

# Toe tourniquet syndrome

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## ABSTRACT

متلازمة عاصبة اصبع القدم تشير إلى اختناق خارجي ميكانيكي دائري لأصابع القدم. نحن هنا نسجل سلسلة من 4 أطفال يعانون من متلازمة عاصبة اصبع القدم من المملكة العربية السعودية، الذين قدموا لنا خلال فصل الشتاء مع أعراض متشابهة جدا، (حوالي 48 ساعة من البكاء والتهيج)، ونفس المنطقة المتأثرة (أصابع القدمين)، ونفس وسيلة العصب (الشعر). وقد تمت الإزالة الفورية لألياف الشعر من جميع المرضى، ولحسن الحظ تلاه الشفاء السريع مع عدم وجود علامات نخر الأنسجة. وقد كان التشخيص السريع والعلاج الفوري حيويًا في تحقيق نتائج جيدة ومنع المضاعفات.

Toe tourniquet syndrome refers to external, mechanical, circumferential constriction of the toes. We report a series of 4 infants with toe tourniquet syndrome from Saudi Arabia who presented during wintertime with very similar symptoms (approximately 48 hours of inconsolable crying and irritability), similar involved region (toes), and similar constricting agent (hairs). Immediate removal of the hair fibers was carried out in all patients, fortunately followed by fast healing with no signs of tissue necrosis. The prompt diagnosis and treatment of the condition were vital in attaining the good outcome and preventing ischemic complications.

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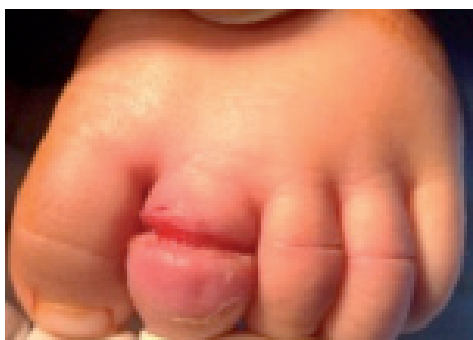
The term toe tourniquet syndrome (TTS) was introduced by Quinn<sup>1</sup> in 1971 when he reported 5 cases and implicated leotard-type clothing as an important cause of this condition. Hair TTS is a rare condition with only around 20 reported cases in which a hair or thread encircles and becomes tightly wrapped around a toe and results in ischemic strangulation with acute digital ischemia. The peak incidence of TTS is

under the age of one year. Immediate diagnosis and surgical intervention with removal of the constricting agent are necessary to prevent permanent tissue necrosis and loss of the affected digit.<sup>2</sup> We report 4 cases of TTS affecting multiple toes to highlight the importance of meticulous examination of any infant with unexplained prolonged excessive crying, keeping in mind TTS as an important differential diagnosis. Early diagnosis and proper immediate intervention of TTS will prevent catastrophic ischemic complications of the affected toe.

**Case Report. Patient 1.** A 6-months-old girl presented to the pediatric emergency room (ER) in December 2013 with irritability and persistent severe crying for 48 hours. Meticulous thorough examination revealed erythema, swelling, and tenderness affecting the left second, third, and fourth toes with constriction rings at the level of the middle phalanges (Figure 1). Several tightly wrapped hairs were found encircling the affected toes with a circumferential deep cut wound in the second toe. The third and fourth toes were less severely involved with superficial circumferential wounds. The hairs were cut and removed with fine forceps. She was taken to the operating room (OR) and the wound repaired after refreshing the margins under general anesthesia. She was then admitted to the Pediatric ward where the swelling resolved with good wound healing, and she was discharged home after 4 days. No chronic sequelae were noted on follow-up.

**Patient 2.** A 5-months-old female infant presented to the pediatric surgery clinic in December 2013 with persistent crying for 48 hours associated with swelling of the right second toe, which was just discovered by the mother. Physical examination revealed multiple hair coils around the second right toe with swelling and erythema (Figure 2). The hair was removed at the pediatric surgery clinic. It was observed that the wound was not deep; hence, the baby was discharged from

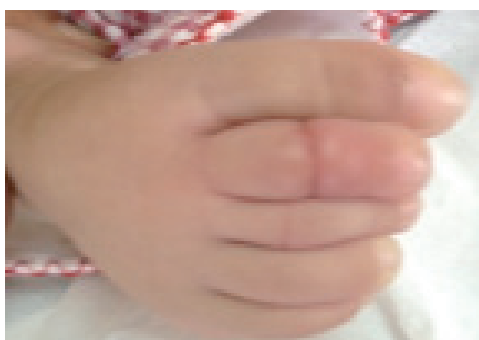
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**Figure 1** - Left foot showing a circular deep cut wound with erythema and edema distal to the hair tourniquets at the middle phalanges of the second (most affected), third, and fourth toes.



**Figure 3** - Examination of toe swelling showing: A) Deep cut wound involving the left third toe, with erythema and edema distal to the hair tourniquets. B) The third toe is severely injured while the fourth toe is mildly affected.



**Figure 2** - Hair coiled around the second right toe imbedded deep in the skin with distal swelling and erythema.



**Figure 4** - Extensive edema, erythema, and color changes are seen distal to the hair tourniquet affecting the left fourth toe.

the clinic with advice of daily dressing and follow-up after a week. On follow-up visit, the wound had healed completely.

**Patient 3.** A 3-months-old male infant presented to the pediatric ER in January 2014 with a history of crying for 2 days with swelling and redness noticed by the mother on the left foot on the morning of the day of presentation. According to the mother, she changed the baby's clothes 2 days ago followed by the problem of continuous crying, and the toe swelling started a day later. On examination, there was left third toe swelling and redness with hair-threads encircling the toe and cutting deeply into the skin. The fourth toe was only mildly affected with only hair marks (Figure 3). The hair-threads were removed in the OR. Distal vascularity was good, and he was discharged in good condition after 3 days. The follow-up healing was good with no residual injury in the affected toes.

**Patient 4.** A 6-months-old male infant presented to the pediatric ER in February 2014 with a history of excessive crying for one day. The mother noticed a constriction followed distally by massive swelling of

the left fourth toe a few hours before presentation. On examination, there was multiple hair coils encircling the left fourth toe and extending into the deep tissues (Figure 4). Urgent removal of the constricting hair was carried out in the OR, and he was discharged home after 2 days with no complications noted on follow-up and the digit survived well.

**Discussion.** Toe tourniquet syndrome is neither very rare nor new but is under reported and many clinicians remain unaware of it. It typically occurs in children under one year,<sup>2</sup> with mean age  $5.5 \pm 4$  months.<sup>3</sup> Toes are the most involved, but other body appendages can be also affected.<sup>4,5</sup> In our series toes were affected with a hair tourniquet, which was in agreement with other reports that showed that toe tourniquets are usually caused by hairs. Although unknown why, the third toe is the most frequently affected digit? All the 4 patients presented with excessive crying, local swelling, and erythema along with coiled hair around the toes. Excessive and protracted crying may be the only symptom in babies, although some cases have been reported without any irritability despite having

TTS for weeks.<sup>6</sup> Circumferential digital strangulation causing distal edema was encountered in all patients who, fortunately, were discovered early before the development of tissue ischemia. Sivathasan and Vijayarajan<sup>7</sup> highlighted that circumferential digital strangulation impairs lymphatic and venous drainage causing distal edema, and that further obstruction may cause arterial occlusion and ischemic injury. Prolonged ischemic injury leads to tissue necrosis and ultimately auto amputation. The 4 patients presented during wintertime. Cold weather may be a factor due to a lot of clothes being used by the parents for their babies to achieve warmth where hair may be entangled, and the toes being covered may delay the diagnosis.

The time period was not certain in all the series, but roughly patients presented after 48 hours of excessive crying. The parents were not sure how it happened. The incident seemed to be accidental, but we feel that if the mothers were more vigilant in checking their infants, the incident might not have happened or at least been discovered earlier. A hidden neglect may be suspected in certain cases. There is a lack of consensus how and when the offending ligature wraps so tightly around a structure! A question remains to be answered; "Tourniquet syndrome—accident or abuse?"

In 2010, Cevik and Kavalci<sup>8</sup> pointed to the importance of maternal *postpartum telogen effluvium* with excessive hair shedding as a causative agent. Hairs are supple and easily stretched when wet and brittle and contract when dry. The high tensile strength of hair makes it an effective tourniquet. Pain control, and proper examination, sometimes using a magnifying glass is essential.<sup>9</sup> Trials to release the hair mechanically, or depilatory agents can be used, but if the constricting band is unclear or has involuted under the edematous skin, or if doubt persists as to the completeness of removal, especially as the hair cut through the skin and becomes invisible, surgical exploration becomes mandatory.<sup>10</sup> A simple and safe technique is performing a short, longitudinal (peritendinous), dorsal, deeply, placed perpendicular incision over the area of strangulation, until the phalanx bone, which allows complete section of the constricting fibers to be removed without injury to the anatomical structures of the toe (the antero-laterally-positioned neurovascular bundles). Antibiotic coverage should be provided as appropriate.<sup>7</sup>

Post-decompression, all our patients returned to their usual states without any complications. It was reported that the affected structure may heal well without consequence, or flexion-deformity may occur depending on the duration of strangulation.<sup>7</sup>

In conclusion, TTS is a dangerous but preventable condition of young infants. The prompt diagnosis and treatment of the condition are vital to attain a good

outcome and prevent complications. All doctors should be aware of this entity, and those children presenting with irritability should have their digits examined for signs of strangulation with awareness that numerous strands of hair may be involved. Mothers should also be counseled regarding *telogen effluvium* and new parents should avoid using coverings on their infant's extremities for extended periods of time without inspection, launder children's clothes inside-out and carefully check their infants regularly to make sure that no hairs are becoming entangled in the fingers or toes.

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