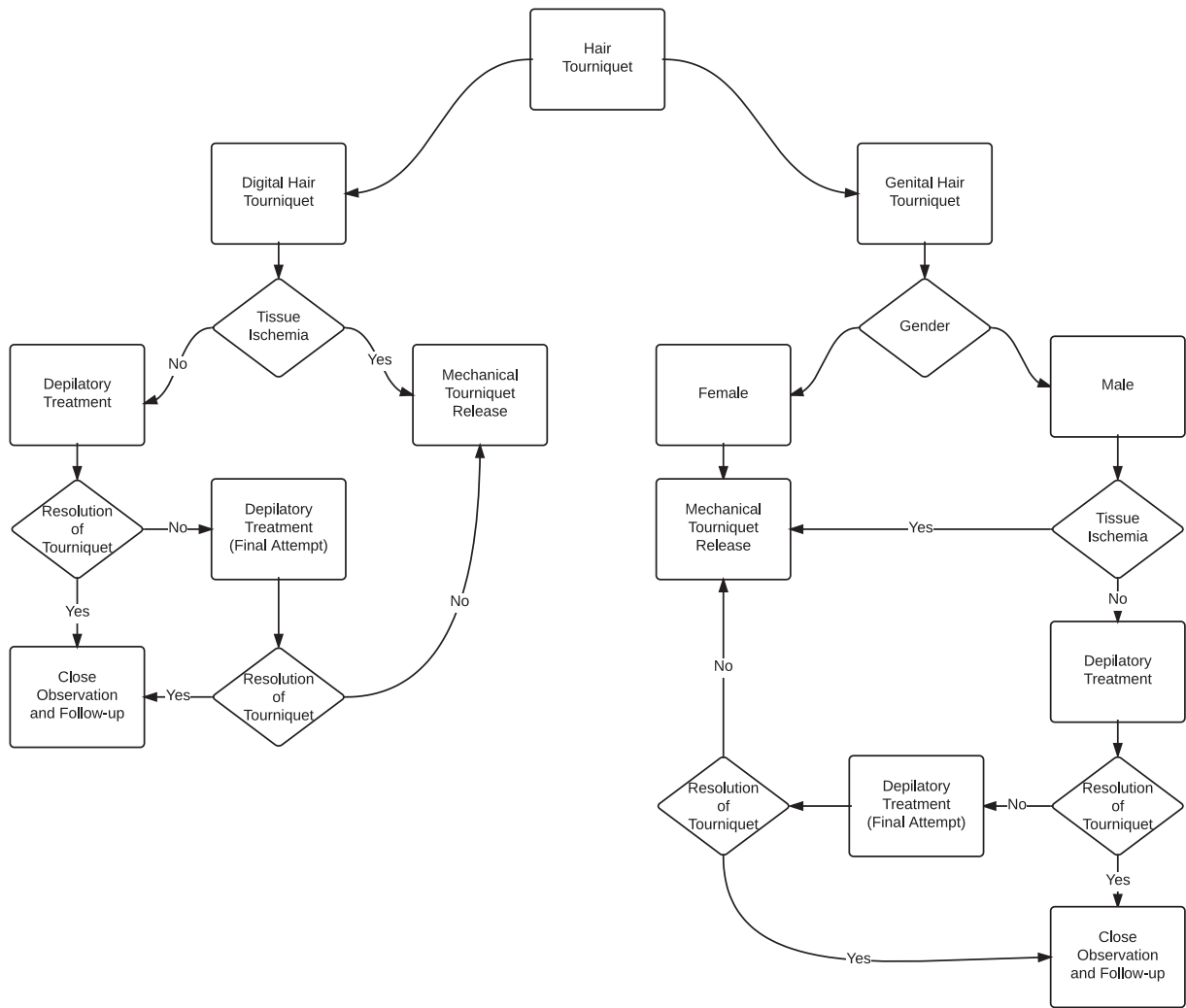


Fig. 3. Devised algorithm for the treatment of hair tourniquet syndrome.

the contraindications to the use of chemical depilatory agents near mucous membranes. In male patients, penile hair tourniquets can be readily treated with two attempted trials of a chemical depilatory agent and in the event of treatment failure then progression to mechanical release should be undertaken. In contrast, female patients with genital hair tourniquets should be treated with primary mechanical tourniquet release given the proximity of mucous membranes.

4. Conclusion

In conclusion, hair tourniquet syndrome is a rare disorder that occurs mainly on the toes of infants. Complications such as tissue ischemia or cellulitis are rare but with appropriate therapy we found that these issues are readily resolved. Given the rarity of infectious complications after hair tourniquet release, any patient that presents with persistent erythema, swelling or tenderness should be examined for persistent un-released tourniquet. Chemical depilatory agents are an effective first-line agent in the treatment of HTS when not contraindicated because of the location near mucous membranes.

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