Management of ulnar nerve injuries

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Ulnar nerve injuries are common in young people. When there is a delay in the diagnosis and surgical management, the results are usually poor and can be permanent. Nerve grafting procedures were carried out in 85 patients with ulnar nerve injuries and 30 patients with both ulnar and median nerve injuries between 1981 and 1992. The patients could be divided into three categories according to the level of the trauma. Group A with injuries in the carpal area consisted of 43 cases with ulnar nerve injuries and 30 cases with both ulnar and median nerve injuries. Group B comprised 25 patients with ulnar nerve injuries in the area of elbow due to bone fractures. Group C comprised 18 patients with ulnar nerve injuries in the upper arm area. The quality of the functional results was closely related to the age of patients with better results in younger people and to early post-traumatic management of the injury. This was particularly notable in group C where, although there was high nerve damage, young patients and patients with early treatment generally had a better response than patients with lower ulnar nerve lesions. In contrast, we found that in cases of delay in surgical procedures for mixed nerve damage, the response was poor.

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A high incidence of ulnar nerve injuries, which may occur in conjunction with injury to the median nerve, take place in the carpal area. Generally, however, ulnar nerve injuries may be described at three different levels: the carpal area, which is the most common; the elbow area, which usually is usually combined with bone fracture; and in the area of the upper arm, which is usually the middle part. Microsurgical reconstruction has been found necessary to bridge the nerve gap and restore minimal function to the muscle innervated by the damaged nerve.

Patients and methods

85 ulnar nerve lesions and 30 lesions of both the ulnar and median nerves underwent fascicular nerve grafting using microsurgical technique between 1981 and 1992. Ages ranged from 6 to 45 years. The lesion was diagnosed based on the patient's history, a detailed examination of motor and sensory damages, a clinical examination and finally, an electromyographic (EMG) examination. 43 patients had ulnar nerve lesions and 30 patients had both ulnar and median nerve injuries in the carpal area. All of these cases were accompanied by tendon injuries. 25 lesions of ulnar nerve in the elbow area were treated. These patients underwent secondary microsurgical procedures and elbow fractures usually accompanied the nerve damage. 18 ulnar nerve injuries were treated in the upper arm and all had secondary surgical procedures.

All patients underwent nerve reconstruction with grafts which ranged in length between 2 to 13 cm. For peripheral ulnar nerve injuries, 4 to 5 nerve cables were used, while for central nerve lesions (elbow and upper arm area) and for those combined with median nerve lesions, 5 to 6 nerve cables were used. The sural nerve was considered the best choice for a nerve graft as its removal is not associated with loss of sensitivity. The length of the graft removed was between 33 and 35 cm. The second choice for a nerve graft was the lateral femoral cutaneous nerve. The medial antebrachial cutaneous nerve is not used as nerve graft in ulnar nerve injuries. Post-operative follow-up ranged from 2 to 9 years.

Results

The 43 patients with ulnar nerve lesions in the carpal area demonstrated gradual recovery of the motor branch according to the MRC system (M0–M5) for motor branch function (Table 1). On the other hand, according to S0–S4 grading for sensory branch function, the sensory branch demonstrated a relatively slow recovery. Surgical procedures done in the immediate post-traumatic period gave positive results. The

Table 2. Functional results of combined ulnar and median nerve injury using nerve grafts in 30 patients

Time (months)	M4–5 S3–4	M3 S3	M3 S2	M2 S3+–4	M0 S3
< 6	8	5	7	2	1
6–12	2	9	1	0	0
> 12	0	0	0	0	0

Table 1. Functional results of ulnar nerve repair in the carpal area using nerve grafts in 43 patients

No of patients	Age	Denervation time (months)	Length of defect (cm)	Results	
18	13–25	3	0.5–13	M4–5	S3+–4
20	6–22	4.5	9–20	M3	S3
4	16–40	6.5	0.5–10	M2	S2
1	35	8	8	M2	S3

Table 3. Functional results of ulnar nerve repair in the elbow area using nerve grafts in 25 patients

No of patients	Age	Denervation time (months)	Length of defect (cm)	Results	
5	6–20	4.5	2–8	M4–5	S3+–4
6	6–28	4	7–12	M4–5	S3
2	16–40	55	6–7.5	M4–5	S2
5	10–32	3.5	3.5–8	M3	S3+–4
4	16–21	5	6–10	M3	S3
1	18	4	5	M3	S2
1	43	6	8	M2+	S2
1	35	7	50	M2	S2

Table 4. Functional results of ulnar nerve repair in the upper arm using nerve grafts in 18 patients (20 cases)

No of patients	Age	Denervation time (months)	Length of defect (cm)	Results	
4	13–28	4	5.5–8	M4–5	S3+–4
6	7–29	4	4–13	M4–5	S3
4	7–23	5.5	4–9	M3	S3+–4
3	17–35	4	6–10	M3	S3
1	40	6	75	M2+	S2
1	39	8	50	M2	S2
1	45	8		M1	S2

patients age was also found to play a significant role. The length of the graft used in the reconstruction, however, was not found to correlated with the quality of the results.

The group of 30 patients with combined ulnar and median nerve lesion in carpal area (level A; Table 2), demonstrated favorable results in cases where early microsurgical nerve grafting procedures were performed (Figure 1). 60 percent of the early secondary reconstructions in the carpal area had good results. Furthermore, sensory recovery of ulnar nerve was faster compared to the motor branch of median nerve (McEwan 1962, Sakellarides 1962, Nicholson and Seddon 1957, Posch et al. 1980, Stromberg et al. 1961, Moase et al. 1980, Millesi et al. 1972, Millesi et al. 1976). However, it may be that successful results of this group of patients are related to secondary procedures which occurred relatively early in the postoperative course compared to the emergency posttraumatic procedures, since the nerve injuries in all of these patients was combined with tendon lesions.

25 patients were treated for ulnar nerve lesions in the elbow area (level B; Table 3). In these patients, the ulnar nerve damage was due to bone fracture. Early surgical reconstruction with nerve grafts produced successful results in most patients, particularly those who were young.

18 patients had nerve lesions in the upper arm (level C; Figure 2). Sensory recovery of high ulnar nerve lesions to the degree of S3+ and S4, has been reported to have an incidence of about 25 percent (Boswich et al 1965, Onne 1962, Nielsen 1964). The greater success rate in the present series may be related to the relatively young age of the patients and the early surgical management. The length of the graft did not appear to relate to functional recovery.

Discussion

Microsurgical procedure appears to be necessary for effective management of peripheral nerve injury, particularly for damage on the fascicular level. The aim of peripheral nerve surgery is to maintain the continuity of axon sprouts, as much as possible, with exact coaptation and the creation of minimal scar tissue. Clearly, however, the surgeon does not have the ability to control central factors which regulate nerve regeneration. Nonetheless, proper and careful nerve suturing, absolute coaptation and the absence of tension, significantly improves the functional outcome.

4 factors appear to be significantly associated with the results following microsurgical nerve coaptation and use of nerve grafts. These include: 1) characteristics of the patient, such as age; 2) quality of the trauma, such as the type of injury; 3) the surgical technique applied; and 4) postoperative rehabilitation. Specifically, factors which affected nerve grafting results included the patient's age and the time delay from injury to the nerve grafting procedure (denervation time). The importance of these factors have been demonstrated in the experimental research of

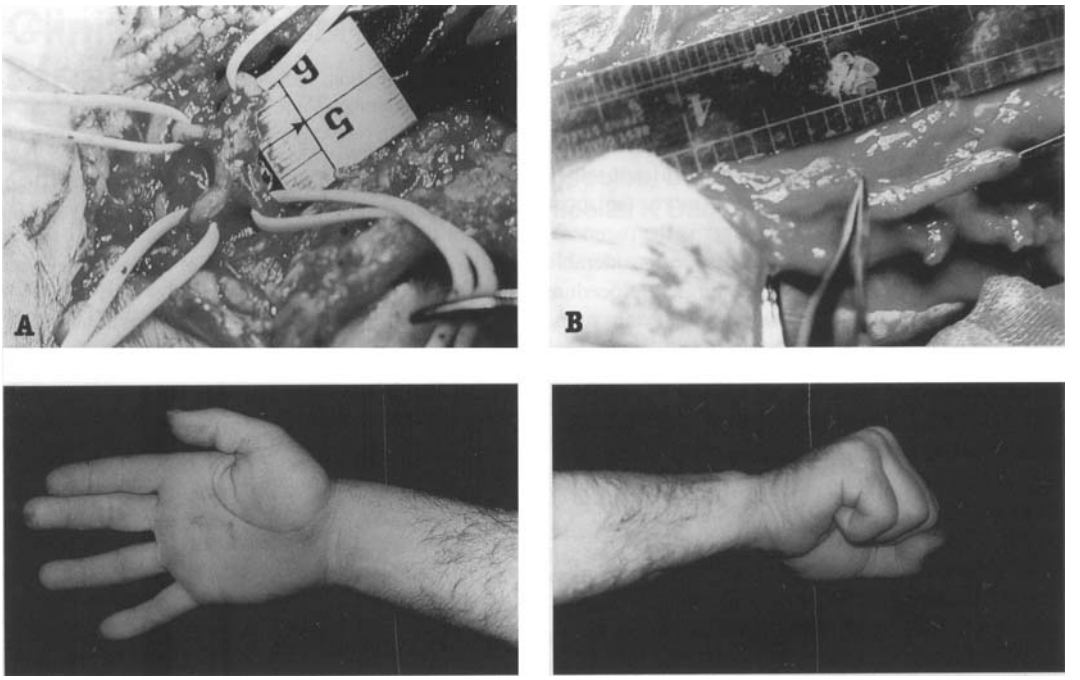

Figure 1. Intraoperative view of the distal and proximal part of median and ulnar nerve injury in the carpal area (top). Clinical results 24 months postoperatively (bottom).

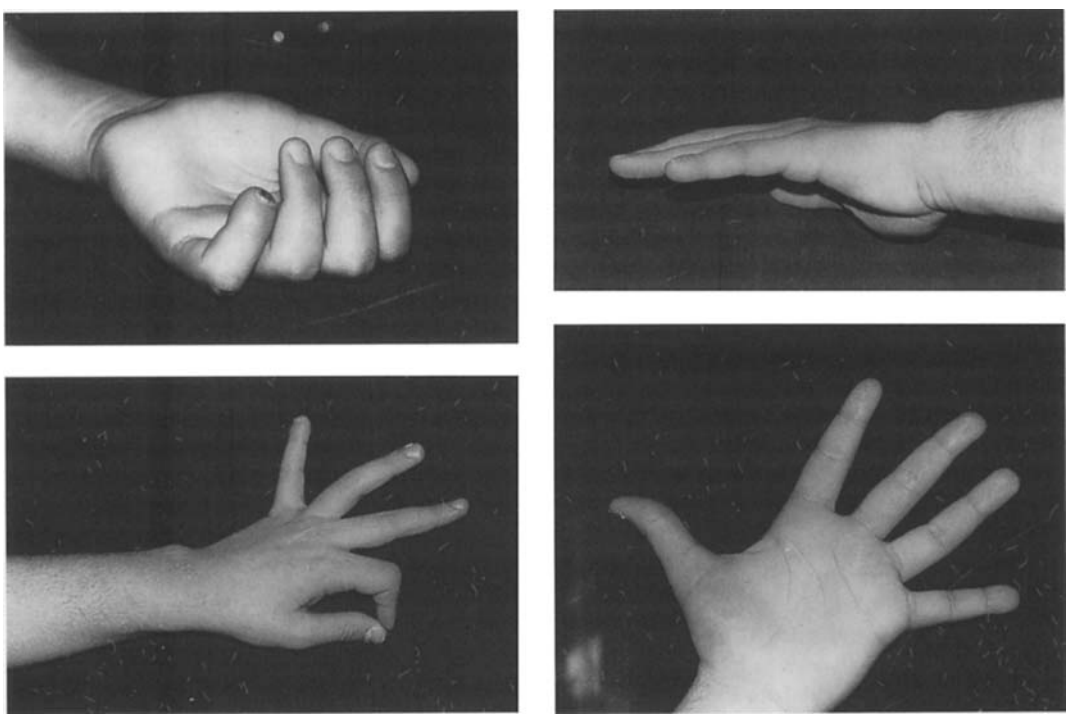

Figure 2. Preoperative appearance of the hand indicating ulnar nerve injury at the level of the upper arm (upper left). Clinical results 18 months postoperatively (lower left and right).

Merzenich 1984, Merzenich et al. 1984 and Jenkins and Merzenich 1987. The excellent results in children may be related to their ability to adapt centrally to the altered profiles experienced after nerve repair. It should be kept in mind that other disorders such as diabetes and alcoholism also play a significant role in altering nerve regeneration. Furthermore, the more central the nerve damage, the longer is the regeneration time and the chances for success are considerable reduced (Kristensson 1981). The surgical procedure used appear to play one of the most important roles. The various microsurgical techniques are geared towards the need of avoiding tension at the coaptation site. In this regard, Millesi has emphasized the use of nerve graft to bridge large nerve gaps without producing tension (Millesi et al. 1972, Millesi 1973, Millesi 1977, Millesi and Meisel 1981, Millesi 1987).

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