INTERCOSTAL NERVE TRANSFER: LESS IS MORE

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Introduction

Intercostal nerve transfer (ICNT) is an established technique for neurotization of the musculocutaneous nerve (MCN) in patients with total brachial plexus injury. Given that individual intercostal nerves (ICN) provide a poor size match for reinnervation of the MCN, multiple ICNs are frequently combined to form a functional donor nerve unit. Despite this, the optimal number of intercostal nerves to transfer to the MCN remains poorly defined. In this study we identify differences in outcomes between two ICN, three ICN, and four ICN transfer to the MCN and analyze factors associated with post-operative success after ICN-MCN transfer.

Methods

A systematic review of the literature was conducted by two independent reviewers according to PRISMA guidelines. Studies included reported individual patient demographics and outcomes (age, time from injury to surgery, extent of injury, number of ICNs transferred, elbow flexion MRC scores, follow-up). Exclusion criteria were the following: follow-up <1 year, use of interposition nerve grafting in ICN transfer, and any procedure for enhancement of elbow flexion other than ICN to MCN transfer. The primary outcome was final elbow flexion Medical Research Council (MRC) score. Secondary outcomes were % of patients with MRC≥3/MRC≥4 and frequency of ICN use. Comparisons were made using chi-square tests and one-way ANOVA. Logistic regression analysis was completed with the following factors: age, extent of injury (C5-C6, C5-C7, C5-T1), time from injury to operation, and number of ICNs transferred.

Table 1. Summary of patient demographics.

	2 ICN	3 ICN	4 ICN	P-value
Number	43	77	8	
Age	28.4 (13.0)	25.9 (9.4)	30.5 (11.6)	0.331
Extent of BPI				
C5-C6	2.3	10.4	12.5	
C5-C7	11.6	48.1	50	
C5-T1	86.1	41.6	37.5	
Preop Delay	5.2 [2.7]	4.8 [2.8]	2.6 [1.5]	0.05
ICN—MBB (%)	53.5	0	0	<0.001
Follow-up Time	54.7 (26.1)	50.2 (31.1)	75.5 (60.6)	0.182
Sex	0.89	0.88	1	0.665

Results

There were 43 patients from 10 studies who underwent two ICNT, 77 patients who underwent three ICNT, and 8 patients who underwent four ICNT. Mean MRC score was similar for all ICNTs (2ICN 3.0 [SD: 1.3], 3ICN 2.9 [SD:1.3], 4ICN 3.0 [SD:3.0]. No significant differences were seen in % of patients achieving MRC≥3/MRC≥4. On multivariate regression analysis, the following factors were significantly associated with outcomes: age (OR:0.920, p<0.001), extent of brachial plexus injury (OR:0.482, p=0.03), and time from injury to surgery (OR:0.857, p=0.045). Number of ICNs transferred was not associated with MRC≥4 on univariate or multivariate analysis (OR: 0.895, p=0.722; OR:0.55, p=0.126).

Table 2. Elbow flexion MRC scores by numbers of ICNs transferred.

	2 ICN	3 ICN	4 ICN	P-value	Chi-squared
Avg MRC score (SD)	3.0 (1.3)	2.9 (1.3)	3.0 (1.4)		
MRC Score				0.93	4.362
0	9.3	9.1	12.5		
1	4.7	5.2	0.0		
2	7.0	18.2	12.5		
3	30.2	24.7	25.0		
4	48.8	41.6	50.0		
5	0	1.3	0		
% MRC≥3	79.1	67.5	75.0	0.395	1.858
% MRC≥4	48.8	42.9	50.0	0.789	0.474

Conclusions

ICN-MCN transfer is an established technique for improving elbow flexion in patients with brachial plexus injury. Multiple ICNs are frequently transferred to the MCN simultaneously, although the optimal number of ICNs to transfer is unclear. These results indicate that two ICN transfer may be as effective as three ICN and four ICN transfer. Taken together, this data leads us to question the utility of transferring >2 ICNs.