Anatomische und Funktionelle MR-Neurographie peripherer Nerven

Fortbildung Rheumatologie 01/2022

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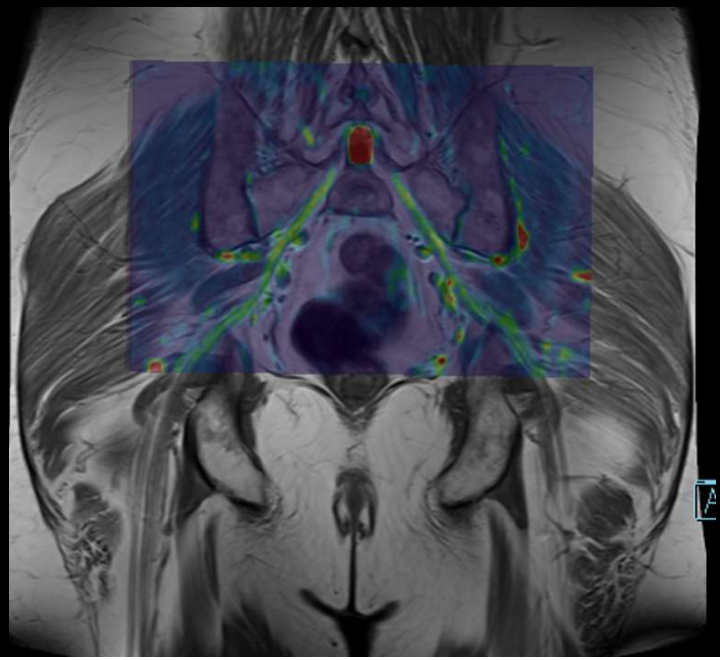
ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

Universität Zürich[UZH]

Structure

Max. 20 min

- How to do it
- What it can reveal



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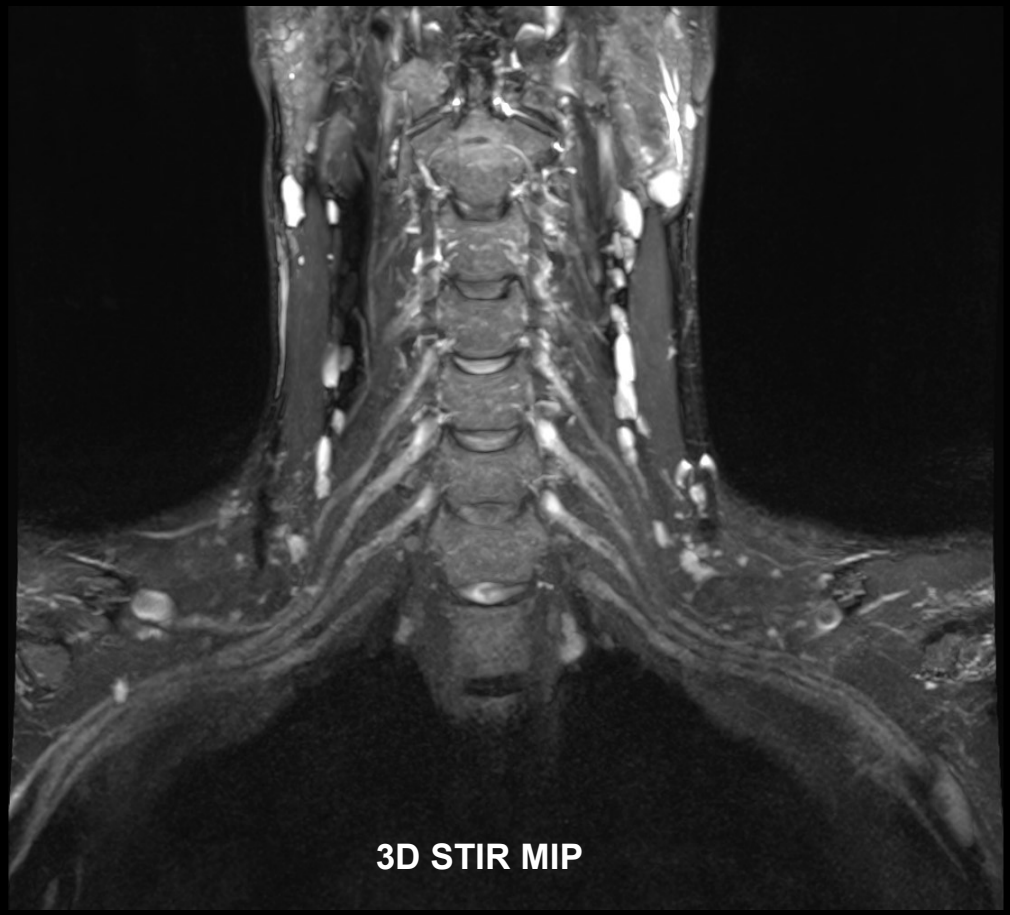
MR Neurography Technique

- Protocol
  - anatomy
    - T1, T2, MR-Angiography
  - specific
    - T2fs, T1pCM, (functional imaging/DTI)
- Duration
  - ca. 20-45 min per region

MR Neurography Technique

Specific T2fs

- 3D imaging
- high spatial resolution (≤ 1mm)
- isotropic voxels
- strong T2 weighting
- homogenous fat saturation



3D STIR MIP

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MR Neurography Technique

- 3D STIR → supression of fat only
- nerve specific → supression of fat **and** vessels
- Diffusion weighting
- 3D DW PSIF
  - b value ~80 s/mm^2
  - fat and vessel supression

STIR

PSIF

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MR Neurography Interpretation

- Caliper
- Signal Intensity

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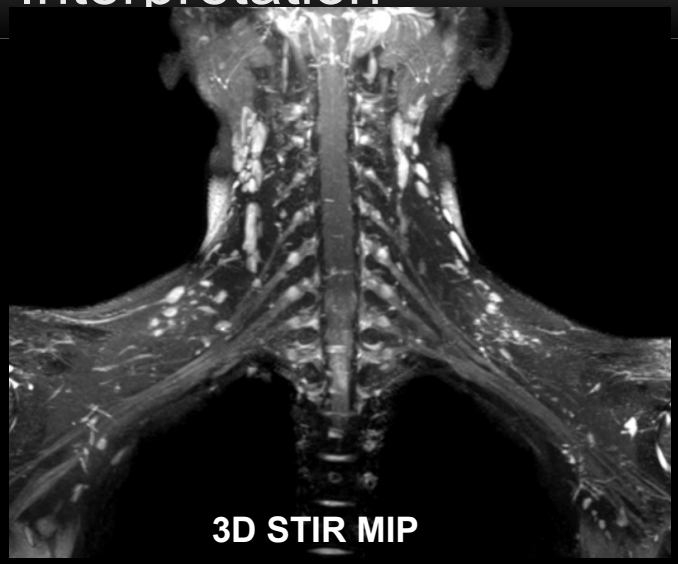

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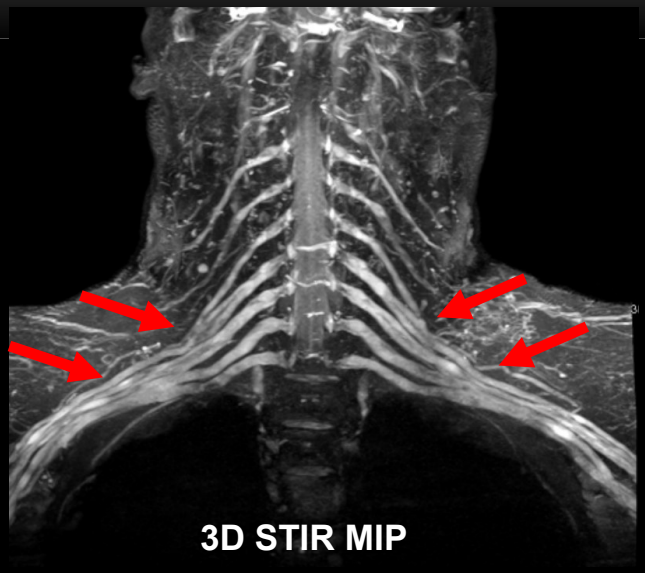

3D STIR MIP

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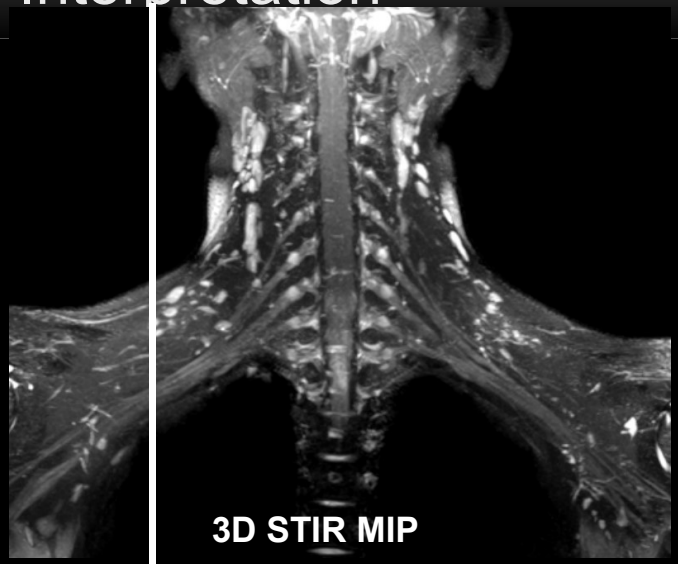

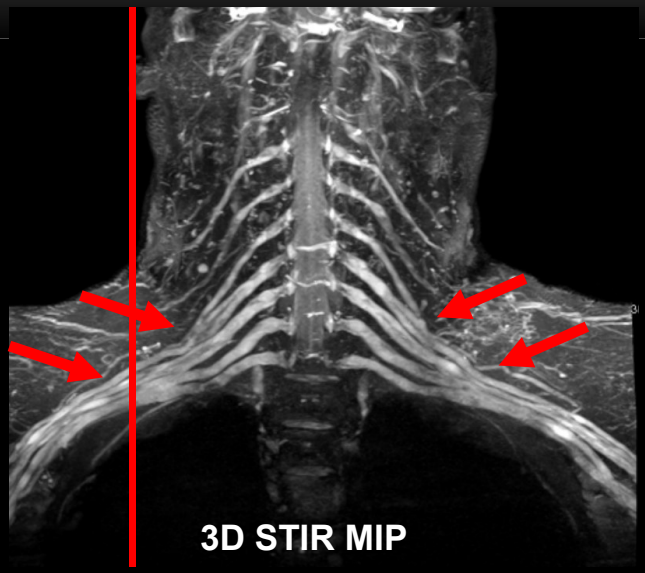

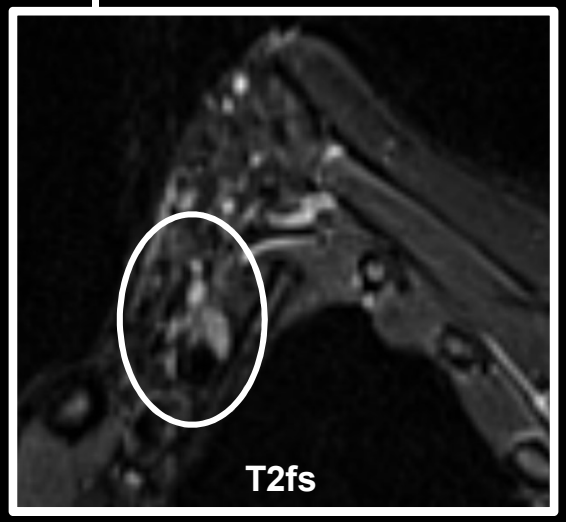

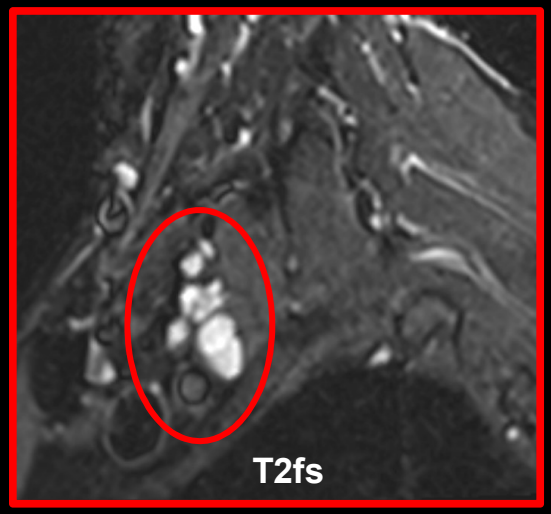

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MR Neurography Interpretation

- Caliper
- Signal Intensity
- Fascicular Pattern

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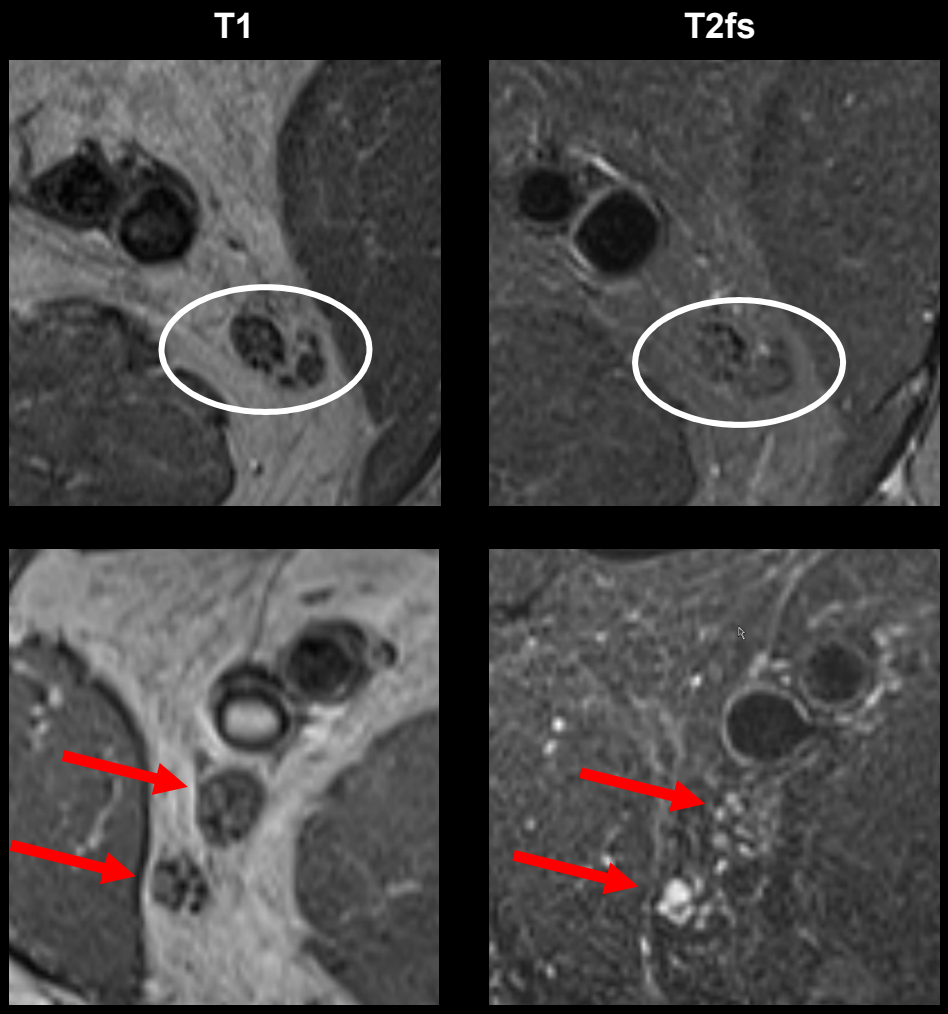

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MR Neurography Interpretation

- Caliper
- Signal Intensity
- Fascicular Pattern
- Perineural Fat

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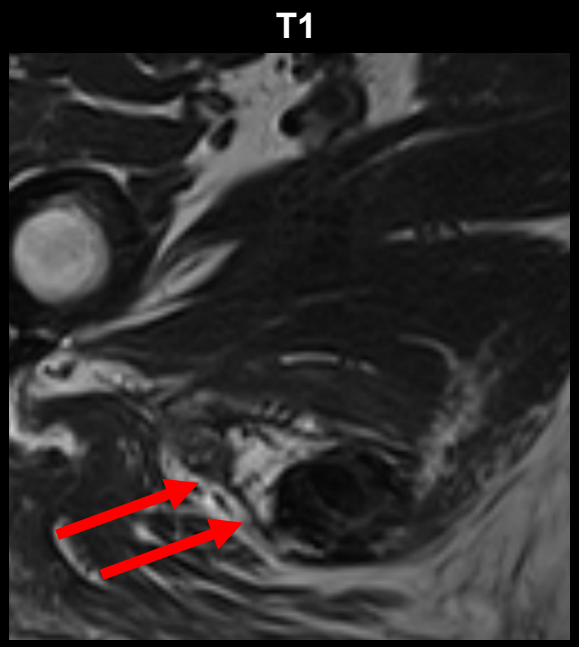

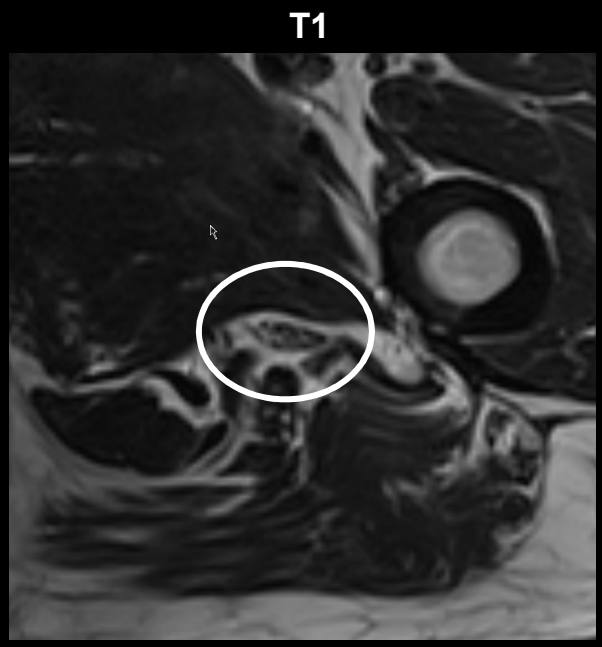

MR Neurography Interpretation

- Caliper
- Signal Intensity
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- Course

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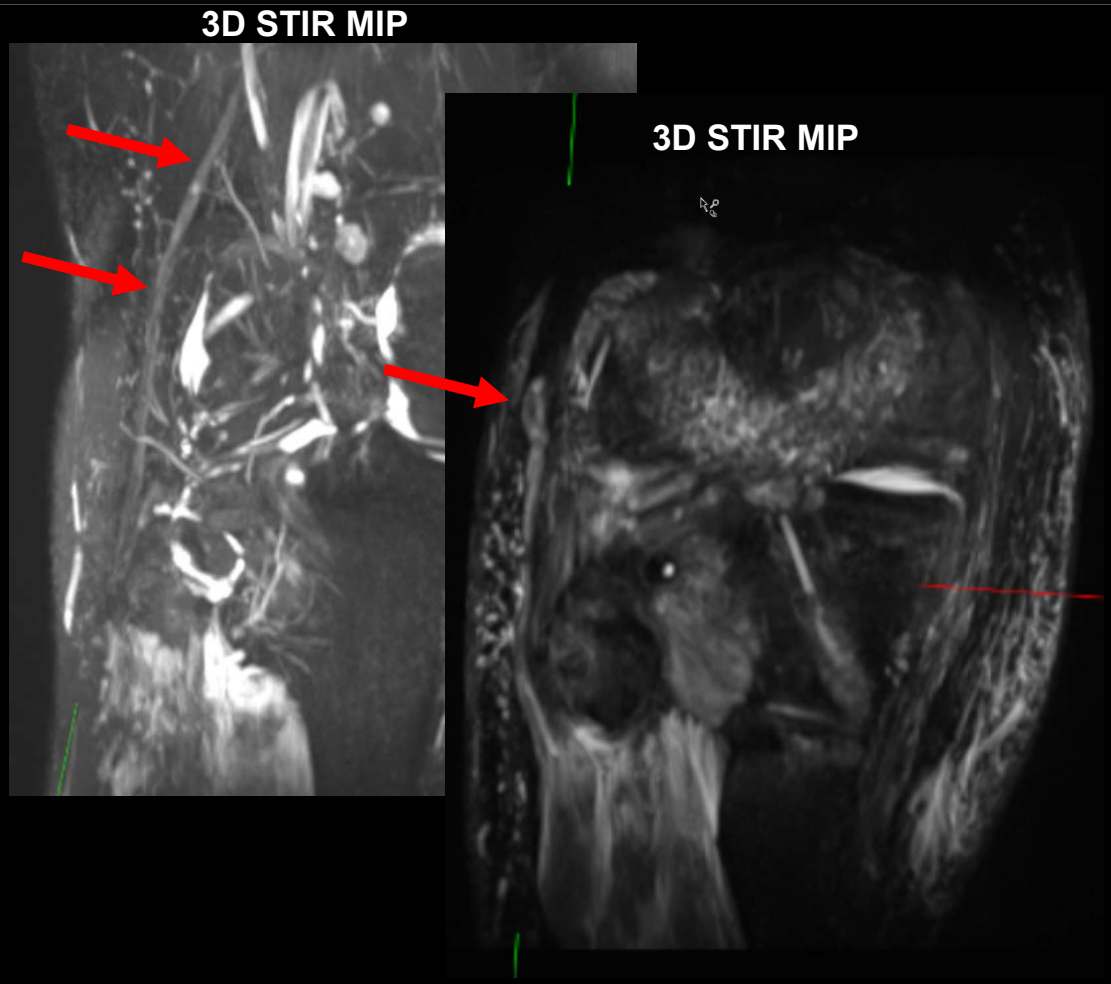

MR Neurography Interpretation

- Caliper
- Signal Intensity
- Fascicular Pattern
- Perineural Fat
- Course
- CM Affinity

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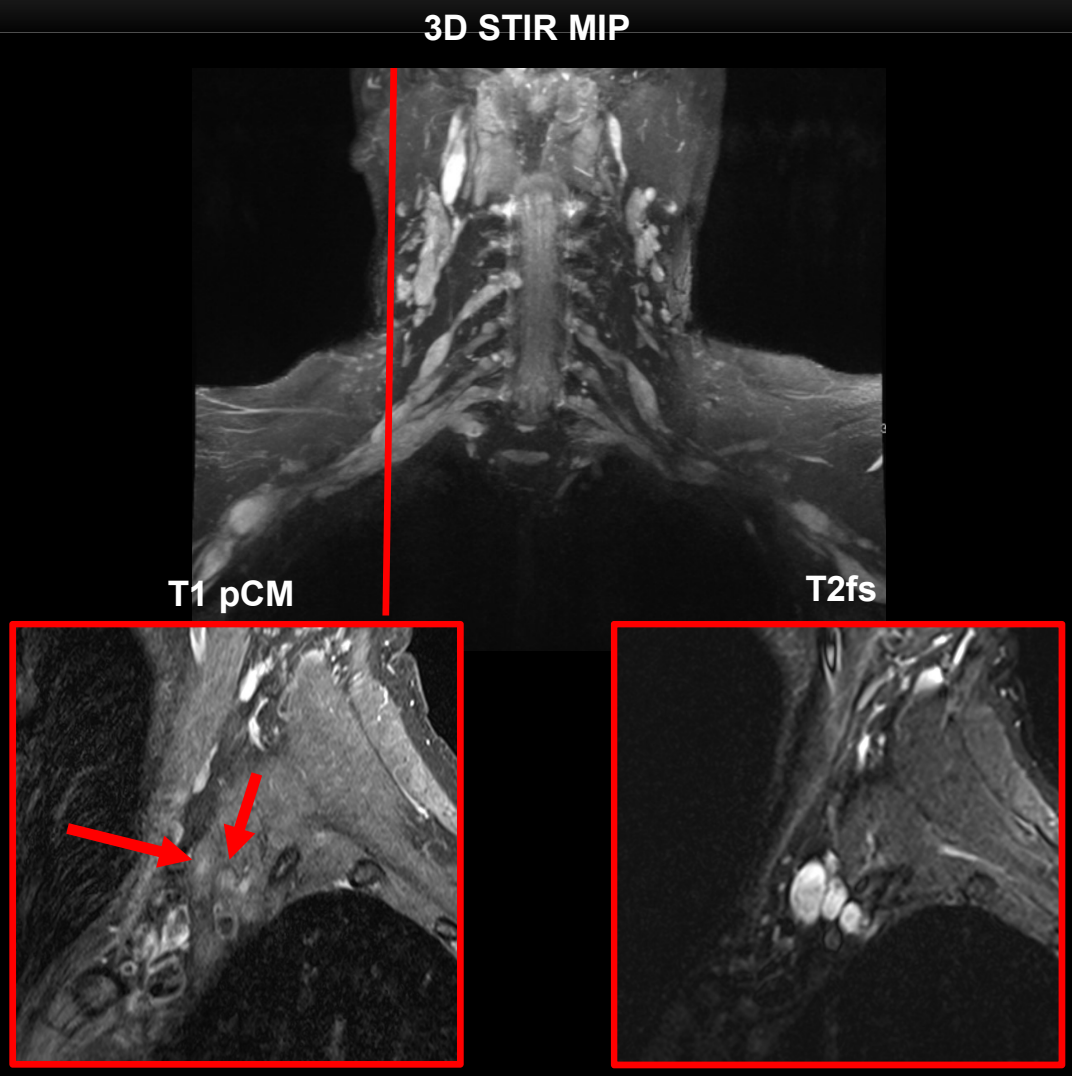

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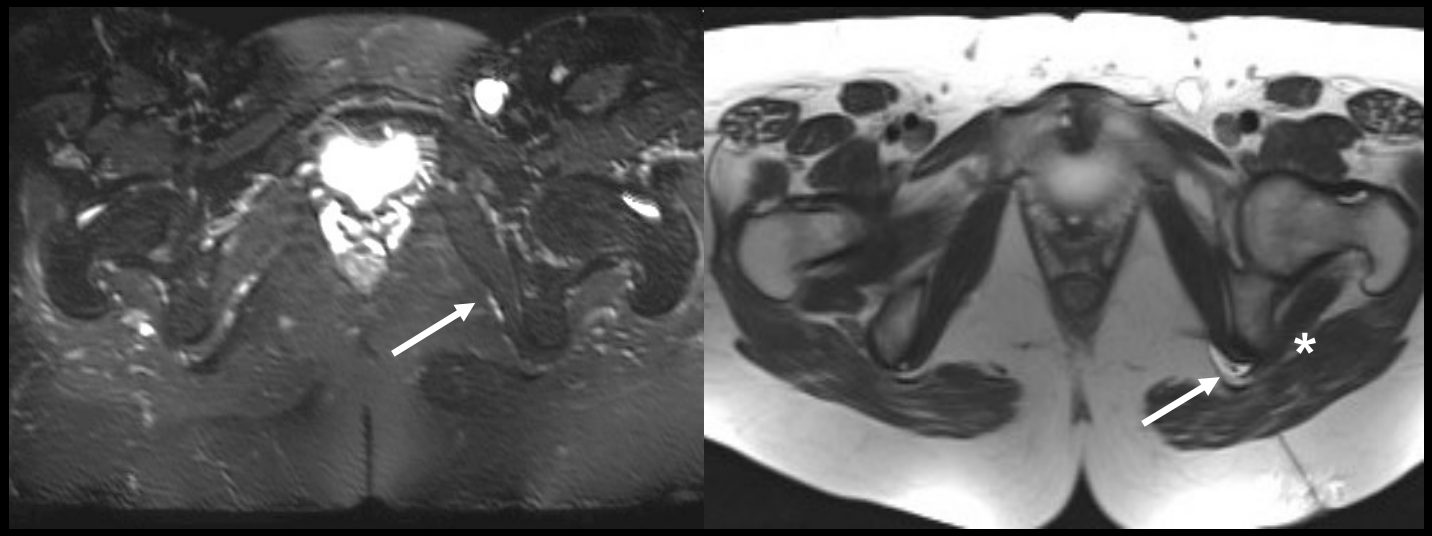
MR Neurography applications

- Main indication weakness or pain
- possible aetiologies:
  - Neuritis (idiopathic, infectious, inflammatory)
  - Trauma
  - Compression
  - Tumor
  - hereditary

Anatomic Non-Selective Imaging

- **MR-guided Intervention**



MR-guided Infiltration of Zoster-Neuropathy of left N. pudendus

Functional Nerve-Selective Imaging

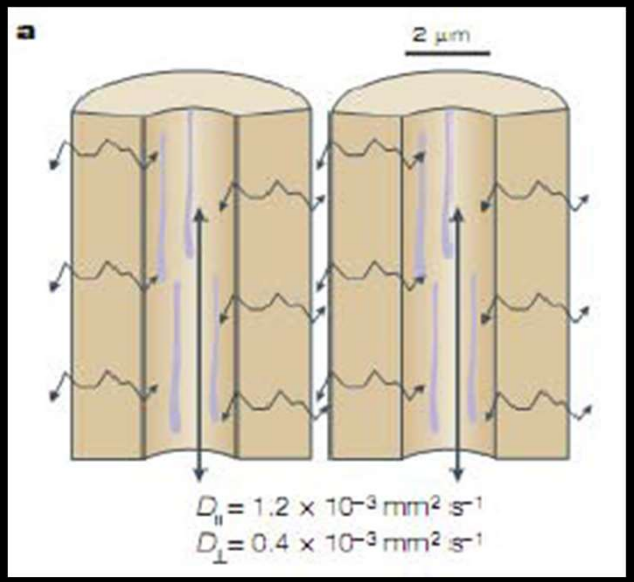
- Beyond anatomic imaging …
- Functional information
  - e.g. axonal regeneration
  - new therapeutic agents and novel interventions

  →

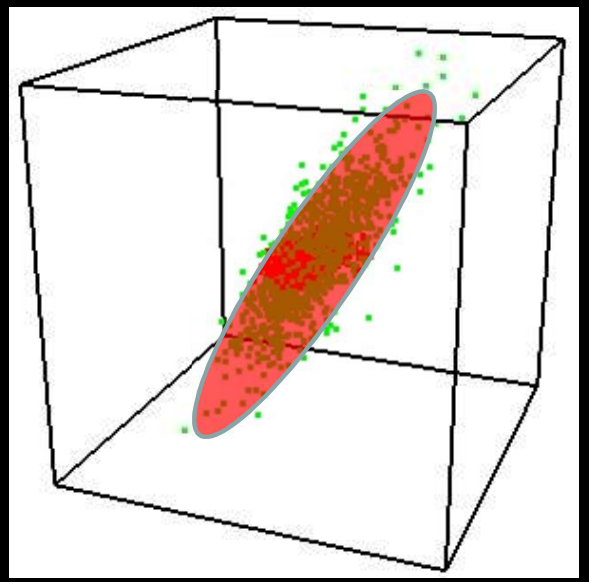
- Diffusion Tensor Imaging

Diffusion in Peripheral Nerves

Proton Diffusion is directional.



Nerve Fibers



Anisotropic Diffusion

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Graphic taken from http://www.smoldyn.org/

Quantitative Parameters

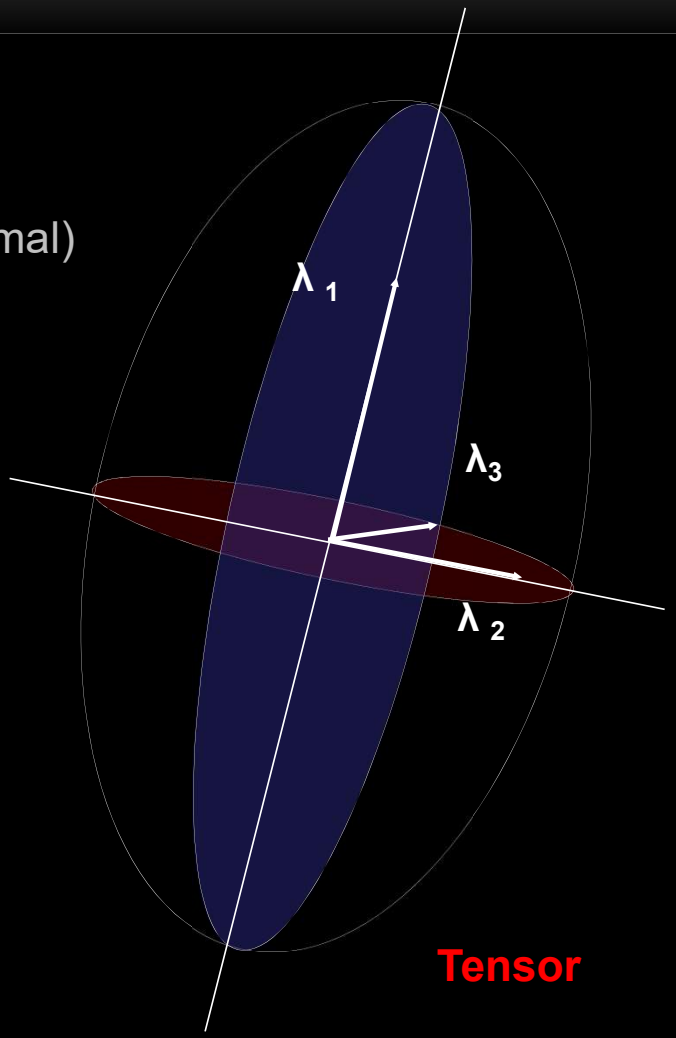
- FA (fractional anisotropy):

  Scalar value between 0 (minimal) and 1 (maximal)

  Relationship of vectors (λ1-3)

- ADC (apparent diffusion coefficient)

$$signal_{attenuated} = signal_{0} * e^{-b*D}$$



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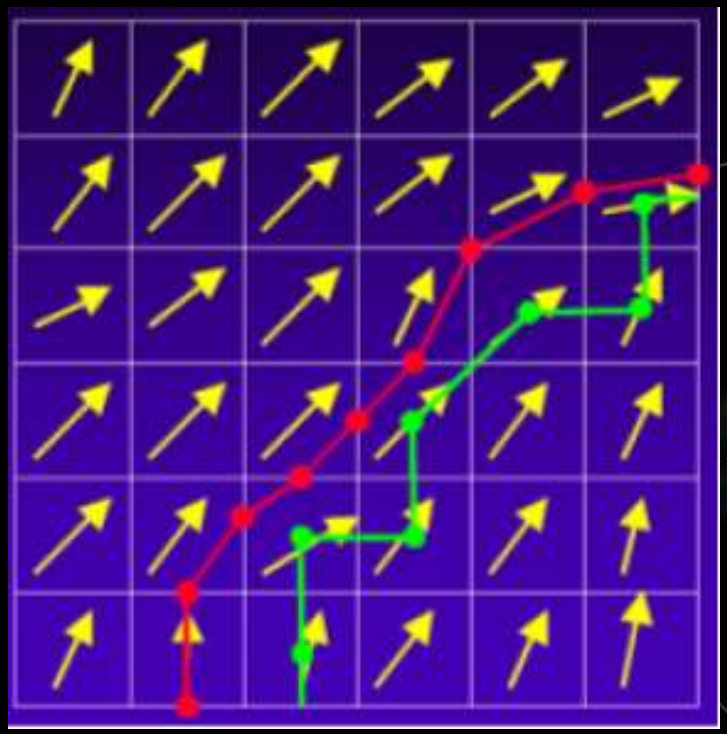
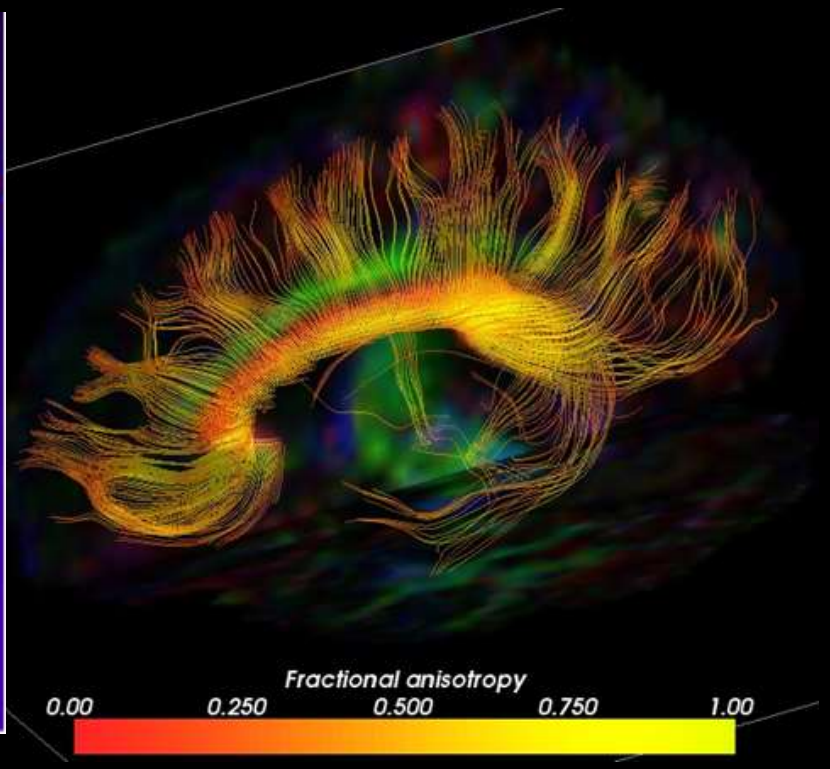
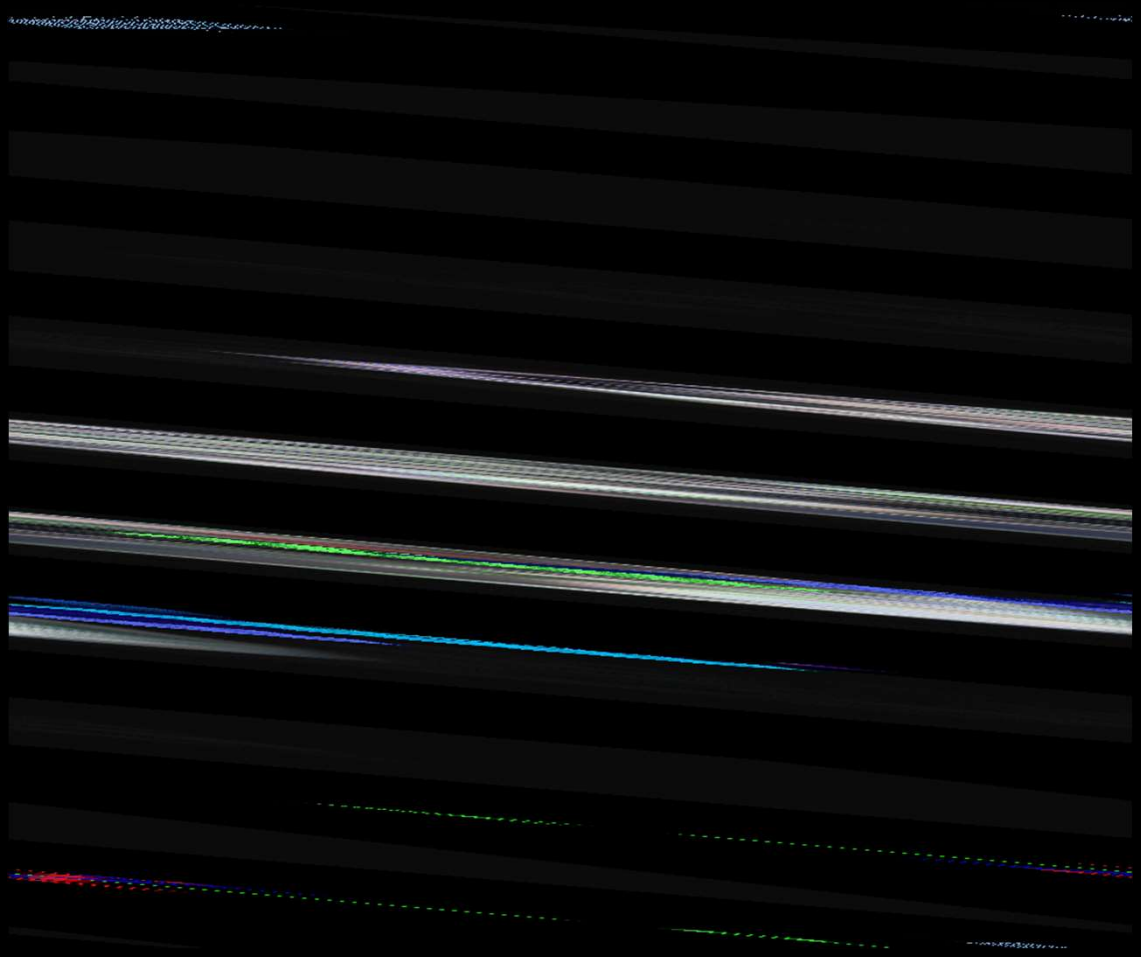
Visualization of DTI data





Median Nerve Tracking



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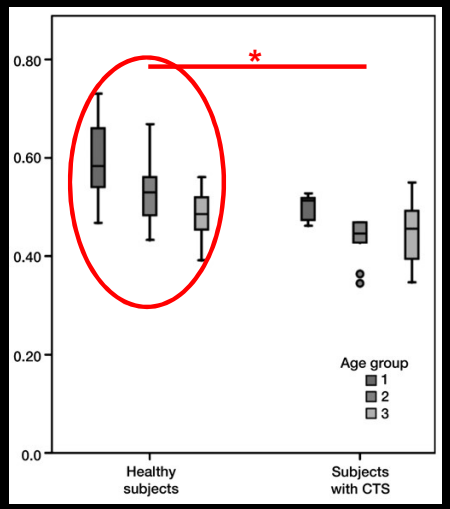
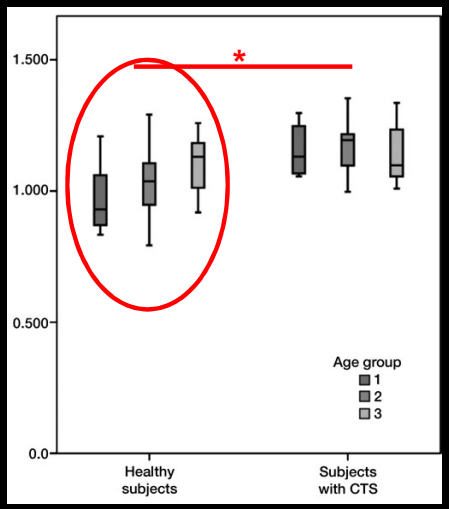
FA ↓ and ADC ↑ in Peripheral Neuropathies

- FA and ADC are age-dependent
  - FA ↓ and ADC ↑ with age
- FA and ADC were different in controls versus CTS patients
  - FA 0.47: Sens.: 83%, Spez.: 67%

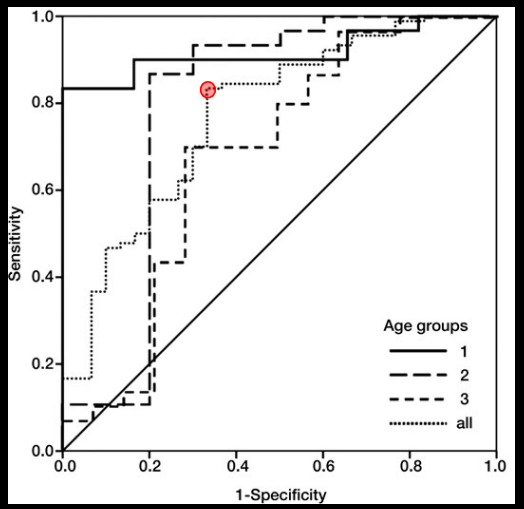
FA



ADC

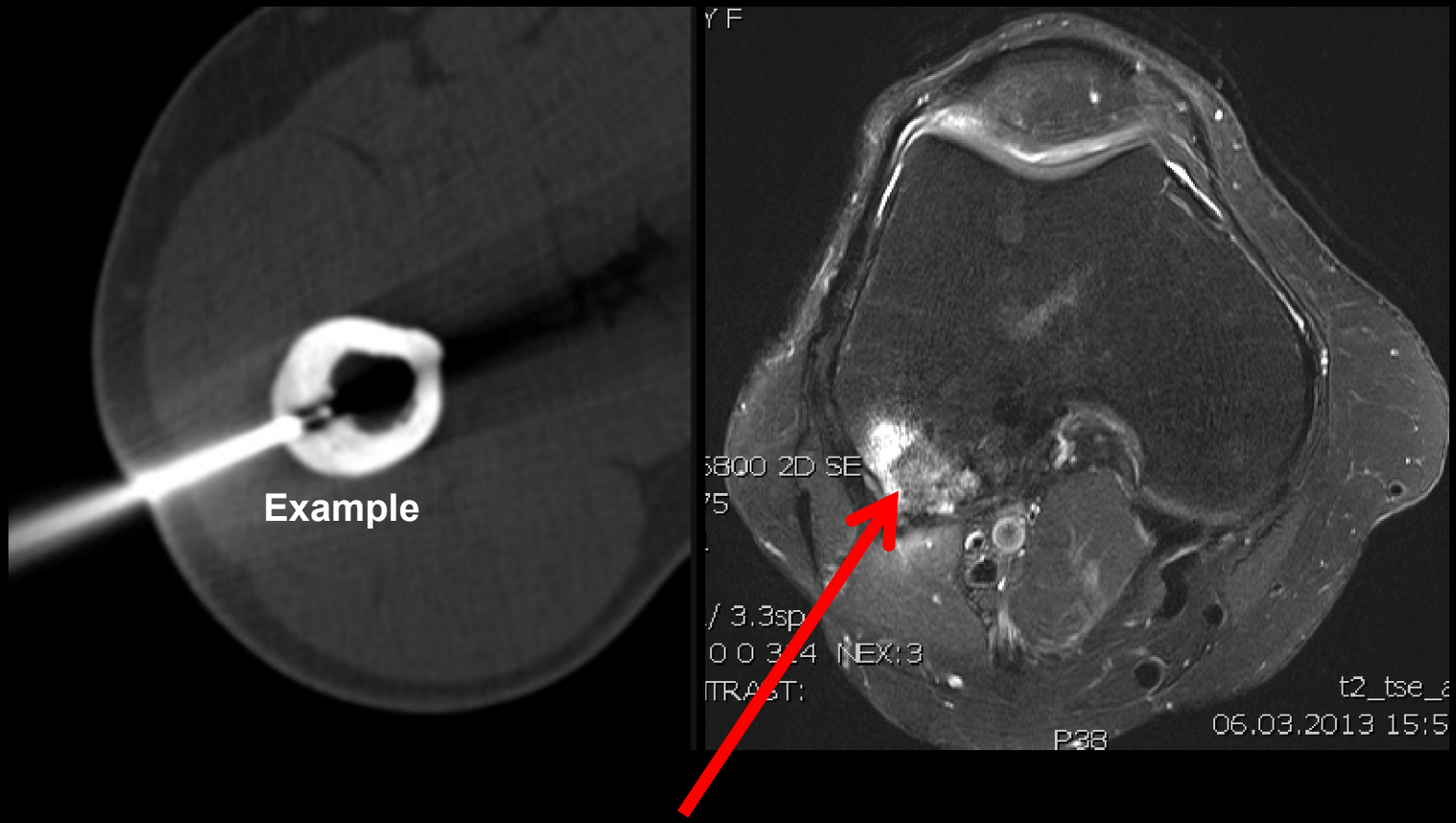


FA



Guggenberger R, Andreisek G et al., Radiology. 2012

50 ys old female w kryoablation of osteoid osteoma



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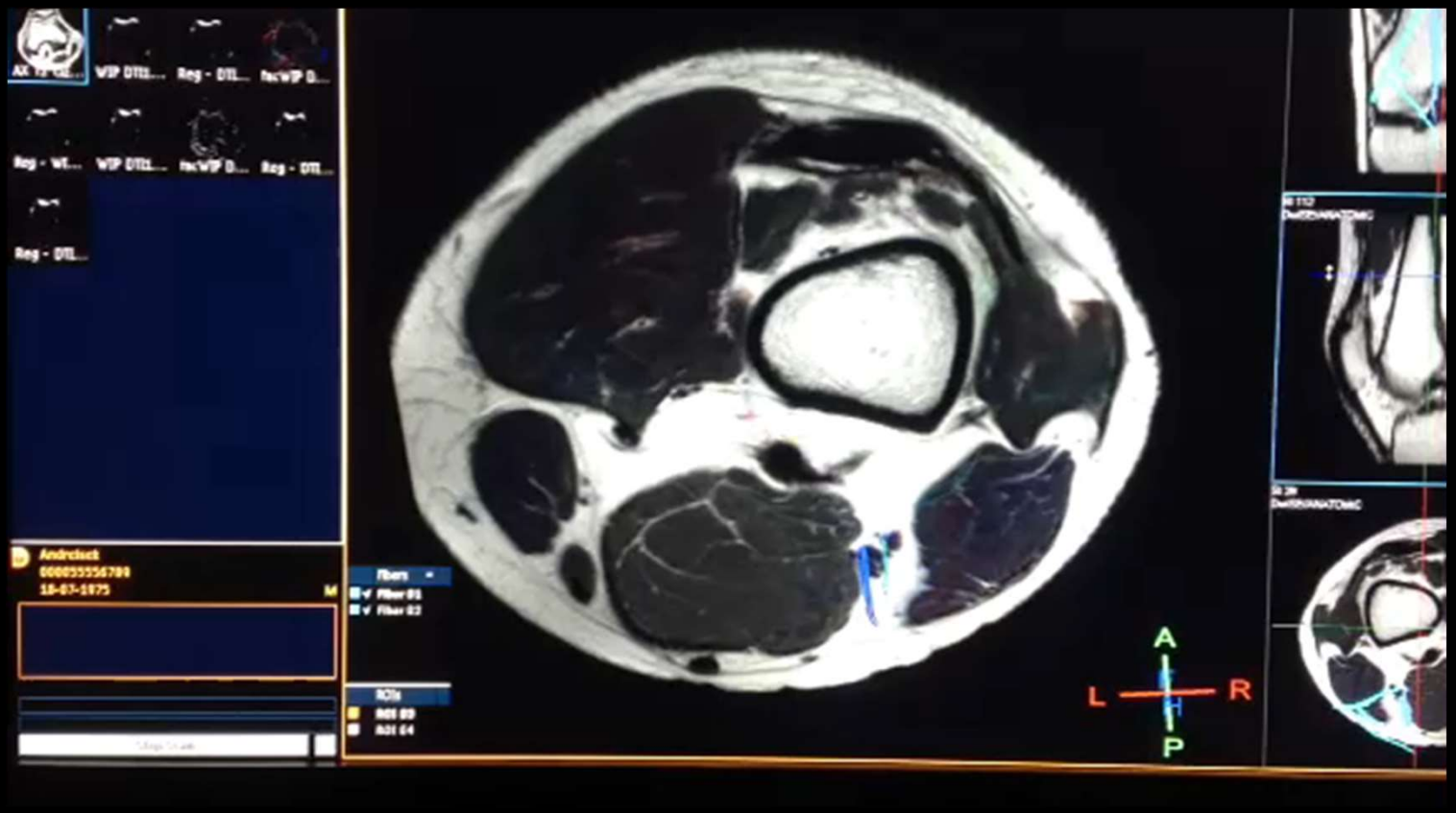
Thermo-Lesion of the Peroneal Nerve



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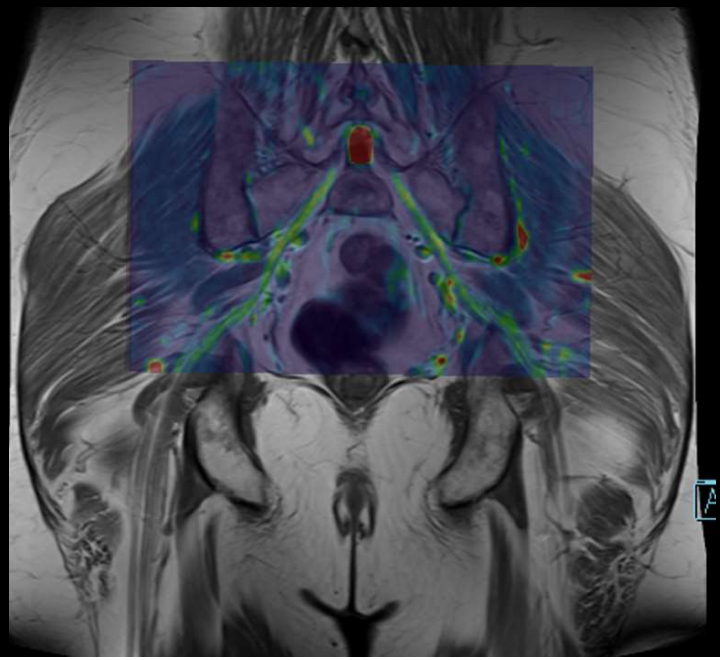
Structure

Max. 20 min

- How to do it
- What it can reveal



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MR Neurography Interpretation

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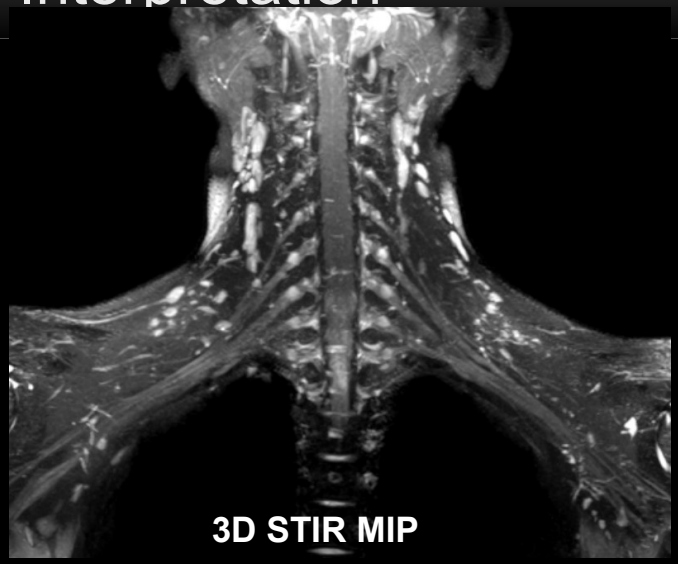
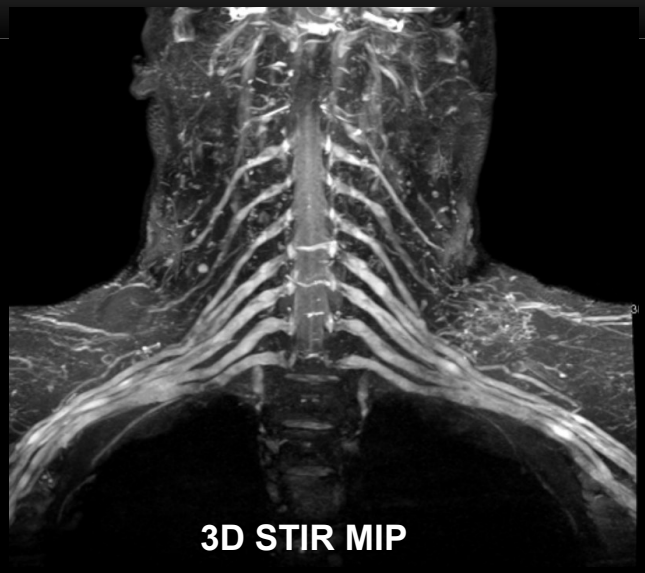
- Signal Intensity



3D STIR MIP

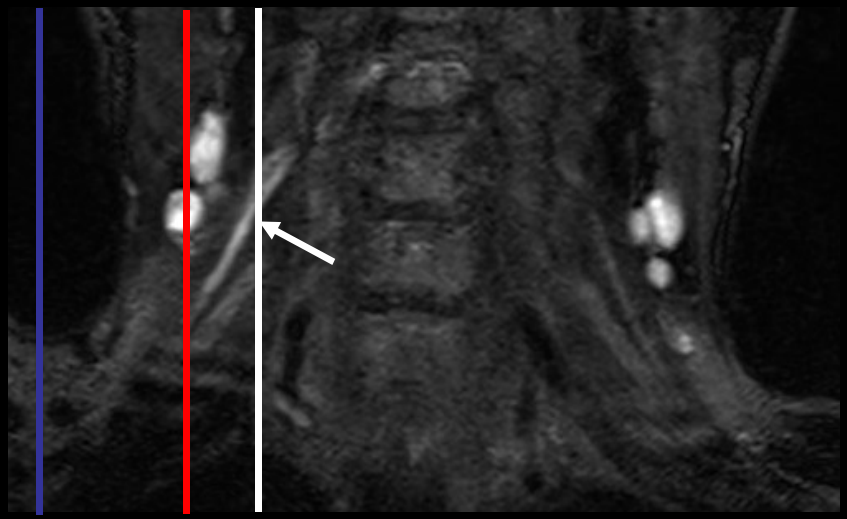


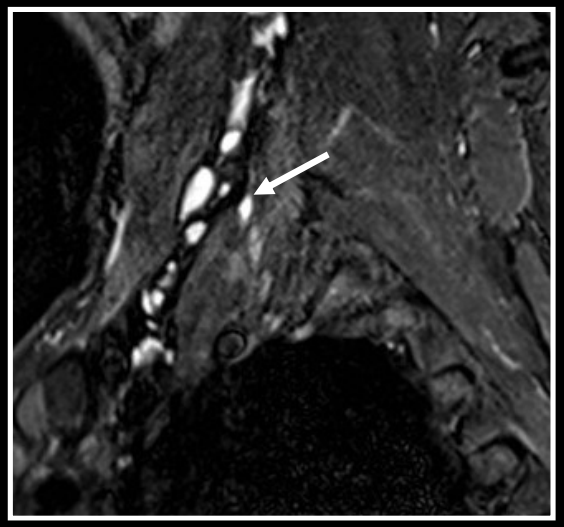
3D STIR MIP

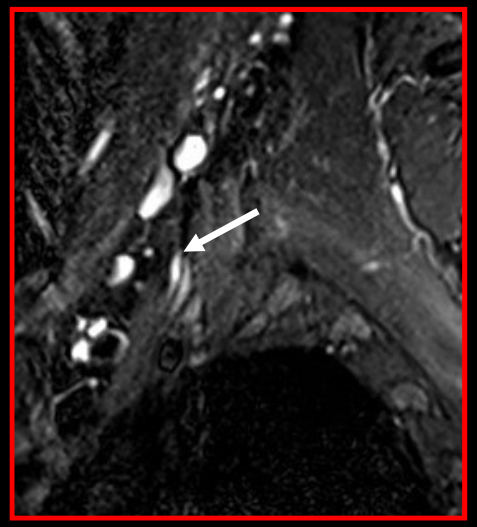
Case 1

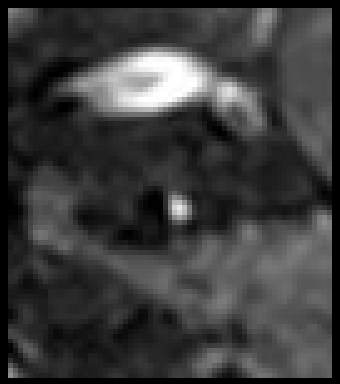
- 50y male
- Pain in right shoulder / arm
- Abduktion and outward rotation markedly reduced on right side

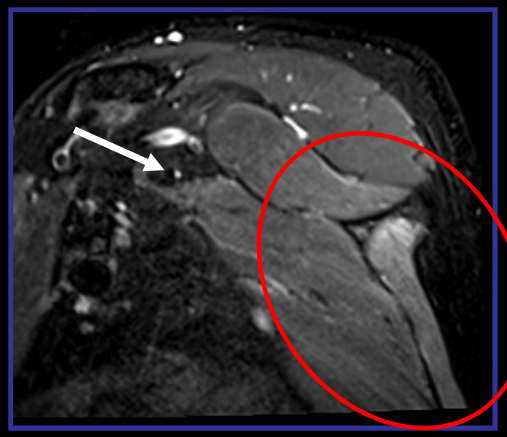
Case 1











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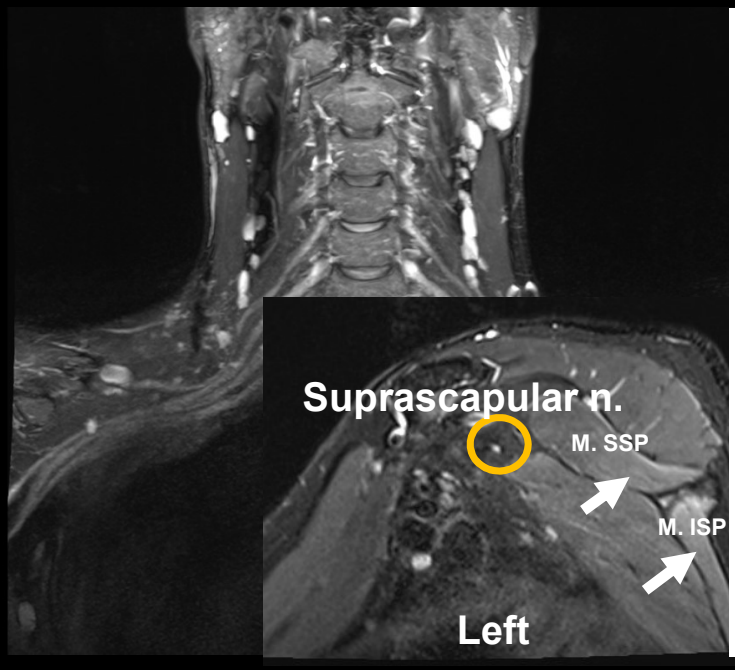
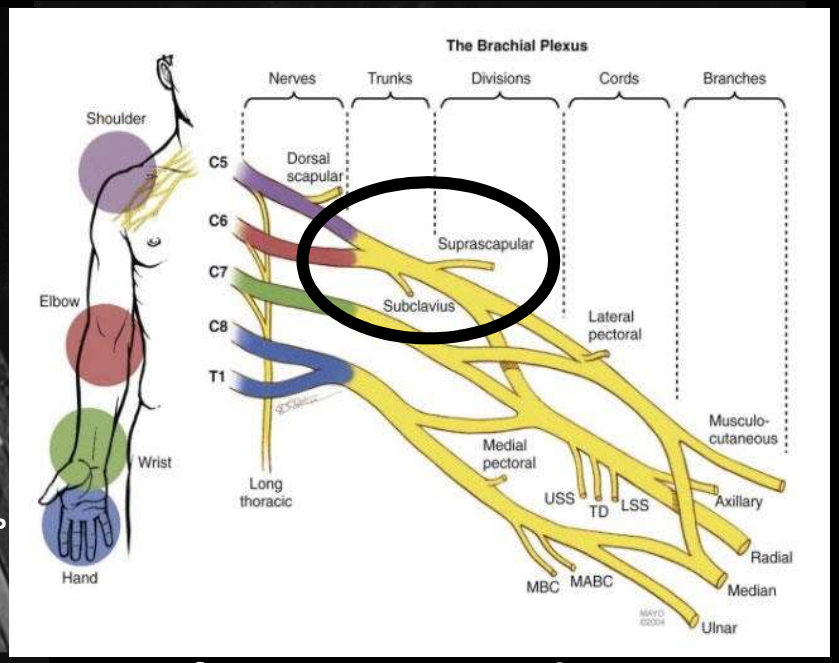
Compression C5/C6 with neuropathy of suprascapular nerve

Case 2





ft ht

Parsonage Turner Syndrome

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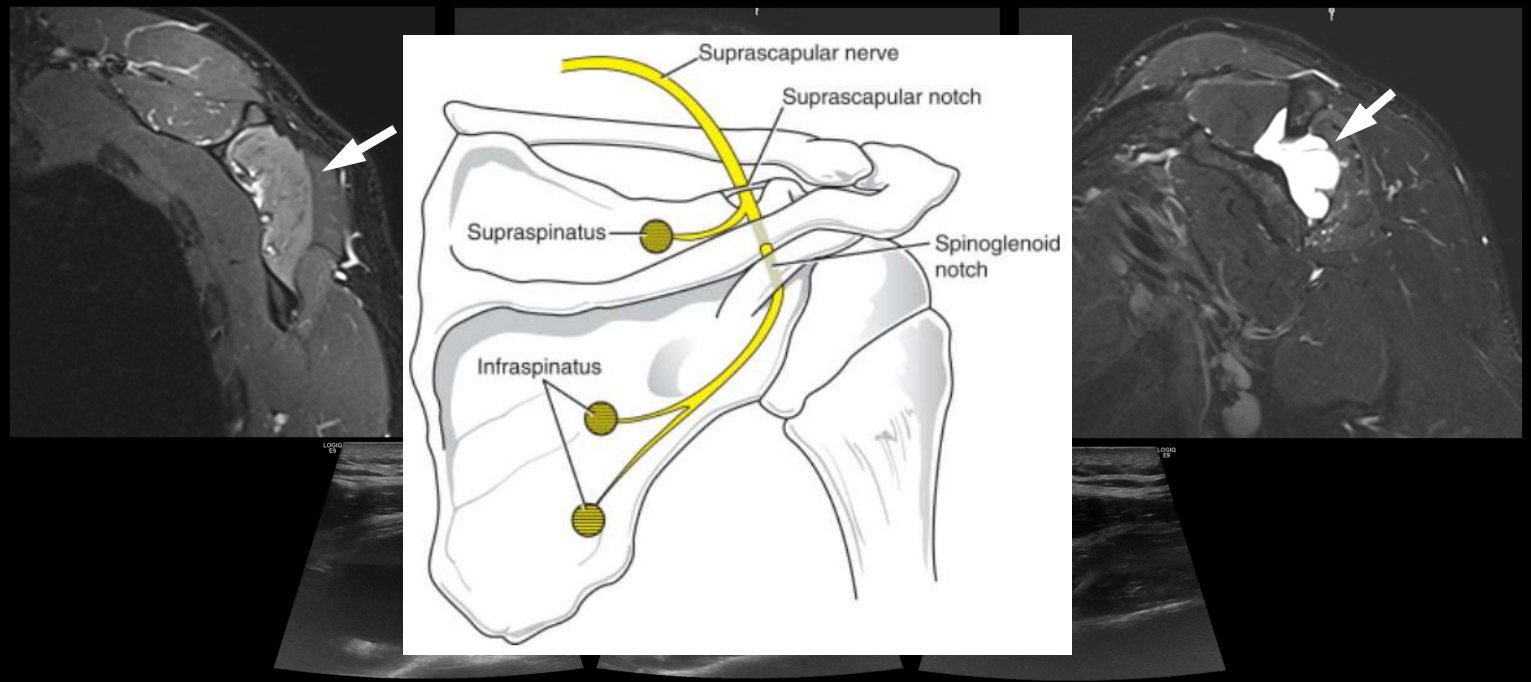
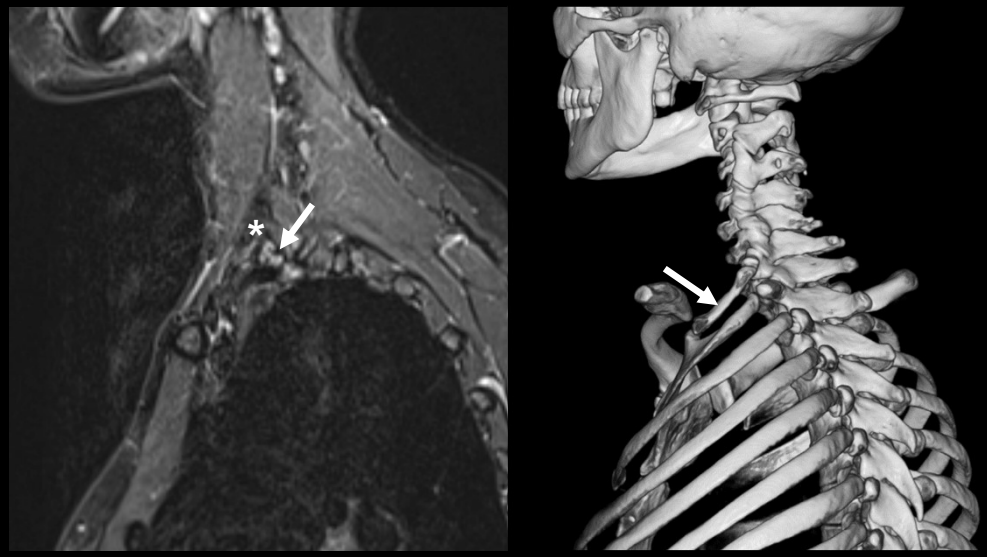
Case 3



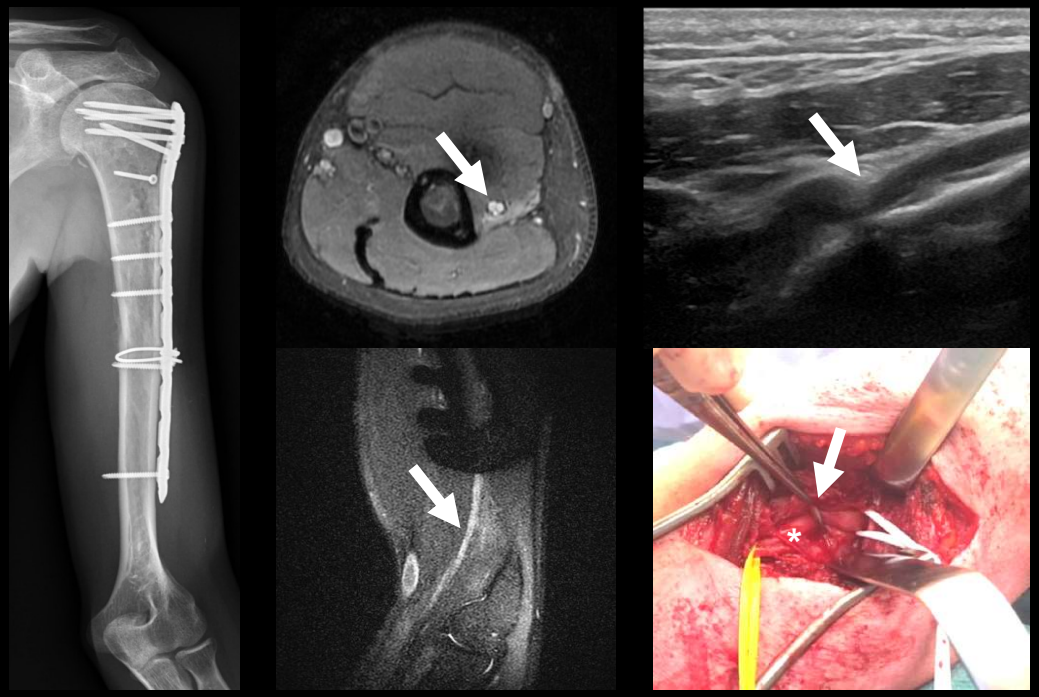
Spinoglenoid notch ganglion with compression of suprascapular nerve

Case 4



Cervical Rib

Case 5



Radial Nerve Strangulation

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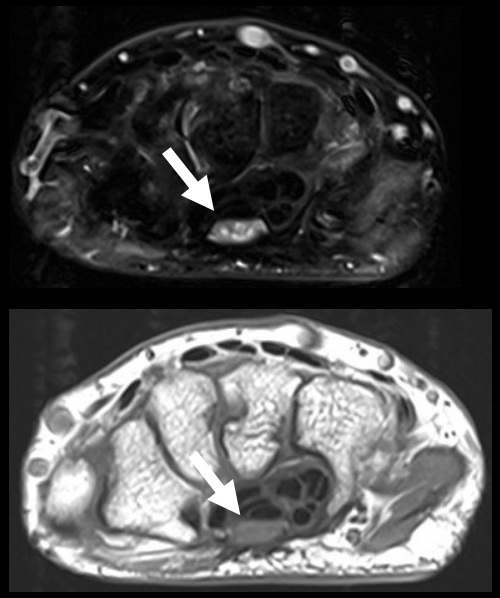
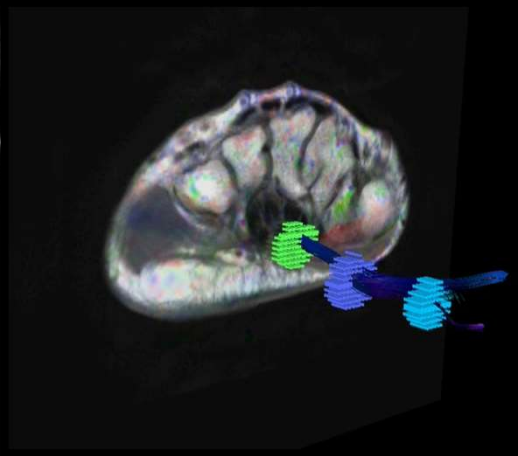
Case 6





Tractography of median nerve

Traumatic axonotmesis of median nerve

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Case 7

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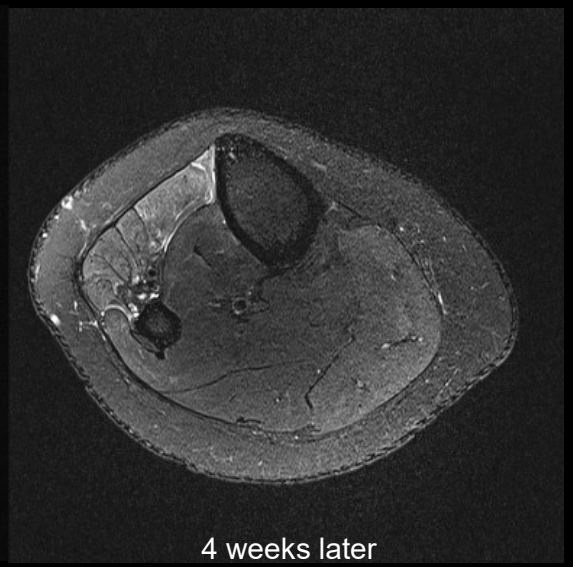
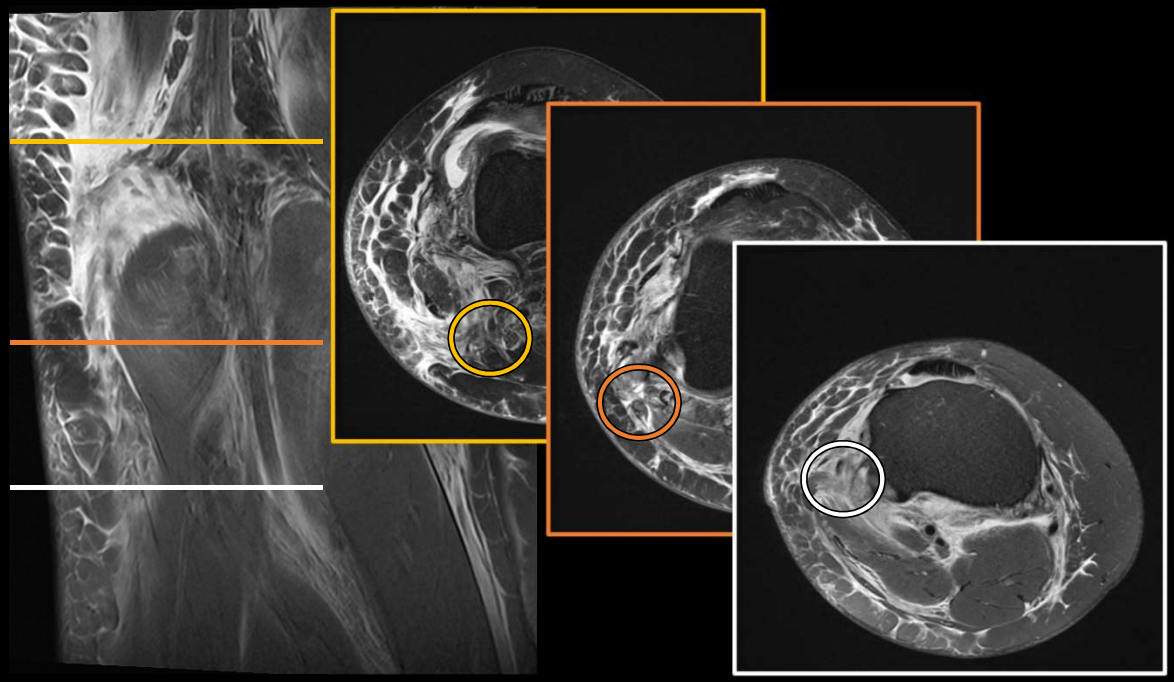
Case 7

4 weeks later



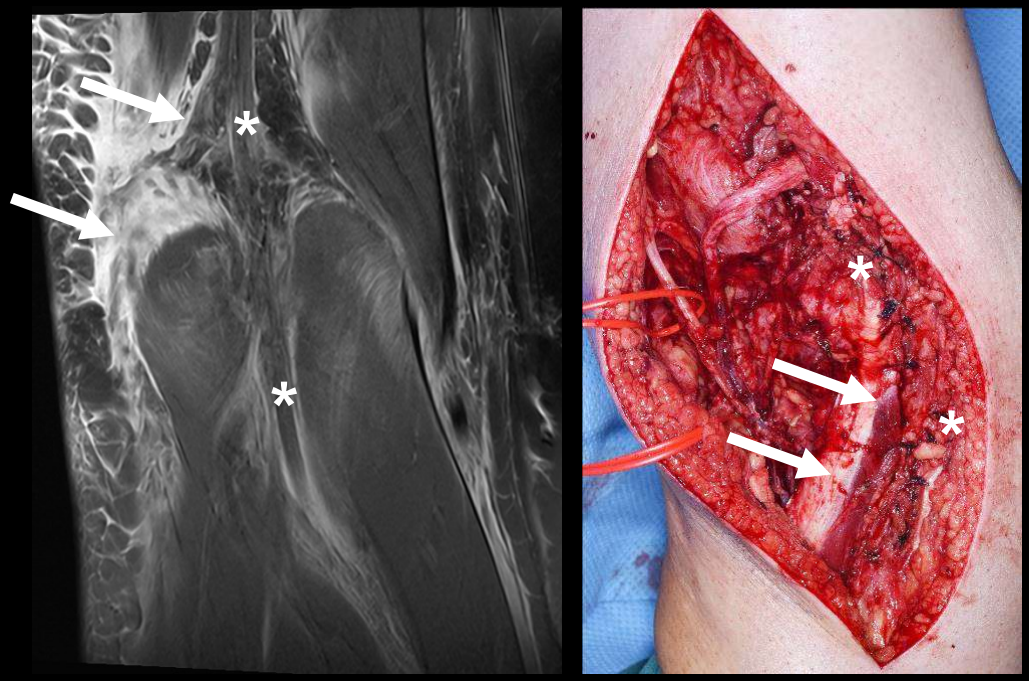
4 weeks later

Case 7



Common peroneal nerve injury (neurotmesis)

Case 7



Common peroneal nerve injury (neurotmesis)

Summary

You have learned about MRN …

- **How to do it**
- **What it can reveal**

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