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CASE REPORT

A closed degloving injury of the fifth toe: a case of empty toe

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ABSTRACT

Empty toe injury is a rare type of closed degloving injury; only seven cases have been reported previously, with controversial outcomes. Our case is a 22 year old male who was drafted by a trolley bus. The patient presented at our emergency department with extensive swelling of the right foot, deformity of the fifth toe, bruising and intact skin. On clinical examination the phalangeal bone could not be palpated in the fifth toe and there was no capillary refill. The patient was immediately taken to the operating room and underwent open reduction combined with fasciotomies. The toe regained perfusion after the reduction and was under close observation to ensure its viability. Finally the distal and part of the middle phalanx of the toe was amputated. The purpose of this report is to inform health providers about this unique type of injury and contribute to a more sufficient treatment plan.

Keywords: closed degloving injury; toe; compartment syndrome

Introduction

Closed degloving injuries are rare and occur as a result of a violent shearing force applied across the skin surface that separates the skin and subcutaneous soft tissue from the deeper fascia planes without rupture of the dermal or epidermal tissue plane. The shear force transects the perforating vessel anastomoses between the tissue planes, creating a resultant void, liquefied fat necrosis and vascular injury [1,2]. The management of closed degloving injuries is not as well established as in open degloving injuries due to the rarity of such cases. To the best of our knowledge only seven cases have been documented describing "empty-toe" and "closed degloving injuries" specific to the lower extremity and only one case of "empty thumb". According to the literature in four cases amputation of the toe was the final outcome (**table**).

Material and Methods

A 22 year old male motorbike driver was treated from July 2017 until December 2017 in our department. He presented in the emergency room after he was drafted by a trolley bus, with no other injuries. His right foot was swollen, with a deformity of the fifth metatarsal and of the fifth toe but the skin was intact. The fifth toe was extremely flexible, insensate and with no capillary refill. The rest of the foot

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TABLE. *Review of the literature*

Author	Age	Sex	Mechanism of injury	Injured toe/finger	Circulatory status	Treatment	Outcome
Matelic and Manoli	38	M	His left foot and leg were caught under the wheel of a forklift	Fifth toe	No evidence of capillary refill but regained normal color after open reduction	Open reduction	Returned to normal activities as tolerated
Flaherty et al.	46	M	A forklift truck ran over his left foot	Secondary toe	Distal circulation was absent	Closed reduction	Amputated
Singh and Downin	33	F	A truck ran over her right foot	Fifth toe	Capillary refilling was sluggish	Open reduction	Amputated
Chen-Ling Tang MD	20	F	Foot was stuck between 2 collided motorcycles	Fifth toe	Capillary refilling was sluggish	Open reduction	Amputated
Andrew A. Tarleton	25	M	Twisting injury in a motorcycle accident	Fifth toe		Open reduction and K-wire.	Gangrene auto-amputated
Adam L. Bingham	27	M	Foot was crushed by train car wheel	Dislocation of hallux IP,translocation of toes 2,3,5	intact biphasic dorsalis pedis and posterior tibial pulses	Open reduction and K-wires	Transmetatarsal amputation
Adam L. Bingham	60	M	a hydraulic fork lift was driven over his left foot	fifth toe	dorsalis pedis and posterior tibial arteries were intact	Closed reduction, K-wire	Non amputated-chronic pain
Our case	22	M	RTA	Fifth toe	the digital arteries of the fifth toe could not be found on Doppler scan	Open reduction	Partial amputation

was neurovascularly intact. The dorsalis pedis artery was palpable, but the digital arteries of the fifth toe could not be found on Doppler scan.

Plain imaging identified a dislocation of the fifth toe with only the distal phalanx being contained under the skin. (**Figures 1,2**) There was also a nondisplaced fracture of the fourth metatarsal. Treatment The patient underwent immediate open reduction and fasciotomies of the foot compartments, in the operating theatre. After reduction the skin colour immediately improved and digital artery pulses were identified by Doppler. The patient could feel the touch of a 14G needle in the whole dorsal and plantar area of the foot including the fifth toe. The foot was placed in a cast and elevated. The patient was on a strict non weightbearing status for the first

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Fig. 1: *Preoperative AP Radiograph Note the displacement of the 5th proximal and part of middle phalanx in the web space. Fracture of the neck of the fourth metatarsal*

Fig. 2: *Post reduction and fasciotomy clinical image. Use of the shoelace technique for wound closure. Note the normal color of the fifth toe indicating adequate return of perfusion.*

Fig. 3: *Post amputation Radiograph. Note the absence of distal and part of the middle phalanx and fracture of the neck of the fourth metacarpal.*

Fig. 4: *Post amputation clinical photograph. Almost complete healing of the fasciotomy wound and no signs of ischaemia around the stump.*

2 weeks, and was under enoxaparin 4000IU and acetylsalycilic acid 100mg once per day. However, 48 hours after the operation the distal phalanx of the fifth toe displayed signs of inadequate perfusion and necrosis as there was no capillary refill and no sensation of the plantar area of the distal phalanx, while the rest of the toe seemed normal. We decided to wait and observe the progress of the necrosis.

Results

Five days postoperatively the patient was discharged and he was followed up as an outpatient every three days. The patient started hyperbaric oxygen therapy ten days after the fasciotomies. He completed three hyperbaric oxygen sessions within twelve days. The toe was evaluated for edema, sensation, and temperature in the follow up visits. Outcome One month after injury the necrotic area of the middle and distal phalanx that included the nailbed was amputated. The patient had uneventful wound healing and has had painless ambulation on the affected limb at the six month postoperative visit.

Discussion

Reviewing the literature available we could only find seven previously reported similar cases and one case of "empty thumb". The earliest case was reported by Metalic and Manoli in 1994. A crush injury with degloving and translocation of the fifth digit into the fourth web space was described, treated with closed reduction which led to immediate restoration of perfusion. The patient was placed in a walking cast for one week, after which he returned to his normal activities with no

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Fig. 5: *Final Radiograph. Union of the fourth metacarpal neck fracture.*

Fig. 6: *Final clinical photograph. Complete healing, no signs of hypoperfusion.*

subsequent complications [3]. In 1998 Flaherty et al reported a similar injury of the second toe. A forklift truck ran over the patient's left foot, distal circulation was absent, the digital soft tissue envelopes were unsalvageable, and the patient underwent transametatarsal amputation [4]. The third case was reported by Singh and Dowinf. A 33 year old female, had her right foot run over by a truck with injury of the fifth toe. The capillary refill was sluggish and the toe was amputated. Moreover, Tang et al reported a similar case of the fifth toe which underwent open reduction and fasciotomies, but eventually, after one week amputation was necessary [5]. Auto-amputation was the final outcome in the case described by Page 2 of 13 3 Tarleton et al. It concerns a 25-year-old man who sustained a twisting injury to his left foot in a motorcycle accident. Open reduction of the fifth toe was performed and it was immobilized by a Kirschner wire, the patient was placed into short leg splint and the toe appeared viable that time. On day twenty the patient presented to the emergency department diagnosed with a deep venous thrombosis. One month after the injury the patient developed dry gangrene of the toe [5]. Bingham et alreported two cases. The first case, was a crush injury with dislocation of the right interphalangeal joint and translocation of the second digit, also complete translocation of the third digit with reentry into the second digit soft tissue envelope and of the fifth digit into the fourth digit soft tissue envelope. Fasciotomies of the second, third interosseous and deep central compartments were performed, closed reduction was performed with intraoperative fluoroscopic assistance. Kirschner wires were used to maintain the reduction and stabilize toes 2 through 5 [6]. At about seven months the patient agreed to transmetatarsal amputation due to complex regional pain syndrome [6]. The other case of A.L. Bingham was a crush injury with transposition of the fifth digit into the fourth web space and distal tuft fractures of the distal phlanges of digits 3 through 5. Open reduction with K-wires was performed to stabilize the fifth digit and distal tuft fracture and keep the toe in its soft tissue envelope [6]. At week ten the patient presented deep vein thrombosis. The toe was not amputated after 16 months follow up, but the patient complained of chronic pain and disability. Empty toe injury is an extremely rare type of injury that could provoke a great amount of disability. In case it is not on time recognized and managed could lead to amputation. The purpose of this report is to describe this rare injury and suggest that clinicians should work on a common therapeutic policy so as the patient to have the best therapeutic results.

Conflict of interest:

The authors declared no conflicts of interest.

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ΠΕΡΙΛΗΨΗ

Περιγράφεται η σπάνια περίπτωση απογαντισμού δακτύλου ποδός τύπου «empty toe» σε νεαρό άρρενα ηλικίας 22 ετών μετά από εμπλοκή του σε τροχαίο ατύχημα.

ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ: Απογαντισμός δακτύλου, σύνδρομο διαμερίσματος