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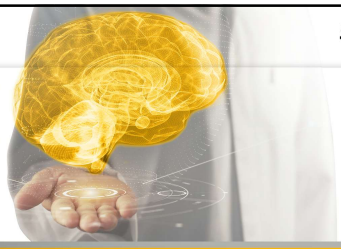
SKILL™
Stroke Knowlege Initiatives
for Learning and Leadership



NIHSS course

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NIHSS training course

- **Welcome**
- **Introductions**
- **Objectives**
  - Describe what the NIHSS is, reasons to perform, and when to test
  - Perform the NIHSS and based on exam demonstrate localization of the infarct
  - Demonstrate knowledge of the NIHSS by practicing exam on each other and with training videos

Handouts
- ✓ Slides
- ✓ NIHSS worksheet
- ✓ NIHSS one page with coma notes

You will leave here with:
- ✓ Certificate of completion

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NIHSS training course

Outline

Stroke basics
- Types of stroke
- Anatomy
- Treatment

NIHSS instruction
- Video
- Presentation
- Coma tips
- Tele-presenter tips

NIHSS questions you may be asking
- *What* is the big deal?
- *Why* does it matter?
- *When* to perform?

NIHSS demonstration
- Instructor on volunteer
- Video
- Participants with each other

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SKILL™ Stroke Knowlege Initiatives for Learning and Leadership

Section 1

(30 mins)

- Stroke basics
- NIHSS – what, why, when

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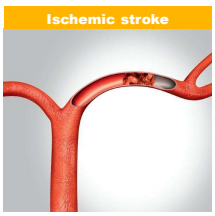
Stroke basics

Types of stroke

Ischemic = type of condition in which oxygen is deficient

Often caused by a blood clot or plaque buildup that blocks blood flow



Hemorrhage = bleeding

Occurs when a blood vessel ruptures, causing blood to leak into the surrounding tissue

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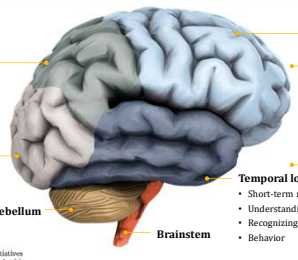
Stroke basics

Neuroanatomy



Parietal lobe
- Awareness of body parts
- Academic skills
- Naming objects
- Eye/hand coordination

Occipital lobe
- Ability to see and understand what you are seeing
- Reading

Frontal lobe
- Voluntary movement such as lifting your arm
- Ability to focus your attention
- Emotional, social and sexual control
- Ability to speak
- Decision-making

Cerebrum

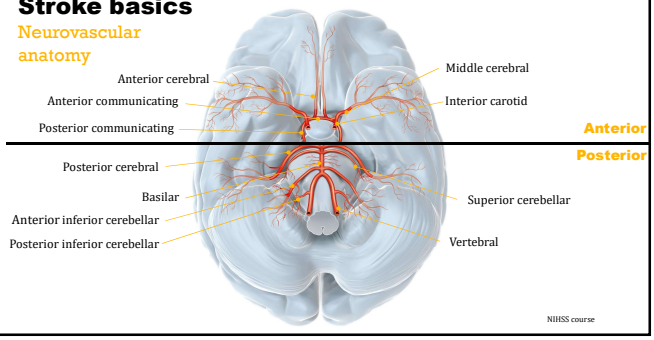
Temporal lobe
- Short-term memory
- Understanding speech
- Recognizing faces
- Behavior

Cerebellum

Brainstem

Stroke basics

Neurovascular anatomy



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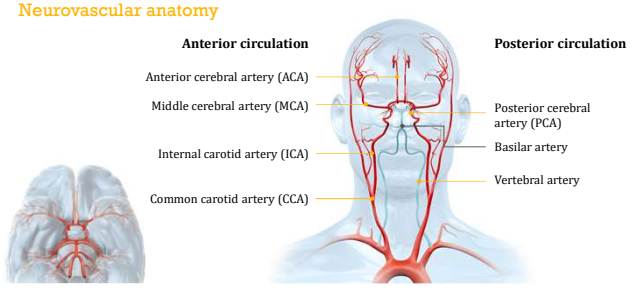
Stroke basics

Neurovascular anatomy



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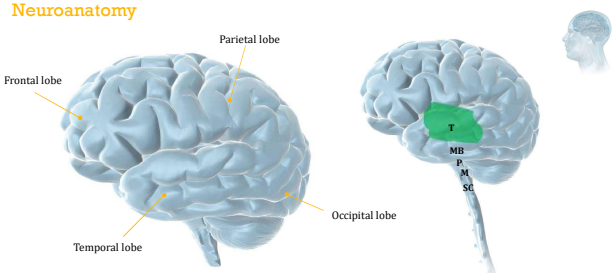
Stroke basics

Neuroanatomy



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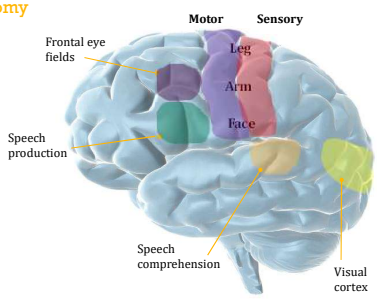
Stroke basics

Neuroanatomy



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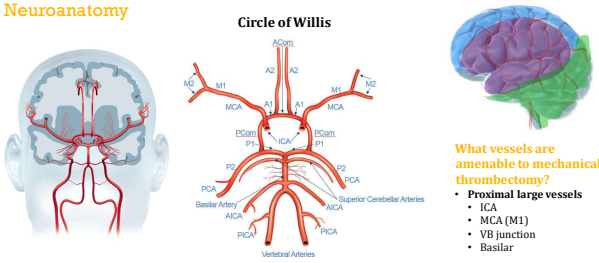
Stroke basics

Neuroanatomy

Circle of Willis



What vessels are amenable to mechanical thrombectomy?

- **Proximal large vessels**
  - ICA
  - MCA (M1)
  - VB junction
  - Basilar

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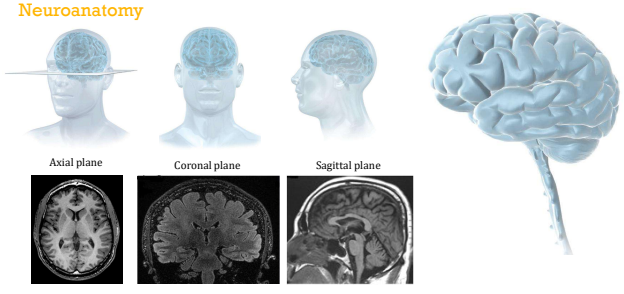
Stroke basics

Neuroanatomy



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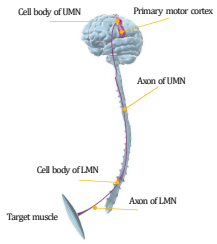
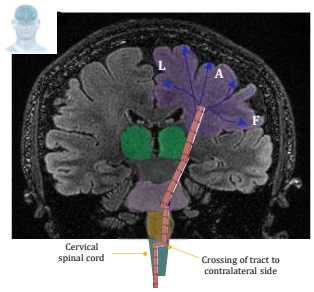
Stroke basics
Neuroanatomy





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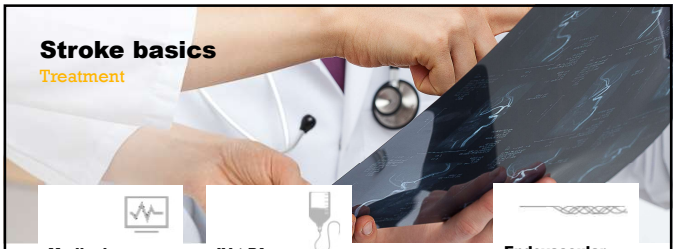
Stroke basics
Treatment



Medical management
Monitor vitals and provide secondary stroke prevention.

IV t-PA
Gold-standard in ischemic stroke care. Drug is designed to break apart the clot.

Bridging therapy

Endovascular clot removal
Mechanical disruption or removal of the clot using standard endovascular approaches.

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Introduction to NIHSS
Why, what, when

NIHSS
Why

- **Gold standard** for stroke severity score
- Common diagnostic **tool** and objectively quantifies impairment
- **Improve communication** – provide objective information and speak a **consistent language**
- **Monitor** the effectiveness of treatment methods and quantify a patient's improvement or decline

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NIHSS
What

- **Tool to objectively quantify impairment caused by a stroke**
- **11 items (0 - 4 points each)**
  - 0 = normal
  - 1 - 4 = degree of impairment
- **Total score range: 0 – 42**
- **Used to guide risk benefit for administering IV-tPA**
- **Designed in 1983 to be a standardized and repeatable assessment of stroke patients**
- **Used internationally and by most large multi-centered clinical trials**
- **High level of consistency – although not perfect**

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Deficit vs disability

- **Stroke is the leading cause of disability in the US**
- **The score itself does not necessarily relate to disability and even a score of 2 can be highly disabling**

55 yo woman
Right hand weakness

76 yo man
Ataxic gait

33 yo man
Dysphagia

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NIHSS
When

- **How often and when needs to be determined at your own organization!**
- **Consider**
  - Frequent and repeated assessments
  - With alteplase (t-PA), on admission and discharge
- **Review certifications standards, clinical practice guidelines, and stroke literature**
- **Understand it's limitations**
  - Acknowledge NIHSS was designed for trials and not widespread use as a bedside tool

NIHSS
Pitfalls

- **Score differs for dominant hemisphere strokes**
  - Left > right hemisphere by 4 points
- **Lessened weight for posterior circulation stroke**
  - By design does not quantify brainstem stroke (most clinical trials exclude)
  - Appendicular vs truncal ataxia
- **Items with poor reliability**
  - LOC, facial palsy, limb ataxia, dysarthria
- **A score of 42 – worst score**
  - Can't happen (max score for coma pt is 39)

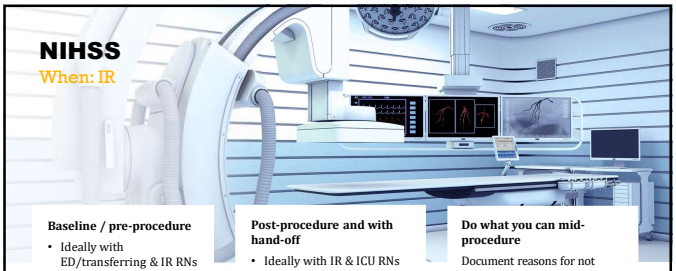
Implications

Importance of understanding, training and demonstration

"Lack of accuracy designed intentionally as a sacrifice to gain reproducibility"

Lyden, P. (2017). Using the National Institutes of Health Stroke Scale: A Cautionary Tale. *Stroke, 48*(2), 513-519.

NIHSS
When: IR



Baseline / pre-procedure
- Ideally with ED/transferring & IR RNs
- Confirm deficits

Post-procedure and with hand-off
- Ideally with IR & ICU RNs
- Confirm deficits

Do what you can mid-procedure

Document reasons for not able to complete (shows acknowledgement of the requirement) & do what IS appropriate

NIHSS instructions

- Administer stroke scale items in the **order listed**
- **Do not coach, except where indicated**
  - (i.e., repeated requests to patient to make a special effort)
- **Accept patient's first effort**
- Scores should reflect **what the patient does**, not what the clinician thinks the patient can do
- **Score old deficits**
- **Follow directions** provided for each exam technique
- **Do not go back** and change scores
- **Record answers** while administering the exam and work quickly

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Section 2
(1 hour & 25 mins)

- NIHSS instruction (lecture/video/demonstration)
- Includes localization of symptoms

1a. Level of consciousness

Instructions

Choose a response,
- Even if obstacles, i.e., ET tube, language barrier, orotracheal trauma/bandages

Exception to the first effort rule
A 3 is scored
- Patient makes no movement (other than reflexive posturing) in response to noxious stimulation

Coma note: 1a = 3
Intubated note: testable

Scoring 1

- 0 Alert; keenly responsive
- 1 **Drowsy, lethargic;** not alert, but arousable by minor stimulation to obey, answer, or respond
- 2 **Stupor, obtunded;** not alert, requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements
- 3 **Coma;** reflex motor or autonomic effects or totally unresponsive, flaccid, areflexic - Coma

1b. LOC questions

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Instructions

Ask month and age
No partial credit
Score 1st answer
No cues allowed
Intubation, trach, language barrier, severe dysarthria, etc.
- Score is 1

Aphasic and stuporous pts
- Score is 2

Coma note: If 1A = 3, then 1B = 2
Intubated note: 1

Scoring 1

0 Answers both questions correctly
1 Answers one question correctly
2 Answers neither question correctly

How aware is the patient in relation to:
- Other people
- Place
- Time

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1c. LOC commands

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Instructions

Ask to close and open eyes
Ask to grip and release non-paretic hand
Credit is given if an unequivocal attempt is made but not completed due to weakness
Physical impediments should be given suitable one-step commands

Coma note: 2
Intubated note: testable

Scoring 1

0 Performs both tasks correctly
1 Performs one task correctly
2 Performs neither task correctly

Localization tips:
1c starts to look at language
- **Comprehension**
- **Naming**
- **Repetition**
- **Reading**

Score 2 for receptive aphasia

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Mental status: What are we examining?

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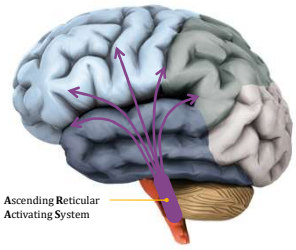
Localization tips

Decreased LOC common in:
- Bilateral diffuse cerebral hemisphere
- Hemorrhagic stroke
- Large ischemic stroke

Brainstem
- Midbrain and pons, which includes the RAS



Ascending **R**eticular
Activating **S**ystem

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Decrease mental status causes:

1. **Structural**
2. **Metabolic**
3. **Lack of energy substrates**
   (i.e., seizures, cerebral edema)

A – E – I – O – U
Alcohol, epilepsy, insulin, opium, uremia

TIPSS
Tumor, injury, psychiatric, stroke, sepsis

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Best gaze

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Instructions
- Test voluntary or reflexive (oculocephalic) horizontal eye movements
- Partial gaze palsy: conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity
- Isolated peripheral nerve paresis (CN III, IV or VI) - score is 1
- Ocular trauma, bandages, pre-existing blindness or other disorder of visual acuity
  - Test with reflexive movements
- Can attempt having pt track face to clarify the presence of a partial gaze palsy
- Aphasic patients: you can ALWAYS test gaze

Coma note: testable with oculocephalic maneuver
Intubated note: testable

Scoring 2

0 Normal
1 Partial gaze palsy, gaze is abnormal in one or both eyes, but where forced deviation or total gaze paresis are not present
2 Forced deviation, or total gaze paresis not overcome by the oculocephalic maneuver

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Best gaze

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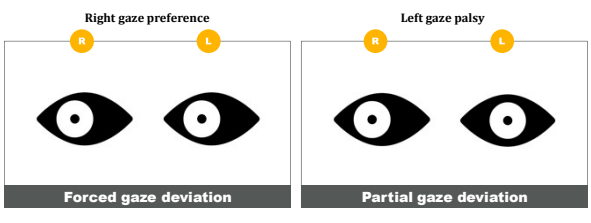

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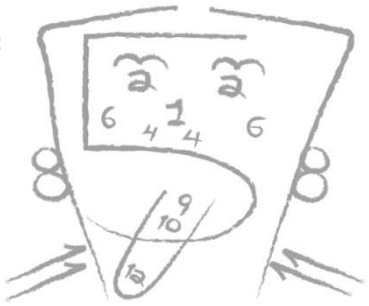
Stroke assessment



All photographs taken by Stryker Neurovascular.
Bolek, B. (November 2006). Face cranial nerve assessment. American Nurse Today .

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Oculocephalic reflex

Doll's eye

	Unimpaired	Impaired
Head turned right	Eyes turn left	Eyes fixed
Head turned left	Eyes turn right	Eyes fixed

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Best gaze: What are we examining?

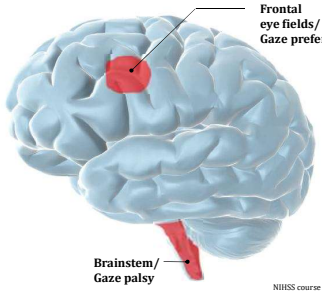
Localization tips

Frontal eye fields:

- Can produce gaze preference
- Inability to produce gaze contralateral to the side of the lesion and the tendency is for deviation of the eyes toward the side of the lesion
- Forced gaze looks toward lesion

Brainstem:

- **Can produce gaze palsy**
- **Cranial nerves III, IV and VI**
- **Bilateral pontine lesions**
  - Abolish all horizontal eye movements, allows vertical eye movements (ocular bobbing)



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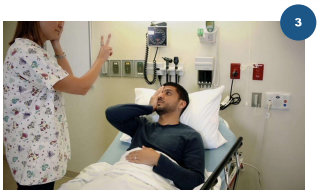
Visual

Instruction

- Test one eye at a time
- Tell patient you are testing peripheral vision
- The examiner covers their opposite eye
- Finger moving – visual threat as appropriate
- May encourage patient
- Confused/language barrier but looks at the correct side - score is 0
- Blindness
  - Unilateral = score the remaining eye
  - Bilateral = 3
- Aphasia and unresponsive: test using threat
- Test for visual neglect at this time



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Coma note: testable with visual threat – use one finger in each quadrant, blink = intact
Intubated note: testable

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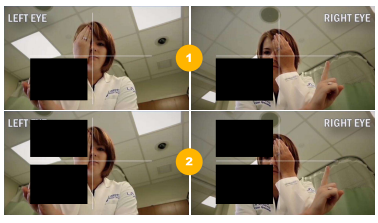
Visual



3

Scoring

0 No visual loss

1 Partial hemianopia: a clear-cut asymmetry, including quadrantanopia is found or for extinction (inattention)

2 Complete hemianopia

3 Bilateral hemianopia (blind from any cause including cortical blindness)

Coma note: testable with visual threat – use one finger in each quadrant, blink = intact
Intubated note: testable

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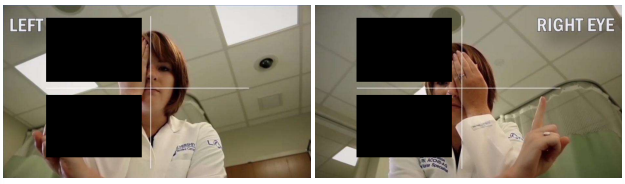
Left complete hemianopia



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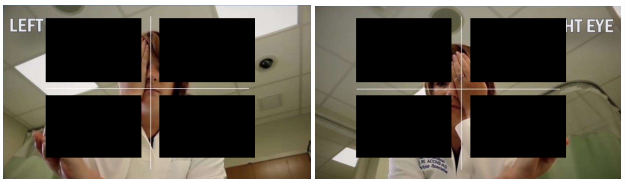
Bilateral hemianopia

Total blindness



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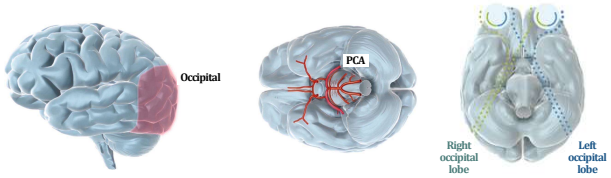
Visual: What are we examining?

Localization tips

- Typically occipital lobe and anywhere along the optic tract
- Large MCA territory infarcts can intercept visual tracts and produce a homonymous hemianopia



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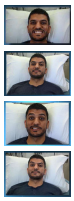
Facial palsy

Instructions

- Ask patient to show teeth, raise eyebrows, and close eyes tight
- May pantomime
- Poorly responsive/severely aphasic
  - Score symmetry of grimace in response to noxious stimuli
- Remove barriers if possible

Coma note: 3
Intubated note: testable



Scoring 4

- 0 Normal symmetrical movement
- 1 Minor paralysis (flattened nasolabial fold, asymmetry on smiling)
- 2 Partial paralysis (total or near total paralysis of lower face)
- 3 Complete paralysis of one or both sides (absence of facial movement in the upper and lower face)

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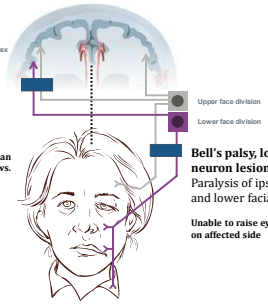
Facial palsy

What are we examining?



Central VII, upper motor neuron lesion
Paralysis of contralateral lower facial musculature

Unable to smile on affected side, but can raise both eyebrows.

Bell's palsy, lower motor neuron lesion
Paralysis of ipsilateral upper and lower facial musculature

Unable to raise eyebrow or smile on affected side

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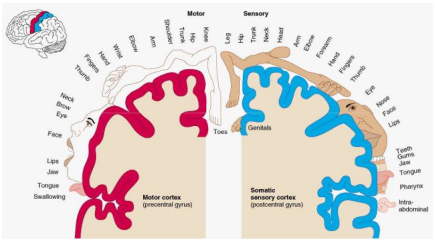
Facial palsy

What are we examining?

Localization tips

- Facial nerve
- Brainstem
- Motor cortex



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Motor

Instructions

- **Arm:** extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine) for ***10 sec***
- **Leg:** lift 30 degrees (always tested supine) for ***5 sec***
- Drift is limb falls before time frame
- Aphasic patient is encouraged using urgency in the voice and pantomime but not noxious stimulation
- Each limb is tested independently, beginning with the non-paretic arm
- Arthritis/joint pain: use best judgement

Coma note: 4
Intubated note: testable, permissible to use noxious stimuli if not following commands to determine if they can lift against gravity or not, or if there is no movement

5 6

- 0 No drift
- 1 Drift, limb drifts down before full time frame; does not hit bed or other support
- 2 Some effort against gravity, limb cannot get to or maintain position, drifts down to bed, but has some effort against gravity
- 3 No effort against gravity, limb falls, may have small proximal movement (ie. shrug shoulder)
- 4 No movement
- UN UN = Amputation, joint fusion explain

5a. Left arm
5b. Right arm
6a. Left leg
6b. Right leg

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Motor

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5 6

What component of the motor system is tested?

- Muscle strength

Muscle strength scale

Absent					Normal
0	1	2	3	4	5
No muscle contraction or movement of any kind detected	Slight muscle contraction detected	Movement when gravity is eliminated	Movement against gravity	Movement against gravity with some resistance	Movement against gravity with full resistance

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Motor anatomy:

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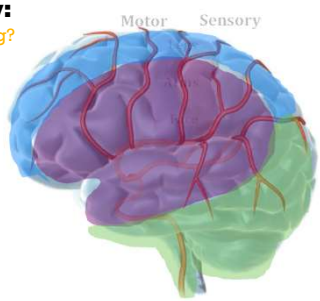
What are we examining?

Localization



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Limb ataxia

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Instruction

- The finger-nose-finger and heel-shin tests are performed on both sides
- Scored only if present out of proportion to weakness
- Have the patient fully extend arm
- Ataxia is absent in the patient who cannot understand or is paralyzed
- In case of blindness, test by touching nose from extended arm position
- Make sure this is done in intact visual field

0	Absent
1	Present in one limb
2	Present in two limbs
UN	Amputation or joint fusion, explain

Coma note: 0
Intubated note: testable

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Coordination:

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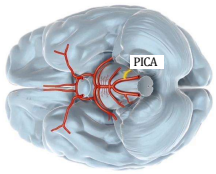
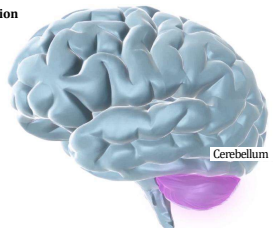
What are we examining?

Localization

The cerebellum is responsible for balance and coordination
Commonly posterior circulation

- Posterior inferior cerebellar artery
- Vertebrobasilar





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What about gait?

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Sensory

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8

Instructions

- Sensation or grimace to pin prick when tested, or withdrawal from noxious stimulus in the stuporous or comatose patient
- Comparing sides, not sharp or dull
- Score bare skin: not through clothing
- Test proximally - only sensory loss attributed to stroke is scored as abnormal (not neuropathy)
- Stuporous and aphasic patients will probably score 1 or 0 due to inability to clearly demonstrate
- Aphasic patient: test withdrawal of limb from noxious stimulus
- Brainstem stroke with bilateral loss of sensation is scored 2
  - Score of 2 is very rare!! There has to be complete sensory loss!

Coma note: 2
Intubated note: testable, may need to ask patient to point to where they are being touched

0	Normal; no sensory loss
1	Mild to moderate sensory loss; patient feels pinprick is less sharp or is dull on the affected side; or there is a loss of superficial pain with pinprick but patient is aware he/she is being touched
2	Severe to total sensory loss clearly demonstrate; patient is not aware of being touched in the face, arm, and leg

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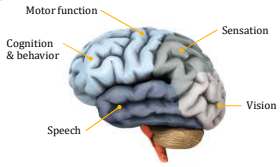
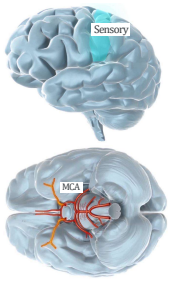
Sensory anatomy:

What are we examining?

Localization

- The **parietal lobe** controls sensation, speech organization, hand skills, grammar, and proprioception
- **Thalamus** can result in a pure sensory stroke
  - Thalamic pain syndrome





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Best language

Instructions
Ask patient to
1. Describe what is happening in the picture
2. Name the items on the naming sheet
3. Read the sentences

- Vision loss: ask the patient to identify objects placed in the hand, repeat, and produce speech
- Engage the patient in conversation and assess their language fluency
- Cultural implications
- 3 should be used only if the patient is mute and follows no one step commands

Coma note: 3
Intubated note: show the patient the pictures and have them write their answers

Scoring 9

0 **No aphasia, normal**

1 **Mild to moderate aphasia**
- Some obvious loss of fluency or facility without significant limitation on ideas expressed or form of expression
- Reduction of speech and/or comprehension, however, makes conversation about provided material difficult or impossible
  - For example in conversation about provided materials examiner can identify picture or naming card from patient's response.

2 **Severe aphasia**
- All communication is through fragmentary expression
- Great need for inference, questioning, and guessing by the listener
- Range of information that can be exchanged is limited
- Listener carries burden of communication
- Examiner cannot identify materials provided from patient response

3 **Mute, global aphasia; no usable speech or auditory comprehension**

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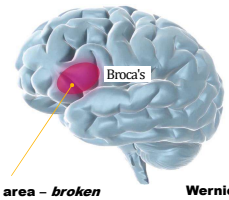
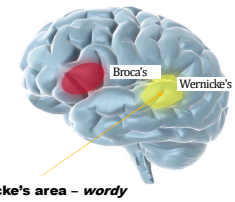
Language:

What are we examining?

Localization tips
- Left brain vs right brain dominance





Broca's area – *broken*
Frontal lobe
Expressive aphasia
Non-fluent aphasia

Wernicke's area – *wordy*
Temporal lobe
Receptive aphasia
Fluent aphasia/word salad

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Dysarthria

Instructions
- Ask patient to read or repeat words from the attached list
- For severe aphasia, the clarity of articulation of spontaneous speech can be rated
- If mute: score 2
- Intubated or has other physical barrier to producing speech – UN with clear explanation

Coma note: 2
Intubated note: unable to test (UN)

Scoring 10

0 Normal

1 Mild to moderate; patient slurs at least some words and, at worst, can be understood with some difficulty

2 Severe; patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric

UN UN = Intubated or other physical barrier, explain

Mama	**Thanks**
Tip-top	**Huckleberry**
Fifty-fifty	**Baseball player**

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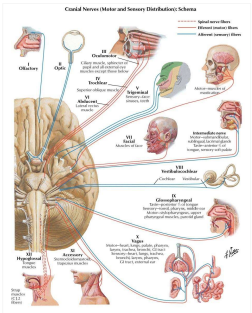
Dysarthria:

What are we examining?

Localization tips
- Problem with articulation (basic language is intact)
- Due to nerve, brain or muscle disorders
- Loss of control of the muscles of the mouth, tongue, laranyx, or vocal cords



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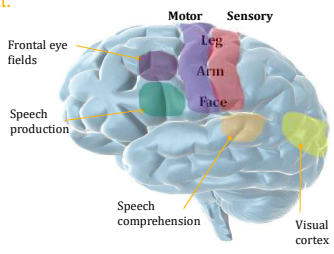
Dysarthria

Localization tips cont.

Dysarthria can coexist with aphasia



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Extinction and inattention
(formerly neglect)

Instructions
- Have patient close eyes and examiner touches limbs
  - Left – right – both
- Touch in a "one time" on and immediately off fashion instead of stroking back and forth
- Score normal if:
  - Severe visual loss preventing visual double simultaneous stimulation
  - If the patient has aphasia but does appear to attend to both sides
  - Blind person with intact sensory attention
- The presence of visual spatial neglect or anosagnosia may also be taken as evidence of abnormality
- Can test with visual stimuli as well
  - Looks at nose, wiggle fingers on left, right, both
  - Does not represent a vision problem!

Coma note: 2
Intubated note: testable

Scoring 11

0 No abnormality

1 Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities

2 Profound hemi-inattention or extinction to more than one modality; Does not recognize own hand or orients to only one side of space

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Extinction and inattention
What are we examining?

Localization tips
- Most common in right hemisphere stroke (non-dominant hemisphere)
- Damage to the parietal lobe
- Results most commonly in left neglect
  - Disclaim "ownership" with left side
  - Don't recognize familiar people on the left side

Model

Patient's copy

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SKILL™ Stroke Knowledge Initiatives for Learning and Leadership

Section 3
(25 min)

- NIHSS demonstration
- Watch video #1 and #2
  - Score on your own
  - Review results

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NIHSS demonstration

Instructor demonstrates

Conclusions

Congratulations!

1 **NIHSS is a great stroke assessment tool**

2 **Helpful to be able to tie anatomy to assessment**

3 **You are an NIHSS examiner**
- You now know some tips and tricks
- You've listened to, watched and demonstrated exam techniques

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SKILL™ Stroke Knowledge Initiatives for Learning and Leadership

Questions

Thank you for attending this continuing education presentation.

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