

Reconstruction and Replantation of Hand in 7-month-old infant due to crush injury: A case report

Abstract

Upper extremity injuries consist of a wide range of presentations, from small skin wounds to severe injuries that require replantation and reconstructive surgeries. Herein we present a hemi-amputation and crush injury to the upper extremity in a 7-month-old-infant following a motor vehicle accident which led to a replantation and reconstructive procedure. A replantation and reconstruction procedure was performed under general anesthesia. A month later, a wrist disarticulation procedure was performed due to necrosis. The bones were fixed with two pins. The following muscles and tendons were repaired: flexor digitorum profundus (tendons of the digits 4 and 5), extensor carpi radialis brevis, extensor carpi ulnaris, and flexor carpi ulnaris. Right radial and ulnar arteries were anastomosed and a splint was used to protect the injured limb. After a 6-month-follow-up, on the examination of the upper limb proximal to the wrist, the sensory examination including tactile, pain, temperature, and vibration sensation was normal.

Keywords: Hand transplantation, Transplantation, Traumatic limb amputation, Pediatrics

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Introduction

Upper extremity injuries are frequently seen in pediatric patients. Falls, strikes, and cuts are the common mechanisms of trauma-related injuries in children. 3.8% of all upper extremity injuries in children are motor vehicle-related. The upper extremity amputations consist only 0.3% of all the injury types in children⁽¹⁾. Finger and thumb amputations are the most frequent amputation locations with a prevalence of 54%, while upper limbs proximal to the fingers are the least frequent location⁽²⁾. Because of the favorable plasticity and healing capacity, replantation should be considered for amputations at any level in children⁽³⁾. We hereby present a 7-month-old-female infant who was admitted to our center due to a drastic hemi-amputation and crush injury to her hand and forearm after being involved in a road traffic accident.

Case Description

A 7-month-old-female infant was brought to the emergency department after 10 hours by air ambulance following a rollover road traffic accident. On admission, the patient was in an unstable condition and her vital signs were not within the normal range. On the lab data, a hemoglobin of 6.2 g/dL, white blood cell count of 14.6/ μ L, and blood sugar of 287 mg/dL were reported. The patient had a severe crush injury to her right upper limb causing hemi-amputation of her hand and forearm (Figure 1). The right upper limb along with the vessels and nerves were completely amputated, and the patient's right forearm was hanging at the elbow with only a little skin. Due to the patient's unfavorable condition and hemodynamic instability, it was not possible to take radiographs and the patient was immediately transferred to the operating room. Due to the sustained injury, a consultation with the plastic surgery team was done. After general anesthesia, exploratory hemi-amputation of the right forearm was performed. An one stage

replantation and reconstruction surgery was performed under general anesthesia. The possibility of necrosis of the right upper limb was predicted. Digits 1, 2 and 3 of the right hand had been destroyed at the accident scene. The bones were fixed with two pins. The following muscles and tendons were repaired: flexor digitorum profundus



Figure 1. Amputation of the right hand and forearm due to severe crushing injury



Figure 2. Affected limb immediately after surgery

(tendons of the digits 4 and 5), extensor carpi radialis brevis, extensor carpi ulnaris, and flexor carpi ulnaris. The great saphenous vein was cut in front of the inner ankle of the left leg. The right radial and ulnar arteries were anastomosed and a splint was used to protect the injured limb. The place of anastomosis of the arteries was in the 5th zone of the hand. After 3 days the patient was discharged from the hospital and oral and topical antibiotics were prescribed. A month later, a wrist disarticulation procedure was performed due to necrosis. After a 6-month-follow-up, on the examination of the upper limb proximal to the wrist, the sensory examination including tactile, pain, temperature, and vibration sensation was normal. Radial and ulnar pulse examination and elbow range of motion were normal. In the reported patient, a forearm transplant was performed for the patient, and considering that a long time had passed since the amputation of the forearm, it was expected that the patient's entire forearm would become necrotic and the patient's transplant would be rejected. But only the areas distal to the forearm became necrotic and we were able to save the patient from the forearm to the wrist.

Discussion

20,793 cases of amputation were reported in children ≤ 5 years in the US between 2008 and 2012⁽¹⁾. Traumatic amputations in children have potential risk of permanent physical and psychological consequences⁽²⁾. Different types of procedures including replantation, revascularization, reconstruction, flap covering, and stump closure are performed to manage amputations and other severe injuries to the upper limb⁽⁴⁾. Replants following crush and avulsion injuries have shown lower survival rates compared to other mechanisms of injury. The crushing, rotational stretching, and shredding components cause a large injured area and severe vascular damage⁽⁵⁾. Replantation and reconstructive procedures of a wide range of upper extremity injuries in young children have been described in the literature. Duteille et al. reported a 18-month-old boy who presented with amputation of the forearm and severe injury to his back and shoulder after being bitten by a dog. A series of expanders and flaps were placed to enable him to use a mechanical prosthesis⁽⁶⁾. Gaul et al. performed a microvascular



Figure 3. Disarticulated wrist due to necrosis 6 months later

replantation on a 7-month-old girl after her thumb got amputated with a pair of shears. 5 months after the surgery, her thumb had normal function⁽⁷⁾. Hee et al. reported a 2-year-old girl with a near-total amputation of the forearm caused by a sawing machine. A distal forearm replantation was performed. The patient developed a supination difficulty after 10 years but it was successfully managed. 30 years after the procedure she had normal motor and sensory functions⁽³⁾. Takeda et al. reported a 22-month-old-patient with multiple digit amputations. The treatment included an abdominal pocket in conjunction with composite grafts of the distal phalanxes and nails that got amputated⁽⁸⁾.

Conclusion

Upper extremity injuries are common and occasionally severe conditions presenting to the emergency departments. A multidisciplinary approach to these injuries, particularly in pediatric patients who may sustain life-long adverse consequences, is required.

Conflict of interest:

The authors of this study have no conflicts of interest to report.

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