Al-Azhar Med. J. *Vol. 46(1), January, 2017, 131-141*
DOI: 10.12816/0035542

RECONSTRUCTION OF UPPER LIMB TRAUMA

By

Rady E. Abdel-Hady[1], Abdel-Hakeem A. Masoud[2], Amr M. Kamal[1], Ayman A Mohy-Eldin[3], Esam A. Taman[4] and Khaled M Attia[3]

General Surgery[1], Orthopedic Surgery[2], Vascular Surgery[3] and Plastic Surgery[4] Departments, Faculty of Medicine, Al-Azhar University

ABSTRACT

Background: Upper limb trauma is an injury caused by cutting, tearing, or crushing which leads to the limb becoming unrecognizable. In essence, there are two treatment options amputation and salvage reconstruction. **Objective:** The aim of this study was to assess the outcome of reconstructive surgery in upper limb trauma. **Patients and Methods:** This study was conducted upon 30 patients (24 males and 6 females) with mean age 28.53 ± 9.06 years presented with more than two elements, e..g. bone and tendons, vascular, nerve and skin. They were selected from Al-Azhar University Hospitals. They were admitted in General Surgery Department, Al-Azhar University Hospital, Faculty of medicine (Damietta), between April 2011 and January 2016. After appropriate consent, clinical assessment and radiological evaluation, reconstruction of upper limb trauma by repaired tendons, vascular, skin injuries and bone fixation were done. Postoperative clinical assessments of sensation and function were done. Hand functions were grouped as excellent, good, fair and poor. Nerve injury was tested using both sensory and motor components, while assessment of the hand and fingers vascularity was carried out by original and modified Allan's test. All cases were followed up in first postoperative year for vascularity, sensation and functions of the hand. **Results:** For 30 patients over a period of a year of clinical follow up, there was marked reduction in morbidity and mortality with satisfactory significant improvement in upper limb and hand functions, and no ischemia, neuroma or tendon ruptures were observed during the follow-up period. **Conclusion:** Upper limb trauma reconstruction required a thorough understanding of the advantages and limitations of local, regional, distant, and free flap options. Only those wounds with exposed neurovascular structures, tendon, or bone typically require flap coverage. Multidisciplinary team can prevent or at least minimize post-operative functional disability of upper limb.

Key Words: Upper limb, elbow, flexor, tendon, radial artery, ulnar artery, median nerve, ulnar nerve.

INTRODUCTION

Road traffic accidents are the main causes of upper-extremity trauma. Injuries may be multiple. A mangled upper extremity may require multiple procedures and years to rehabilitate. The management of extensive and complex defects is challenging and may result in limb amputation or shortening **(Adkinson and Chung, 2014).**

Limb amputation is a severe mutilation that compromises the patient's everyday routine by limiting self-sufficiency. The evolution of microsurgery has radically changed the treatment of complex upper limb wounds. Soft tissue reconstruction with well-vascularized muscle or fascio-cutaneous flaps provides soft tissue coverage of metalwork, fills the dead space, and helps in the delivery of oxygen and antibiotics to the wound bed. Thus, the functional, morphologic, and cosmetic

outcome is improved in most instances, avoiding the need for limb amputation or shortening **(Fang and Chung, 2014).**

The aim of this study was to assess the outcome of reconstructive surgery in upper limb trauma.

PATIENTS AND METHODS

This study was a prospective carried out on 30 patients (24 males and 6 females). Their mean age was 28.5 ± 9.1 years. They were presented with upper limb trauma with more than two elements, e.g. bone, tendons, vascular, nerve and skin. They were selected from Emergency Department, Al-Azhar University Hospital. They were admitted in General Surgery Department, Al-Azhar University Hospital, Faculty of Medicine (Damietta), between April 2011 and January 2016.

Our patients were selected with Mangled Extremity Severity Score (MESS) between 4 and 7 score.

The procedure, possible complications, benefits, risks and other alternative interventions were explained to the patients, and an informed consent was obtained from every patient.

Any patients with upper limb trauma less than two elements, irreversible ischemic limb, severely crushed un-salvagable limb, or those with associated life threatening injuries were excluded from this study

All our patients were subjected to:

A) Pre-operative evaluation:

- **Careful history taking**.
- **Examination:** The primary survey included the ABCs (i.e., airway, breathing, circulation). A Glasgow Coma Scale score was recorded. No case in our study had severe head injury. The secondary survey included the chest, abdomen, and pelvis for life threatening injuries, as well as the lower limbs and the contralateral upper limb. We had to save the patient first and the limb next.

  Thorough local examination of injured limb was done. All constricting clothing about the injury were removed. Wound inspection was done and documented including its location, length, configuration and condition of the adjacent skin. The radial and ulnar pulses were palpated in the wrist. The vascularity of the limb, including limb color, warmth and perfusion, palpable pulses and capillary return was recorded. A neurologic examination was documented for both sensory and motor functions. Fracture site noted if present.
- **Photography:** Photos of the wound were taken for documentation and follow up.
- **Investigations:**

- Preoperative blood tests were ordered including, blood group, CBC, creatinine, blood sugar and INR.
- Focused assessment with sonography for trauma (FAST) was done to exclude internal hemorrhage.
- Doppler assessment on the affected limb was done to confirm or exclude vascular injury.

- X-rays were done on the affected limb.

- **Primary management:** Initial care consisted of I.V lines, fluids and analgesia in the form of NSAID but in some cases. Nalbuphine was given to control the severe pain. Anti-tetanic serum and intravenous antibiotics were given to the patient once arrival in emergency department. Betadine scrub of the wound was done. Saline lavage was done only in cases with foreign bodies in the wound as glass, then the wound was covered with a sterile dressing and it wasn't inspected again until the patient was in the operative room. Well-padded splint stabilization was done for fracture.

B) **Intra-operative evaluation:** Intra-operative debridement of the wound was done under general anesthesia, as soon as the general condition of the patient permitted. Tourniquet was applied in special circumstances only, like profuse bleeding or very bad hemodynamic condition of the patient. The wound was thoroughly evaluated and meticulous attention was given to all the tissues from skin to bone, from pheripheral to central, and the amount of contamination and severity of damage noted. After a thorough Betadine scrub, the limb was draped with sterile sheets and the wound was irrigated with normal saline for removal of contaminated material from the wound. Stepwise debridement starting from skin to bone was carried out. The dead margins of the skin were excised until dermal bleeding was encountered. Muscles were debrided with particular attention to color, consistency, contractility and capacity to bleed.

The neuro-vascular structures were examined in cases where neuro-vascular status was found impaired on clinical examination. The bone ends were inspected and the fracture edges were curetted. Small fragments of bone which were stripped of soft tissues and any grossly contaminated bone were discarded. Attempts were made to retain major clean bone fragments contributing to fracture stability. At the end of initial debridement, the wound was again thoroughly irrigated with 4 liters of normal saline. Post debridement grading and radiological evaluation of fracture was recorded. Any fracture was managed by external fixation or limited internal fixation by pin/K-wires(particularly with phalangeal, metacarpal and carpal bone injuries).

Vascular reconstruction was performed after the fractures have been stabilized. According to diameter of vessels, proline 7/0, 6/0, and 5/0 were used by simple interrupted end-to-end primary anasto-mosis and some cases were repaired by interposition venous graft. In multiple level injuries we started by repairing the more proximal vascular injury, and then working distally. Sometimes for fear from time of ischemia we repaired the arterial injury before skeletal stablization if the patient came late to our hospital. Using magnification, injured vessels were trimmed back to healthy viable tissue and undergone to primary repair, without tension. Vein grafts were used where there is doubt about vessel viability or tissue tension. Reversed saphenous vein grafts was used in two cases.

Tendon repairs and musculotendinous reconstructions were addressed next. Flexor tendons repaired from deep to superficial fashion using modified Kessler technique with 3/0 proline and reinforced with 5/0 continuous epitendinous suture, and early protected motion/dynamic immobilization was vital to tendon function preservation and prevention of scar tissue adhesions. The flexor tendons repaired directly where possible.

Nerve repaired by preparation, approxi-mation, alignment and main-tenance. Nerves sutured by 9/0 proline simple interrupted epineural suture. Microscopic or surgical loupes were used for careful repaired of nerve fascicles. Tension was avoided at the repair site, at all costs. Small nerve gaps were resolved by mobilizing the nerve ends, through proximal nerve transpositions.

Wounds were closed un-tightly, to decrease the risks of ischaemia and wound dehiscence. The choice of graft was determined by the size and location of the defect and follows the "reconstructive ladder" principles. Type of coverage used included direct closure, flaps including radial forearm flap, bilobed groin flap, medial arm flap and lateral arm flap.

C) **Post-operative evaluation:** In first few hours postoperatively, antibiotics were instituted and were continued till wound closure. Evaluation of hand vascularity were assessed by skin color, capillary refilling, distal pulsation with comparison with other side. Further assessment of hand vascularity were done by pulse oximeter and hand doppler.

In case of SSG, wound was examined on 1st day for seroma collection and evacuation if present, 5th day for dressing and then every other day for changing dressing.

In case of flap, close observation was done in the 1st week for temperature, color, capillary refilling, firmness and point bleeding.

Limb inresting position was maintained and tight dressings were avoided, especially over flaps. Patients were started on elbow and wrist exercises as per the stability of fixation and the soft tissue cover. Patients were discharged at around 5^{th} to 7^{th} post-operative day. If external fixator was used then the patient was examined for pin tract infection.

Follow up:

The discharged patients were followed up in the outpatient clinic weekly for first month, then every two weeks in second month, then every 3 weeks for third and fourth months and then monthly up to 6th months.

At every visit patient was examined clinically for wound coverage, elbow and hand functions and the radiograph was obtained. Any complications noted were recorded. We begin early passive range of motion to prevent tendon adhesion and leave the patient in a dorsal blocking splint to prevent hyperextension and additional strain to the repair site.

In both motor and sensory nerve repairs, an advancing tingling sign seen during the regeneration phase is followed until the patient has restoration of function or sensation. Even before there is clinical

evidence of recovery, we begin desensitization of the affected area to assist in sensory reeducation and to prevent hypersensitivity. Semmes-Weinstein testing (1960), and sensory grading were used for motor and sensory nerve assessments. Motor reeducation begins as soon as the patient has some clinical evidence of muscle contraction.

Vascular assessments: Assessment of the hand and fingers vascularity was carried out by inspecting the color, palpating the temperature of the hand, and assessment of capillary refilling and palpation of both radial and ulnar pulses with comparison of arterial blood pressure at both brachial arteries. Allen's test (original and modified) (1929) was an excellent tool for evaluation of perfusion.

Neurological assessments: A complete neurological examination including the radial nerve, median nerve and ulnar nerve was done:

Motor Examination of the Hand: Focused motor examination included evaluation of extrinsic forearm and intrinsic hand muscle innervation. Evaluation of median nerve integrity includes thumb opposition with little finger, and flexion of thumb interphalangeal (IP) joint with index finger proximal IP (PIP) joint to form an "OK" sign.

Ulnar nerve was evaluated by abduction of fingers by spreading them apart, and cross-crossing the index and third finger.

Radial nerve evaluated by thumb extension to make a "thumbs-up" sign, dorsal wrist extension and extension of fingers at the metacarpophalangeal (MCP) joint.

Functional assessment of the hand was performed according to criteria of Kleinert and Verdan (1983):

- Excellent: function of tendon 85% or distance from fingertip to distal palmar crease <1.0 cm.
- Good: function of tendon 70-84% or distance from fingertip to distal palmar crease <2.0 cm.
- Fair: function of tendon 50-69%.
- Poor: Fixed contracture or adhesion.

Flexor digitorum profundus (FDP) function was tested by blocking flexion at the proximal inter phalangeal (PIP) joint of the finger in advising the patient to flex the distal inter phalangeal joint.

Flexor digitorum superficialis (FDS) function was tested passively keep the adjacent fingers extended to block the deep flexor tendons, while looking for flexion at the PIP joint.

Sensory Examination of the Hand was assessed by sensation to light touch and pin-prick as well as two-point discrimination test, with ≤5mm as normal.

Postoperative rehabilitation

Early-protective, immediate-mobilization, and late-strengthening, occupational therapies, psychological support, social assistance as post-traumatic stress disorder (PTSD), and depression were common following these catastrophic injuries .

Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social

Sciences (SPSS) version 18.0 (IBM, Chicago, IL). Data are presented as mean±SD, or numbers and percentages.

RESULTS

Preoperative Data

There were a total of 30 patients: 24 men (80.0%) and 6 women (20.0%). Their mean age was 28.5 ± 9.1 years. 17 (56.7%) of enrolled patients were carpenter, 5 (17 %) were housewives, 2 (6.7 %) were students, two cases (6.7%) were mechanic, one case (3.3%) was plumper, one case (3.3%) was driver, one case (3.3%) was fishermen and one case (3.3%) was butcher. Only 3 cases (10%) were on medical drugs for hypertension. The time lasted from trauma until present to hospital ranged between 1 and 4 hours with a mean of time 2.40 ± 0.78 hours (Table 1).

Structures involved in current study were flexor digitorum superfialis tendon in 60%, flexor digitorum profundus tendon in 53.33%, flexor carpi radialis tendon in 16.67%, flexor carpi ulnaris tendon in 43.33%, radial artery injury in 23.33%, ulnar artery injury in 56.66%, ulnar nerve injury in 73.33% and median nerve in 43.33% of cases, while raw area (skin loss) occurred in 16.67%.

As regard to **bone fractures**, one case presented with humoral, two cases with radial, one case with metacarpal, and one case with phalangeal fracture. As regard to **vascular repair,** twenty six (86.67 %) of vascular repair were done by direct technique, while only two (6.7 %) of vascular repair were done by great saphenous vein graft, and two (6.7 %) repaired by superfacial forearm vein graft. As regard to **time of wound repair,** twenty eight (93.3 %) of repair of wound were done immediately, while only two (6.7 %) of repair were done later on. As regard to **type of structure repair,** 56.67 % of structure repair were done by primary closure, while 13.3 % of repair were done by radial forearm flab, 10.0% by medial arm flab, 10.0% by lateral arm flab, 6.7% by bilobed groin flab and 3.3% by hand revascularization (Table 1).

Postoperative assessments: All patients participating in this study showed normal vascular return tested by Allen's test (1929). As regard to motor assessment by Kleinert and Verdan (1983) criteria; 53.3% of cases were good, 40% were excellent and 6.67% were fair response. As regard to sensory assessment by two point discrimination test: 90% of cases have a distance of discrimination between 5 and 8 mm, 10% of cases have a distance of discrimination between 9 and 13 mm, and no cases have a distance of discrimination more than 13 mm.

Twenty five (83.3%) of enrolled patients did not show any complications, 1 case (3.3%) showed no pulse on UA, one case (3.3%) showed seroma formation, 1 case (3.3%) showed hematoma and 1 case (3.3%) showed infection. The patients had minor functional deficit after muscle harvesting treated by physiotherapy. No donor site complications were noted (Table 2).

Table (1): Demographic and operative data of studied cases.

Parameters	Value
Age (mean ± SD) years	28.53 ± 9.06
Sex (males)	24 (80%)
History of hypertension	3 (10.0%)
Time since trauma (mean+SD) hours	2.40 ± 0.78
Status of the wound	
Sharp cut	25 (83.3%)
Crushed	4 (13.3 %)
Lacerated	1 (3.3%)
Structure involved	
Flexor digitorum superfialis tendon	18 (60%)
Flexor digitorum profundus tendon	16 (53.33%)
Flexor carpi radialis tendon	5 (16.67%)
Flexor carpi ulnaris tendon	13 (43.33%)
Radial artery injury	7 (23.33%)
Ulnar artery	17 (56.67%)
Ulnar nerve	22 (73.33%)
Median nerve	13 (43.33%)
Raw Area (skin loss)	5 (16.67%).
Fracture	
Humoral fracture	1 (3.3 %)
Radial fracture	2 (6.7 %)
Metacarpal fractures	1 (3.3 %)
Phalanges fracture	1 (3.3 %)
Type of vascular repair	
Direct	26 (86.67%)
Great saphenous vein graft	2 (6.7 %)
Superfacial forearm vein graft	2 (6.7%)
Time of wound repair	
Immediate	28 (93.3%)
Late	2 (6.7 %)
Type of structure repair	
Primary closure	17 (56.67 %)
Radial forearm flab	4 (13.3 %)
Medial arm flab	3 (10.0 %)
Lateral arm flab	3 (10.0 %)
Bilobed groin Flab	2 (6.7 %)
Hand revasculaization	1 (3.3 %)

Table (2): Post-operative assessments of studied cases.

Parameters	Value
Vascular assessments by Allen's test	
Normal (color returns < 6 seconds)	30 (100 %)
Positive (color returns < 6 seconds)	0 (0 %)
Motor assessments by Kleinert and Verdan criteria	
Excellent	12 (40 %)
Good	16 (53.3%)
Fair	2 (6.67)
Poor	0 (0 %)
Sensory assessments by two point discrimination test	
Distance 5 - 8 mm	27 (90 %)
Distance 9 - 13 mm	3 (10 %)
Distance > 13 mm	0 (0 %)

DISCUSSION

Upper limb trauma require a stable and durable solution. Important differences remain, however, regarding the reconstructive demands intrinsic to each anatomic area. Forearm wounds can often be closed directly or covered with skin grafts. Only large wounds or those with exposed neurovascular structures, tendon, or bone typically require flap closure. Conversely, elbow wounds have limited simple solutions for coverage as underlying structures and prostheses are easily exposed **(Stevanovic and Sharpe, 2013).** Upper limb wounds also have the unique requirement of a pliable, yet well-padded reconstruction. These characteristics promote early mobilization to prevent contracture and stiffness **(Jensen and Moran, 2008).**

In our study, 24 patients were males (80.0 %) and 6 females (20.0 %) with male to female ratio 4:1. Male predominance in current study similar to **Jones et al. (2008)**, **Lytle et al. (2009**) and **Taman et al. (2015)** studies.

Seventeen (56.7%) of enrolled patients were carpenter, 5 (17 %) were housewife, 2 (6.7 %) were students, two cases (6.7%) were mechanic, one case (3.3%) was plumper, one case (3.3%) was driver, one case (3.3%) was fisherman and one case (3.3%) was bucher. In contrast to our results the study conducted in Egypt by **Taman et al. (2015)**, in which the most frequent mechanisms of injuries was glass laceration (66.6%) then knife wounds at 5 patients (33.4%). **Rubin et al. (2015)** reported upper extremity injuries highly associated with road traffic accidents. Motorcycle (27%) and bicycle riders (25%) had the greater risk for upper extremity injuries (P<.0001). In our study, FDS was the most common injured tendon affected in 18 cases (60%), this was in agreement with **de Jong et al. (2014)** and **Taman et al. (2015)** studies, they found that FDS has been the most commonly injured tendon. Upper extremity arterial injuries constitute up to 50% of peripheral vascular injuries. Penetrating injury to the forearm is a less common subset of upper extremity trauma. Lacerations of the forearm and wrist by knife, glass or machinery (often from occupational injury), are frequent to both the radial and ulnar arteries **(Thai et al., 2015)**. In our study, 23.33%, 56.66%, 73.33% and 43.33% of enrolled patients suffered from radial artery, ulnar artery, ulnar nerve and median nerves injuries respectively. However arterial repair is mandated if both the radial and ulnar arteries are injured, or if suspicion of an incomplete arch exists **(de Jong et al., 2014).**

In Egypt, a study done by **Taman et al. (2015)** on 15 patients presented with acute volar wrist injuries, they found that, the least common injury was in the FPL with 13.3% involvement and the most common injury was in FDS with 100% involvement. Synchronous median and ulnar nerve injury was present in 26.6%. Synchronous injury in radial and ulnar arteries were presented in 13.3% of cases.

A study by **Antony et al. (2014)** used a similar setup for the ulnar artery, assessed the literature for hand morbidity after ulnar flap elevation. They reported impaired wrist/finger mobility in 5% of patients (18 of 358 cases) and grip strength loss in 0.8% of patients (3 of 358 cases).

Lateral intermuscular septum between the brachial muscle and the brachioradial muscle, it runs to the lateral condylus of humerus and provides several periostal, muscular, fascial, and cutaneous branches. In our series, we can approve that there is a reliable vessel anatomy of the lateral arm flap.

The free lateral arm flap provides a good option for reconstruction of simple and complex multistructural defects of small to medium size at the hand and forearm. Besides the great variety of tissue components that are included, this flap provides a constant anatomy with a relatively long vascular pedicle.

In our study, Three cases(10%) were reconstructed by medial arm flab. The medial arm flap has shown to be an excellent flap for injured hands and is the most reliable, versatile flap for upper limb soft tissue reconstruction and can be used as a free flap or pedicled flap **(Griffin et al., 2014).**

In our study, Two cases(6.7%) were reconstructed by bilobed groin flap for defect closure of the hand.

This result was similar to **Jokuszies et al. (2010)** study, in which defect closure with a pedicled groin flap was performed in 14 patients.

In our study vascular assessment of the hand was performed by Allen's test with normal value in all cases (color retained within 6 seconds). In addition, the results of Allen's tests do not appear to correlate with distal blood flow as demonstrated by fluorescein dye injections**.** Motor assessment of the hand was performed according to Kleinert and Verdan criteria. excellent result (function of tendon 85% or distance from fingertip to distal palmar crease <1.0 cm) was achieved in 40% of cases. Good (function of tendon 70-84% or distance from fingertip to distal palmar crease <2.0 cm) was achieved in 53.3% of cases. Fair (function of tendon 50-69%) occur in 6.67% of cases while poor result (fixed contracture or adhession) not recorded in our cases. These results were in closer to **Taman et al. (2015)** study, they found that motion in wrist and finger was 33.3% of cases were 46.7% were good, and 13.3% were fair and fixed contracture was observed in 6.7%. Degrees of claw hand deformity were present in these 20% of cases (20%).

Success rate in our study was 100% and the survival of flap was 100. However, 1 case (3.3%) show no pulse on UA, one case (3.3%) show seroma formation, 1 case (3.3%) show hematoma and 1 case (3.3%) show infection. The patients had minor functional deficit after muscle harvesting which was overcome by physiotherapy**.** Our results were in agree with **Sajjad et al. (2010)** study. They found 90% success rate with 100% survival of flap and necrosis was done in 10% of patients, seroma formation was seen in 28% of patients. **Bernd et al. (2015)** found that only one patient (8.3%) with the crush injury incurred a postsurgical complication (necrosis of skin graft).

CONCLUSIONS

Upper limb trauma reconstruction requires a thorough understanding of the advantages and limitations of local, regional, distant, and free flap options. Only those wounds with exposed neurovascular structures, tendon, or bone typically require flap coverage. Multi-

disciplinary team can prevent or at least minimize post-operative functional disability.

REFERENCES

1. Adkinson JM, and Chung KC. (2014): Flap Reconstruction of the Elbow and Forearm: A Case-Based Approach. Hand Clin., 30(2): 153–163.
2. Allen EV. (1929): Thromboangiitis obliterans: methods of diagnosis of chronic arterial lesions distal to the wrist with illustrative cases. Amer J Med Sci.,178: 237.
3. Antony AK, Hootnick JL and Antony AK. (2014): Ulnar forearm free flaps in head and neck reconstruction: systematic review of the literature and a case report. Microsurgery, 34:68–75.
4. Bernd L, Bliley, Jacqueline BS; James, Isaac B. MS; Wang, SS; Sivak, W; Kim, K; Fowler, J and Spiess, A. (2015): Long-term Patency of Primary Arterial Repair and the Modified Cold Intolerance Symptom Severity Questionnaire. Plastic and Reconstructive Surgery - Global Open, 3 (11): e551-58.
5. de Jong JP, Nguyen JT, Sonnema AM, Nguyen EC, Amadio PC and Moran ST (2014): The Incidence of Acute Traumatic Tendon Injuries in the Hand and Wrist: A 10-Year Population-based Study. Clinics in Orthopedic Surgery, 6:196-202.
6. Fang F. and Chung KC. (2014): An Evolutionary Perspective on the History of Flap Reconstruction in the Upper Extremity. Hand Clin., 30(2): 109–11.
7. Griffin M, Hindocha S, Malahias M, Saleh M and Juma A (2014): Flap Decisions and Options in Soft Tissue Coverage of the Upper Limb. The Open Orthopaedics Journal, 8 (2) 409-14.
8. Jensen M. and Moran SL. (2008): Soft tissue coverage of the elbow: a reconstructive algorithm. Orthopedic Clinics of North America, 39 (2):251–264.
9. Jokuszies A, Niederbichler AD, Hirsh N, Kahlmann D, Herold C and Vogt PM. (2010): The pedicled groin flap for defect closure of the hand. Oper Orthop Traumatol., 22 (4):440-51.
10. Jones NF, Jarrahy R and Kaufman MR. (2008): Pedicled and free radial forearm flaps for reconstruction of the elbow, wrist and hand. Plast Reconstr Surg. 121(3):887–99.
11. Kleinert HE. and Verdan C. (1983): Report of the committee on tendon injuries. J. Hand Surg. 8: 794.
12. Lytle IF. and Chung KC. (2009): Radial forearm flap. In: Rayan, GM.; Chung, KC., editors. Flap Reconstruction of the Upper Extremity: A Master Skills Publication. American Society for Surgery of the Hand; Rosemont, IL, 97-105.
13. Rubin G, Peleg K, Givon A and Rozen N (2015): Upper extremity fractures among hospitalized road traffic accident adults. Am J Emerg Med.. 33 (2): 250-53.
14. Sajid MS, Betal D, Akhter N, Rapisarda IF and Bonomi R. (2011): Prevention of postoperative seroma-related morbidity by quilting of latissimus dorsi flap donor site: a systematic review. Clin Breast Cancer, 11:357–63.
15. Sebat K, Bagdatl D. Demir Zuhtu M.; Tuccar E and Selim D. (2005): Use of Medial Arm Skin as a Free Flap. Plastic and Reconstructive Surgery, 115(7): 2025-31.
16. Semmes J., and Weinstein S. (1960): Somato-sensory changes after penetrating brain wounds in man. Harvard University Press, Cambridge, 13:125-128.
17. Stevanovic M. and Sharpe F. (2013): Soft-tissue coverage of the elbow. Plastic and Reconstructive Surgery, 132(3):387e–402e.
18. Taman E, Khereba W and Megahed H. (2015):Acute Volar Wrist Injuries: Evaluation and Management. Egyptian Journal of Vascular & Endovascular Surgery, 11 (2): 45-62.
19. Thai JM, Jose A, David S, Tianyi S, Brandon Z, John A, Jordan L and Joseph E. (2015): Evidence-based Comprehensive Approach to Forearm Arterial Laceration. West J Emerg Med., 16 (7): 1127–34.

إعادة بناء إصابات الطرف العلوى

راضي السعيد عبد الهادي[١] - عبد الحكيم عبد اللـه مسعود[٢] - عمرو محمود كمال[١]
أيمن أمين محي الدين[٣] - عصام على طمان[٤] - خـالد محمـد عطية[٣]

أقسام الجراحات العامة[١] والعظام[٢] والأوعية الدموية [٣]والتجميل[٤] - كلية الطب – جامعة الأزهر

خلفية البحث: تؤدي إصابات الطرف العلوي الناتجة عن القطع أو التمزق أو السحق إلي صعوبة في التعرف عليها .وهناك نوعان من الخيارات المتاحة لعلاج الأطراف العلوية إما البتر وإما إعادة بنائها. ومع التقدم في التطوير المستمر في أجهزة التثبيت و إعادة بناء العظام والأنسجة عن طريق الأجهزة المجهرية أصبح الناتج الوظيفي والإكلينيكي لهذه الأطراف جيداً ومرضياً لكل من المريض و الجراح، وكلما كان التدخل مبكرا كانت النتائج أفضل بكثير عن تلك المتأخرة.

الهدف من البحث: تقييم نتائج جراحة إعادة بناء إصابات الطرف العلوي.

المرضي و أدوات البحث: أجريت الدراسة الحالية علي ثلاثين مصابا بالطرف العلوي: ٢٤ من الذكور و ٦ من الإناث ، متوسط أعمارهم ٩،٠٦ ± ٢٨،٥٣ عاما ، ومصابين بأكثر من عنصرين من الإصابات مثل عظم ووتر ، أو وتر ووريد ، أو شريان ، أو قطع جلدي .و تمت الدراسة بقسم الجراحة العامة - مستشفي الأزهر الجامعي - بدمياط الجديدة في الفترة من شهر أبريل ٢٠١١ وحتى شهر يناير ٢٠١٦.

وبعد أخذ الموافقة المناسبة من المرضي ، تم أخذ التاريخ المرضي و الفحص العام و الموضعي وعمل التحاليل والأشعة اللازمة وتم معالجة الطرف المصاب بعمل غسيل وتنظيف بواسطة المحاليل المعقمة ، كما تم إصلاح الأوتار والأعصاب و الأوعية الدموية ، وكذلك الأنسجة الرخوة وتثبيت الكسور إن وجدت.

وبعد إجراء العملية، تم التقييم الإكلينيكي و الوظيفي للطرف العلوي ، وتم تقسيم وظائف اليد إلي ممتازة وجيدة ومقبولة و ضعيفة. وتم تقييم الأعصاب حسياً وحركياً ، كما تم إختبار التغذية الدموية لليد عن طريق إختبار آلان ، وتم متابعة المرضي لمدة عام من تاريخ إجراء العملية.

النتائج : هناك إنخفاض ملحوظ في الحالة المرضية و الوفاة لدي هؤلاء المرضي ، مع تحسن في كل من وظائف الطرف العلوي واليد بدون حدوث أي مضاعفات

الإستنتاج: إعادة بناء إصابات الطرف العلوي تستلزم الفهم الجيد لأضرار و منافع إستخدام الرفارف الجلدية في إصابات الطرف العلوي المصحوبة بفقد أجزاء من الجلد وتعرض الأنسجة الداخلية والأوردة والشرايين والأعصاب للتلف ، كما أن تعاون أكثر من تخصص أثناء إعادة بناء إصابات الطرف العلوي يمنع أو علي الأقل يقلل من إعاقة الحركة بعد عملية الإعادة.