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Stair-rail avulsion amputation of the middle finger: A ring-avulsion-type injury without a ring

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Abstract

Ring avulsion injuries are uncommon but potentially severe traction injuries of the finger, caused by a sudden longitudinal force on a ring-bearing digit. Damage may range from superficial skin tears to complete degloving or amputation with involvement of tendons, joints and neurovascular bundles. Several classifications, including those of Urbaniak and Nissenbaum, have been proposed to grade tissue damage and circulatory status and to guide the choice between salvage procedures and amputation. Most published lesions follow a true ring-related mechanism. We report an unusual ring avulsion-type injury of the middle finger in a young adult whose digit was suddenly hooked under a horizontal metal stair-rail during a fall, in the absence of any ring. The trauma caused a distal interphalangeal joint-level amputation, with a non-viable distal part and avulsion of the flexor digitorum profundus tendon. In a resource-limited setting without microsurgical facilities, early revision amputation at the distal interphalangeal level was chosen after assessment of tissue viability and discussion with the patient. At short-term follow-up he recovered a painless, stable and mobile stump. This observation shows that, in selected patients and contexts, a carefully planned revision amputation may represent a pragmatic and functionally acceptable option for high-grade ring avulsion-type injuries.

Keywords: Ring avulsion injury, middle finger, stair-rail trauma, digital amputation, hand trauma, case report

Introduction

Ring avulsion injuries form a particular subgroup of hand trauma in which a sudden traction force is transmitted along a ring-bearing finger. They are infrequent but can be devastating, because the external wound sometimes underestimates the depth of damage to tendons, joints and neurovascular bundles ^[1, 2]. If inadequate attention is paid to circulatory status and soft tissues, attempts at salvage may result in prolonged treatment, stiffness and chronic pain.

To help in decision-making, several classifications have been proposed. Urbaniak *et al.* focused on vascular status and distinguished viable, compromised and complete amputation patterns that can benefit from different strategies. ^[3] Nissenbaum later underlined that some high-grade lesions, although technically accessible to revascularisation, are unlikely to provide a durable, functional digit and may be better treated by amputation. ^[4] These schemes invite surgeons to balance the theoretical possibility of salvage with real chances of recovery, the patient's expectations and the available resources.

Most reported cases involve a metallic ring caught on a fixed object such as a ladder, hook or vehicle part. ^[5, 6] Situations in which another structure plays the role of a ring are far less documented. We report a case of middle-finger amputation with flexor digitorum profundus avulsion after the finger became trapped beneath a stair-rail. Through this case we discuss the mechanism and the reasons that led us to choose revision amputation rather than attempted replantation in a low-resource environment.

Case report

A 21-year-old right-hand-dominant male student, with no relevant medical history, presented to our emergency department after a domestic accident. While he was going down a staircase he slipped and instinctively reached for the handrail.

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His right middle finger became suddenly hooked under a horizontal metal bar, and he immediately felt a violent traction followed by intense pain and bleeding. He noticed that the distal part of the finger had been torn off.

On admission he was stable and alert. Examination of the right hand showed a circumferential soft-tissue injury of the middle finger at the distal interphalangeal joint level, with exposed bone and devitalised skin margins. The distal segment had been brought in a plastic bag. It consisted of the distal phalanx and surrounding soft tissues, with the entire length of the flexor digitorum profundus tendon attached, having been pulled out of the flexor sheath along the digit. The proximal edge was ragged, and the pulp was crushed with contaminated surfaces. The amputated part was pale and insensate, with no active bleeding (Figure 1). The metacarpophalangeal joint was intact and painless, and the remainder of the hand and wrist was normal. Clinical examination showed preserved flexion at the proximal interphalangeal joint of the middle finger, indicating that the flexor digitorum superficialis tendon was intact.

Plain radiographs confirmed a transarticular amputation through the distal interphalangeal joint without fracture of the proximal phalanx or adjacent rays. Given the extent of soft-tissue damage and doubtful viability of the amputated part, the segment was considered unsuitable for replantation. Our institution does not have microsurgical revascularisation facilities. After explaining the situation to the patient, we opted for early revision amputation at the distal interphalangeal level under local anaesthesia.

After careful irrigation, non-viable skin and subcutaneous tissue were excised. The flexor digitorum profundus tendon was found to be ruptured and avulsed proximally, whereas the extensor apparatus was preserved. The distal phalanx was shortened and shaped to obtain a smooth stump. Digital nerves were trimmed proximally to reduce the risk of painful neuroma. A volar advancement flap was raised to provide soft-tissue coverage, and the skin was closed without tension. A dorsal splint was applied, immobilising the proximal interphalangeal joint in slight flexion.

The postoperative course was uneventful. Wound healing was achieved by the third postoperative week, when supervised active mobilisation of the finger was started. At three months, the patient had recovered a full range of motion at the metacarpophalangeal and proximal interphalangeal joints, with preserved grip and no neuroma-related pain. He rated his pain as 1/10 on the visual analogue scale during everyday tasks and had returned to his university activities without functional complaint.

Discussion

Ring avulsion injuries represent a small proportion of hand trauma but often raise difficult reconstructive questions because skin, tendons and neurovascular bundles are simultaneously involved.^[1, 2] The goals of treatment are to relieve pain, obtain a stable and sensate finger and maintain enough length and mobility to ensure an effective grip. When available, microsurgery makes it possible to revascularise or replant some severely injured digits, but results are variable, especially in high-grade lesions with long ischaemia times and major soft-tissue devascularisation.^[6, 9]

In our patient, the distal part of the finger was completely amputated and clearly non-viable. The pulp was crushed,

contamination was present and the vessels were probably damaged along a long segment. Even in a specialised centre the chances of obtaining a warm, painless and mobile finger after replantation would have been low, and the patient would have been exposed to prolonged hospitalisation and repeated procedures. In this context, attempting replantation would have been unreasonable, as the crushed wound edges and the need for an extensive proximal approach to reinsert the flexor digitorum profundus at its origin would have greatly increased the operative burden for a very uncertain functional gain. In a hospital without microsurgical facilities, the indication for revision amputation was therefore strong.

The mechanism is also of interest. Most published ring avulsion injuries involve a true ring acting as a rigid loop around the finger.^[5, 8] In this case, the horizontal stair-rail behaved like a fixed ring through which the finger was violently pulled, reproducing the same longitudinal traction on soft tissues. This observation reminds clinicians that ring avulsion-type injuries may occur even in patients who do not wear rings, and that the absence of jewellery should not lead to underestimation of the severity.

From a functional point of view, preservation of motion at the proximal interphalangeal and metacarpophalangeal joints is more important than full length at the distal interphalangeal joint^[2]. Our therapeutic objective was therefore to obtain a painless, mobile and cosmetically acceptable stump that would allow a normal grip. Early revision amputation, with meticulous attention to bone contour, nerve management and flap design, met these goals. At three months the patient was satisfied with function and appearance, which supports the relevance of this simple solution in his situation.

In ring avulsion injuries, treatment decisions are largely driven by vascular status, associated bone and tendon damage, and the condition of the amputated part. The scheme proposed by Urbaniak and the modifications introduced by Nissenbaum, together with subsequent treatment algorithms, provide a framework for choosing between salvage and amputation. Most authors agree that revascularisation or replantation can be considered in low-grade lesions with limited segmental vascular damage and intact joints and flexor tendons, whereas high-grade injuries with long-segment arterial disruption, crushed soft tissues or destruction of the distal joint are better treated by primary or revision amputation. Even in specialised microsurgical centres, replantation of severe ring avulsion or complete degloving injuries frequently results in stiff, painful fingers that require multiple secondary procedures and may ultimately offer no clear functional advantage over a well-planned amputation. Our choice of revision amputation is therefore in line with these published indications and would likely have remained the most reasonable option even in a unit with full microsurgical capability^[1-8].

Limitations

This report concerns a single patient with short-term follow-up and does not allow firm conclusions about long-term outcomes. Objective functional scores were not used, and radiographic control was limited to confirming the level of amputation. Nevertheless, the favourable clinical course and the patient's subjective satisfaction provide useful information for surgeons confronted with similar injuries.



Fig 1: Clinical photographs of the right middle finger injury showing a transarticular amputation at the distal interphalangeal (DIP) joint level. (A) Dorsal view (B) Volar view

Conclusion

Stair-rail trauma can reproduce the mechanism of classical ring avulsion and cause severe digital injuries even in the absence of jewellery. When the amputated part is non-viable and microsurgical replantation is not available, early revision amputation at the distal interphalangeal joint may offer rapid pain relief, preserve useful motion and provide a good functional result. This option should be honestly discussed with patients, especially in low-resource environments.

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Conflict of Interest

Not available

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