

Caring for patients at risk for neurologic decline: the gray matters!

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Objectives

- Identify etiologies of neurological decline
- Acquire neuro exam “pearls” for pediatric and adults
- Apply strategies from lecture to case study



Which is an early sign of increased ICP?


- A. Headache
- B. Vomiting
- C. Cushing's Triad
- D. A & B
- E. A, B, & C



Extensor posturing to noxious stimuli is considered purposeful movement.

A. True

B. False



The GCS score takes into consideration changes in brainstem function, hemiparesis and/or aphasia.

A. True

B. False



Identification of at-risk patients

+

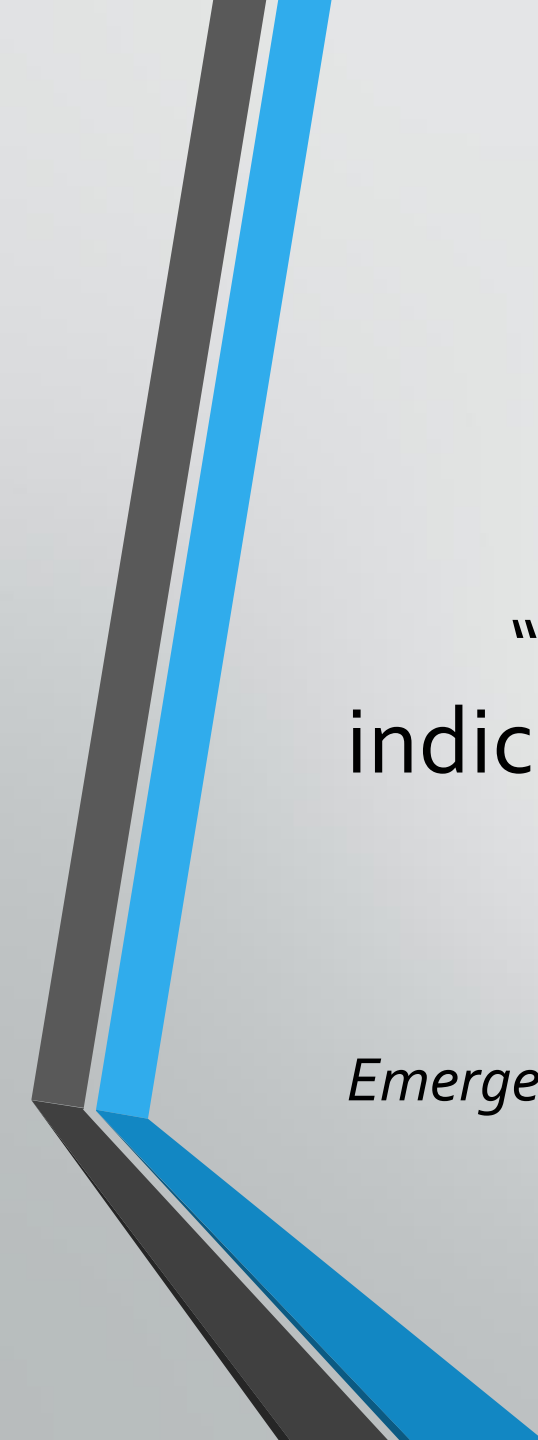
High quality, focused neuro exam

+

Shared mental model of the patient's
current status

=

Early recognition of neurologic decline



What is a brain code?

“Life threatening neurological emergency
indicating that the adaptive intracranial compliance
mechanisms have been overwhelmed.”

Emergency Neurological Life Support: Intracranial Hypertension and Herniation.
Neurocritical Care Society, 2017.

Extra-axial process

- Epidural/subdural hemorrhage

Focal process

- Primary/metastatic brain tumor
- Ischemic stroke

Diffuse process

- TBI (can also be focal)
- Meningitis/encephalitis
- Non-infectious neuroinflammatory diseases
- Toxic-metabolic encephalopathies

Etiologies of brain code

Onset

Abrupt


- Stroke, seizure or cardiac event with impaired cerebral perfusion

Gradual

- Metabolic, toxic, or infectious process

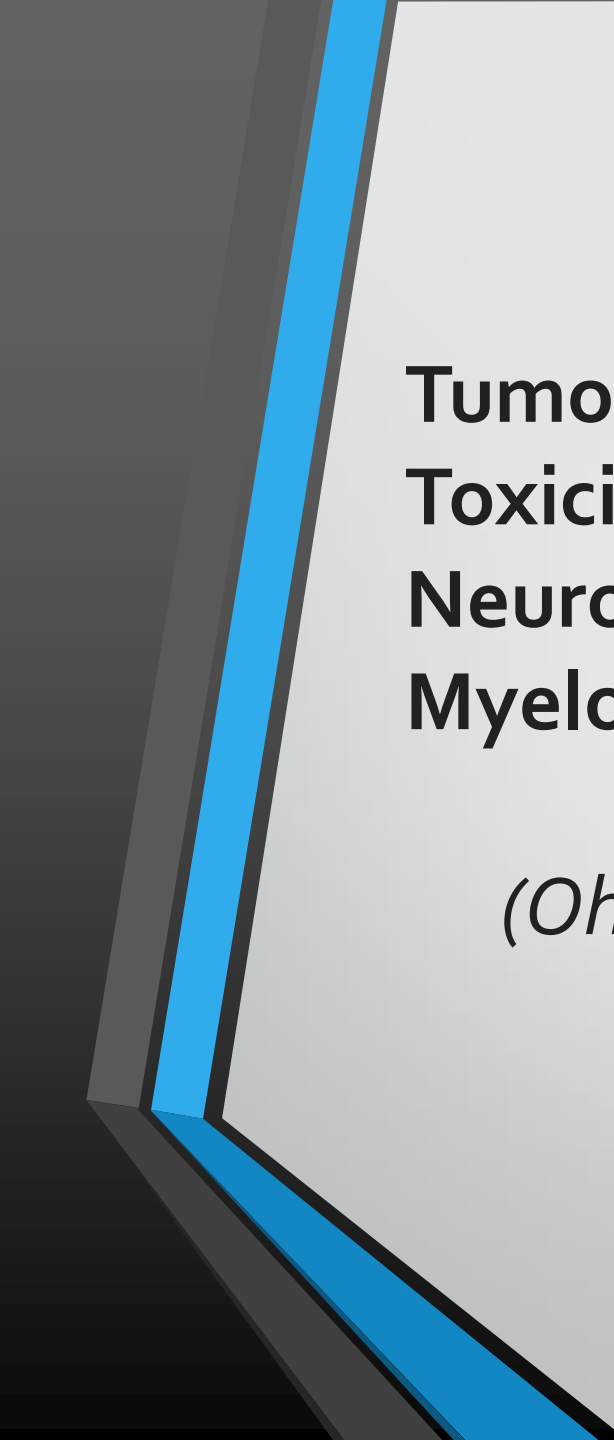
The fundamentals

- Understand which patients are at risk and why
- Be aware of potential neurologic complications (from medical or surgical intervention)
- **Obtain a baseline exam** and serial exams
- Document and communicate findings



Who will benefit from a neuro
exam?

***Most patients at the
Clinical Center!***



Tumors
Toxicities
Neuropathies
Myelopathies

(Oh my!)

Intracranial and spinal cord tumors (primary or metastatic)

Tumor infiltration of nerve roots

Toxic neuropathies (chemotherapy-induced peripheral neuropathy)

platinum compounds, vinca alkaloids, taxanes, proteasome inhibitors and thalidomide

Myelopathy from intrathecal chemotherapy

Methotrexate and cytarabine

CAR T-cell neurotoxicity (aphasia, confusion, memory loss, meningismus, focal weakness, ataxia, myoclonus, seizures)

Checkpoint inhibitor neurotoxicity (encephalitis, GBS-like syndrome, mononeuropathies)

Neuro exam challenges

Perceived as labor intensive

Lack of confidence:

- Performing exam
- Accuracy of findings secondary to subjectivity
- Interpretation of findings

Neuroanatomy knowledge deficit

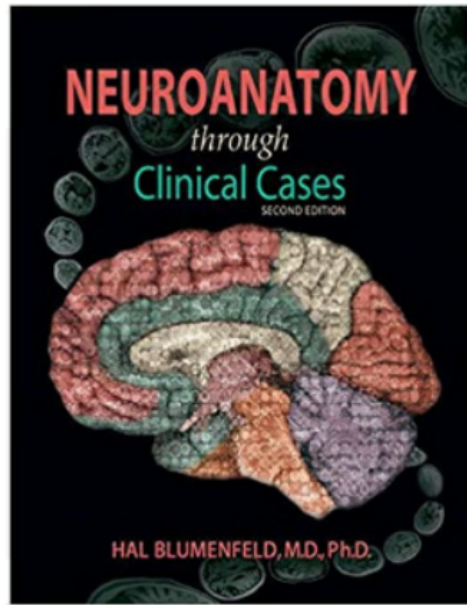
Why do an exam when we can get HCT?

Books > Medical Books > Medicine

Neuroanatomy through Clinical Cases 2nd Edition

by [Hal Blumenfeld](#) (Author)

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Deficit describes
the motor or
sensory
abnormality (what)

Lesion describes
the area of
dysfunction
(where)

Is the symptom neurologic?

Localization

- Determines if problem is neurologic
- Requires practice = confidence in assessment
- Clinical changes don't always correlate with imaging

High index of suspicion

- *Any change in baseline exam*
- New deficit or asymmetry
- Worsening of known focal deficit
- *Any patient who because of their disease process or treatment is at increased risk for adverse neurologic event!*

The focused neuro exam

Doorway assessment

Vital signs, including pain (5th vital sign)

Level of consciousness

Cranial nerves

Motor exam

Gait (if possible)

**Doorway
assessment:**
*invaluable in
the COVID era*

What is the underlying diagnosis?

What treatments or conditions predispose to adverse neurologic event?

Sick or not sick?

Activity level

Any obvious asymmetries?

Vital signs

- Sudden blood pressure elevation
- Sudden onset, severe headache
- Cushing's triad (hypertension, bradycardia, irregular respirations/apnea)—*late finding*

Level of Consciousness

Arousal: wakefulness

- Eye opening
- GCS score: *does not account for changes in brainstem function, hemiparesis or aphasia.*

<https://www.glasgowcomascale.org/#video>

Awareness: follow commands, content processing

Pearls for assessing LOC and mental status

Caution with "A&O x 3"

Caveats for pediatric testing

Command crossing midline (touch left thumb to right ear")

Brief language testing: fluency, repetition ("Today is a sunny day.")

Attention: days of week forward/backwards

Pupils and eyelids

- Baseline anisocoria? Ptosis?

Gaze

- Dysconjugate primary gaze, roving eye movements

Extraocular movements

- Decreased **AB**duction, decreased upgaze
- Visual fields

Facial/tongue symmetry

- Show me your teeth, raise your eyebrows

Cranial nerve exam

Describe what you see—which CN is involved?



<https://eyerounds.org/atlas/Quiz/Q5/index.htm#tab1>

Describe what you see—which CN is involved?



<https://eyerounds.org/atlas/Quiz/Q5/Q5p07.htm#tab1>

Cranial nerve pearls

- Ensure adequate light source for checking pupils
- Intentionally look for physiologic anisocoria and document what you see
- Check EOMs and look for head tilt for new complaint of diplopia

Motor exam

Spontaneous movement

- Purposeful
- Reflexive

Posturing

- Decerebrate (extensor posturing)
- Decorticate (flexor posturing)

Flexor or extensor posturing to noxious stimuli is reflexive!



Strength

- 0 No muscle activation
- 1 Trace muscle activation, such as a twitch, without achieving full ROM
- 2 Muscle activation with gravity eliminated, achieving full ROM
- 3 Muscle activation against gravity, full ROM
- 4 Muscle activation against some resistance, full ROM
- 5 Muscle activation against examiner's full resistance, full ROM

(Medical Research Committee Manual Muscle Testing)

Caveats to manual muscle testing

Subjective:
examiner's
perspective

- Can miss subtle changes over time

Variability in
examiner's
strength

Confounding
conditions (ie
arthritis, pain,
sedating
medications)

Patient effort

UMN patterns

Motor findings:

- contralateral weakness and spasticity
- UE flexion is stronger than extension
- LE extension is stronger than flexion
- Plantar flexion is stronger than dorsiflexion

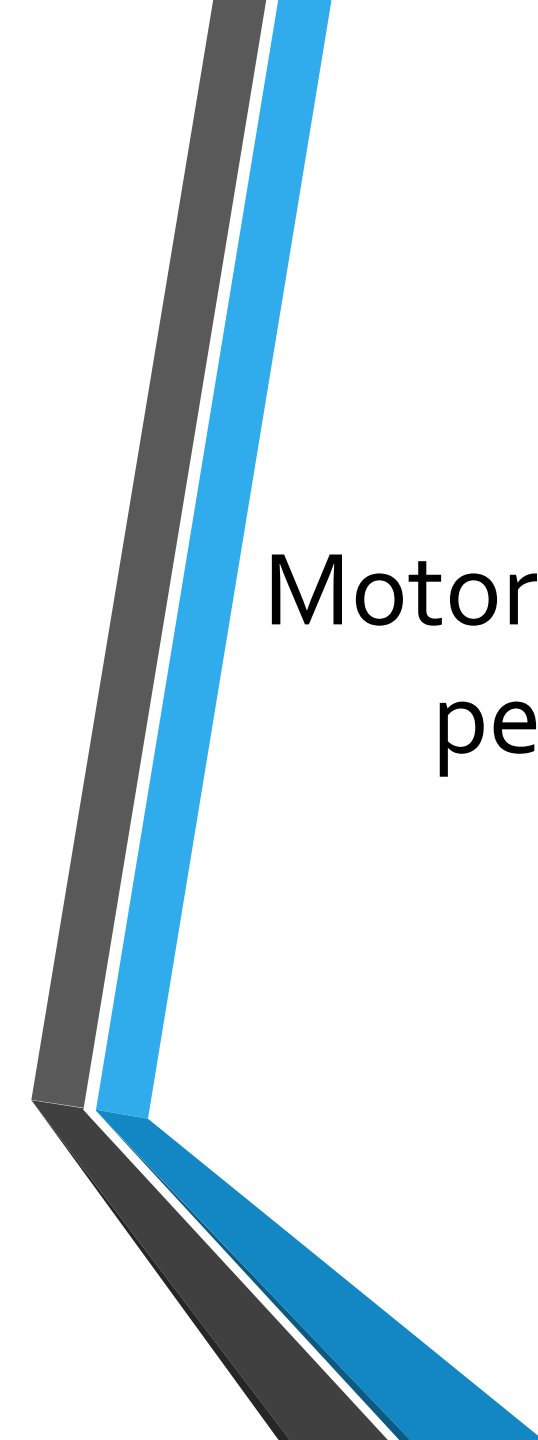
Sensory findings:

- contralateral deficits

Reflexes:

- Increased





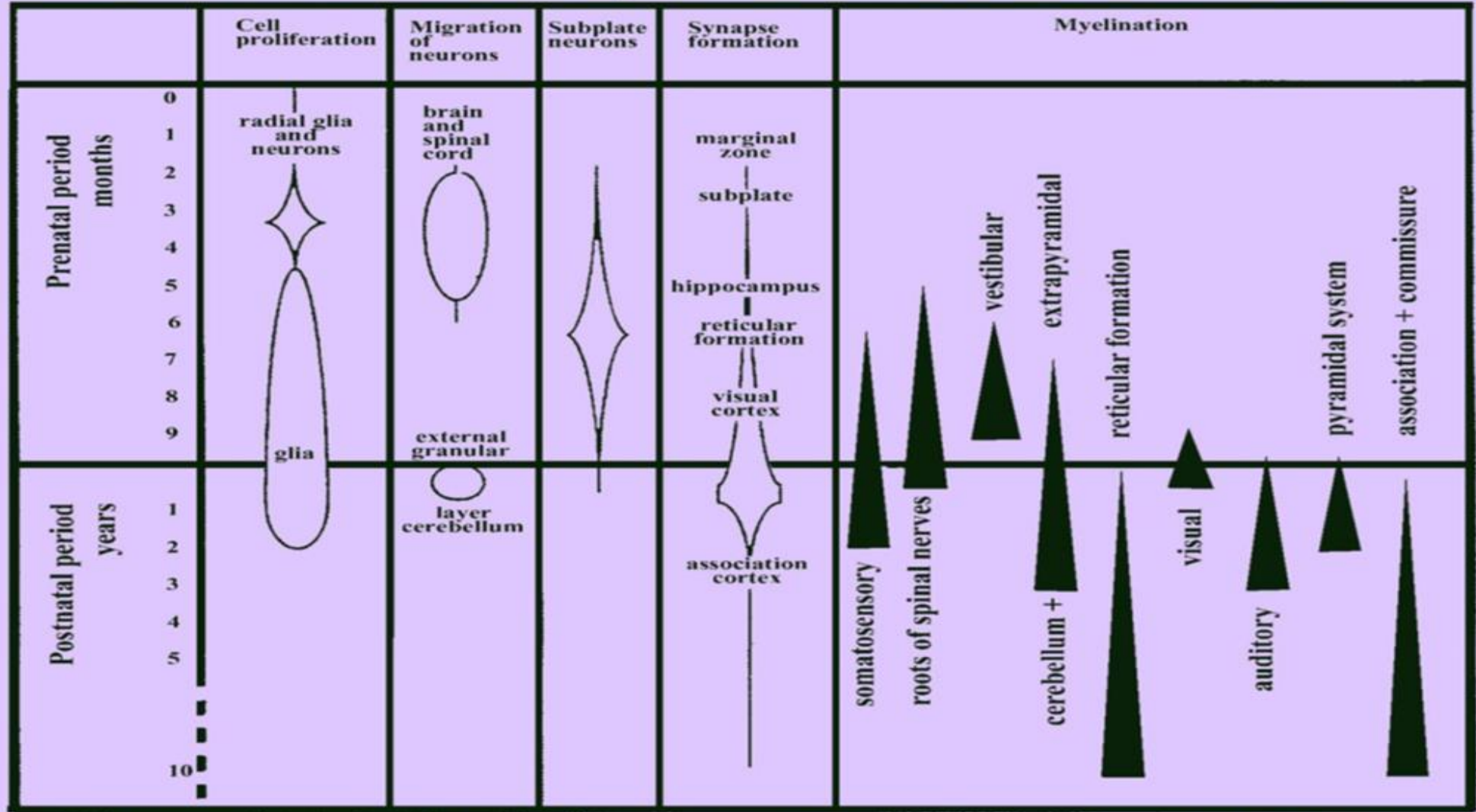
Motor testing pearls

- Pronator drift = subtle sign of upper extremity weakness
- Upper motor neuron weakness pattern:
- UE: flexion is stronger than extension
- LE: extension is stronger than flexion
- Plantar flexion is stronger than dorsiflexion
- Gait is a very sensitive test: checks motor, sensory, cerebellar and extra-pyramidal functioning

Pediatric considerations

- 90% of brain development occurs by age 5. By 2 years old, brain has attained 75% of adult weight! Different systems myelinate at different times.
- Infants have an immature neurological system
- Innumerable factors that impair normal neurodevelopment (environmental toxins, stress, medications, malnutrition, maternal influences)
- Sedative agents including benzos, propofol and ketamine, interact with the receptors for the neurotransmitters gamma-aminobutyric acid and glutamate, and potentially have long-term neurodevelopmental effects.

Time Lines of Developmental Processes in Humans



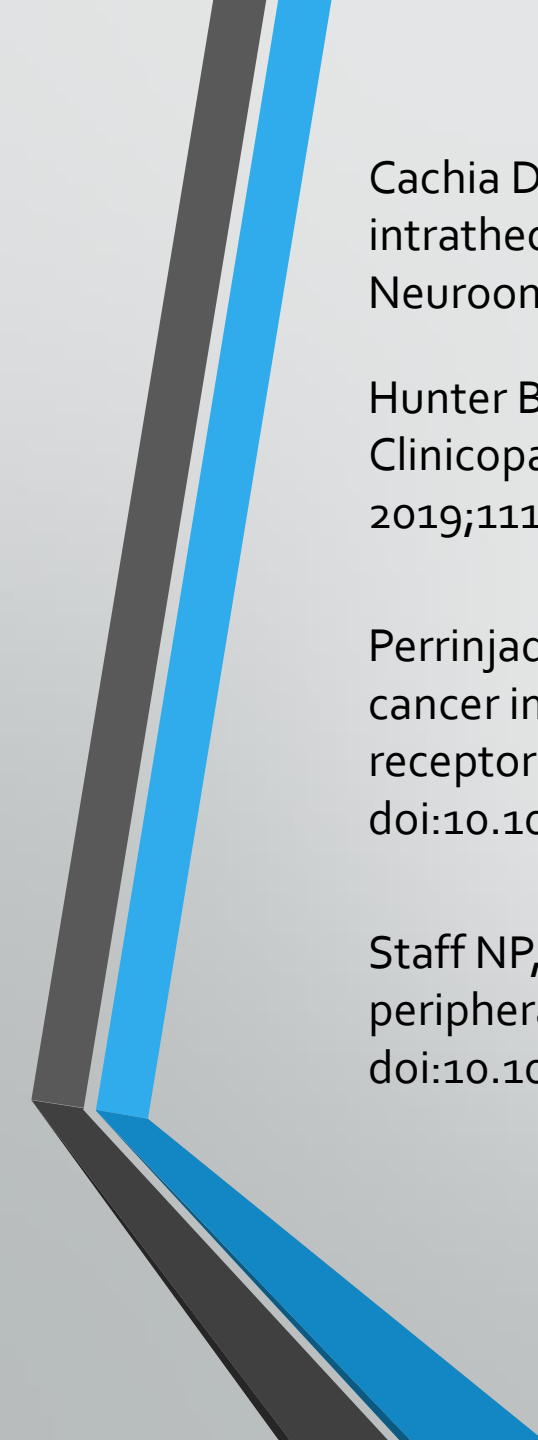
Rice and Barone, EHP 108(S3):511-533, 2000. Adapted from Herschkowitz et al., 1997

The pediatric neuro exam

- **The exam begins at the doorway, regardless of age**
- Smile! Comment on outfit/toy, guess age to gain rapport
- For kids >8, the exam is essentially the same for adult unless there is developmental delay
- For younger children, gain rapport and play! Anything can become a game
- “Catch as catch can” and save the hardest parts for last (usually eye exam)
- Be willing to be silly
- Look at old pictures to verify baseline findings
- Engage parents in the exam

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