

# Double Embedded Rings of a Digit Leading to Amputation

Siew Khei Liew\*, Teck Siong Fong<sup>†</sup>, Kok Kheng Teh<sup>‡</sup>

\**Hand and Reconstructive Microsurgery Unit, Orthopaedic Department, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Selangor*; <sup>†</sup>*Department of Orthopaedic Surgery, Putrajaya Hospital, Putrajaya*, <sup>‡</sup>*Hand and Microsurgery Unit, Sunway Medical Centre, Selangor, Malaysia*

Chronic embedded-ring injury is a rare and uncommon presentation. This is also known as “chronic ring erosion” or “embedded ring syndrome” in the literature. Injury of this type has been associated with psychological impairment causing neglect of such injury. We herein describe a case of double embedded rings on the right ring finger in a 30-year-old healthy construction worker. A primary amputation at the metacarpophalangeal joint was performed in view of the chronicity of his condition and associated neurovascular damage. Early removal of ring is of paramount importance in any ring-associated injuries. However, fear of losing a digit has been the reason of delay in seeking medical treatment, which in turn ended up in dire consequences.

**Keywords:** *Ring, Amputation, Erosion, Digit, Embedded*

## INTRODUCTION

Chronic embedded-ring injury to the finger is a rare and uncommon presentation. It is interesting to note that injury of this type has been associated with cognitive or mental impairment, described by Fraser et al. as the ‘Embedded- Ring Syndrome’.<sup>1)</sup> Most of these patients cannot recall any specific injury prior to presentation and had been wearing the ring for a long period of time, as evident in this patient’s presentation. It is possible that this chronic problem developed due to deliberate neglect of the ring erosion by the patient. Female sex, mental illness, poor social support, and a timid personality have also been implicated as an indirect cause of this condition.<sup>2)</sup> A MEDLINE search of English-language journals showed the paucity of reported cases, whereby fewer than 20 cases were reported, and none involved amputation of the involved digits. This case report brings new insight of sequelae of a delayed presentation of chronic

embedded multiple rings in a digit.

## CASE REPORT

A 30-year old construction worker presented to Emergency Department with two partially embedded rings in his right ring finger, associated with severe pain, foul-smelling discharge and fever for the past 2 weeks. He was able to vaguely recall an abrasion injury sustained over the right ring finger, 4 weeks prior to presentation. He was admitted to another hospital previously and was advised for removal of the rings. However due to fear of pain and being extremely distressed with the procedure, he had refused treatment. He claimed to have been wearing the rings for more than 5 years. Family members gave an impression of him being quiet, introvert and being able to withstand pain due to his work as a labourer. Thus, they were not aware of the seriousness of his condition.

Physical examination of the right ring finger revealed a grossly swollen digit distal to the embedded rings (Fig. 1). Approximately two-thirds of the rings were embedded deep into the soft tissue of the volar aspect of proximal phalanx with evidence of pus exuding from the wound. The widest part of the rings was only partially visible dorsally. Distal to the embedded ring, the skin appeared dusky and insensate, with reduced capillary

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Correspondence to: Siew Khei Liew

Orthopaedic Department, Faculty of Medicine & Health Sciences,  
Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

Tel: +60-397698030, Fax: +60-397692637

E-mail: kheils@upm.edu.my

refill time. Stiffness of both the proximal and interphalangeal joints were noted. X-ray of the hand showed two adjacent rings on proximal phalanx with no bony erosion (Fig. 2).

Attempts to remove the ring in Emergency Department had failed due to severe pain of the embedded rings site. Further plans of surgery were discussed in detail with patient and family, which include removal of rings, exploration and repair of neurovascular bundle and tendons and ray amputation of the ring finger. Despite counselling of the advantages and disadvantages of amputations at level of metacarpophalangeal joint versus ray amputation, patient chose the first option.

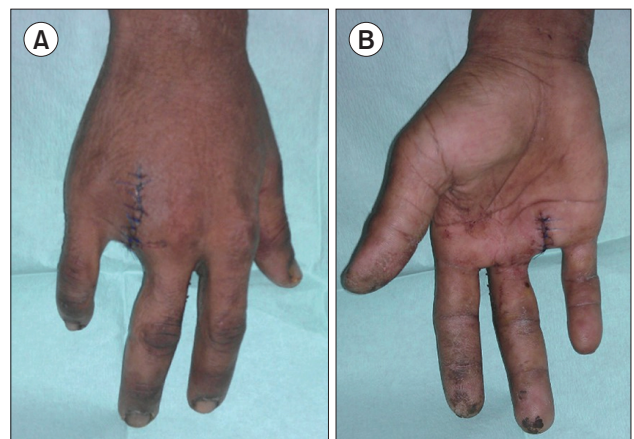
Surgery was performed under general anaesthesia. Intra-operatively the rings were found tightly embedded with a cuff of soft tissue enveloped over the volar aspect of the ring finger. The rings were cut using ring cutter in a gentle manner under saline irrigation to avoid heat necrosis of soft tissue. Both the radial and ulnar neurovascular bundle were found contused and thrombosed.

Collaterals blood supply were scanty to distal finger, Fibrous tissue constriction band was present around the wound with destruction of the flexor sheath and A2 pulley. Primary disarticulation of the right ring finger at the metacarpophalangeal joint was performed. Exploration of the amputated digit found a mass of necrotic tissue with pus collection. The wound swab analysis showed a mixed growth of *Staphylococcus aureus* and coagulase-negative staphylococci. He was given a course of two weeks Cefuroxime, in which one week of intravenous and one week of oral prescription.

The wound healed at 2 weeks (Fig. 3) and physiotherapy was commenced primarily for grip strength training. His grip strength measured via Jamar<sup>®</sup> hydraulic hand dynamometer at 3 months post-operative was only 66% of his left hand (Left 45.6 kg, Right 30.1 kg). He also noted frequent falling of small objects from the right hand. Option of ray amputation of the fourth metacarpal bone was again offered but patient opted for a finger prosthesis.



**Fig. 1.** (A) The embedded rings were partially visible on the dorsum of right ring finger. (B) The rings were completely embedded on the volar surface of right ring finger.



**Fig. 3.** Postoperative evaluation of right hand. (A) Dorsal view. (B) Volar view.



**Fig. 2.** (A) Right hand X-ray AP view. Two rings were seen adjacent to each other with no bony erosion. (B) Right hand X-ray oblique view.

## DISCUSSION

The usual clinical presentation of an embedded ring of a finger involves gradual development of post-stenotic edema and hypertrophic subcutaneous soft tissue distal to the ring. The ring is initially tight and barely mobile. Once the skin and subcutaneous tissues are eroded, the ring may become more mobile. Erosion of the soft tissue usually begins on the volar surface and spreads dorsally, since the dorsal surface of the finger is closer to the bone, which is stiffer than the volar soft tissue.<sup>3,4)</sup> The volar skin may re-epithelialise as in our case, revealing only the dorsal surface of the ring. In chronic cases, the initial discomfort experienced by the patient may subside, which may explain the later presentation of these group of patients.

The wound is usually associated with a low-grade infection with formation of granulation tissue. In advanced cases there may be injury to the extensor tendons, since they are only protected by thin dorsal soft tissues.<sup>5)</sup> Tendon adhesions and rupture may lead to finger deformity with limitation of range of motion. With progression of the infection, the soft tissue, digital nerves, phalangeal bone and the interphalangeal joint may also be involved.<sup>6)</sup> Direct injury to the bony and neurovascular structures by the ring itself is uncommon. The circular structure and rigidity of the ring itself usually does not impinge onto the neurovascular bundle. This is in contrast to the use of tourniquet which when applied circumferentially around the finger causes compression of soft tissue against the bone.<sup>7)</sup>

A delayed capillary refill or dusky skin is seen in chronic cases when the distal circulation is compromised, especially in the final stage where the viscous cycles of stenosis and edema compromise digital arteries. Permanent damage to the neurovascular bundles and flexor-extensor mechanisms may occur secondary to bony erosions of the proximal phalanx.<sup>8)</sup> This case which had two rings embedded was especially carried higher risk of neurovascular damage, having a double crush injury at a close distance on the proximal phalanx.

There are many descriptions of methods for ring removal, both destructive and non-destructive techniques abound. These include lubricated pull, suture reign longitudinal traction, icing, compression, exsanguination, rubber bands, string techniques and combinations of these methods.<sup>9)</sup> Vigorous attempts in ring removal carry risks of thermal burn and laceration. In more advanced cases, surgical option would provide the best outcome and good recovery of function.

To our knowledge, there is no case of digital amputation in the literature as a consequence of ring embedment.<sup>10)</sup> This could be explained by the digit developed collateral circulation after chronic irritation.<sup>11,12)</sup> Awan et al. described revascularization of a ring embedment case with intact vessel found on the outer surface of the embedded ring.<sup>13)</sup> However, in this case, the patient was presented to another hospital four weeks ago with attempts to remove the rings in which he described as painful and distressing. Subsequently he developed signs of digital infection with pus collection. Another attempt of removal was done upon presentation at the Emergency Department. The digit could have been traumatized during the multiple attempts of removal and infection further compromise the vascular perfusion of the digit. Intra-operative findings corresponded to thrombosed digital vessels with insufficient collateral and pus collection.

A primary disarticulation or amputation at the metacarpophalangeal joint was performed in view of the chronicity of this problem and the associated damage to the neurovascular structures. Based on functional and cosmesis grounds, the best level for surgical amputation of the ring finger should be removal of the fourth ray. Ray amputation is preferable to either reshaping of the stump or disarticulation at the level of the metacarpophalangeal joint.<sup>14)</sup> It has been demonstrated that serious impairment of hand function occurs when a gap is caused by the absence of a missing finger. As we expected, the grip strength of the affected hand was weakened with frequent falling of small objects from the hand. Skilled movements will become hard to control due to the misalignment of adjacent fingers. However, for this patient, he refused the option of ray amputation, allowing only disarticulation of the ring finger at the level of the metacarpophalangeal joint, understanding the full implications of his decision.

In conclusion, embedded ring injury to the finger is rare. The morbidity correlates with the duration of injury, therefore early removal of the ring is of paramount importance if detected early. Further delay in seeking treatment may end up with dire consequences. Diligent history taking and examination should be emphasized in cases involving swollen digits with rings, as the rings could be embedded and easily missed. X-ray is paramount in determining the numbers of ring and bony erosion, which will affect the plan of management. Cases with embedded ring injury should be explored in an adequately equipped theatre under general anaesthesia. Multiple traumatic removal should be avoided.

We believe that this is the first case reported to have two embedded rings causing chronic digital erosion, complicated with neurovascular compromise that required metacarpophalangeal joint disarticulation.

### CONFLICT OF INTEREST

All authors have no conflict of interest to declare.

### CONSENT

Informed consent was obtained from patient prior to submission of this article.

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