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# Nerve and tendon transfer to the triceps for elbow flexion contracture

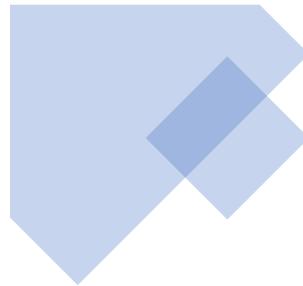
1st International Mediterranean Symposium  
Elbow Stiffness – Pathogenesis & Management  
Stiffness in Children

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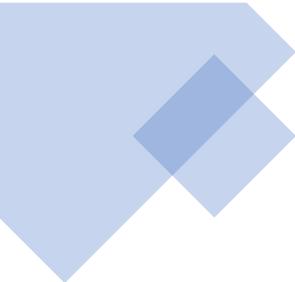


# Introduction

Triceps reanimation “for elbow flexion contracture”...

“II - Stiffness in children” and “Contracture after obstetrical palsy” session...





# Introduction

Triceps reanimation “for elbow flexion contracture”...

“II - Stiffness in children” and “Contracture after obstetrical palsy” session...

**Not a therapeutic option = Prevention only**

**Related literature = Adult >> Neonatal**

**First indication of elbow extension restoration = Tetraplegia**





# Introduction



## Indications of triceps reanimation

- Isolated Triceps Palsy = rare
- Brachial Plexus Injury (BPI) = C5-C7 / C5-T1 / Posterior Cord
- Tetraplegia





# Introduction



## Prerequisites

- Satisfactory volitional elbow flexion and shoulder function
- Satisfactory passive elbow extension
- Satisfactory donor strength (i.e.,  $\geq M4$ )





# Introduction



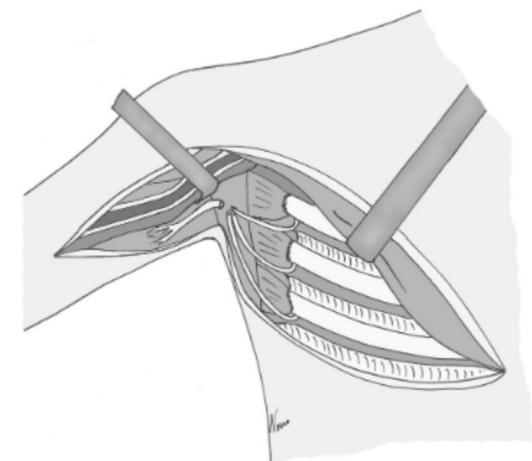
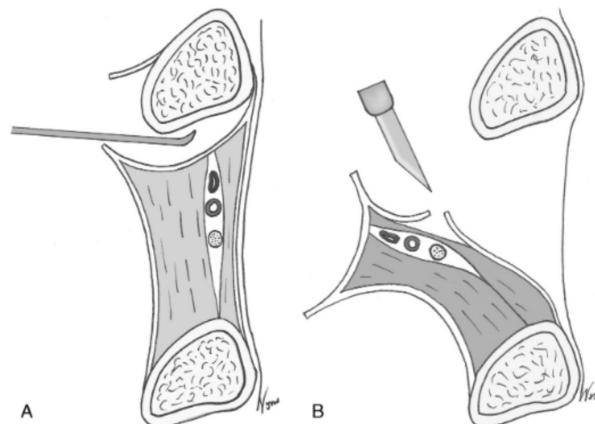
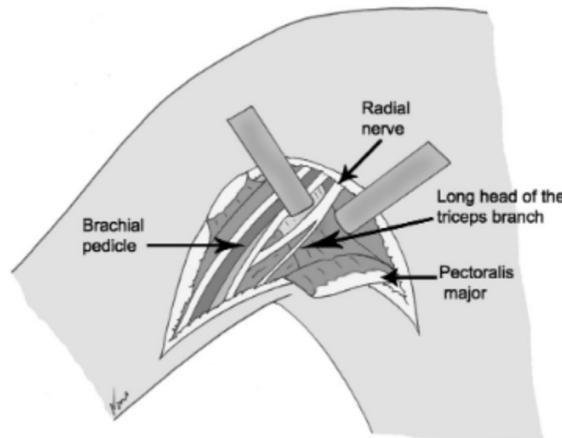
Nerve / Tendon ?

- Injury-Surgery delay
- Available donors
- Surgeon's discretion



# Nerve transfers

Intercostal Nerves to the Long Head of the Triceps Motor Branch (ICN-LHTMB)



Goubier and Teboul, 2007



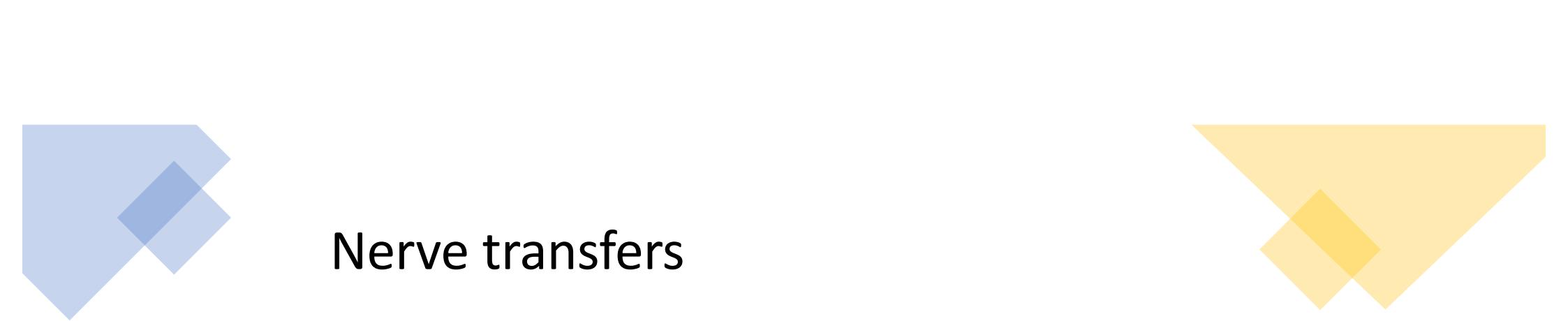
# Nerve transfers



## ICN-LHTMB – Indications

- C5-C7 +/- C8
- C5-T1 = only if viable root(s) for elbow flexion (+/- shoulder function)
- Posterior Cord





# Nerve transfers

## ICN-LHTMB – Technical notions

- At least 3 ICN
- Most commonly ICN3 to 5
- LHTMB = purely motor & easy to find & satisfactory length





# Nerve transfers

## ICN-LHTMB – Outcomes

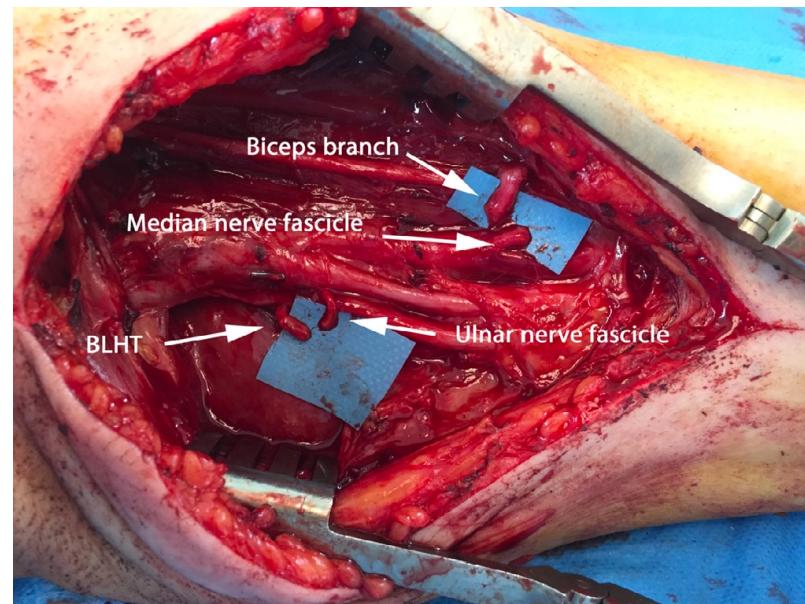
- Reinnervation within 9 months (Goubier et al., 2012)
- 3 ICN → 70-80% ≥ M3 / 2 ICN → 33% = M3 (Malungpaishrope et al. 2012; 2018; 2022)
- No difference between C5-C7 and C5-T1 (Goubier et al., 2012; Malungpaishrope et al., 2022)
- Positive predictive factors: BMI  $\leq 25$  , preop delay  $\leq 6$  months (Kittithamvongs et al., 2022)



# Nerve transfers

Partial Ulnar Nerve to the Long Head of the Triceps Motor Branch

- Indication = C5-C7
- Outcomes = 100%  $\geq$  M3

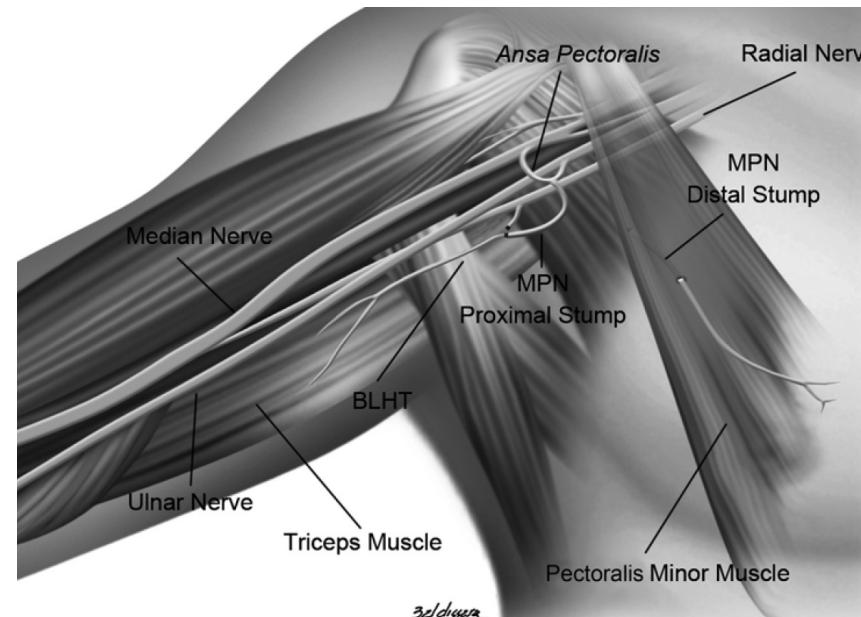


Goubier et al., 2019

# Nerve transfers

Medial Pectoral Nerve to the Long Head of the Triceps Motor Branch

- Indication = C5-C7
- Outcomes = 100%  $\geq$  M3

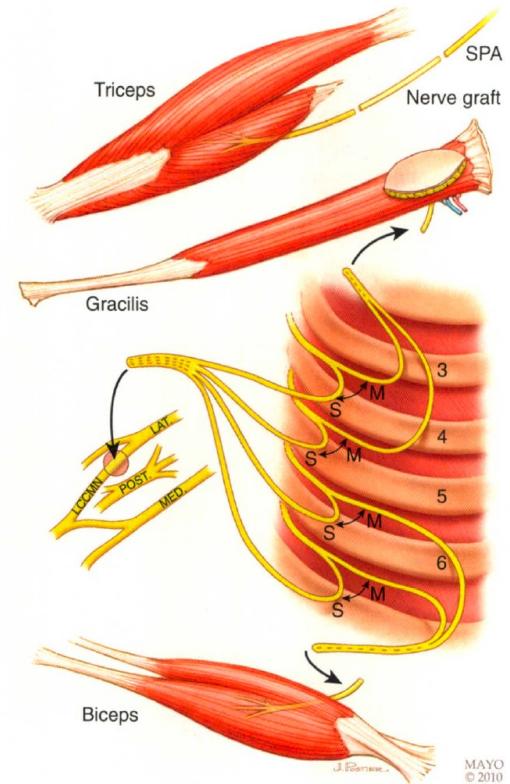


Flores, 2013

# Nerve transfers

## Other donors

- Spinal Accessory Nerve (C5-T1) (Spinner et al., 2015)
- Axillary Nerve Posterior Branch (C7-T1) (Soldado et al., 2020)
- Musculocutaneous Nerve (Posterior Cord) (Bertelli et al., 2017)

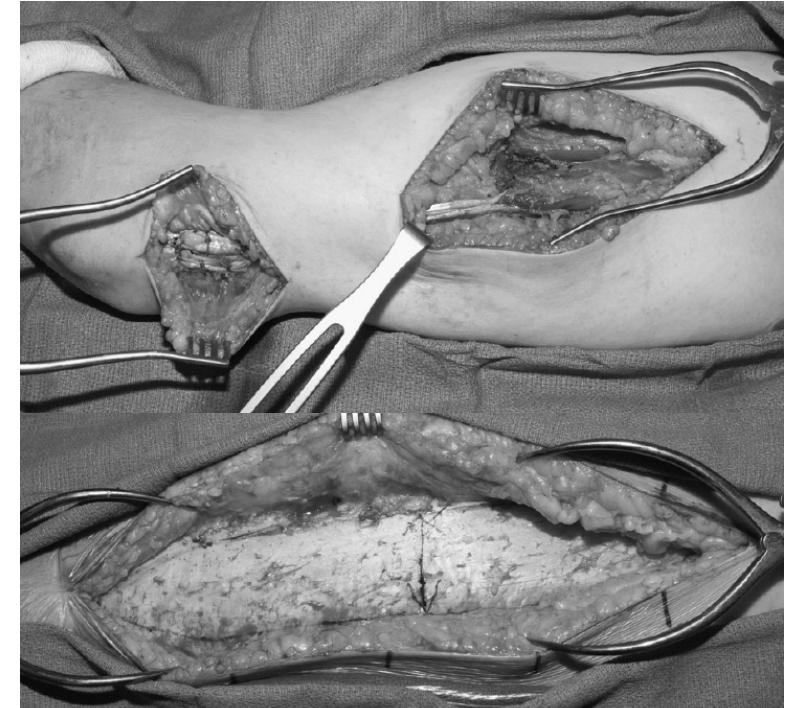


Spinner et al., 2015

# Tendon transfers

Posterior Deltoid to Triceps

- Indication = Tetraplegia
- Outcomes = 100%  $\geq M3$



Bonds and James, 2009



# Tendon transfers

Biceps to Triceps

- Indication = Tetraplegia
- Outcomes = 100%  $\geq M3$

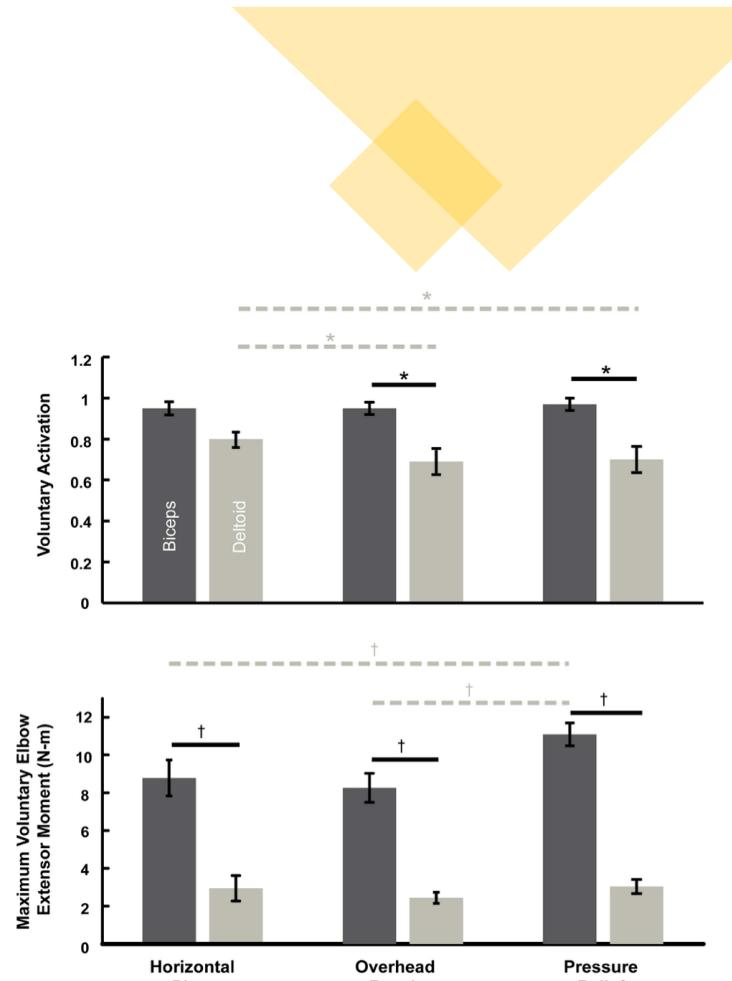


Kozin et al., 2010

# Tendon transfers

Posterior Deltoid = Gold Standard ?

- No elbow flexion / forearm supination weakening  
→ No functional impairment / Deformities correction
- No radial nerve palsy  
→ Medial route
- Graft augmentation
- Lesser volitional activation / affected by shoulder position

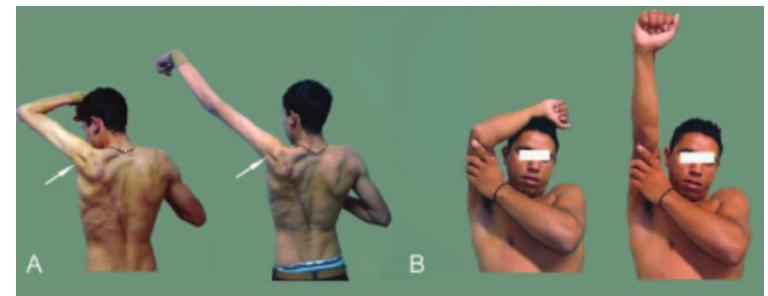
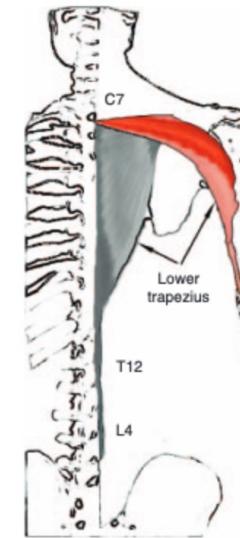


Peterson et al., 2017

# Tendon transfers

## Lower Trapezius to Triceps

- Indication = C5-C7
- Outcomes = 100%  $\geq$  M3
  - Improved forearm positioning
  - No body transfer



Bertelli, 2009

# Neonatal BPI specificities

Enhanced recovery capacities → Delayed nerve transfers

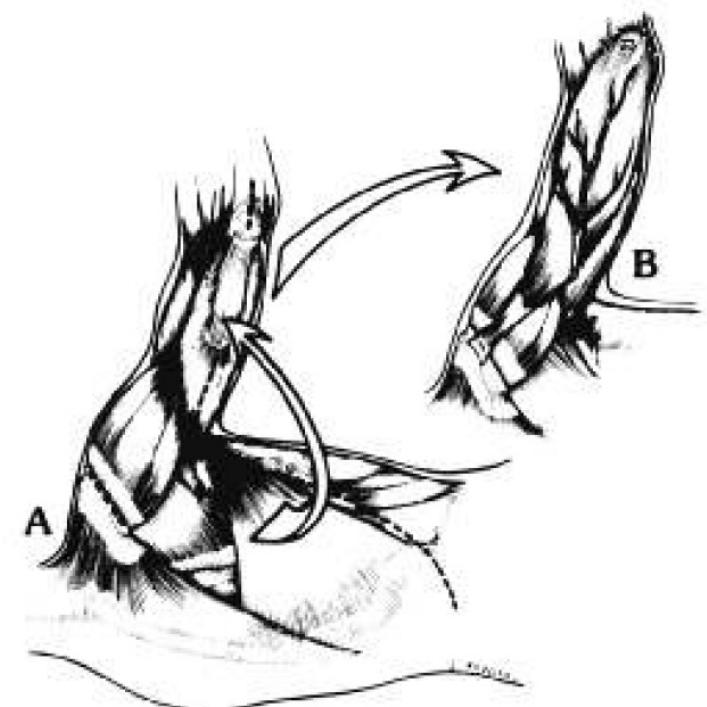
- ≤ 6 mo = BP exploration & nerve grafts

Mosaic-like recovery → Unexpected donors

- Muscle transfers

Growth potential → Dysplasia potential

- Donor (ICN – Chest growth?)



Jones et al., 1985



# Conclusions

Careful preoperative examination

Numerous presentations = Numerous techniques

Rare indications

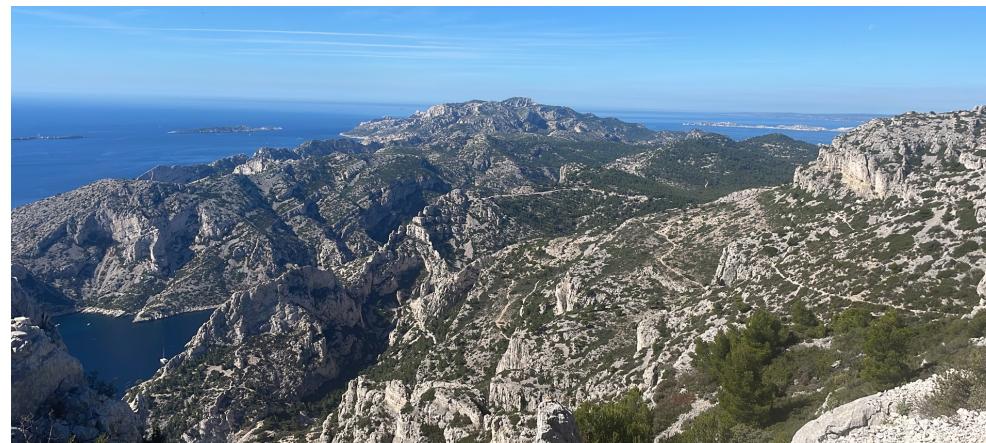
Satisfactory results



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# Thank you for your attention



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