NEURO EXAM ESSENTIALS

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Disclaimer

- I work here ☺

Overview

- Cranial Nerves
- Unconscious patient
  - GCS, eyes and limbs
- Spine
  - Tone, reflexes, motor
  - Lumbar and cervical spine
- Cases
- Giving Report
- Stroke

NEURO ESSENTIALS

Examination of the Cranial Nerves

Case 1

- 45 y/o female triaged as an A4, comes to you in fast track
- CC: HA x2 days, intermittent, located behind both eyes
- Two episodes of blurred vision in the left eye
- Pt happens to tell you that she has noticed she has been bumping into walls with increasing frequency in the last few months
- What do you do?

Cranial Nerves

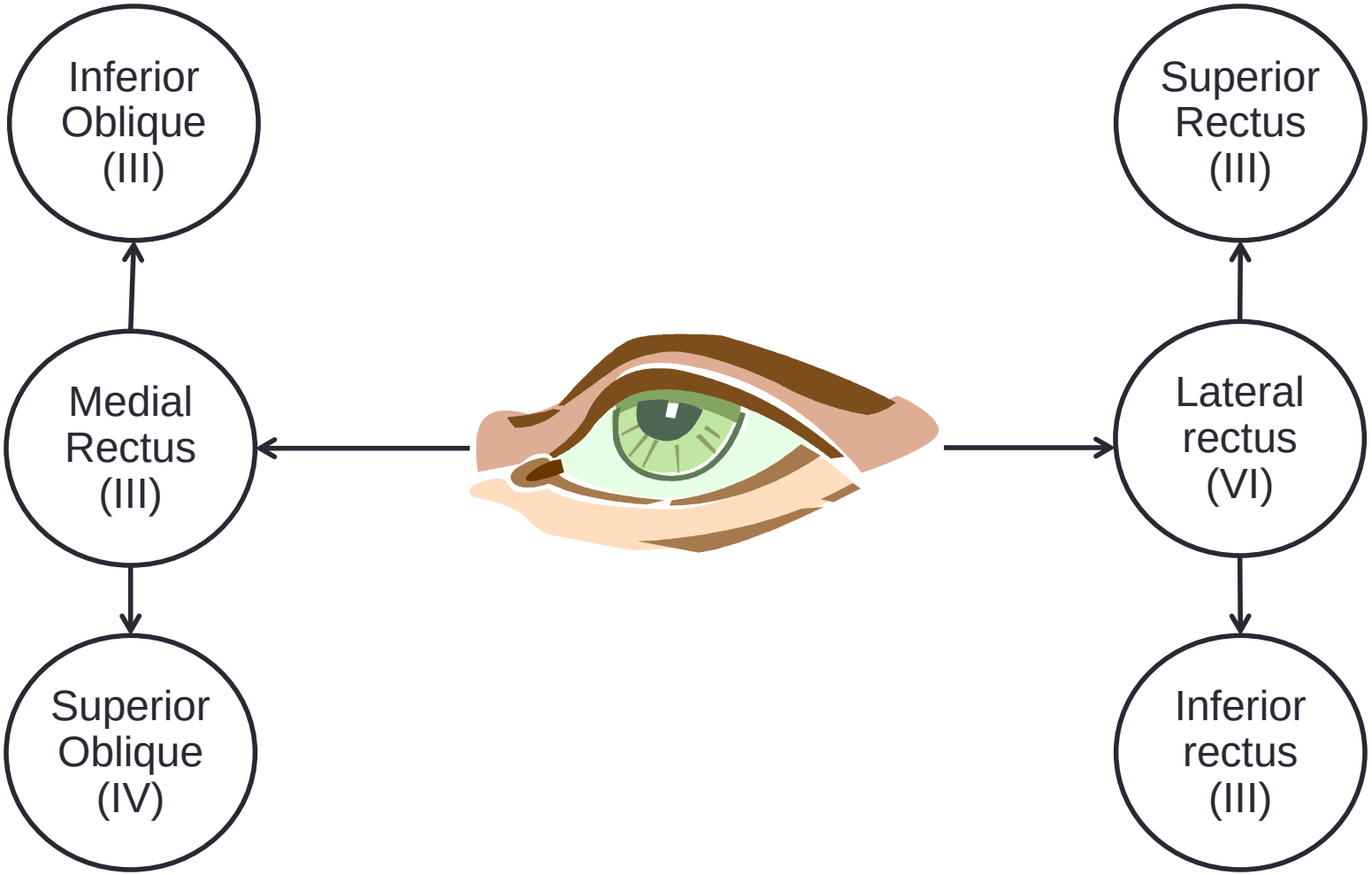
- Head injury
- Cranial complaint (Ex: HA, vision change, weakness)

- CN I – the eye
- CN III, IV, VI – extraocular movements
- CN V & VII – trigeminal and facial nerves
- CN VIII – auditory
- CN IX, X & XII – glossopharyngeal, vagus, hypoglossal
- CN XI - accessory

CN I – The Eye

- General
  - Eyelid – ptosis or retraction
  - Eye position – exophthalmos, enophthalmos
- Pupillary light reaction
  - Direct & consensual
- Acuity – see light? Movement? Snellen chart?
- Fields
  - Wiggle fingers in all four outer quadrants with patient looking at your nose

CN III, IV, VI – Extraocular Movements



https://www.youtube.com/watch?v=zDsPfkMU46A&list=PL46ACD8F237DE564B&index=10

Nystagmus

- A slow drift in one direction with a fast correction in the opposite direction
- Vertical (rare) – indicates brainstem disease
- Horizontal (common)
  - Common causes: drugs, alcohol, MS, CVD, vascular lesions

https://www.youtube.com/watch?v=YntJiBCz3pA

CN V & VII – Trigeminal & Facial

- VII – Facial nerve VII
  - INSPECTION – Look for asymmetry (forehead, nasolabial folds)
  - MOTOR – muscles of facial expression
    - Test: smile, close eyes

- V – trigeminal nerve
  - SENSORY:
    - V1 (ophthalmic - forehead)
    - V2 (maxilla - cheek)
    - V3 (mandible – lower lip)
  - MOTOR: muscles of mastication (clench teeth, resist jaw opening)

CNIII – Auditory

- Test – click nails next to each ear to see if hearing is present and/or subjectively symmetric
- Gross test of hearing

CN IX, X & XII – glossopharyngeal, vagus, hypoglossal

- Glossopharyngeal
  - SENSORY – posterior third of the tongue, pharynx, middle ear
  - MOTOR – stylopharyngeus
    - Test: swallow
- Vagus
  - SENSORY – tympanic membrane, EAC, external ear
  - MOTOR – muscles of the palate, pharynx, larynx
    - Test: “say ah”
- Hypoglossal
  - SENSORY – none
  - MOTOR – intrinsic muscles of the tongue
    - Test: stick out tongue
      - Protruded tongue deviates toward the side of weakness

CN XI – Accessory Nerve

- SENSORY – none
- MOTOR – innervates SCM and trapezius
  - Test:
    - Resist forehead movement (SCM)
    - Resist shoulder shrug (trapezius)

Cerebellar Function/Coordination

- Gait
- Finger to nose
  - Negative findings: intention tremor when approaching; past pointing or dysmetria
- Hand flap or heel-to-shin
- Also:
  - Speech
    - hesitant → expressive dysphasia
    - fluent with inability to follow simple commands→ receptive dysphasia
  - Nystagmus

NEURO ESSENTIALS

The Unconscious Patient

Case 2

- 85 year old male
- Found unresponsive at 8am in bed by his wife
- Last known responsive 4am when he used the bathroom
- Arrives to the ED via EMS who states “he has been unresponsive since we found him”

- What does your exam look like?

The Unconscious Patient: Exam

- Level of Consciousness
- Eye exam
- Brain stem reflexes
- Motor response & peripheral reflexes

The Unconscious Patient: Assessment of Level of Consciousness: GCS Scale

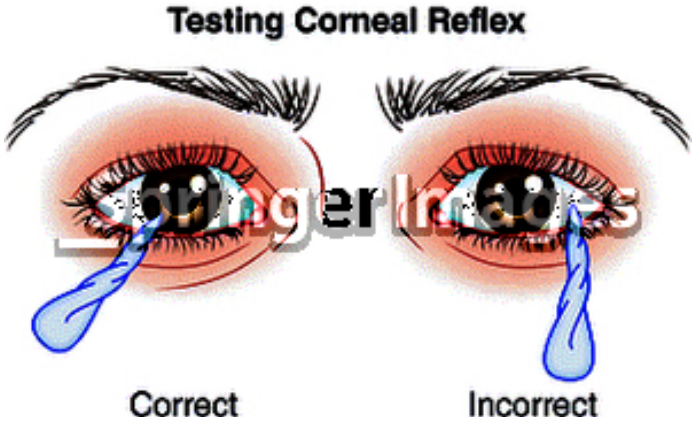
- Eyes
  - 4 spontaneous
  - 3 to speech/verbal
  - 2 to pain
  - 1 none
- Verbal
  - 5 oriented
  - 4 confused
  - 3 words
  - 2 sounds
  - 1 none
- Motor
  - 6 obeys verbal commands
  - 5 localizes
  - 4 withdraws
  - 3 decorticate/flexion
  - 2 decerebrate/extend
  - 1 none

The Unconscious Patient: Eye exam

- Eyes open or closed?
- Open spontaneously?
- Conjugate or disconjugate gaze?
- Deviated? One or both?
- Any abnormal eye movements? (nystagmus)

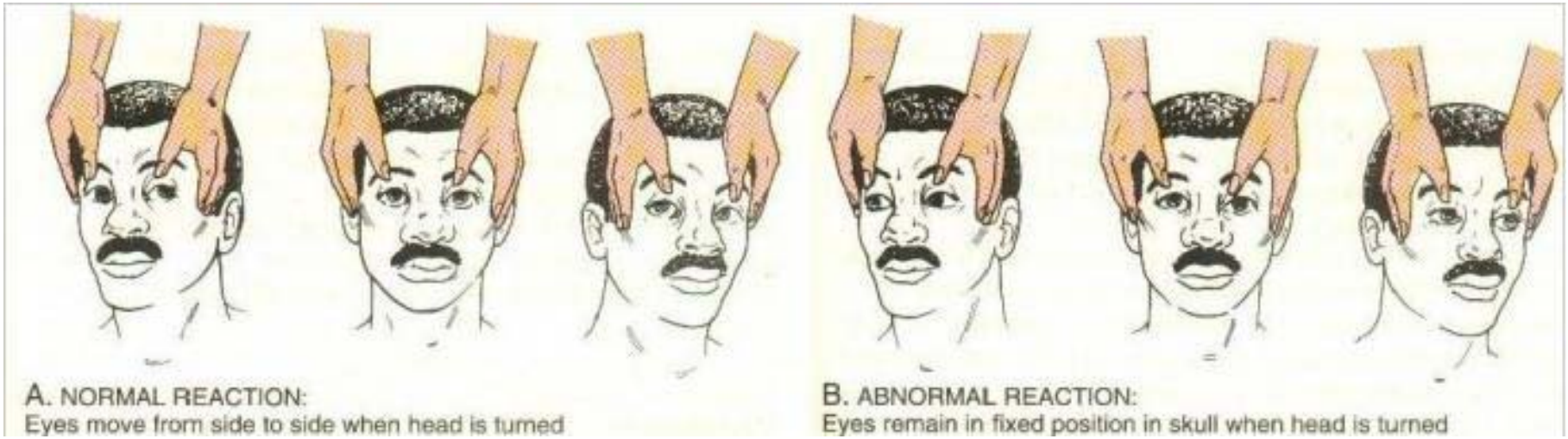
The Unconscious Patient: Brainstem Reflexes – Corneal Reflex

- Visual threat
  - Quick movement of examiner's hand to pts eye induces blinking
- Supraorbital pain causes a facial grimace – is the face symmetrical?
- Pupil response – brisk, sluggish, none
- Corneal reflex
  - Elicits involuntary blinking of the eyelids
  - Direct and consensual response
  - Contact use decreases response



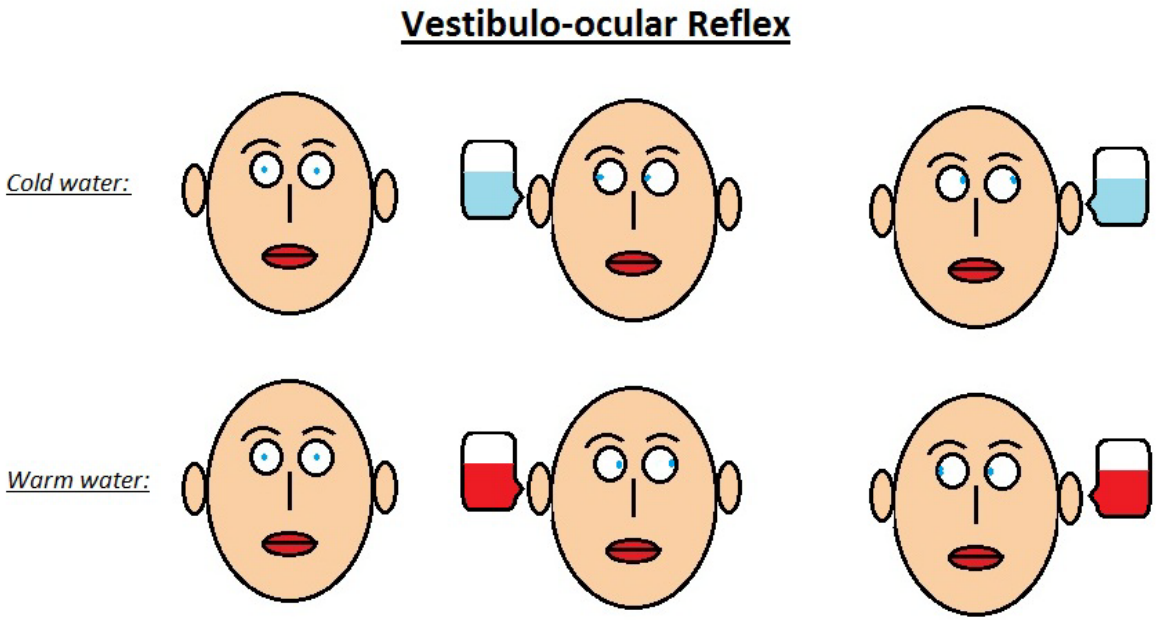
The Unconscious Patient: Brainstem reflexes – Doll's Eyes

- Doll's eyes (oculocephalic reflex)
  - Rule out cervical pathology
  - Rotation or flexion/extension of the head
  - Normal: Eyes should move in the opposite direction as the head movement as if trying to get back to center



The Unconscious Patient: Brainstem reflexes – Cold Calorics

- Cold calorics
  - Water irrigated into the external auditory meatus induces nystagmus
  - Normal (in unconscious patient, cold water) – toward the stimulus
  - Normal (in unconscious patient, warm water) – away from the stimulus

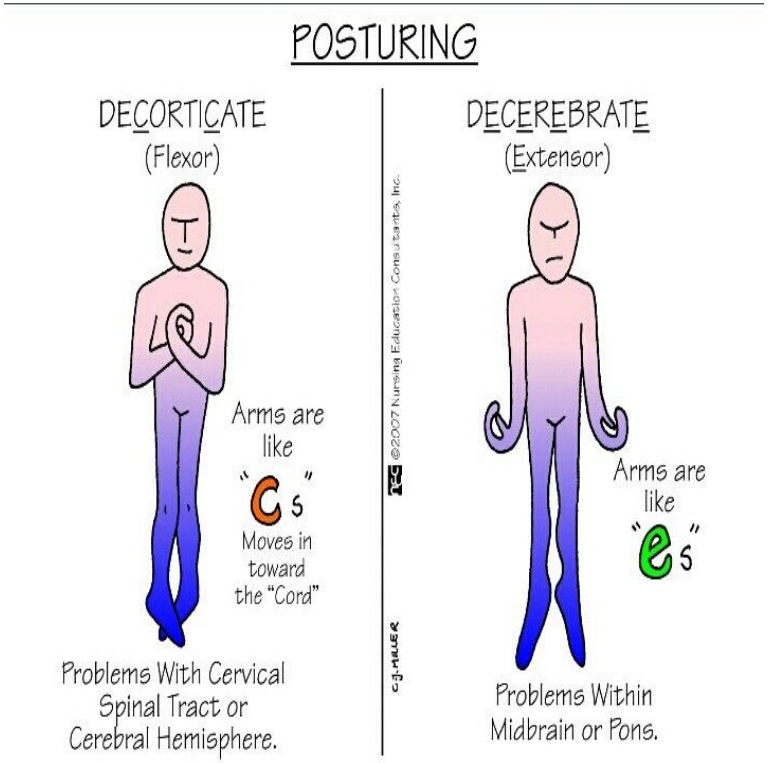


The Unconscious Patient: Brainstem reflexes - Gag

- Depress tongue, then touch palate, pharynx or tonsil on one side to elicit ‘gag’
- Intubated? Push/pull on tube slightly to elicit gag
- Intubated for a long time? Suction
- Findings: either present or absent

The Unconscious Patient: Motor & Reflexes

- Sternal rub, pain to limbs
  - Localizing→flexion→extension



- Triple reflex/triple flexion
  - dorsiflexion of ankle, flexion of the knee and hip
  - Can be mistaken for withdrawal (purposeful)
  - may be found in brain death

Case 3

- Triage note:

- Pt brought to the ED by FD with mental status change, he is verbal but slow to respond and speech is garbled. extremities are tremulous. Waiting for family to arrive for further assessment of condition

What do you want to know?

- 56YO male
- PMHx: EtOH abuse (per wife last drink 3 wks ago), liver cirrhosis, hepatic encephalopathy, esophageal varices, portal HTN, anal fistula repair, DM2, s/p cataract surg 1 wk ago
- Meds: Diamox 500 mg BID post surgery
- Per wife progressive AMS since surg w confusion x1d
- Last night unwitnessed fall, found down, no LOC

- HCT - small, thin acute on chronic L SDH

Labs

- CBC:

WBC	15.9
RBC	4.29
HGB	13.7
HCT	39.3
PLT	219

- BMG:

GLU	102
NA	136
K	3.5
CL	112
CO2	18
BUN	15
CREAT	1.0
CA	9.7

- Coags
  - PT 11.8
  - PTT 28
  - INR 1.1

- Urinalysis:
  - UACOL YELLOW
  - UAPP SLCLOUDY
  - USPG 1.015
  - PHU 7.0
  - UAPROT TRACE
  - GLUUR NEGATIVE
  - UAKET NEGATIVE
  - BILI NEGATIVE
  - URBLD 1+
  - NITRITE NEGATIVE
  - UROBIL 0.2
  - LEUKEST 1+
  - MUCTHRU 1+
  - SQEPIUR RARE
  - BACTU 1+
  - WBCURINE 11-25
  - URBC 5-10

- Also: liver enzymes, lipase, elevated ammonia

Exam

- Exam in brief
  - Orientation
  - Shine a light in the pupils, EOMs, visual fields
  - Smile, stick out tongue
  - Hold hands palms up with eyes closed
  - Hold hands and test upper extremity strength/sensation; Hoffman’s
  - Lower extremity strength/sensation; Clonus
  - Reflexes in a counter clockwise fashion
  - Rectal?

Documenting Your Exam

- A&Ox1 (name only), NAD, speech garbled
- CN II: deferred
- CN III, IV, VI: EOMi without nystagmus, R pupil round and reactive; L surgical pupil; scleral icterus
- CN V: Muscles of mastication intact
- CN VII: Facial Symmetry
- CN VIII: Hearing grossly intact
- CN IX, X: Palate elevation midline
- CN XI: SCM and Trap intact and symmetric
- CN XII: Tongue Midline
- Motor: MAEx4 w/ mild tremor x4, strength 4/5 throughout (limited to pt effort)
- Sensation: Intact to light touch throughout
- No drift
- Gait deferred
- No midline C spine tenderness

NEURO ESSENTIALS

Examination of the Spine/Extremities

Examination of the Spine/Extremities

- Tone
- Motor
- Reflexes
- Lumbar Spine
- Cervical Spine
- Special tests

Tone

- Reduced/flaccid
  - LMN (PNS) or cerebellar lesion, spinal shock
    - wasting, fasciculation, decreased tone and absent reflexes
- Spasticity
  - UMN (CNS)
    - increased tone, increased reflexes
    - predominantly affects hip flexion, knee flexion, foot dorsiflexion
- Rigidity/cogwheel
  - Parkinsons
- Myotonia
  - Delayed relaxation. Myotonic dystrophy.

Motor

- Grading Power
  - 5 = normal power
  - 4 = moderate movement against **resistance**
  - 3 = moves against **gravity** but not resistance
  - 2 = moves with gravity eliminated
  - 1 = flicker
  - 0 = no movement
- Pronator
  - Unilateral downward drift: unilateral weakness on that side
  - Bilateral downward drift: bilateral weakness
  - Arm rises: cerebellar disease

Reflexes

- Grading Reflexes
  - 0 = absent
  - 1+ = present but depressed/hyporeflexic
  - **2+ = normal**
  - 3+ = increased/hyperreflexic
  - 4+ = clonus
- Biceps, triceps, brachioradialis, patellar, Achilles
- Reinforcement
  - Use if unable to elicit/difficult
  - Have pt clench jaw for arm, link hands across chest and pull for leg

Bonus reflexes

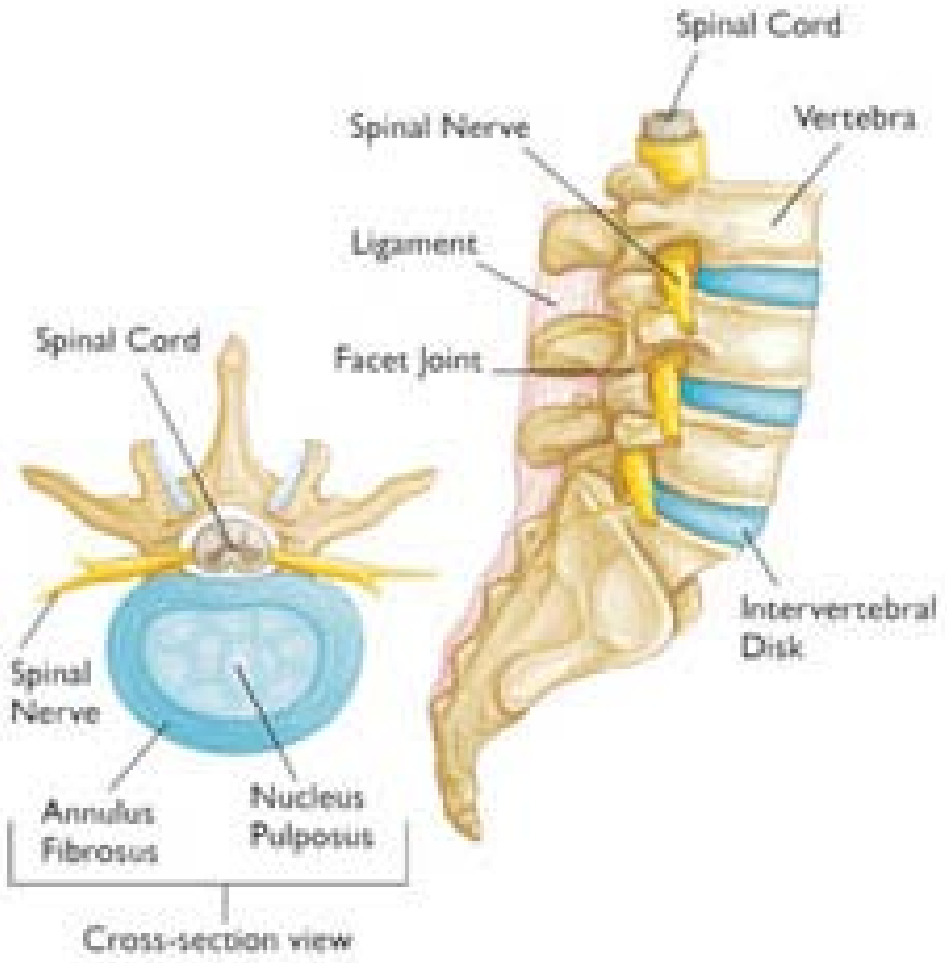
- Clonus
  - Dorsiflex the relaxed ankle briskly and hold
  - Abnormal: Rhythmic contraction with more than three beats
- Babinski's Sign
  - run sharp instrument across plantar surface of foot from calc to forefoot
  - Negative: toes do not move at all or bunch up uniformly
  - Positive: great toe extends while others plantar flex and splay
    - Positive result indicates upper motor neuron lesion usually associated with brain damage after trauma or with an expanding brain tumor
  - Normal in the newborn; should disappear shortly after birth
- Hoffman's Sign
  - Flick the terminal phalanx, suddenly stretching the flexor tendon on release
  - Positive: thumb flexion indicates hyperreflexia

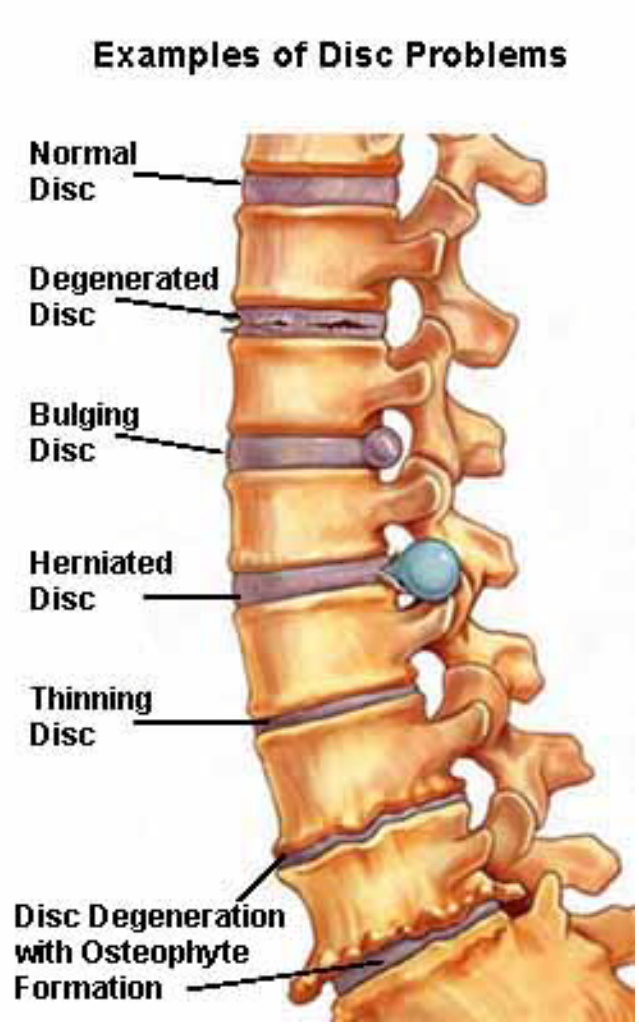
Case 3

- 33y/o male construction worker
- CC: low back pain x6mo
- Worsened when lifting bags of concrete 3 days ago
- Now with shooting pain down the back of the right leg
- No weakness, numbness or tingling

- What are you thinking? What do you do?

Lumbar Spine: anatomy





Lumbar Spine: anatomy

- Top of iliac crests = L4-5 interspace
- End of spinal cord L1/L2
- The only way to fully palpate the coccyx is through a rectal exam
- Sciatic Nerve
  - Largest nerve in the body
  - Exits through the greater sciatic foramen, passes midway between the greater trochanter and the ischial tuberosity
  - To examine: flex hip, press firmly at the midpoint between the greater trochanter and the ischial tuberosity

Lumbar Spine: movements

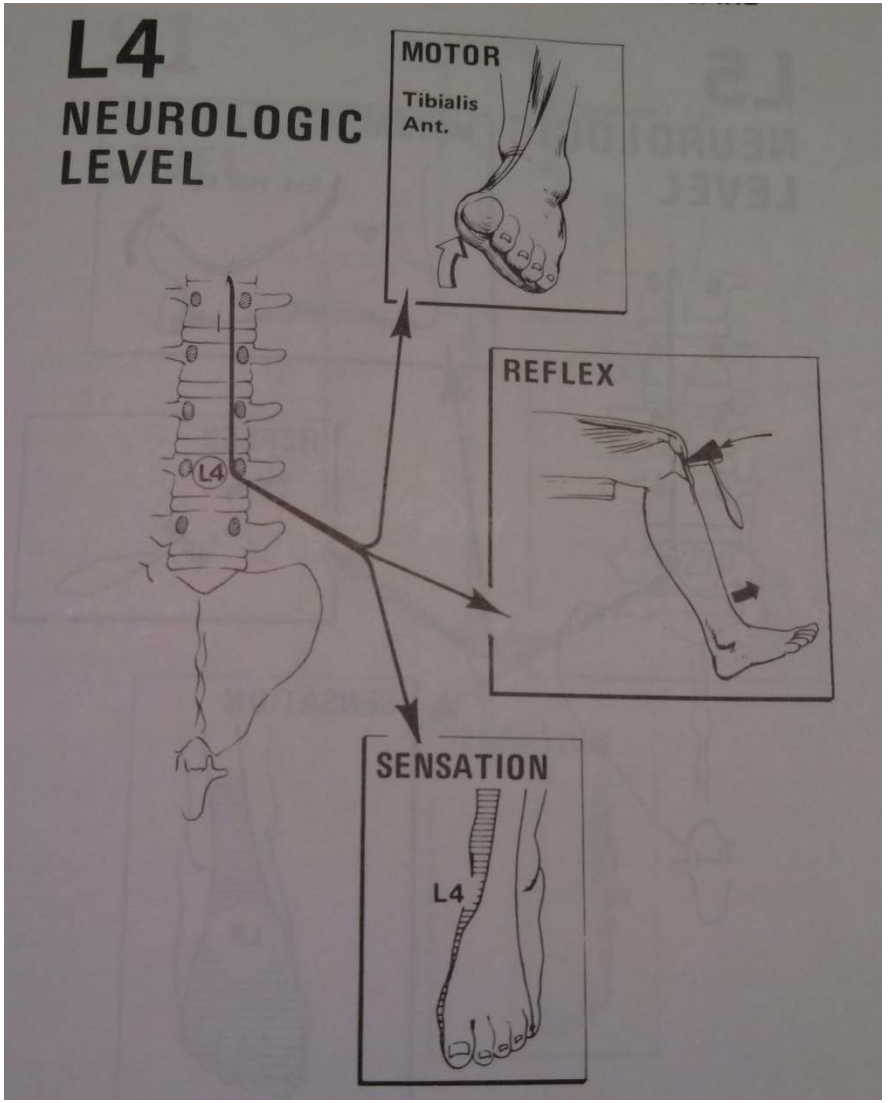
- Flexion
- Extension
- Lateral bending
- Rotation

Lumbar Spine: neuro exam

- T12, L1, L2, L3
  - Motor: iliopsoas/hip flexion
  - Sensory: anterior thigh
  - Reflexes: none
- L2, L3, L4
  - Motor:
    - Quadriceps/knee extension, Hip adductor

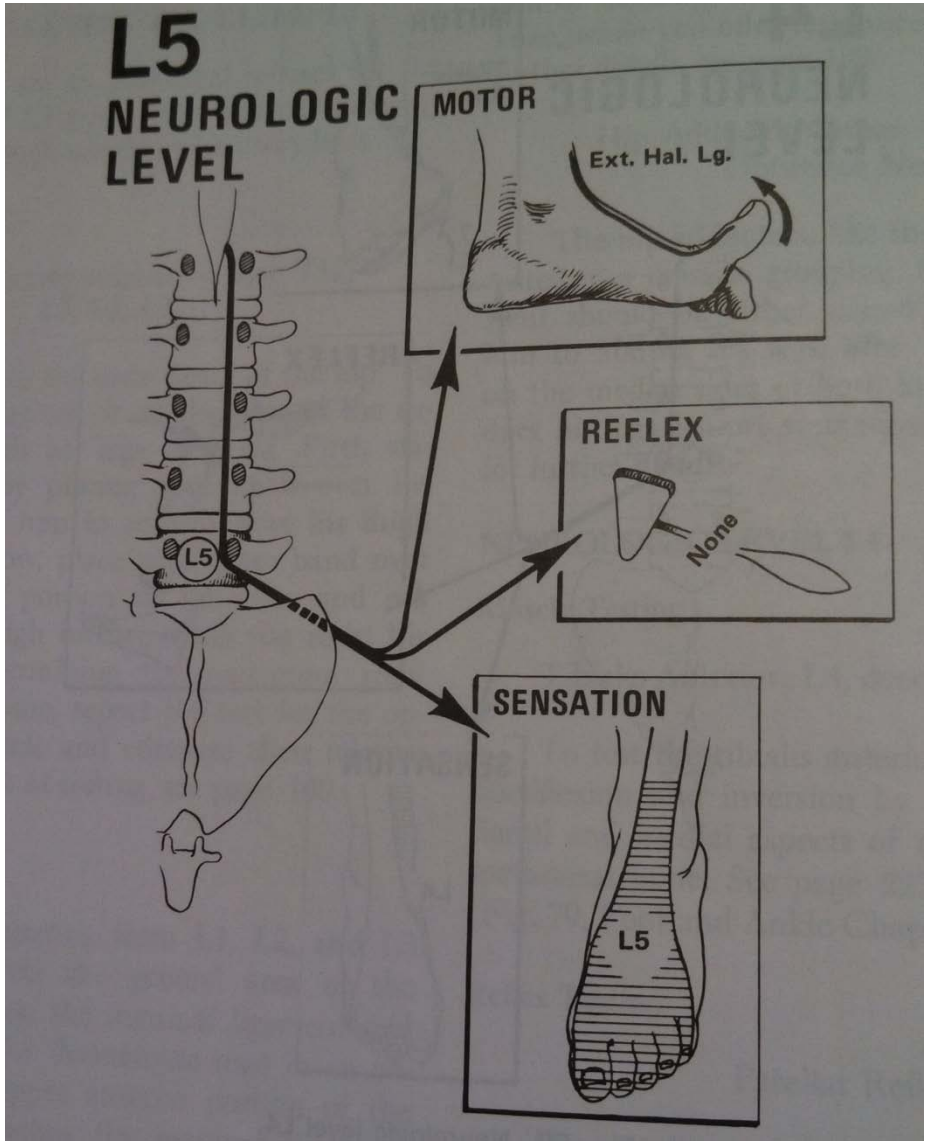
L4

- Motor: dorsiflexion and inversion
- Sensory: medial foot
- Reflex: patellar



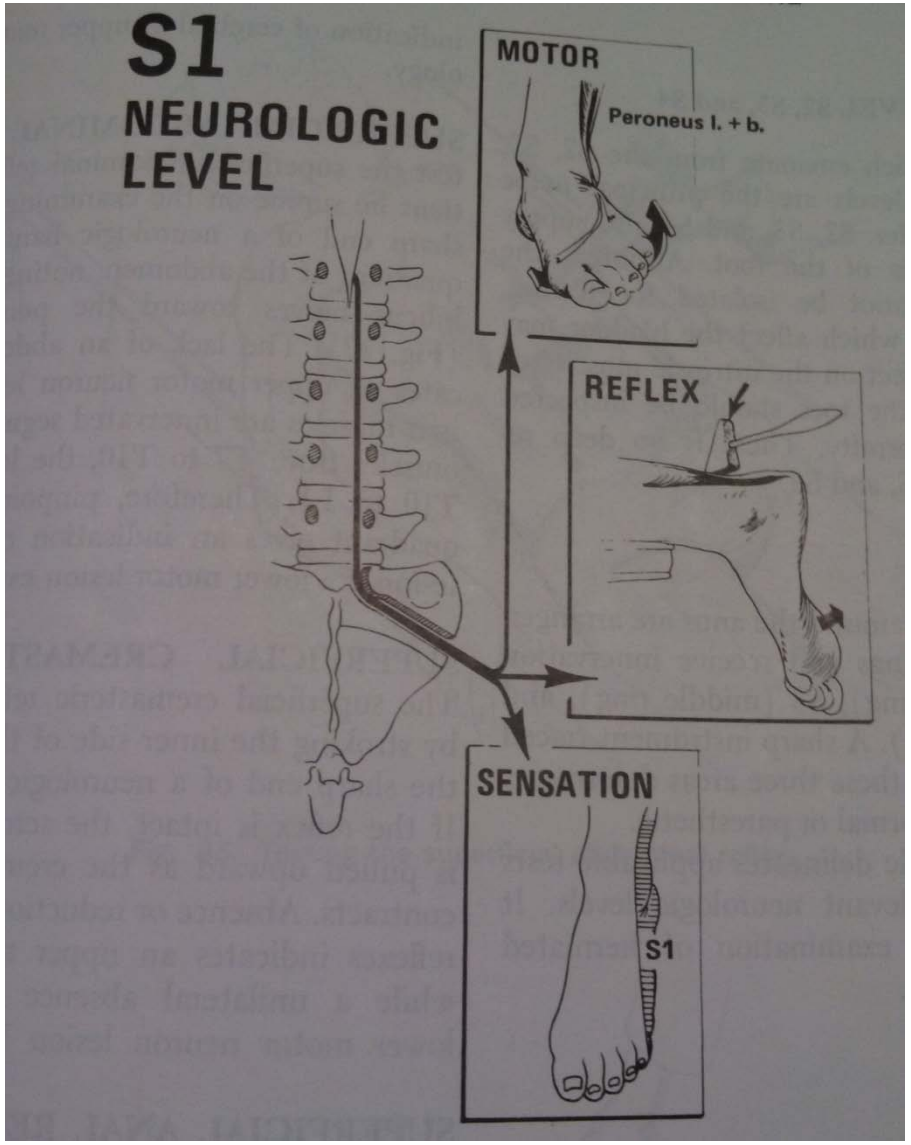
L5

- Motor:
  - EHL/dorsiflexion of great toe
  - *Gluteus medius/hip abduction*
  - *Extensor digitorum longus and brevis/dorsiflexion of toes*
- Sensory: dorsum of foot
- Reflex: none



S1

- Motor:
  - Foot inversion
  - Gluteus maximus/hip extension with palpation of glut
- Sensory
  - lateral malleolus and lateral side and plantar surface of the foot
- Reflex
  - Achilles



Lumbar Spine: neuro exam

- S2, S3, S4
  - Motor
    - Principal nerve supply for the bladder, intrinsic muscles of foot
  - Sensory
    - superficial anal reflex, dermatomes around anus (S2 outermost, S3 middle, S4-5 innermost)
  - Reflex
    - none

Lumbar spine: special tests

- Straight leg raise – raise leg on involved side. At that point dorsiflex the foot to reproduce pain
  - Positive: pain down the leg induced, not back pain
  - Nerve root impingement, i.e. herniated disc
  - Hamstring (thigh only) v Sciatic (down the leg) pain
- Hoover test – as pt tries to raise leg, hold opposite ankle
  - True: pt will put pressure on the opposite calcaneus when attempting to raise the leg
  - Malingering: does not bear down
- Rectal exam – tone and sensation
- Babinski

Case 4

- 55y/o woman, secretary at local church
- CC: numbness and tingling in her $4^{th}/5^{th}$ digits right hand
- Progressive over the last month
- Pain in the neck

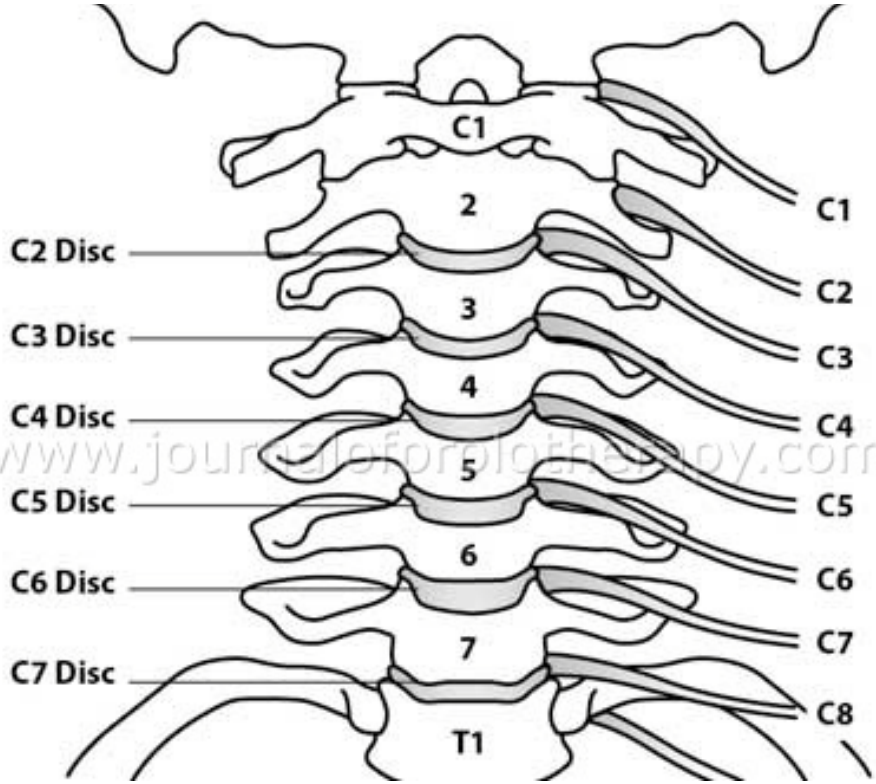
- What are you thinking? What do you do?

Cervical spine

- Functions
  - support and stability for the head, range of motion, housing for spinal cord and vertebral artery
- Movements
  - flexion/extension, rotation, lateral bending

Cervical Spine: Anatomy

- Anatomy
  - 7 cervical vertebrae, 8 nerves
  - Brachial plexus C5-T1

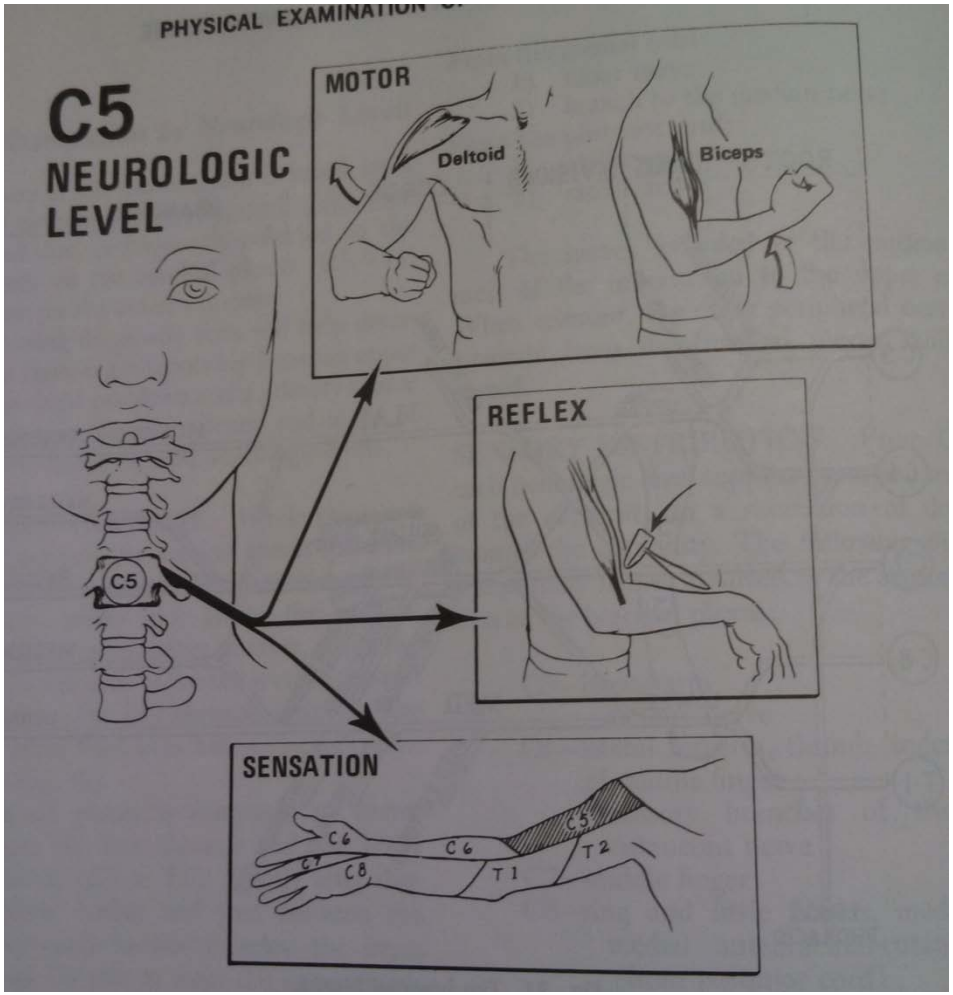


Cervical Spine: Neuro Exam

Disc	Root	Reflex	Muscles	Sensation
C4-5	C5	Biceps	Deltoid Biceps	Lateral arm Axillary nerve
C5-6	C6	Brachioradialis	Biceps Wrist Extension	Lateral forearm Musculocutaneous nerve
C6-7	C7	Triceps	Wrist Flexors Finger extension Triceps	Middle finger
C7-T1	C8	NONE	Finger Flexion Hand Intrinsics	Medial forearm Med. Ant. Brach. Cutaneous nerve
T1-T2	T1	NONE	Hand Intrinsics	Medial arm Med. Brach. Cutaneous nerve

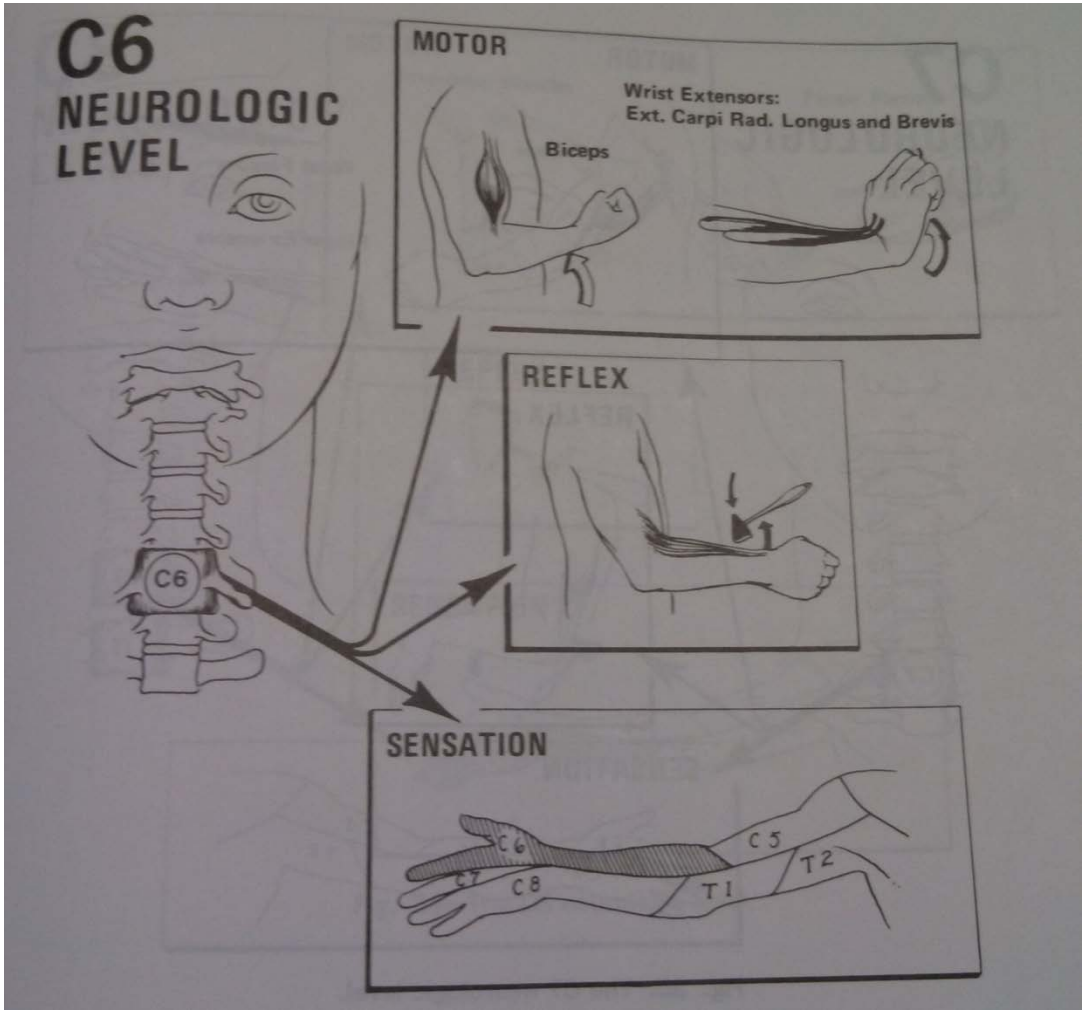
C5

Disc	Root	Reflex	Muscles	Sensation
C4-5	C5	Biceps	Deltoid Biceps	Lateral arm Axillary nerve



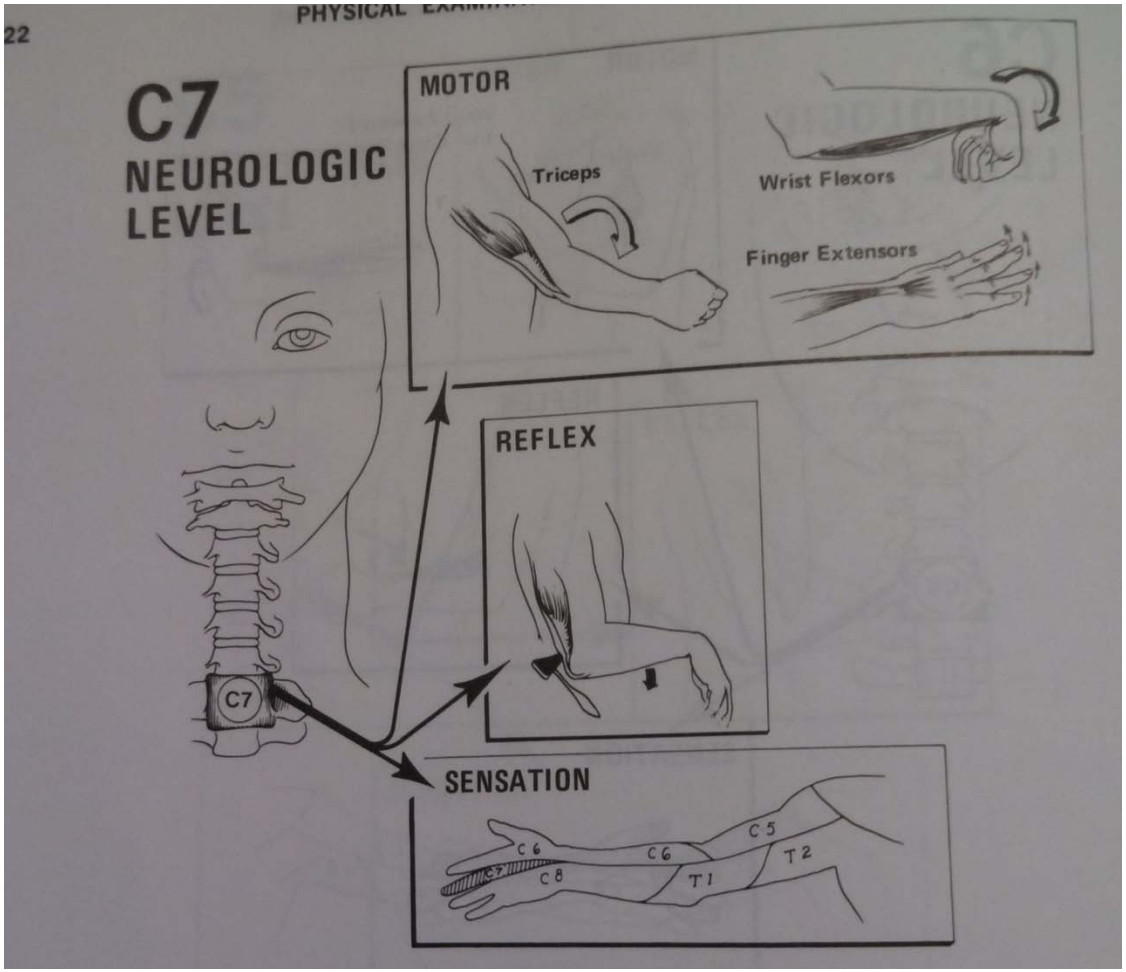
C6

Disc	Root	Reflex	Muscles	Sensation
C5-6	C6	Brachioradialis	Biceps Wrist Extension	Lateral forearm Musculocutaneous nerve



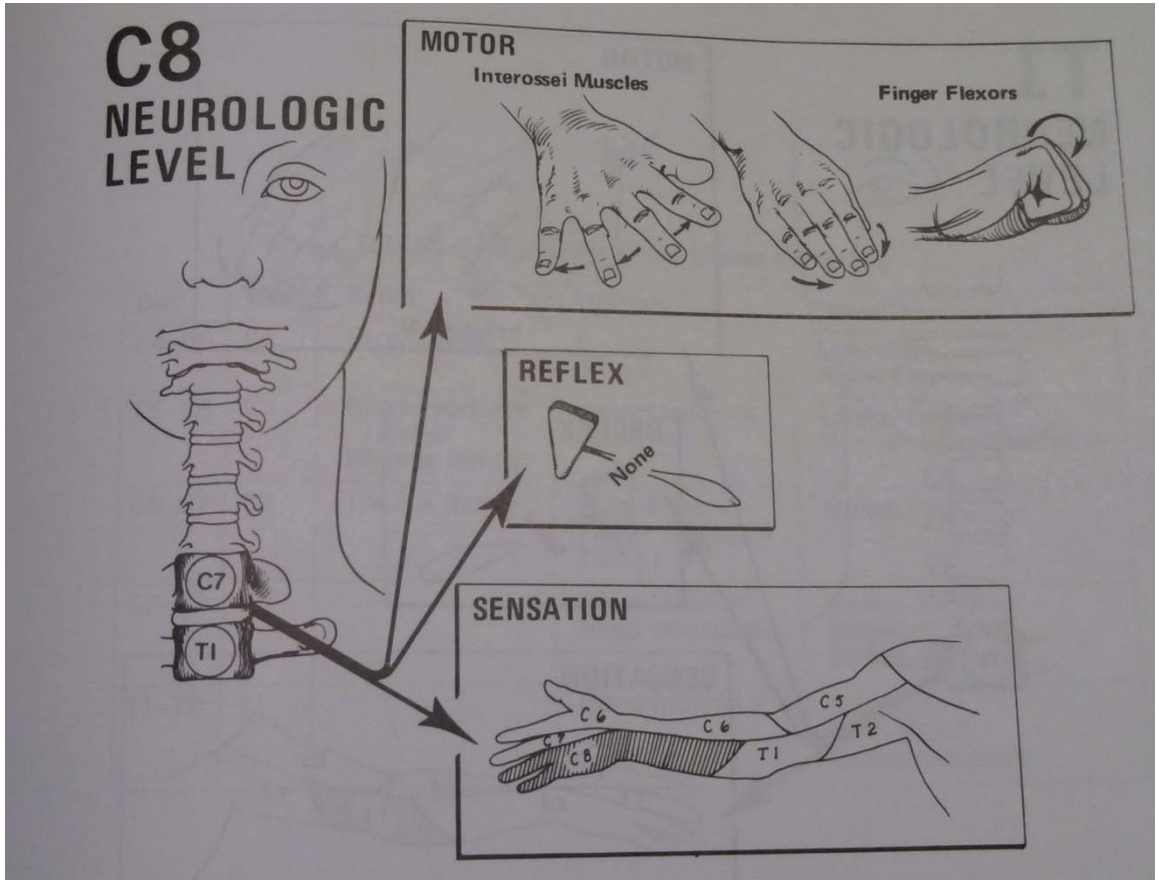
C7

Disc	Root	Reflex	Muscles	Sensation
C6-7	C7	Triceps	Wrist Flexors Finger extension Triceps	Middle finger



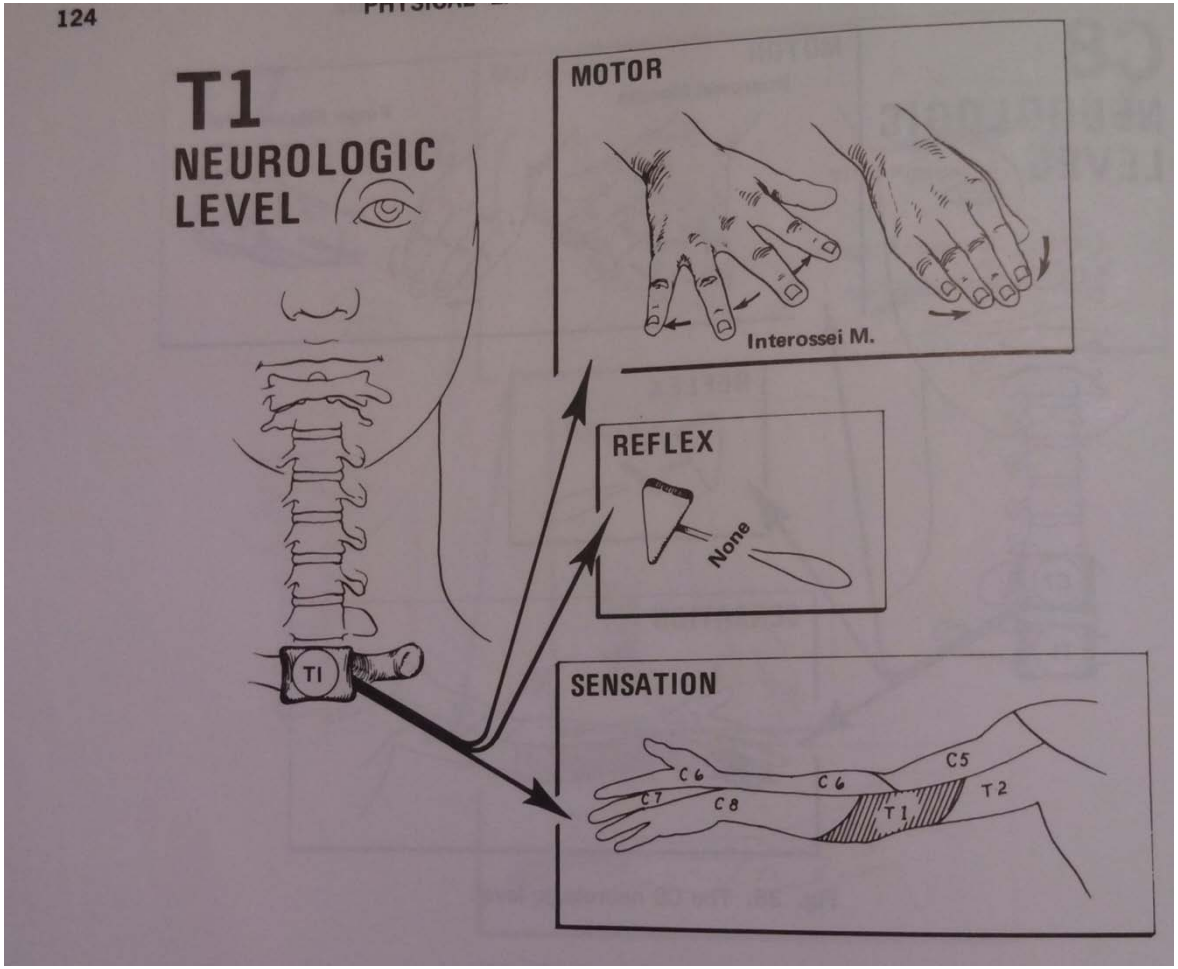
C8

Disc	Root	Reflex	Muscles	Sensation
C7-T1	C8	NONE	Finger Flexion Hand Intrinsics	Medial forearm Med. Ant. Brach. Cutaneous nerve

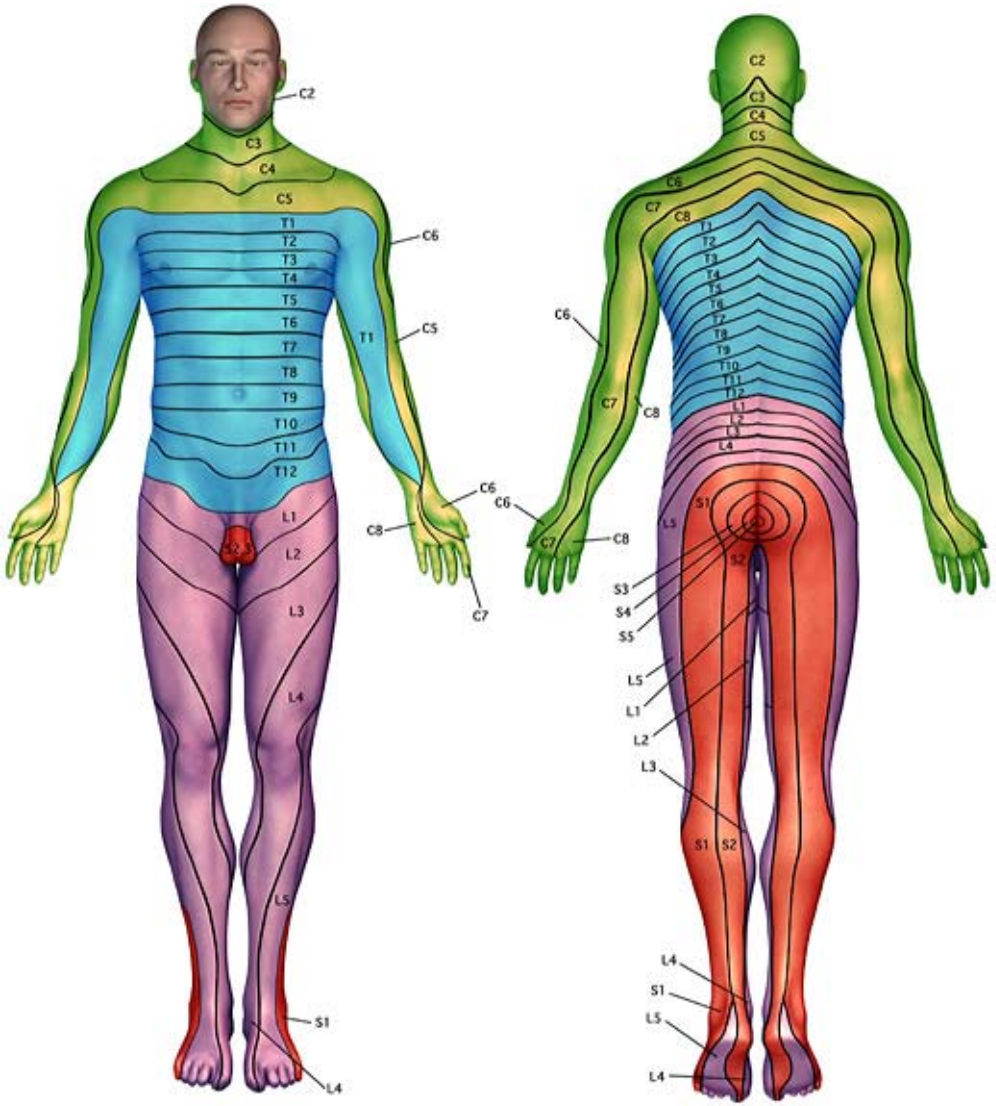


T1

Disc	Root	Reflex	Muscles	Sensation
T1-T2	T1	NONE	Hand Intrinsics	Medial arm Med. Brach. Cutaneous nerve



Dermatomes



MAP KEY

L1,2,3,4	Anterior and inner surface of lower limbs
L4,5, S1	Foot
L4	Medial side of great toe
S1,2,L5	Posterior and outer surface of lower limbs
S1	Lateral margin of foot and little toe
S2,3,4	Perineum
T10	Level of umbilicus
T12	Inguinal or groin regions
C5	Clavicles
C5, 6, 7	Lateral parts of upper limbs
C8, T1	Medial sides of the upper limbs
C6	Thumb
C6, 7, 8	Hand
C8	Ring and little fingers
T4	Level of nipples

Neuro Exam Nuts and Bolts

- Inspection
  - Awake/alert? Sleepy? Arousable to voice or pain?
  - Symmetric spontaneous movements and facial symmetry
  - Muscular atrophy
- Ask
  - Injury, h/o seizures, syncope or surgery
  - PMHx/PSHx/Medications
  - HA or neck pain, visual deficits, nausea/vomiting
  - Weakness, numbness/tingling
  - Bowel or bladder incontinence
  - Orientation

Neuro Exam Nuts and Bolts

- Exam in brief
  - Shine a light in the pupils, EOMs, visual fields
  - Smile, stick out tongue
  - Hold hands palms up with eyes closed
  - Hold hands and test upper extremity strength/sensation; Hoffman's
  - Lower extremity strength/sensation; Clonus
  - Reflexes in a counter clockwise fashion
  - Rectal?

  - Follow the deficit

  - When in doubt, ask or check again

Case 5

- TRIAGE NOTE:

- pt amb to a triage with back pain. pt states this flare started Monday. pt with radiation down right leg. pain meds not helping. LD motrin and norco and prednisone at 0600.

Ask

- 52y/o male
- Location: Right lumbar down RLE into the foot
- Duration: 3 months, recent increase after walking off a plane 4 days ago
- Quality: shooting
- Severity:
- Associated with: weakness & numbness
- No Bowel/bladder incontinence
- Previous treatments: MDP, ESI, norco, motrin
- Has an appointment with another neurosurgeon in 5 days but the pain is too great
  - Scheduled for surgery in 3 weeks with this surgeon
- Demanding surgery today or tomorrow
  - Business trip in two weeks

Exam

- Exam in brief
  - Orientation
  - Shine a light in the pupils, EOMs, visual fields
  - Smile, stick out tongue
  - Hold hands palms up with eyes closed
  - Hold hands and test upper extremity strength/sensation; Hoffman’s
  - Lower extremity strength/sensation; Clonus
  - Reflexes in a counter clockwise fashion
  - Rectal?

Documenting Your Exam

- AOx3
- PERRL, EOMI, no droop
- Right EHL 4+/5. Rest of exam 5/5
- Mild decreased sensation over the top of the foot
- 2+ bil B/BR/P
- No hoffmans, no clonus downward toes
- + straight leg test on the right with leg fully extended
- + pain with internal/external rotation on right hip

Giving Report

- Identify yourself
- Name, age, room number
- Pertinent meds
  - Know if pt is on any blood thinners: aspirin, plavix, coumadin
    - Some of the newer ones: brilinta, pradaxa, eliquis
  - Seizure prophylaxis
- CC, pertinent history
  - Include pertinent neuro history and who the doc/surgeon was
- Exam!
- Labs – specifically coags, sodium, glucose
- Identify size and location of lesions

Stroke: brief points

- An interruption of blood flow to the brain
- Do a thorough neuro exam, with attention to…
- Sudden:
  - Numbness or weakness of face, arm or leg, especially on one side of the body
  - Confusion, trouble speaking or understanding
  - Vision changes
  - Gait disturbance

- Page the stroke team ☺

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