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Roles of pre and post operative electrodiagnosis(EDX) in brachial plexus injury patients:Case series

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Introduction

Brachial plexus injury is a catastrophic event for patients in perspective of upper extremity motor function. To dates, for improving its functional features, various nerve transfer techniques targeting brachial plexus nerves involving axillary nerve and musculocutaneous nerve are adapted and it shows outstanding results. Pre- and post-operative electrodiagnosis (EDX) could be used as a tool assessing nerve, muscle denervation potentials and functional motor unit. Post-surgery EDX also could demonstrate reinnervations of nerves and muscles. In cases, we try to find out roles of pre- and post-operative EDX in brachial plexus injury patients who underwent nerve transfer operations.

Method

Between November 2017 to june 2019, we retrospectively reviewed four patients who underwent nerve transfer surgery involving musculocutaneous or axillary nerve in a single center. All patients took EDX for pre- and post-operation, 6-12 months after surgery. In outpatient clinic, we tested motor power of upper extremity after 6 and 12 months of surgery. For evaluating motor power, we used MRC grade of shoulder, elbow, wrist and finger, and motricity index.

Result

Table 1. shows characteristics of the patients. Four men (mean age 47.25) underwent nerve transfer and all targeted at least one of musculocutaneous or axillary nerve. One patient (case 3) underwent neurotization. Mean period of injury to surgery was 203.5 days, and surgery to post-operative EDX was 239.5 days. Table 2. demonstrates EDX indexes, and table 3. demonstrates motor power. All patients showed improvement in MRC grade of upper extremity especially shoulder abduction, and motricity index from initial to 6 months, 12 months respectively. 3 Patients displayed improvement in target nerve compound muscle action potential (CMAP). 2 patients displayed decreased denervation potential, and better recruitment pattern. 3 patients had at least one result of reinnervation sign (Increased CMAP, better recruitment pattern).

Conclusion

It is not enough to verifying relationships between motor power and result of pre- and post-operative EDX. But we coarsely presumed that improvement of target nerve's CMAP or better recruitment pattern could be related to better outcome of corresponding muscle function. EDX could be possible to use as a predictive tool because all studies had done before motor power testing, 12 months after operation. More cases and further evaluations should be needed to verify its correlation.

Table 1. Characteristics of the patients

CASE NO.	SEX	AGE	CAUSE OF INJURY	LEVEL OF INJURY	SIDE OF INJURY	DONOR NERVE	TARGET NERVE	TIME FROM INJURY TO SURGERY(D)
1	M	46	Bicycle	C5-8	Left	Spinal accessory nerve Ulnar nerve	Suprascapular nerve Musculocutaneous nerve	177
2	M	30	Bicycle	C5-8	Rt.	3,4 intercostal nerve	Axillary nerve	148
3*	M	40	TA	C5-T1	Lt.	Spinal accessory nerve Contralateral C7	Musculocutaneous nerve Median nerve	265
4	M	73	TA	C5-6	Rt.	Median nerve Radial nerve	Musculocutaneous nerve Axillary nerve	224

1. **Nerve transfer (Spinal accessory nerve to suprascapular nerve & ulnar nerve fascicle to biceps branch of musculocutaneous nerve)**
2. **Nerve transfer (3,4 intercostal nerve to axillary nerve & ulnar nerve FCU branch to radial nerve triceps long head branch) Neurolysis and neuroplasty, upper trunk of brachial plexus**
3. **Neurotization (Spinal accessory to musculocutaneous & contra-lateral C7 to median)**
4. **Nerve transfer (Median nerve to Musculocutaneous nerve(Brachialis br.) & radial nerve augmentation to axillary nerve))**

Table 2. EDX index of patients

CASE NO.	TIME FROM PRE-EDX TO SURGERY(D)	PRE-OP EDX: TARGET NERVE CMAP(%)*	PRE-OP EDX: DENERVATION POTENTIAL		PRE-OP EDX: RECRUITMENT PATTERN***	TIME FROM SURGERY TO POST-EDX(D)	POST-OP EDX: TARGET NERVE CMAP(%)*	POST-OP EDX: DENERVATION POTENTIAL		POST-OP EDX: RECRUITMENT PATTERN***
			Fib**	PSW**				Fib**	PSW**	
1	41	Musculocutaneous nerve: 4%	2+	3+	0	366	Musculocutaneous nerve: 13%	1+	2+	1
2	56	Axillary nerve: 0%	0+	3+	0	184	Axillary nerve: 0%	0+	2+	0
3	30	Musculocutaneous nerve: 0%	3+	3+	0	195	Musculocutaneous nerve: 2%	3+	3+	0
4	113	Musculocutaneous nerve: 8%	0+	2+	1	213	Musculocutaneous nerve: 27%	2+	2+	3

*** Recorded site: Axillary nerve – Deltoid, Musculocutaneous nerve – Biceps brachii**

****Fib: Fibrillation, PSW: Positive sharp waves**

*****Recruitment pattern: (No MUAP=0 Maximal reduced =1 Moderate reduced=2 Minimal reduced=3)**

Table 3. Motor power index of patients

Table 3.1 Motor power index of patients(MRC grade)

CASE NO.	PRE-OP SHOULDER (AB/ER/FXT)*	PRE-OP ELBOW (FLX/EXT)**	POST-OP SHOULDER (AB/ER/FXT)*(6M)	POST-OP ELBOW (FLX/EXT)**(6M)	POST-OP SHOULDER (AB/ER/FXT)*(1Y)	POST-OP ELBOW (FLX/EXT)**(1Y)
1	0/0/0	0/3	1/1/0	1/4	2/2/0	3/4
2	0/0/0	0/0	2/0/0	0/0	3/0/0	0/0
3	2/1/2	0/1	3/4/2	0/2	4/4/4	1/2
4	0/0/0	2/5	3/3/3	3/5	-	-

***Abduction, External rotation, Extension**

****Flexion, Extension**

Table 3.2 Motor power index of patients(Motricity index of upper arm)

CASE NO.	INITIAL MOTRICITY INDEX	6 MONTHS MOTRICITY INDEX	12 MONTHS MOTRICITY INDEX
1	5	7	11
2	5	7	8
3	3	4	6
4	8	12	-

***Motricity index of upper arm: MRC grade of shoulder abduction + elbow flexion + pinch grip(finger flexion) +1**