

Key Factors in Zone V Flexor Tendon Repair, Our experience at Liaquat National Hospital

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ABSTRACT

Objective: The aim of this study is to analyze the outcome of long flexor tendon injuries in zone 5 when repair done using Modified Kessler Technique.

Study Design: Descriptive case series study

Place and Duration of Study: This study was conducted at the Plastic surgery Department, Liaquat National Hospital, Karachi from January 2015 to June 2015.

Materials and Methods: It was a single centered descriptive case series. All tendons were repaired by Modified Kessler Technique and patients were assessed postoperatively at 2,4,6,8 and 12 weeks via goniometer. The Strickland scoring system was used to assess range of motion and data was recorded on SPSS v. 20

Results: On the basis of Strickland scoring system, good to excellent results were obtained in 79% of Flexor Pollicis Longus and 82% of other flexor tendons, while a small number had fair to poor results. Tendon dehiscence was seen in 2 FPL and 2 Flexor Digitorum Profundus). 3 patients required tenolysis after 6 months of surgery including 1 FPL and 2 FDS.

Conclusion: Early exploration with proper identification of structures, repair with meticulous technique along with early postoperative mobilization in a compliant patient are necessary to return to normal daily activities and leads to good results in majority of the patients.

Key Words: Tendon injuries, zone V, spaghetti wrist, modified Kessler technique, modified Belfast regimen

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INTRODUCTION

E.V. Lucas had once said 'the art of living is to show your hand' and this statement rightly explains the importance of hand. Hand is a vital organ which perform many functions which are essential for daily activities. Apart from its role in performing daily functions, it performs other essential work that ranging from gripping to touching to writing. Loss of hand function is a frightening experience; it not only effects the emotional status of an individual but also the socioeconomic status of the family specially in third world countries. Hand injuries in the form of fractures, tendon injuries, neurovascular injuries, or combination of all these, due to RTAs, glass cuts or non-accidental injuries are commonly seen.

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Tendons of hand are most vulnerable as it is beneath the skin and in lacerations, glass cut injuries and knives injuries tendons are first one to be injured. Tendons play a fundamental role by connecting the muscles to bone to allow the force to be transmitted from muscle to bones in order for joints to move. 90 % to 95 % of tendons comprise of tenocytes and tenoblasts whereas remaining 5% to 10% are composed of chondrocytes at the point of origin and insertion of muscle, vascular cells, capillary endothelial cells and smooth cells of the arterioles¹. Prolonged disability following flexor tendon injury can result in physical and emotional instability of the patient.

The hand is divided into 5 zones because the management is specific for each zone. Zone 1 extends distal to the flexor digitorum superficialis (FDS) insertion and involves injury of the flexor digitorum profundus (FDP). Zone II (no man's land) is between the limits of the flexor tendon sheath which is at the A1 pulley and the insertion of the flexor digitorum superficialis. Zone III extends from the distal edge of the transverse carpal ligament and the A1 pulley, and involves injuries to the lumbricals. Zone IV involves the tendons within the carpal tunnel and zone V extends from the origin of the flexor tendons at their respective muscle bellies to the proximal edge of the carpal tunnel^{2,3,4}. Zone V is most commonly injured zone.⁵

Patients are usually presented with either inability to flex the fingers, pain while flexing the fingers in incomplete injuries or with obvious cuts. In all 5 zones, tendon injuries are common. Zone V is most exposed and most vulnerable zone. Injuries in this zone are associated with injuries to arteries and nerves and hence this zone is most important zone^{6,7}.

Despite recent advances and researches, no guideline has been formulated for the management of different zones. Flexor tendon injuries can be associated with adhesions and loss of hand functions despite advance surgical techniques and high protocol rehabilitation programs.

Modified Kessler repair was employed for all tendon repairs as core suture with additional epitendon repair⁸.

Repair of flexor tendons after injuries can show variable outcomes depending on surgeon's experience, extent of injuries and above all postoperative physiotherapy.

Modified Belfast regimen was used in which patient was asked to perform 10 active and 10 passive flexion of fingers and straightening all fingers till they just touch the splint on hourly basis⁹. The patient is asked to touch fingers to the palm in passive motion while palm is kept dressing free for ease of motion. The aim is to achieve the fingertip to palm distance of less than 1 cm in 2 weeks.

The Strickland scoring system sums the degrees of active flexion at the distal interphalangeal joint and the proximal interphalangeal joint and subtracts the degrees of extension deficit. The result is compared with an ideal of 175 degrees (total active motion)^{9,10,11}.

(Active PIP+DIP flexion – (PIP + DIP losses of extension))

----- x

100

175°

Rating	Original	Modified
Excellent	85-100 degrees	75-100 degrees
Good	70-84 degrees	50-74 degrees
Fair	50-69 degrees	25-49 degrees
Poor	0-49 degrees	0-24 degrees

We present our experience with a known regimen modified according to our own culture.

MATERIALS AND METHODS

This descriptive case series study was conducted at Plastic Surgery Department, Liaquat National Hospital from January 2015 to June 2015.

Sample size: 50

Inclusion criteria:

- Patients between 10 years to 60 years
- Patients with long finger flexor tendon injuries involving zone V with no tendon loss.
- Neurovascular injuries requiring primary repairs

Exclusion criteria:

- Joint disease or connective tissue disorder.

- Past history of tendon or nerve repair.
- Presenting 10 days after injury.
- Associated hand fractures.
- Associated hand and radius and ulna fractures
- Non-complaint patients

Modified Kessler technique was used for the repair of all tendons. Double stranded core suture 3/0 or 4/0 proline or ethibond was used to repair the tendon and epitendon was repaired with circumferential 6/0 proline. Hand was kept in dorsal plaster splint with wrist in neutral or 20-30-degree extension depending on tightness of repair in order to keep tendon repair tension free. Metacarpophalangeal joints were kept at 90-degree flexion and interphalangeal joints fully extended. Active and passive movements were allowed in splint from 1st postoperative day according to modified Belfast regimen.

Splint was removed after 6 weeks but night splint was continued for further 2 weeks. Movements were assessed at 2,4,6,8 and 12 weeks via goniometer.

Range of motion was assessed by Strickland scoring system in which active PIP and DIP flexion and PIP and DIP loss of flexion measured and graded according to the score.

Data was analyzed was used via SPSS v.20. Quantitative data was presented in frequencies.

RESULTS

Out of 24,462 emergency visits from January 2015 till June 2015, 1260 patients presented with hand injuries which accounts for 5.1% of all emergency consultations. Total number of 340 patients were picked to have tendon injuries out of which 192 were flexor tendon injuries of all zone. This was further sub-divided according to zonal injuries. Zone I had 26 patients whereas 52, 34, 13 and 50 were in Zone II, III, IV and V respectively.

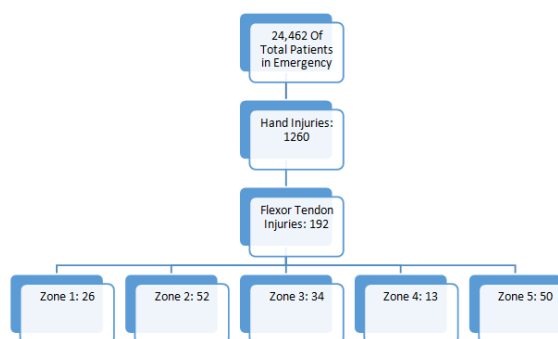


Figure No.1: Details of sub-divided zonal injuries

In our study, mean age was 32 years with male to female ratio was 1.7:1. Non-dominant hand was commonly injured as compared to dominant hand i.e. 28 non-dominant and 22 were dominant

191 tendons were repaired and there were further evaluated in terms of finger or thumb involved.

According the Figure 2, FDS of middle finger was most commonly injured whereas FDP of little finger was least commonly injured.

79% of Flexor Pollicis Longus (FPL) and 82% of other flexor tendons showed good to excellent results and a small number had fair and poor result (Figure: 3). 4 patients had tendon dehiscence (2 in FPL and 2 in FDP). 3 patients required tenolysis after 6 months of surgery including 1 FPL and 2 FDS

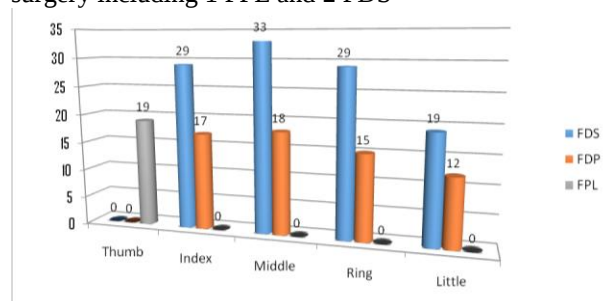


Figure No.2: Number of Tendons injured.

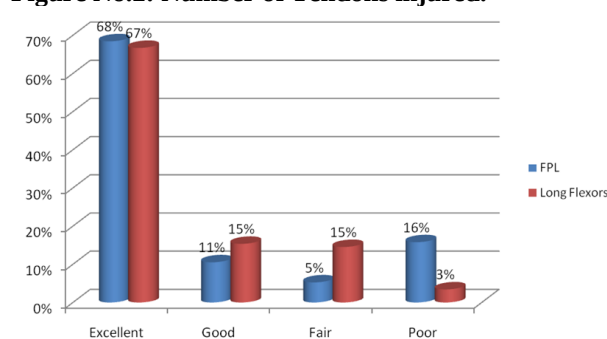


Figure No.3: Outcomes

DISCUSSION

Hand is the most active part of body and most vulnerable with least protection. The normal integrity of hand is essential for its function even a trivial injury can cause severe loss of its function. Volar wrist laceration has potential to cause severe debilitating outcomes¹². As per Puckett and Meyer¹³ minimum of three completely transected structures in lacerations occurring between the distal wrist crease and the flexor musculotendinous junctions at least one nerve and often a vessel was defined as spaghetti wrist. Some studies define it as injuries involving 10 structures or more with a nerve and artery and it is a common presentation in zone V. Definition of spaghetti wrist is not clearly defined¹⁴. Preoperatively, proximity of structure helps in accurate identification and repair demands high skills and precision. In postoperative period, early physiotherapy is essential for prevention of adhesion¹⁵. Olivier et al compared two techniques of repair in his study. In Motion-stable wire suture group, splint was not applied and early motion was allowed as compared to modified Kessler suture but the outcome was similar in both the group¹⁶. Hudson and Dejager did study on 15 patients and 76 flexors were repaired and found that

5 had satisfactory results however 20 and 15 had fair and poor outcomes¹⁷.

Factors like mechanism of injury, time since injury, surgeon's experience and technique, associated neurovascular injuries, and postoperative rehabilitation are important to obtain satisfactory results. In fast movers, tendon rupture was more common whereas in those who are slow movers developed adhesion and this was also observed in our study.

There has been a debate in literature regarding early mobilization versus late mobilization in order to give resting time for tissues to heal but more recent studies are inclined towards early mobilization as this had been shown to be more beneficial in terms of function of hand.

Kleinert regime which supported passive mobilization was initially used involved dorsal splinting of hand blocking the wrist in 45 degrees of flexion and MP joints in 10-20 degrees, traction was applied by rubber band directed to the finger nail from the proximal wrist and patient was instructed to actively extend fingers 10 times every hour, allowing the rubber band to flex the fingers^{18,19}. Hegazy et al did a case series and concluded that early mobilization improves the outcome as well as minimize the risk adhesion as it is a limiting factor in return of adequate hand function²⁰. In our study, this is further endorsed, as we had patients from mix backgrounds from PhD to manual worker and this modified Belfast regimen was reproducible by majority of our patients resulting in better outcome.

Our study had limitations that it is a single centered study and the function of FCU and FCR and PL were not assessed. Associated neurovascular injuries need to be addressed separately and were included in our study. In terms of compliance and following mobilization orders, each patient was different and subjective assessment was being done hence a proper protocol needs to be devised to have objective assessment.

CONCLUSION

Acute hand injuries are common presentation in Emergency department. Proper and focused history and physical examination is needed to identify the injured structures including tendons, nerves and arteries. Early exploration with proper identification of structures and repair with meticulous technique along with early postoperative mobilization in a compliant patient are necessary for satisfactory results. If properly managed in postoperative period, functional disabilities can be minimized and patient can be returned to normal activities early.

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Author's Contribution:

Concept & Design of Study: Batool Urooj Rajput
 Drafting: Batool Urooj Rajput
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 Revisiting Critically: Maryam Noor
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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