

Interventional Management of Neuropathy



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Disclosure

I have no relevant relationships with ineligible companies to disclose within the past 24 months.

Objectives

At the conclusion of this session, participants should be able to:

- Describe common causes and presentations of neuropathy
- Describe a patient identification and diagnostic process
- Discuss treatment options from injections to implants

Outline

- Review Common terms
- Pain pathway and gated theory
- Review of pain fibers
- Review Mechanisms and patters of nerve damage
- Quick Review on diagnostic evaluations
- Review of neuropathic presentations

"I have been to _____, what are you going to do for me?"

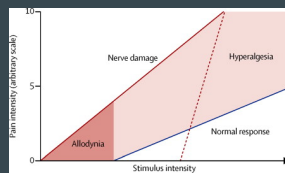
Important Terms

Pain: unpleasant or emotional experience originating in real or potentially damaged tissue.

Hyperanalgesia: increased sensitivity to pain

Allodynia experience pain from stimuli that are not typically painful. (neuropathy/fibromyalgia)

Dysesthesia refers to an abnormal or unpleasant sensation experienced in response to touch



Types of Peripheral Nerves

Large Fiber Sensory Nerves:

- Aβ fibers
- Aδ fibers

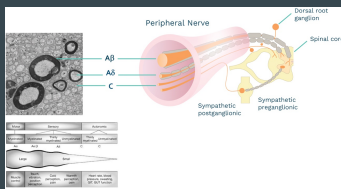
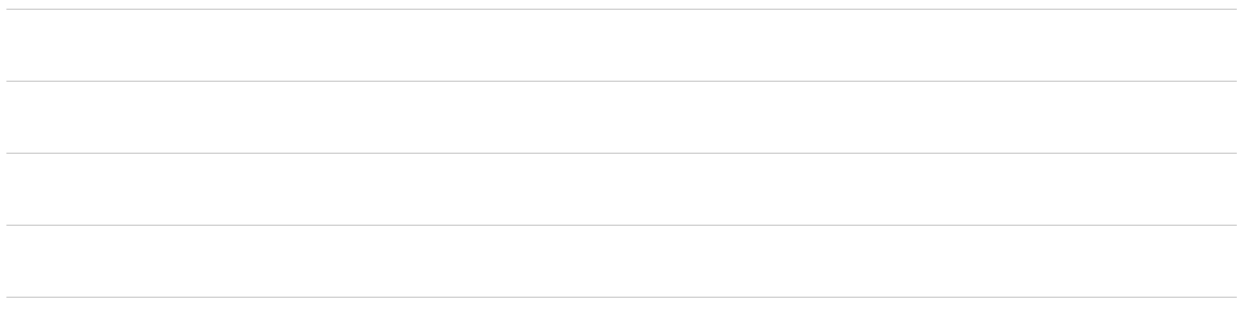


Photo credit: <https://relaxiotherapeutics.com/four-focus-dtu/>



Types of Peripheral Nerves

Small Fiber Sensory Nerves:

- C fibers (nociceptive)
- C fibers (non-nociceptive)

Autonomic fibers

- Aδ fibers (non-nociceptive):
- C fibers (non-nociceptive)

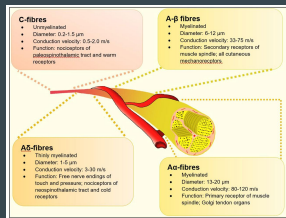
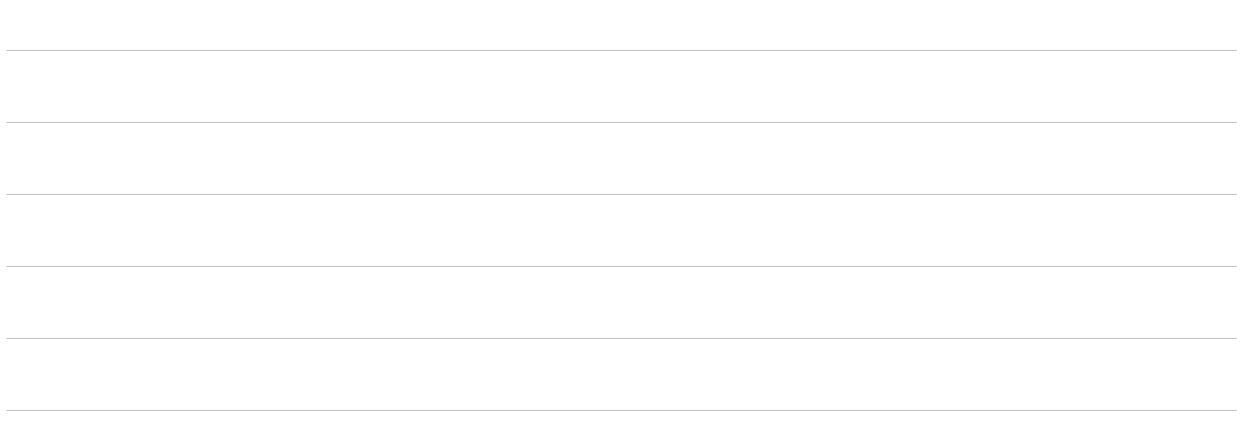
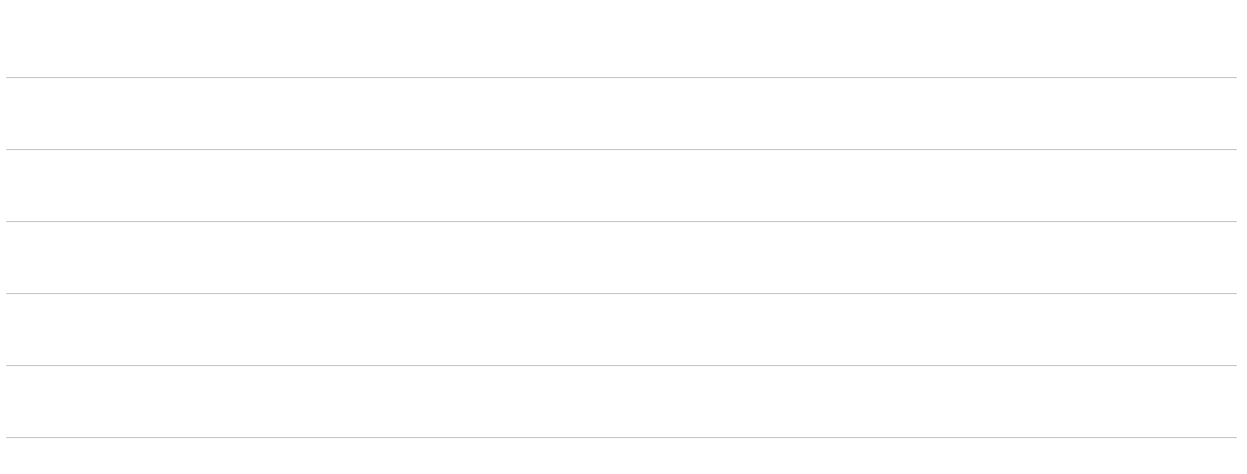
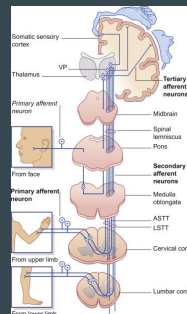


Photo Credit: <https://www.frontiersin.org/journal/10.3389/fnana.2019.00049/full>



Pain Pathway (Acute)

- Stimulus! >>>> Transduction:
- >>>Transmission>>>Modulation
- >>> Ascending Pathway >>>
- Perception>>> Descending Pathway >>>
- Response!



Pain Pathway (Chronic)

Persistent Nociceptive Input
 >>>>Sensitization>>>>Neuroplastic
 Changes>>>>Central
 Sensitization>>>>Descending Modulation
 Dysfunction

- Psychological Factors
- Neuroinflammation
- Peripheral and Central Neurodegeneration
- Altered Pain Processing
- Maladaptive Neuroplasticity
- Genetic and Epigenetic Factors

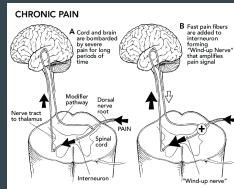


Photo Credit: https://www.researchgate.net/publication/348988892/figure/fig1/figure-pdf/348988892_1.jpg

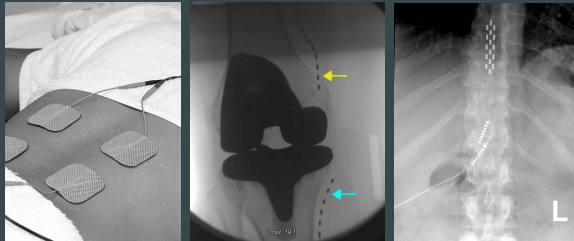
Gated Theory of Pain

Ronald Melzak and Patrick Wall, 1965.



Photo Credit: <https://reporter.mcgill.ca/patrick-wall-and-melzak-and-walls-gate-control-theory/>

Neurostimulation



https://www.researchgate.net/publication/348988892/figure/fig1/figure-pdf/348988892_1.jpg

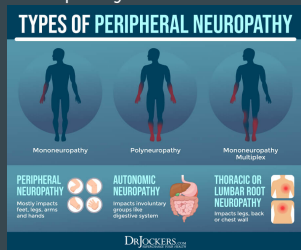
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Implant Process

1. Identify patient
2. Failed prior treatment (medication and injections)
3. Diagnostic Block (sometimes)
4. Psychological evaluation
5. Trail the implant for 7 days
6. Follow up, remove trial
7. Implants

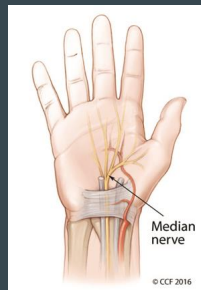
Peripheral Neuropathy



Mononeuropathy

Focal damage of a single nerve from trauma, entrapment, compression, lesion, or neoplasm

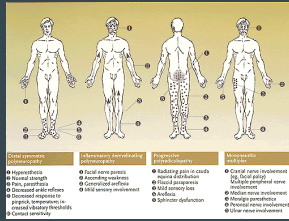
- Carpal Tunnel
- Radial Nerve Palsy
- Ulnar Nerve Entrapment
- Peroneal Nerve
- Femoral Nerve



Mononeuropathy Multiplex

Simultaneous and subsequent damage to **multiple noncontiguous nerves**

- Ischemia secondary to vasculitis
- Diabetes microangiographic damage
- Sarcoid, neoplasms



Polyneuropathy

Symmetrical, distal motor and sensory deficits

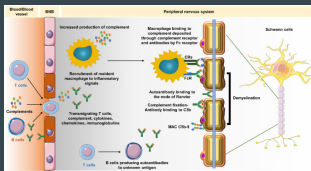
- Diabetic
- Alcoholic
- Autoimmune
- Toxic
- Infectious
- Hereditary



Photo Credit: <https://www.everydayhealth.com/neuropathy/guide/polyneuropathy/>

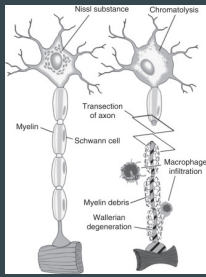
Peripheral Neuropathy: Mechanisms of Damage

- Segmental Demyelination



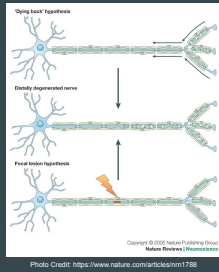
Peripheral Neuropathy: Mechanisms of Damage

- **Wallerian Degeneration:**



Peripheral Neuropathy: Mechanisms of Damage

- **Axonal Degeneration**



Helman's Clinical Patterns

1. Slowly Progressive, distal, symmetric + sensory
2. Slowly progressive, long standing + muscle wasting + motor predominant
3. Neuropathy with subacute onset + proximal involvement
4. Neuropathy with subacute, rapidly progressive, multifocal symptoms, pain + autonomic function
5. Sensory Ataxic Neuropathy - loss of proprioception + vibration

"These are not exclusive or absolutely since overlap of these patterns is not uncommon."

Risk Factors

- Advanced age
- Hypertension
- Peripheral vascular disease
- Smoking
- Dyslipidemia
- Poor glucose control
- A long duration of diabetes
- Heavy intake of alcohol
- Positive HLA-DR3/4 genotype

Medications Causing Peripheral Neuropathy

Chemotherapy drugs:

- Cisplatin
- Paclitaxel
- Vincristine
- Vinblastine
- Docetaxel
- Etoposide
- Thalidomide
- Borizomib
- Lenalidomide
- Pomalidomide

Antiretroviral drugs:

- Didanosine (ddI)
- Stavudine (d4T)
- Zalcitabine (ddC)
- Dideoxycytidine (ddC)
- Zidovudine (AZT)
- Lamivudine (3TC)
- Abacavir (ABC)
- Tenofovir (TDF)

Antibiotics:

- Fluoroquinolones:
- Ciprofloxacin, Levofloxacin
- Metronidazole

Anticonvulsants:

- Phenytoin
- Carbamazepine
- Gabapentin
- Pregabalin
- Valproate
- Lamotrigine
- Topiramate

Antipsychotics:

- Clozapine
- Phenothiazines: Chlorpromazine, Fluphenazine, Perphenazine, Thioridazine, Trifluoperazine
- Atypical antipsychotics: Olanzapine, Risperidone, Quetiapine, Aripiprazole, Ziprasidone

Antidepressants:

- Tricyclic antidepressants: Amitriptyline, Imipramine, Desipramine, Nortriptyline, Doxepin
- Selective serotonin reuptake inhibitors (SSRIs): Fluoxetine, Sertraline, Paroxetine, Citalopram, Escitalopram
- Serotonin-norepinephrine reuptake inhibitors (SNRIs): Venlafaxine, Duloxetine

Lab Evaluations

- CBC
- ESR
- CRP
- Thyroid
- Vit B12
- Serum Protein Immunofixation

A Note on EMG

Nerve conduction studies (NCS) and needle electromyography (EMG) are carried out to:

- confirm the clinical diagnosis of peripheral neuropathy
- exclude neuropathy mimics
- reveal subclinical involvement of clinically unaffected nerves
- assess the primary mechanism of damage (axonal vs. demyelinating)
- determine disease severity.



Photo credit: <https://www.youtube.com/watch?v=9292929292>

Common Medications Used in Neuropathy

Anticonvulsants:

- Gabapentin (Neurontin)
- Pregabalin (Lyrica)

Anti-seizure

- Carbamazepine (Tegretol)
- Valproic acid (Depakote)

Antidepressants:

- Tricyclic antidepressants (TCAs): amitriptyline, nortriptyline, and desipramine
- SNRI: duloxetine (Cymbalta) and venlafaxine (Effexor XR)
- SSRI: fluoxetine (Prozac) and sertraline (Zoloft)

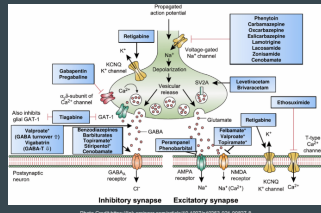


Photo Credit: <https://www.springer.com/978-1-4939-9827-8>

Common Medications Used in Neuropathy

Topical Medications:

- Lidocaine patches (Lidoderm)
- Capsaicin cream (Zostrix)
- Topical NSAIDs (NSAIDS)

Opioid Analgesics (last resort)

- Tramadol (Ultram)
- Oxycodone (OxyContin)
- Morphine

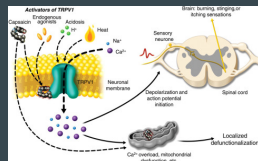


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Uncommon Medications Used in Neuropathy

NMDA Receptor Antagonists

- Ketamine
- Dextromethorphan

Sodium Channel Blockers

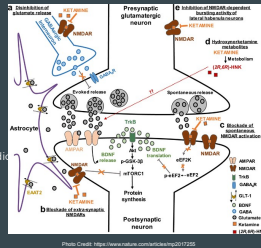
- Lamotrigine (Lamictal)
- Topiramate (Topamax)

Cannabinoids

- Medical marijuana or cannabinoids like cannabidiol (CBD) oil

Alpha-2 Adrenergic Agonists:

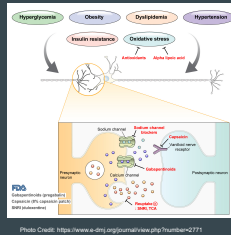
- Clonidine



Supplements Used in Neuropathy

Alpha-Lipoic Acid (ALA)

- Acetyl-L-Carnitine
- Omega-3 Fatty Acids
- Vitamin B Complex
- Magnesium
- N-Acetyl Cysteine (NAC)
- Curcumin/Coenzyme Q10 (CoQ10)
- Gamma-Aminobutyric Acid (GABA)



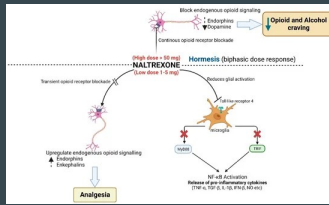
Low Dose Naltrexone

"Naltrexone has no therapeutic indication in the United States, aside from treatment of substance use disorder. The off-label dose of 1–5 mg of naltrexone (LDN) is compounded and not currently covered by most insurance companies or available in retail pharmacies." (Mckenzie-Blown)

We have successfully used LDN in the treatment of

- fibromyalgia
- CRPS
- polyneuropathy (refractory to other treatment)
- facet arthropathy, etc.

Patient have noted at least a 50% relief of their pain in the clinic



Patient Caveat #2

“I don't know...stick a needle in it”

Common Neuropathic Presentations

- Diabetic Neuropathy
- Greater Occipital Neuralgia
- Trigeminal Neuralgia
- Complex Regional Pain Syndrome
- Cluneal Neuropathy

CASE

A 55-year-old gentleman, presents with a history of poorly controlled type 2 diabetes mellitus and complains of chronic, burning pain and tingling sensations in his lower extremities, predominantly affecting his feet. The pain is described as constant and exacerbated at night, interfering with his sleep and overall quality of life. Despite optimization of glycemic control and adherence to diabetic management protocols, his symptoms persist, significantly impacting his functional status and mobility. He has attempted treatment with gabapentin and could not tolerate the side effects. Is currently using Lyrica, ALA, and amitriptyline has been added at night to help with neuropathy in the evening.

Diabetic Neuropathy

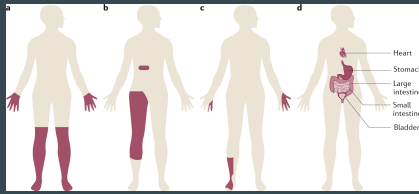


Photo Credit: <https://www.nature.com/articles/nrn1072-019-00001>

Diabetic Neuropathy: Interventional



Photo Credit: <https://www.alliancepain.com/scs-therapy>



Photo Credit: <https://www.alliancepain.com/scs-therapy>

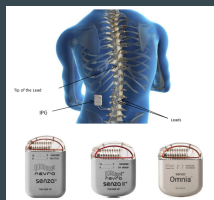


Photo Credit: <https://www.alliancepain.com/scs-therapy>

CASE

At 41 years old presents to the your clinic with a chief complaint of excruciating headaches. He describes the pain as sharp and stabbing, radiating from the base of his skull towards the top of his head. These episodes occur intermittently, often triggered by certain head movements or prolonged periods of sitting at his desk. Despite over-the-counter analgesics and lifestyle modifications, the intensity and frequency of his headaches have progressively worsened, significantly impacting his daily activities and overall quality of life. He has attempted sumatriptan with no relief and other preventative medications did not relieve his headaches. He has gone through multiple rounds of BOTOX injections for headaches, offering him no relief of his headaches. He is worried because he lost his job and is currently on state insurance.

Great Occipital Neuralgia

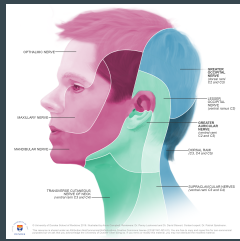


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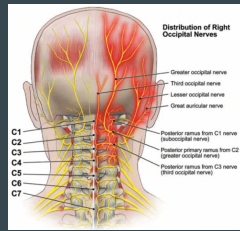
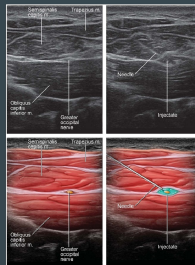
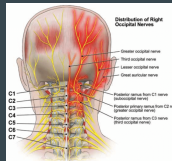


Photo Credit: <https://www.facebook.com/understandingfacialpain/>
<https://www.facebook.com/understandingfacialpain/>

Great Occipital Neuralgia: Treatment

- NSAIDs, TCA, SNRI, anticonvulsants
- Diagnostic and therapeutic nerve blocks
- Botox injections
- RFA



Great Occipital Neuralgia: Interventional

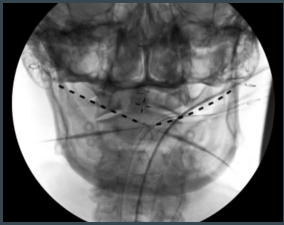


Photo Credit: <https://www.healthline.com/health/occipital-neuralgia>



Photo Credit: <https://www.healthline.com/health/occipital-neuralgia>

CASE

A 60 year old female presents with excruciating, lacing facial pain localized to the right side of his face. Describing the pain as electric shock-like and triggered by routine activities such as eating or brushing his teeth, Patient's symptoms have profoundly impacted his quality of life. Despite attempts at symptomatic relief with over-the-counter analgesics, the intensity and frequency of his pain remain debilitating.

Trigeminal Neuralgia

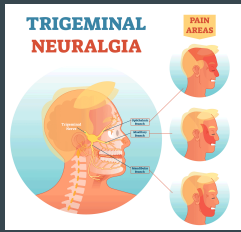


Photo Credit: <https://www.hopkinsmedicine.org/health/conditions-and-diseases/trigeminal-neuralgia>

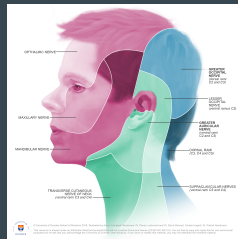
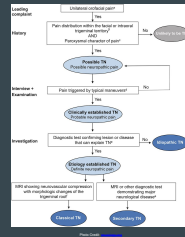
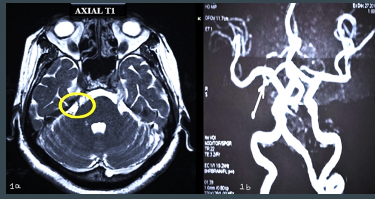


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Trigeminal Neuralgia: Evaluation

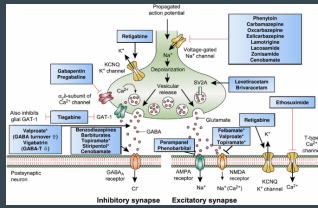


Trigeminal Neuralgia: Treatment

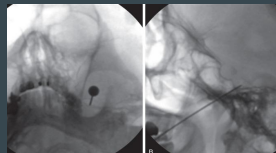
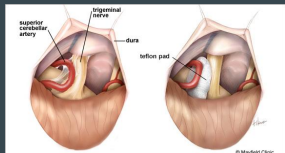
Antiepileptics: Carbamazepine/
Oxcarbazepine

Baclofen is a muscle relaxant that can be used to treat TN. Side effects include dizziness, sedation, and dyspepsia.

Other medications include lamotrigine, phenytoin, gabapentin, clonazepam, and valproic acid



Trigeminal Neuralgia: Treatment



Trigeminal Neuralgia: Interventions

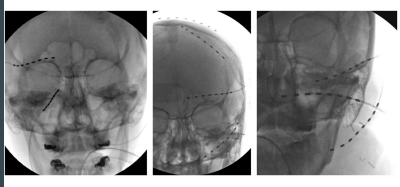


Photo Credit: <https://mian-neurosurgery.com/trigeminal-nerve-stimulation>

CASE

Patient presents with a persistent, burning pain and swelling localized to her left ankle, which manifested abruptly several weeks ago. Despite adhering to conservative measures, including rest, elevation, and over-the-counter analgesics, her symptoms persist unabated. The discomfort has significantly encumbered her ability to perform routine activities, such as walking and standing for prolonged periods, thereby impacting her familial and occupational responsibilities.

Complex Regional Pain Syndrome



<https://dyspareidpne.com/complex-regional-pain-syndrome-crps/>

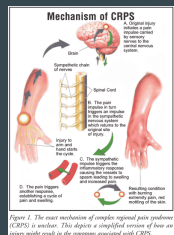


Figure 1. The main mechanism of complex regional pain syndrome (CRPS) is unclear. This depicts a simplified version of how an injury might result in the symptoms associated with CRPS.

Complex Regional Pain Syndrome: Eval

The Budapest Criteria	
1	Sensory Allodynia (aka pain normally not painful situations such as touch, temperature, or movement) Hyperalgesia (heightened pain intensity)
2	Vasomotor Differences in skin temperature (greater than 1°C) Differences in skin colouration between different sides of the body
3	Sudomotor/edema Changes or asymmetry in sweating Changes or asymmetry in swelling
4	Motor/trophic Decreased movement Motor symptoms (weakness, tremors etc) Changes in hair/skin/nails

Photo Credit: <https://pubmed.ncbi.nlm.nih.gov/20155818/>

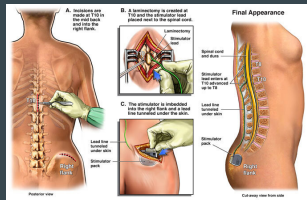
Complex Regional Pain Syndrome: Interventions

EARLY PT

Sympathetic Blocks

Spinal cords stimulation

Dorsal Root Ganglion
Stimulation



Copyright: Credit: Nucleus Medical Media Inc / Alamy
Back Photo

CASE

40-year-old woman presents with chronic, dull aching pain in the lower back and buttock region, radiating laterally toward the iliac crest. She describes the discomfort as constant, exacerbated by prolonged sitting or standing. Despite conservative measures such as rest and non-steroidal anti-inflammatory drugs (NSAIDs), her symptoms persist, significantly impairing her daily activities and mobility. She has been evaluated by neurosurgery, with no surgical recommendations. Has had multiple ESIs performed with no relief. Recently underwent a SI joint injection with no relief. When asked where she experiences pain she point directly to the superior right iliac crest.

Cluneal Neuropathy: Eval

Lower back pain with or without shooting
"Tinel"-like sign
CN is a diagnosis of exclusion typically

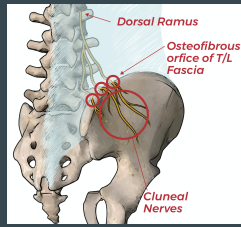


Photo Credit: <https://ichiro.jp.com/blog/essential-skills-to-resolve-cluneal-neuropathy>

Cluneal Neuropathy: Treatment

Initial Treatment Options

Anticonvulsants
Nerve block with ultrasound or flouro
Radiofrequency ablation

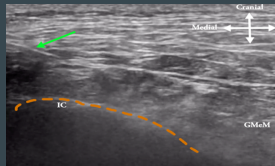


Photo Credit: <https://www.sara.com/news/publications/sara-updates/blog/landing/legacy-by-blog-post/2022/01/10/specialty-cluneal-nerve-block-considerations-for-regional-anesthesia-and-chronic-pain>

Interventional Management

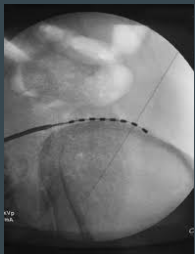


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Conclusion & Take Home Points

- There is incredible potential for interventional of neuropathic pain from spinal procedures, therapeutic blocks and implantable devices.
- We are the in “golden age” of pain - we can set out patients up for success in life while avoid unnecessary opioids
- Having a baseline knowledge of options as a PCP will help you guide patients from initial evaluation and avoid unnecessary opioid management.

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Thank you!

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