WHIPLASH INJURY

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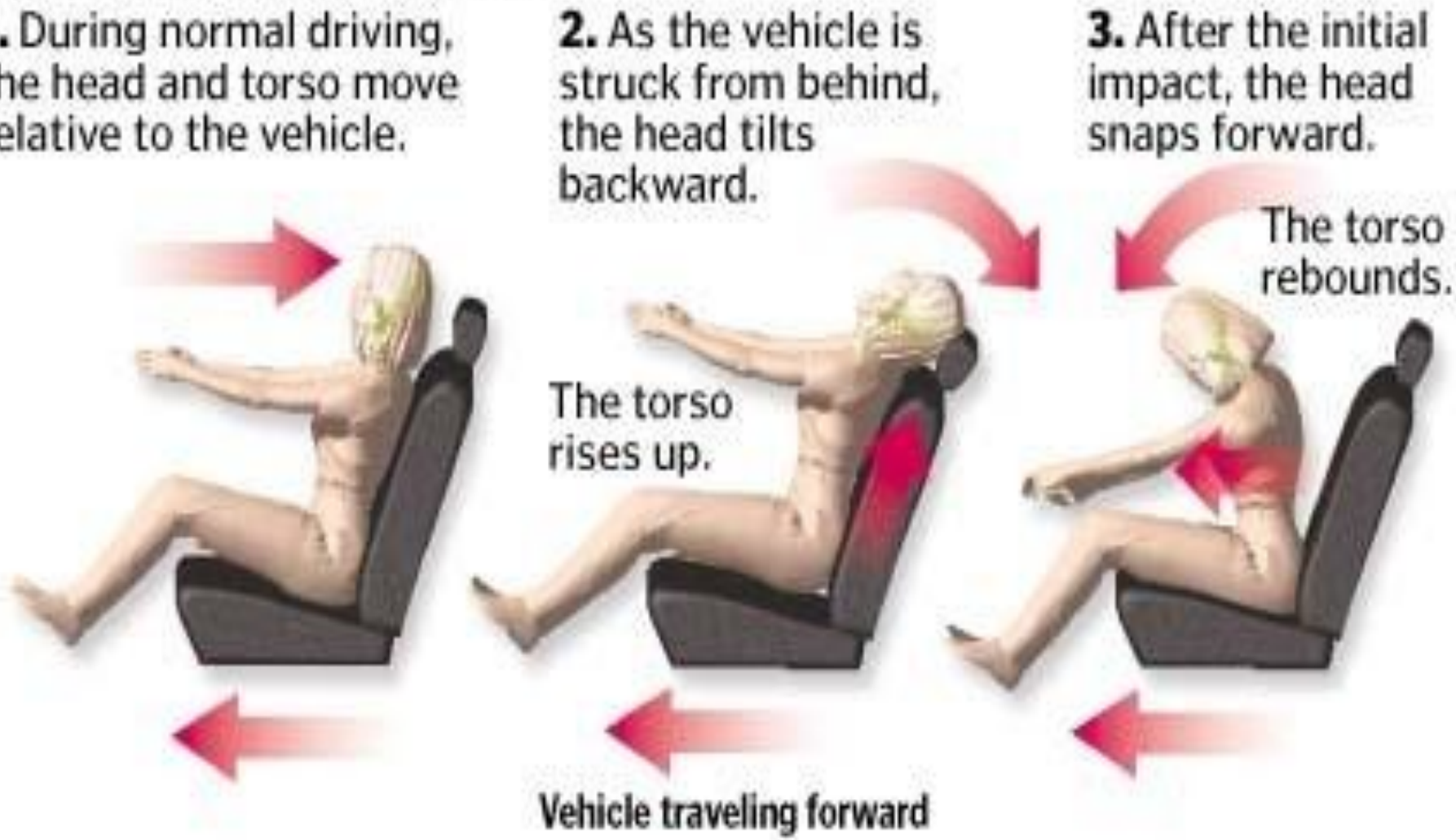
QTF Definition

- The Quebec task force (QTF) on whiplash associated disorders (WAD) defined whiplash
- as "bony or soft tissue injuries" resulting "from rear-end or side impact, predominantly in motor vehicle accidents, and from other mishaps"
- as a result of "an acceleration-deceleration mechanism of energy transfer to the neck"

Spitzer WO, et al. Scientific monograph of the Quebec task force on whiplash-associated disorders: redefining "Whiplash" and its management. Spine. 1995;8S:1S–73S

How whiplash occurs

Motorists involved in rear-end crashes commonly experience whiplash. Injuries to the neck occur as the torso accelerates forward and the neck lags, then the head whips forward.



QTF Grade Classification of WAD

0	No complaint about the neck. No physical sign(s)
I	Neck complaints of only pain, stiffness or tenderness. No physical sign(s)
II	Neck complaints AND musculoskeletal sign(s) Musculoskeletal signs include decreased range of motion and point tenderness
III	Neck complaints AND neurological sign(s) Neurological signs include decreased or absent tendon reflexes, weakness and sensory deficits
IV	Neck complaints AND fracture or dislocation

WAD Clinical Diagnosis

- Neck pain or stiffness
- Arm pain and paresthesias
- Temporomandibular dysfunction
- Headache
- Visual disturbances
- Memory and concentration problems
- Psychological distress

Rodriquez AA, Barr KP, Burns SP. Whiplash: pathophysiology, diagnosis, treatment, and prognosis. Muscle Nerve.2004;29:768–81

Psychosocial Symptoms

- Depression, anger, fear, anxiety, and hypochondriasis may be seen with WAD [1]
- A so-called whiplash profile has been described, which includes high scores on subscales of somatization, depression, and obsessive-compulsive behavior [2]

1. Geothem JW, et al. Whiplash injuries: is there a role for imaging? Eur J Radiol. 1996;22:30–37

2. Cassidy JDDC, et al. Effect of eliminating compensation for pain and suffering on the outcome of insurance claims for whiplash injury. N Engl J Med. 2000;342:1179–86

Most Common X-Ray Findings

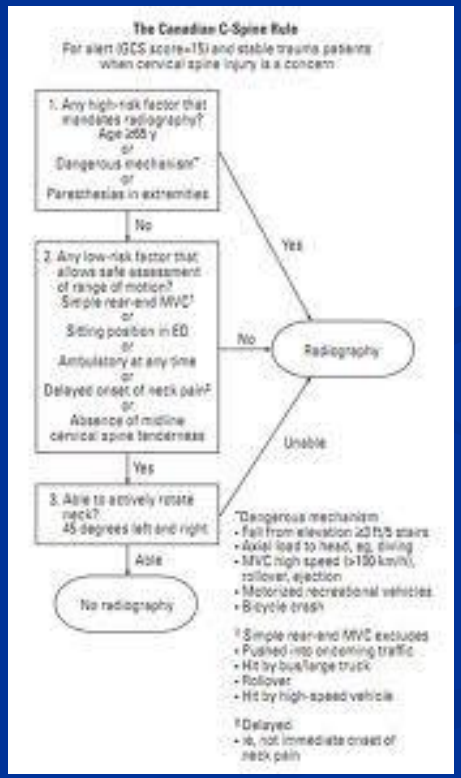
- Preexisting degenerative disease [1]
- Slight loss of the normal lordotic curve of the cervical spine [1]
- Flexion-extension films at the time of injury may also reveal a kyphotic angle. This is thought due to hypermobility at a level adjacent to a level of hypomobility, secondary to muscle spasm [2]

1. Eck JC, Hodges SD, Humphreys SC. Whiplash: a review of a commonly misunderstood injury. Am J Med. 2001;110:651–6

2. Rodriquez AA, Barr KP, Burns SP. Whiplash: pathophysiology, diagnosis, treatment, and prognosis. Muscle Nerve.2004;29:768–81

When to Order C-Spine Films

Canadian C-Spine Rule



Canadian C-Spine Rule

For alert (GCS=15) and stable trauma patients where cervical spine injury is a concern.

1. Any High-Risk Factor Which Mandates Radiography?

Age ≥ 65 years
or
Dangerous mechanism*
or
Paresthesias in extremities

Rule Not Applicable If:

- Non-trauma cases
- GCS < 15
- Unstable vital signs
- Age < 16 years
- Acute paralysis
- Known vertebral disease
- Previous C-spine surgery

No

Yes

2. Any Low-Risk Factor Which Allows Safe Assessment of Range of Motion?

Simple rearend MVC**
or
Sitting position in ED
or
Ambulatory at any time
or
Delayed onset of neck pain***
or
Absence of midline c-spine tenderness

No → Radiography

Yes

3. Able to Actively Rotate Neck?

45° left and right

Unable → Radiography

Able

No Radiography

*** Dangerous Mechanism:**

- fall from elevation ≥ 3 feet / 5 stairs
- axial load to head, e.g. diving
- MVC high speed (>100km/hr), rollover, ejection
- motorized recreational vehicles
- bicycle struck or collision

**** Simple Rearend MVC Excludes:**

- pushed into oncoming traffic
- hit by bus / large truck
- rollover
- hit by high speed vehicle

***** Delayed:**

- i.e. not immediate onset of neck pain

MRI and CT

- MRI is not generally indicated at initial presentation due to high false positive results

CT and MRI are reserved for:

- Suspected disc or spinal cord injury
- Fracture
- Ligamentous injury
- Persistent arm pain, neurologic deficits, or clinical signs of nerve root compression

Geothem JW, et al. Whiplash injuries: is there a role for imaging? Eur J Radiol. 1996;22:30–37

Incidence

- Based on US population evaluation
- Neck pain following WAD is common
- More than 300 persons per 100,000 population evaluated each year

Quinlan KP, Annest JL, Myers B, et al. Neck strains and sprains among motor vehicle occupants-United States, 2000. Accid Anal Prev 2004;36(1):21-27

Predictors of Poor Prognosis

- Increased symptom severity
- Neurological signs
- Feelings of helplessness in controlling pain
- Fear of movement
- Catastrophizing
- Anxiety
- Low educational level

Berglund A, Alfredson L, Jensen I et al. Occupant- and crash-related factors associated with risk of whiplash injury. Ann Epidemiol 2003;13(1):66-72

Chronic Work Impairment

- Hospital population studies at an average 2 year follow-up report
- 20-45% of patients with soft tissue neck injuries after WAD complained of pain sufficient to interfere with capacity to work

Merskey H, Teasell RW. Problems with insurance-based research on chronic pain. Med Clin North Am 2007;91(1):31-43

Economic Burden

- $3.9 billion estimated annually in the US including medical care, disability, and sick leave [1]
- Greater than $29 billion if litigation is included [2]

1. Eck JC, Hodges SD, Humphreys SC. Whiplash: a review of a commonly misunderstood injury. Am J Med. 2001;110:651–6

2. Macnchikanti L, Singh V, Rivera J, et al. Prevalence of cervical facet joint pain in chronic neck pain. Pain Physician 2002;5:243-249 Freeman MD. A review and methodologic critique of the literature refuting whiplash syndrome. Spine. 1999;24:86–98

Acute Treatment

- WAD are difficult to treat due to complex interactions of psychosocial, legal, and physical factors that make effective treatment highly variable among different patients
- Initial treatment has traditionally included a soft cervical collar to restrict cervical range of motion
- More recent studies suggest, that early mobilization may lead to improved outcomes and that rest and motion restriction may delay recovery

Borchegrevnik GE, Kaasa A, McDonagh D, et al. Acute treatment of whiplash neck sprain injuries. Spine 1998

WAD Treatment

- **Clinical guidelines for best practice management of acute and chronic whiplash-associated disorders.** South Australian Centre for Trauma and Injury Recovery (TRACsa) 2008
- Acute pathway: 0-12 weeks
- Chronic pathway: greater than 12 weeks

Acute WAD Pathway

- Active exercise including functional, range of motion, strengthening of neck and scapular muscles and strengthening of deep neck flexors
- Advise ‘act as usual’, reassurance and education
- Short term NSAIDs and non-opioid analgesics
- Passive modalities: heat, massage, TENS & U/S
- No collars
- Trigger point injections *
- Greater Occipital Nerve Blocks for occipital neuralgia *

Chronic WAD Pathway

- Continue exercise including an active treatment component , reassurance and education
- Vestibular rehabilitation for chronic dizziness
- Trigger point injections
- Radiofrequency neurotomy after positive diagnostic medial branch facet blocks
- Cognitive behavioral therapy
- No collars, rest, analgesic injections or Botox
- Greater Occipital Nerve Blocks *

Cervical Pain Treated in Pain Clinics

- -Facet (zygaphophyseal) joints
- -Whiplash associated disorders (WAD)
- -Radiculopathies (disc herniation)
- -Spondylosis and myelopathy
- -Cervicogenic headache
- -Myofascial
- -Peripheral nerve entrapments
- -Arthritis
- -Failed surgery (postlaminectomy syndrome)
- -Neuropathic pain & CRPS

Most Common Cause of Chronic Neck Pain is Cervical Facet Joint

- In pain clinics this is the overall basis about 60% (50-70%) of the time [1]
- In all whiplash patients with high impact speeds it is the cause in about 74% (65-83%) of the cases [2]
- In rehabilitation clinic patients it accounts for at least 36% (27-45%) of occurrences [3]

1. Macnchikanti L, Singh V, Rivera J, et al. Prevalence of cervical facet joint pain in chronic neck pain. Pain Physician 2002;5:243-249

2. Gibson T, Bogduk N, Macpherson J, et al. The accident characteristics of whiplash associated chronic pain. J Musculoskeletal Pain 2000;8:87-95

3. Speldewinde GC, Bashford GM, Davidson IR. Diagnostic cervical zygapophysial joint blocks for chronic cervical pain. Med J Aust 2001;174:174-176

Radiofrequency Medial Branch Neurotomy

- No other form of treatment for neck pain is as effective as cervical rhizotomy according to three independent reviews

Fishman, Scott, Jane Ballantyne, James P. Rathmell, and John J. Bonica. *Bonica's Management of Pain.* Baltimore, MD: Lippincott, Williams & Wilkins, 2010:1473

Centre for Health Services and Policy Branch. Percutaneous radio-frequency neurotomy treatment of chronic cervical pain following whiplash injury. Vancouver, University of British Columbia, British Columbia Office of Health Technology Assessment 01:5T;2001

Cousins MJ, Walker S. Chronic pain: management stategies that work. Anaest Analg 2001;92(suppl):15-25

Boswell MV, Shah RV, Everett CR, et al. Interventional techniques in the management of chronic spinal pain; evidence-based practice guidelines. Pain Physician 2005;8:1-47

Medial Branch RF Neurotomy

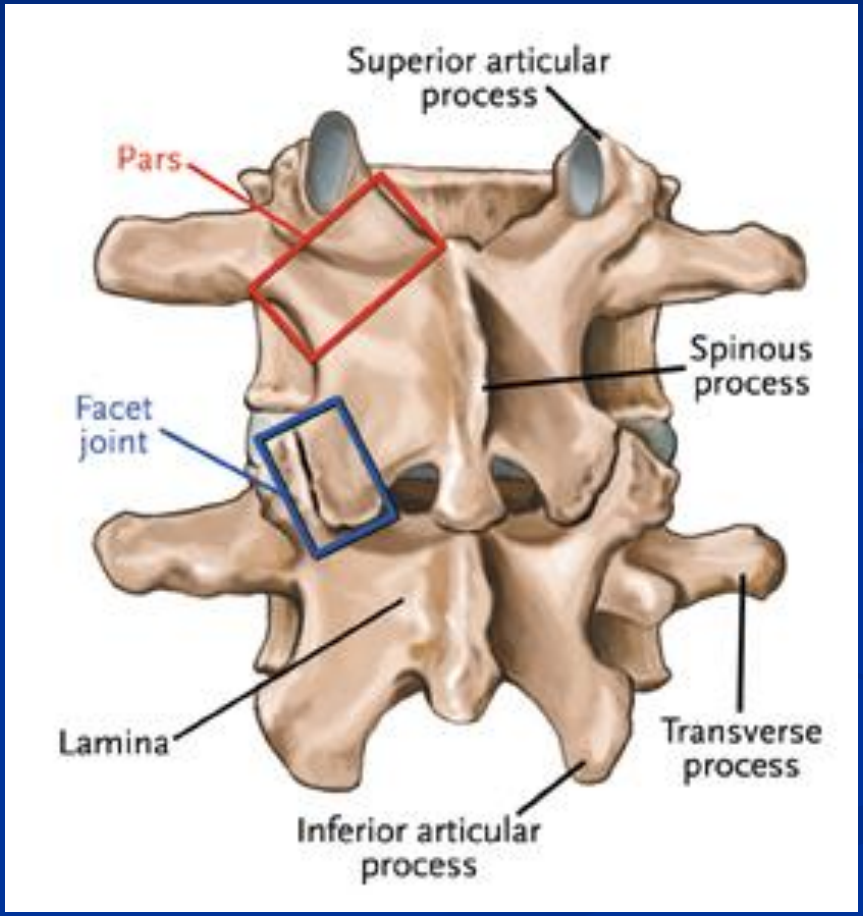
- At least 64% of patients had complete pain relief for an average of about 14 months [1,2,3]
- People with at least 90 days of relief had an 82% chance of further success with a repeat of the treatment [1,3]

1. Fishman, Scott, Jane Ballantyne, James P. Rathmell, and John J. Bonica. *Bonica's Management of Pain*. Baltimore, MD: Lippincott, Williams & Wilkins, 2010:1473

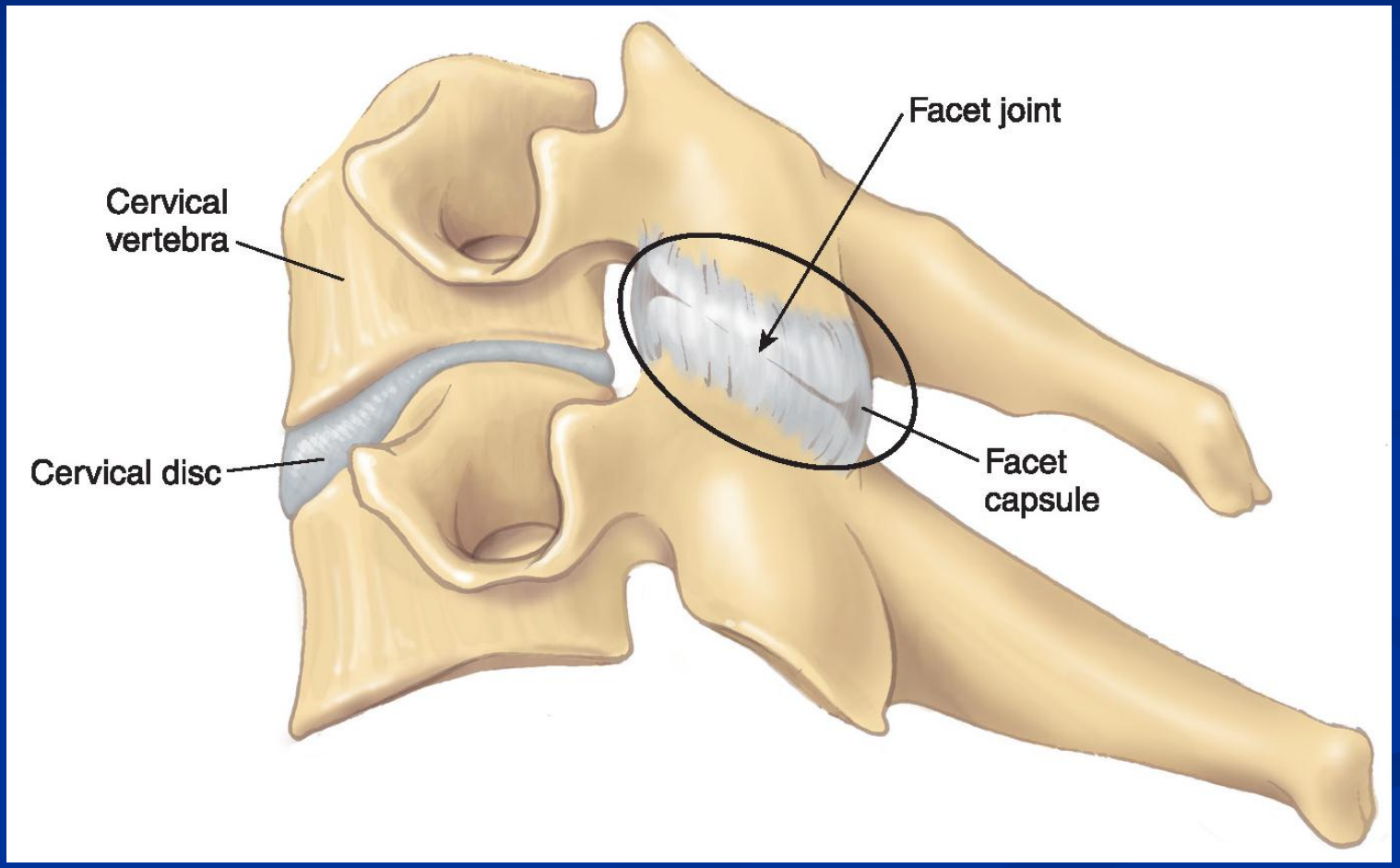
2. Lord SM, McDonald GJ, Bogduk N. Percutaneous radiofrequency neurotomy of the cervical medial branches: a validated treatment for cervical zygapophysial joint pain. Neurosurg Q 1998; 8:288-308

3. McDonald GJ, Lord SM, Bogduk N. Long-term follow up of patients treated with cervical radiofrequency neurotomy for chronic neck pain. Neurosurgery 1999:45:61-68

Facet Joint (A-P)



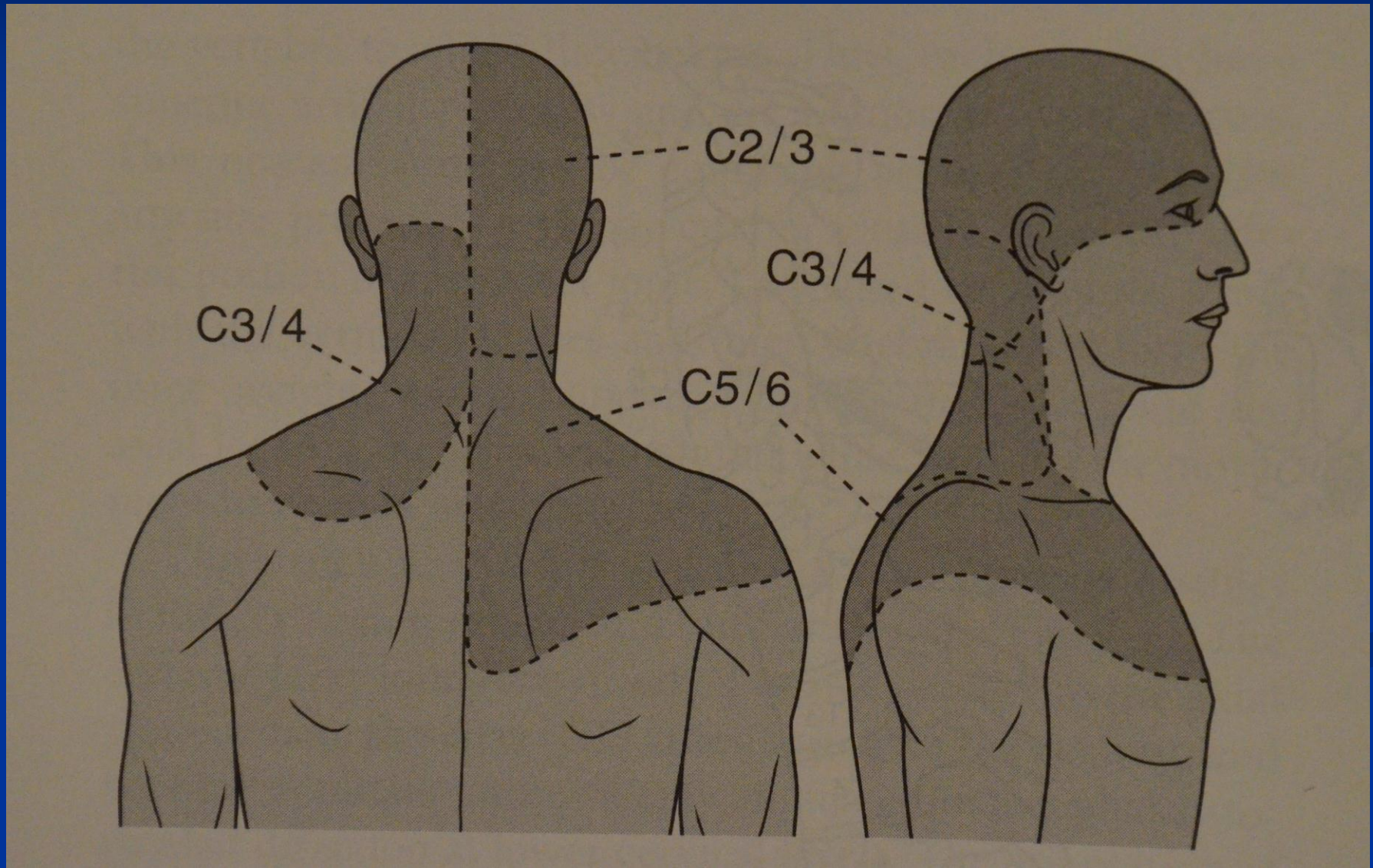
Facet Joint (Lateral)



Facet Joint Innervation

- Facet joints are innervated by the medial branch of the dorsal ramus of spinal nerves
- There is dual innervation from the corresponding level and the level above

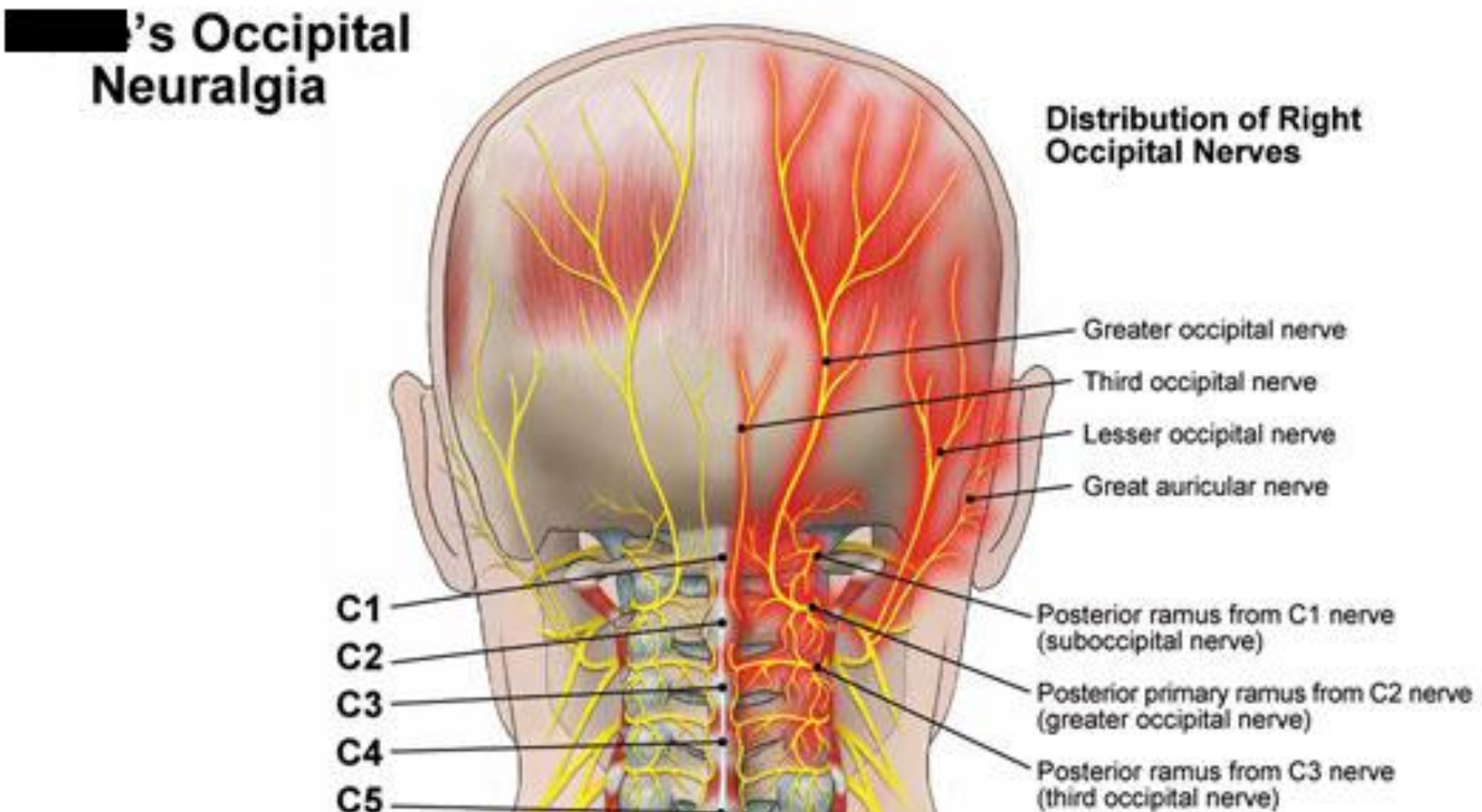
Cervical Facet Pain Referral Patterns



Occipital Nerve Origins

- Greater Occipital Nerve (GON) is the medial branch of the dorsal ramus of C2
- TON is the medial branch of the dorsal ramus of C3
- Lesser Occipital Nerve is not a medial branch nerve. It is one of the cutaneous branches of the cervical plexus, formed by the ventral rami of the upper 4 cervical spinal nerves

Occipital Nerves



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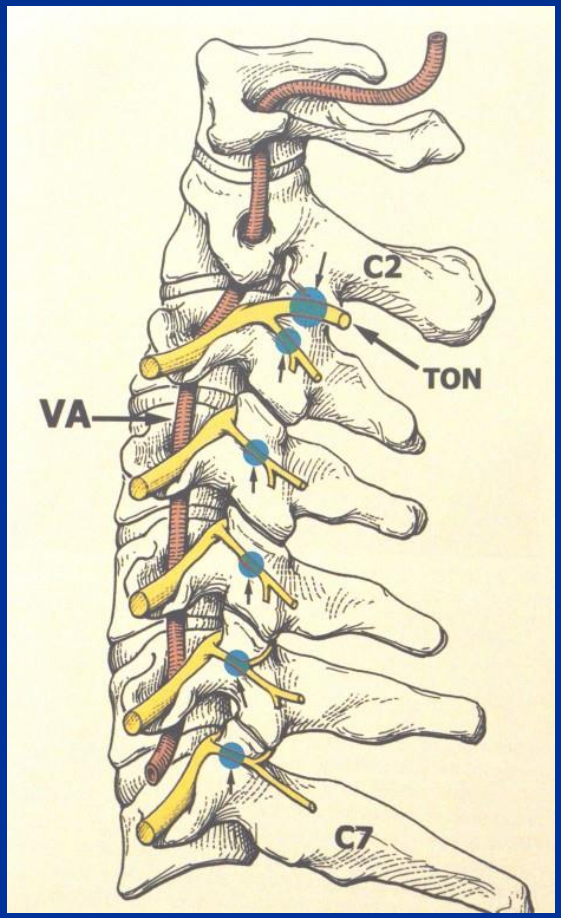
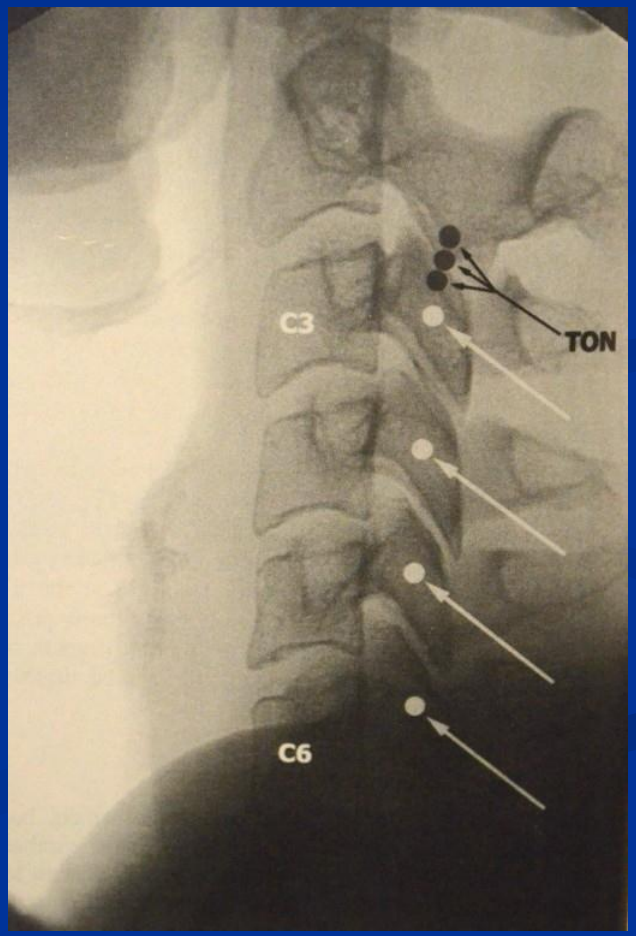
Medial Branch Block and Radiofrequency Target

- Midportion of the articular process usually.



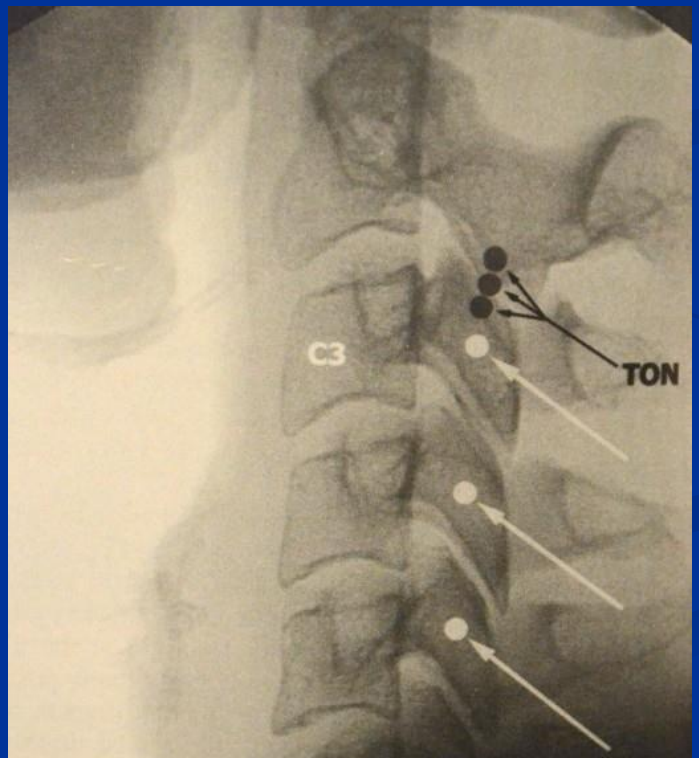


The Third Occipital Nerve (TON) is the Exception

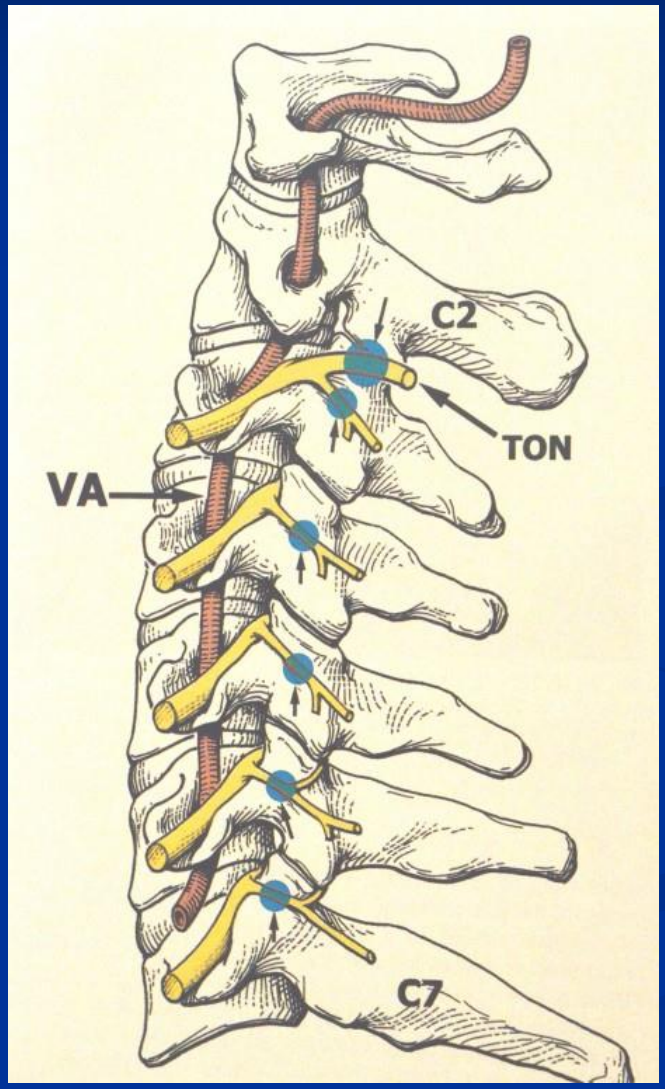
- The TON, the medial branch of the dorsal ramus of C3, runs transversely across the lateral aspect of the C2-3 facet joint and may be at a level anywhere between opposite the apex of the C3 superior articular process to opposite the bottom of the C2-3 intervertebral foramen

The TON Requires Three (3) Separate Blocks:

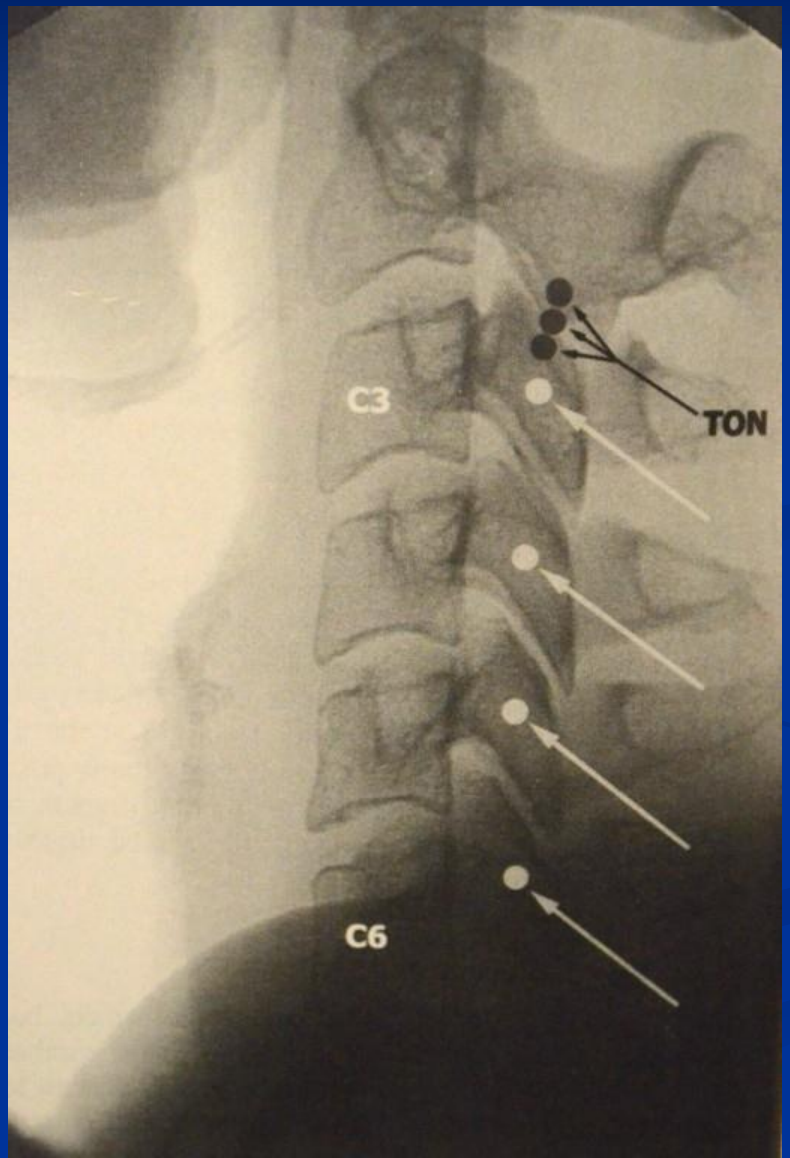
- C2 inferior facet
- C3 superior facet
- Over the middle of the C2-3 facet joint



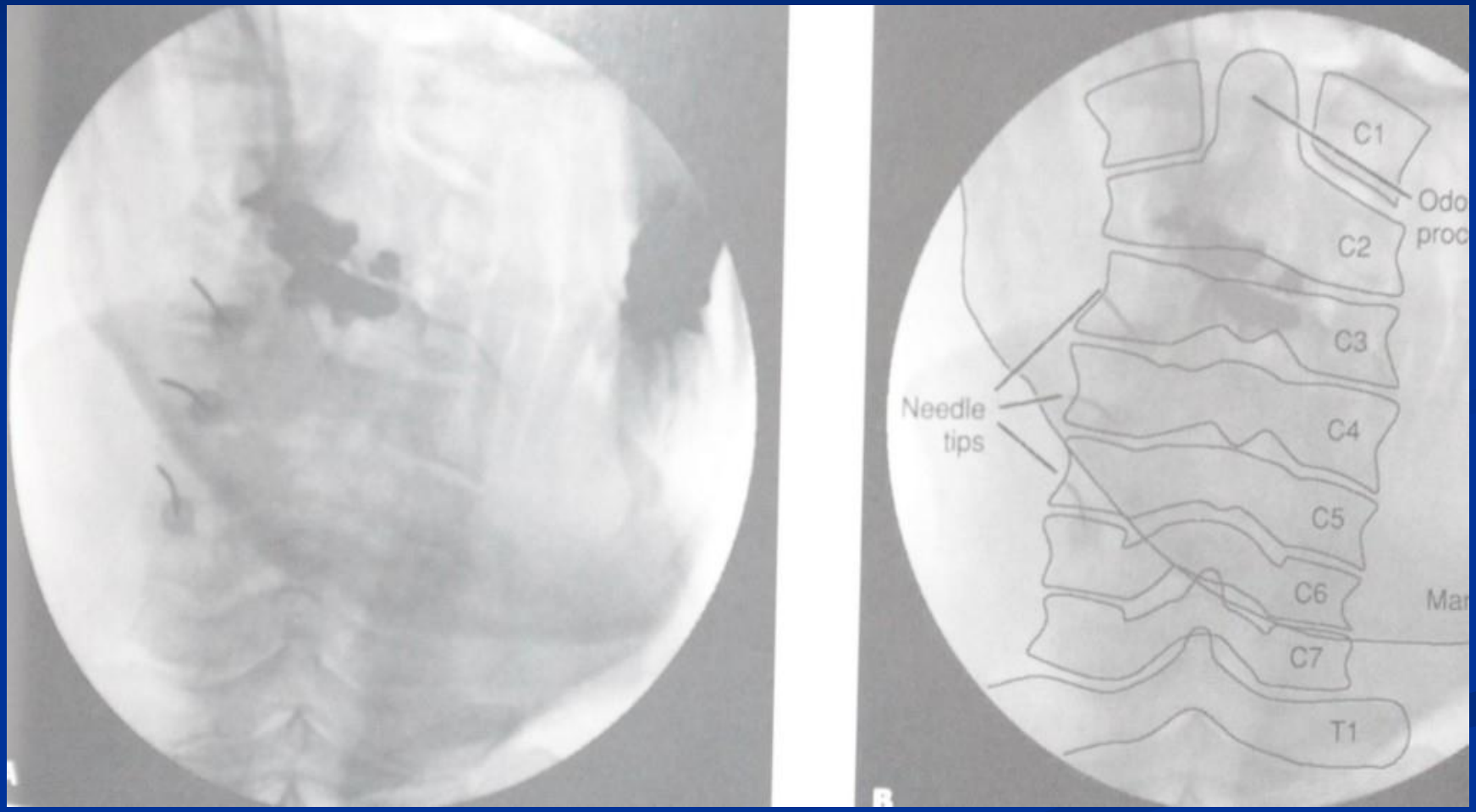
Target Zones for Cervical MBB & Rhizotomy



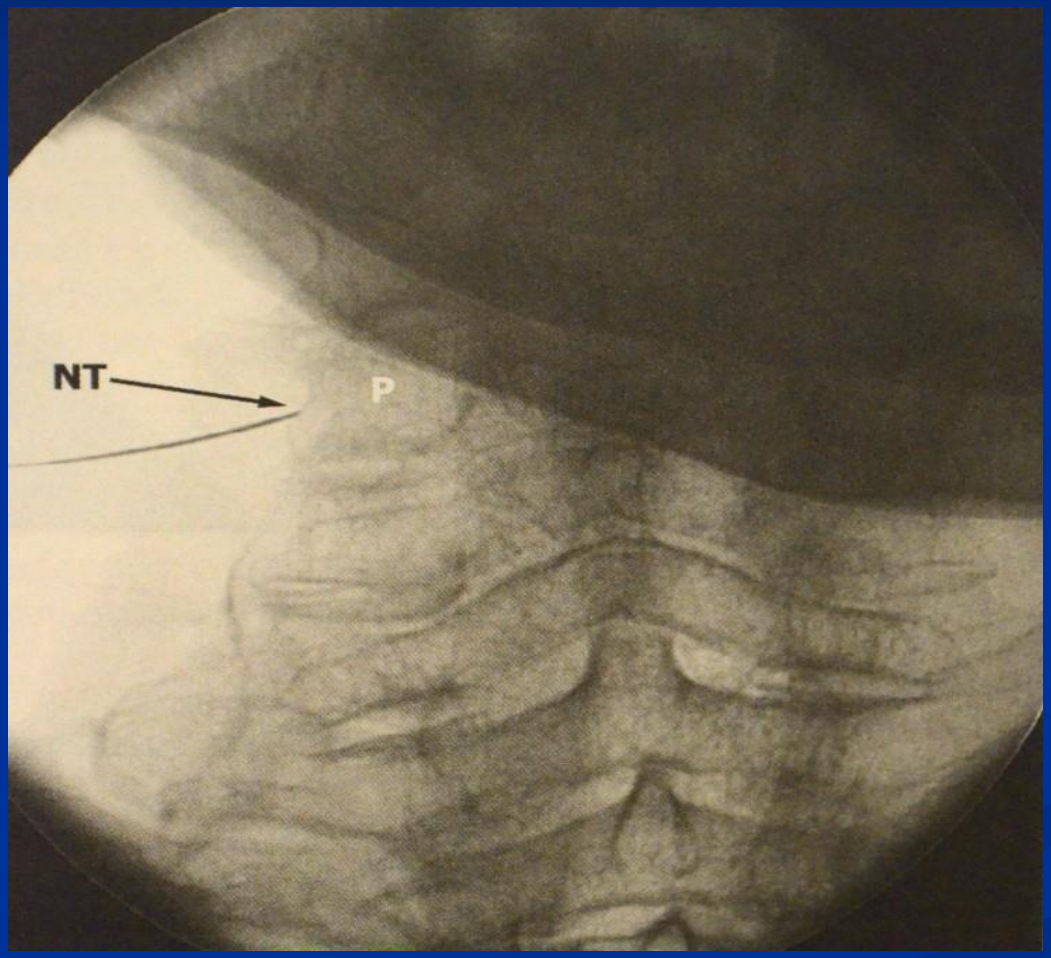
Target Zones C3 to C6 & TON (Lat)



3 RF Cannulae in Middle of Facet Pillar at C3, C4 & C5 on Left (A-P)

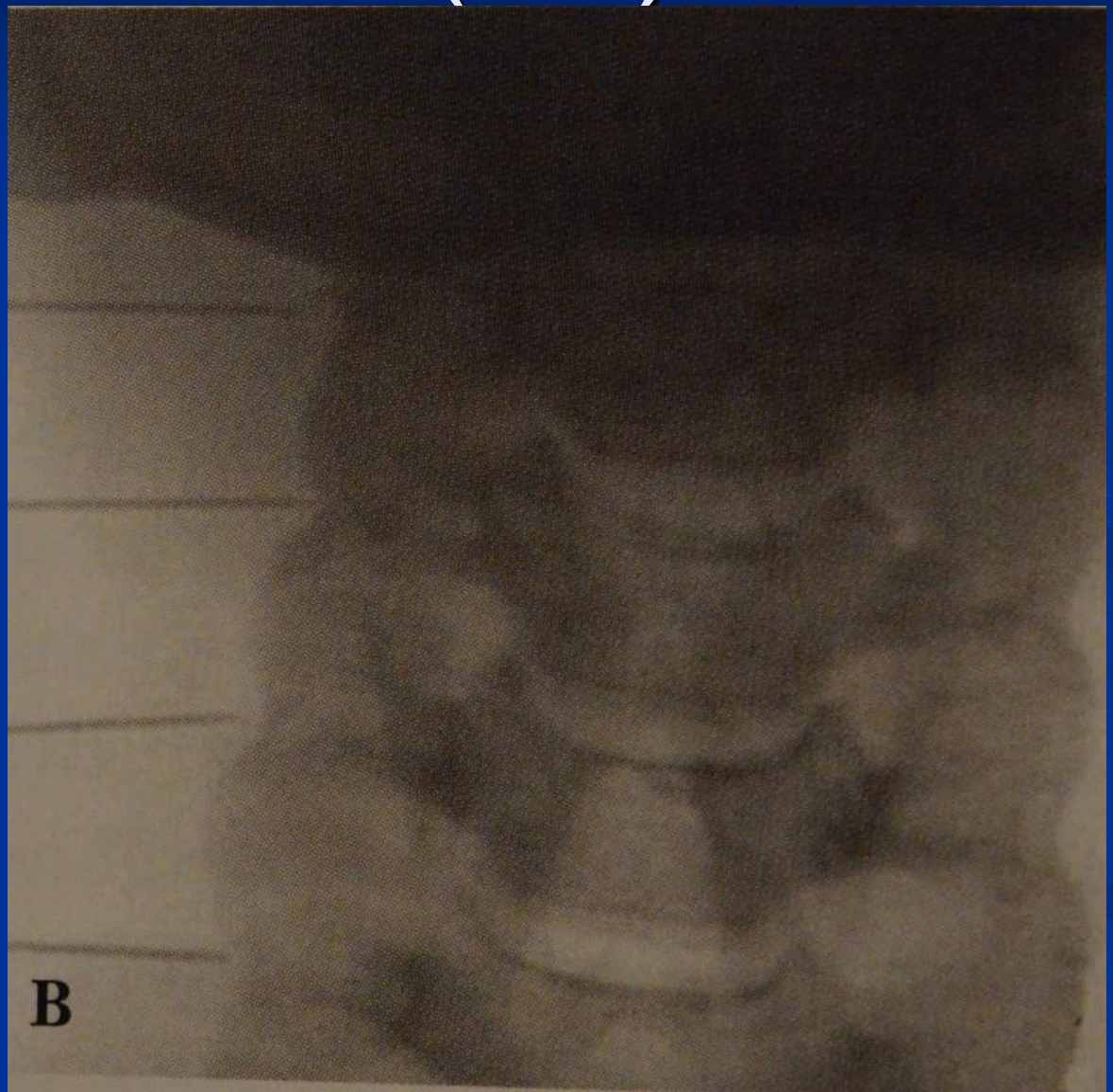


C5 Medial Branch Technique (Oblique A-P)

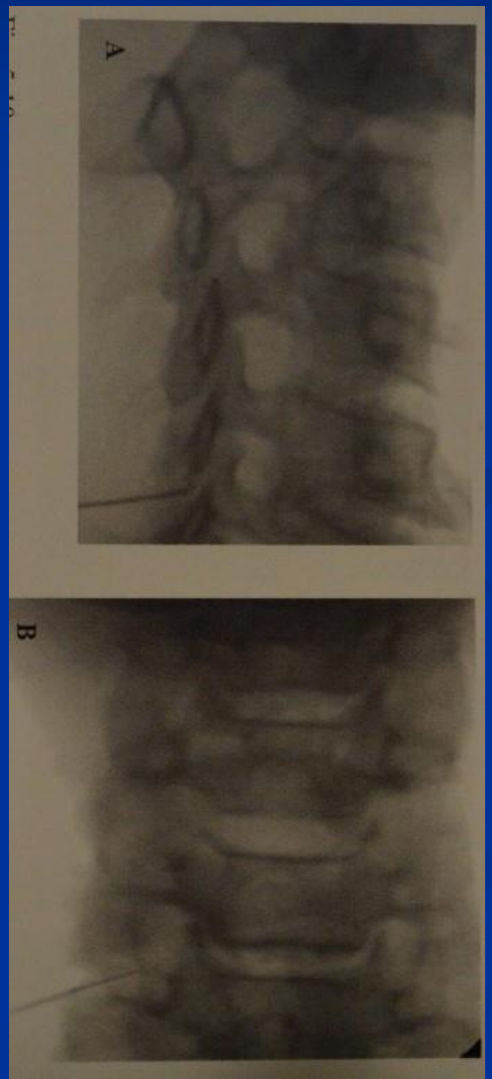


Multilevel Cervical MB Technique (Oblique)

Multilevel Cervical MB Technique (A-P)



Dangerous Needle Placement: Posterior to Bone of Facet Column: May Pass Between Laminae into SC



Use Magnification as Needed with Fluoroscopy

- To get good cervical A-P views

Sensory Testing Prior to Radiofrequency Lesioning

- Stimulation at 50 Hz at less then 0.5 V according to the literature
- Clinical experience shows that in certain cases, especially following fusion surgery, need up to 1.0 V
- Pearls: Proper questioning of patients during stimulation and during lesioning

Motor Stimulation Prior to Radiofrequency Lesioning

- 2 Hz at 1-10 V quickly. Look for “thumping” of midline muscles
- Beware of extremity or facial twitching
- Again, questioning is paramount

Pulse RF & Then Thermal Lesioning

- Pulse RF: maintaining voltage fluctuation of 40-45 V for 120 seconds at 42° centigrade
- Pulse RF mechanism is unclear, ISIS & others [1] note disruption of axonal transport & not a structural lesion
- Recently (2013): modulated expression of pain regulatory genes was observed in the SNI animal model after pulse RF along with reversal of mechanical allodynia [2]

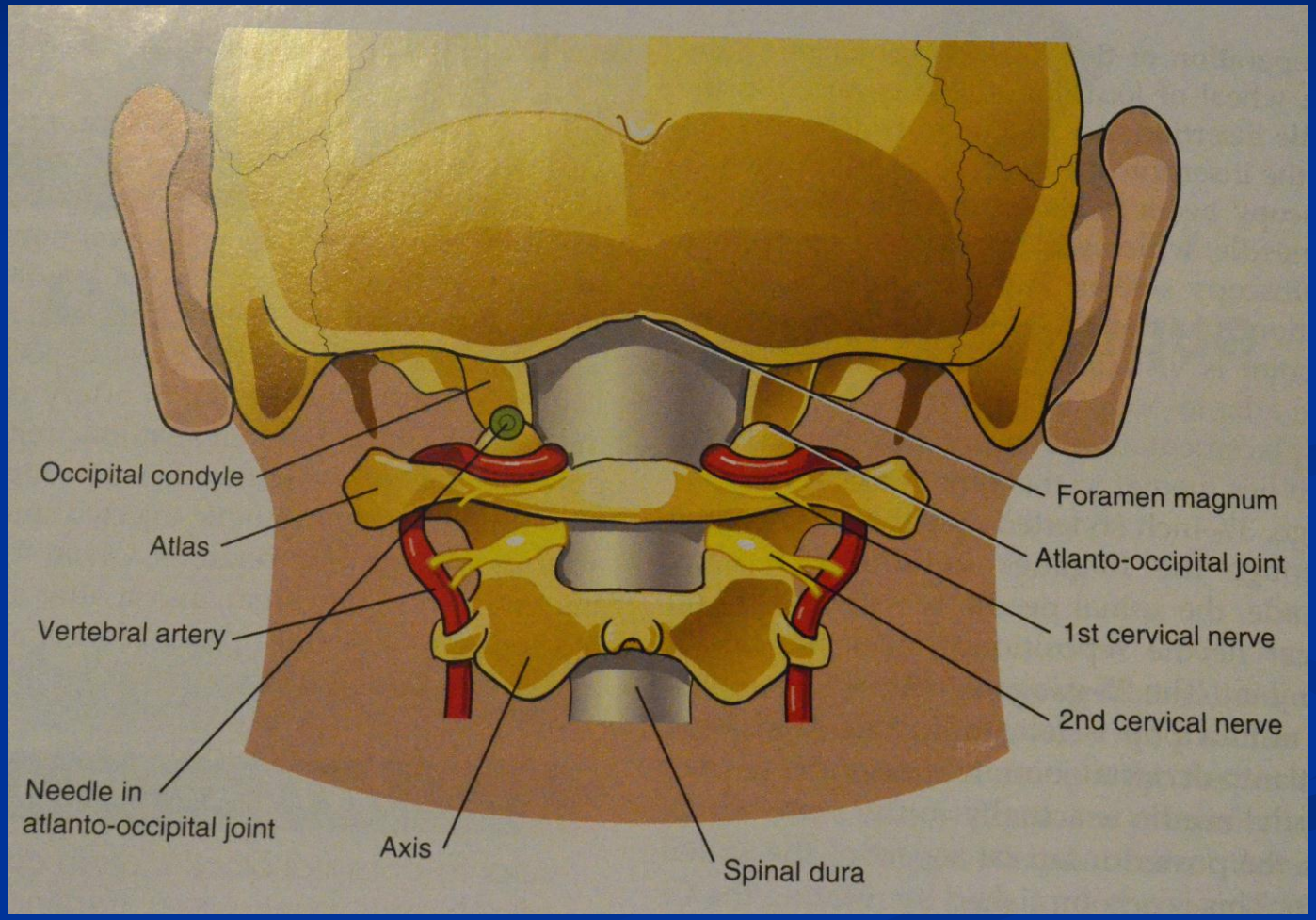
1. Erdine, S., Bilir, A., Cosman, E. R. and Cosman Jr., E. R. (2009), Ultrastructural Changes in Axons Following Exposure to Pulsed Radiofrequency Fields. Pain Practice, 9: 407–417

2. Vallejo R, Williams J, et al. Pulsed Radiofrequency Modulates Pain Regulatory Gene Expression Along the Nociceptive Pathway. Pain Physician 2013; 16:E601-E613

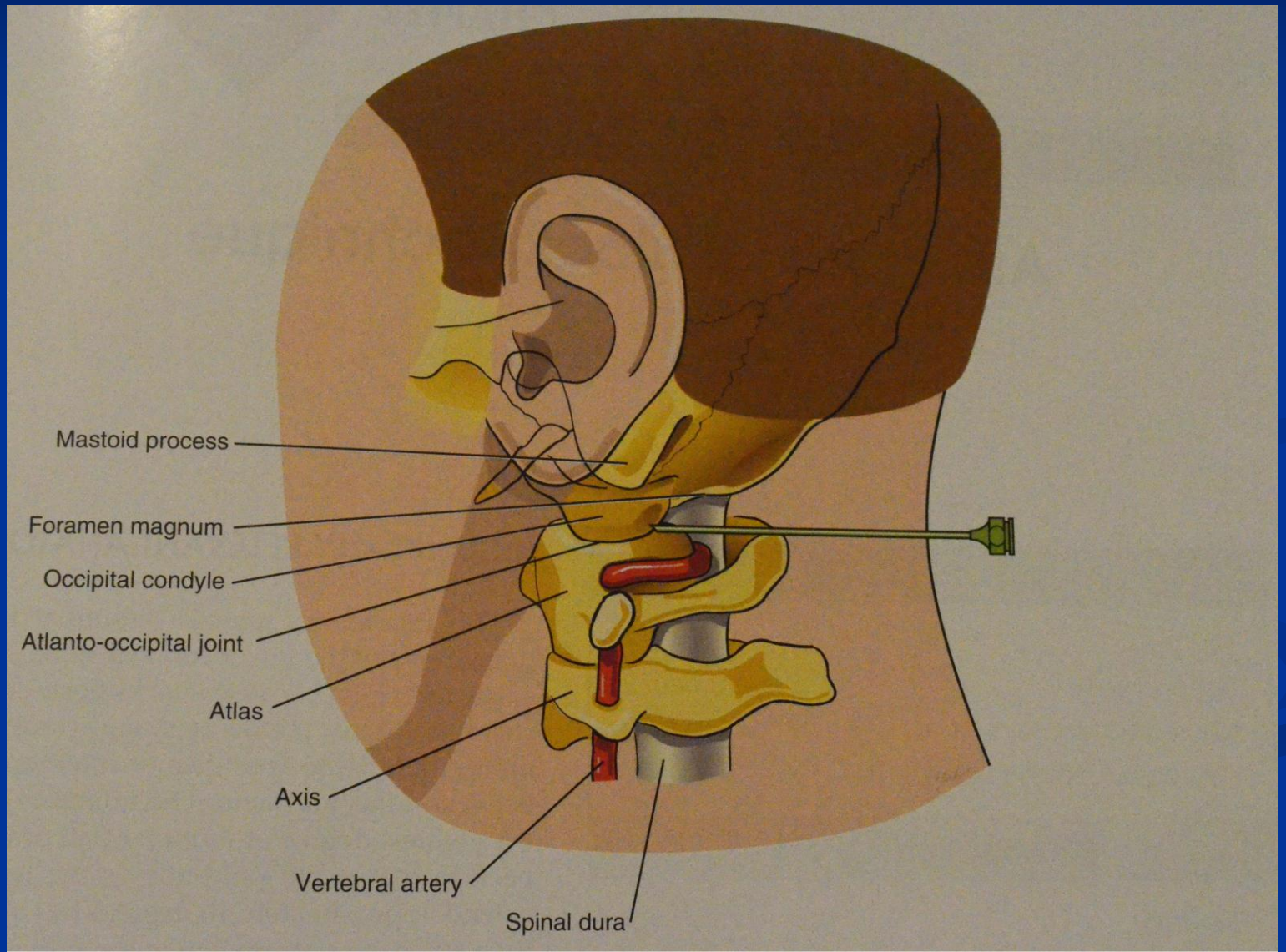
Cervical Thermal RF Lesioning

- 65° Centigrade for 60 seconds *versus 80° for 90 seconds for lumbar rhizotomy*. (60° minimum temperature for reimbursement by most US insurance companies)
- In cervical applications a 5cm length, 5mm active tip, 22 gauge cannula is used.
- (While for lumbar RF a 10cm length, 10mm active tip, 20 gauge cannula is sufficient)

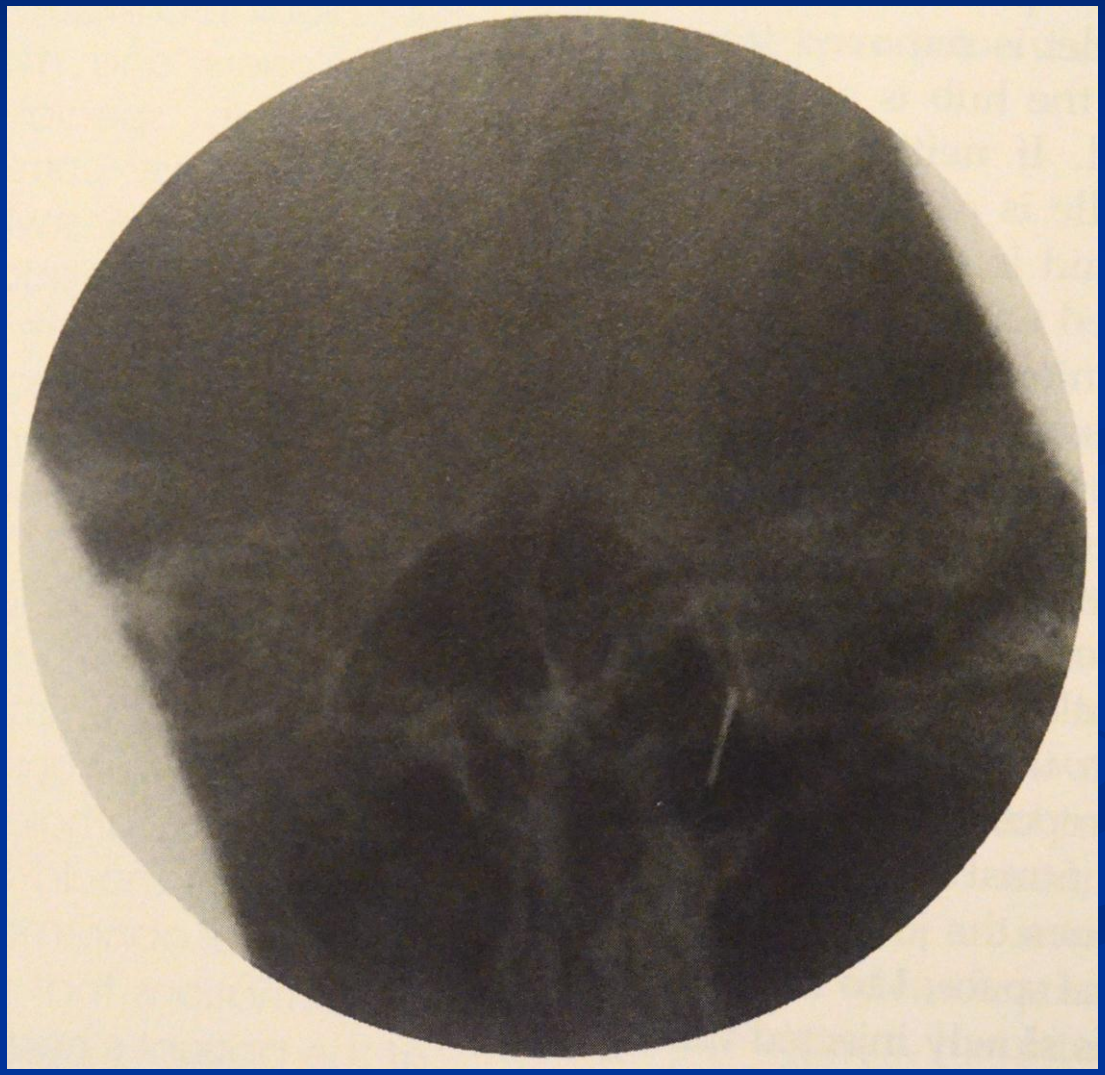
Atlanto-Occipital (A-O) Block for WAD & Cervicogenic HA



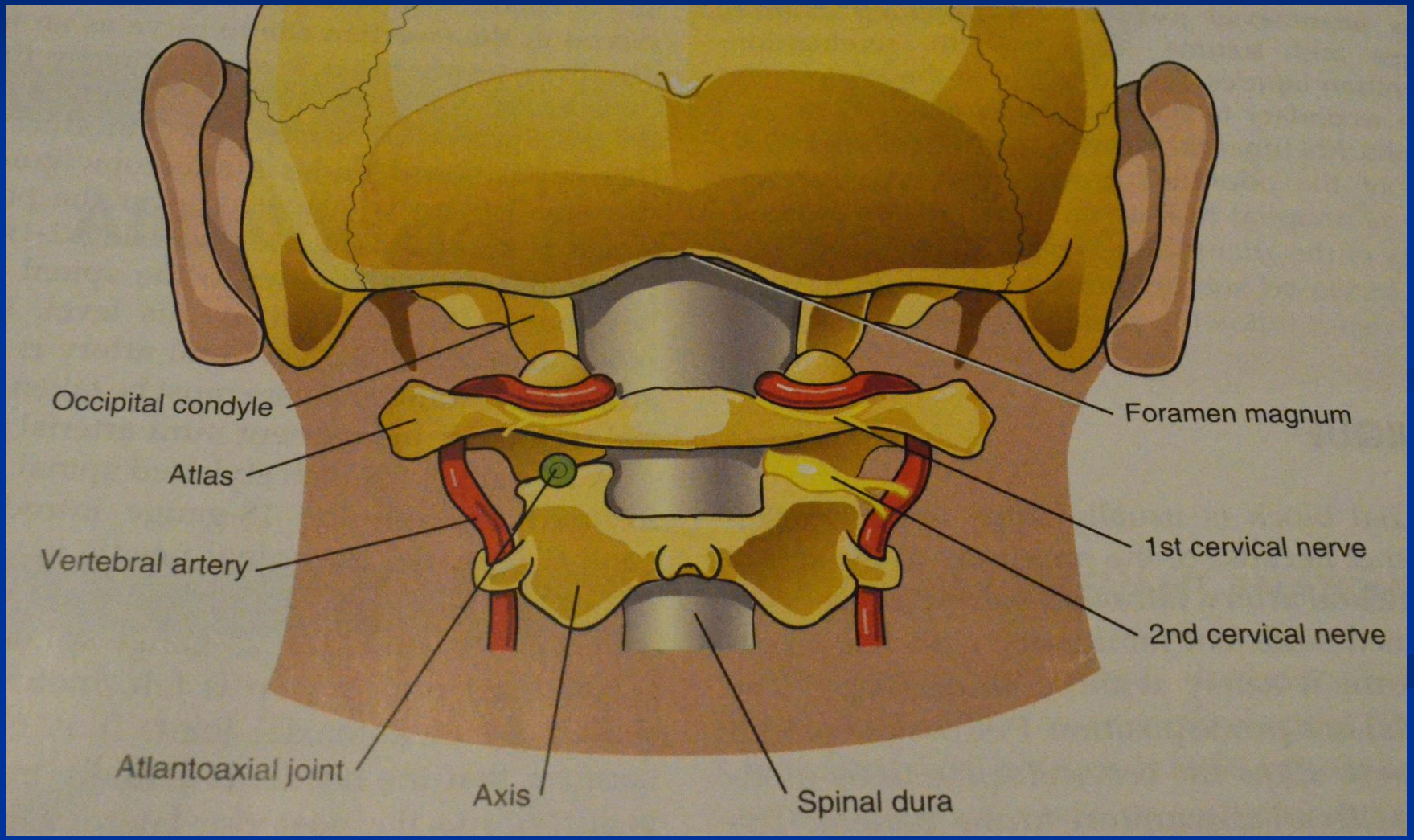
Atlanto-Occipital Block



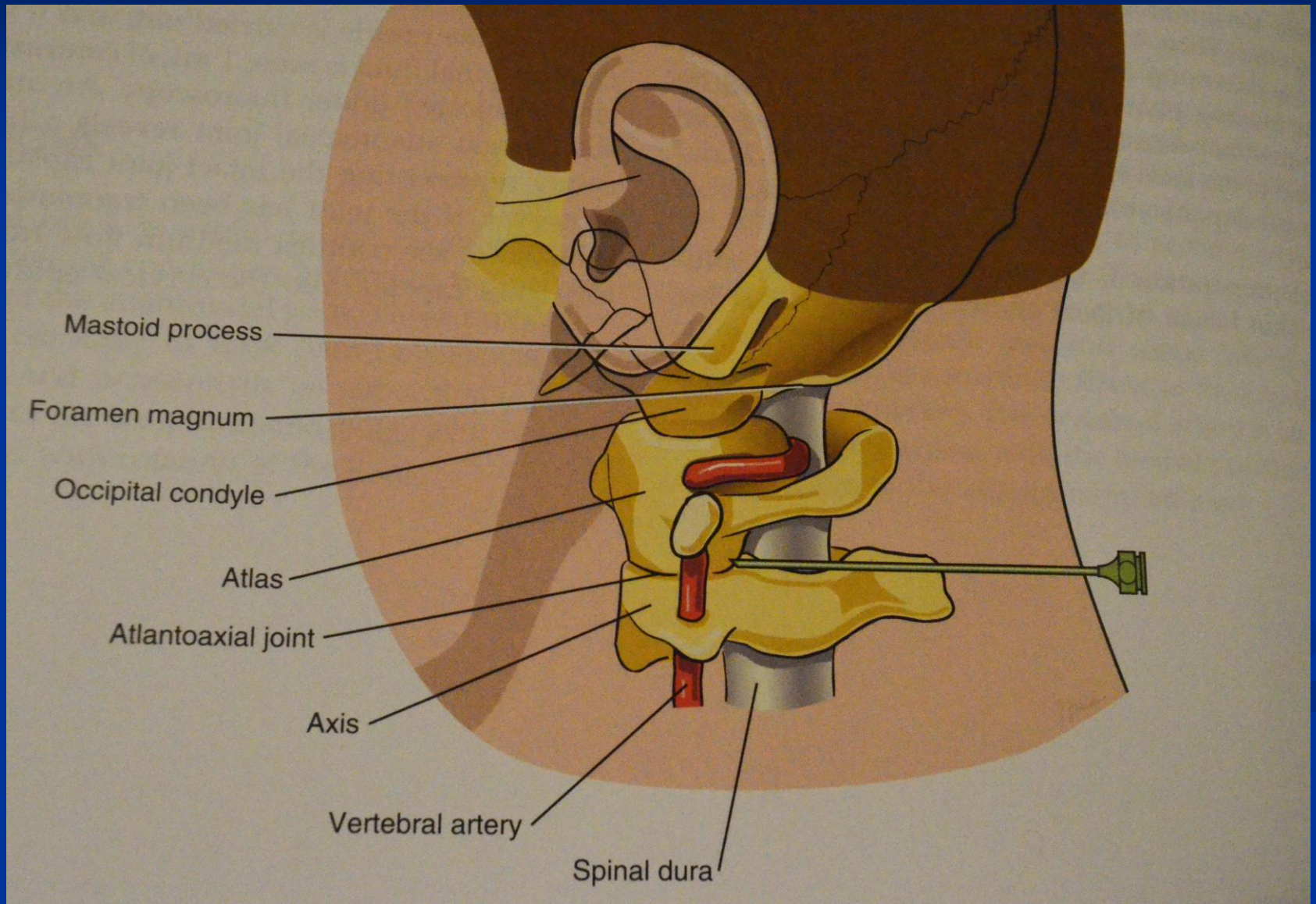
Atlanto-Occipital Block



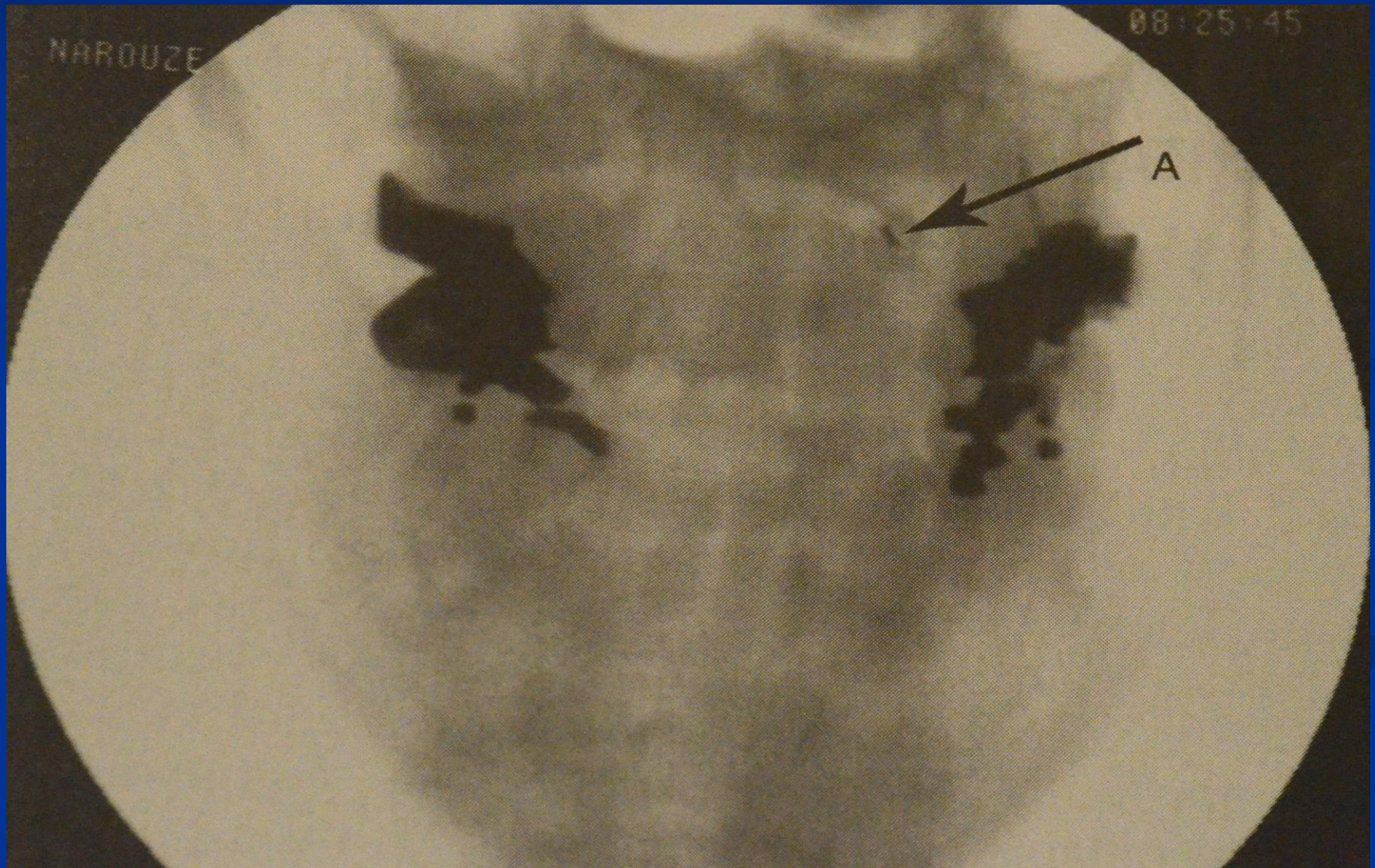
Atlantoaxial (A-A) Block is Often Combined with A-O Block



Atlantoaxial Block



Needle in Lateral Part of A-A Joint (A-P)



A: Lateral A-A Joint
B: Needle Tip & Contrast in Lateral A-A Joint

Side Effects & Complications with A-O & AA Blocks

- Seizure- intravascular inj. of 1 cc or less of LA
- Direct cord injury, syringomyelia and paralysis
- Respiratory arrest
- Hypotension- secondary to LA via epidural inj.
- Total spinal block- with intrathecal injection
- Episodes of dizziness & ataxia post injection
- Injury to Chiari malformation and other path.
- Infarction & Death

Before & During A-O & AA Blocks

- MRI to R/O brainstem & intracranial pathology
- Cervical Spine X-Rays to R/O congenital anomalies
- Consider the Risks Versus Benefits
- During both blocks do contrast injection under real-time fluoroscopy, preferably with digital subtraction
- During A-A block direct needle toward posterolateral aspect of joint to avoid C2 nerve root medially & vertebral artery laterally


QUESTIONS


CANADA
oach Tours

מרפאת כאב מתקדמת
American Pain Clinic

ד"ר סטיבן שיינר

מומחה ברפואה לשיכוך כאב
מומחה בנוירולוגיה

רופא בכיר, יחידה לשיכוך כאב
המרכז הרפואי הדסה

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