THE RESULTS OF NERVE GRAFTING IN UPPER EXTREMITY

Yalçın ADEMOĞLU(*), Arslan BORA(**), İbrahim KAPLAN(*), FuaT ÖZERKAN(*), Firdevs KUL(***)

SUMMARY

We reviewed, between 1988 and 1995, the functional results after interfascicular grafting of 10 median, 8 ulnar, 3 radial and 9 common digital nerves in 24 patients ranging in age from 5 to 51 years. Of these, 3 nerves had primary grafting and 21 were secondary grafted.

Evaluation of function was based on the Medical Research Council (MRC) classification for motor and sensory recovery. According to this classification useful and moderate results were obtained in the majority of cases.

Key Words: *Nerve grafting, upper extremity.*

INTRODUCTION

The microsurgical approach to peripheral nerve surgery has occurred as a major step to reach to "functional hand". Advances in microneurosurgery instrumentation, intraoperative electodiagnosis and particularly increased understanding of the interaneural and functional anatomy have provided important contributions in peripheral nerve surgery.

After the first nerve grafting was performed by Albert in 1876, this technique was used as a salvage and alternative procedure to all other possiblities for managing nerve defects (bone shortening, transposition, mobilization etc.) until 1960. However, thick nerve grafts (> 3 mm.) and unsuitable surgical technique caused a high percentage of failure, especially if the defect was large.

Beginning from 1963, Millesi introduced the method of interfascicular nerve grafting based on experimental and clinical studies. According to this new method; adequate blood supply of the recipient site of the nerve graft, the use of small diameter grafts, to avoid tension at the suture sites, the alignment of corresponding fascicles and good microsurgical technique have been possible to obtain successful results.

In this study w present our results of long follow-up and our experience related to nerve grafting procedures in upper extremity.

PATIENTS AND METHOD

Between 1988-1995, 49 patients with peripheral nerve injuries in the upper extremity were performed nerve grafting and we got in touch with all of them. 24 patients who where able to come to control were taken into the study. Five subgroup of 24 patients were formed because of our series involved injuries concerning different nerves; Median, Ulnar, Median+Ulnar, Radial, Common digital. All cases were male, the mean age was 27.6 (5-51) years.

The technique of interfascicular nerve grafting described by Millesi et al was applied primarly in three patients and secondary in 21 patients. Donor nerves for grafting were used sural nerve in 16 patinets, dorsal cutaneous branch of the radial nerve in five patients, medila antebrachial cutaneous nerve in two patients and ulnar nerve (splitting of fascicles) in one patient. The length of the defects ranged from 3 to 13 cm. (av. 6.4 cm.). The mean follow up was 5.5 years (2.5-11.5 years).

Subjective symptoms (cold intolerance, paresthesia, pain, weaksness, etc.), the strength of extrinsicintrinsic muscle (power grasp, key grip, pulp, grip, manuel testing) and sensibility tests (light touch, vibration, two-point discrimination, localization, object recognition) were undertaken in all patients. Evaluation of function was based on Medical Research Council (MRC) classification for motor and sensory recovery.

(*) *Ege University Medical School of Orthop. and Traum. Associate Professor M.D.*
(**) *Ege University Medical, Dep. of Orth. Surg. and Travm., Resident, M.D.*

Table1. *The documentation of patients and functional results*

Nerve	Patient	Age	Type of Injuy	Delay	Follow up	Level	Defect	Nerve	Associated Injury			
									Artery	Tendon	Bone	Recovery
MEDİAN	H.T.	40	Guntshot	3.5 years	4.5 years	Forearm	10 cm.	Sural	+	+	+	S2/M0
	H.B.	22	Electric	1.5 mts.	4 years	Wrist	11 cm.	DCRB MAC	-	+	-	S2/M0
	N.Ü.	22	Glass	1 mts.	3.5 years	Wrist	3.5 cm.	Sural	-	+	-	S3+/M3
	A.T.	15	Glass	2.5 mts.	3 years	Wrist	5 cm.	Sural	-	-	-	S4/M4
	V.K.	30	Glass	6 mts.	9 years	Wrist	5 cm.	Sural	-	+	-	S3+/M2
ULNAR	E.T.	22	Circular saw	12 days	4.5years	Wrist	3 cm.	DCRB	+	-	-	S3+/M3
	H.E.	53	Circular saw	Primarly	3 year	Wrist	5 cm.	Sural	+	+	+	S3+/M2
	A.K.	25	Knife	1.5 mts.	9.5 years	Arm	10 cm.	Sural	+	-	-	M:S3/M4 U:S3/M0
MEDİAN + ULNAR	T.G.	39	Traffic accident	4.5 mts.	7.5 years	Elbow	12 cm.	Ulnar MAC	+	+	-	S3/M3
	K.D.	36	Machine	21 mts.	3.5 years	Wrist	10 cm.	Sural	+	+	+	M:S2/M3
	U.S.	5	Falling	6 mts.	2.5 years	Forearm	M:13 cm. U : 9 cm.	Sural	-	+	+	M:S4/M3 U:S3/M3
	A.Ö.	26	Machine	1.5 mts.	3.5 years	Arm	M : 5 cm. U : 4 cm.	Sural	+	-	-	M:S3/M4 U:S3/M3
	H.H.	18	Machine	Primarly	3 years	Elbow	7 cm.	Sural	+	+	+	S3/M4 İnt. M0
RADİAL	G.V.	51	Knife	1.5 mts.	7.5 years	Forearm	4 cm.	DCRB	-	-	-	M4
	Z.K.	20	Gunshot	3 mts.	5 years	Arm	7.5 cm.	Sural	+	-	-	S3+/M4
	M.T.	17	Circular saw	9 mts.	10 years	Palm	3 cm.	Sural	-	+	-	S4
	H.G.	13	Knife	17 mts.	11.5 years	Palm	3.5 cm.	Sural	+	+	-	S3+
	M.U.	34	Gunshot	4 years	5 years	Palm	4.5 cm.	Sural	+	+	+	S3
COMMON DİGİTAL	P.Ü.	33	Circular sar	3.5 mts.	4.5 years	Palm	3 cm.	RDD	+	+	+	S3+
	E.B.	26	Hizar	6 mts.	8 years	Palm	2.5 cm.	Sural	-	-	-	S3+
	S.E.	31	Dung Machine	2 mts.	7.5 years	Palm	5 cm.	DCRB	+	+	-	S3+
	D.K.	26	Circular saw	6 mts.	4.5 years	Palm	4 cm.	DCRB	+	+	+	S4
	U.İ.	18	Belt injury	10 days	4 years	Palm	5 cm.	Sural	+	+	-	S3+
	C.K.	42	Injection machine	Primarly	4.5 years	Palm	4 cm.	MAC	+	+	+	S3+

RDD : Dorsal Cutaneous Branch of Radial Nerve, MAC: Medial Antebrachial Cutaneous Nerve, M: Median, U: Ulnar, Int.: Intrinsics.

RESULTS

The parameters of 24 patinets concerning periods of injury, treatment and recovery are shown in detail on Table 1. In all patients, common symptoms were cold intolerance, paresthesia, pain and weakness in the otonom regeon of injured nerve.

Median Nerve: In 2 of 4 cases were observed useful (≥S3+/M3) motor and sensory recovery. The results of other 2 cases, whose nerves were severly injured and had long defects of the nerve, were poor (S2/MO).

Ulnar Nerve: Useful sensory recovery (S3+) was achieved in 3 patinets. Recovery of intrinsic muscles innervated by ulnar nerve was poor.

Median+Ulnar Nerves: In one patient who had high-level and severe injury and a delay of 4.5 months, ulnar nerve (splitting of fascicles) was used as grafts. Motor recovery of intrinsic muscles was very poor, especially in patients who had high-level injury, but in extrinsic muscles (M3 and M4). Sensory recovery in one patinet who had a delay of 21 months was poor (S2), in other patients were obtained fair sensation (S3).

Radial Nerve: In two patients were achieved good (M4) motor function.

Common Digital Nerve; While in one patient who had gunshot wound and a delay of four years was obtained fair (S3) sensation, sensory return in other patinets were good (S3+,6 patients) and excellent (S4, 2 patinets).

DISCUSSION

Optimal approach in the peripheral nerve injuries is primary repair and this method have given better results. However, the unique way of treatment of large nerve gaps caused by different mechanism to provide useful functions is nerve grafting today. Most authors reported that age, level of defect, level of injury, delay to repair and associated injuries affect the functional prognosis of nerve injury.

Because our series is small to comparison with other series in the literature with regard to peripheral nerve lesions is not possible.

In our series, however, excellent results (≥S3+, 8/9) in digital nerve subgroup and good results (≥M4, 262) in

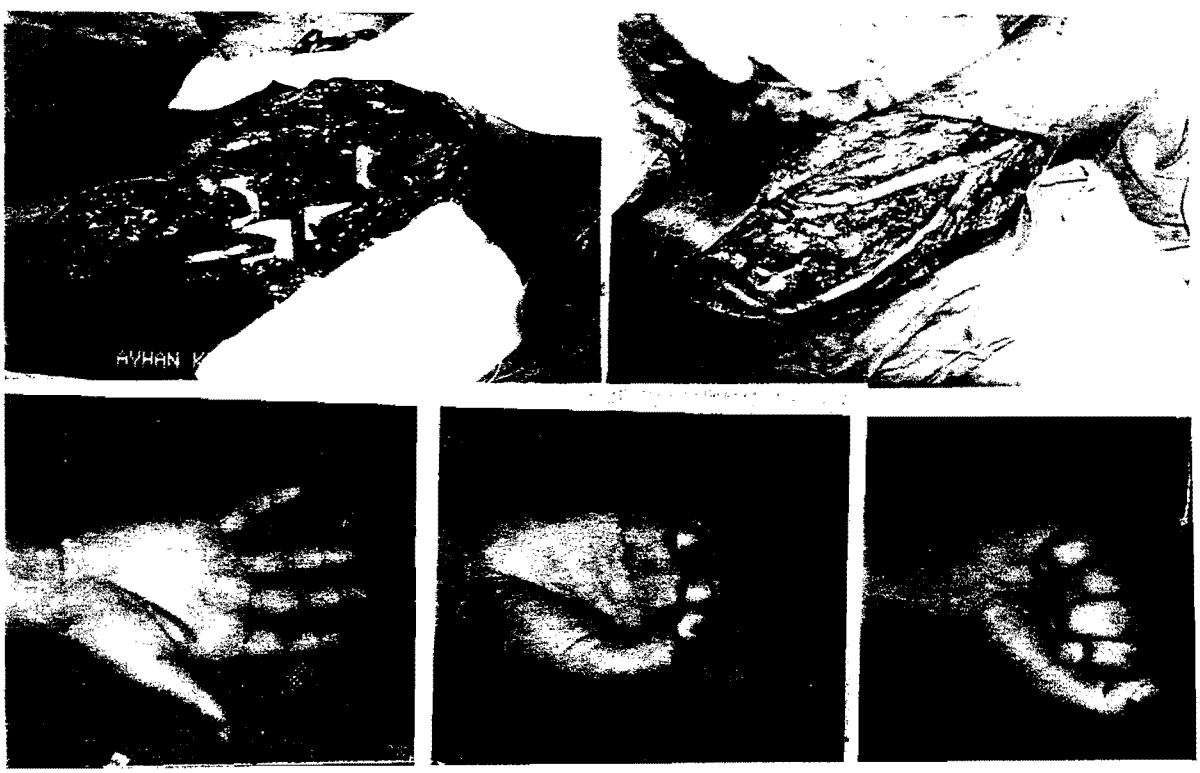

Fig.1. Median and Ulnar nerve injury at the level of distal arm. Intraoperativ views and clinical results 9.5 years after nerve grafting.

radial nerve subgroup are similar as that of reported from different centers. On the other hand, our results from median and ulnar nerve grafting are inferior to successful results -in 43 median nerves 83%:≥SM3, 97%:≥S3) and in 44 ulnar nerves (100%:M2+, 85%:≥S3)- reported by Millesi. We have considered that the cause of this difference with regard to our results has arisen from high percentage of the ratio in severe injury; while this ratio is 45.8% (11/24) in our series, it is 25% (11/43) for median nerve and 18% (8/44) for ulnar nerve in Millesi series.

Our experience indicates that the reinnervation of intrinsic muscles occurs minimal or none in median and/oulnar nerve grafting, particularly in adult population and high-level injuries. For this reason, we suggest that surgical strategy must include tendon transfers to provide intrinsic function during the procedure of nerve grafting in appropriate patients.

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