# STROKE MIMICS

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# FINANCIAL DISCLOSURES

- None

# LEARNING OBJECTIVES

- What is a stroke?
- What is a stroke mimic?
- Types of mimics
- Importance of recognizing a mimic

# WHAT IS STROKE?

Sudden onset of a focal neurological deficit

Interruption of blood flow or from blood vessel rupture into brain parenchyma

Number one cause of disability in US: annually ~800,000 cases per year and number one cause of disability

Estimated total cost ~$50 billion/year

# MAJOR STROKE TYPES

- Ischemic 87%
- Hemorrhagic 10%
- Subarachnoid 3%

# STROKE SUBTYPES

- Cardio-embolic
- Large artery atherosclerosis
- Small vessel disease
- Stroke of other determined source (RARE)
- Stroke of undetermined etiology (ESUS)

# COMMON SYMPTOMS OF STROKE

- Hemiplegia
- Hemianesthesia
- Aphasia –receptive or expressive, NOT dysphasia
- Dysarthria
- dysphagia
- Vision loss
- Neglect
- Facial droop
- Confusion – not usual
- Dizziness

# WHAT IS A STROKE MIMIC?

- DISEASE OR CONDITION THAT PRESENTS WITH STROKE-LIKE SYMPTOMS BUT IS NOT A TRUE STROKE
- MAJOR CHALLENGE
- 1 OUT OF 4

Journal of Stroke and Cerebrovascular Diseases
Volume 27, Issue 10, October 2018, Pages 2738-2745

# Stroke Mimics Transported by Emergency Medical Services to a Comprehensive Stroke Center: The Magnitude of the Problem ☆

Joel Neves Briard MD *†, Rahel T. Zewude BSc ‡, Mahesh P. Kate MD ‡, Brian H. Rowe MD, MSc §, Brian Buck MD, MSc ‡, Ken Butcher MD, PhD ‡, Laura C. Gioia MD, MSc *†

- 960 PATIENTS TRANSPORTED BY EMS DURING AN 18- MONTH PERIOD
- 42% MIMICS
- 55% OTHER NEUROLOGIC DIAGNOSES

- 20% SEIZURES, 19% MIGRAINES, 11% PERIPHERAL NEUROPATHIES

- 45% NON-NEUROLOGIC DIAGNOSES

- 16% CARDIAC, 12% PSYCHIATRIC, 9% INFECTIONS

- NEUROLOGIC MIMICS WERE YOUNGER (~64 YEARS) THAN NON-NEUROLOGIC MIMICS (~70 YEARS)

## Predictors of acute stroke mimics in 8,187 patients referred to a stroke service

**José G. Merino, MD, MPhil[1,2,3], Marie Luby, PhD[1], Richard Benson, MD, PhD[1,4], Lisa A. Davis, RN[1], Amie W. Hsia, MD[1,4], Lawrence L. Latour, PhD[1], John K. Lynch, DO[1], and Steven Warach, MD, PhD[1,5]**

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[2]Johns Hopkins Community Physicians, Bethesda, MD

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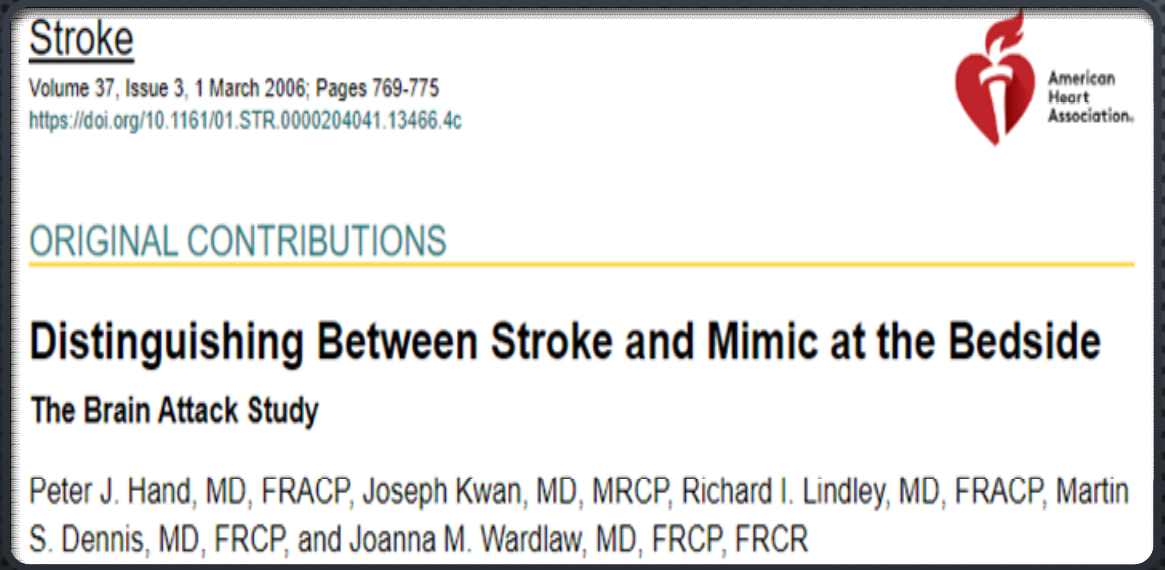
[5]Department of Neurology and Neurotherapeutics, UT Southwestern, Austin, TX

- Prospective study over 10 years
- 1/3rd patients were stroke mimics
- Younger, women>men, no risk factors of stroke, less acuity



Stroke

Volume 37, Issue 3, 1 March 2006; Pages 769-775

https://doi.org/10.1161/01.STR.0000204041.13466.4c

American Heart Association.

ORIGINAL CONTRIBUTIONS

**Distinguishing Between Stroke and Mimic at the Bedside**

**The Brain Attack Study**

Peter J. Hand, MD, FRACP, Joseph Kwan, MD, MRCP, Richard I. Lindley, MD, FRACP, Martin S. Dennis, MD, FRCP, and Joanna M. Wardlaw, MD, FRCP, FRCR

- 2006
- 336 patient, 109 (31%) were stroke mimics
- Exact time of onset, definite focal symptoms, high NIHSS, being able to lateralize the signs to right or left, determine a clinical stroke syndrome predicted a stroke
- Cognitive impairment, abnormal signs in other systems predicted a mimic

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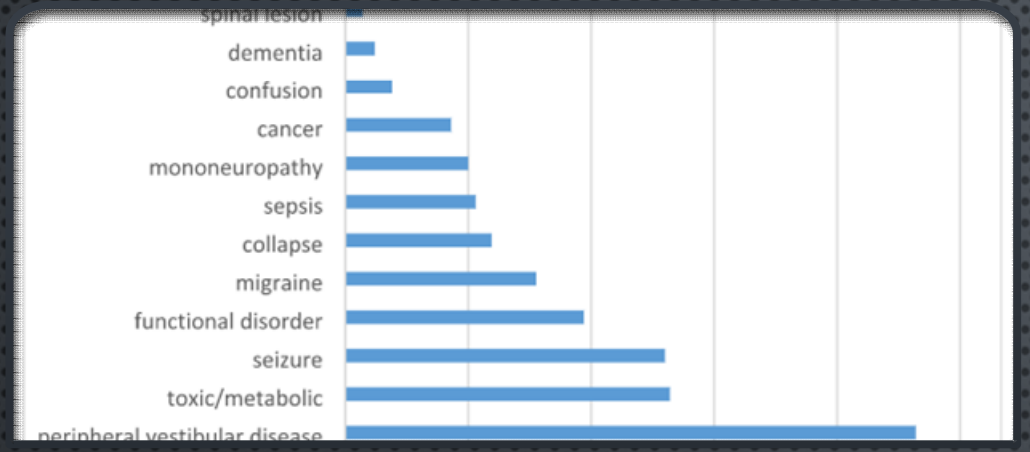
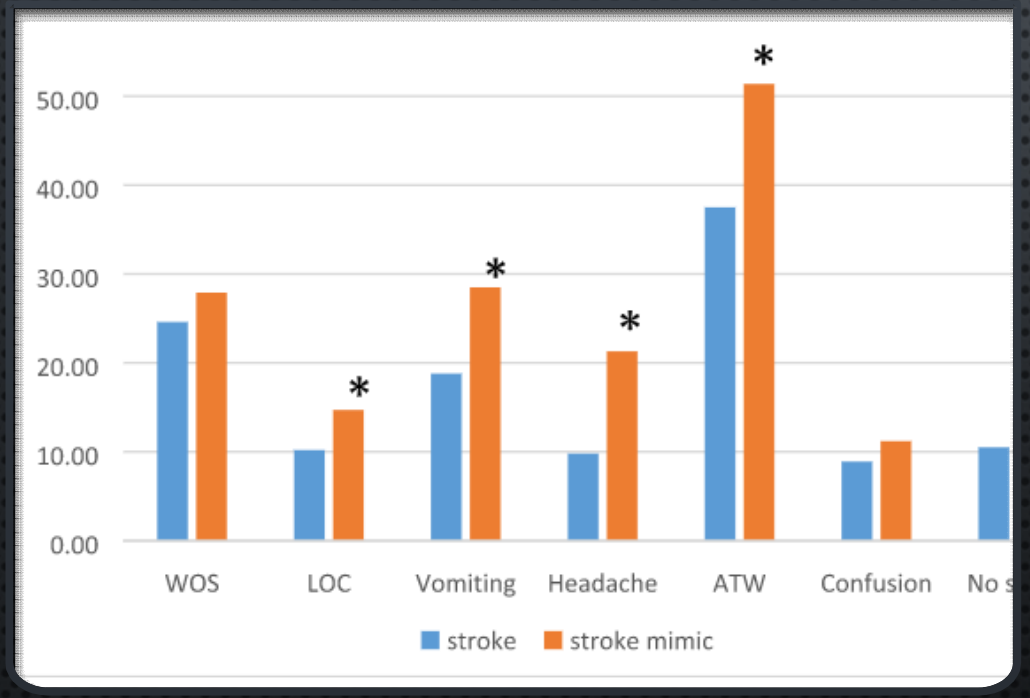
Review article

# Ischemic stroke mimics: A comprehensive review

Marietta Pohl [a], David Hesszenberger [b], Krisztian Kapus [a], Janos Meszaros [a], Andrea Feher [c], Imre Varadi [a], Gabriella Pusch [d], Eva Fejes [e], Antal Tibold [a], Gergely Feher [a f]

- 2021, European review
- 61 studies with overall 62,000+ participants
- Stroke mimic rate was 24.8%
- Ischemic stroke mimics Have less vascular risk factors, younger age, female predominance, lower (nearly normal) blood pressure, no or less severe symptoms.
- 61.7% of ischemic stroke patients received thrombolysis versus 26.3% among stroke mimics




- COMMON TYPES: VESTIBULAR DYSFUNCTION (23%), TOXIC/METABOLIC (13%), SEIZURE (13%), FUNCTIONAL DISORDER (9.7%) AND MIGRAINE (8%)

# 1. VERTIGO

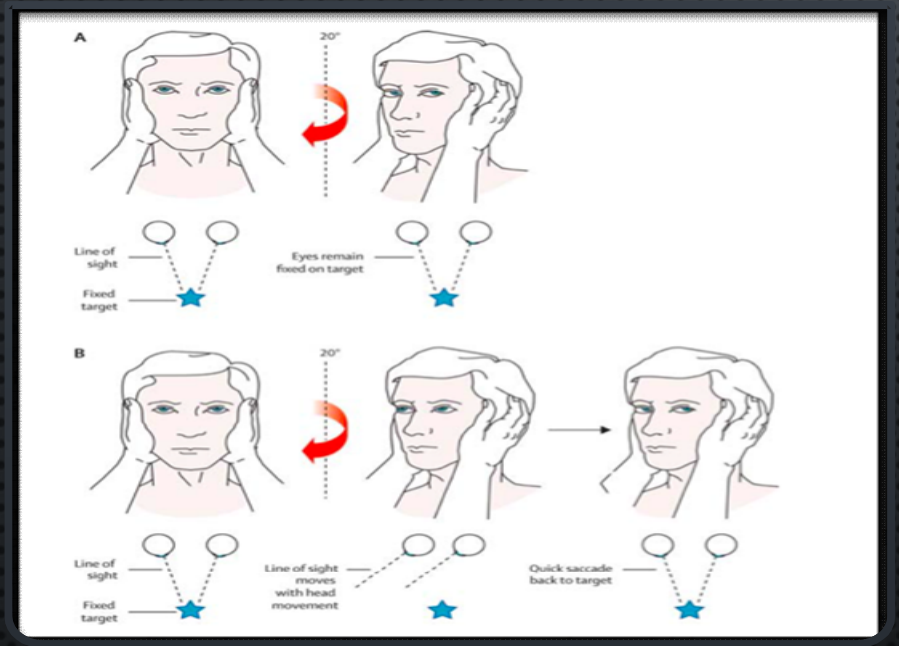
- Main challenge for stroke/emergency physicians
- Accounts for ~25% of all mimics
- Stroke syndromes are responsible for only 3-5% of all ER cases
- Most often caused by BPPV, vestibular neuritis (viral infection of labyrinthine organs), Meniere disease, vestibular migraine
- BPPV – 10% of acute dizziness cases, diagnosis based on canal-specific positional testing maneuvers and detection of nystagmus

# CENTRAL VS PERIPHERAL

**TABLE 2. CENTRAL VS. PERIPHERAL NYSTAGMUS**

| | Central | Peripheral |
|---|---|---|
| *History* | Numbness, weakness, diplopia, dysarthria | Prior viral illness, change in symptoms with posture |
| *Symptoms* | Vertigo (dizziness/spinning sensation), diplopia | Vertigo (dizziness/spinning sensation) that worsens with head movements, possible loss of hearing in one ear, tinnitus, loss of balance |
| *Duration* | Longer duration, occurring more often than not | Episodic, acute onset |
| *Nystagmus – Direction* | Horizontal, upbeat, downbeat, torsional | Horizontal, horizontal/torsional |
| *Nystagmus – Eccentric Gaze* | Gaze-evoked: changes direction on gaze | Unidirectional: horizontal direction does not change with gaze position |
| *Fixation* | Persists, or worsens, with fixation | Dampens with fixation |
| *Occlusion* | No change | Can be induced with occlusion, latent |
| *HINTS* | Head impulse: normal (no corrective saccade)<br>Nystagmus direction: changes direction on eccentric gaze<br>Skew deviation: positive (vertical ocular misalignment) | Head impulse: abnormal (corrective saccade)<br>Nystagmus direction: does not change direction on eccentric gaze<br>Skew deviation: negative |

| | Peripheral Vertigo | Central Vertigo |
|---|---|---|
| **Head Impulse Test** | Abnormal; corrective saccade to midline with rotation of head | Normal; no corrective saccade |
| **Nystagmus** | Unidirectional; horizontal | Horizontal & direction-changing; vertical; torsional |
| **Test of Skew** | No skew deviation | Skew deviation present |

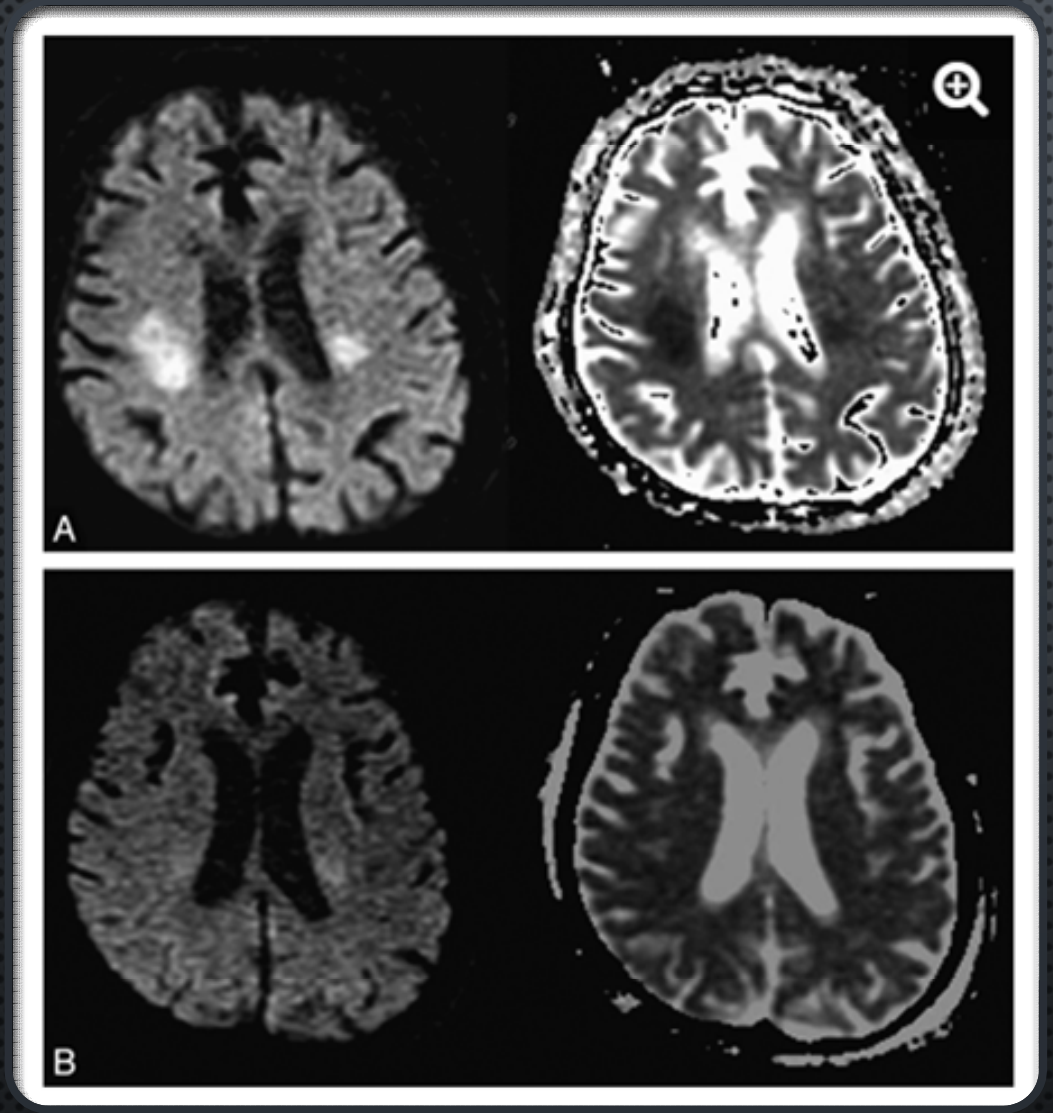



# HINTS TEST

- Should be performed in patients with continuous symptoms
- HIT should be abnormal in one direction only
- Cannot do it in patients who have neck or head trauma
- Fast component in looking to the right; if bi-directional then concerning for central etiology
- If all three components present, it is 100% sensitive and 96% specific for peripheral vertigo
- Caveat: this has not been validated by a large external group so err on side of caution in patients with risk factors

- Atypical nystagmus (persistent downbeat or horizontal nystagmus, no latency) – central paroxysmal positional vertigo which is caused by alcohol intoxication or vestibular migraine
- Hearing loss- Meniere disease or labyrinthitis
- Episodic vertigo- BPPV or meniere disease
- Persistent vertigo – vestibular neuritis or labyrinthitis
- Migrainous vertigo – 3% of population, h/o episodic vertigo with migraine history +/- migraine headache, photophobia, phonophobia or aura

- In ischemic stroke, dizziness/vertigo usually accompanies other neurological symptoms
- Posterior circulation stroke, such as in AICA territory may have isolated recurrent vertigo, fluctuating hearing loss and/or tinnitus as initial symptoms




# METABOLIC/TOXIC DISTURBANCES:

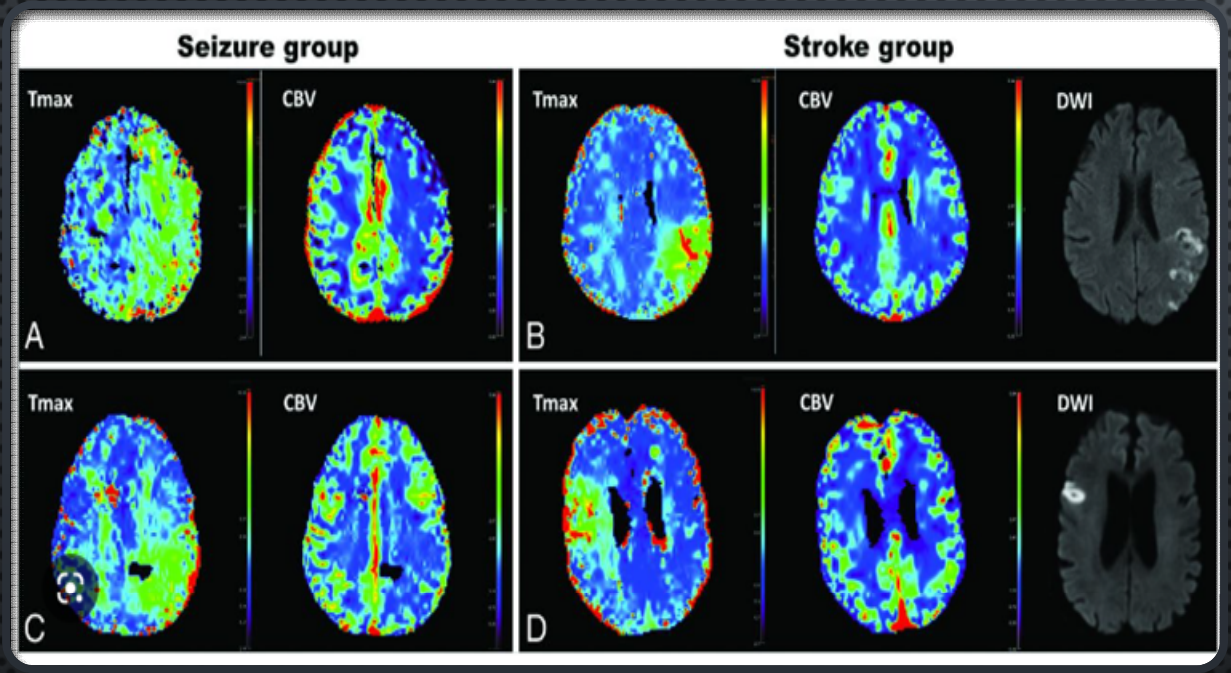
- Second most common
- Hypoglycemia can present with asymmetric focal neurologic findings
- Neurologic abnormalities usually resolve rapidly
- All potential stroke symptoms have a mandatory POC glucose checked
- Hypoglycemia is one of the exclusion criteria for IV thrombolytics as it is a profound stroke mimic
- Can be insulin overdose, alcohol excess
- Brain MRI can show transient diffusion restriction

American journal of Neuroradiology March 2010

Mercy

- Hyponatremia- Symptoms include lethargy and confusion at mild levels, to seizures, coma and respiratory arrest at significant lower levels
- Hypokalemia or intoxication with alcohol or drugs
- Focal neurological symptoms can occur

# SEIZURES

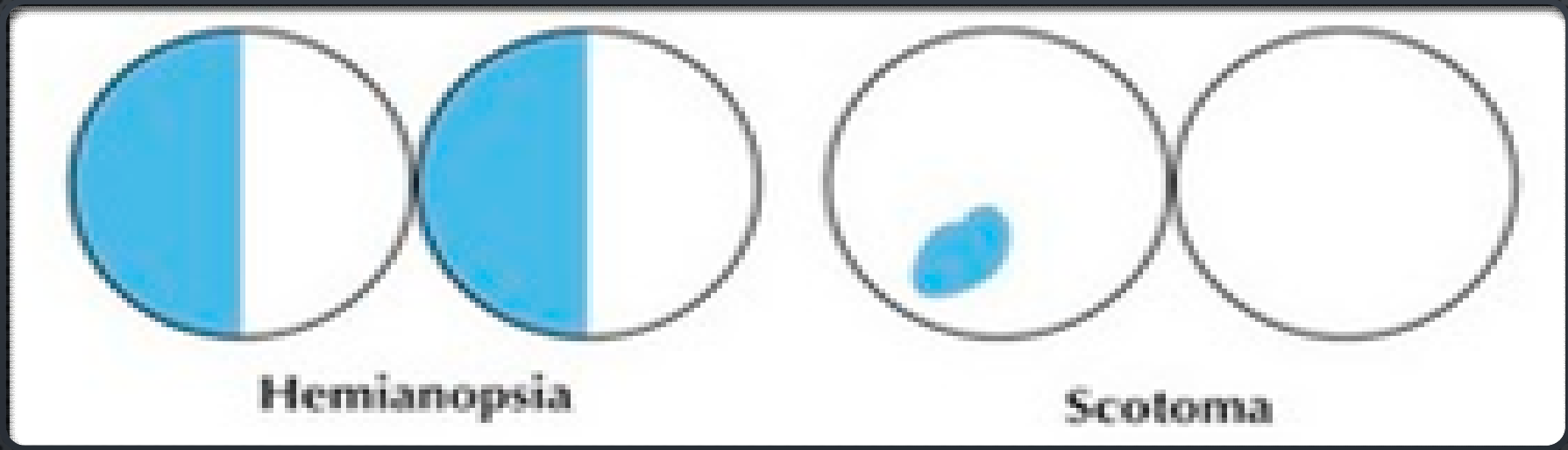


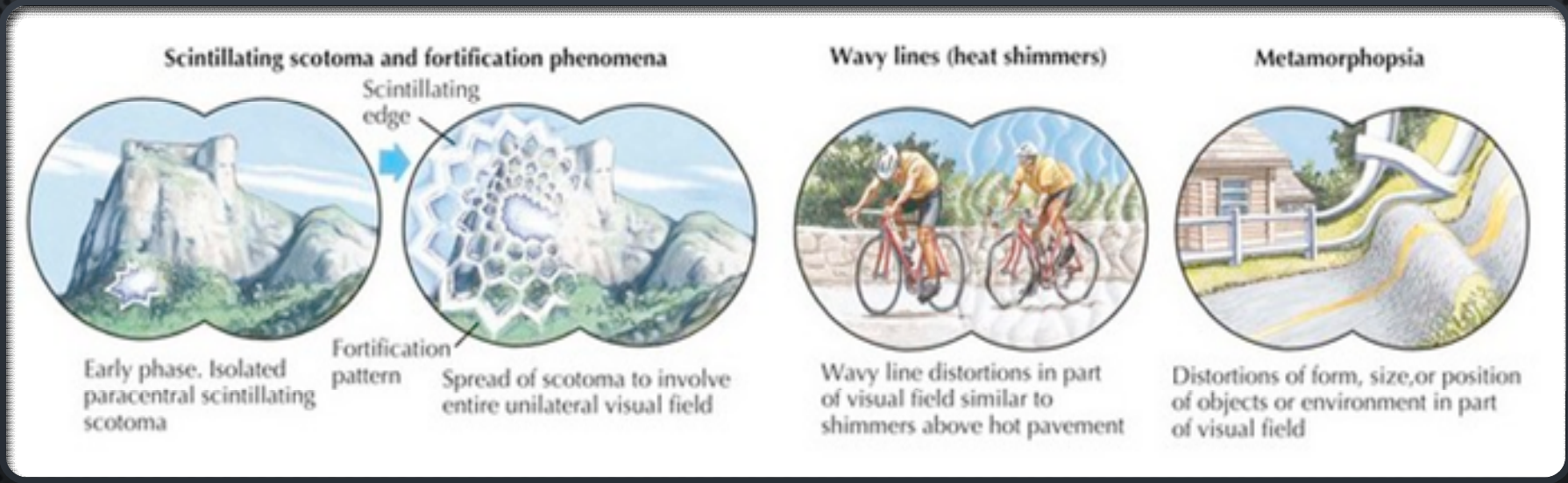

- UP TO 13% OF ALL MIMICS
- CAUSES TODD'S PARALYSIS – POST-SEIZURE PARESIS
  - DESCRIBED INITIALLY IN 1849 BY ROBERT BENTLEY TODD
  - BRIEF OR PROLONGED
  - +/- CONFUSION, SENSORY LOSS, VISUAL CHANGES
  - ETIOLOGY: EXHAUSTION OF MOTOR CORTEX OR HYPOPERFUSION

- Any seizure, even alcoholic withdrawal seizures
- Possible History of seizures
- Postictal Aphasia has been reported in dominant hemisphere seizures
- Can be secondary to ischemic strokes, especially cortical lesions
- 3.8% patients present with early seizures and only 1.5% had seizure at onset of stroke symptoms
- Can use CT perfusion to differentiate between stroke and seizure, however limitations are additional IV contrast, delay and cost
- Unless a seizure is witnessed, reasonable to call it out as a potential stroke

# COMPLEX MIGRAINE

- ~ 8% OF MIMICS
- HEADACHE MAY PRESENT BEFORE, DURING OR AFTER NEUROLOGIC SYMPTOMS START
- AT TIMES, THERE IS NO ASSOCIATED HEADACHE – KNOWN AS 'ACEPHALGIC' VARIANT
- SYMPTOMS CAN BE APHASIA, VISUAL LOSS, HEMIPLEGIA, CONFUSION ETC
- BASILAR MIGRAINE: UNCOMMON, BUT DEVASTATING, CAN PRESENT WITH VERTIGO, DYSARTHRIA, ATAXIA AND DECREASED CONSCIOUSNESS
- HEMIPLEGIC MIGRAINE: PREVALENCE ~ 0.01%, MOTOR SYMPTOMS TYPICALLY LAST UP TO 72 HOURS BUT CAN PERSIST FOR WEEKS, +VE FAMILY HISTORY, GENETIC TESTING?
- PATIENT MIGHT HAVE A HISTORY OF MIGRAINE HEADACHES
- IF THEY HAVE POSITIVE NEUROLOGIC SYMPTOMS SUCH AS VISUAL SCOTOMA, IT HELPS TO MAKE DIAGNOSIS



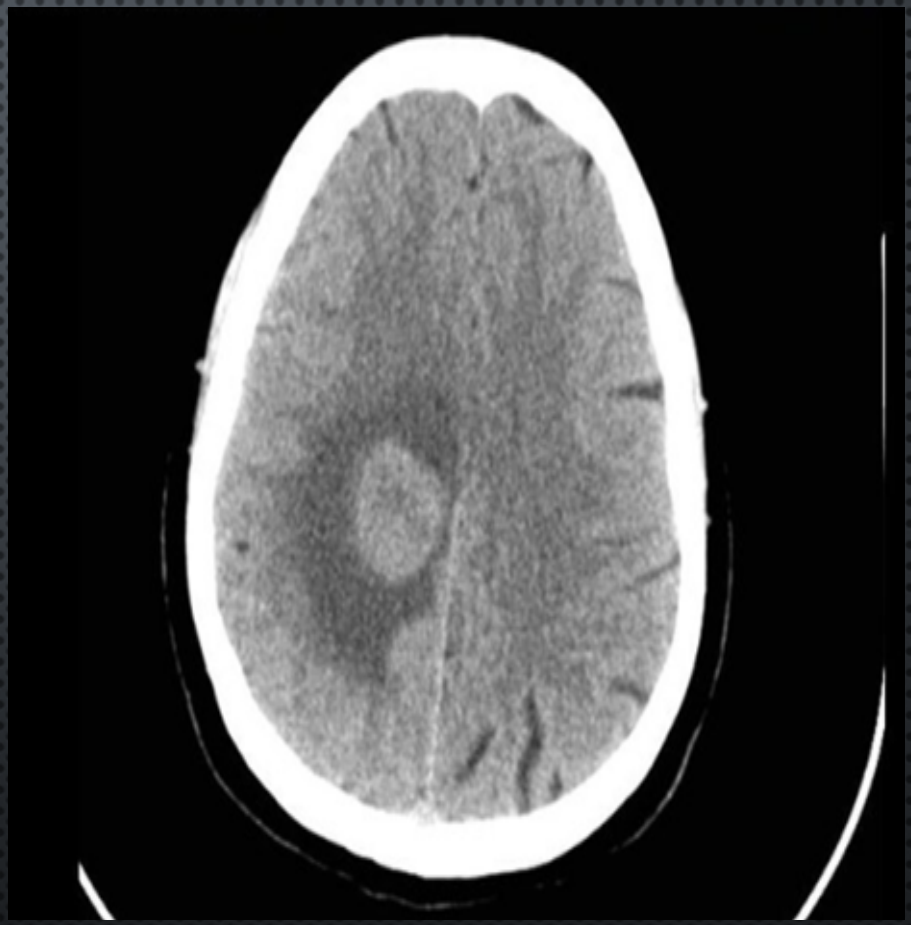




- HTTPS://OBGYNKEY.COM/HEADACHE-3/

# BRAIN TUMORS

- Sudden onset of neurological symptoms can develop in 4.3% of patients
- Plain CT head can usual help distinguish between stroke and malignancy in vast majority of cases
- Can occur from hemorrhage into lesion, increased cerebral edema or a seizure causing Todd's paralysis

https://radiopaedia.org/cases/stroke-progression-on-ct



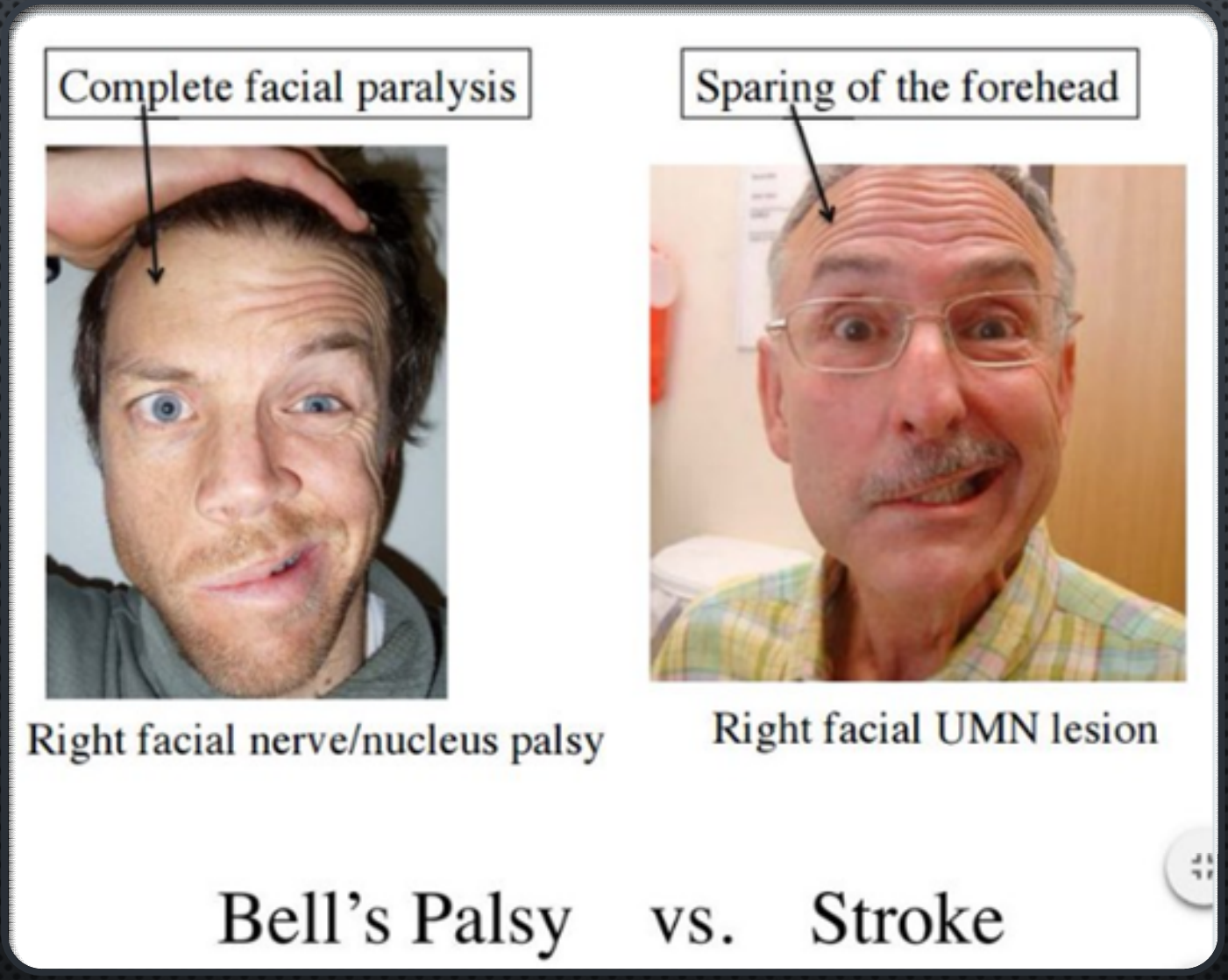
https://www.researchgate.net/figure/CT-scan-image-of-brain-tumor_fig1_277132123

# SEPSIS/INFECTION

- Most commonly in elderly: UTI
- Can present with confusion, which is often misinterpreted as slurred speech or aphasia
- Can have decreased consciousness, which as a general rule is unusual in stroke
- Obtain collateral history
- Signs of systemic illness and raised inflammatory markers
- However, dual pathology can exist as sepsis can induce a hypercoagulable state which predisposes to ischemic stroke

# Bell's Palsy

- Most common cause of unilateral facial paralysis
- Occurs over hours to days
- Younger population
- Increased auditory sensitivity
- Increased lacrimation
- Taste abnormality (can do taste test)
- Affects upper and lower face
- Rarely has sensory change, but CAN occur
- Ear vesicles, ear drainage, recent infection
- Not always easy to distinguish and at times can progress to complete Bell's palsy




- HTTPS://TWITTER.COM/PGMEDICINE/STATUS/1180370352729415681

# SYNCOPE

- More commonly cardiac than neurologic
- Abrupt, transient LOC
- Loss of postural tone
- Rapid and complete recovery
- Caused by interruption of cerebral blood flow
- Examples:
  - Vasovagal (neurocardiogenic)
  - Cardiac arrhythmia
  - Situational (coughing, defecation, urination )
  - Orthostatic

# STROKE RECRUDESCENCE

- Re-emergence of previous stroke-related deficits
- In setting of metabolic, infectious, toxic dysfunction
- Short-lived symptoms
- Improvement within 24 hours
- Can occur weeks to years after previous stroke
- Needs MRI brain for final diagnosis

# DIALYSIS DISEQUILIBRIUM SYNDROME

- Occurs during or following dialysis
- Headache, nausea, blurred vision, confusion, coma or seizures
- Seen in new initiation of dialysis or chronic dialysis patients
- Arises from fluid shifts during hemodialysis, causing cerebral edema and a variety of neurological symptoms

# FUNCTIONAL DISORDERS

- ~10% OF STROKE MIMICS
- DIFFERENT FROM MALINGERING AS THIS IS NOT DELIBERATE
- PATIENTS ARE YOUNGER, MORE LIKELY TO BE FEMALE, USUALLY PRESENTING WITH MORE WEAKNESS/NUMBNESS THAN SPEECH DISTURBANCE OR REDUCED CONSCIOUSNESS
- PREVIOUS PSYCHIATRIC HISTORY IS COMMON
- FREQUENTLY TRIGGER IS PRESENT SUCH AS PANIC ATTACK
- SYMPTOMS ARE USUALLY ATYPICAL AND FLUCTUATING
- EXAMINATION FINDINGS ARE INCONSISTENT

Stroke
Volume 51, Issue 5, May 2020; Pages 1629-1635
https://doi.org/10.1161/STROKEAHA.120.029076

TOPICAL REVIEW

# Functional Neurological Disorder

## A Common and Treatable Stroke Mimic

Stoyan Popkirov, MD, Jon Stone, PhD, and Alastair M. Buchan, DSc

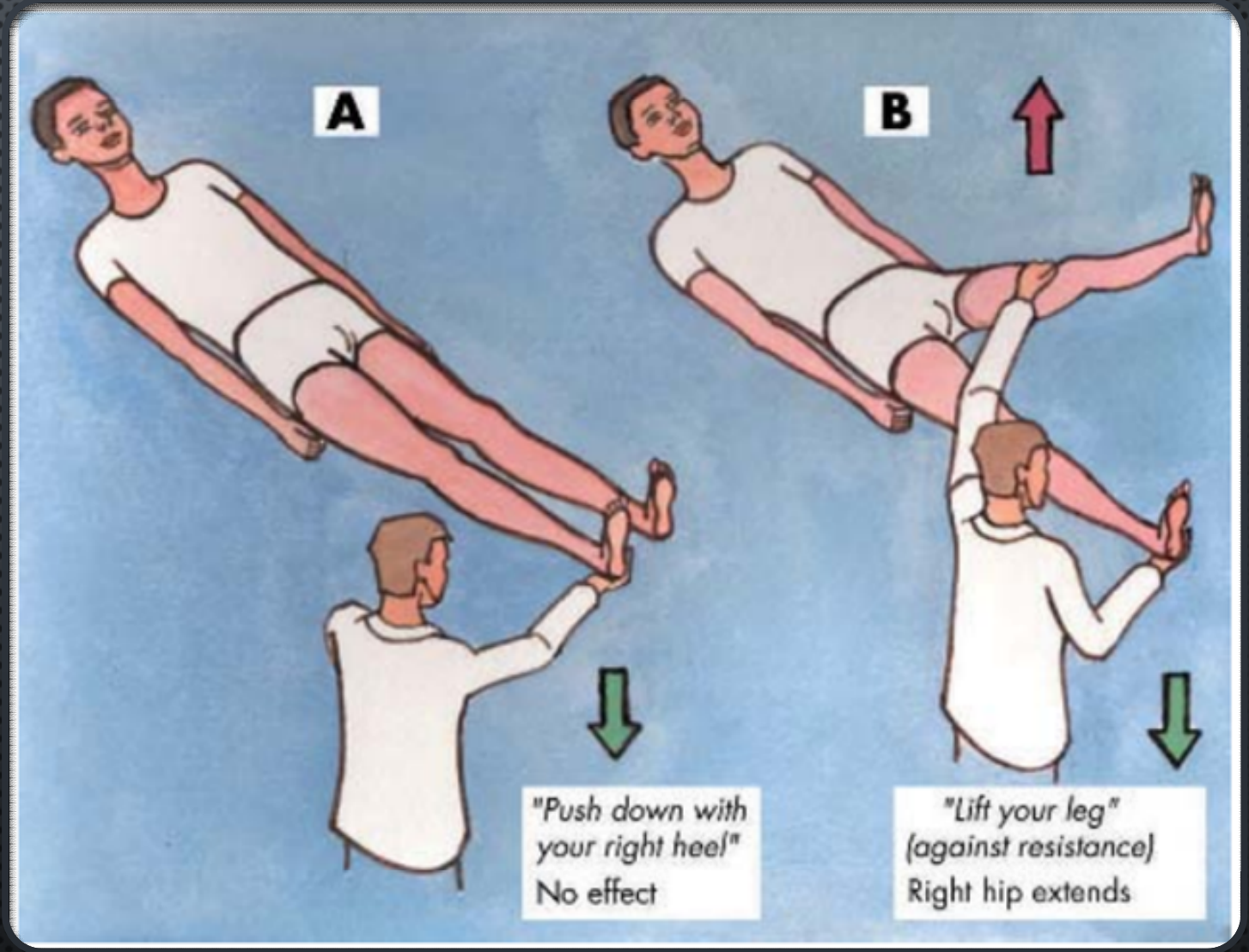
- MISDIAGNOSIS BETWEEN 3.5 TO 4.1%
- SAFETY OF THROMBOLYSIS IN STROKE MIMICS, COMPLICATION RATE 1.5%
- ERR ON SIDE OF OVERTREATMENT DUE TO POTENTIAL BENEFIT
- KNOWN AS  PSYCHOGENIC OR CONVERSION DISORDER
- TWO RECENT STUDIES: RATES UP TO 8%

**Table 1.** Examination Techniques for the Diagnosis of Functional Stroke Mimics With Motor Symptoms (Table view)

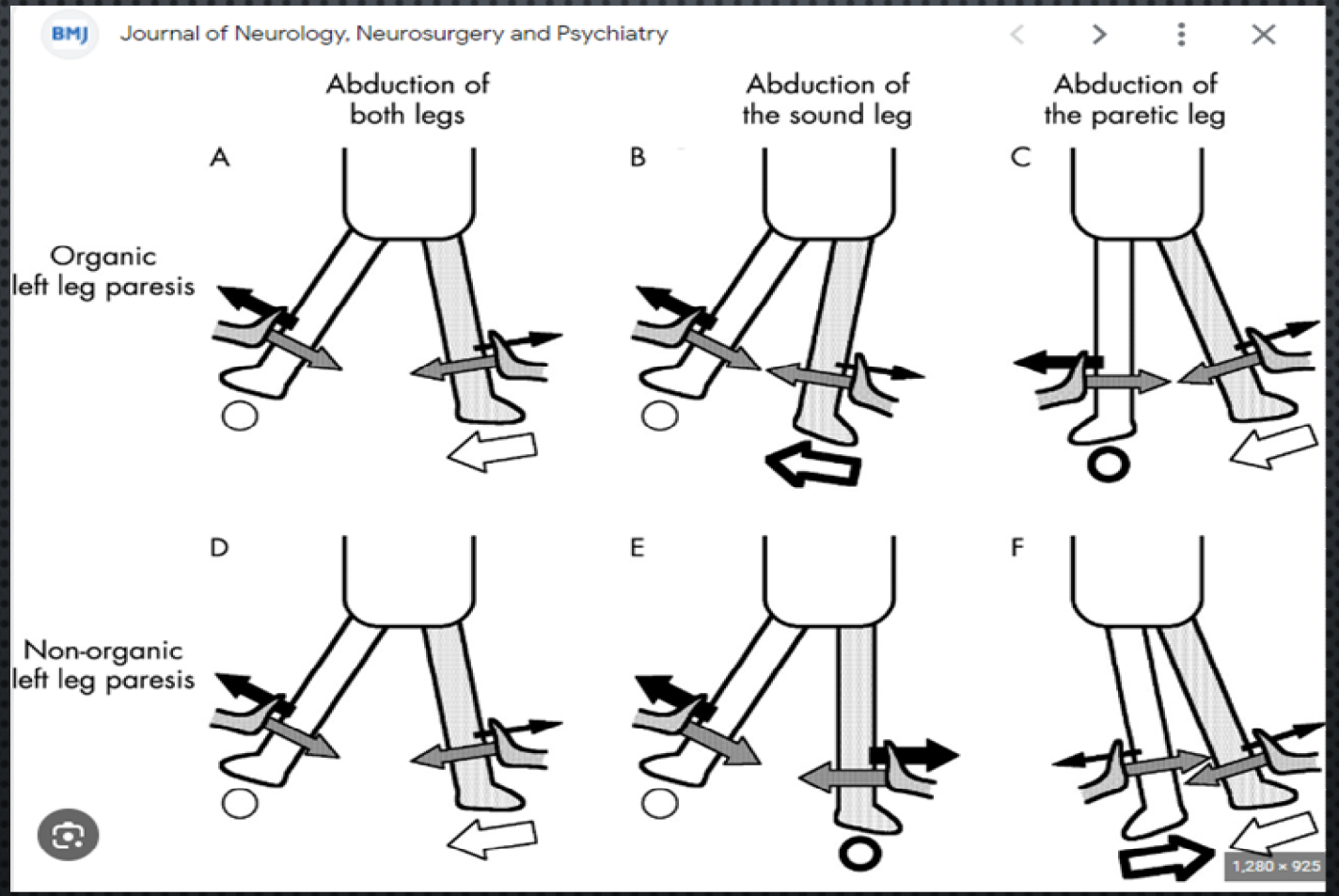
| Sign | Description | Comment | PPV* |
|---|---|---|---|
| Hoover's sign | Hip flexion and extension testing reveals inconsistency in attended vs unattended movement in affected leg | False positive in patients with supplementary motor area or parietal lobe strokes possible | 67%–100% |
| Hip abductor sign | Hip abduction testing reveals inconsistency in attended vs unattended movement in affected and unaffected leg | Limited evidence for utility in clinical practice | 100% |
| Drift without pronation | The affected arm drifts downward without pronation | Only testable in mild-to-moderate upper limb weakness | 93%–100% |
| Unilateral facial lip pulling/platysma contraction/jaw deviation | Functional facial spasm or dystonia typically presents with contraction of platysma, which may pull the lip down or the jaw to one side | May be accompanied by orbicularis oculis activity and ipsilateral convergent spasm, which can mimic a sixth nerve palsy | NA |
| Give-way weakness (collapsing weakness) | Sudden loss of tone or strength during strength testing | False positive in patients with joint/limb pain or when instructions are unclear | 60%–100% |
| Global or inverse pyramidal pattern of weakness | Weakness of upper limb with extensors weaker than flexors and vice versa in lower limbs | No formal studies but good evidence that such a pattern is not found in structural disorders causing limb weakness | NA |

# HOOVER SIGN

- Described in 1908
- Most useful test for functional weakness, found to have good sensitivity and specificity
- Principle: extend our hip when flexing our contralateral hip against resistance
- Prospective study: Hoover's sign positive in 5/8
- Sensitivity of 68% and specificity of 100%



# HIP ABDUCTOR SIGN



# DRIFT WITHOUT PRONATION

- First described in 1901
- Arm drifts down but no pronation
- Pyramidal tract lesion
- Counts as pronation if even the 4th or 5th fingers rotate slightly


https://www.researchgate.net/figure/The-drift-without-pronation-sign-The-test-is-carried-out-by-asking-the-patient-to-keep_fig4_261032919

# GIVEWAY WEAKNESS

- Sudden loss of tone or strength during isometric muscle testing
- Good interrater reliability, excellent specificity

- Ask patient to resist against force
- Knee buckling while walking

# GLOBAL OR INVERSE PYRAMIDAL PATTERN OF WEAKNESS

- Weakness of upper limb with extensors>flexors
- Vice versa in lower limbs
- Good evidence that such a pattern is not found in structural disorders

# HEMISENSORY SYNDROME/MIDLINE SPLITTING

Exact splitting of sensation in the midline is said to be a functional sign because cutaneous branches of the intercostal nerves overlap from the contralateral side, so organic sensory loss should be 1 or 2 cm from the midline

Similarly, difference in sensation of a tuning fork place over the left compared to the right side of a sternum or frontal bone as bone is a single unit and must vibrate as one

# Functional Speech and Language Disorders:

1. Most common: stuttering
- Differentiate: excessive variability, excessive consistency, struggling behaviors, absence of dysarthria or aphasia, agrammatic without aphasia
- Most reliable indicator: complete resolution to therapy
2. Dysarthria: isolated in 1.3% to 2.8% strokes
- Always report some dysphagia, as motor components of speaking and swallowing overlap
3. Aphasia: true isolated in only 3% of strokes
- Typically will accompany limb deficit, facial droop, vision or sensory disturbance
- Functional aphasia is rare, presents as non-fluent aphasia but with preserved comprehension and naming

# PREDICTORS:

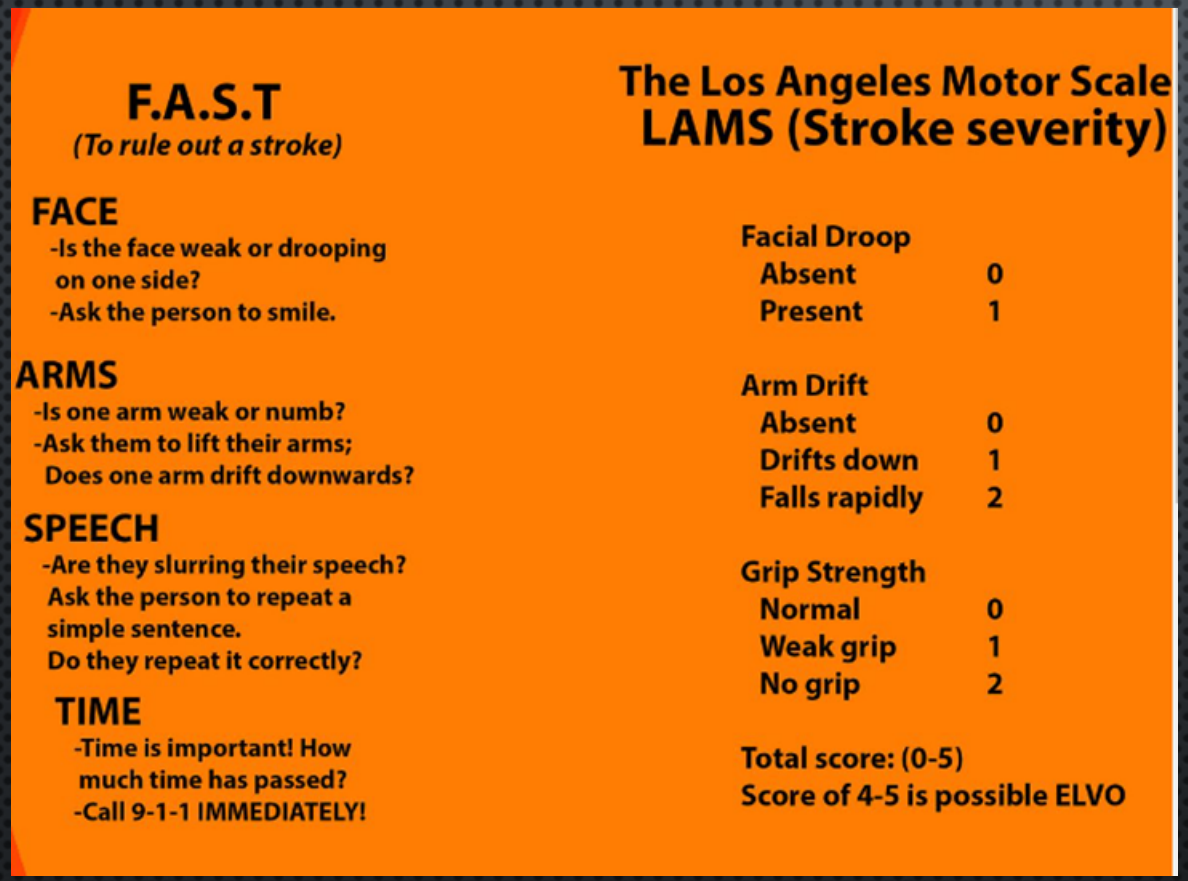
Increased odds of stroke:

- Definite focal signs
- Lateralizing symptoms to either side of body
- High NIHSS, severe at onset
- Stroke risk factors
- Elevated BP
- Acute and sudden

Increased odds of mimic:

- Altered level of consciousness
- Younger age
- Females>males
- Fluctuations in symptoms
- Signs of systemic illness

# PRE-HOSPITAL ASSESSMENT



**F.A.S.T**
*(To rule out a stroke)*

**FACE**
-Is the face weak or drooping on one side?
-Ask the person to smile.

**ARMS**
-Is one arm weak or numb?
-Ask them to lift their arms; Does one arm drift downwards?

**SPEECH**
-Are they slurring their speech? Ask the person to repeat a simple sentence. Do they repeat it correctly?

**TIME**
-Time is important! How much time has passed?
-Call 9-1-1 IMMEDIATELY!

**The Los Angeles Motor Scale**
**LAMS (Stroke severity)**

| | |
|---|---|
| **Facial Droop** | |
| Absent | 0 |
| Present | 1 |
| **Arm Drift** | |
| Absent | 0 |
| Drifts down | 1 |
| Falls rapidly | 2 |
| **Grip Strength** | |
| Normal | 0 |
| Weak grip | 1 |
| No grip | 2 |

**Total score: (0-5)**
**Score of 4-5 is possible ELVO**

- Detect symptoms of a stroke
- 2015 systematic review
- Sensitivity up to 97%
- Specificity up to 93%
- Be-fast
- Lams for LVO
- However, even with these, chances of missing stroke are ~30%

# IMPORTANCE OF RECOGNIZING A STROKE

- **TIME IS BRAIN**
- SOONER A STROKE IS RECOGNIZED, SOONER THE PATIENTS RECEIVE THROMBOLYSIS
- 1.9 MILLION NEURONS EACH MINUTE IN WHICH STROKE IS UNTREATED
- STROKE PATIENTS UNDERGO THOROUGH WORK-UP AND STARTED ON SECONDARY PREVENTION
- FASTER THE TREATMENT, BETTER THE OUTCOME

# IMPORTANCE OF RECOGNIZING STROKE MIMIC

- Avoids potentially harmful effects of IV thrombolytics – sICH rate of ~4 to 6%
- Sits International Stroke Thrombolysis Registry – out of 10,436 patients, only 4.1% stroke mimics treated
- Get-With-The-Guidelines-Stroke Registry – out of 72,582 patients, IV thrombolysis given in 3.5% of stroke mimics
- Not being put on Long-term secondary stroke prevention
- Being properly diagnosed
- Cost of being in ICU as well as cost of thrombolytics

# CONCLUSION:

- Misdiagnosis of stroke is a major health problem
- 20-25% of suspected strokes are mimics
- Brain imaging is not always the easy answer :
- Smaller hospitals do not necessarily have MRI capabilities
- It may be normal
- A pooled meta-analysis of 3236 patients revealed 6.8% DWI-negative stroke, can occur most commonly in small posterior circulation stroke syndromes

- ***Correct diagnosis depends upon clinical history and initial crucial investigations as well as a good neurological examination***

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# THANK YOU ..

Mercy IT


WHAT
WHERE
WHEN
WHY