

Functional Outcome of Primary Repair of Long Flexors of Finger at Zone V with Early Mobilization

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Abstract

A prospective, observational study was conducted in National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh, between September 2019 and March 2021, to observe the functional outcome of primary repair of long flexors of finger at zone V with early mobilization. Our study included 51 patients, who had follow-up visits up to 12 months after operation. Tendon functionality was assessed by Buck-Gramcko score, while grip strength was assessed by modified sphygmomanometer. The mean age was 30.08±13.38 years. Middle and index fingers were most involved with both flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP) injury. In this study, most of the patients had excellent or good outcomes. The average return to work time was 32.82 weeks. 9.8% of the patients developed post-operative complications like infections, adhesion, and rupture. Most of the patients obtained good to excellent results (90%), while 3.92% had fair and only 2% had poor outcome. Early motion of the fingers seems to improve outcome in these patients. However, worse outcomes were seen in patients with a greater number of damaged structures, especially in concomitant nerve injury.

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Introduction

Flexor zone V extends from the distal wrist crease to the flexor musculotendinous junction as described by Verdan in 1960;¹ it is the most exposed and most vulnerable zone for injuries.² The functional importance of the closely packed structures, blood vessels, nerves and flexor

tendons, makes the injuries in this zone very hazardous and the careful management importance.^{2,3} Flexor tendon injuries are common and have debilitating sequelae, with re-operation rates with poor patient-reported outcomes.²⁻⁴ Most clinicians would agree that a

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combination of surgical repair and hand therapy is the best treatment; however, the outcomes of such injuries are not quite well understood and require further study to assess the surgical outcomes.⁵ There is no such study on primary repair of flexor zone V in hand injury cases in our country. Hence, we proposed this study is to observe functional outcome of primary repair with early active mobilization of long flexors of fingers at zone V.

Methods

This prospective, observational study was carried out between September 2019 and March 2021, at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, a superspecialized orthopaedic hospital in Bangladesh. Complete examination of the limb was done including proximal and distal neurovascular evaluation and musculoskeletal examination was done after resuscitation, pain management and tetanus prophylaxis without causing pain and discomfort to patient. The rest of the examinations were done after anesthesia. Patients were evaluated pre-operatively. A semi-structured questionnaire was used. Data from the patients were collected through face-to-face interview. Radiological study was done preoperatively to exclude fracture. Each patient was anesthetized as ASA-E. Within the study period, a total of 58 patients were treated. Out of them, 51 patients were included in this study, as 7 patients did not show up for regular follow up. All tendons except palmaris longus were repaired by 4 '0' atraumatic prolene for core suturing by 4 strand modified Kessler's method and epitendinous suture by prolene 6 '0' (Fig. 1). After the operation, we discharged the patient on 3rd post-operative day (POD) after checking the

wound condition. The patient was advised to remove stitch on 14th POD from nearest hospital.



Fig. 1: Perioperative status of injured hand.

Postoperative rehabilitation started after 24 hours of operation. We followed flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP) repair as per Modified Duran Protocol of The Brigham and Women's Hospital, Department of Rehabilitation Services.

The results were assessed using the Buck-Gramcko assessment system, while grip strength was assessed by modified sphygmomanometer. Modified sphygmomanometer grading was considered excellent (at least 90% of normal value), good (75–90% of normal value), fair (50–75% of normal value), and poor (less than 50% of normal value). Results of the repair of the nerves were evaluated serially by advancing Tinnel's sign and two-point discrimination compared to normal opposite upper limb.

The power of opponens pollicis and adductor muscles was evaluated from P0-4. Functional recovery was also evaluated by the duration to return to work (Fig. 2,3).

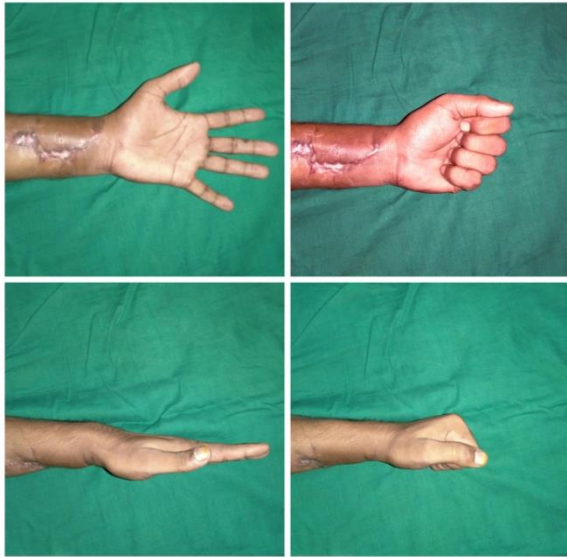


Fig. 2: Movement of fingers at last follow up.



Fig. 3: Movement of thumb at last follow up.

Data was analyzed statistically after 12 months of follow up with Statistical Package for Social Sciences (SPSS) version 21.0 for Windows. The study was approved by the Ethical Review Committee of the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh.

Results

In this study, a total of 51 patients were enrolled, who came to the emergency department of the same hospital within 7-12 hours of injury. The mean age of the patients was 30.08 ± 13.38 years ranging between 12 and 65 years. 10 patients were females, while 41 were males. The injuries were: accidental 42(82.35%), homicidal 5(9.80%) and suicidal 4(7.85%) in nature. In 20 cases, the involved hand was the left one, while in 31 cases the right hand was injured. Accidental injury was the most common 82.35%, cut by glass or knife. The most involved structures included palmaris longus, ulnar artery, ulnar nerve and flexor digitorum superficialis. Isolated flexor digitorum superficialis (FDS) injury occurred in 34 fingers, and both the flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP) tendons were severed concomitantly in 92 fingers. In addition to the tendons, 32 patients also had one or more major nerve injuries (Table-I). Five patients had injuries to both nerves. At least one of the ulnar or radial arteries was divided into 39 patients. In addition to tendon 32 patients had minimum one major nerve injury. Five patients had injuries to both nerves. At least one of the ulnar or radial arteries was severed in 39 patients (Table-I). As evaluated by the Buck-Gramcko system, good and excellent results were obtained in 92% of patients. Excellent results were observed in 41 hands (80.3%) and good in 7 hands (13.7%). Others had fair (3.92%, n=2) and poor (2%, n=1) outcome (Fig. 4). We did primary repair of FPL in 2 patients. Both scored excellent (100%). The average return to work time was 32.82 weeks. No patients required re-exploration for ischaemia of distal limb. Grip strength recovered to an average of 74.62% of the

uninjured hand. One tendon rupture was observed in a patient during a follow-up visit. It was FDP in the index finger. There was adhesion formation in 2 patients (3.92%), while 2 patients had wound infection. We repaired 20 median and 22 ulnar nerves. The rate of sensory and motor recovery was comparatively better in median nerve than ulnar nerve.

Table-I: Distribution of the patients by involvement of each structure (n = 51)

Structure involved	Number	Frequency	Percentage
Only FDS	34	11	21.57
Both FDS & FDP	92	38	74.51
FPL	2	2	3.92
FCR injury	19	19	37.25
FCU	20	20	27.4
PL	39	39	76.47
Isolated median nerve injury	15	15	23.52
Isolated ulnar nerve injury	17	17	39.22
Both nerve injury	5	5	9.80
Ulnar artery	25	25	49.01
Radial artery	14	14	27.45

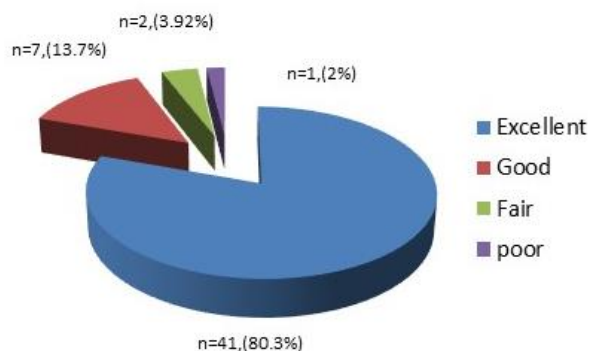


Fig. 4: Outcome observed by using Buck-Gramcko scoring system.

Discussion

Results of flexor tendon repair depends on many factors such as time since injury, technique of suture, associated injuries, surgeon's experience, and post-operative rehabilitation.² There are many post-operative mobilization protocols ranges from strict immobilization to early protected mobilization of the fingers.² We started early protected mobilization protocol. During this study, a total number of 58 patients full-filled the inclusion criteria and enrolled in the study. 7 patients dropped out of the study. The mean age of the patient's was 30.08 ± 13.38 years, ranging from 12 to 65 years. The types of injuries were much more common in younger and manual workers as reported by Tuncali *et al.*⁶ Males have a significantly higher proportion of injuries to females which is supported by Mehdi Nasab *et al.*⁷ Majority of the patients had injury on the right hand which is supported by a study done by Raza *et al.*³ Most of the injury was accidental, some were self-inflicted and homicidal. Most of them came to the emergency room between 7 and 12 hours of injury. Similar duration was reported by a study done in Pakistan.³ All of the accidental cut was by broken glass and sharp metallic objects, e.g., knife. Self-inflicted wound was done by using was razor blade. Raza *et al.* also reported that sharp objects were the most frequent cause of such injuries.³ Majority of patients had 2 finger involvement. The majority of patients had both FDS and FDP with neurovascular involvement (80.40%). In a study done by Yii *et al.* also reported same.⁸ We got 2 patients with FPL injury. After primary repair, rehabilitation started from day one. The functional outcome of the hand was evaluated according to Buck-Gramcko evaluation systems. In our study,

most of the patients had excellent to good outcome (90%). Yii *et al.* reported that good to excellent results were achieved in 90% of flexor tendon repair in zone V,⁸ while Bircan *et al.* found that 92.8% of the fingers achieved excellent result.⁹ Yazdanshenas *et al.* observed that the majority of patients with spaghetti wrist injuries had excellent or good outcomes for tendon function (92%).⁵ However, Mehdi Nasab *et al.* achieved good to excellent functional outcome only in 79.34% of the patients.⁷ In our study, we repaired 20 isolated median, 22 isolated ulnar nerve and 5 case of combined median and ulnar nerve injuries. Isolated nerve injury recovery was good in comparison to simultaneous median and ulnar nerve injuries. Mehdi Nasab *et al.* stated that simultaneous injury in median or ulnar nerve with flexor tendon cuts may further deteriorate the functional outcome with respect of grip strength and pinch strength of the hand, but isolated median or ulnar nerve injuries does not affect the overall gliding excursion of the repaired tendons.⁷

In our study, rate of sensory and motor recovery was comparatively better in median nerve than ulnar nerve also supported by previous studies.^{7,10,11} We observed that average time of return to work was 32.82 (ranging from 20 to 39 weeks) weeks. Duration was less in patient without nerve injuries. Patients with single nerve injury had returned to work earlier than those having both nerve injuries. Yazdanshenas *et al.* reported that the average return time to activities of daily living was 10 months.⁵ We found that early mobilization after proper repair is safe and beneficial, which is also supported by Raza *et al.*³ The stress theory stated that controlled early stress promotes the healing process of tendons.

However, prolonged rest may cause adhesion formation, which is an important limiting factor for the final outcome. It was elaborately shown by Hung *et al.*¹¹

Conclusion

Our data suggests that primary repair of long flexors of fingers at zone V combined with early controlled mobilization shows satisfactory results in wrist injury patients. Most of the patients obtained good to excellent results; however, worse outcomes were seen in patients with a greater number of damaged structures, especially in concomitant nerve injury. We would like recommend further multicenter based studies with larger sample size and longer duration.

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