Board Review Neurology

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ARS Question

A 48 y.o. male presents with gradual progressive weakness of his proximal legs and arms without sensory loss. The exam confirms the weakness, reflexes are reduced, and no fasciculations are seen.

The best anatomical localization is?

A. Brain
B. Muscle
C. Motor neuron
D. Spinal cord
E. Peripheral nerve

ARS Question

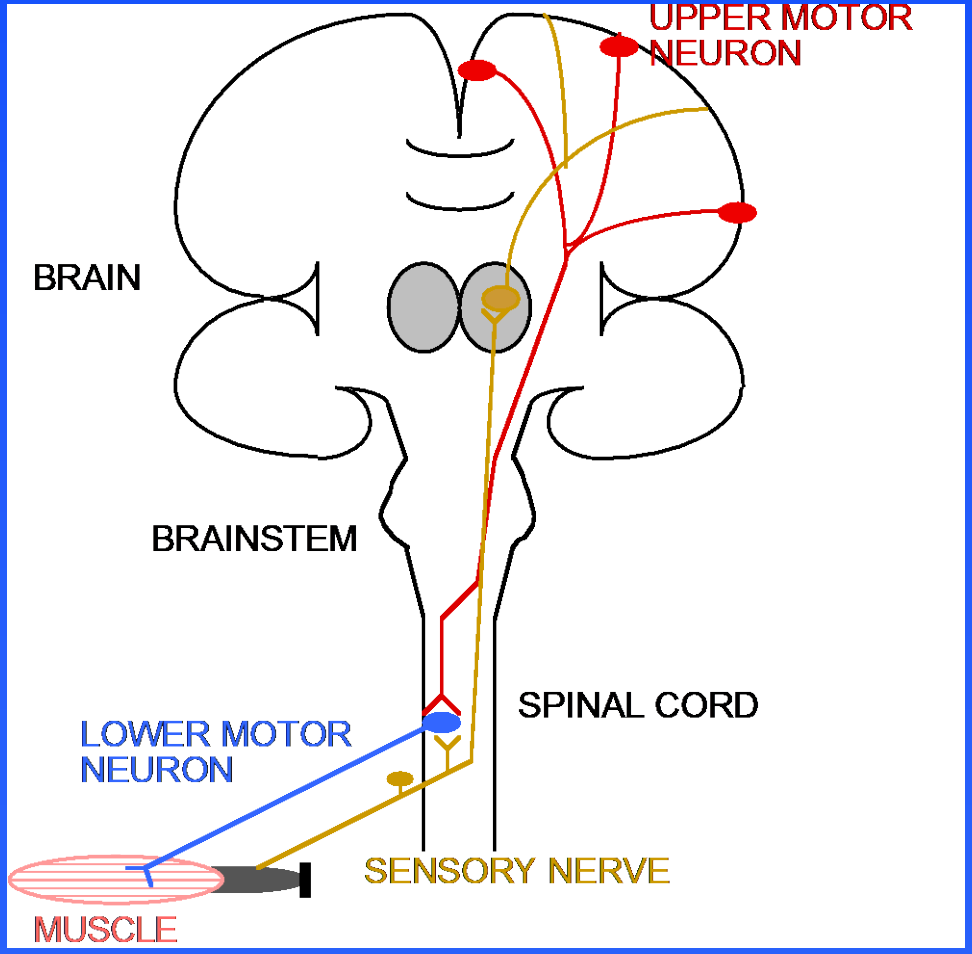
A 52 y.o. male presents with subacute sensory loss in the feet that ascended to his chest. Arm sensation is fine. Weakness is present in both legs. Urinary urgency has developed. The exam confirms leg weakness without atrophy or fasciculations. There is a sensory level at T6.

The best anatomical localization is?

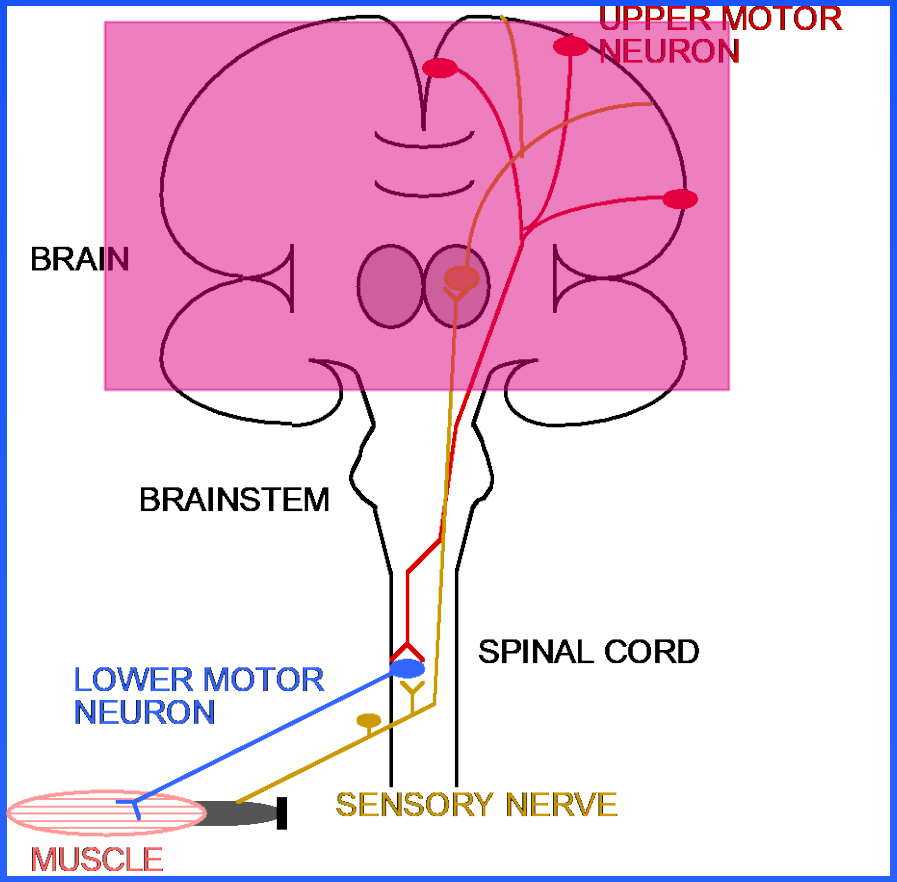
A. Brain
B. Muscle
C. Motor neuron
D. Spinal cord
E. Peripheral nerve

Neurological "Levels"

- Brain
- Brainstem
- Spinal cord
- Motor neuron
- Peripheral nerve
- Neuromuscular junction
- Muscle

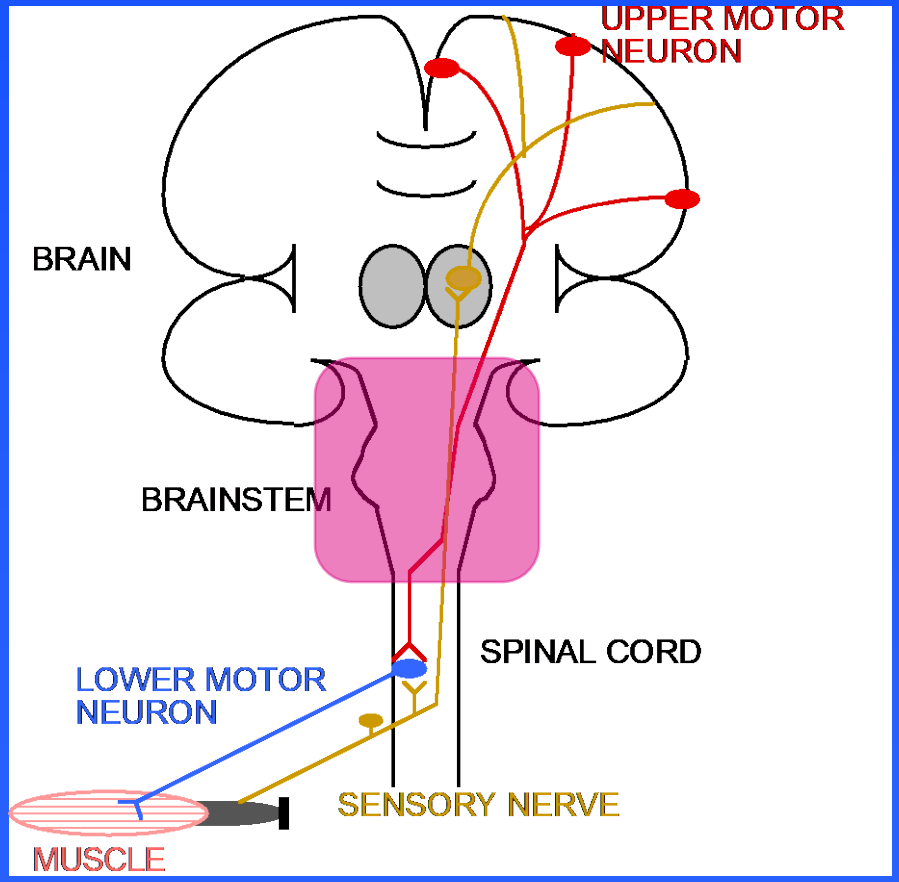


Level: Brain



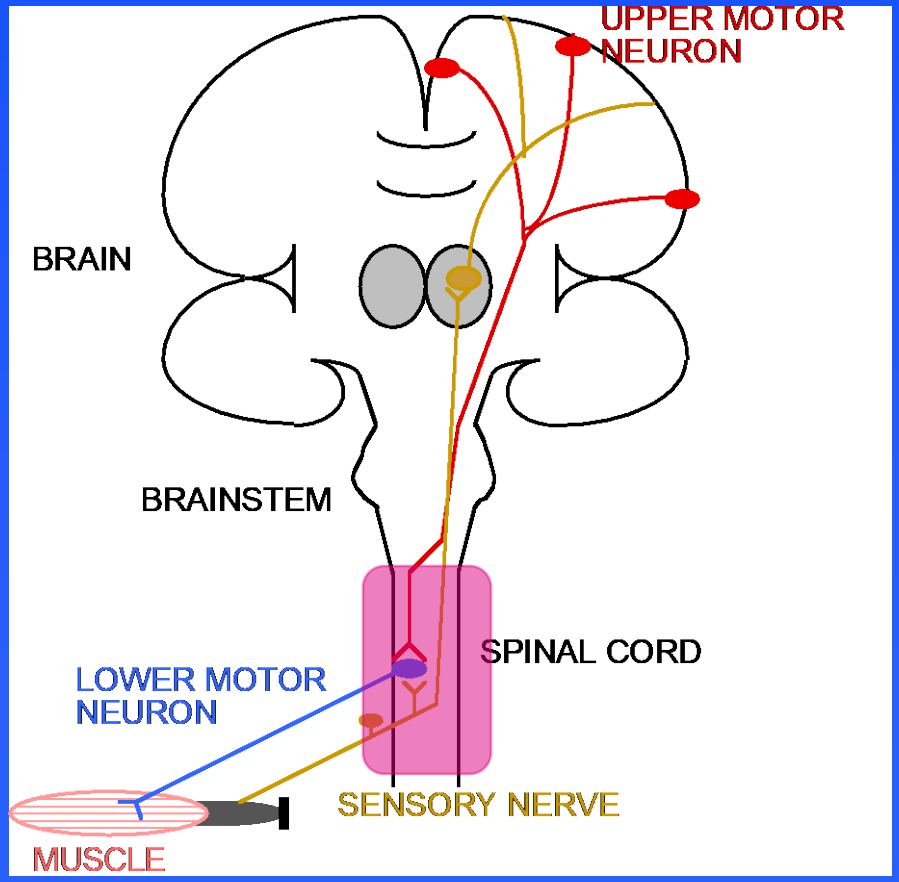
- Often unilateral
- Motor and/or sensory
- Language
- Consciousness
- Memory
- Behavior
- Vision
- Seizures
- Movement d/o

Level: Brainstem



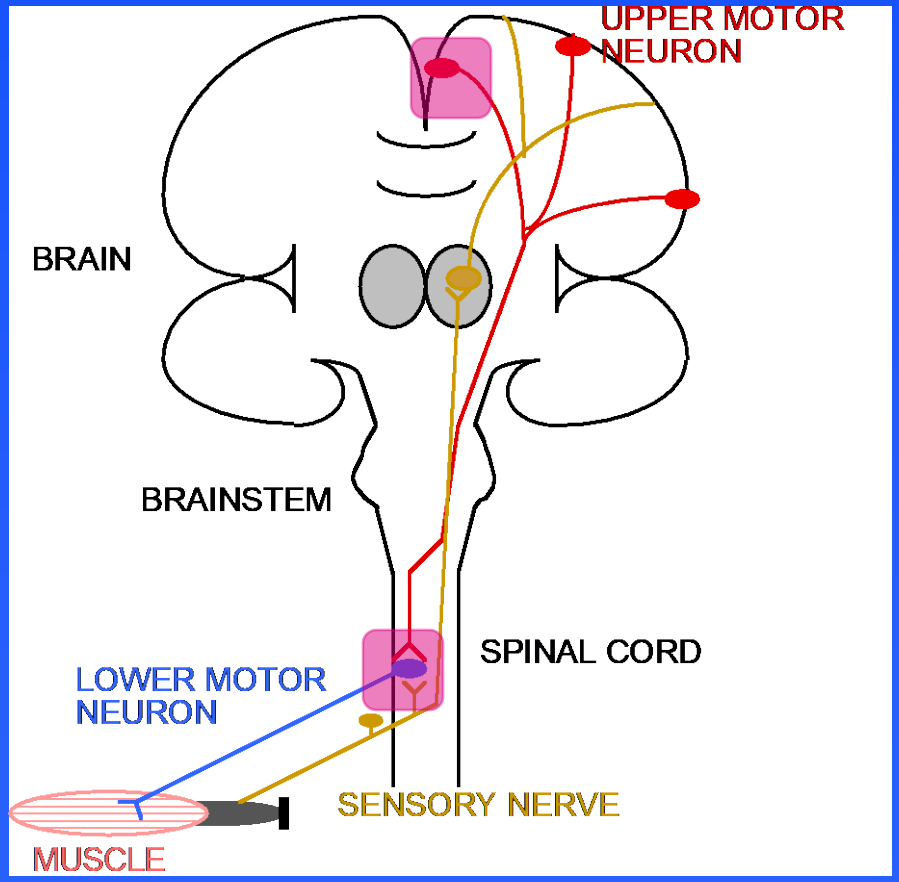
- Often unilateral
- Motor and/or sensory
- Consciousness
- Cerebellar
- Movement d/o
- Cranial nerves
  - Diplopia
  - Vertigo
  - Face
  - Swallow
  - Tongue

Level: Spinal Cord



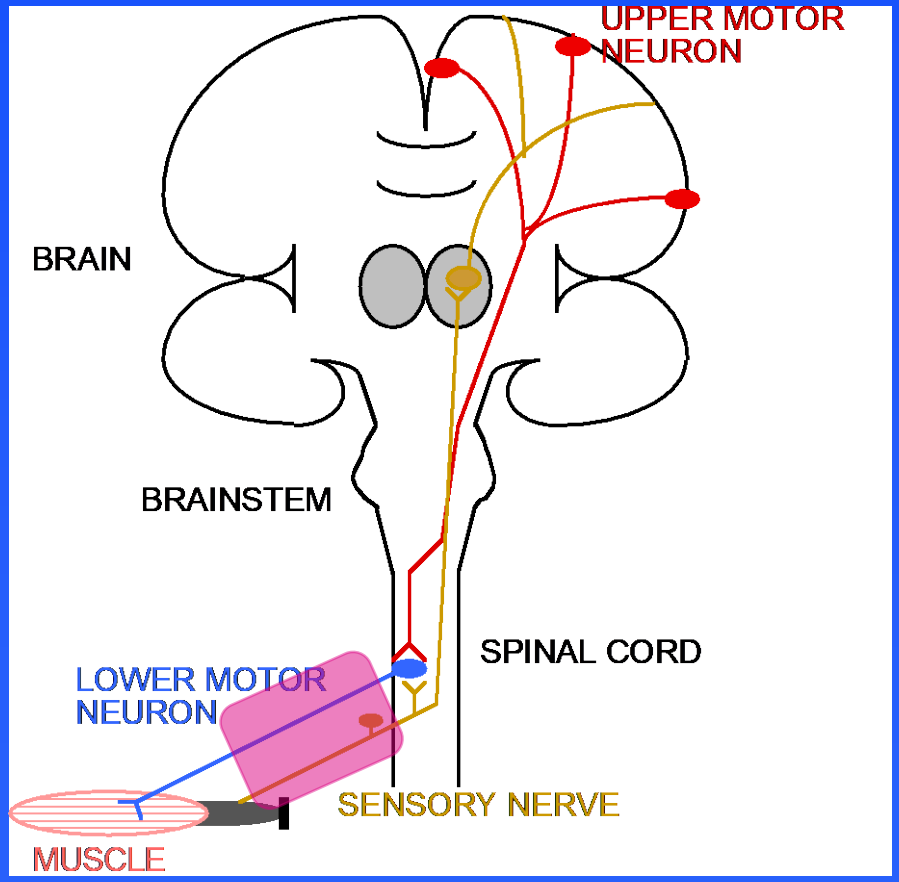
- Often bilateral
- Motor and/or sensory
- Head OK
- Bowel, bladder and erectile

Level: Motor Neuron



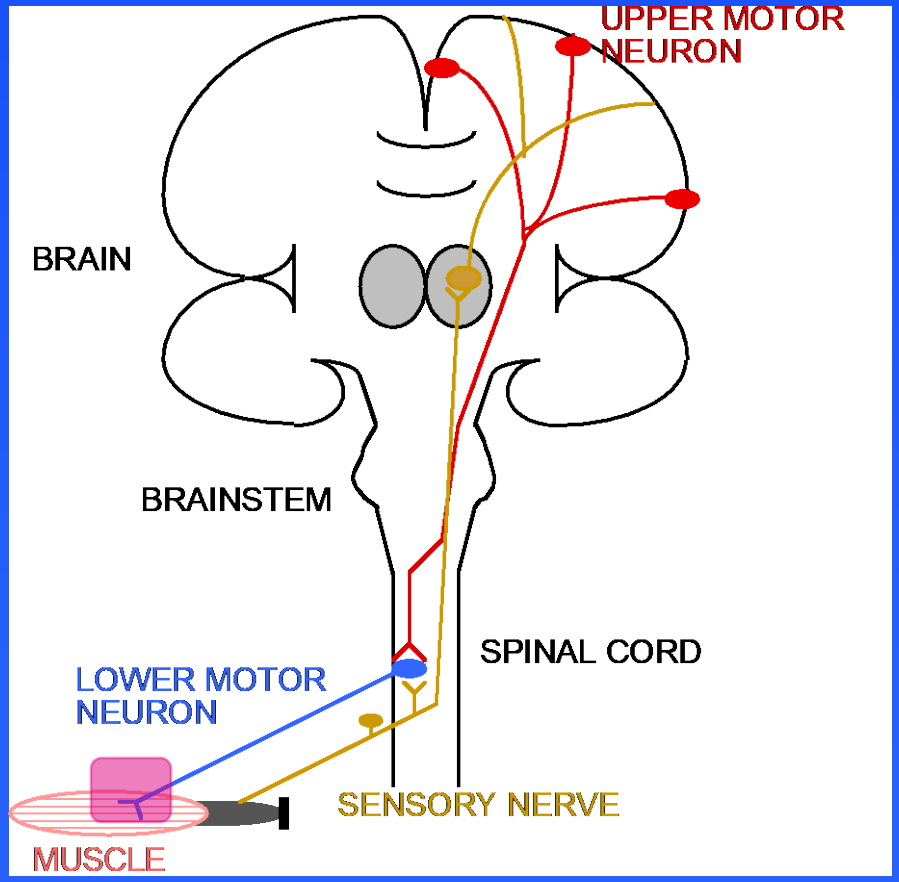
- Asymmetric bilateral
- Motor
- Proximal and distal
- Insidious onset
- Fasciculations

Level: Peripheral Nerve



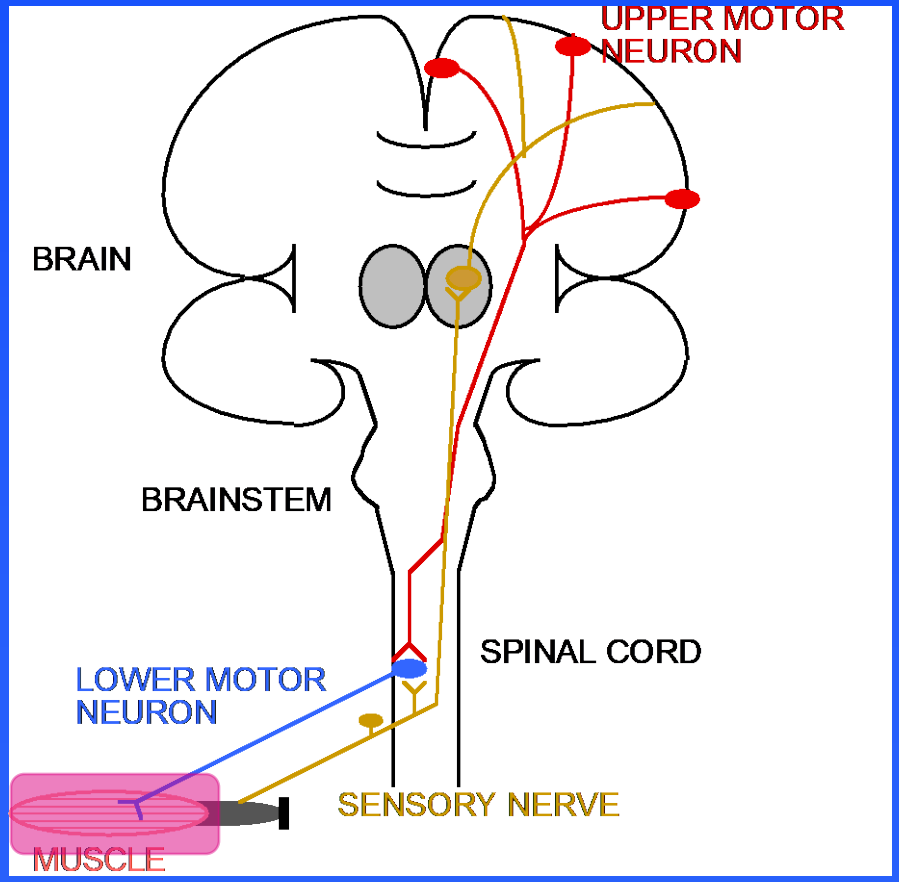
- Symmetric or focal
- Sensory > motor
- Cranial nerves 3-12
- Often distal
  - Stocking-glove
- If proximal think
  - Demyelinating (UE + LE)
  - Cauda equina (LE)

Level: NMJ



- Asymmetric bilateral
- Motor only
- Proximal and distal
  - Eyes involved in myasthenia gravis
- Fatigable weakness
  - Myasthenia gravis
- Progressive weakness
  - Lambert-Eaton myasthenic syndrome

Level: Muscle



- Symmetric bilateral
- Motor only
- Usually proximal

ARS Question

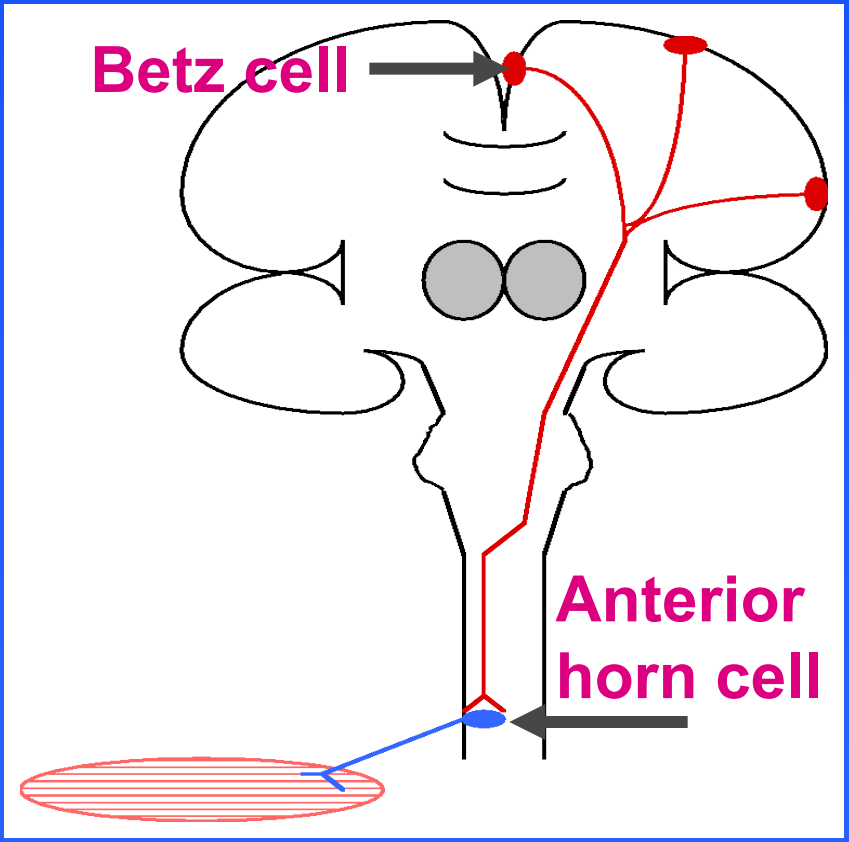
This is a 56 yo woman with gradual weakness of her right arm such that she can no longer open jars. She stopped playing tennis 3 months ago. Gait feels stiff. Her friends wonder why her speech is slurred. She denies sensory, cognitive, and bowel/bladder difficulties. Her exam is remarkable for diffuse weakness and hyperreflexia that is greater in the right arm, and diffuse fasciculations.

What test is likely to confirm your diagnostic suspicion?

A. Brain MRI
B. Spinal fluid for increased protein
C. Cervical MRI
D. Electrodiagnostic testing
E. Tibial evoked potentials

Amyotrophic Lateral Sclerosis

- Degeneration of motor neurons
- Etiology unknown
- No sensory, visual, or B/B involvement
- 20% have dementia
- Asymmetric weakness
- Bulbar or limb onset
- Survival usually 2-5 years
- Rx: Riluzole, Edaravone



ALS: Diagnosis

- H&P
- Electrodiagnostic testing = nerve conduction + EMG
  - Denervation and reinnervation + fasciculations in three body segments
  - Thoracic spine segment (look for this EMG info)

ARS Question

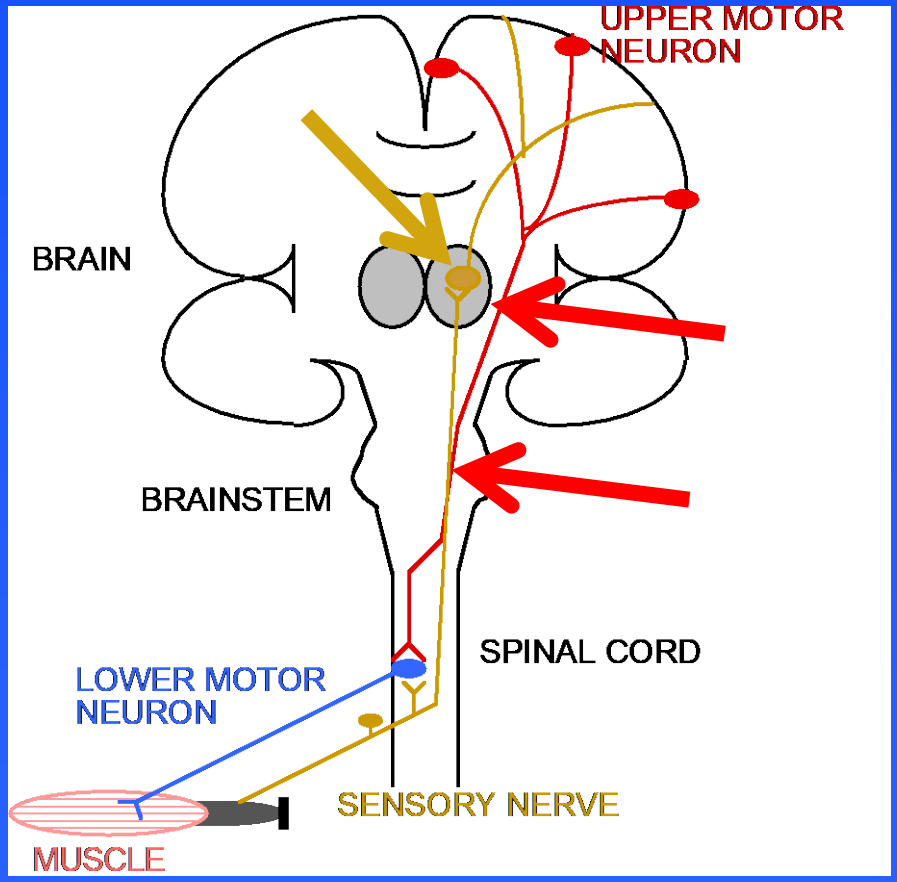
A 66 y.o. female presents with acute onset of sensory loss in the right face, arm and leg. No weakness, vision or cognitive change.

Reduction of which risk factor will have the greatest impact at preventing a second event?

A. Hyperglycemia
B. Hyperlipidemia
C. Weight loss
D. Hypertension
E. Smoking

Lacunar Syndromes

- Pure motor stroke
  - Internal capsule
  - Basis pontis
- Pure sensory stroke
  - Thalamus



HTN: Secondary Prevention

Recommendations for Hypertension
Referenced studies that support recommendations are summarized in online Data Supplements 11 and 12.

COR	LOE	Recommendations
1	A	1. In patients with hypertension who experience a stroke or TIA, treatment with a thiazide diuretic, angiotensin-converting enzyme inhibitor, or angiotensin II receptor blockers is useful for lowering BP and reducing recurrent stroke risk.[185–189]
1	B-R	2. In patients with hypertension who experience a stroke or TIA, an office BP goal of <130/80 mm Hg is recommended for most patients to reduce the risk of recurrent stroke and vascular events.[185,190–194]
1	B-NR	3. In patients with hypertension who experience a stroke or TIA, individualized drug regimens that take into account patient comorbidities, agent pharmacological class, and patient preference are recommended to maximize drug efficacy.[188,189,195,196]

AHA Guidelines 2021

Dyslipidemia: Secondary Prevention

Recommendations for Treating and Monitoring Hyperlipidemia
Referenced studies that support recommendations are summarized in online Data Supplement 13.

COR	LOE	Recommendations
		Treatment
1	A	1. In patients with ischemic stroke with no known coronary heart disease, no major cardiac sources of embolism, and LDL cholesterol (LDL-C) >100 mg/dL, atorvastatin 80 mg daily is indicated to reduce risk of stroke recurrence.[208,209]
1	A	2. In patients with ischemic stroke or TIA and atherosclerotic disease (intracranial, carotid, aortic, or coronary), lipid-lowering therapy with a statin and also ezetimibe, if needed, to a goal LDL-C of <70 mg/dL is recommended to reduce the risk of major cardiovascular events.[210]

AHA Guidelines 2021

Rosuvastatin 20-40mg

Dyslipidemia: Secondary Prevention

Recommendations for Treating and Monitoring Hyperlipidemia
Referenced studies that support recommendations are summarized in online Data Supplement 13

2026: For very high-risk patients with multiple cardiovascular events, consider LDL<55.
Other options besides statins to reach goal LDL: Ezetimibe, PCSK9 inhibitors

1	A	erosclerotic disease (intracranial, carotid, aortic, or coronary), lipid-lowering therapy with a statin and also ezetimibe, if needed, to a goal LDL-C of <70 mg/dL is recommended to reduce the risk of major cardiovascular events.[210]

AHA Guidelines 2021

Rosuvastatin 20-40mg

Antiplatelet Summary

MEDICATION	COMMENTS
ASPIRIN	325mg (81mg). Inexpensive. Often first choice.
CLOPIDOGREL	Once daily. More effective than ASA. Best first-line choice. Expensive. Rash
ASA + CLOPIDOGREL	Potent antiplatelet effect. Consider for 3 weeks after minor stroke or TIA. (POINT[2]) Higher bleeding risk long-term and when major stroke (MATCH[3], CHARISMA[4]).

Adapted from AAN, Continuum: Secondary Stroke Prevention. 2011;17(6):1260

[1] N Engl J Med. 2008;359(12):1238-51

[2] *N Engl J Med*2018;379:215-25

[3] Lancet 2004;364:331

[4] N Engl J Med. 2006;354(16):1706-17

2018 Antiplatelet Guidelines

Dual Antiplatelet Therapy (DAPT)

When started w/in 24 hours for :

--Minor stroke (NIHSS ≤ 3)

--High risk TIA (ABCD2 ≥ 4)

Used for 21 days.

Evidence: Reduces non-fatal recurrent stroke in the first 90 days by 1.9%.

ARS Question

A 63 y.o. male presents with right hemiparesis, hemisensory loss and nonfluent aphasia. Onset 1 day ago. The work-up ascribes the cause to emboli from 50% stenosis of the left carotid artery.

What treatment do you recommend to prevent another stroke?

A. Anti-platelet therapy
B. Anti-coagulation
C. Carotid endarterectomy

Extracranial Carotid Stenosis

Recommendations for Extracranial Carotid Stenosis
Referenced studies that support recommendations are summarized in online Data Supplement 28.

COR	LOE	Recommendations
1	A	1. In patients with a TIA or nondisabling ischemic stroke within the past 6 months and ipsilateral severe (70%–99%) carotid artery stenosis, carotid endarterectomy (CEA) is recommended to reduce the risk of future stroke, provided that perioperative morbidity and mortality risk is estimated to be <6%.[369]
1	A	2. In patients with ischemic stroke or TIA and symptomatic extracranial carotid stenosis who are scheduled for carotid artery stenting (CAS) or CEA, procedures should be performed by operators with established periprocedural stroke and mortality rates of <6% to reduce the risk of surgical adverse events.[370]
1	A	3. In patients with carotid artery stenosis and a TIA or stroke, intensive medical therapy, with antiplatelet therapy, lipid-lowering therapy, and treatment of hypertension, is recommended to reduce stroke risk.[210]

AHA Guidelines 2021

ARS Question

A 63 y.o. male presents with right hemiparesis, hemisensory loss and nonfluent aphasia. Time of onset was 3 hours. The work-up reveals a left proximal MCA occlusion.

What treatment do you recommend?

A. Anti-platelet therapy
B. Tenecteplase (TNK) alone
C. Thrombectomy alone
D. TNK followed by thrombectomy
E. Heparin SQ

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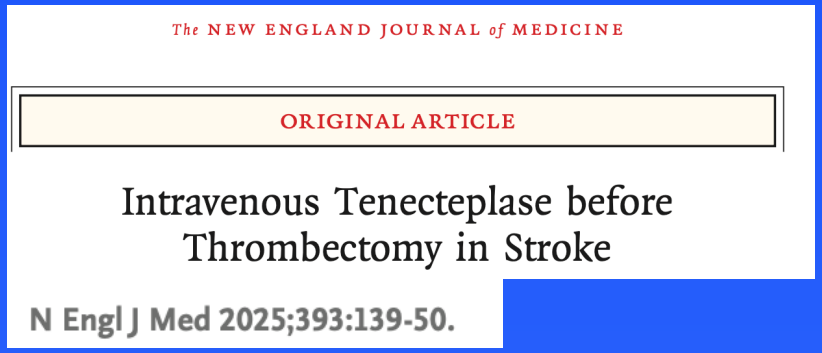

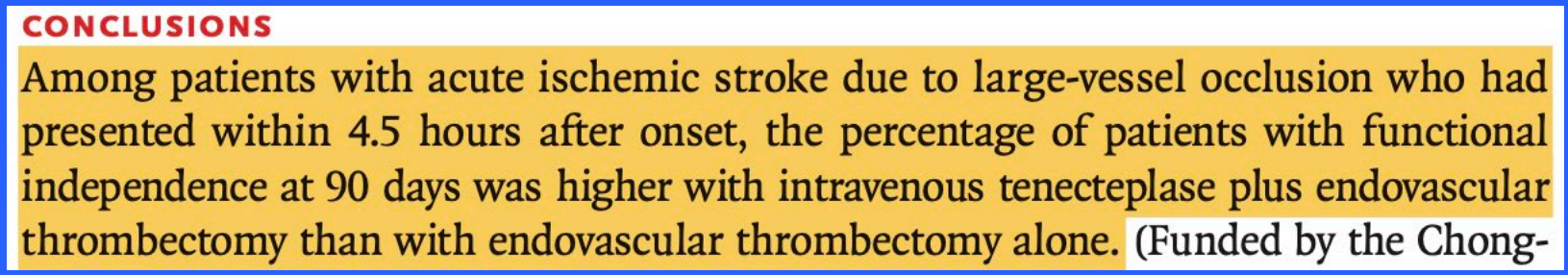

Stroke Trials

Outcome: One more patient with good outcome = No or minimal disability at 3 months

Time-based from last known normal (now use TNK)

T-PA: <3 hours. NNT 7

T-PA: <4.5 hrs. NNT 14

1. NINDS group. NEJM 1995;333:1581
2. ECASS - III group. NEJM 2008;359:1317
3. Mr. CLEAN group. N Engl J Med. 2015;372(1):11
4. DAWN. N Engl J Med. 2018;378:11
5. DIFUSE-3. N Engl J Med 2018;378:708

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T-PA: <3 hours. NNT 7

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Time-based wake-up stroke using perfusion mismatch or MRI

TNK

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2. ECASS - III group. NEJM 2008;359:1317
3. Mr. CLEAN group. N Engl J Med. 2015;372(1):11
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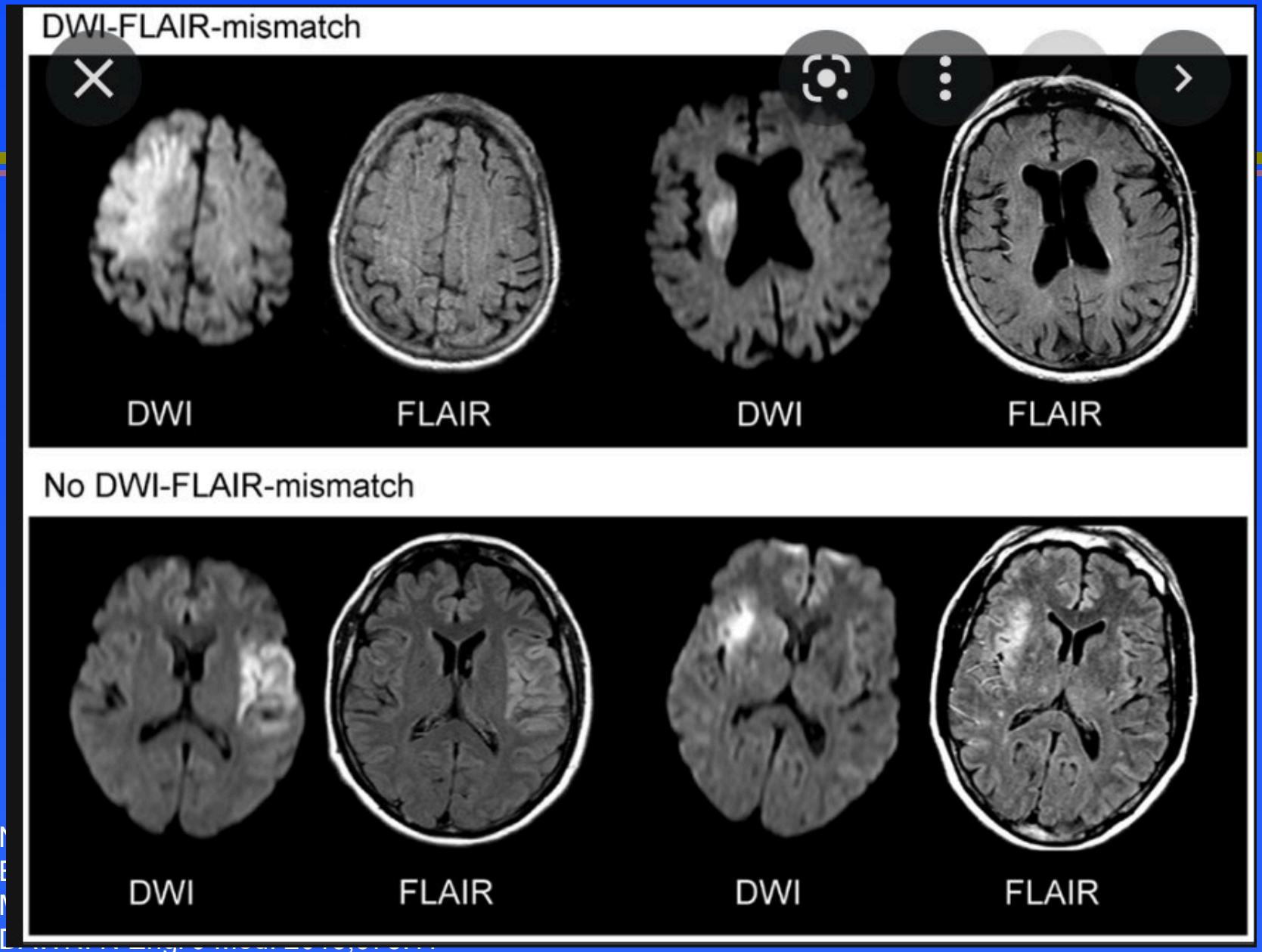

1. N
2. E
3. N
4. D
5. DIFUSE-3. N Engl J Med 2018;378:708

Stroke Trials

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T-PA: <3 hours. NNT 7

T-PA: <4.5 hrs. NNT 14

Time-based wake-up stroke using perfusion mismatch or MRI

TNK

Large vessel occlusion (IC, M1, basilar) and time-based

Thrombectomy: < 6 hours. NNT 7

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2. ECASS - III group. NEJM 2008;359:1317
3. Mr. CLEAN group. N Engl J Med. 2015;372(1):11
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Stroke Trials

Outcome: One more patient with good outcome = No or minimal disability at 3 months

Time-based from last known normal (now use TNK)

T-PA: <3 hours. NNT 7

T-PA: <4.5 hrs. NNT 14

Time-based wake-up stroke using perfusion mismatch or MRI

TNK: 9+ hours

Large vessel occlusion (IC, M1, basilar) and time-based

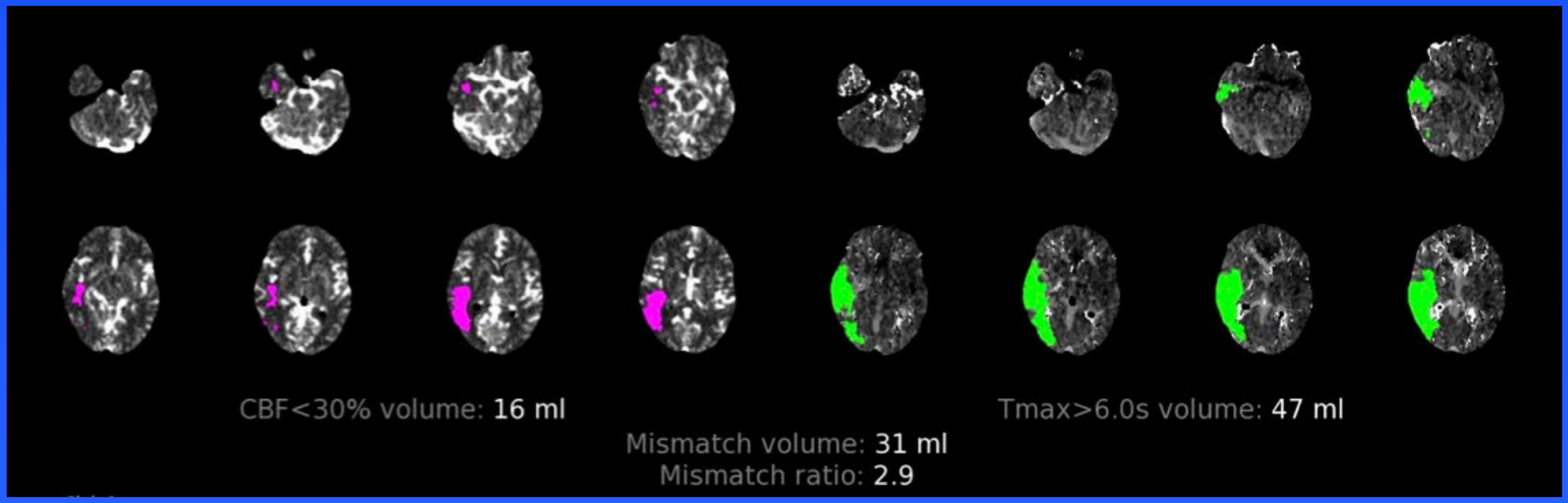
Thrombectomy: < 6 hours. NNT 7

LVO (IC, M1, basilar), time-based and perfusion mismatch

Thrombectomy: 6-24 hours. NNT 3

1. NINDS group. NEJM 1995;333:1581
2. ECASS - III group. NEJM 2008;359:1317
3. Mr. CLEAN group. N Engl J Med. 2015;372(1):11
4. DAWN. N Engl J Med. 2018;378:11
5. DIFUSE-3. N Engl J Med 2018;378:708

CT Perfusion



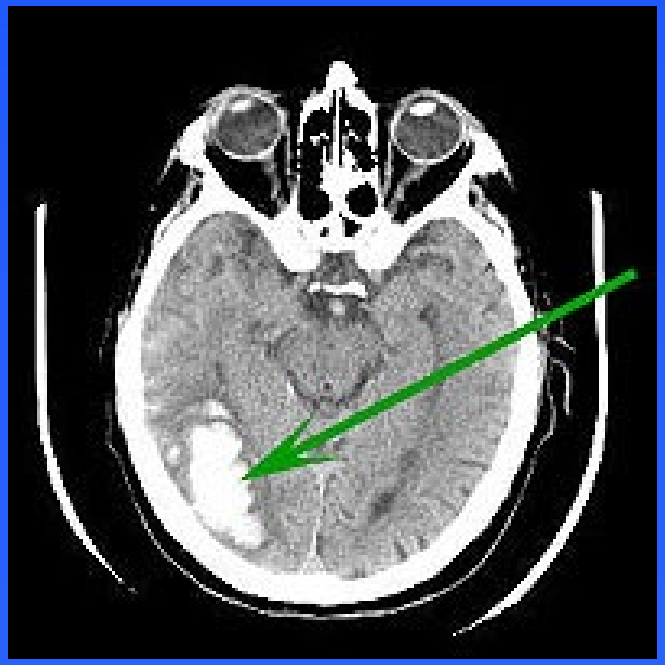
Mismatch ratio > 1.8
Mismatch volume 15+ ml

ARS Question

An 82 y.o. woman has diabetes mellitus, and ASCVD. On the day prior to admission, she had acute onset of left vision loss and headache. The work-up shows a right temporal-occipital lobar hemorrhagic stroke. She is on ASA 81mg.

What is the most likely cause of lobar hemorrhage in this age group?

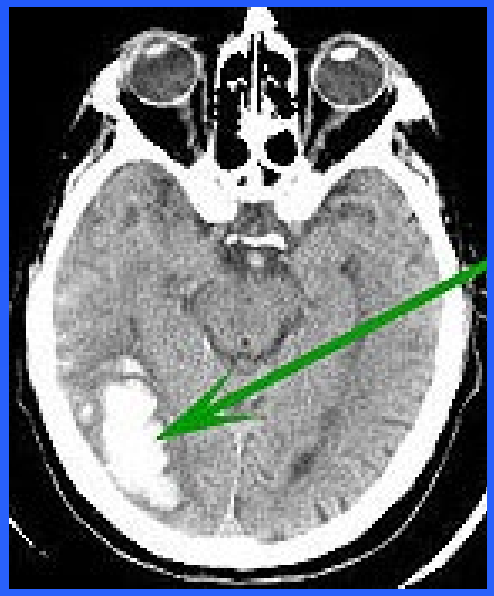
A. Amyloid angiopathy
B. Hypertension
C. Endocarditis, septic emboli
D. Vascular malformation
E. Brain tumor



Stroke: Hemorrhagic

- HTN
  - Most common cause of hemorrhage
  - Deep location
- Amyloid angiopathy
  - Lobar location
- Vascular malformations
  - Any location
- Treatment
  - Control HTN
  - Avoid blood thinning
  - Surgery

HTN



Amyloid angiopathy

ARS Question

This 24 yo female presents with blurry vision and pain in the right eye for 3 days. Last year she had numbness in her left leg for 2 weeks?

You make a presumptive diagnosis and prescribe what to treat her acute symptoms?

A. Betaseron
B. IV steroids
C. Ocular steroids
D. Amantadine
E. Nataluzimab

MS: Glucocorticoids

- Level 1 evidence
  - Methylprednisolone 1000mg IV qd x 3-5d
  - Short-term benefit to hasten recovery
  - No long-term influence on course
  - Cochrane Database Syst Rev 2000;(4):CD001331
- Level 2 evidence
  - Following IV methylpred with PO prednisone (ex. 60mg x 10d)
  - Using a PO equivalent dose instead of IV. Cochrane Database Syst Rev. 2009 Jul 8;(3):CD006921

ARS Question

A 56 y.o. man presents with trouble walking, small handwriting, and a resting tremor.

You make a presumptive diagnosis and suggest:

A. Sinemet trial
B. Head MRI
C. Propranolol for essential tremor
D. Stroke work-up
E. SSRI for anxiety

PD: Clinical

- Slow progressive course
- 3 cardinal features
  - Resting tremor
  - Bradykinesia
  - Rigidity (cogwheel)
- These features lead to gait trouble
- Other: dementia, depression, autonomic

PD: Treatment

- Sinemet = carbidopa/levodopa
  - Levodopa converts to dopamine
  - Most potent drug for PD
- Dopamine agonists
  - Act directly on dopamine receptors
  - Synergy with levodopa
  - Ex. Pramipexole, Ropinirole
- Other: COMT inhibitors, MAO-B inhibitor, anticholinergics

ARS Question

This is a 42 yo woman with an uncomfortable feeling in her legs 5 days per week in the evening. Walking will relieve the problem temporarily. Her neurological exam is normal.

What test should you order next?

A. Serum copper and ceruloplasmin
B. B12
C. Potassium
D. Iron studies
E. TSH

Restless Leg Syndrome

- Common, F>M
- Etiology
  - Primary: CNS dopamine deficiency
  - Secondary: iron deficiency, pregnancy, uremia, medication, diabetes mellitus, venous insufficiency.
- Treatment
  - Replace iron (ferritin 75ng/ml), gabapentinoids (gabapentin, pregabalin), dopamine agonists, others

ARS Question

This is a 26 yo man with diarrheal illness 2 weeks ago. Distal paresthesias started 2 days ago, followed by leg weakness yesterday and today he can't get out of bed. He denies cognitive or bowel/bladder difficulties. His exam is remarkable for poor smile, proximal and distal weakness of the arms and legs, and areflexia. Eye function and pupils are normal.

You make a diagnosis and start treatment with?

A. No treatment is helpful
B. IVIG or plasmapheresis
C. Steroids or IVIG
D. Steroids
E. Botulism immune globulin

Guillain-Barre Syndrome

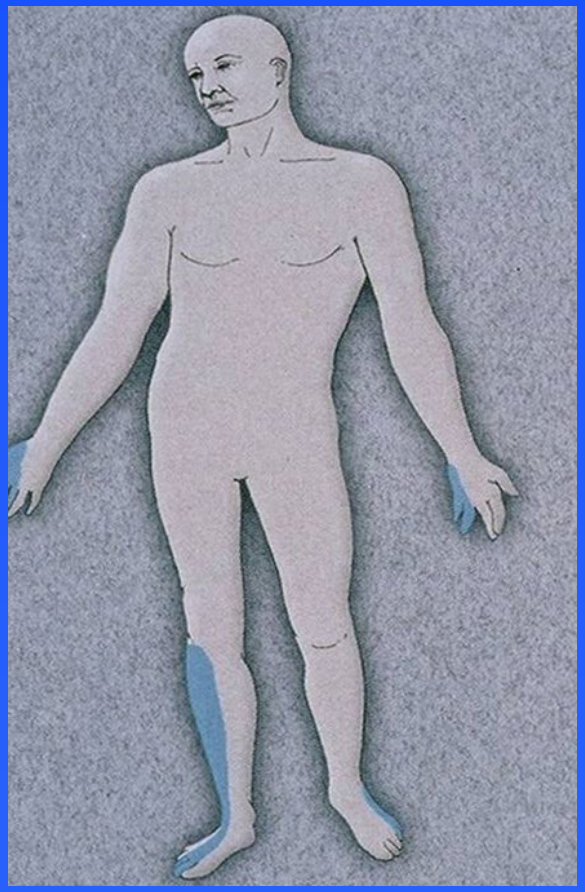
- Clinical
  - Paresthesias
  - Ascending weakness
  - Face
  - Mostly symmetric
  - Absent DTRs
  - Autonomic
  - Diarrhea - Campylobacter
- Studies
  - High CSF protein
  - Slow nerves (AIDP type)
- Course
  - Max weakness < 4wks
  - Slow recovery
  - 85% do very well
  - 10% disabled
  - 5% die
- Treatment
  - Avoid complications
  - Plasmapheresis
  - IVIG

ARS Question

This is a 56 yo woman with acute painful sensorimotor symptoms over 6 days in all 4 extremities: R median, L ulnar, R peroneal, and L sural.

Your work-up should focus on what type of neuropathy?

A. Monoclonal protein neuropathy
B. B12 deficiency
C. Diabetes mellitus
D. Drug-induced neuropathy
E. Vasculitic neuropathy



Questions?

Answers: ARS

Slide 2: B
Slide 3: D
Slide 12: D
Slide 15: D
Slide 22: A
Slide 24: D
Slide 32: A
Slide 34: B
Slide 36: A
Slide 39: D
Slide 41: B
Slide 43: E