Original Article

OPEN ACCESS

Outcome of nerve repair in forarm and hand injuries

Abdul Khaliq Malik[1], Fatima Ghaffar[2], Hameed Ud Din[3]

Assistant Professor[1], Postgraduate Resident[2], Professor and Head of Department[3]
Department of Plastic Surgery, Pakistan institute of Medical Sciences, Islamabad

Author`s Contribution

[1] Drafting the work or revising it critically for important intellectual content
[1,2]Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work.
[3]Final approval of the version to be published

Funding Source: None
Conflict of Interest: None

Received: May 2, 2019
Accepted: September 8, 2019

Address of Correspondent
Dr Abdul Khaliq Malik
Assistant Professor of Plastic Surgery, Pakistan Institute of Medical Sciences, Islamabad
Email: drakmallek@gmail.com

ABSTRACT

Objectives: To determine the outcome of nerve repairs in terms of motor and sensory improvement in patients with nerve injuries at distal forearm and hand.

Methodology: This descriptive case series was conducted at department of Plastic Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad, from June 2016 to October 2016. Primary suturing was carried out on all those cases who presented in emergency with clean wound. Patients with crush injury and contaminated wounds were considered for secondary suturing. End to end nerve repair without tension was done in both primary and secondary suturing. Nerve graft applied where required. Data was recorded on the proforma and statistically analyzed using SPSS version 20.

Results: 28 patients (29.5%) were diagnosed as open nerve injury while 67 patients (70.5%) were diagnosed as closed nerve injury. Mean age of the patients was 34.3±4.9 year. Associated tendon injury or bone fracture was seen in 24 cases (25.3%). Three operative procedures were performed, primary suture in 18 (18.9%) cases, secondary suture in 55 (57.9%) cases and nerve graft in 22 cases (23.2%). Good outcome in terms of motor grade recovery was in 64 patients (67.3%) and in terms of sensory grade recovery in 59 patients (62.1%).

Conclusion: Nerve repair after nerve injuries represents a challenge to the plastic surgeons. Good motor and sensory outcome is observed in forearm and hand injuries in our local setup.

Key words: Nerve repair, Nerve injuries, Hands, Forearm.

Cite this article as: *Malik AK, Ghaffar F, Uddin H. The outcome of nerve repair after nerve injuries in forearm; hand trauma. Ann Pak Inst Med Sci. 2019; 15(2): 48-51.*

Introduction

Nerve injuries can be expressed as a deficit that leads to a nerve disruption such that it can no more transfer action potentials.[1,2] Within developed nations, hand injuries represent around 10.0% of all presentations to emergency departments. In clinical practice, about 3% hand injuries comprise injury to peripheral nerve trunks,[3] and take place further frequently in the right hand, probably due to reflexive defensive acts.[4] The most commonly damaged nerves were digital nerves, after that median nerve followed by ulnar nerves and radial nerves.[5] Sharp cut injury restoration outcomes at different levels for radial and median nerves were likewise good (91.0% each) and superior than (73.0%) ulnar nerve. Graft repair and secondary wound closure outcomes were superior for median nerve (68.0% and 78.0%, in that order) contrasted to radial nerve (67.o% and 69.0%, respectively) and ulnar nerve (56.0% and 69.0%, correspondingly).[6] A satisfactory and suitably timed management of peripheral nerve wounds is vital to in adults to achieve a reasonably substantial clinical outcome even though a full nerve injury will always cause permanent dysfunction.[7]

Components that influence the aftereffects of nerve fixes are changed, and just a not many of them depend on doctor capability. In spite of this, attention to these elements is helpful to empower

the patient and specialist to have reasonable desires for the result. The aim of this study is to determine outcome of nerve repairs in patients with nerve injuries in hand & forearm trauma.

Methodology

This descriptive case series study was done in the Department of Plastic Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad. Study was carried out from April 2016 to October 2016. All patients of distal forearm/hand trauma of either gender undergoing nerve restoration at hand/distal forearm were enrolled. All the patients unwilling to participate in study, patients with injection injury and already previously treated at some other healthcare facility were excluded. Informed well-versed consent was received from every patient. Permission was taken from hospital ethical committee for accomplishing the study. The patients were firstly evaluated by detail history, examination, and NCS Studies. Other investigation needed for evaluation of fitness for surgery was performed where necessary. Patients admitted in ward and all surgeries done under general anesthesia by Consultant Plastic and Reconstructive Surgeon. Patients were managed according to standard management protocols of management of nerve injury. Primary suturing was done on those cases who presented in emergency with clean wound. Patients with crush injury and contaminated wounds were considered for secondary suturing. Both primary and secondary suturing was done if transected nerve ends allows end to end repair without tension. Nerve grafting (Sural nerve) was done if nerve defect is not repairable by primary and secondary suturing. Patients were again reassessed post-operative at 1 month and 3 months and 6 months. Patient after nerve repair was regularly followed up by taking telephone contact and address. Follow up was done by trainee researcher. Data was filled in proforma and then statistically analyzed to assess the objectives.

Data analysis was done by SPSS version 20 and different descriptive statistics calculated means and standard deviation, percentages and frequencies. The numerical data for example age assessed as Mean Standard deviation whereas the categorical data such as the factors of trauma, nerve involved, type of nerve injury, operative procedures and outcome was expressed in terms of percentages and frequency.

Results

A total of 95 cases were enrolled in present study, Mean age of patients was 34.3±4.9 year. Out of 95 patients, 73(76.8%) were males, and 22 (23.2%) were females. Age distribution and causes of trauma were noted in Table I.

Distribution of cases according to diagnosis, associated tendon injury or bone fracture and nerve involvement is described in Table II.

Three operative procedures were performed, primary suture in 18 (18.9%) cases, secondary suture in 55 (57.9%) cases and nerve graft in 22 cases (23.2%). (Figure 1)

Table I: Distribution of cases according to age, gender and causes of trauma (n=95)

Variables	Number	Percentage
Age groups (Year)		
< 20	15	15.8
21-30	17	17.9
31-40	31	32.6
41-50	19	20.0
> 50	13	13.7
Total	95	100.0
Gender		
Male	73	76.8
Female	22	23.2
Total	95	100.0
Causes of trauma		
Road traffic accident	29	30.5
Glass cut injury	24	25.3
Machine injury	14	14.7
Electric injury	10	10.5
Kitchen injury	6	6.3
Firearm injury	12	12.7
Total	95	100.0
Age (Mean±SD)	34.3±4.9 years	

Table II: Distribution of cases according to diagnosis, associated tendon injury or bone fracture and nerve involvement(n=95)

Diagnosis	Number	Percentage
Open nerve injury	28	29.5
Closed nerve injury	67	70.5
Total	95	100.0
Associated tendon injury or bone fracture		
Present	24	25.3
Absent	71	74.7
Total	95	100.0
Involved nerve		
Median nerve	37	38.9
Ulnar nerve	30	31.6
Radial nerve	15	15.8
Digital nerve	13	13.7
Total	**95**	**100.0**

Good outcome in terms of motor grade recovery was in 64(67.3%) and in terms of sensory grade recovery 59(62.1%) in patients.

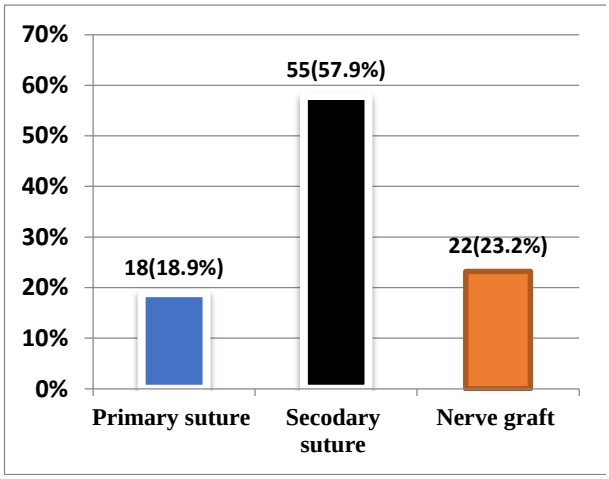

Figure 1. Distribution of cases by operative procedure (n=95)

Discussion

The hand is the human body part which is mostly injured in and treated within hospital emergency department. In 30-40% of the injuries the upper extremity is involved. Hand damage usually happens among young and economically active people.[7]

A number of retrospective reviews have found age as a significant cause for functional restoration following nerve repair.[11-13] Neuronal activity re-institutes rapidly among children, mainly among very young ones, in whom the rate of axonal restoration is believed to be up to 5 mm per day.[14]

Postoperative appraisal of hand function following peripheral nerve injury is very complex, because several assays are available and often assays are challenging to administer and take too much time.[15] There are various appraisal approaches used in various studies can fluctuate significantly, a wide comparison amid diverse outcome studies is problematic and study outcomes aren't always demonstrative for "true" operative outcome of hand function.

Looking at the results of our study, several differences from the international literature can be seen.

Furthermore, axonal restoration delay occurs due to age by decelerating axonal degeneration, Schwann cell response, and axon sprouting. The outcome is a restored nerve with less myelination and fewer axons in older subjects. It has usually been believed that children show a higher capacity for nerve restoration contrasted to adults.[13,14]

After nerve repair, axons can possibly restore and, consequently, re-innervate the sensory receptors and motor end plates. If nerve injury is much proximal, nerve restoration can possibly not take place in necessary time for muscle re-innervation. Additionally, due to shorter distance between final receptors and extent of injury and better organized motor and sensory fascicles in distal wounds there is less risk of mismatching.

Our study demonstrates that Good motor and sensory outcome is observed in 67.3% and 62.1% patients respectively in PIMS. Julia demonstrated that in general, excellent and good motor outcomes (≥M3+) were noted in 31 of 44 patients (70.00%) and excellent and good sensory outcomes were noted among 28 of 44 patients (64.0%). The patient's age, length of nerve graft, denervation time, injury level, and variety of surgical restoration considerably affected the functional outcomes.[15] These results are analogous to our results, regarding the radial nerve, excellent and good motor outcomes were noted among 27 out of 35 patients (77.1%). Grip intensity of the affected side and postoperative lateral pinch were equal to 76.4% and 75.5% of those of the non-affected side, in that order. Patient's age, related nerve injuries, denervation time, injury level, nerve graft length, and variety of surgical restoration considerably influenced the functional outcomes. For the superficial radial nerve, excellent and good sensory outcomes were noted among 10 out of 13 (77%) cases.

In future more detailed and elaborated work would be required to see the effect of age, sex, cause of injury, type of nerve injury, type of reconstructive method on functional outcome of nerve repair after nerve injury.[16-18]

Conclusion

Nerve repair after nerve injuries represents a challenge to plastic surgeons.

Good motor and sensory outcome was observed with primary suturing in our setup. Patients' subjective experience is an important outcome that needs in future for researchers to design a validated scoring system.

References

1. Dahlin LB. Nerve injury and repair; from molecule to man. In: Slutsky DJ, Hentz VR, editors. Peripheral nerve surgery-practical applications in the upper extremity. Philadelphia: Churchill Livingstone Elsevier; 2006:1-22.
2. Mackinnon SE, Myckatyn TM. Microsurgical repair of peripheral nerves and nerve grafts. In: Thorne CH, Beasley RW, Aston SJ, Bartlett SP, Gurtner GC, Spear SL, editors. Grabb and Smiths plastic surgery. 5thed. Philadelphia USA: Lippincott-Raven ;2007: 73-83.
3. Lese AB. Soft tissue hand injury http://emedicine. medscape.com /article/ 826498
4. Wu F, Ng CY. Management of acute nerve injuries of the hand. Orthopaedics and Trauma. 2019;33(1):18-22.
5. Millesi H. Nerve grafting. In: Slutsky D, Hentz VR, editors. Peripheral nerve surgery-practical applications in the upper extremity. Philadelphia: Churchill Livingstone Elsevier; 2006:39-59.
6. Murovic JA. Upper-extremity peripheral nerve injuries: a Louisiana State University Health Sciences Center literature review with comparison of the operative outcomes of 1837 Louisiana State University Health Sciences Center median, radial and ulnar nerve lesions. Neurosurg 2009;65:A11-7.
7. Vanderhooft E. Functional outcomes of nerve grafts for the upper and lower extremities. Hand clinics. 2000 ;16(1):93-104.
8. Merzenich MM, Nelson RJ, Stryker MP. Somatosensory cortical map changes following digital amputation in adult monkey. J Comp Neurol 1984;224:591-605.
9. Ruijs AC, Jaquet JB, Kalmijn S, Giele H, Hovius SER. Median and ulnar nerve injuries: a metaanalysis of predictors of motor and sensory recovery after modern microsurgical nerve repair. Plast Reconstr Surg 2005;116:484-496.
10. Jaquet JB, Luysterburg AJM, Kalmijn S, Kuypers PDL, Hofman A, Hovius SER. Median, Ulnar and combined median-ulnar nerve injuries: functional outcome and return to productivity. J trauma 2001;51:687-692.
11. Hundepool CA, Ultee J, Nijhuis TH, Houpt P, Jaquet JB, Spauwen PH, Hofman A, et al. Kon M, Hovius SE. Prognostic factors for outcome after median, ulnar, and combined median–ulnar nerve injuries: A prospective study. Journal of Plastic, Reconstructive & Aesthetic Surgery. 2015 ;68(1):1-8.
12. Costales JR, Socolovsky M, Lázaro JA, García RÁ. Peripheral nerve injuries in the pediatric population: a review of the literature. Part I: traumatic nerve injuries. Child's nervous system. 2019 ;35(1):29-35.
13. Tajima T, Imai H. Results of median nerve repair in children. Microsurgery. 1989;10:145-146.
14. Luo TD, Alton TB, Apel PJ, Cai J, Barnwell JC, Sonntag WE, Smith TL, Li Z. Effects of age and insulin-like growth factor-1 on rat neurotrophin receptor expression after nerve injury. Muscle & nerve. 2016 ;54(4):769-775.
15. Julia KT, Petros K. Radial nerve injuries and outcomes: our experience. Plast Reconstr Surg 2011;127:739-51.
16. Ceynowa M, Mazurek T, Pankowski R, Rocławski M, Treder M. The thermal sensitivity test in evaluating outcome after peripheral nerve injury. BioMed Research International. 2015; http://dx.doi.org/10.1155/2015/528356
17. Amadio P. Outcome assessment in hand surgery. what's new? Clin Plast Surg 1997;24:191-194.
18. Gesslbauer B, Furtmüller GJ, Schuhfried O, Roche AD, Sporer M, Aszmann OC. Nerve grafts bridging the thenar branch of the median nerve to the ulnar nerve to enhance nerve recovery: a report of three cases. Journal of Hand Surgery. 2017; 42(3):281-285.