Epidural Steroid Injections

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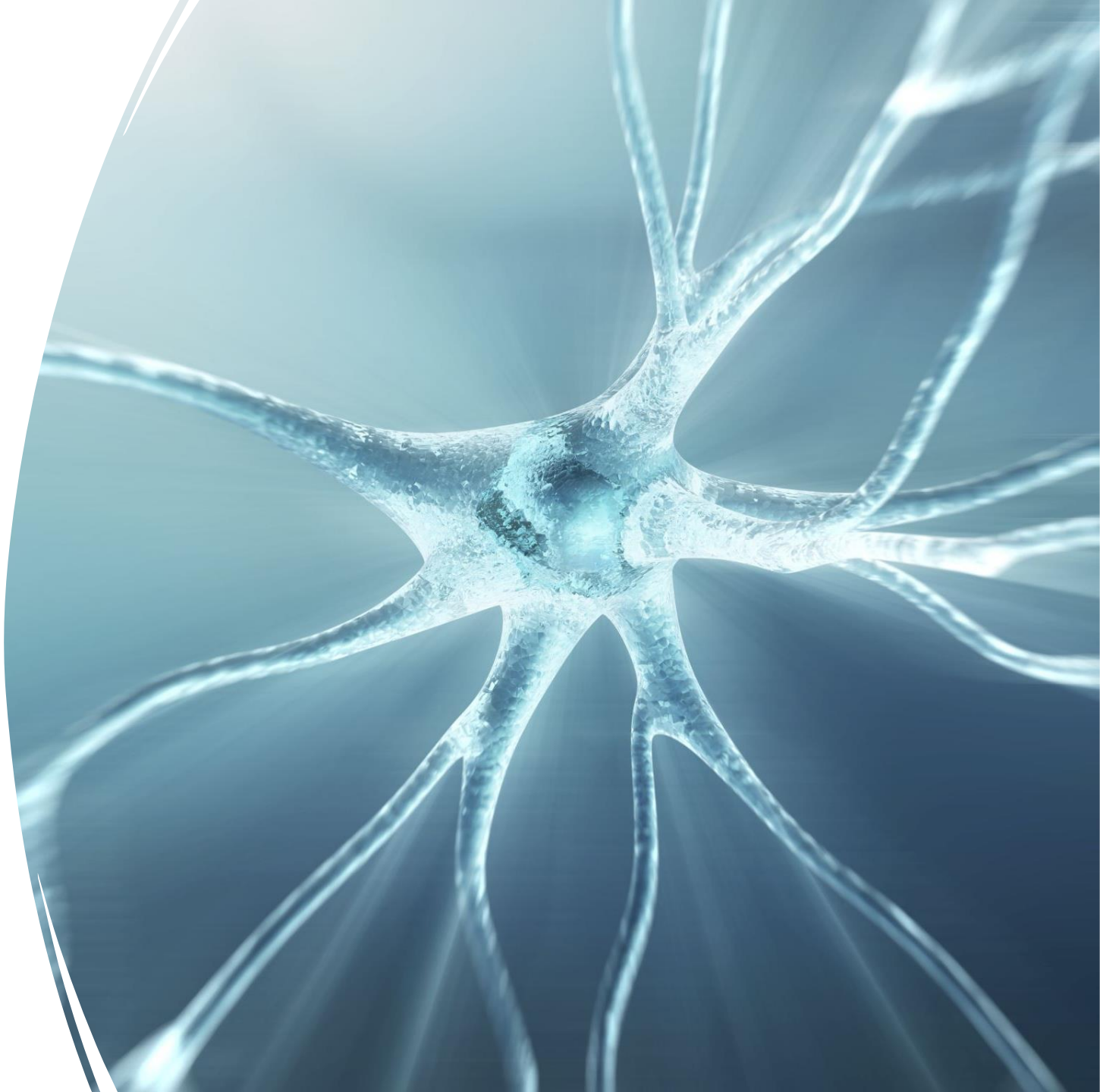
Disclosures

- None

Table of Contents

Indications



Incidence

- Lifetime prevalence of low back pain is 51-84%
- Leading cause of disability
- Incidence of lumbar radiculopathy 13-40%
- Predominantly neuropathic pain in up to 40%

Radiculopathy

- Neurologic conductive loss caused by compression of the spine or exiting nerve roots
- Can include numbness, weakness (myelopathy), and tingling (paresthesia)
- Painful when compression is accompanied by inflammation
- Symptoms often described as “shooting,” “burning,” “electrical”
- Aka “Sciatica” in the lumbar spine

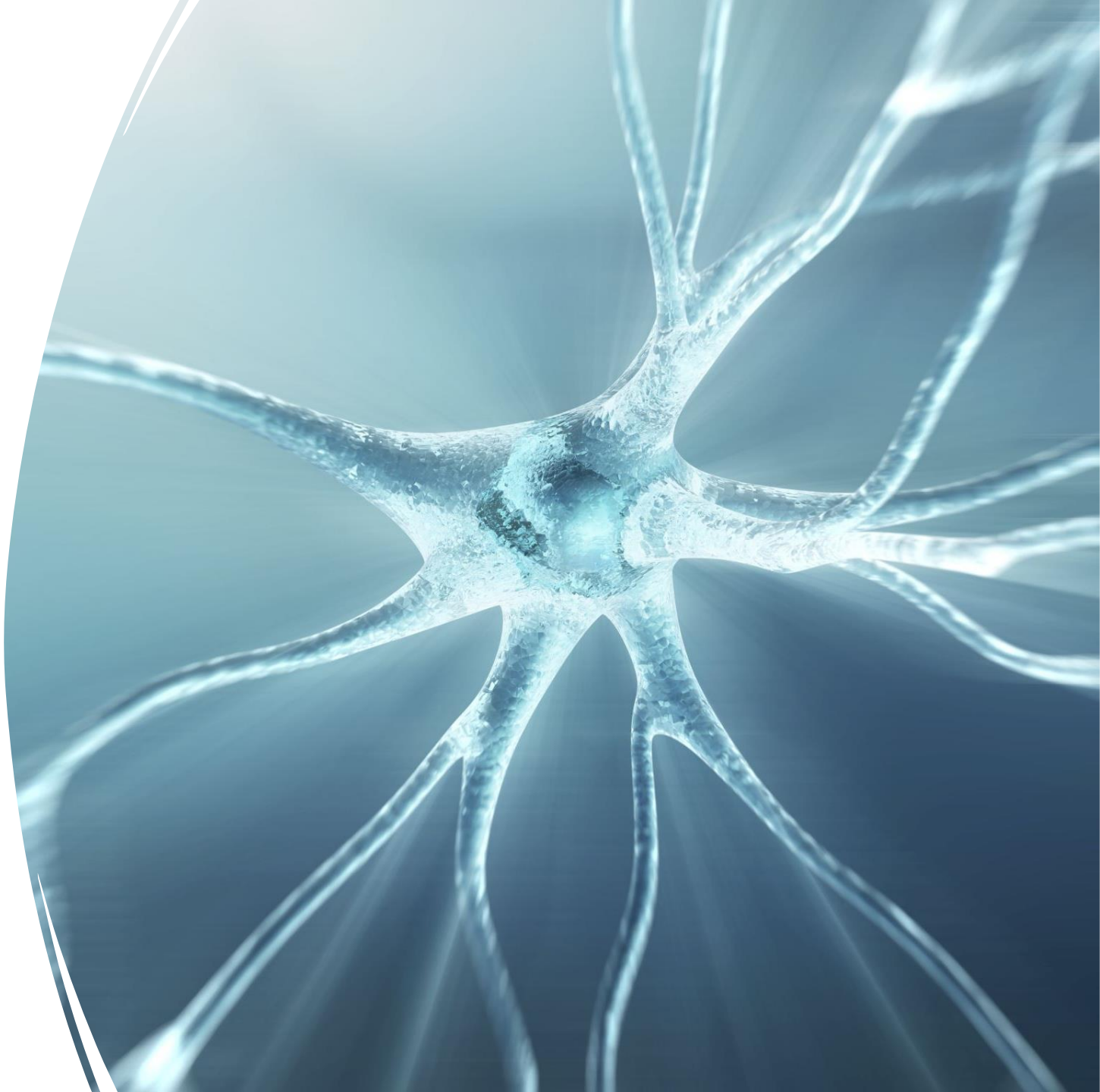
Radiculopathy

- Contributions from degenerative/ bulging discs, lumbar facet hypertrophy, hypertrophied or ossified spinal ligaments, bone spurs, cysts, congenital narrowing of the foramen, infection
  - Herniated disc material contributes to chemical radiculitis
    - IL-6, IL-8, TNF-a have been implicated
  - “Lateral” vs. “Medial” disc herniation relative to nerve root
  - Can dictate direction of antalgia (away vs. toward symptomatic side)

Indications

- Conservative therapies: PT, NSAIDs, antidepressants, membrane stabilizers, muscle relaxers, oral steroids, opioids
- Epidural steroid injections
  - Most performed pain management procedure in the US
  - Reduce pain, shorten duration, improve function, minimize need for additional healthcare services, avoid surgery
  - Fewer risks than opioids, less invasive than surgery
- Surgical intervention
  - Superiority has recently come into question
  - Natural course of cervical and lumbar radiculopathy is slow improvement
  - Conservative treatments can help avoid need for surgery

Physical Exam



Physical Exam

- Provocative maneuvers: designed to stress the intervertebral discs and put pressure on irritated nerves
  - Hip flexion and internal rotation, knee extension, ankle dorsiflexion, cervical flexion
- Palliative maneuvers: relieve disc stress and nerve irritation, promotes symptom resolution/ improvement
  - Hip extension, Knee flexion
- Active vs. passive maneuvers
- Correlation with history and imaging strongly recommended
- Observe for signs of antalgic posture or gait

Physical Exam

Seated	Bechterew	Seated on exam table, extend each leg separately, then both together Stretches sciatic nerve, + elicits radicular pain
	Slump	Hands clasped behind back, slumping posture Tuck chin to chest, extend leg, add passive foot dorsiflexion
	Tripod	Evaluate for hamstring contracture Positive if patient leans back or slumps to relief tension Rule out radiculopathy

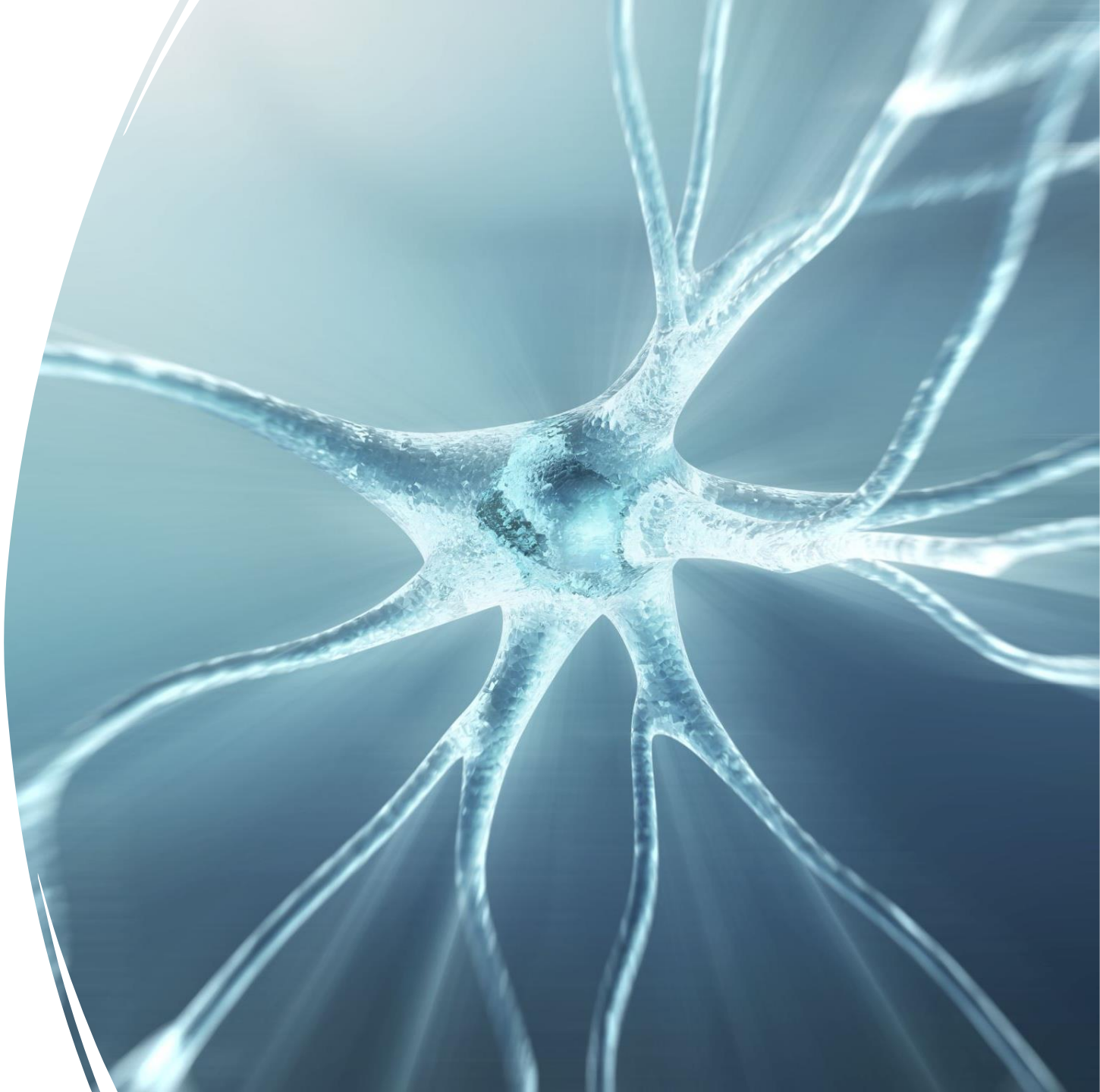
Standing	Neri bowing	Forward flexion, knee of affected side bends to provide relief Pressure/ palpation in popliteal fossa elicits pain
	Kemp standing	Test for signs of neurogenic claudication or lumbar spinal stenosis Spine flexion and lateral rotation toward affected side

Physical Exam

Lateral	Piriformis test	Bend top knee and hip flexed to 60°, straight lower leg Downward pressure on the knee Positive if pain elicited in buttock or posterior knee

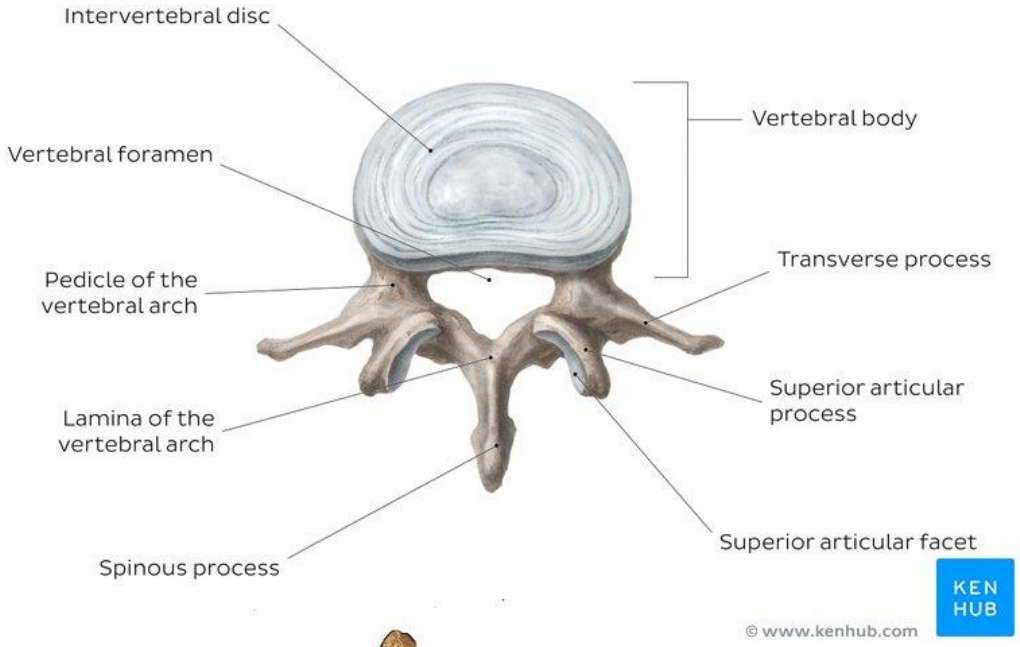
Supine	Straight leg raise	Positive in the 35°-70° range Can add Bragard (ankle flexion) or Neri's (neck flexion) sign
	Crossed straight leg raise (Fajersztajn)	Low sensitivity, high specificity test (confirmatory test) Both legs straight, passive leg raise of unaffected sign Positive if pain elicited in contralateral leg
	Sciatic tension test (Bowstring test)	SLR to elicit symptoms of radiculopathy Lower leg slightly, 20° bend in knee, palpation of popliteal fossa Less reliable than SLR or Slump test

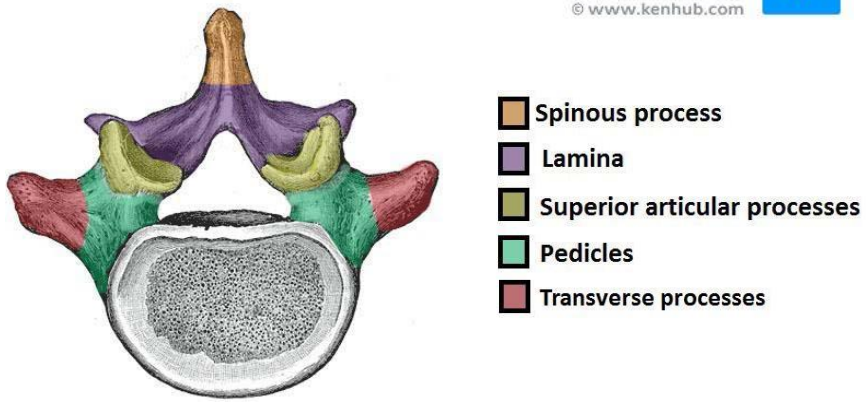
Technique



Spinal Anatomy

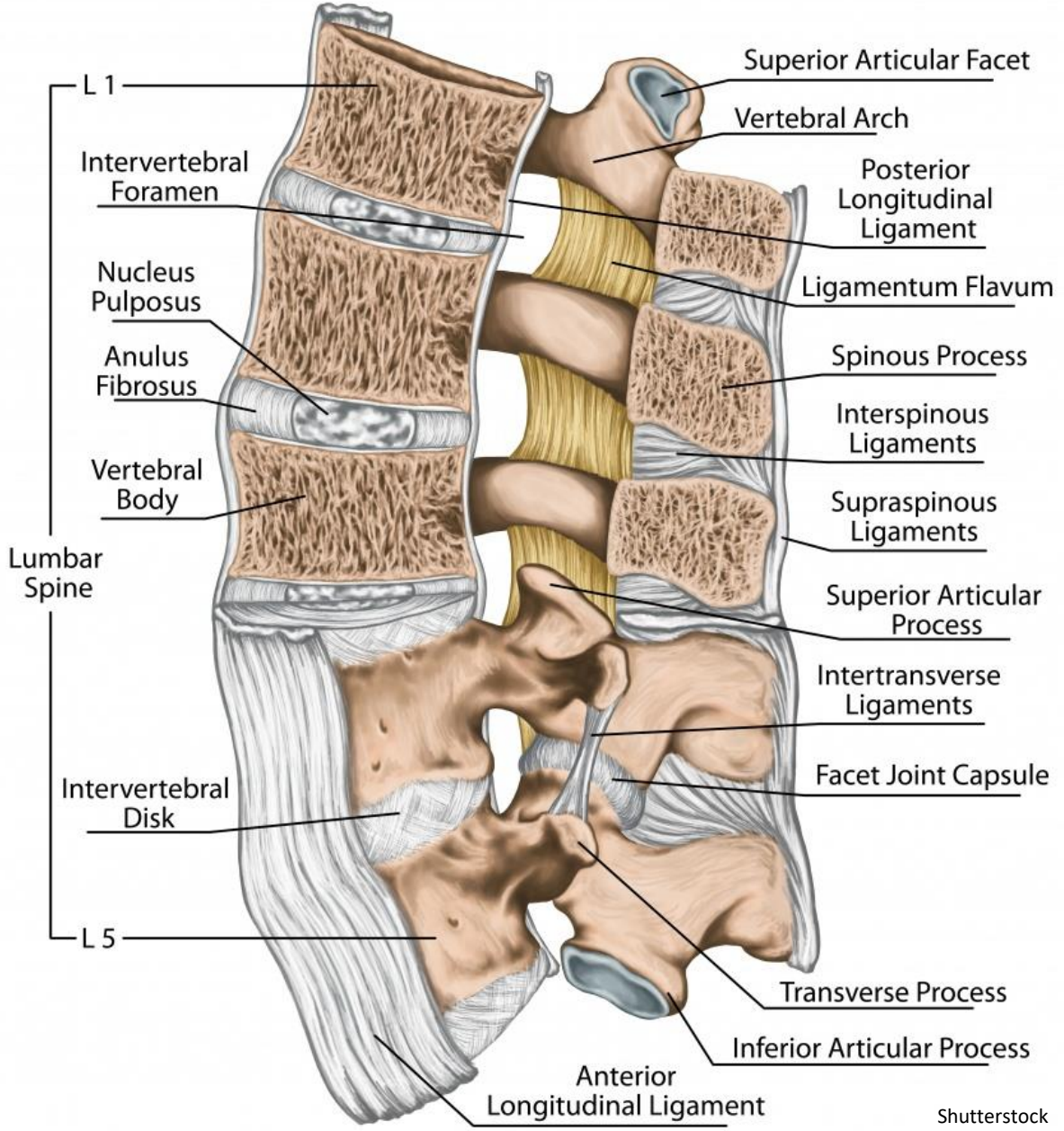
- Vertebral Body
- Spinous Process
- Transverse Process
- Articular Processes
  - Superior, Inferior
- Pedicle
- Lamina
- Nerve Root
- Foramen





Spinal Ligaments

- Anterior and posterior longitudinal ligaments
- Interspinous and supraspinous ligaments
- Intertransverse ligaments
- Ligamentum flavum



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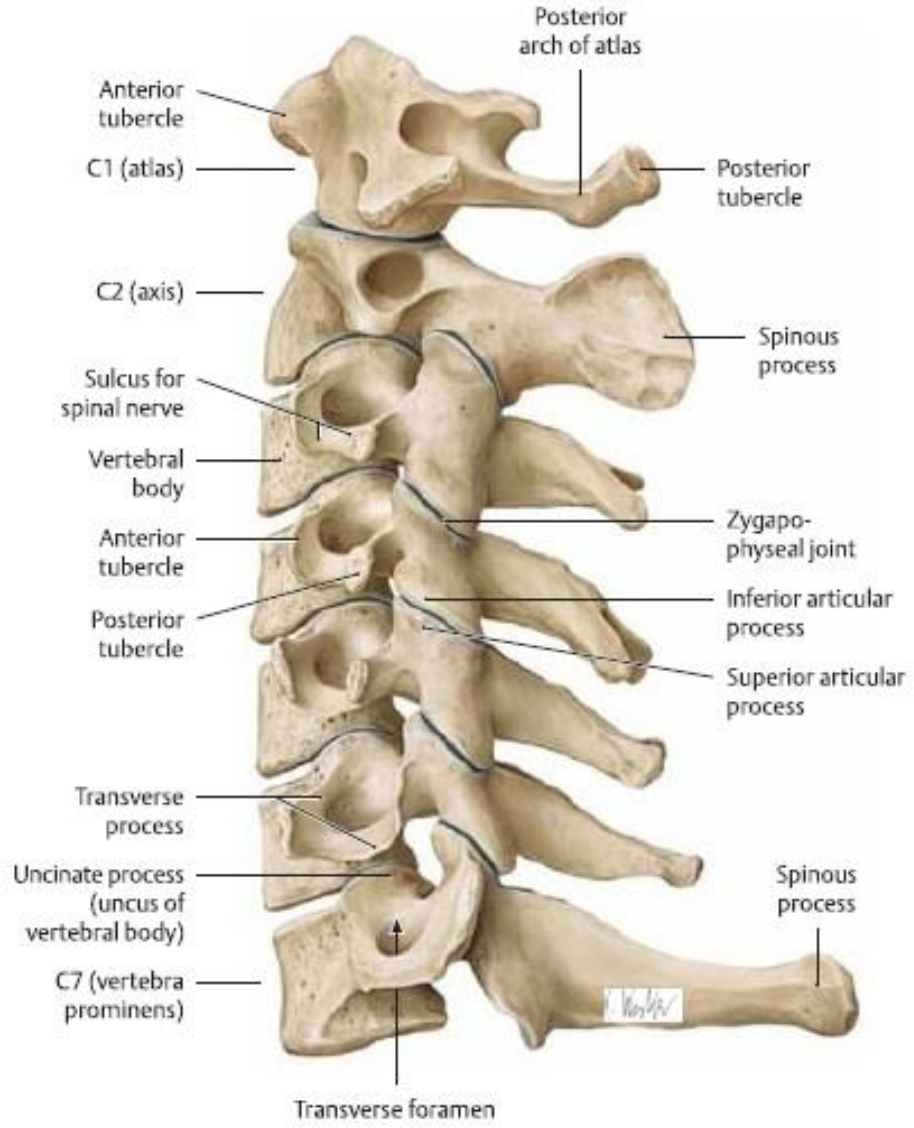
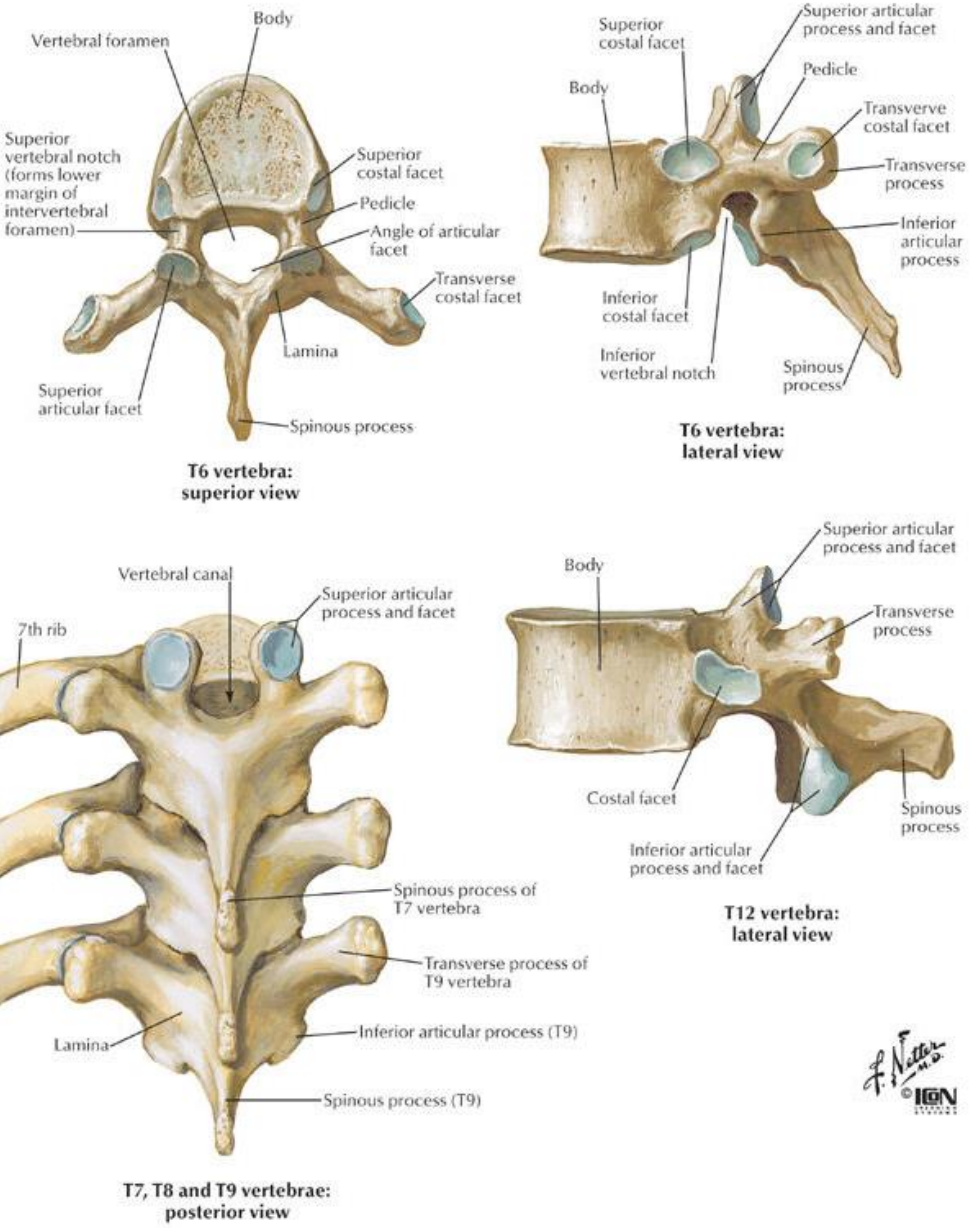
Anatomy of the Cervical Spine

- 7 Cervical vertebrae
- 8 Cervical spinal nerves
- C1 = Atlas
- C2 = Axis



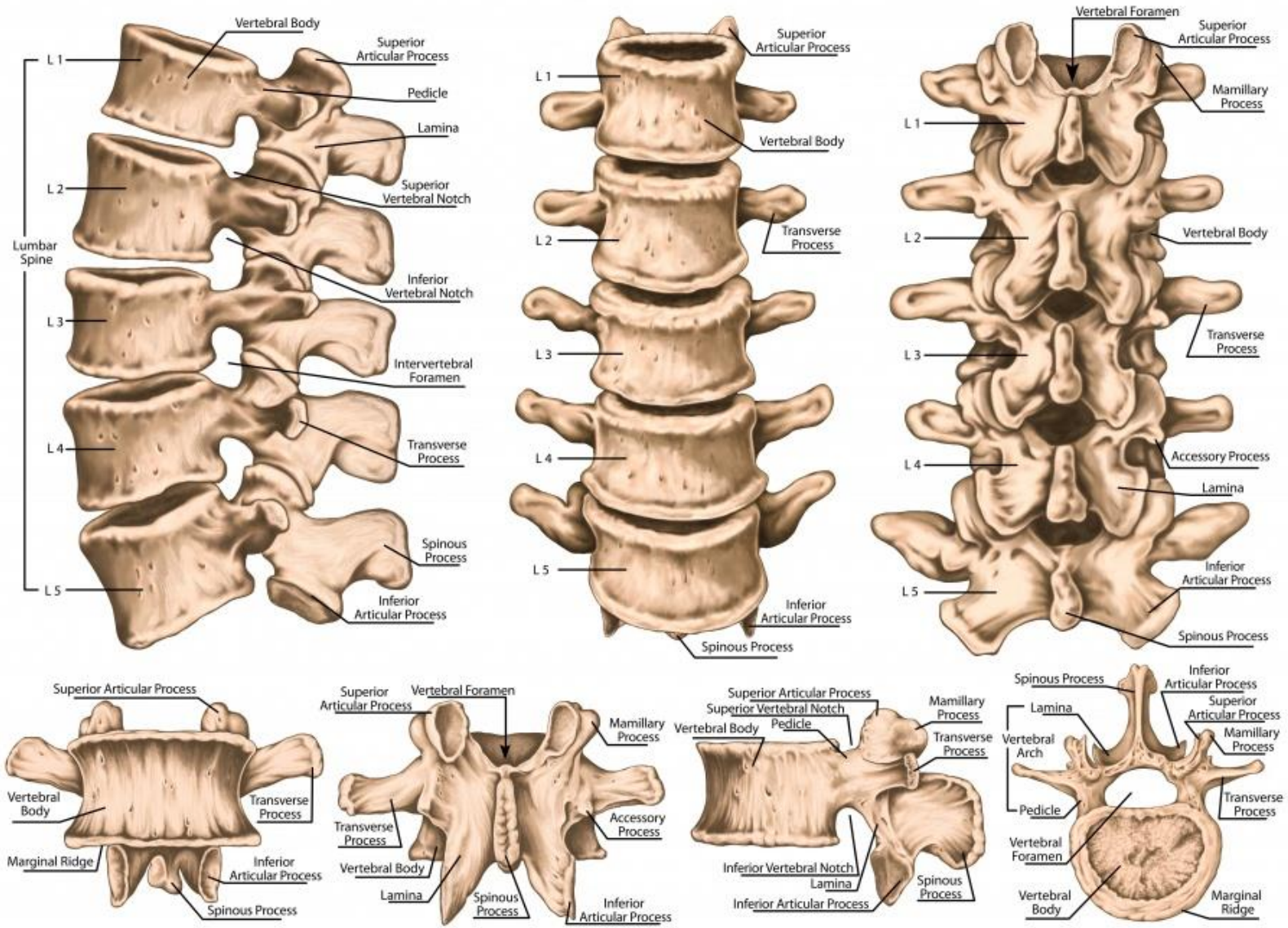
Anatomy of the Thoracic Spine



- 12 Thoracic vertebrae
- Vertebral bodies are heart-shaped, medium in size
- Increasing diameter and thickness
- Laminal are broader, flat, angled
- Spinous processes angled caudally (T1-9 primarily)
- Facet orientation is vertical , limited flexion/ extension

Anatomy of the Lumbar Spine

- 5 Lumbar vertebrae
- Thicker vertebral bodies
- Facet joints have greater mobility for flexion, extension, and rotation



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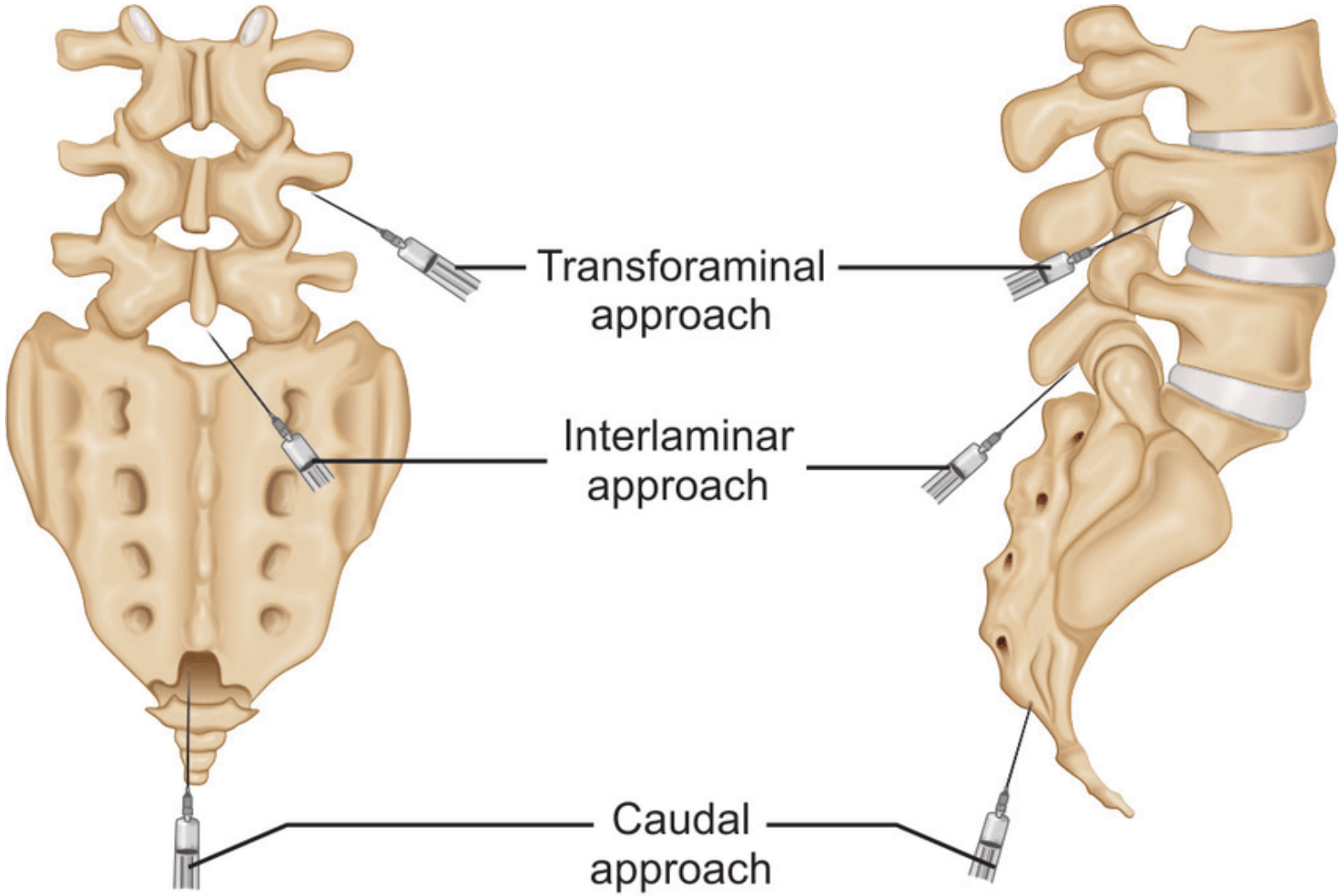
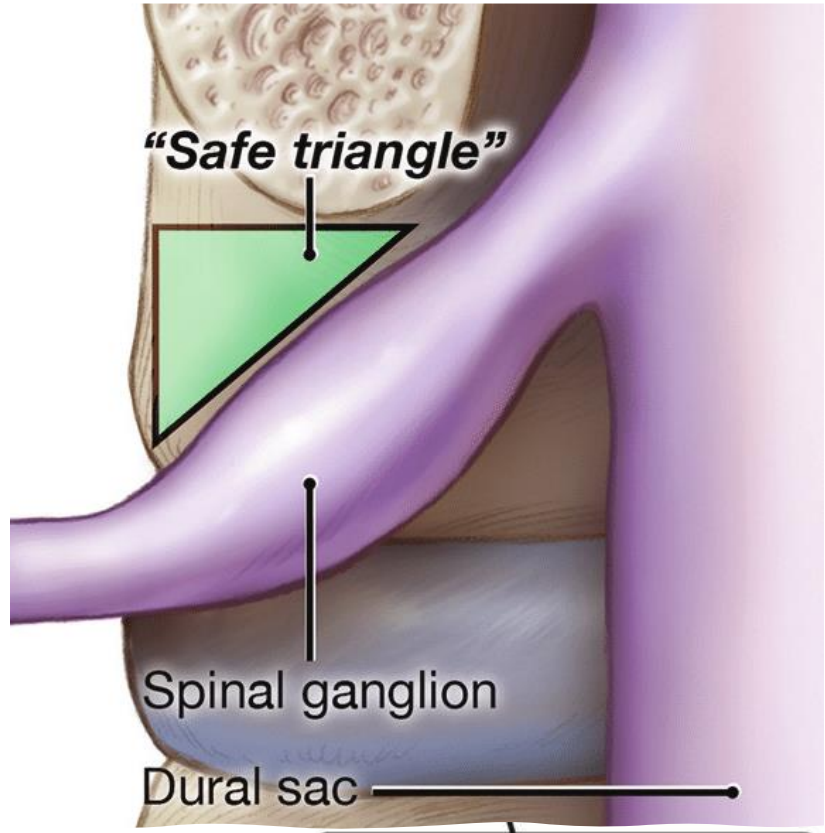
Technique

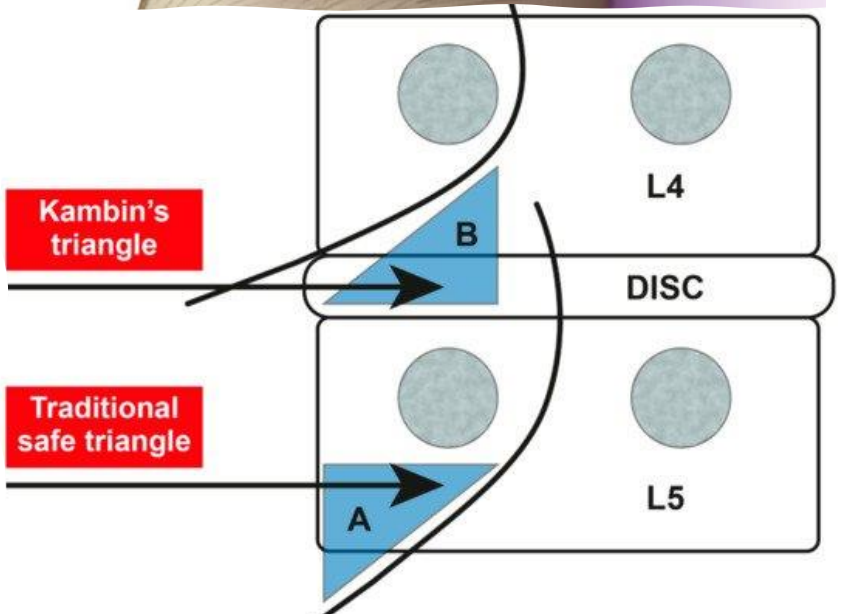
- Interlaminar
- Transforaminal
- Caudal



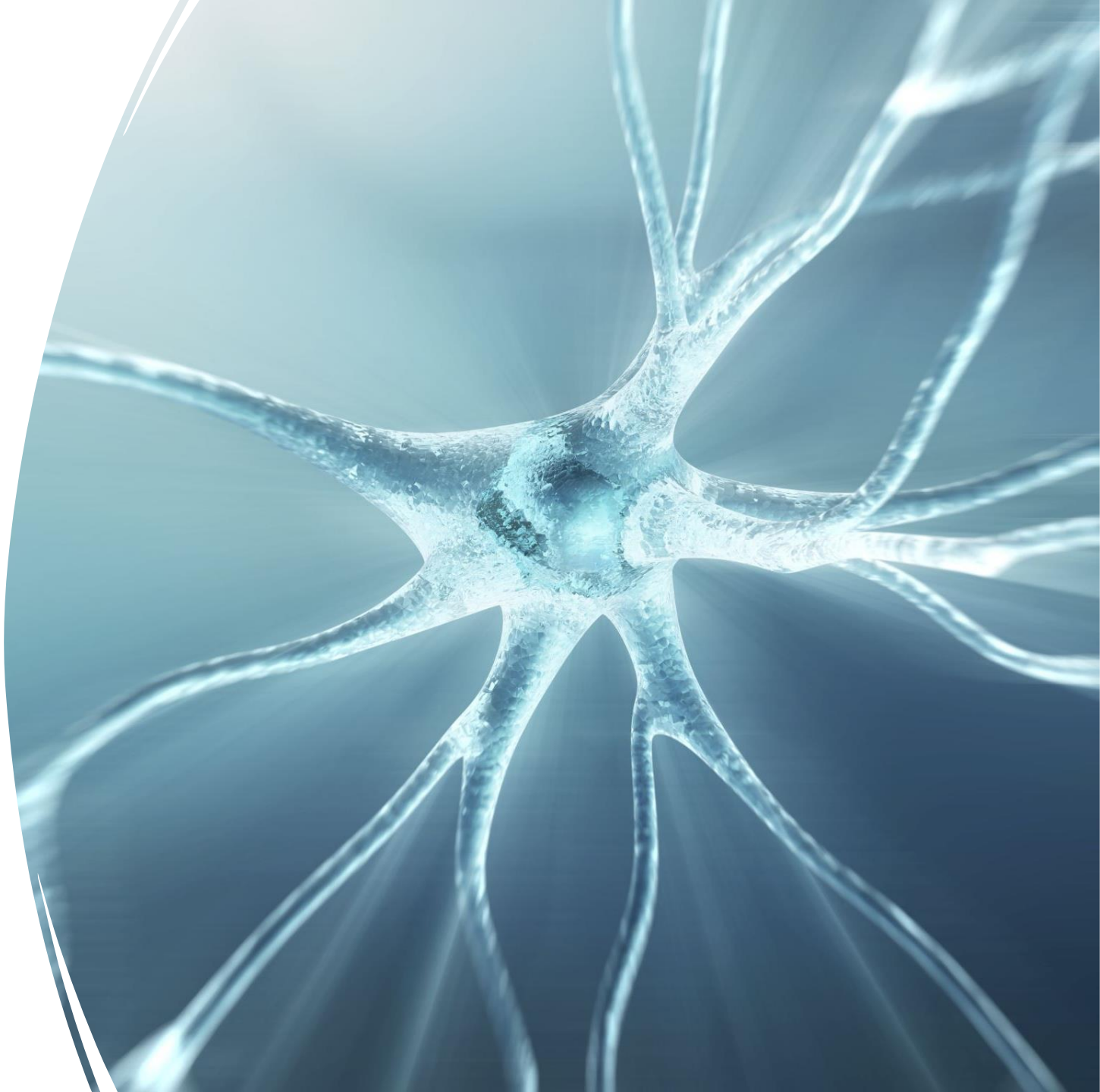
Technique

- Dose limits of epidural steroids:
  - Triamcinolone acetate ≤ 20mg (0.5 to >100µm)
  - Methylprednisolone acetate ≤ 40mg
  - Dexamethasone ≤ 10mg (0.5µm particle size)
- Limit volume for Cervical and Lumbar transforaminal injections to 4 mL
- Needle placement in the ”safety triangle”
  - Alternative approach: Kambin’s triangle



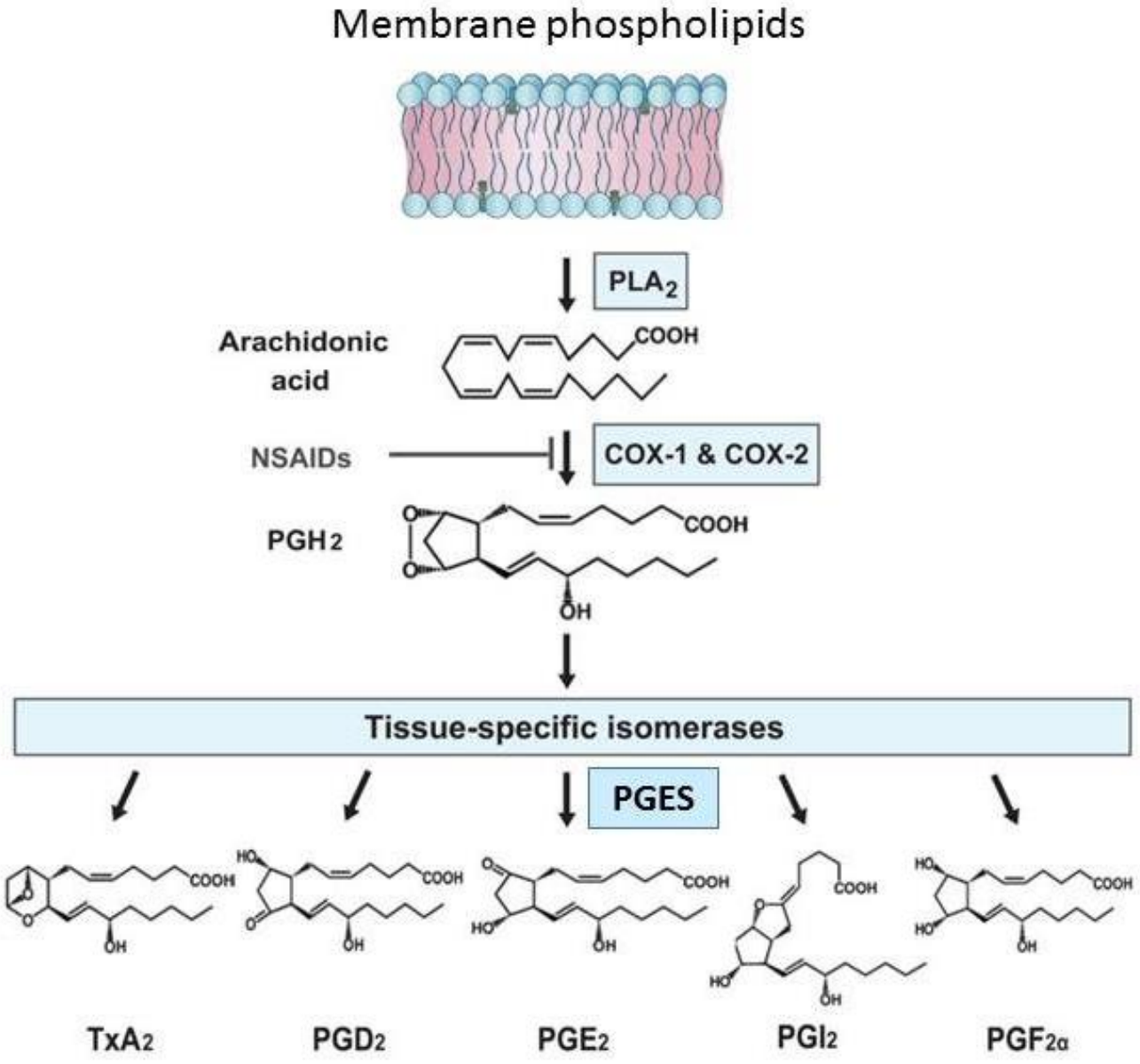


Mechanism of Action

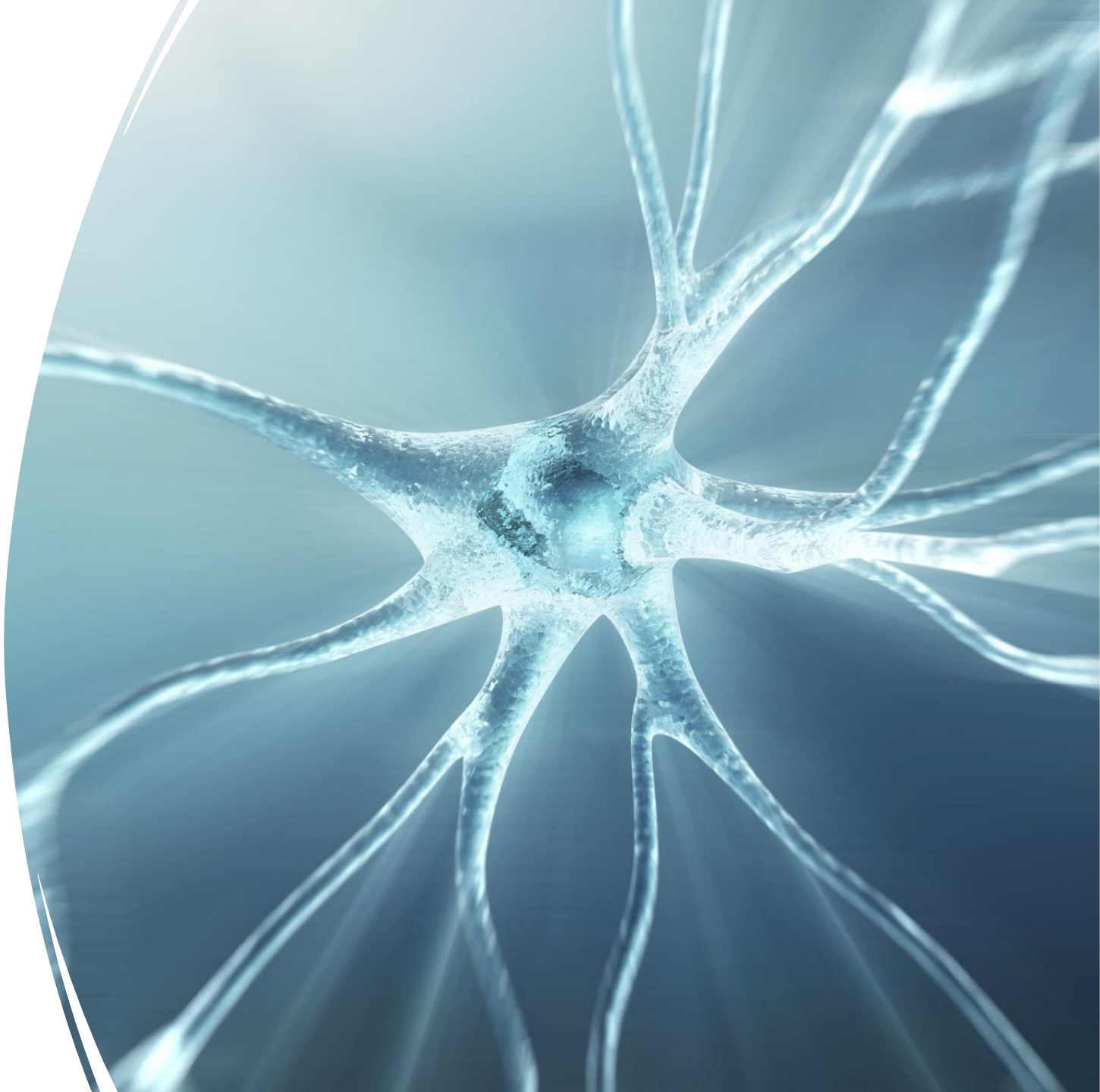


Mechanism of Action

- Corticosteroids inhibit phospholipase A2, which in turn decreases local inflammatory mediators that contribute to painful symptoms of radiculopathy
- Corticosteroids decrease ectopic discharges and slow conduction of unmyelinated nerve fibers
- Local anesthetics improve perfusion of ischemic nerve roots
- Lyse epidural adhesions through lavage of the epidural space



Efficacy



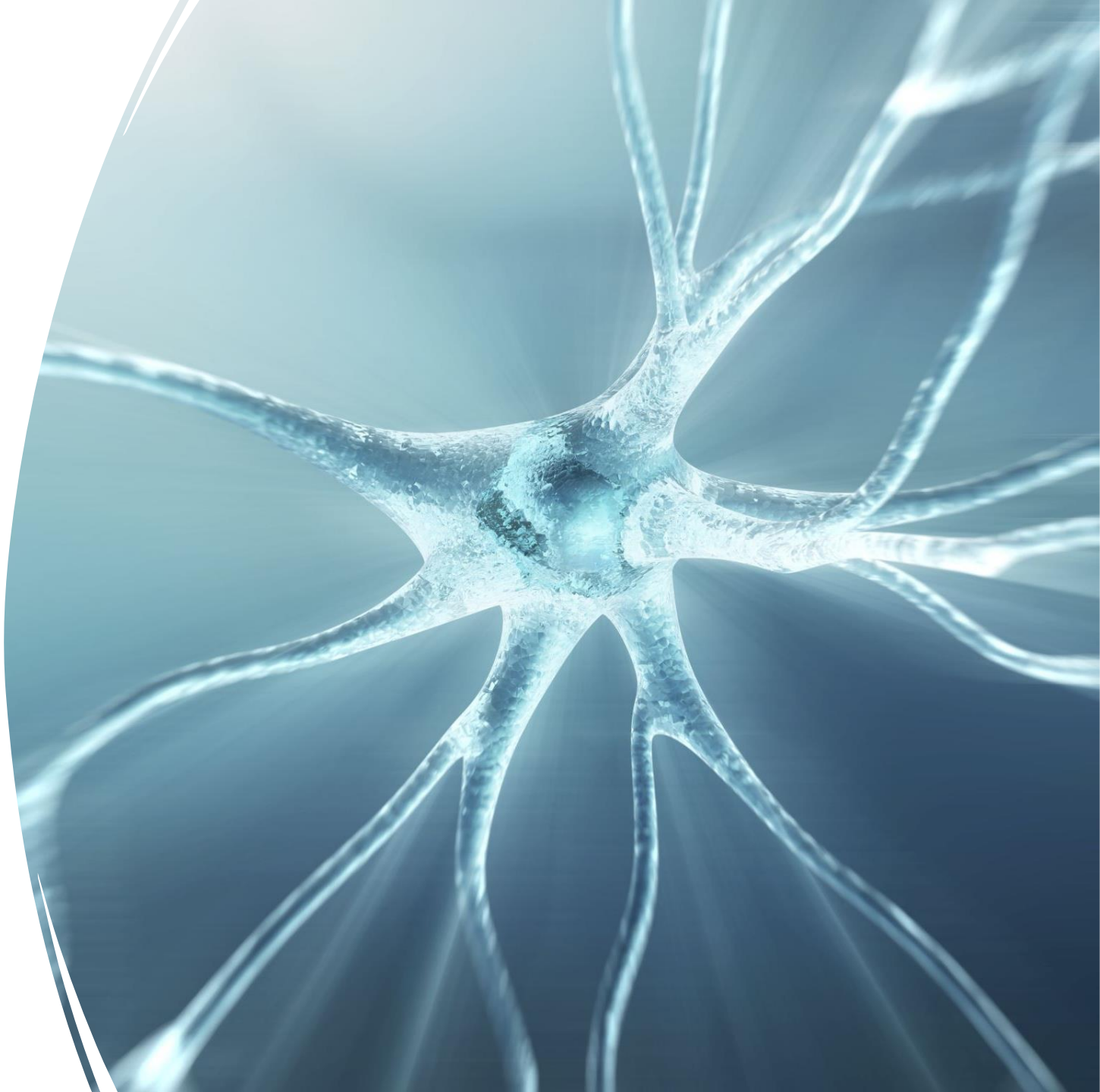
Efficacy

- 45^{+} randomized, placebo-controlled trials
- Transforaminal injection preferred for lumbar radicular pain from disc herniation or stenosis (versus caudal or interlaminar)
- 63% of patients with disc herniation had ≥50% relief at 1 month
- Benefit of persistent pain reduction at 1 year in multiple studies
- Epidural steroid injections shown to decrease rates of surgery in some studies
- Shown to reduce short-term opioid use

Efficacy – Particulate vs. Non-Particulate Steroid

- 7 studies showing comparable efficacy
- 3 studies showing inferiority (effect or duration)
- Baseline pain VAS may impact outcomes, with mild or moderate pain tending to do better overall than severe baseline pain
- One study found that non-particulate injections required more frequent repeat injections
- Multiple studies found superiority of particulate steroid soon after injection (1-2 weeks, 1 month)
  - Discrepancy not observed 3 at 6 months in one study
  - No difference in surgery rates between the 2 groups
- Meta-analysis in 2017 showed non-inferiority of non-particulate steroids for lumbar radicular pain due to disc herniation or stenosis
  - Also recommended non-particulate steroid for cervical epidural injections, citing safety concerns

Complications



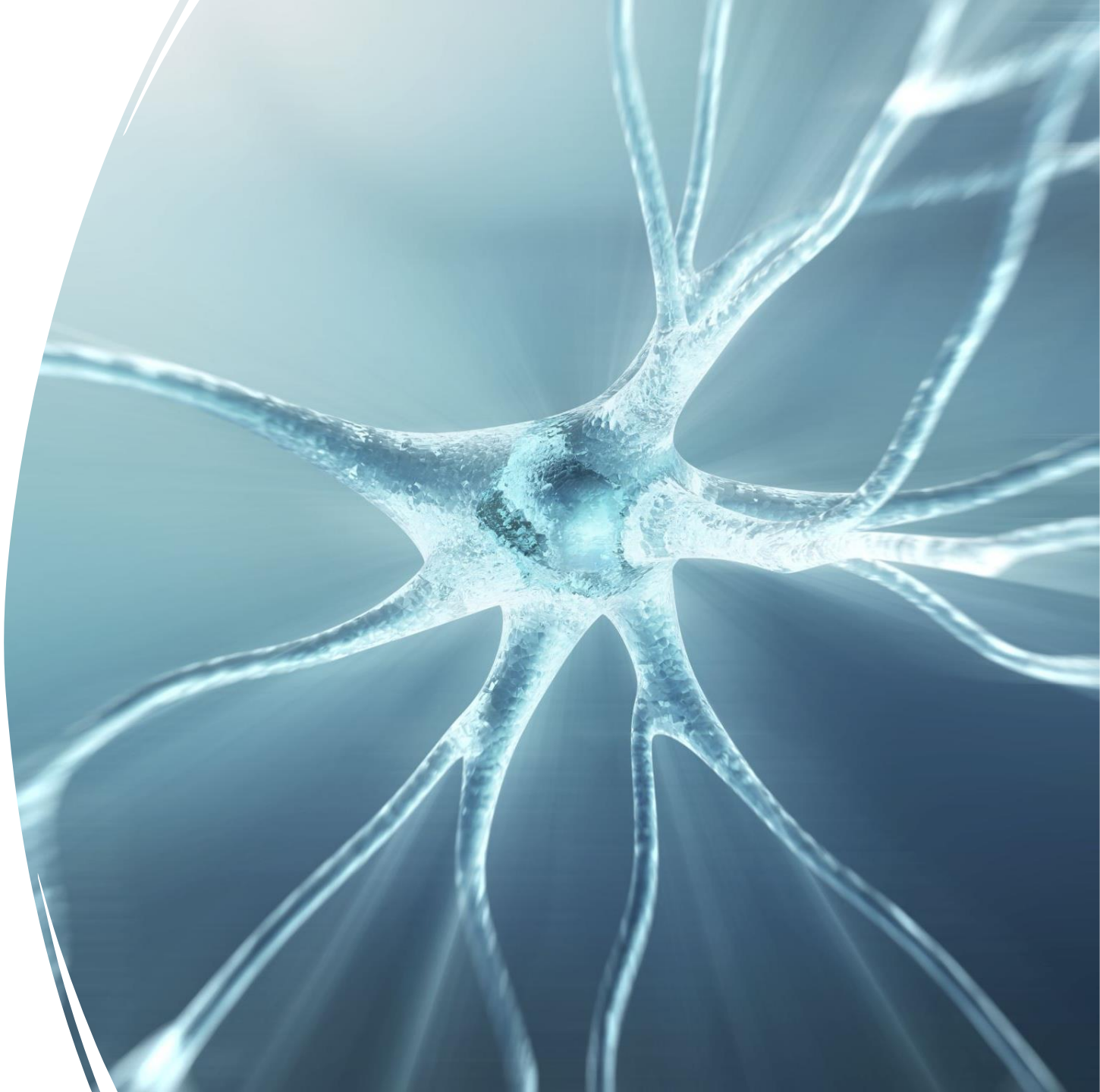
Serious Neurologic Complications

- 90 recorded (1997 – 2014)
  - Compared to 9 million ESI's performed annually
- Paraplegia, quadriplegia, stroke, spinal cord infarction, death
- Unintentional intrathecal injection, epidural hematoma, direct injury to spinal cord arteries, embolic infarction of spinal cord arteries
- Cervical procedures more commonly related, especially due to vascular anatomy and unintentional intra-vascular injection
- Majority occurred after particulate steroid use via transforaminal route
- Those occurring after nonparticulate injection were transient and less severe
- Likelihood of occluding small radiculomedullary arteries feeding the spinal cord increases with particle size, aggregability, and density

Potential for Infection

- Waves of infections linked with contaminated steroid injectate:
  - 2000: methylprednisolone acetate contaminated with *Exophiala dermatitidis*
  - 2010: methylprednisolone acetate contaminated with *Exserohilum rostratum*
- Both times from compounding pharmacies who avoided preservatives thought to cause nerve irritation
- Most commercially available formulations contain preservative
- Preservative-free formulations contain other ingredients to prolong shelf-life and maintain suspensions

Safety



Safety – 2011 Guidelines

- All cervical and lumbar epidural injections performed with fluoroscopy
- A test-dose of contrast should be given prior to injectate
- Transforaminal injections utilize real-time fluoroscopy and/ or digital subtraction
- Avoid deep sedation, elicit patient feed-back during procedure
- Avoid particulate steroid for cervical transforaminal injections, and initial lumbar epidural injections
- Low-volume extension tubing for injection and PPE
- Inject transforaminal local anesthetic prior to steroids
- Limit steroid dose and volume per injection

Safety

- No corticosteroid is approved for epidural injection by the FDA
- 2013: Pfizer requested ban of Depo-Medrol into the epidural space from the FDA
- 2014: all injectable corticosteroids give warning label of “serious neurological events” with epidural injection, although the practice was not banned
- Expert panel assembled in 2014
  - 15 in favor of adding contraindication for cervical transforaminal injections to the label of particulate steroids, with 7 against
  - This consensus was not adopted by the FDA. No alteration to warning label.

Safety

- 2021: FDA published a review of closed claims Medicare database
  - Cervical ESI carry higher risk of adverse neurological event vs. lumbar
  - Cervical TFESI are higher risk thank ILESI
  - Lumbar TFESI are lower risk than ILESI
  - Particulate steroid was not associated with higher incidence of neurological adverse event compared with non-particulates
  - Particulate steroid use with preservatives following inadvertent dural puncture linked to arachnoiditis (39 of 41 reports)

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Questions?