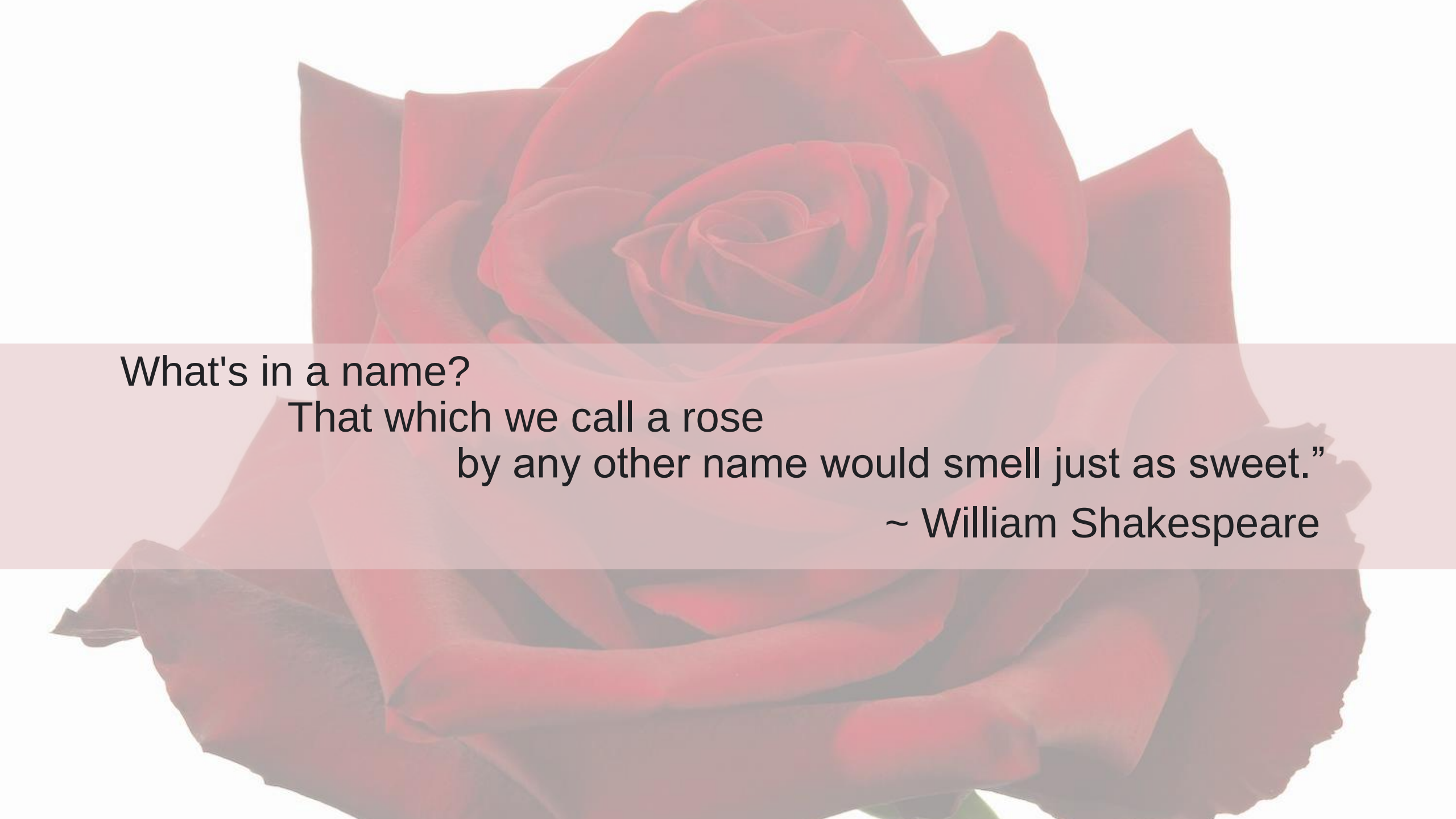
MYELITIS

Diagnose en behandeling

Tatjana Reynders, MD, PhD



What's in a name?
That which we call a rose
by any other name would smell just as sweet.”

~ William Shakespeare

Medullopathie

Myelitis (transversa)

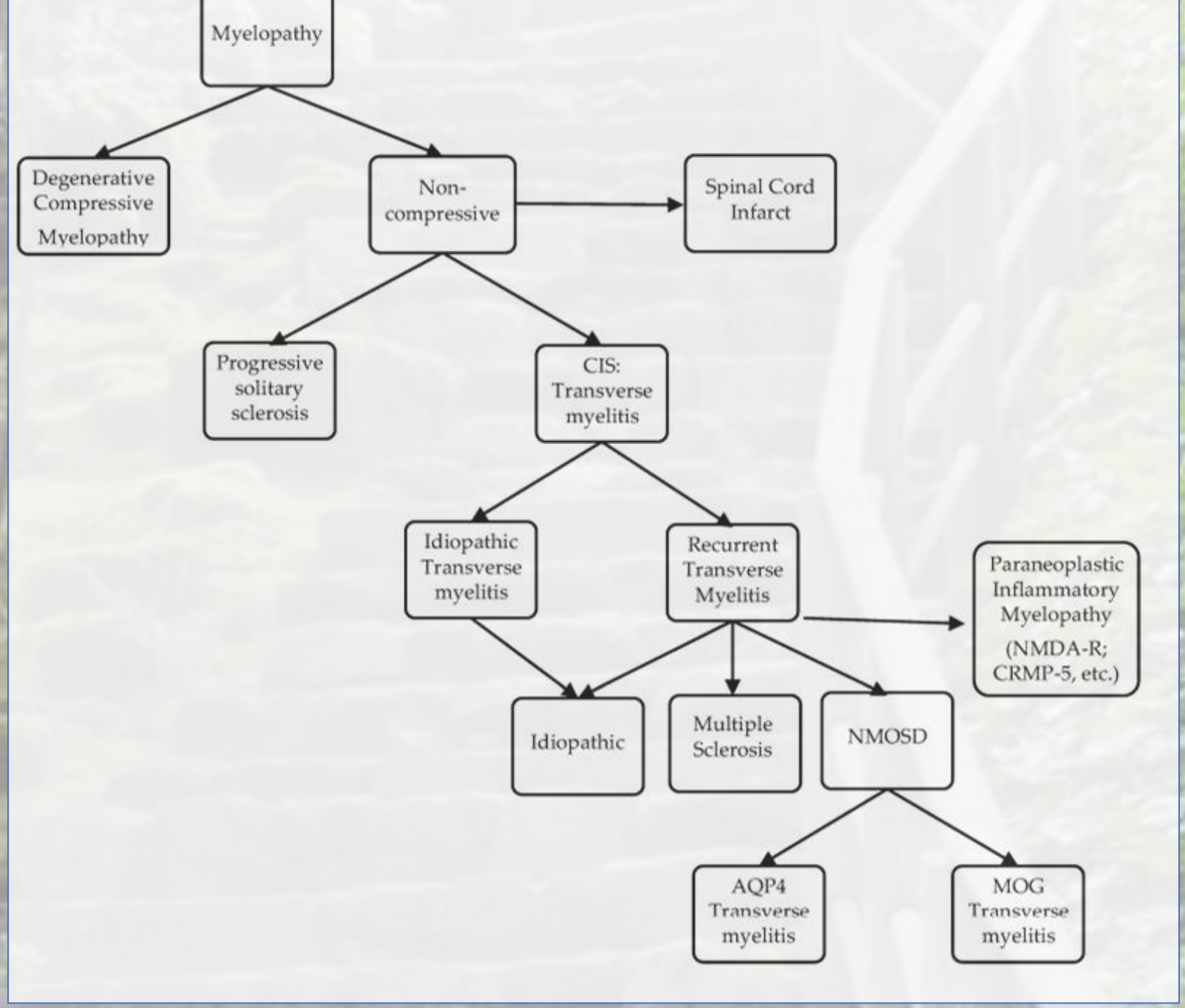
Complete MT

Partiële MT

LETM

Stap voor stap

1. Medullopathie?
2. Argumenten voor inflammatie?
3. Kenmerken op MRI?
4. Aanvullende onderzoeken?



Zabad, R.K.; Stewart, R.; Healey, K.M. Pattern Recognition of the Multiple Sclerosis Syndrome. Brain Sci. 2017,7,138. doi: 10.3390/brainsci7100138

Acute myelitis is klinisch herkenbaar…

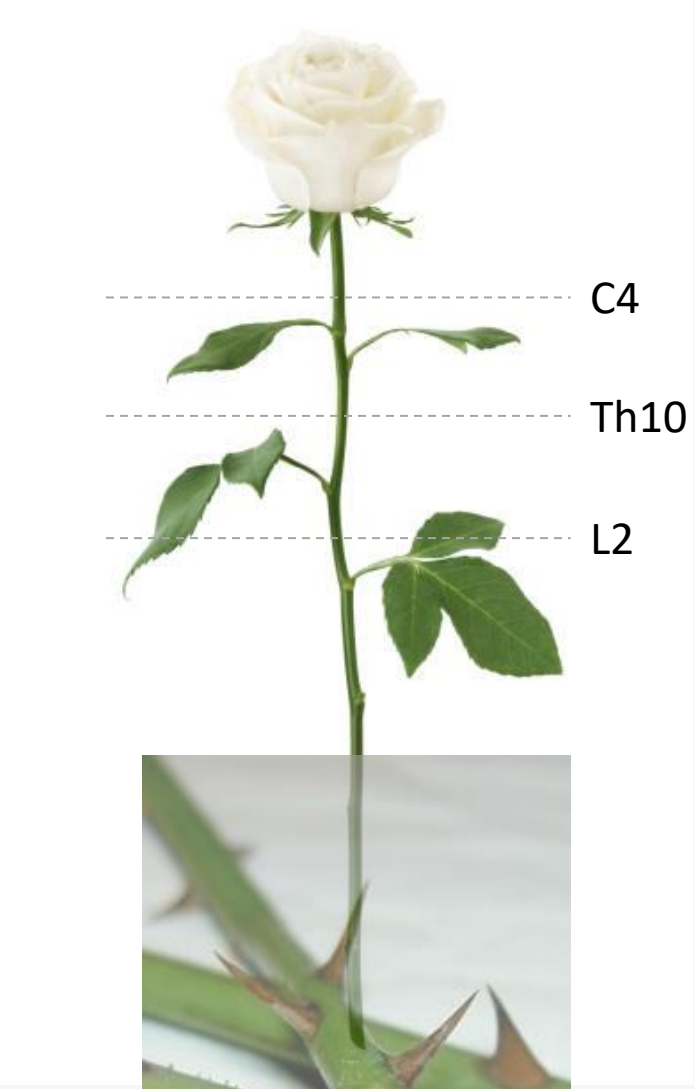
(Sub)acute onset

Sensibel > motorisch > pijn > autonoom

Segmentaal syndroom:

- C4: quadriplegie, diafragmaparalyse
- C5: schouders ophalen, BPR aanwezig
- C7: flexie/extensie elleboog, TPR aanwezig
- Th4: niet kunnen opzitten
- Th10: buikspieren verzwakt
- L2: heupflexie, KPR wisselend aanwezig
- L4: beperkte extensie knie, KPR aanwezig
- Conus: atone blaas
- Cauda equina: autonome blaas

Nadir tussen 1 en 21 dagen



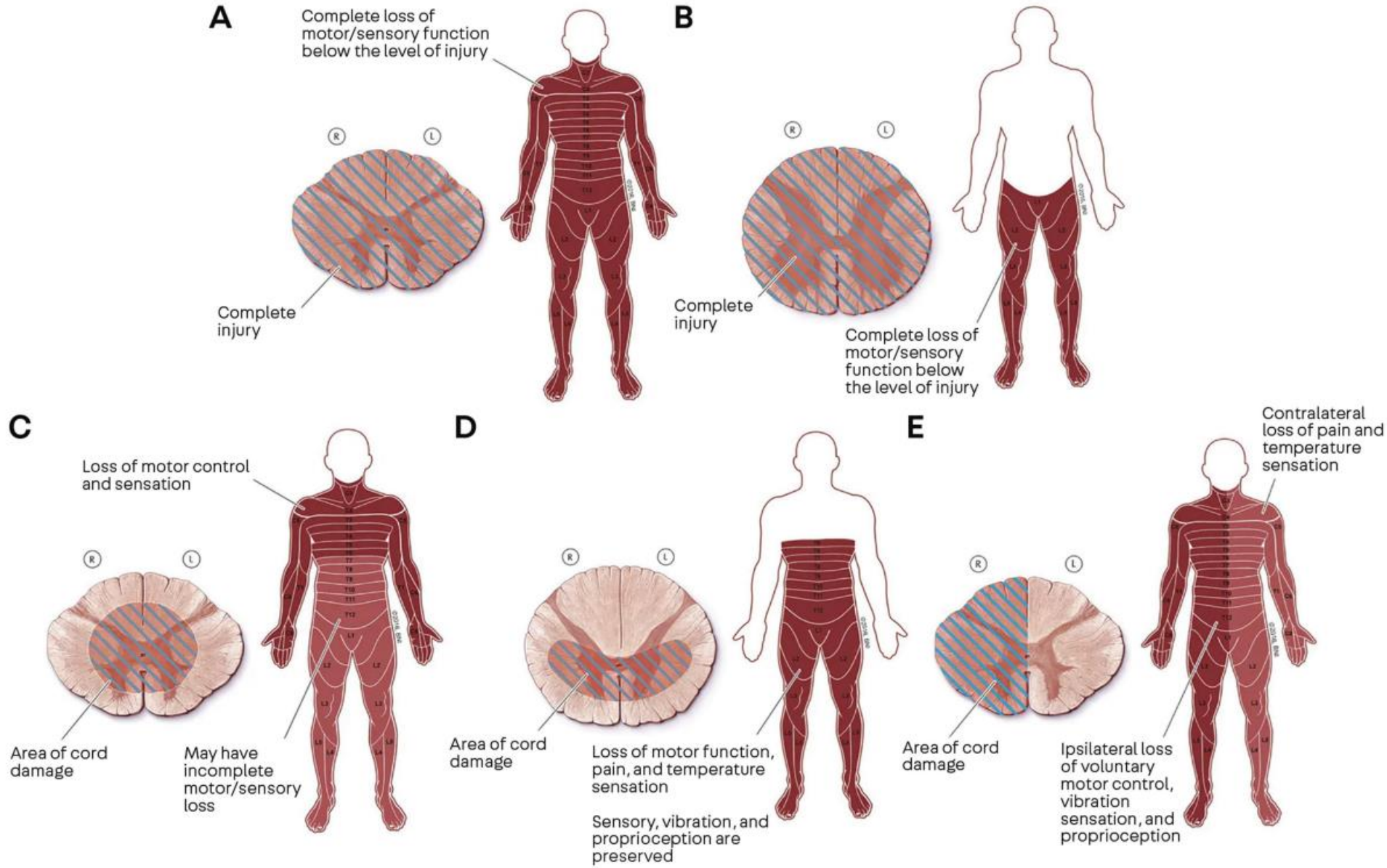
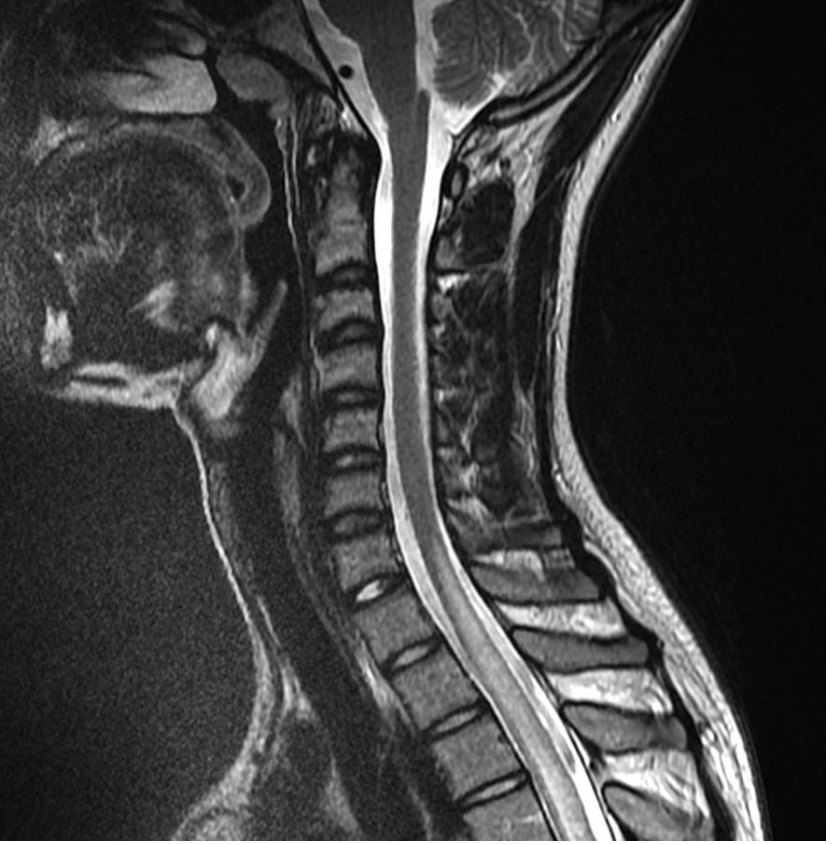
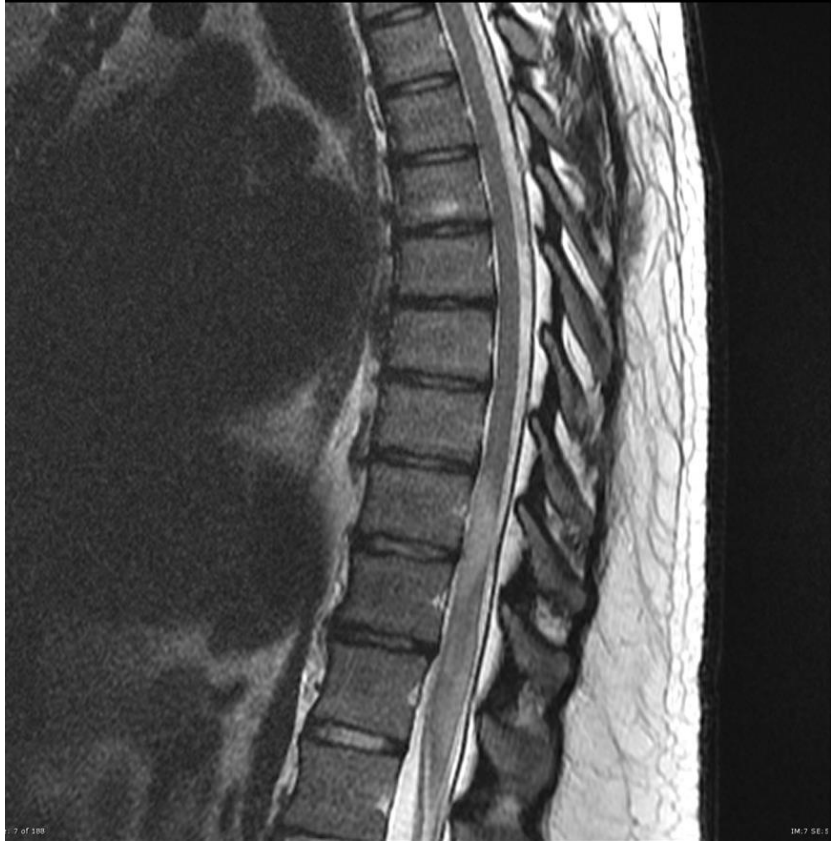
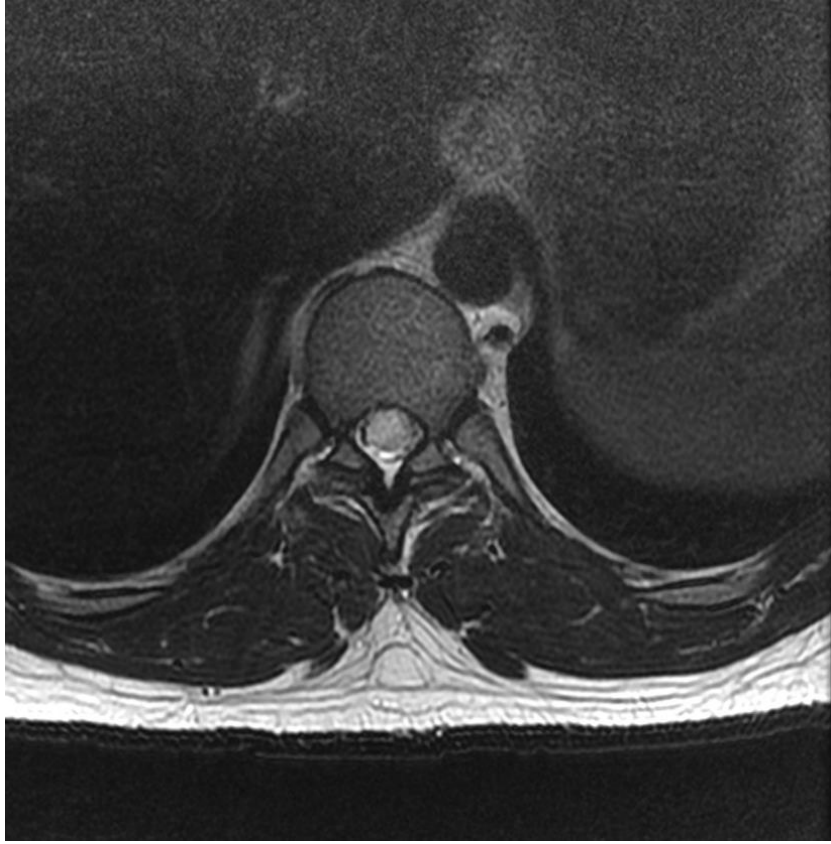


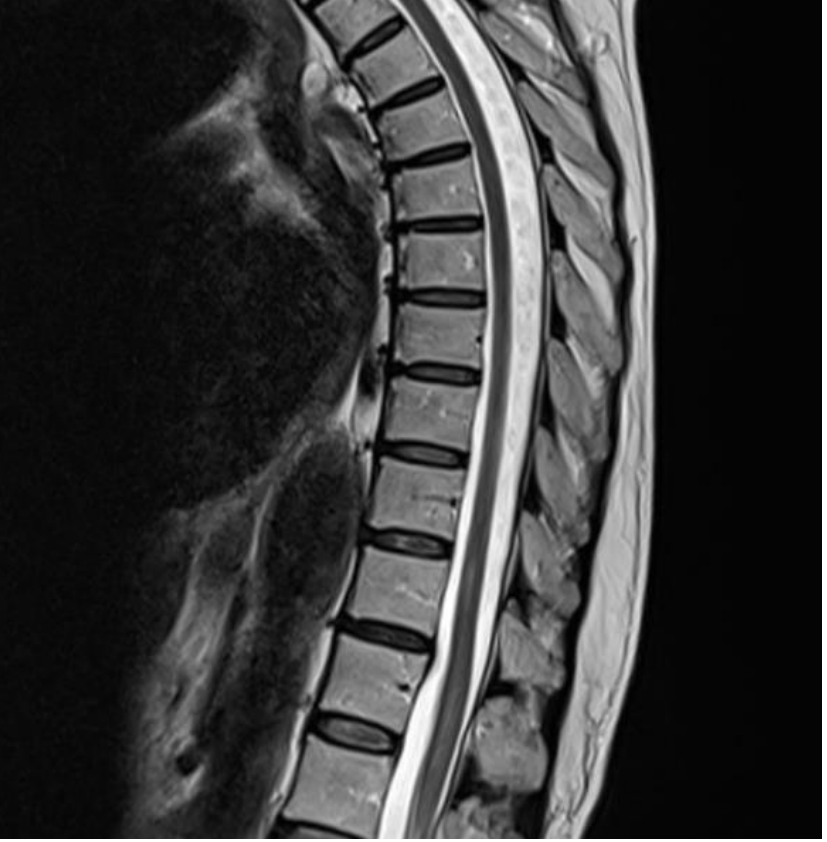
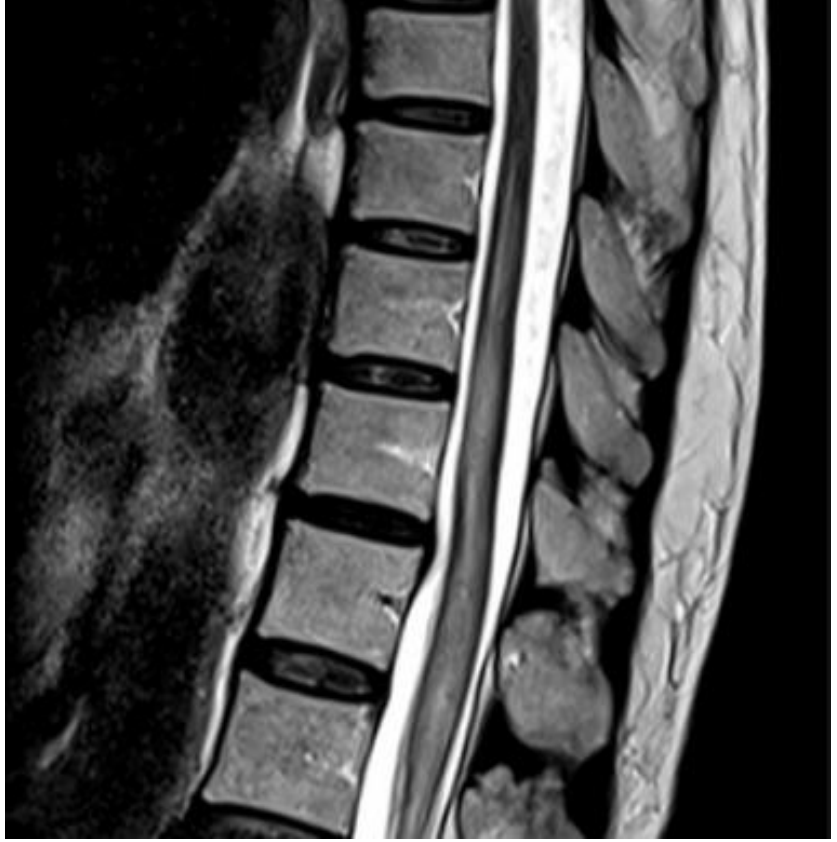
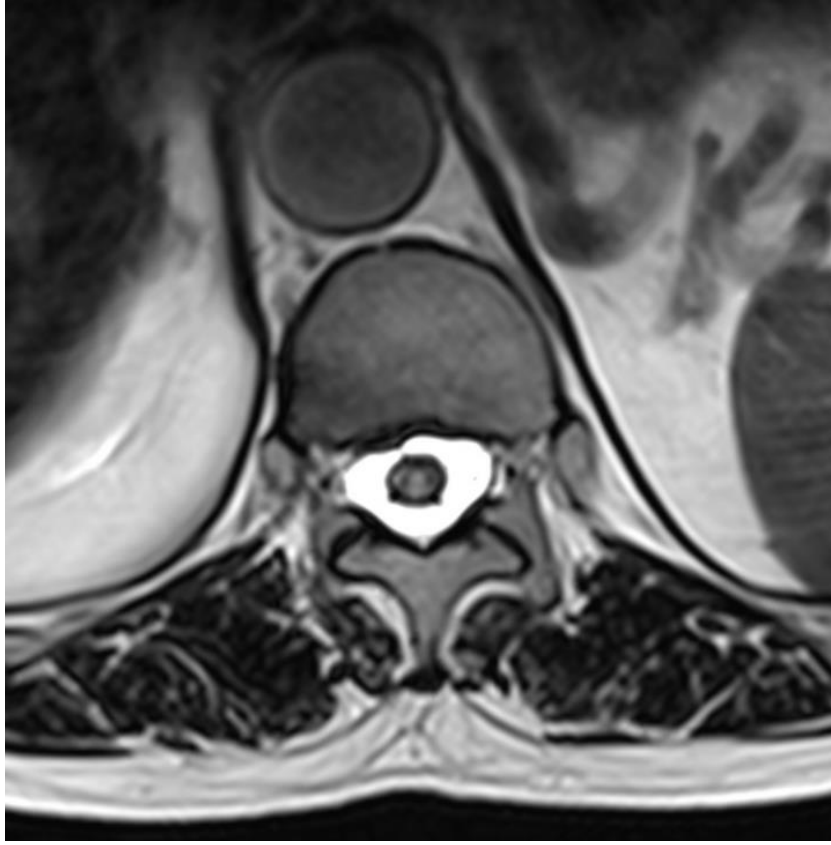
FIGURE 7-3

Continuum (Minneap Minn) 2024;30(1, Spinal Cord Disorders):160–179

… en op MRI (meestal) zichtbaar

Case courtesy of Frank Gaillard, Radiopaedia.org, rID: 19648 & 19649

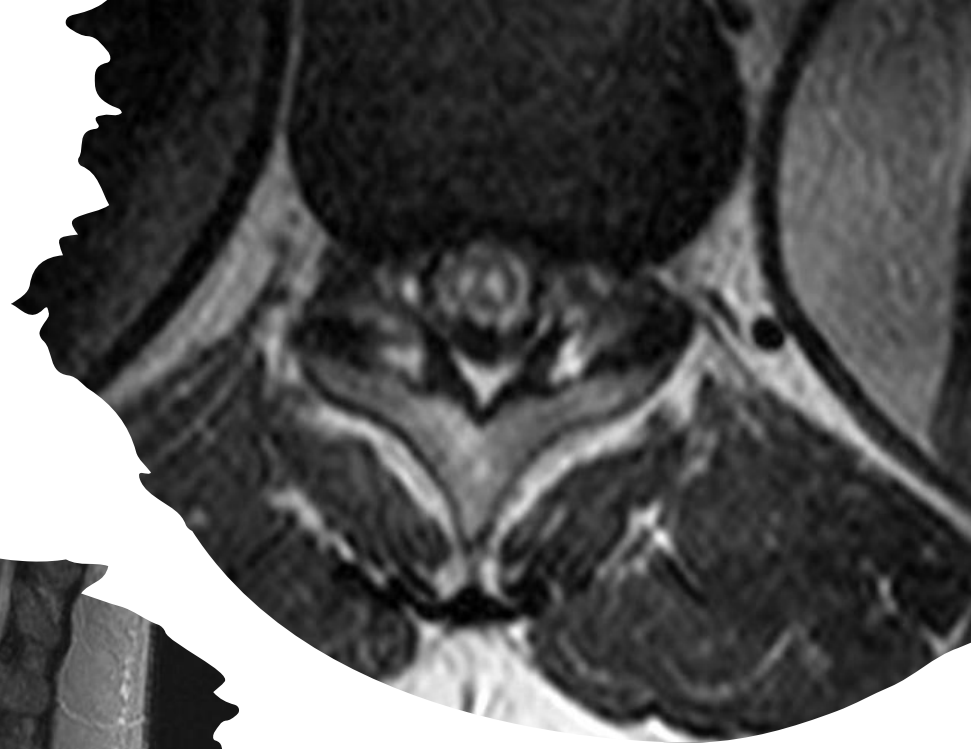
… soms in tweede tijd duidelijker

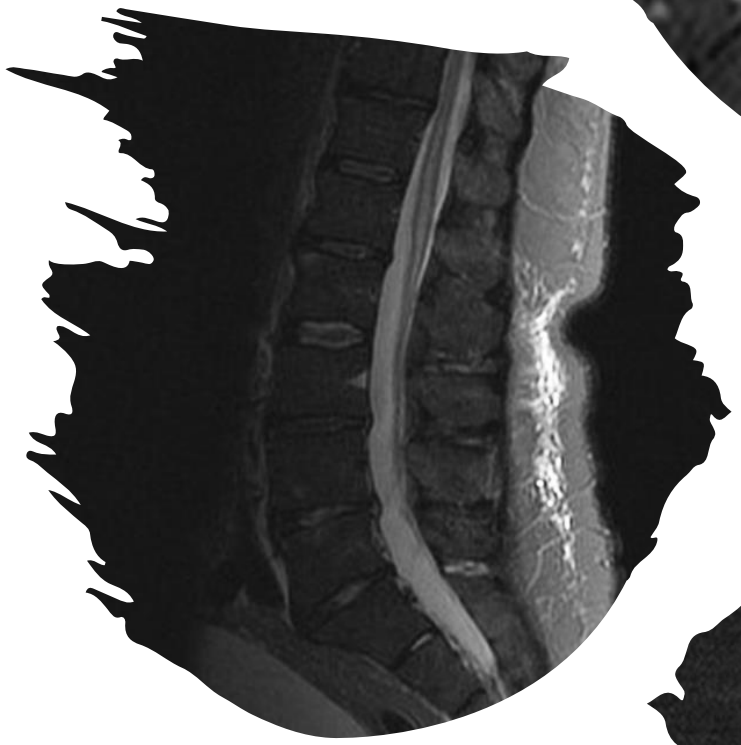
Case courtesy of Mohamed Saber, Radiopaedia.org, rID: 85737

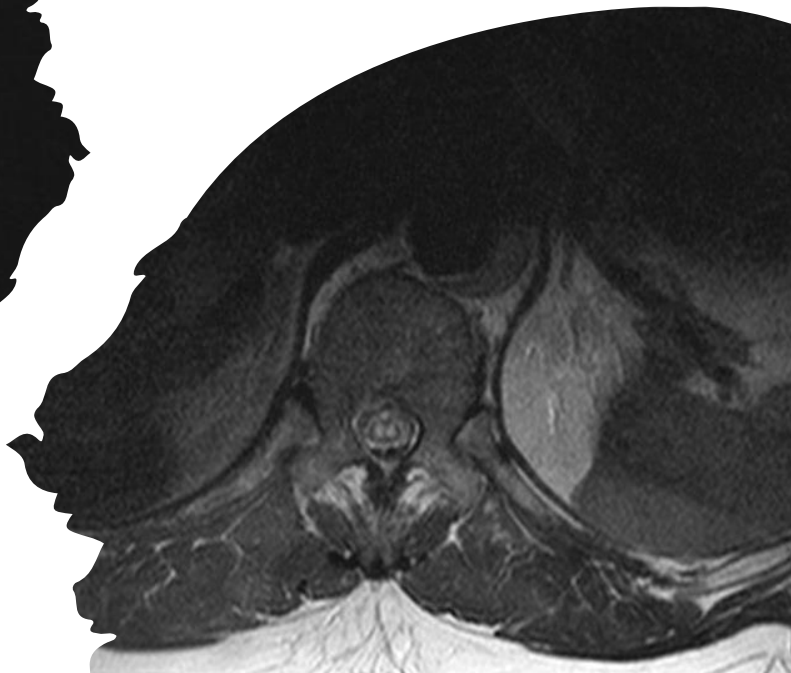
Owl’s eye sign

Pijn > autonoom > sensibel > motorisch

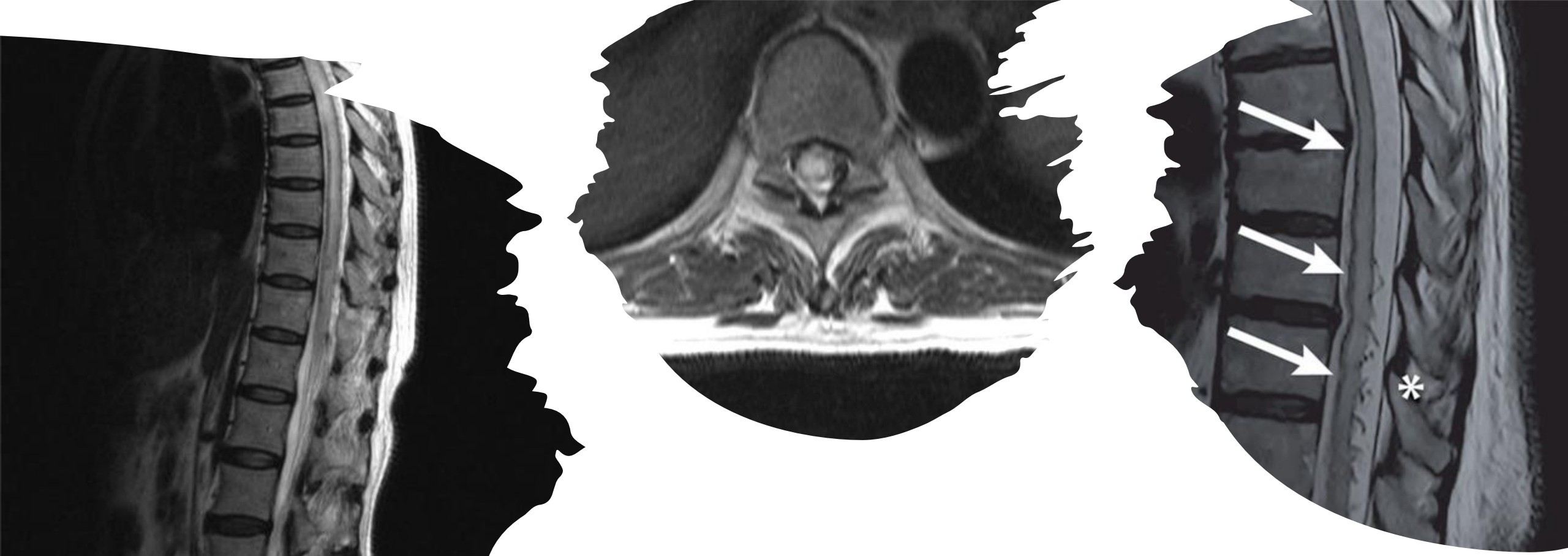
Thoracaal







Case courtesy of Matt Skalski, Radiopaedia.org, rID: 43588



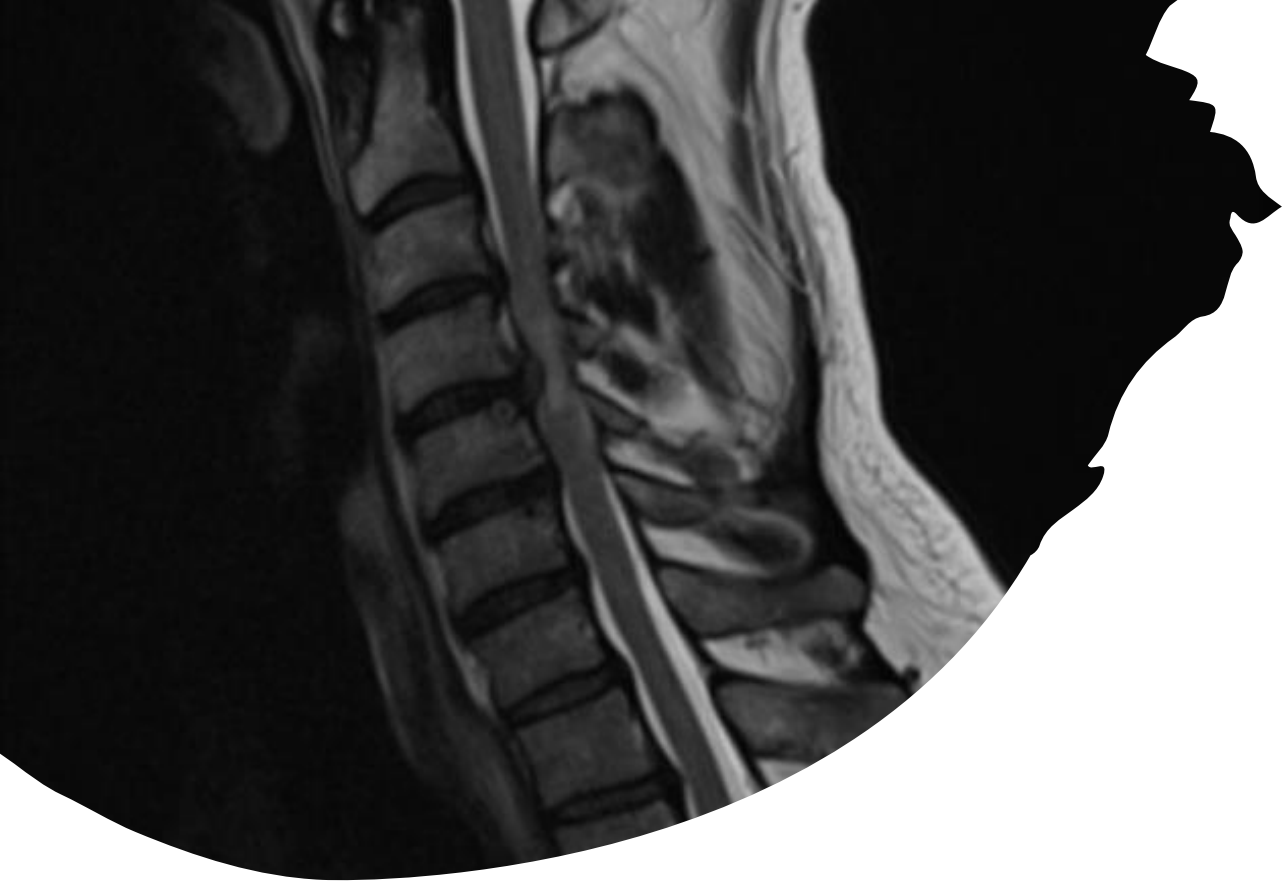
Veneuze congestie

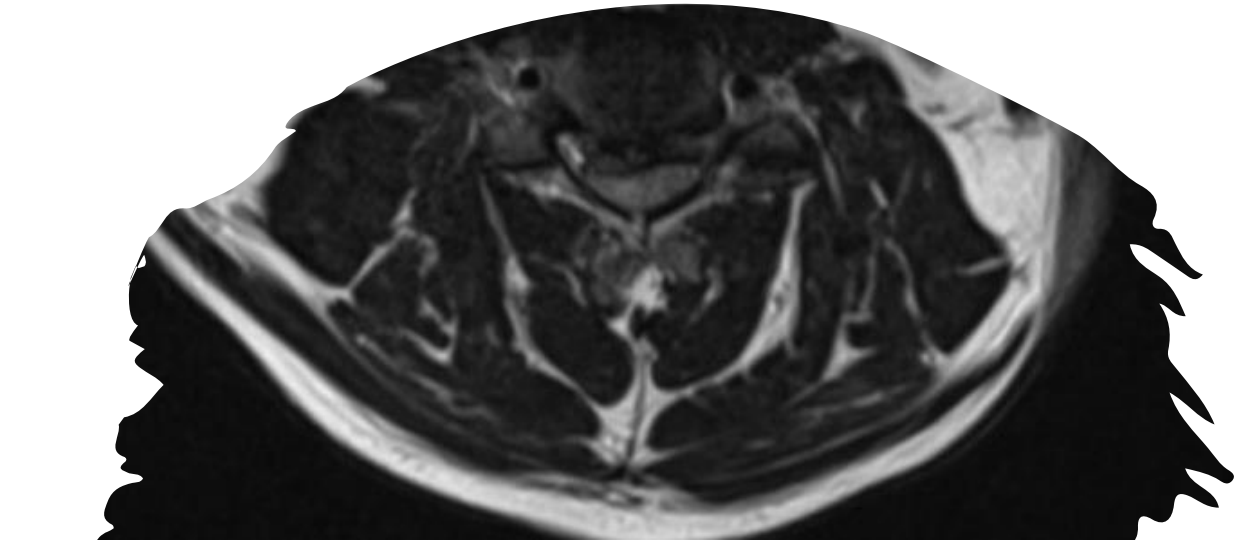
Pijn > sensorimotor > autonoom

Thoracaal

Case courtesy of Frank Gaillard, Radiopaedia.org, rID: 19635

Continuum (Minneap Minn) 2024;30(1, Spinal Cord Disorders):160–179





Compressie

Pijn > sensorimotor > autonoom

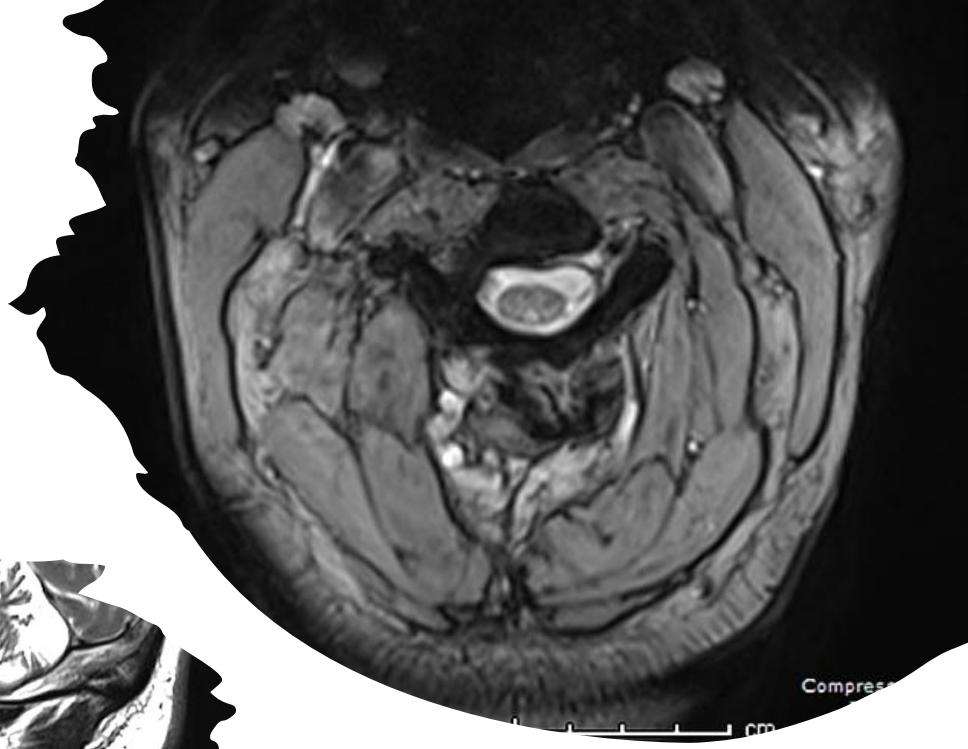
Cervicaal

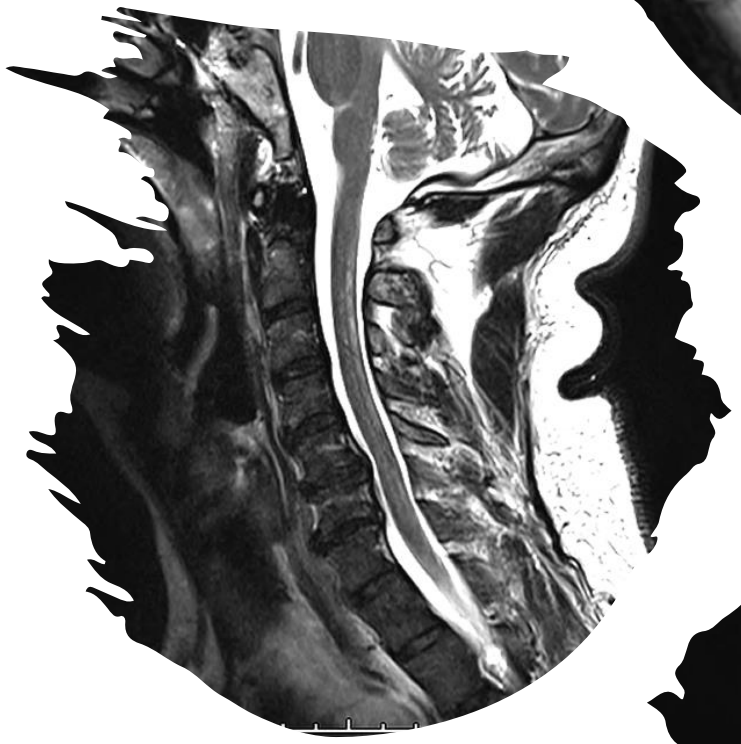
Case courtesy of Bruno Di Muzio, Radiopaedia.org, rID: 48373

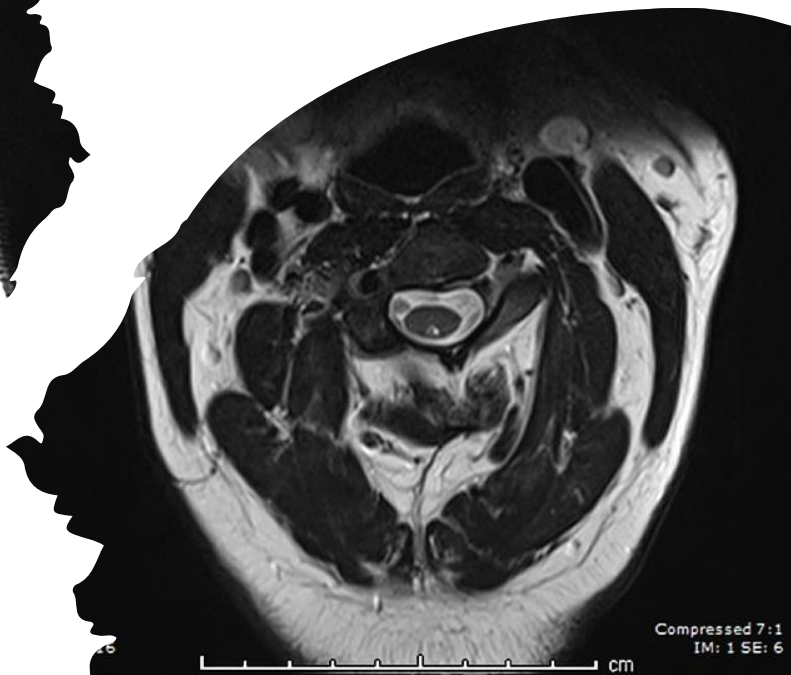
Inverted V-sign

Sensibel > motorisch

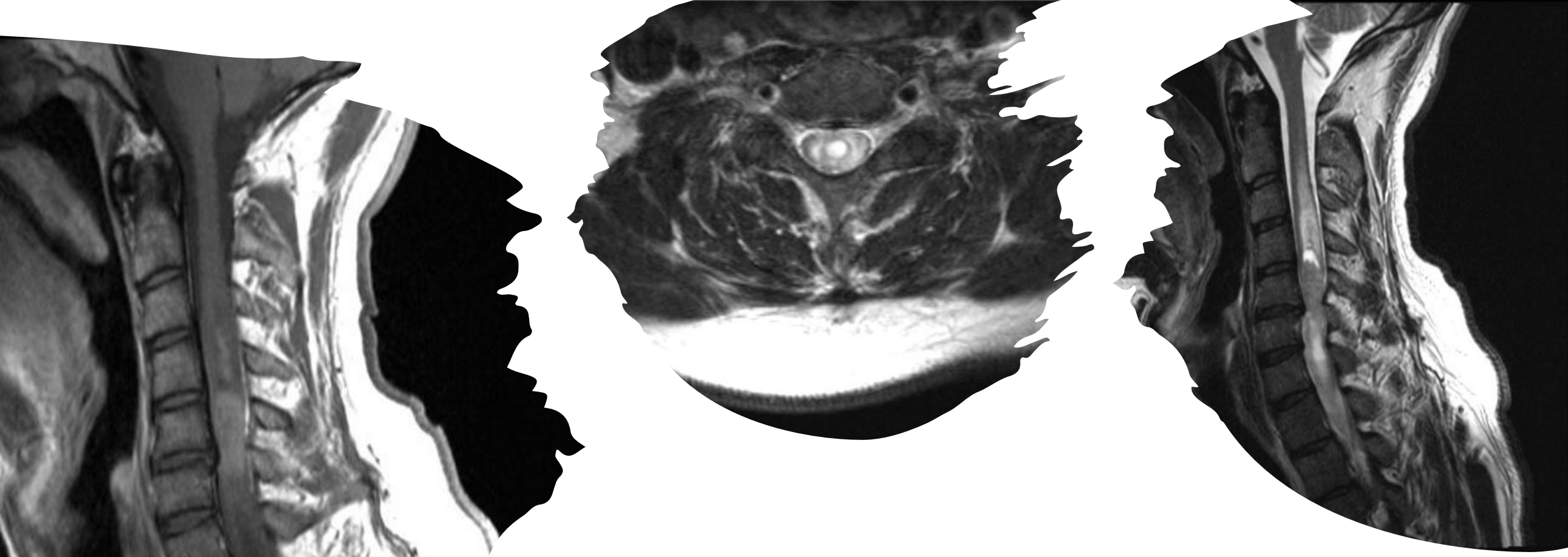
Cerebraal & perifeer







Case courtesy of Ali Alsmair, Radiopaedia.org, rID: 90810



Scherpe grens

Pijn > sensibel > motorisch

Centraal

Case courtesy of Frank Gaillard, Radiopaedia.org, rID: 19290

Transverse Myelitis Consortium Working Group

Inclusion criteria

- development of sensory, motor, or autonomic dysfunction attributable to the spinal cord
- bilateral signs and symptoms (though not necessarily symmetric)
- clearly defined sensory level
- exclusion of extra-axial compressive cause by neuroimaging (MRI or myelography; CT is not adequate)
- inflammation within the spinal cord demonstrated by CSF pleocytosis or increased IgG index or gadolinium enhancement
- progression to nadir between 4 hours and 21 days after the onset of symptoms

Proposed Diagnostic Criteria and Nosology of Acute Transverse Myelitis. Neurology. 2002;59(4):499-505. doi:10.1212/wnl.59.4.499

Transverse Myelitis Consortium Working Group

Exclusion criteria

- radiation to the spine within the last 10 years
- arterial distribution clinical deficit consistent with thrombosis of the anterior spinal artery
- abnormal flow voids on the surface of the spinal cord consistent with AVF

Exclusion criteria for idiopathic acute transverse myelitis

- connective tissue disease
- CNS infection
- brain MRI abnormalities suggestive of multiple sclerosis
- history of clinically apparent optic neuritis

Proposed Diagnostic Criteria and Nosology of Acute Transverse Myelitis. Neurology. 2002;59(4):499-505. doi:10.1212/wnl.59.4.499

Infectieus

Post/para-infectieus/vaccinatie

CNS auto-immuniteit

- Multiple sclerose
- ADEM
- NMOSD
- MOGAD
- (GFAP)

Systeemziekten

Paraneoplastische (E)M

Patroonherkenning

Aantal wervelhoogten?

Conus/cauda equina?

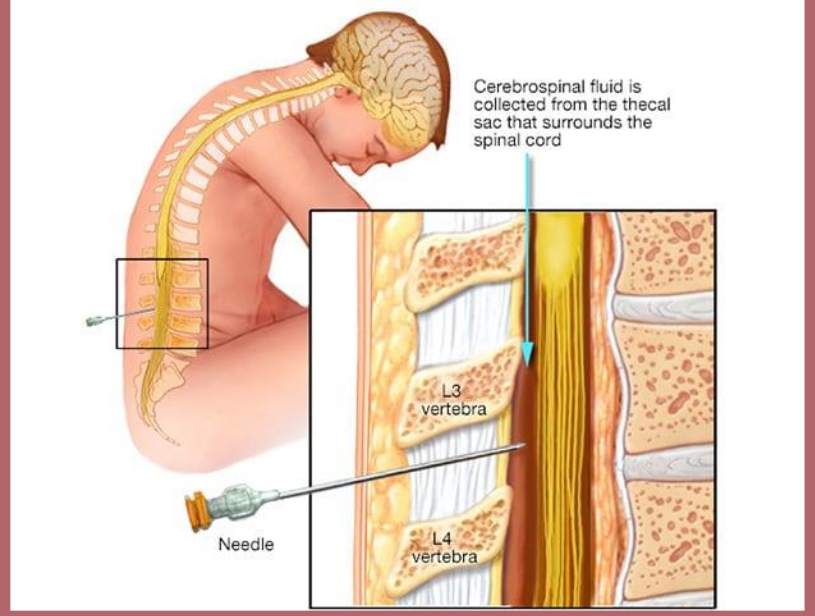
Cerebraal/n. opticus?

Meningen/CN/radices/ganglia?

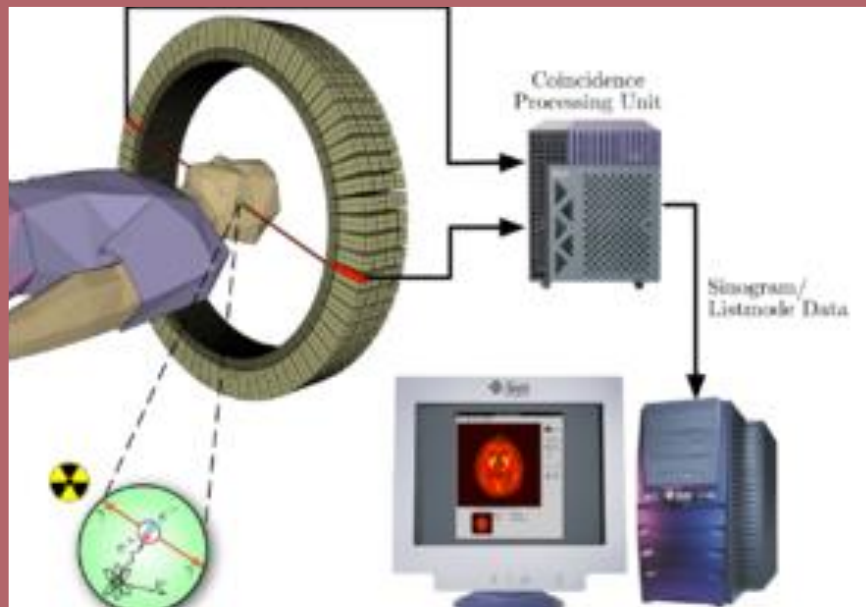
Table 2. Comparative chart of optic nerve (ON) and spinal cord imaging in inflammatory demyelinating diseases (IDDs) of the CNS. LEON: longitudinally extensive optic neuritis; LETM: longitudinally extensive transverse myelitis; MOG-ON: myelin oligodendrocyte glycoprotein antibody associated optic neuritis; SSTM: short segment transverse myelitis; #: number.

MRI	MS	AQP4-NMOSD	MOG-NMOSD
Spinal Cord (Range) [113,115,117]	• SSTM • LETM less frequent • Dorsolateral lesions (SSTM & LETM)	• LETM • SSTM less frequent • Central cord lesion • Complete resolution of lesion • Bright spotty lesions • Linear lesions	• LETM • SSTM less frequent • Central cord lesion • Complete resolution of lesion • Bright spotty lesions? • Linear lesions

Zabad, R.K.; Stewart, R.; Healey, K.M. Pattern Recognition of the Multiple Sclerosis Syndrome. Brain Sci. 2017,7,138. doi: 10.3390/brainsci7100138



What to detect when you’re suspecting



Bloed

Auto-immuun

- ANA, ds-DNA, ANCA, RF, antifosfolipiden
- ACE, soluble IL2R, HLA B27/B51
- AQP4 en MOG AL (CBA)
- Paraneoplastische AL

Metabool

- Vitamine B12, methylmalonzuur, homocysteïne, koper, zink, ceruloplasmine

Infectieus

- Viraal: herpesviridae, flaviviridae, influenza, echovirus, HBV, bof, mazelen, rubella
- Bacterieel: syfilis, tuberculose, actinomyces, kinkhoest, tetanus, difterie, borrelia, c. jejuni, m. pneumonia
- Fungaal, parasitair

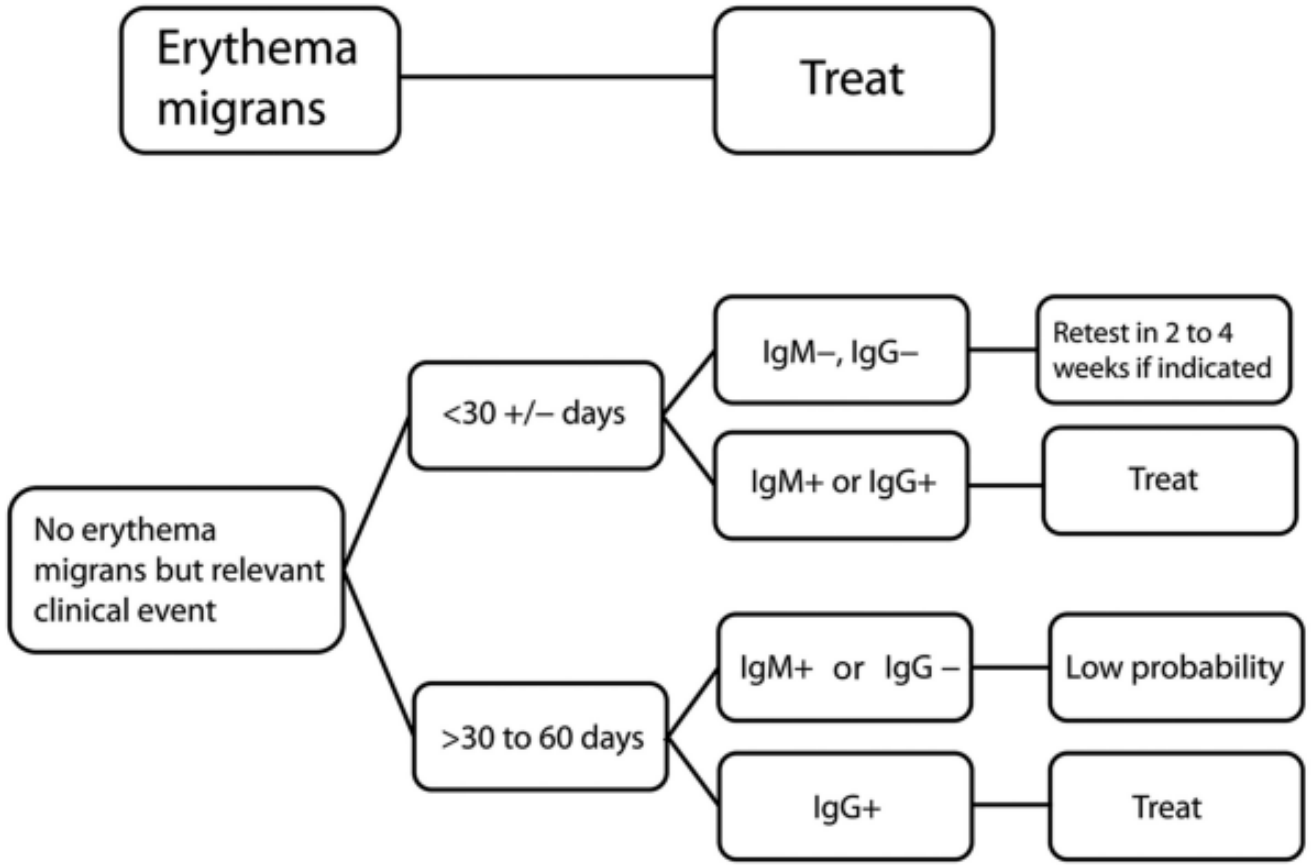


FIGURE 6-2

An algorithm for Lyme disease treatment decisions based on the presence or absence of erythema migrans, duration of symptoms, and results of Western blots for IgM and IgG if the enzyme-linked immunosorbent assay (ELISA) is positive or borderline.

Reprinted with permission from Halperin JJ, Continuum (Minneap Minn).[4] © 2012 American Academy of Neurology.

Continuum (Minneap Minn) 2024;30(1, Spinal Cord Disorders):133–159.

CSV

Hematologie

- Celtelling, differentiatie
- Anatomopathologie
- (Flowcytometrie)

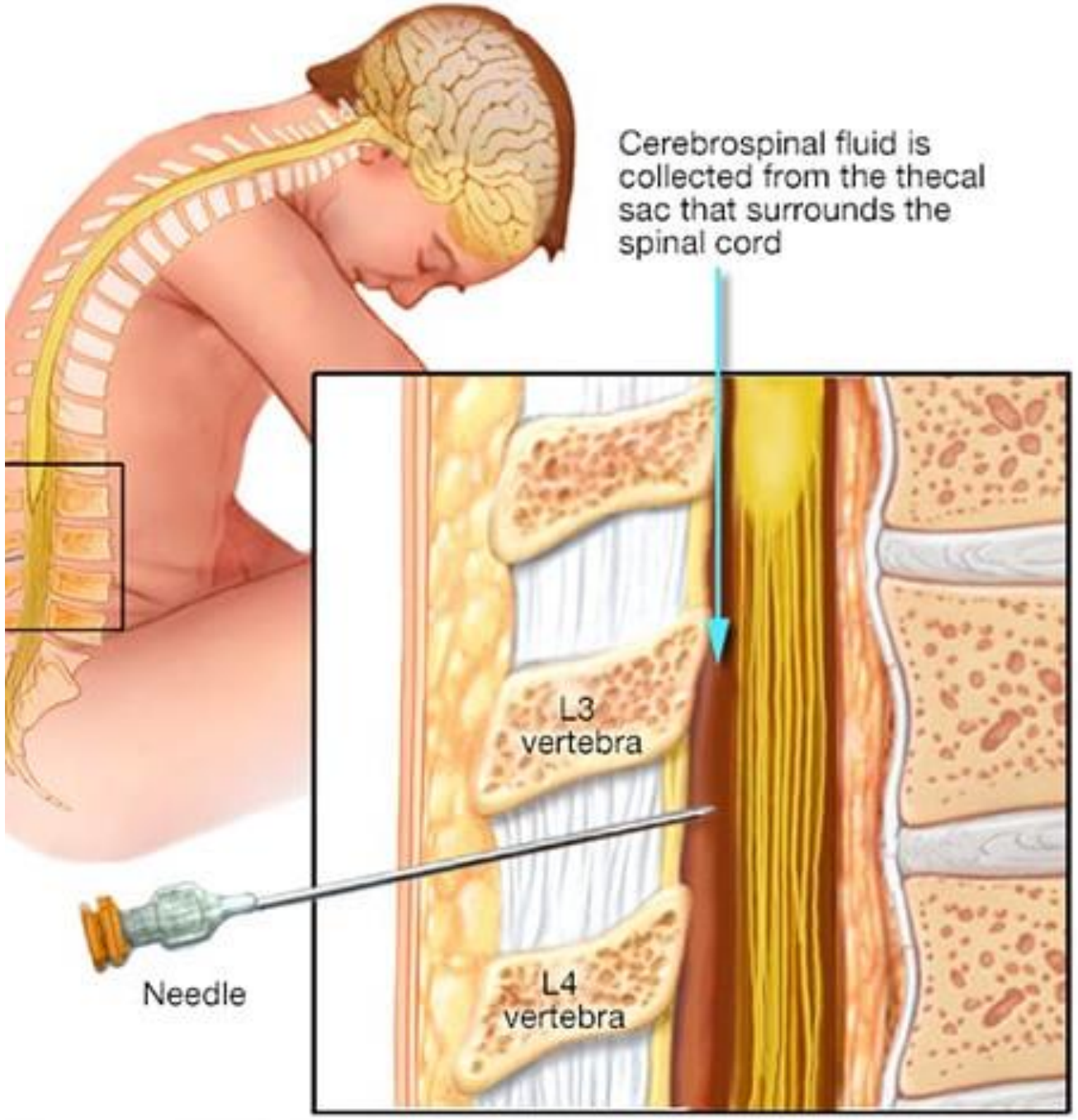
Biochemie

- Gepaard glucose, eiwit
- Lactaat
- IgG index
- Iso-elektrische focusing
- AQP4 en MOG AL (CBA)
- Paraneoplastische AL

Infectieus

- Kweek en PCR
- Serologische index

$$\frac{\text{anti-VZV IgG in CSF/anti-VZV IgG in serum}}{\text{total IgG in CSF/total IgG in serum}}$$

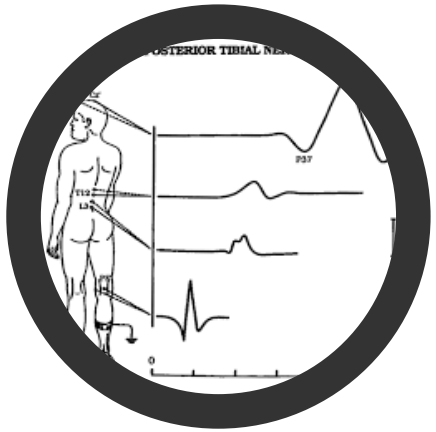


MRI

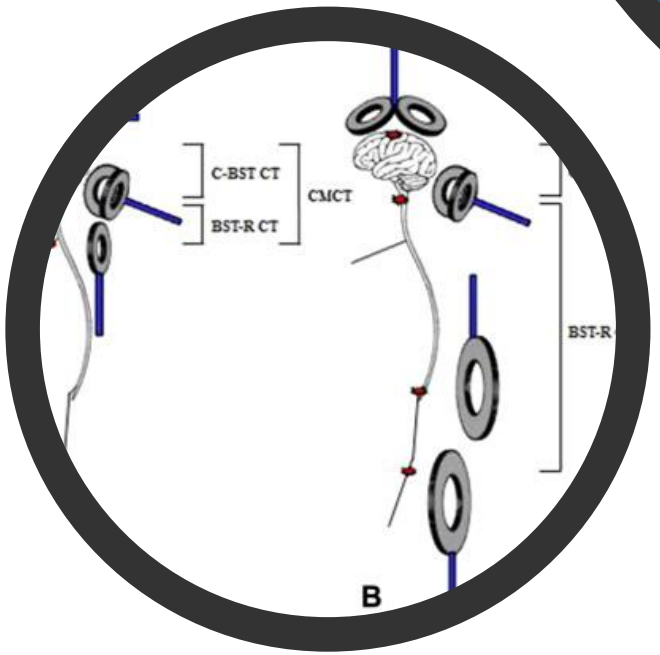
Full spine

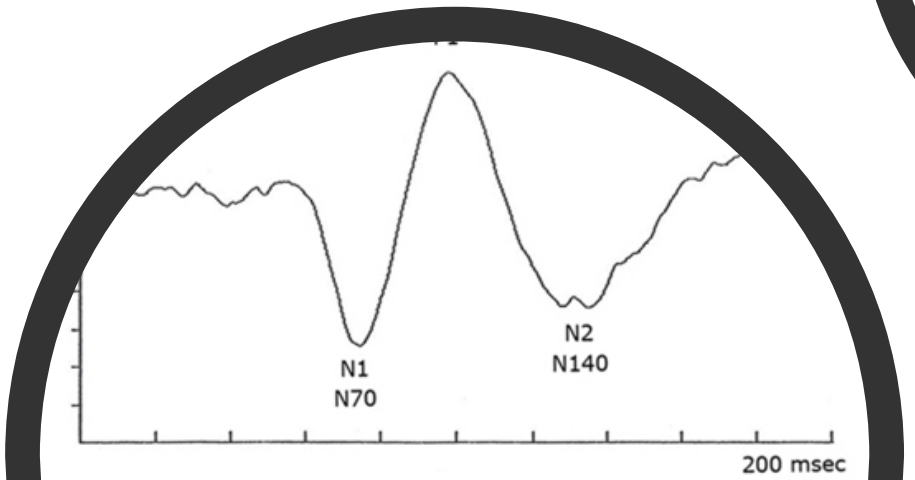
Brain

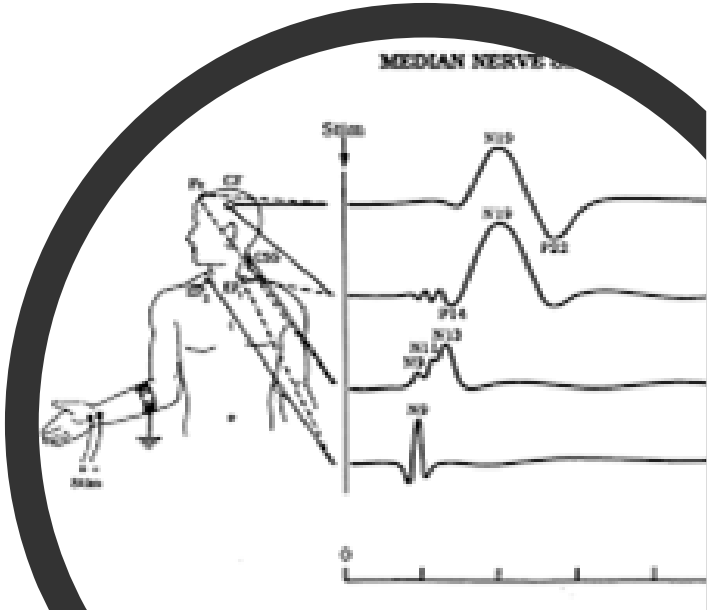
Orbital

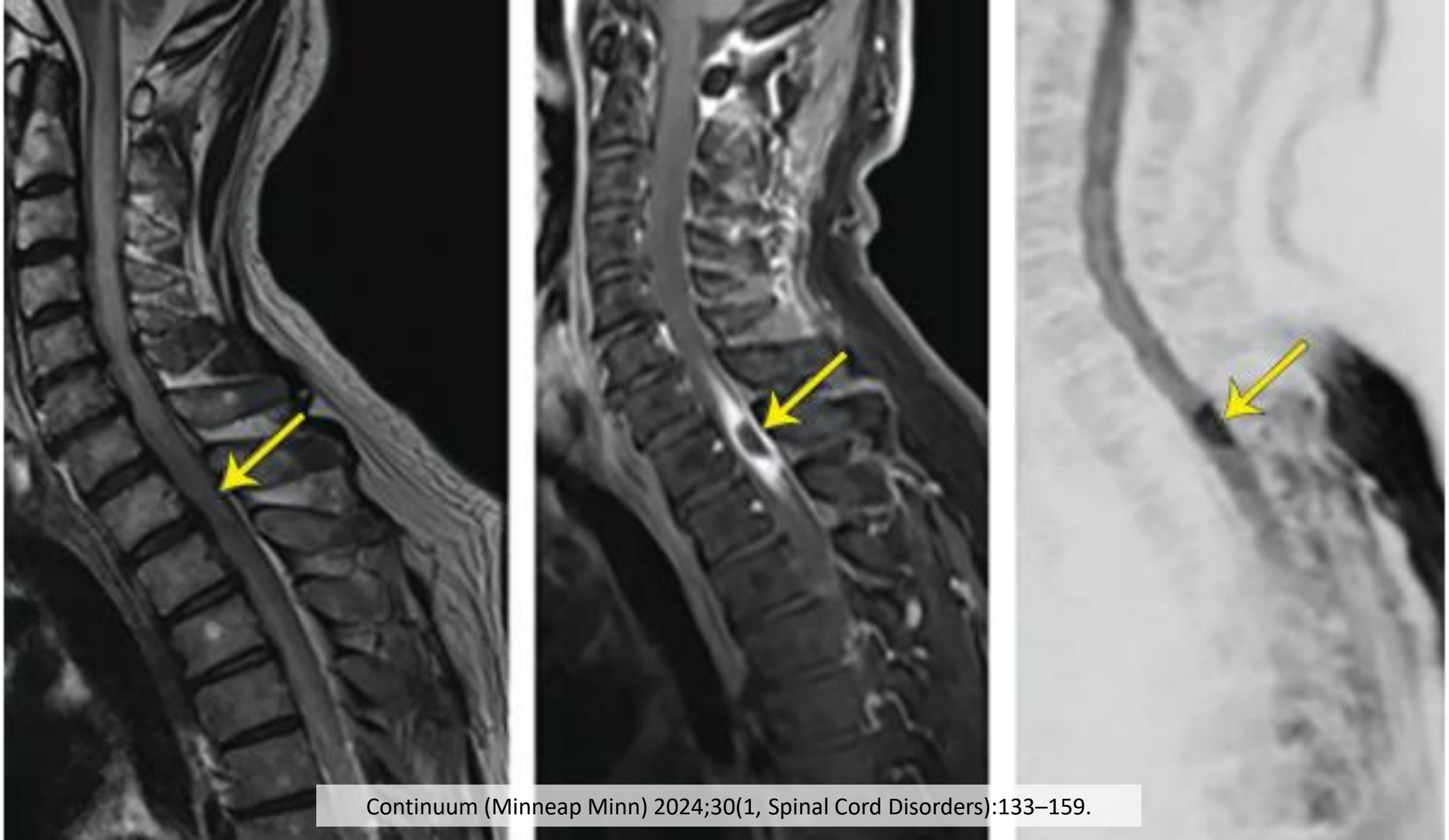


EP









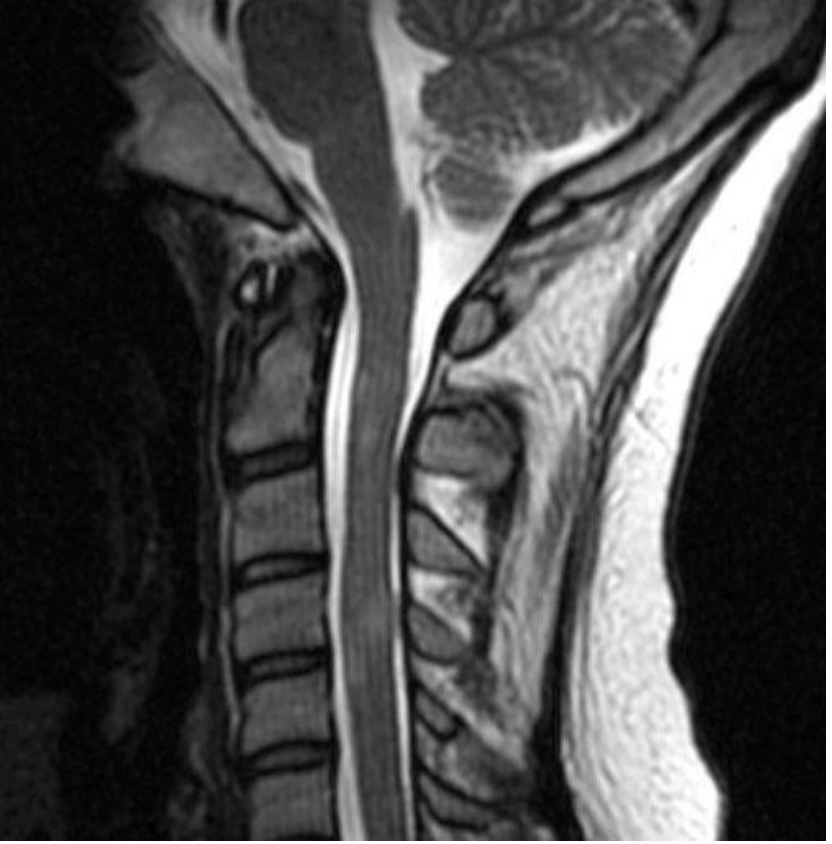
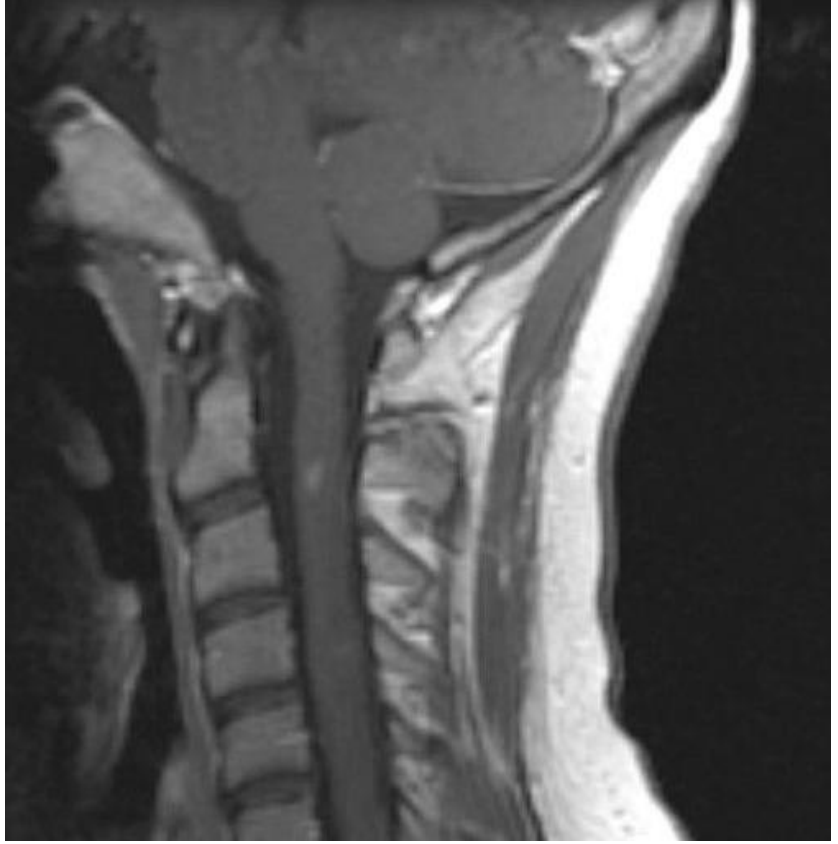
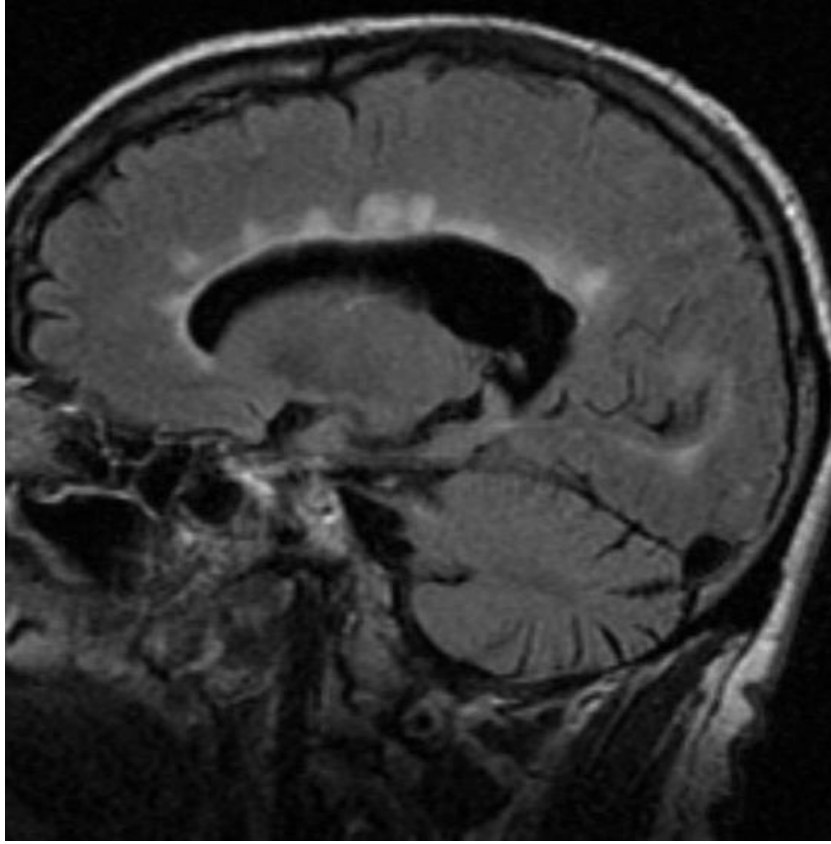
Continuum (Minneap Minn) 2024;30(1, Spinal Cord Disorders):133–159.

TABLE 6-1 **MRI Recommendations for Evaluation of Possible Bacterial Myelopathy or Myelitis[a]**

	MRI series	Image findings	Enhancement
Spondylitis	T2-weighted image (T2WI), short tau inversion recovery (STIR), gradient echo, gadolinium indicated	Variable	Possible
Pyogenic spondylitis	Fat-suppressed T2WI, T1-weighted image (T1WI), diffusion-weighted image (DWI), gadolinium indicated	Hyperintense on T2WI in pyogenic infections of the soft tissue and intervertebral disk; abscess narrowing the intervertebral space	Yes, in acute lesions, surrounding soft tissue or intervertebral enhancement may be seen
Arachnoiditis	T2WI and T1WI, gadolinium indicated	Thickening of cord surface, nerve roots, or cauda equina; pockets of CSF or pus may be seen in later stages of infection	Yes, late infections may show enhancement in the spinal cord
Meningitis	T2WI and T1WI, gadolinium indicated	Thickening of cord surface, nerve roots, or cauda equina	Yes, late infections may show enhancement in the spinal cord
Empyema	T1WI and T2WI, gadolinium indicated	Long-segment lesions, meningeal thickening	Yes, meningeal enhancement (central empyema does not enhance)
Intramedullary abscess	T2WI and T1WI, gadolinium indicated	Varies based on stage of development	Varies; mild to none in myelitis stage; ringlike once abscess forms

[a] Data from Yokota H and Tali ET, Neuroimaging Clin N Am[5] and Modic MT et al, Radiol.[6]

Continuum (Minneap Minn) 2024;30(1, Spinal Cord Disorders):133–159.

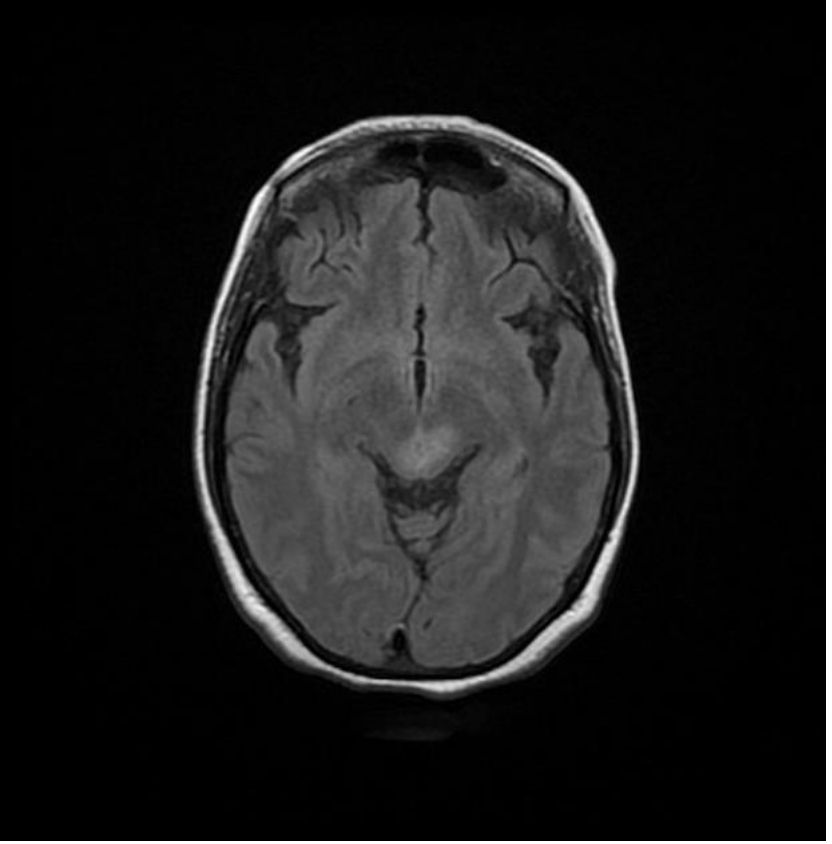




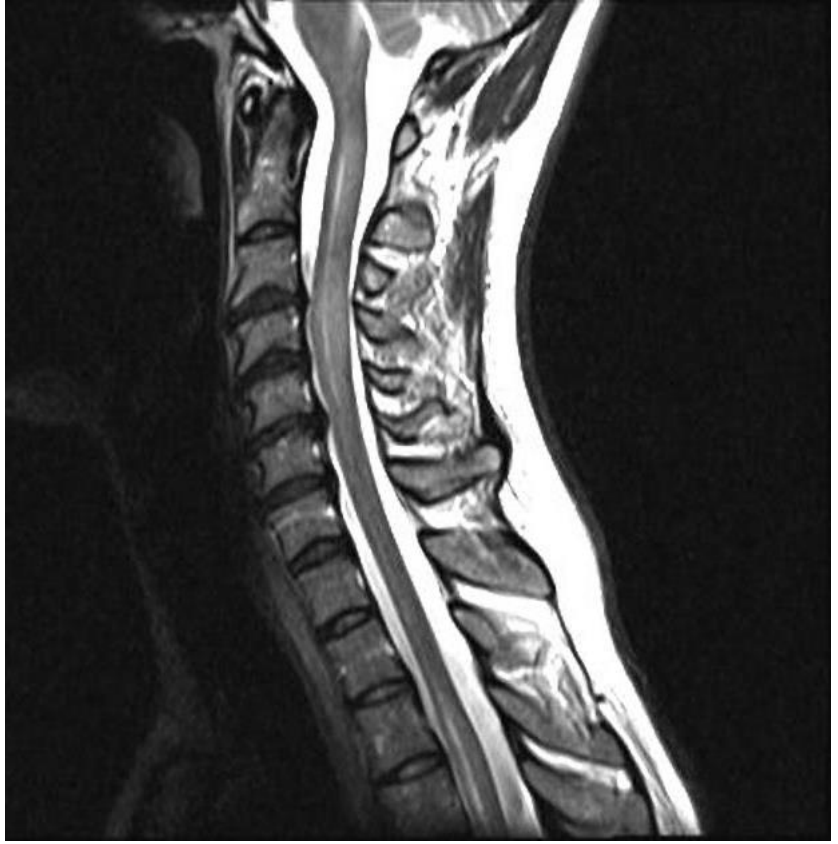
Multiple sclerose

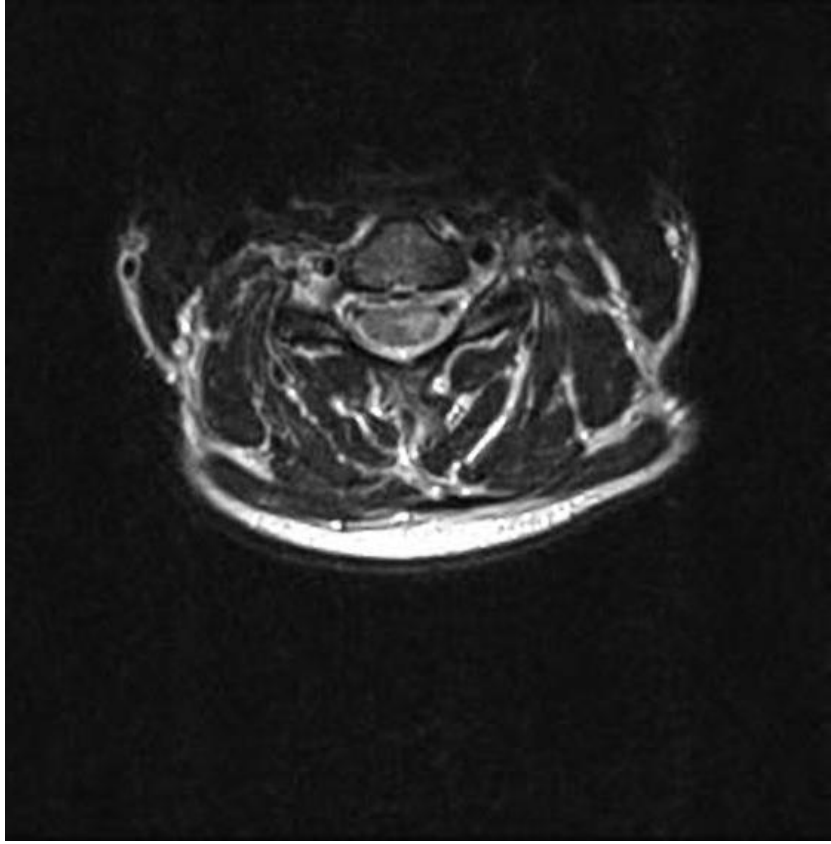
Kortstrekkige myelumletsels

Typische cerebrale letsels

Case courtesy of Frank Gaillard, Radiopaedia.org, rID: 35916 & 2635





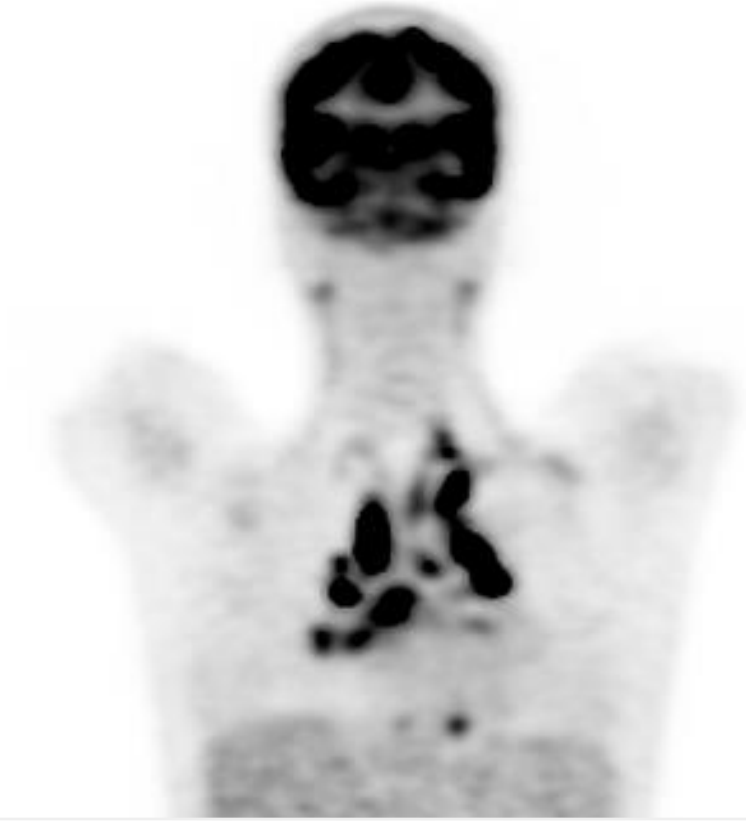


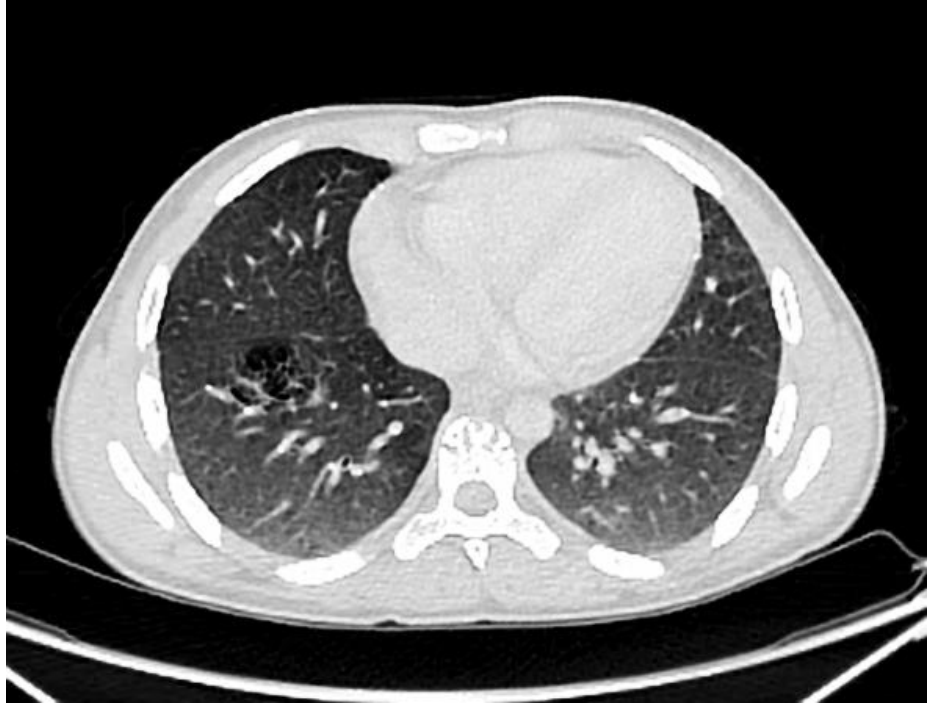
NMOSD

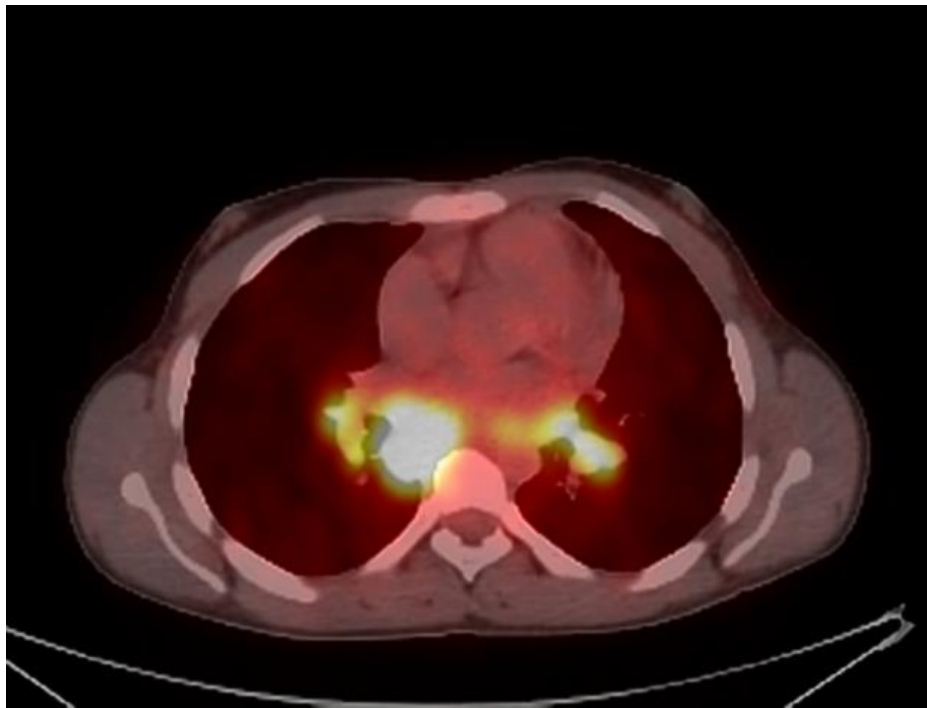
Langstrekkige myelumletsels

Periaqueductaal

Case courtesy of Frank Gaillard & Rajarajan, Radiopaedia.org, rID: 32605 & 46297







(PET)-CT

- Sarcoïdose
- Paraneoplastische (E)M
- Large vessel vasculitis

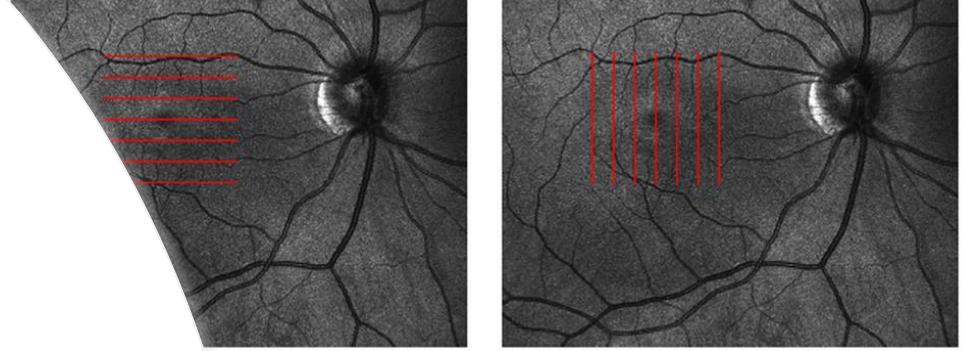
Fluoangiografie & OCT

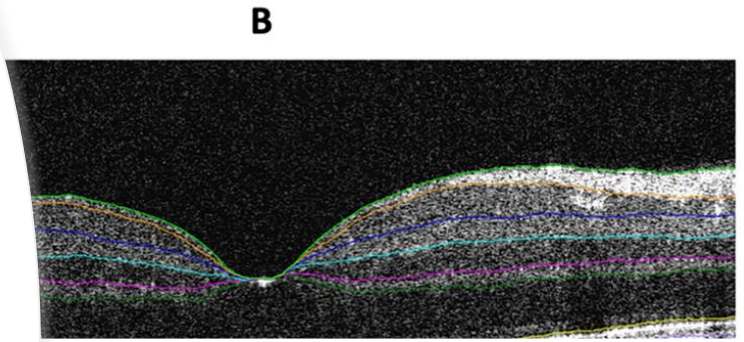
Uveïtis

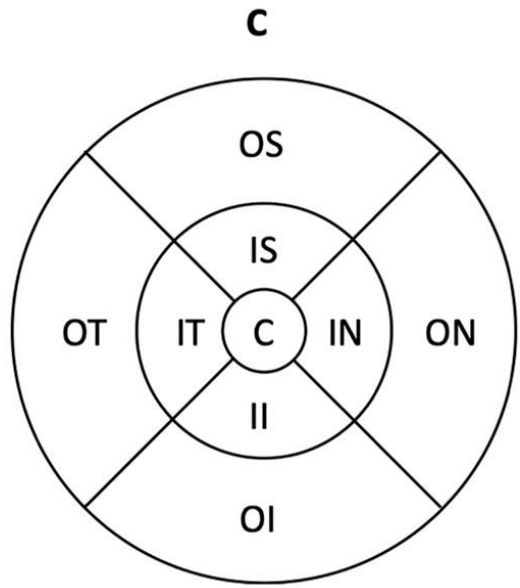
Papiloedeem

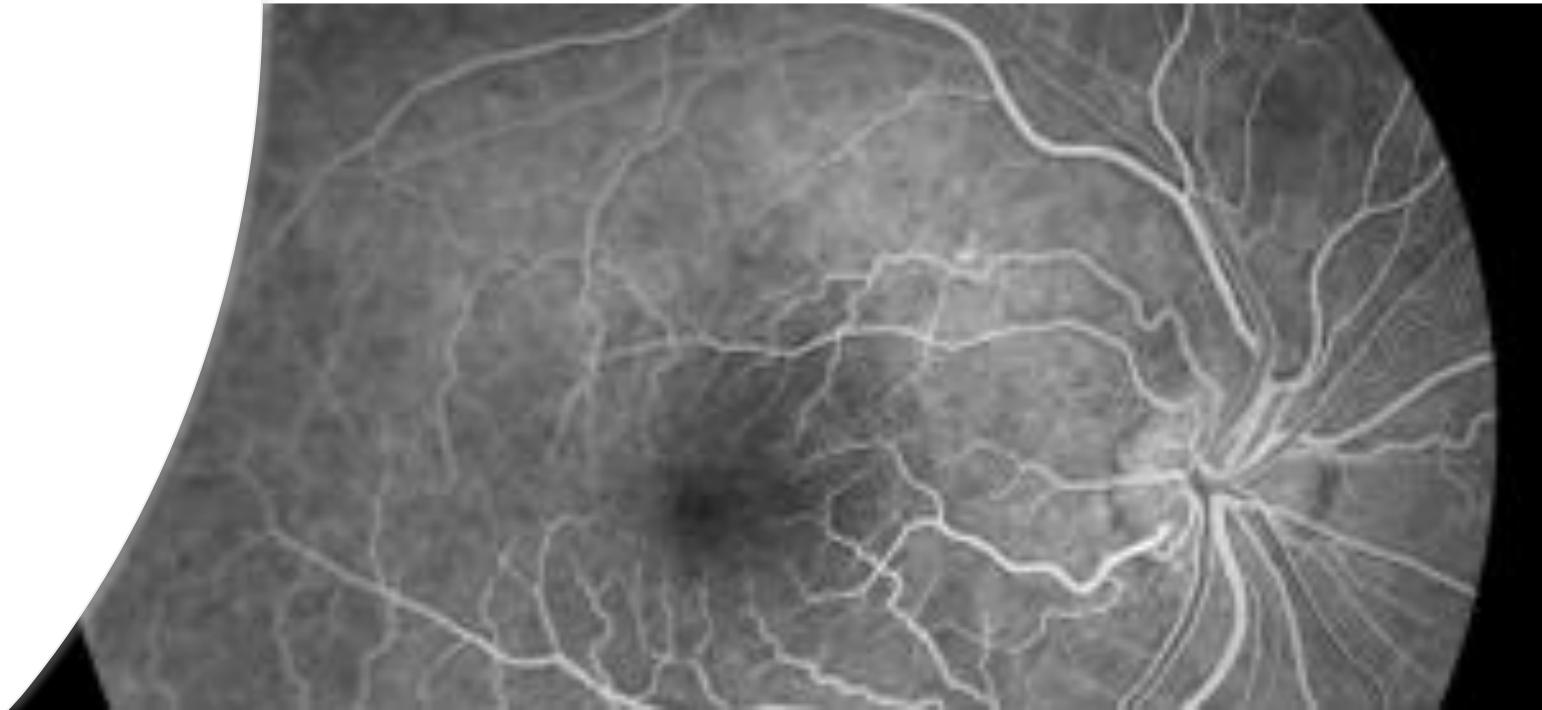
Small vessel vasculitis

Atrofie







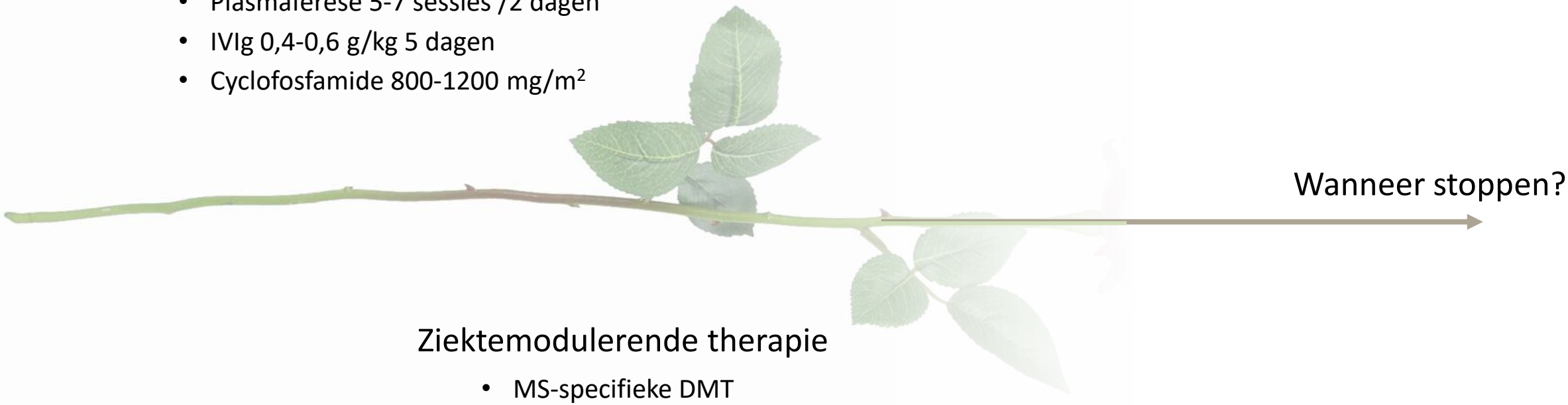


Stap voor stap

1. Wat in acute fase?
2. Ziektemodulerende therapie?
3. Wanneer stoppen?

Acute therapie

- Infectieus: causaal
- Methylprednisolone 1000mg IV 3-5 dagen
- Plasmaferese 5-7 sessies /2 dagen
- IVIg 0,4-0,6 g/kg 5 dagen
- Cyclofosfamide 800-1200 mg/m^2



Wanneer stoppen?

Ziektemodulerende therapie

- MS-specifieke DMT
- Humira, Infliximab, Tocilizumab
- NMOSD: Eculizumab
  Inebilizumab
  Satralizumab
  Ravulizumab

- AZA, MTX, MMF
- IVIg 1g/kg /3-4 weken
- Rituximab 2x 1g /6m
- Cyclofosfamide 1x/m 3-6x

Table 6. Maintenance therapy for NMOSD [233,234]. GI: Gastrointestinal; UTI: urinary tract infection; URI: upper respiratory infection; PML: progressive multifocal leukoencephalopathy; DVT: deep venous thrombosis; TB: tuberculosis.

Medication Name	Mechanism of Action (MOA)	Dosage	Treatment Response	Side Effects
Azathioprine	Thiopurine antagonist of endogenous purines in DNA and RNA, interferes with lymphocyte proliferation	Initial: 2–3 mg/kg/day with concomitant prednisone (5–60 mg daily) for 6–12 months Maintenance: 2–3 mg/kg/day	Approximately 50/50 chance of preventing additional relapse	Nausea, diarrhea, rash, recurrent infections, leukopenia, transaminase elevation, increased risk of lymphoma
Cyclophosphamide	Cytotoxic alkylating agent, inhibits mitosis	Initial: 1000 mg every 2 months with associated steroid Maintenance: same as initial dosing	Specific treatment response unavailable—only recommended when other immunosuppressive therapies fail or are not available due to contradictory preliminary findings.	GI symptoms, hyponatremia, heart block, pancytopenia, opportunistic infections
Eculizumab	Binds to the complement protein C5 specifically, inhibiting its cleavage to C5a and C5b and subsequent generation of the terminal complement complex C5b-9	Standard dose: IV 600 mg weekly for four weeks, then IV 900 mg every two weeks	Specific treatment response unavailable at this time	Headache, increased risk of infection with encapsulated organisms, especially meningococcal infections
Methotrexate	Folic acid antagonist	Initial: start with 7.5 mg weekly with upward titration and concomitant prednisone (5–60 mg daily) Maintenance: 7.5–15 mg weekly with concurrent prednisone (5–10 mg daily for at least sixmonths)	Remission rates in up to 2/3 of subjects when used as monotherapy or in conjunction with corticosteroids	Pneumonitis, GI upset, cytopenia, hepatotoxicity
Mitoxatrone	Causes DNA cross-linking and strand breaks, interferes with DNA repair	Initial: 12 mg/m^2 for 3–6 months Maintenance: 6–12 mg/m^2 every 3 months	Remission in up to 70% of subjects when dosed appropriately	Nausea, transaminase elevation, leukopenia, hair loss, amenorrhea, minor infections including UTI and URI, rarely heart failure and acute leukemia
Mycophenolate mofetil	Inhibits inosine monophosphate dehydrogenase, impairs B- and T-cell synthesis	Initial: 1000–2000 mg daily with concurrent prednisone (5–60 mg daily) Maintenance: 1000–2000 mg	Approximately 60–75% achieve remission with fewer side effects and adverse effects	Photosensitivity, recurrent infections, headache, constipation, abdominal pain, leukopenia, PML is rare
Rituximab	Removal of B cells as antigen presenting cells and reduction in the CD20+ early plasmablast population generating anti-quaporin-4 antibodies	Initial: 1000 mg weekly for two weeks or 375 mg/m^2 weekly for four weeks Maintenance: 375 mg/m^2 or 1000 mg weekly for 2 weeks when CD19 count >1% on flow cytometry	Remission rates up to 83% were achieved with persistent B cell depletion	Sepsis, infections (Herpes zoster, UTIs, URIs), leukopenia, transaminase elevation, PML is rare
Tocilizumab	Directed against the IL-6 receptor reducing plasmablast survival, inhibiting AQP4 antibody production	Standard dose: 8 mg/kg every four weeks	Specific treatment response unavailable at this time	GI disturbance, fatigue, UTIs, neutropenia, leukopenia, elevation of cholesterol, transient mild transaminase elevation, DVT, TB reactivation

Zabad, R.K.; Stewart, R.; Healey, K.M. Pattern Recognition of the Multiple Sclerosis Syndrome. Brain Sci. 2017,7,138
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Vragen?