Intercostal Nerve As A Target for Biopsy

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Peripheral Nerve Biopsies

- Useful diagnostic tool in peripheral neuropathies, especially when unclear with laboratory, clinical and neurophysiological investigations
- Typically sural nerve
  - Pure sensory nerve – limited usefulness for motor neuropathies or lower motor neuron diseases

Peripheral Nerve Biopsy

- Techniques for obtaining motor nerve tissue limited in literature and some with risk for motor impairment
- Motor branch to gracilis muscle has become a popular target but
  - unfamiliar anatomy for neurosurgeons
  - Difficult in obese patient

Alternative: Intercostal Nerve

- Familiar anatomy
- Widely used in neurotization procedures because:
  - Minimal loss of function from sacrifice
  - Adequate amount of motor fibers

Anatomy of Intercostal Nerves

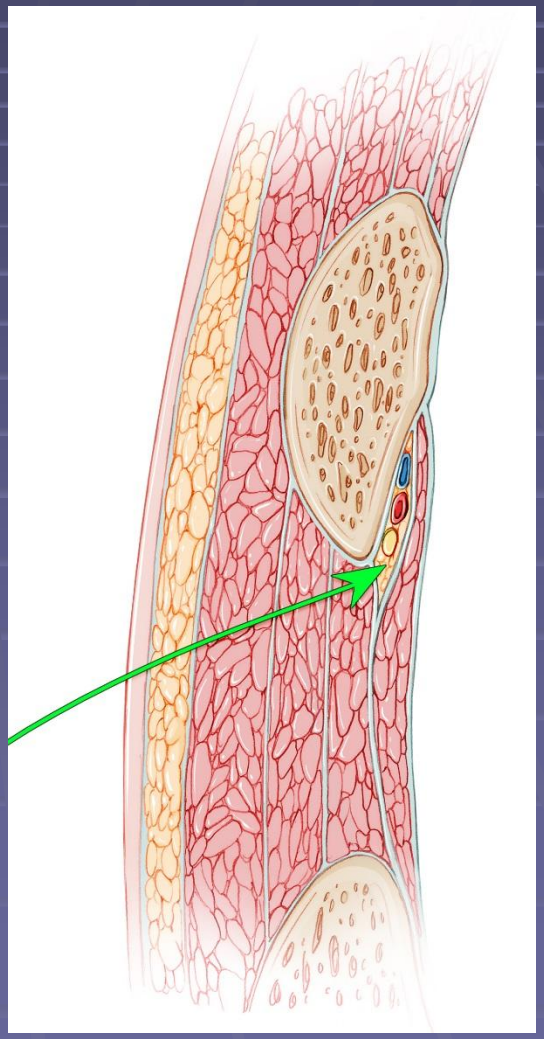
- Mixed peripheral nerve
- Easily accessible, familiar anatomy
- 1200-1300 fibers, 40 % motor
- Somatic nerves arising from anterior divisions of spinal nerves T1-11
- Ventral primary ramus of T12 spinal nerve is subcostal nerve, does not occupy intercostal space

Anatomy Intercostal Nerves

- Supply thoracic wall, pleura, peritoneum
- Intercostal
  - Typical
  - Atypical: T1, 2, 7, 8, 9, 10, 11
    - Atypical because innervates brachial plexus(1,2), peritoneum (7-11),

Anatomy of Intercostal Nerves

- Intercostal space 3 layers
  - External intercostal muscle
  - Internal intercostal muscle
  - Innermost intercostal muscle



Anatomy of Intercostal Nerve

- Upper intercostal nerves (T3, 4, 5, 6) run parallel to their ribs in between internal and innermost muscles
- Lower intercostal nerves (T7, 8, 9, 10, 11) lay superficial to transversus thoracic/abdominis muscle

Case Series

- 4 patients
- 2 male, 2 female
- Age 26-51
- 3 with preliminary diagnosis of CIDP
- One with hereditary polyneuropathy

Procedure

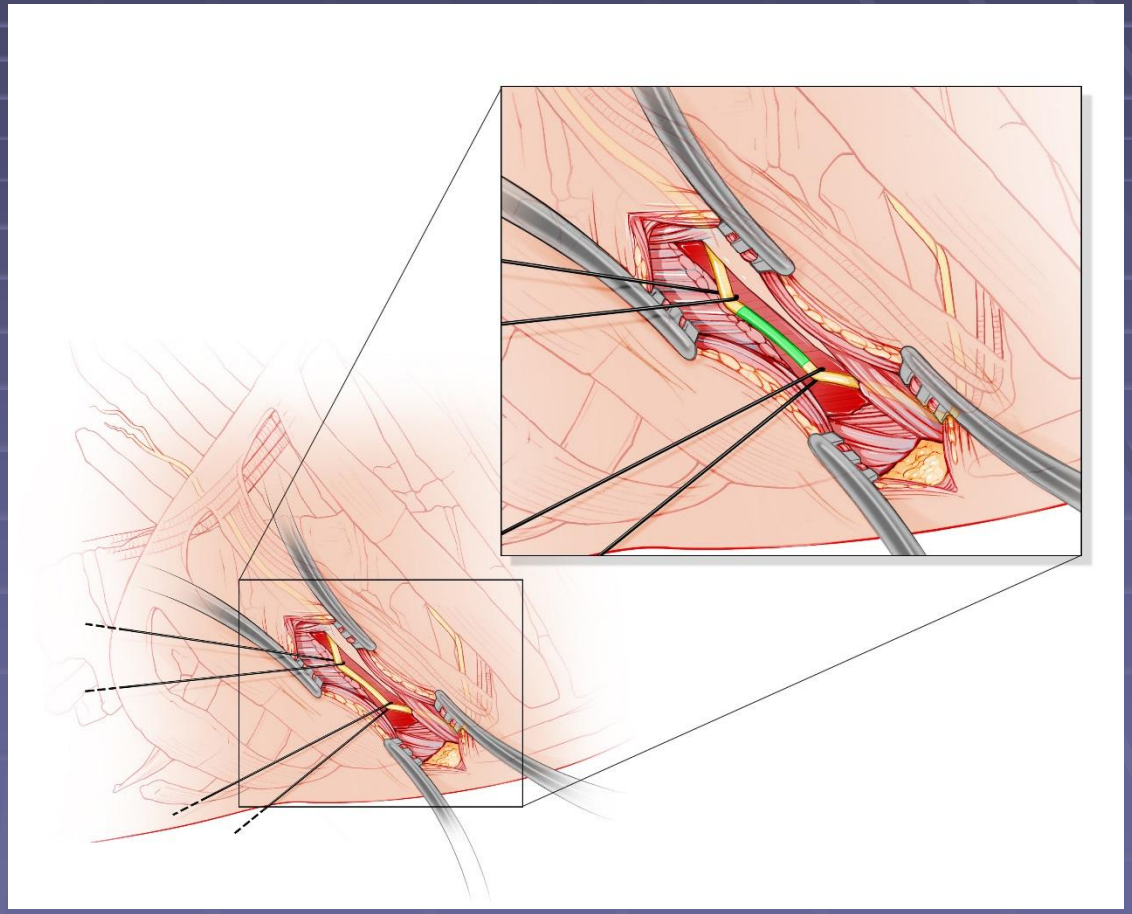
- Patient is placed on side in lateral position or supine
- General anesthesia
- Select rib interspace inferior to pectoralis muscle
- General T7-11 targeted
- T4 avoided to preserve nipple/areola sensation

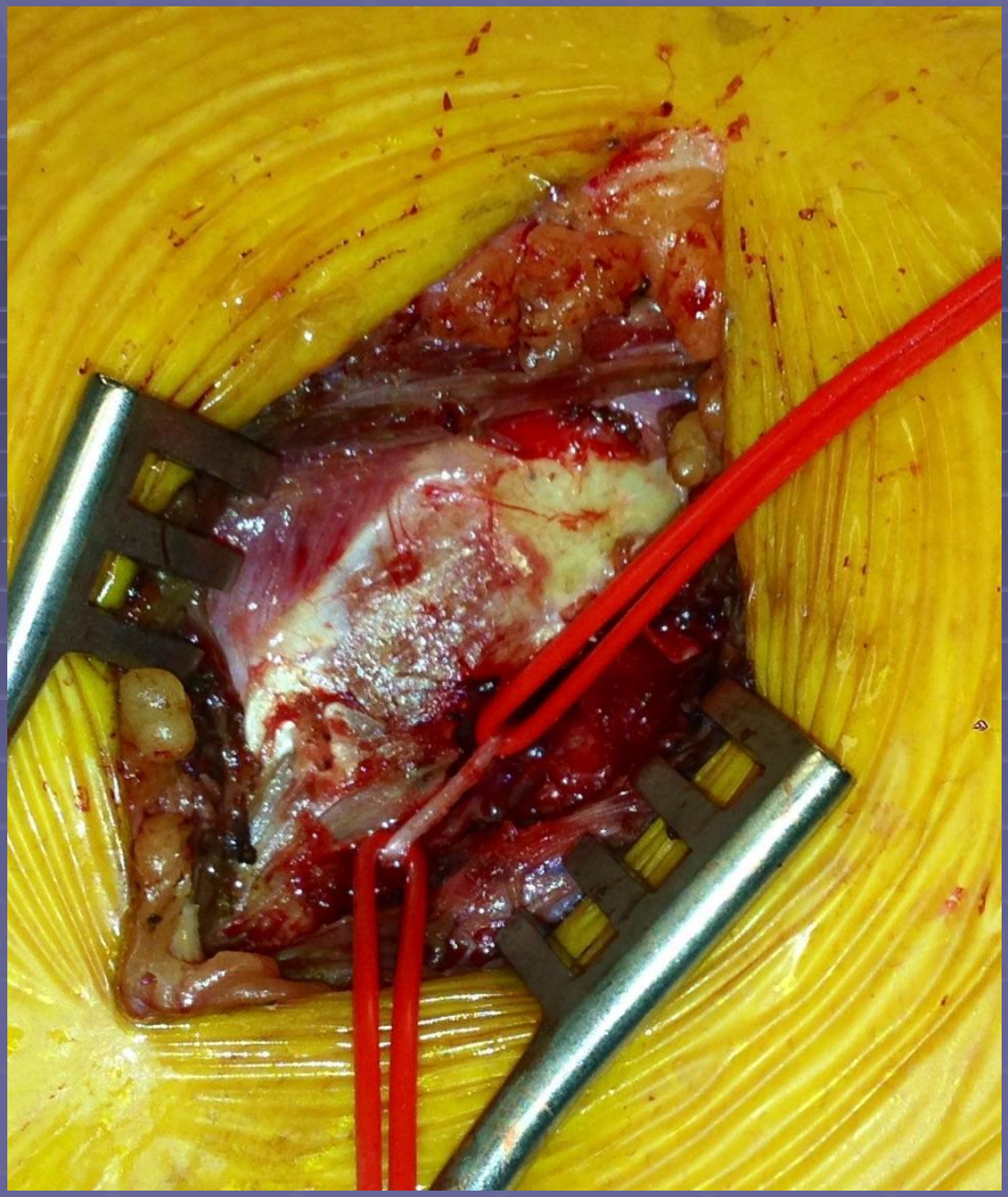
Procedure

- Incision made over inferior aspect of superior rib at chosen interspace
- Dissection performed through external and internal intercostal muscles to access inferior pleural surface of rib
- Blunt dissector passed along inferior surface of rib detaching neurovascular bundle from rib

Procedure

- Segment of nerve isolated between two vessel loops
- Ligated with suture and cut





Results

- Biopsy results of two patients showed axonopathy
- Two others: axonopathy with demyelination
- No short or long term complications
- None reported sensory or motor deficit at 6 week postoperative check

Conclusion

- Indications for motor nerve biopsy rare, but procedure relevant in select cases
- Familiar anatomy
- Low risk
- Intercostal nerve contains motor and sensory nerve fibers

References

- 1. Abouzahr, M. et al. Diagnostic biopsy of the motor nerve to the gracilis muscle. J Neurosurg
- 87:122-124, 1997.
- 2. Wahegaonkar, A. et al. Technique of intercostal nerve harvest and transfer for various
- neurotization procedures in brachial plexus injuries. Techniques in Hand & Upper Extremity
- Surgery 11(3):184-194, 2007.
- 3. Lykissas, M. et al. Use of intercostal nerves for different target neurotization in brachial
- plexus reconstruction. World J Orthop 4(3):107-111, 2013.
- 4. Corbo, M. et al. Motor nerve biopsy studies in motor neuropathy and motor neuron disease.
- Muscle & Nerve 20:15-21, 1997.
- 5. Riva, N. et al. Motor nerve biopsy: clinical usefulness and histopathological criteria. Ann
- Neurol 69:197-201, 2011.