Neuroanatomy (2004) Volume 3 / Pages 15–17

Original Article

Published online 10 May, 2004 © neuroanatomy.org

Upper extremity nerve injuries: the significance of soft tissue associations

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Received 17 February 2004; accepted 7 May 2004

Abstract

The morbidity and social cost is found to be very high for upper extremity nerve injuries. Despite the fast advances in scientific studies and technology, a complete recovery following peripheral nerve injuries is still not possible, though, comprehensible progression in this field is obtained especially following microsurgery techniques. The aim of this study, is to present the anatomical locations of upper extremity nerve injuries treated in our clinic and the relationship between nerve injuries with other vital organ and soft tissue injuries. 111 patients with 134 nerve injuries treated in our clinic between January 2001 and December 2003 were included in this study. A high association of soft tissue injuries was found for all nerve types. The functional deficits observed following upper extremity nerve injuries, generate deep marks on the psychosocial life of the patients. It is a known fact that, an accompanying muscle, tendon or artery injury reveals a worse prognosis. It is clearly observed from our study that an isolated nerve injury is an exception than a rule. This should be a major concern when consequences of upper extremity injuries and the results of treatments are being evaluated. The accompanying soft tissue injuries may overall change the fate of an otherwise successful nerve repair.

Key words: [peripheral nerve] [soft tissue] [injury] [upper extremity]

Introduction

There is a growing attraction in the recent literature regarding devastating upper extremity nerve injuries [1–3]. In the majority of these studies, motor and sensory recovery following injury is evaluated. The morbidity and social cost is found to be very high for nerve injuries. Despite the rapid advances in scientific studies and technology, complete recovery following peripheral nerve injuries is still not possible, though, comprehensible progression in this field is obtained especially following microsurgery techniques.

Upper extremity nerve disruptions may have etiological factors such as; metabolic, tumoral, burns, traction or crush, following fracture or dislocations, gun shots, injections, compressions and laserations. Whatever the reason, since the peripheral nerves of the upper extremity neighbor a good number of other vital organs and soft tissues, it should well be expected that injuries of these will also accompany the nerve injury. The literature is clearly devoid of such studies.

The aim of this study, is to present the anatomical locations of upper extremity nerve injuries treated in our clinic and the relationship between nerve injuries with other vital organ and soft tissue injuries.

Material and Methods

111 patients with 134 nerve injuries treated in our clinic between January 2001 and December 2003 were included in this study. The data regarding nerve injury site and accompanying soft tissue injuries were obtained from patient and operation records. Mann Witney-U, student's t and Wilcoxon signed ranks tests were used in order to calculate statistical significance where indicated.

Results

There were a total of 42 (31.3%) ulnar, 24 (17.9%) median, 6 (4.5%) radial, 12 (9%) common digital, and 50 (37.3%) digital nerve injuries. The allocation of these injuries in relation to their pertaining anatomical locations can be viewed in Table 1. In 9 patients (8.1%), a combined injury of the median, ulnar and radial nerve was observed. In the majority of the patients (77.5%) the right upper extremity was found to be injured. The distal forearm was the most encountered (35.8%) injury site.

The etiology was found to be glass laserations (73.0%) in the majority followed by cutting instruments (27.0%) such as knives. Except in 3, total nerve disruption was observed in the injuries. Isolated nerve injuries were observed only in 3 cases (2.7%), whereas the rest (97.3%)

eISSN 1303–1775 • pISSN 1303–1783

Table 1. Allocation of nerve injuries according to injury location.

	Median	Radial	Ulnar	Common digital	Digital	TOTAL
Arm	2	2	2	–	–	**6**
Proximal half of forearm	6	1	11	–	–	**18**
Distal half of forearm	16	3	29	–	–	**48**
Hand	–	–	–	12	–	**12**
1st finger	–	–	–	–	6	**6**
2nd finger	–	–	–	–	13	**13**
3rd finger	–	–	–	–	9	**9**
4th finger	–	–	–	–	15	**15**
5th finger	–	–	-	–	7	**7**
TOTAL	**24**	**6**	**42**	**12**	**50**	**134**

Table 2. Allocation of vital organ associations accompanying nerve injuries. (***FCU:*** *flexor carpi ulnaris,* ***FCR:*** *flexor carpi radialis,* ***PL:*** *pollicis longus,* ***FDS-P:*** *flexor digitorum superficialis-profundus,* ***T:*** *triceps)*

Nerve	Accompanying Tendon of Vital Organ												
	Isolated	Tendon					Nerve			Artery			
		FCU	FCR	PL	FDS-P	T	Ulnar	Median	Radial		Ulnar	Radial	Digital
Ulnar (n=42)	2	28	–	–	25	–	–	8	–	–	24	–	–
Median (n=24)	–	8	13	14	10	–	8	–	1	1	–	–	–
Radial (n=6)	1	–	3	1	–	2	–	1	–	–	–	4	–
Common digital and Digital (n=62)	–	–	–	–	57	–	–	–	–	–	–	–	57

showed a highly significant ($p<0.05$) participation of various soft tissue injuries.

Anatomical locations for nerve injuries can be viewed in Table 1. The most common injured major nerve was found to be the ulnar nerve (31.3%). Only two (4.8%) isolated ulnar nerve injuries could be found. Of the 42 ulnar nerve injuries, allocation of the accompanying tendon injuries were as follows; 28 (66.7%) flexor carpi ulnaris, 25 (59.5%) flexor digitorum superficialis and profundus. In 24 (57.1%) nerve injuries, an ulnar artery injury was also observed, however, in 8 (19.0%) a combined injury of ulnar and median nerve injury was found. In 4 (9.5%) a combined ulnar nerve, median nerve and ulnar artery injury was recorded.

The injury level was the arm in 2 (8.3%) of the 24 median nerve injuries. One was accompanied by an ulnar nerve injury, while the other was accompanied by a brachial artery injury. Of the 24 median nerve injuries allocation of the accompanying tendon injuries were as follows; 14 (58.3%) palmaris longus, 13 (54.2%) flexor carpi radialis, 10 (41.6%) flexor digitorum superficialis and profundus, 8 (33.3%) flexor carpi ulnaris. In 8 (33.3%) cases the median nerve injury was accompanied by an ulnar nerve injury, whereas a radial nerve injury participation was found in only 1 (4.2%) case.

Of the 6 (4.5%) radial nerve injuries only 1 (16.6%) isolated (superficial radial nerve) injury was found. Allocation of the accompanying tendon injuries were as follows; 2 (33.3%) triceps, 3 (50.0%) flexor carpi radialis, 1 (16.6%) palmaris longus. In 4 cases (66.7%) radial artery, and in 1 (16.6%) case a median nerve injury was accompanying the radial nerve injury.

The most commonly injured nerve in our series was the digital nerve (37.3%). Concerning 12 common digital (9.0%) and 50 digital (37.3%) nerve injuries, associated digital artery and flexor tendon injuries were present in 57 (91.9%) cases, in which a high clinical significance was found.

All data concerning nerve injuries and vital organ associations can be viewed in Table 2.

Discussion

The most important nerve of the upper extremity is reported to be the ulnar nerve [1]. Further, the consequences following ulnar nerve injuries, is not as encouraging as compared to radial and median nerves in the literature [1]. Unfortunately, it is the most

common injured major nerve in our series (31.3%). The comparison of the frequency with other major nerves revealed a statistically significant difference ($p<0.05$). A high accompaniment of flexor carpi ulnaris (66.7%), and ulnar artery (57.1%) injuries can clearly be interpreted to be the result of neighboring of these structures. The most commonly injured flexor digitorum superficialis and profundus tendons were found to be the 4th and 5th tendons. The probability of combined nerve injuries (ulnar + median) were found to be increasing when the injury site is more distal on the upper extremity. Similarly, an ulnar artery injury have a significantly higher probability ($p<0.05$) to be injured in the distal half of the forearm when ulnar nerves are injured.

According to the neighboring of the neurovascular bundle in the upper arm area, the brachial artery, vein and the ulnar nerve injuries can frequently accompany median nerve injuries [4]. Although a limited number of median nerve injuries were observed in the arm, both were accompanied by either the brachial or the ulnar nerve injuries. A high incidence of accompanying palmaris longus (58.3%) and flexor digitorum superficialis and profundus (41.6%) tendons (especially 2nd and 3rd) should be expected. It is interesting that flexor carpi radialis (54.2%) tendon is more injured than its ulnar counterpart (33.3%). In this series, no isolated median nerve injuries were encountered. This is a very important finding, that when a median nerve injury is of concern, an accompanying nerve or tendon injury should always be sought. If a combined nerve injury is of concern, it is highly probable that the ulnar nerve will be the most participated (33.3% in our series) and 87.5% of these will be located in the distal forearm or the wrist areas.

The most commonly injured major nerve in the upper extremity is reported to be the radial nerve [5] in the literature, though, this was not the case in our series. However, it is a known fact that, orthopedic trauma is the most common etiological factor (especially humerus fractures) for the injuries of this particular nerve [3, 6, 7]. This may be the explanation for the lack of cases seen in our series, in which the majority of the cases were due to lacerations. Only one (16.6%) isolated superficial radial nerve injury was encountered. On the other hand, a high incidence of flexor carpi radialis tendon (50.0%) and radial artery (66.7%) injury should be sought when radial nerve injuries are of concern.

Concerning common digital and digital nerves, a high association with digital artery and flexor tendon injuries should always be expected (91.9% in our series). Although these nerves do not contain motor fibers, we always try to repair these when it is feasible.

Conclusion

The functional deficits observed following upper extremity nerve injuries, generate deep marks on the psycho-social life of the patients. It is a known fact that, an accompanying muscle, tendon or artery injury will reveal a worse prognosis. It is clearly observed from our study that an isolated nerve injury is an exception than a rule. This should be a major concern when consequences of upper extremity injuries and the treatment results are being evaluated. The accompanying soft tissue injuries may overall change the fate of an otherwise successful nerve repair.

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