

Near Hand Amputation: A Report of Four Cases

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Abstract

Background: The hand is an important part of the body that helps man express his thought and skills to the physical world. It is very essential to both function and cosmesis. Loss of this important body part can be devastating to the victim. We defined near total hand amputation as injury between the wrist and musculotendinous junction of extrinsic muscles of the hand transecting extensor and flexor compartment structures either passing through the wrist joint or transecting the two bones of the forearm leaving the hand attached to strip(s) of soft tissue. There are few reported cases of this type of injuries and most often completion amputation is done with loss of the hand. This study reports the outcome of near total hand amputation repair without revascularization in four patients seen and managed in Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH) in 2020. This shows that with basic surgical equipment, hand salvage surgeries can be done with very good outcome. **Methods:** Consecutive Patients with near total hand amputation seen and managed in ATBUTH in 2020 were recruited for this case series report. **Results:** Four patients with such injury were seen and managed within four months in 2020. Three had their hands repaired with very good outcome while one had a completion amputation. Three out of the four had injury to their right hand, all four were right-handed males in their third decade of life and injuries commenced from ulnar borders. Majority had transection of virtually all structures except branches of major vessels. **Conclusion:** The study shows that a number of near hand amputation can be salvaged with basic equipment with significant functional and cosmetic outcome.

Keywords: Near amputation; hand; reconstruction; Without revascularization

Introduction

The hand is an important part of the human body located distal to the wrist joint [1]. Muscles that move the hand (extrinsic hand muscles) arise from the forearm and the distal arm [1]. The hand is so important and it is the reason why man is much advanced compared to other animals. Without the hand, the big brain of hominids would have been locked in the calvarium; but it has helped man to express his great creative thoughts in the physical world [1]. The hand also holds a great cosmetic value [2]. This important part of the body is exposed to injuries during normal work, accident or attack while defending oneself [3]. Injuries to the hand can involve any part of the hand or any of its anatomical structures [4]. Most of these injuries have been named for ease of referencing in terms of diagnosis and treatment outcomes [5, 6]. Such injuries can be partial or complete for example if it is limited to the volar (flexor) aspect, it is called a zone V flexor tendon injury or a spaghetti wrist injury (when at least 10 of the 16 longitudinal structures of this region including median or ulnar nerve are involved) [7, 8]. When the dorsal (extensor) aspect only is involved it is termed a zone VIII extensor tendon injury [5]. Partial hand injury occurs when a part of the hand distal to the wrist is affected and this can be from simple injury to near total amputation [9, 10].

Near total hand amputation in this study entails a pattern of injury characterized by transection of both flexor and extensor compartment structures and passing through the wrist joint or transecting the two forearm bones (ulnar and radius) between the wrist joint and the musculotendinous junction of the extrinsic muscles, leaving the distal hand attached to the rest of the limb by a strip of soft tissue which contains a blood vessel. This type of injury is currently treated by revascularization [2] especially where both the radial and ulnar arteries are transected or by completion amputation. There are few reported cases of these injuries which were treated with revascularization [2].

In our experience in the northern part of Nigeria, this pattern of injury often results from activities of hoodlums called 'sarasuka' which literally means 'hacking and stabbing'. The 'sarasuka' often attack their victims with machetes resulting in a predisposition to near amputation. Due to the severity of the injury, the victims often present early to the hospital. We are reporting four cases, three of which had repair without revascularization and all three hands survived with significant functional and cosmetic outcome.

Patients and Methods

This is a retrospective review of all patients that presented with near amputation of the hand and were managed in our centre. All the patients were admitted through the Accident and Emergency (A&E) Department of the Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH), Bauchi. They had initial assessment by a Senior Medical Officer in the Plastic Surgery or Orthopaedic Unit with final decision being taken by the Consultant on call. During assessment, certain parameters were observed and documented, including pallor, capillary refill, differential warmth and presence of a major blood vessel or its branches supplying/draining the hand. Those that had features suggestive of good perfusion or presence of a good preserved blood vessel were planned and taken for surgery as an emergency. The wound was carefully irrigated with normal saline at room temperature and splinted with plaster of Paris while awaiting definitive surgery, usually within 24 hours of presentation.

At surgery, tourniquet was used, the wound carefully inspected, copiously irrigated with saline and devitalized tissues debrided as necessary. Exposed blood vessels were covered with gauze soaked with 2% plain lignocaine to prevent or reverse vasospasm. Rush-nails were used to stabilise the bony fractures or joint disruption. Thereafter, the tendons were repaired from deep to superficial and the major nerves (median and ulnar) were repaired. Kessler or modified Kessler suturing techniques were used for the tendon repair with nylon 3/0 for the core suture followed by interrupted epitendinous suturing while an epineurial interrupted repair was used for the nerves after properly orienting the stumps based on the vasa nervorum or from dissection. No vascular repair was carried out and all interventions were done as a single stage procedure. Wounds were all closed by direct apposition without need for skin grafting. Casting and improvised dynamic splint application was prioritized in favour of flexor tendons since both flexor and extensor tendons were injured.

For all the three patients who had repair, the surgery was done by the corresponding author and were commenced on both active and passive physiotherapy immediately after surgery.

Case 1

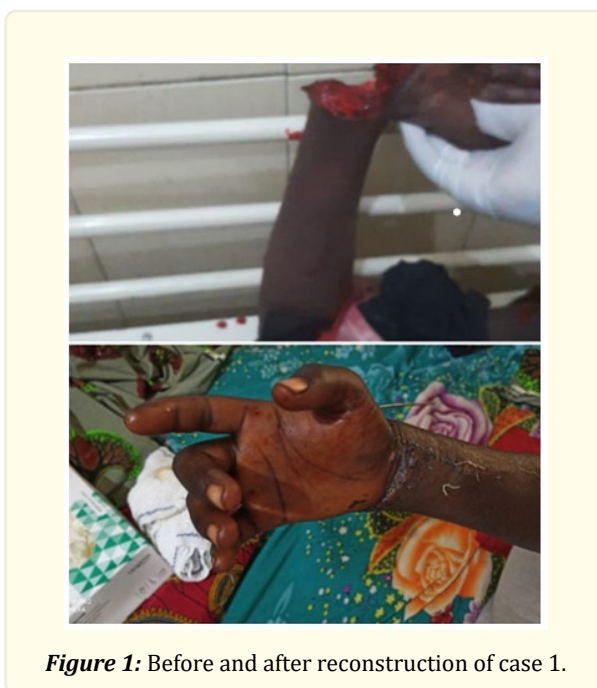
A 24 years old right-handed business man brought to the A & E about an hour after he was assaulted by unknown men armed with machete who took his motor cycle. He sustained deep laceration on the left side of his neck and right wrist with the hand nearly amputated.

On presentation he was restless, sweaty with pulse rate of 120 per minute and an un-recordable blood pressure. There was deep laceration on the left side of his neck extending to the clavicle with inability to abduct the left shoulder. There was a deep laceration starting from the ulnar border of his wrist transecting all structures along its path with the hand sustained on a strip of soft tissue on the radial aspect. The wound distally looks pink with bleeding noted from the distal stump, capillary refill was good and no significant differential warmth.

Patient was resuscitated and taken for surgery within 24 hours from the time of injury. Intraoperative findings showed all extrinsic muscles of the hand transected. The ulnar and median nerves as well as the ulnar artery were also transected but the radial artery was spared. The wrist joint (radiocarpal) was disrupted.

Two rush nails were inserted from the carpal bones to the radius and ulna bones to stabilise the joint and all structures were repaired but the ulnar artery was not revascularized as there was no loupe or operating microscope. The neck wound was also explored and repaired.

A below elbow plaster of Paris cast half was used to further splint the hand and improvised dynamic splint used for range of motion exercises. Patient commenced physiotherapy immediately post operation. He was discharged on the fifth postoperative day to continue follow up as an outpatient. His compliance to physiotherapy was erratic and he had some stiffness of the wrist joint and the joints of the digits. However, he achieved significant range of motion and cosmetic outcome. Figure 1 shows the picture before and after surgery.



Case 2

A 24 years old right-handed male student, a friend of the first case above and were assaulted by the same assailants. They both presented at the same time.

On examination he was fully conscious, pulse rate of 88 per minute and blood pressure of 130/100mmHg. He had a deep laceration about 2 cm proximal to the right wrist joint commencing from the ulnar border transecting all structures along its path leaving the hand sustained by a strip of soft tissue on the radial aspect. Radial pulse was present, good capillary refill and no significant differential warmth. Patient was worked up for and had surgery done within 24 hours of injury.

Intraoperative findings revealed all extensor tendons transected with transection of all flexor tendons except flexor pollicis longus. The ulnar nerve and artery as well as median nerve were transected but the radial artery was preserved. There was fracture of the distal aspect of the radial bone and a chip fracture of the ulnar styloid process. All transected structures were repaired, rushnails used to stabilise the fractured bones but no vascular repair was done. A below elbow plaster of Paris back slab cast was used to splint the hand and improvised dynamic splint used for range of motion exercise. He was commenced on physiotherapy immediately post operation.

Post operative x-rays showed satisfactory skeletal stabilization. He was discharged on the third post-operative day to continue follow up as an outpatient. Patient was compliant with treatment and had significant improvement in hand function. He however was lost to follow up when he returned to school. Preoperative and postoperative pictures are shown in Figure 2.



Figure 2: Before and after reconstruction of case 2.

Case 3

A 22 years old male herder who presented to the A & E about 30 minutes after an assault by his brother after an altercation over the assailant's wife. He sustained machete cuts on his right shoulder and left wrist with significant bleeding.

He was fully conscious at presentation but pale with pulse rate of 92 per minutes and blood pressure of 80/40mmHg. He had deep laceration on right deltoid region with inability to abduct the affected shoulder and a near total amputation of the left hand at the level of the wrist. The wound commenced from the ulnar border through the wrist joint with the hand suspended on soft tissue on the radial aspect. Distal hand looks pale with sluggish capillary refill and some differential warmth. Patient was resuscitated and taken to theatre for re-evaluation.

Intraoperatively, a dorsal branch of radial artery was noticed to be continues but under spasm. Gauze soaked with 2% plain lignocaine was used to wrap around the vessel while other structures were being explored. All structures were transected except that artery with two accompanying venae comitantes were spared and an overlying skin. Wrist joint was stabilised with two rushnails, joint capsules and ligaments repaired. All structures were repaired but ulnar artery was not repaired. Plaster of Paris back slab cast was applied and range of motion exercises commenced immediately after surgery using improvised dynamic splint. Post operative x-ray showed satisfactory skeletal stabilization. He was discharged on postop day 3 to see clinic. There was significant functional and aesthetic preservation but patient also stopped coming for follow up. Figure 3 shows the injury before and after reconstruction while Figure 4 shows intraoperative picture of case 3.

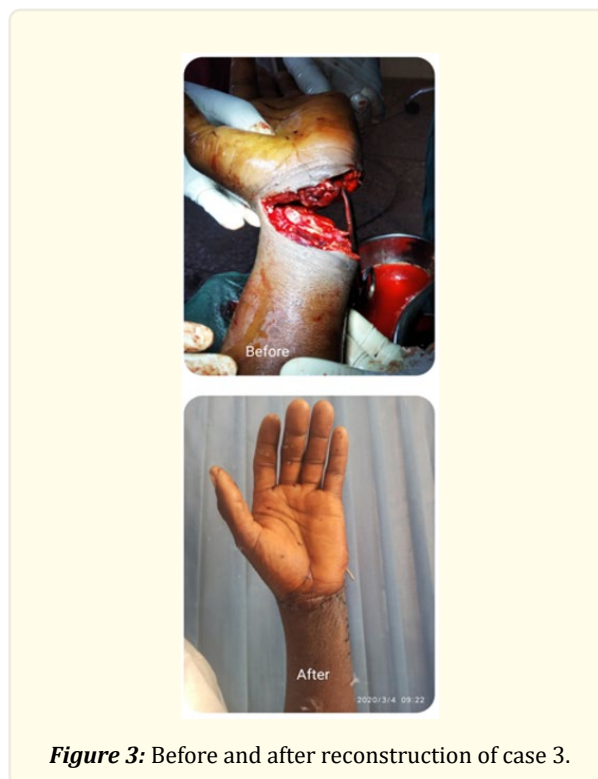




Figure 4: Intraoperative picture case 3.

Case 4

A 25 years old male tricycle driver who was assaulted by unknown persons. He presented to the A & E about 2 hours after the injury with history of assault to his right upper limb at the level of the wrist.

He was conscious at presentation with pulse rate of 86 per minute and blood pressure 120/60mmHg. There was deep laceration at the level of his right wrist extending through the volar aspect of the wrist but distal wound looks pink. There was soft tissue preserved on the dorsal aspect of the wrist radially.

Patient was worked and had completion amputation by the Orthopaedic Surgeons, see Figure 5.



Figure 5: Before and after completion amputation of case 4.

All the patients whose hand were reconstructed (n = 3) were satisfied with the decision and would choose that option again. They were satisfied with the function of the hand post-operatively. Long-term follow-up was poor in all the patients, therefore there was no objective assessment of the long-term functional outcome. In the short term however, all were able to achieve moderate degree of flexion and extension of the digits which improved with physiotherapy. One of the patients was not compliant with physiotherapy resulting in progressive stiffening of the hand.

There were no incidents of systemic complication or surgical site infections.

Discussion

In regions where there is increased rate of violence with sharp objects like machetes, near amputation or complete amputation of the hand will be seen commonly. This happens due to the natural reflex tendency for an unarmed victim to defend himself with his hand to ward off an attack, especially as the assailants often target the victim's neck or head [10]. Initial studies revealed that patients often use their non-dominant hand to defend themselves hence same is often injured. Four out of five patients who sustained machete cut in a study by Yiltok et al [8] in North Central Nigeria had it on their left wrist. In contrast, of the 4 patients in this report, all were right-handed and 3 (75%) had injury on the right hand. It has also been shown that ulnar side of the hand is the most affected in defense injury [8], which was corroborated by this study. All patients in this study had ulnar sided injuries. In studies done on homicidal victims with defense injuries the left hand was more commonly affected [11-13].

This study found out that all patients were males in third decade of life which is in keeping with the study by Olaitan et al [6] who found the mean age of 28 years in a population of 106 patients with hand injury. Cavadas et al [14] while working on patients with amputation around the same region requiring replantation found all the five patients to be male, age range 21 to 32 years. Other studies found the age range to be between 11 and 44 years [7, 15]. This increased prevalence of assault injuries among young male adults is not surprising as this age group is very active physically and are more likely than other age group to engage in violent activities [6-8]. Only one incident (25%) was the assailant known to the victim in our series.

All the patients presented within hours of the injury and they all had primary repair. This is largely due to the severity of the injury where the hand is left hanging on a strip of soft tissue which makes it frightening to the victims and their relatives. That motivates them to present early and seek care to ensure the hand is salvaged. No vascular repair was done, yet the hands were all salvaged except the one that had completion amputation. This underscores the need for proper evaluation of this kind of injury and patients on the side of the surgeons as well as prompt involvement of Plastic or hand surgeons to ensure patients get the best possible outcome from their injuries.

All the patients that had repair of their hands were satisfied with the outcome even though functional recovery was slow and incomplete. All of the patients defaulted from follow up, most likely due to financial constraint as they were required to pay out of pocket for virtually all their health care needs due to non-accessibility of health insurance.

The study demonstrated the importance of proper evaluation of hand injury and the benefits of diligent repair of hand, that could otherwise have been lost, using basic equipment that can be readily sourced in any hospital setting. It also shows a departure from the common left-hand injury seen in defense injury.

Conclusion

With proper evaluation, branches of known vessels to the hand may be preserved in patients with Near Hand amputation, allowing the possibility for repair and salvage. This underscores the need for proper evaluation before condemning such patients to completion amputation.

This is even more important because preservation of the native hand is highly valuable and is an inexpensive gift from the surgeon to the patient as compared to prosthetic devices that bear some resemblance to the native hand but whose costs are prohibitive (hun-

dreds of thousands to millions of naira) where available.

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Declaration

We hereby declare no conflict of interest.

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