



Nerve Cases

Frontiers in Upper Extremity Surgery
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Case #1

40 yo male who fell at work and a coffee mug broke in his hand 3 mos ago.
The work comp orthopaedic surgeon operated on his knee but refused to refer him for the numbness in the radial side of his index finger.



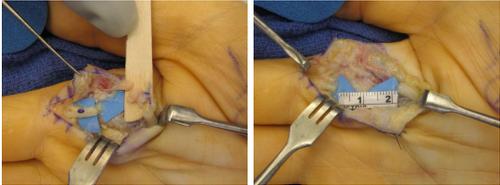


Case #1

What is your next step in the operating room?

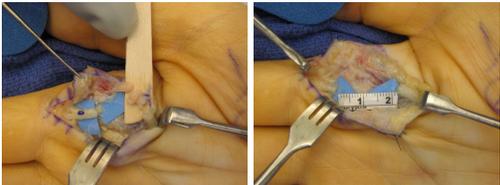
Case #1 

- Resect the neuroma to healthy fascicles
- There is now a defect of 2.4 cm. What is your next step?



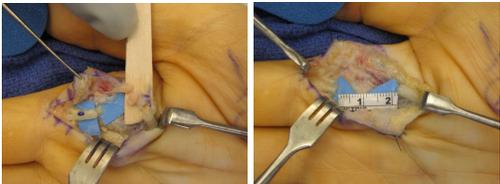
Case #1 

- Conduits can be used to bridge a sensory nerve gap or defect up to what size?



Case #1 

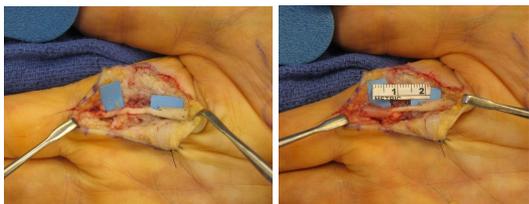
- Conduits can be used to bridge a sensory nerve gap or defect up to what size?
- Answer: equal and up to 3 cm. Though the evidence to support this may not be the strongest



Case #1



- This defect was reconstructed with nerve allograft and conduits at each end (conduit-assisted) of the coaptations
- Discuss with your instructor what they would use



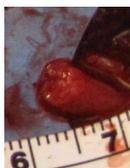
Case #2

22 yo female restrained driver who struck a tree. The unrestrained passenger was ejected from vehicle. She sustained a closed humerus fracture and upon presentation had no radial nerve function. Your trauma partner repaired her humerus fracture and found the nerve transected (NB: the surgical team did not injure the nerve).



Cases

- Initial gap: 4 cm.
- Resection to healthy fascicles led to defect of 6 cm.
- Discuss the options.



Options 

Is there a role for conduits alone as a reconstruction tool in this case?

Options 

Is there a role for conduits alone as a reconstruction tool in this case?

Answer: Probably not. There is no conduit that long and conduits alone are not recommended to bridge defects in large-diameter nerves (mixed nerves). See Moore's study.

Limitations of Conduits in Peripheral Nerve Repairs

Amy M. Moore · Rahul Kanakurthi ·
Christina K. Magill · H. Francis Farhadi ·
Gregory H. Borschel · Susan E. Mackinnon
HAND (2009) 4:180-186

"In large-diameter nerves, the use of conduits should be carefully considered."

Options 

Options in the case include:

- Autograft
- Decellular Nerve Allograft
- Radial nerve palsy tendon transfers

Question 

To answer the question of whether decellular nerve allograft works, one needs to know what meaningful recovery means.

What does meaningful recovery mean on the Medical Research Council Classification?

Medical Research Council Classification 

Table 1 Sensibility Grading*

S0	No sensory recovery.
S1	Recovery of deep cutaneous pain sensibility.
S2	Recovery of superficial cutaneous pain sensibility.
S2+	Same as S2, only with over response.
S3	Recovery of pain and touch sensibility with a disappearance of over response. Two-point discrimination > 15 mm.
S3+	Same as S3, only localization of the stimulus is good. Two-point discrimination 7 to 15 mm.
S4	Complete recovery. Two-point discrimination 2 to 6 mm.

*[British] Medical Research Council classification.⁴⁹ Added is MacKinnon and Dellon's modification of two-point discrimination.⁴⁸

Meaningful Recovery

Table 2 Muscle Strength Grading*

M0	None. No evidence of contractility.
M1	Trace. Evidence of slight contractility. No joint motion. Return of perceptible contraction of the proximal muscles.
M1+	Proximal muscles contract against gravity but intrinsic are paralyzed.
M2	Poor. Complete range of motion with gravity eliminated. Same as M1+ with perceptible intrinsic contraction.
M2+	Proximal and distal muscles are all active against gravity.
M3	Fair. Complete range of motion against gravity. Return of function in proximal and distal muscles to such a degree that all important muscles to such a degree that all important muscles are sufficiently powerful against gravity.
M4	Good. Complete range of motion against gravity with some resistance. All muscles act against strong resistance and some independent movements are possible; some intrinsic weakness.
M5	Normal. Complete range of motion against gravity with full resistance. Full recovery in all muscles.

*[British] Medical Research Council classification.⁴⁹ Included is Higher and Sanders' modification.⁴⁸

Does Decellular Nerve Allograft Work? 

Functional Outcome Following Nerve Repair in the Upper Extremity Using Processed Nerve Allograft

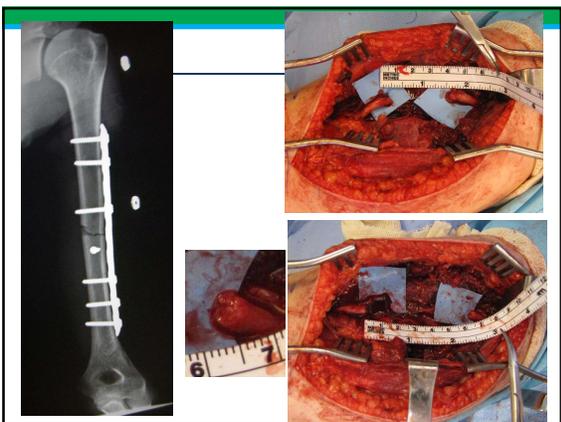
Mickey S. Cho, MD, Brian D. Rinker, MD, Renata V. Weber, MD, Jerome D. Chao, MD, John V. Ingari, MD, Darrell Brooks, MD, Gregory M. Buncke, MD
J Hand Surg 2012;37A:2340-2349.

- 56 subjects, 71 nerves (35 sensory, 13 mixed, 3 motor)
- Mean gap length 23 mm
- S3 or M4 and above achieved in 86%
- Meaningful recovery (>S3/M3) 89% in digital nerves, 75% median nerve repairs and 67% of ulnar nerve
- These results are comparable to autograft reconstructions: meaningful recovery for digital nerves 56% (Kallio); 80% (Frykman & Gramyk)
- For median nerve 60-80%; ulnar nerve approx. 60% (Kim, Brushart, Frykman & Gramyk)

Conclusion 

There is a growing body of literature (animal and clinical studies) to support the use of decellular nerve allograft for mixed nerve gaps and defects.

In this case Dr. Tang decided to reconstruct with sural nerve autograft. Though the allograft data looks promising he feels autograft may be superior and uses it when it is critical, ie. in this young patient in whom we want radial nerve function. However, he would use allograft in a low median nerve injury because it is mainly sensory and thenar palsy is better tolerated and has less morbidity.

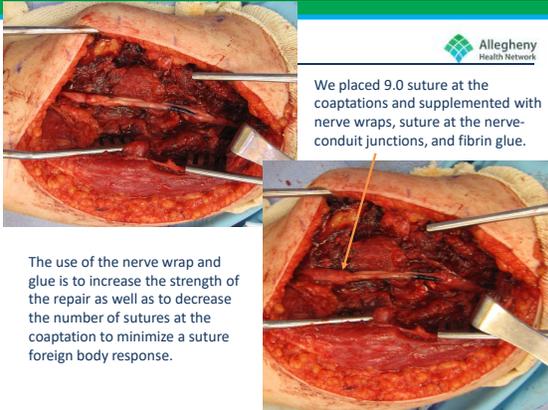


Cases 

We harvested a length of sural nerve with the goal of 15% longer than the defect.

Dr. Tang has studied the importance of gap diameter and has found that making up the diameter of the injured nerve with cabling is critical. The sural nerve of the patient was approximately 3 mm, so 2 grafts made up the 6-7 mm diameter of the radial nerve.





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We placed 9.0 suture at the coaptations and supplemented with nerve wraps, suture at the nerve-conduit junctions, and fibrin glue.

The use of the nerve wrap and glue is to increase the strength of the repair as well as to decrease the number of sutures at the coaptation to minimize a suture foreign body response.



Thank You!

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