The Deltoid to Triceps Nerve Transfer: a Novel Approach to Early Salvage of Elbow Extension in Tetraplegia
Davidge KM, Kahn LC, Novak CB, Juknis N, Ruvinskaya R, Fox IK

Objectives
• To present a novel surgical approach to restoring elbow flexion in spinal cord injury (SCI): the deltoid to triceps nerve transfer

Methods: Case Report

Patient:
➢ 48 year-old male, previously LHD physician
➢ 7 months post C6-level SCI
➢ PMH: DVTs, IVC filter, pressure sore, recurrent UTIs

Preoperative clinical exam:

<table>
<thead>
<tr>
<th>Left UE</th>
<th>Manual Muscle Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder</td>
<td>Deltoid: 5/5 (ant, post, middle)</td>
</tr>
<tr>
<td>Elbow</td>
<td>Biceps: 5/5</td>
</tr>
<tr>
<td></td>
<td>Brachialis: 5/5</td>
</tr>
<tr>
<td></td>
<td>Triceps: 1+/5</td>
</tr>
<tr>
<td>Forearm</td>
<td>Pronation: 3+/5</td>
</tr>
<tr>
<td></td>
<td>Supination: 4+/5</td>
</tr>
<tr>
<td>Wrist</td>
<td>ECR: 5/5</td>
</tr>
<tr>
<td></td>
<td>ECU: 0/5</td>
</tr>
<tr>
<td></td>
<td>FCR: 0/5</td>
</tr>
<tr>
<td>Hand</td>
<td>No function</td>
</tr>
</tbody>
</table>

Preoperative EMG:
➢ Coexisting lower motor neuron injury to triceps branches of radial nerve
➢ Acute denervation all 3 heads triceps (+ fibrillations)
➢ Reinnervation (+ motor unit potentials/volitional control) of long and lateral heads of triceps muscle, but NOT the medial head

Surgical Approach: Axillary to Triceps Nerve Transfer
1. EXPOSURE (Posterior Approach, Left):
   • Longitudinal incision over triceps

Surgical Approach (cont):
2. MEDIAL TRICEPS NERVE BRANCH IDENTIFICATION (RECIPIENT):
   • Intraoperative stimulation: No contraction seen

3. AXILLARY NERVE - POSTERIOR DELTOID BRANCH IDENTIFICATION (DONOR):
   • Intraoperative stimulation: normal

4. DIRECT COAPTATION OF POSTERIOR DELTOID TO MEDIAL TRICEPS NERVES:
   • “Donor distal, recipient proximal”
   • Coaptation within 2 inches of medial triceps muscle
   • Simultaneous Brachialis to AIN/FCR nerve transfer performed in the same extremity (left)

RESULTS:
Donor morbidity:
➢ Postoperative shoulder abduction: 5/5
➢ Specific testing posterior deltoid: 4/5, normalized by 4 months follow-up

Outcome: Triceps Reinnervation:
➢ 10 mo follow-up: improved elbow extension range of motion with gravity eliminated
➢ Patient notes improved ability to reach out for objects (i.e. medical charts)

Conclusions
➢ Posterior deltoid to medial triceps nerve transfer is a feasible method to restore elbow extension in SCI
➢ This is an analogous approach to the triceps-to-axillary nerve transfer for brachial plexus injury
➢ Early reinnervation of the triceps in cases of direct lower motor neuron injury may help to salvage the invaluable function of elbow extension in patients with tetraplegia.

Challenges
➢ Contribution of nerve transfer to medial triceps vs spontaneous recovery of lateral/long triceps?
➢ Further define role of “acute” nerve transfer in SCI?
➢ Appropriate identification of “acute” nerve transfer candidates?