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North of England
Acute Neurology
Update

# Stroke mimics

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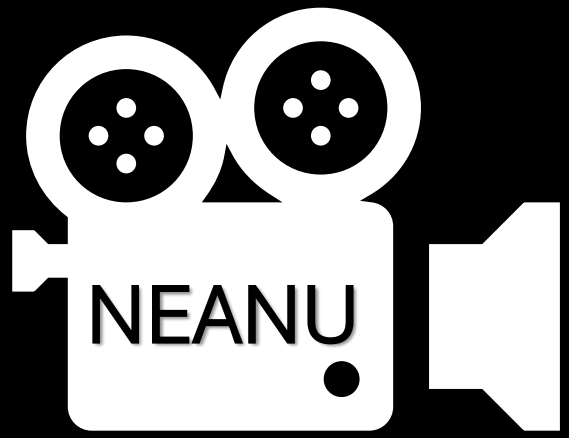
# Disclaimer




This presentation is inspired by true events.

While artistic license has been taken, we believe that this presentation is true to the events described.

Names or identifiers have been eliminated and information has been simplified for the sake of clarity.

# Stroke worldwide

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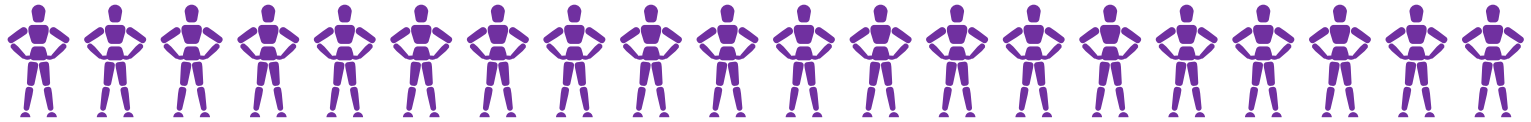

- 16.9 million strokes in 2010: 1 every 2 seconds
- 70% of them occurred in low- and middle-income countries
- In that same year, there were already 33 million stroke survivors.

# Stroke burden by 2019. Ages 50-74 years

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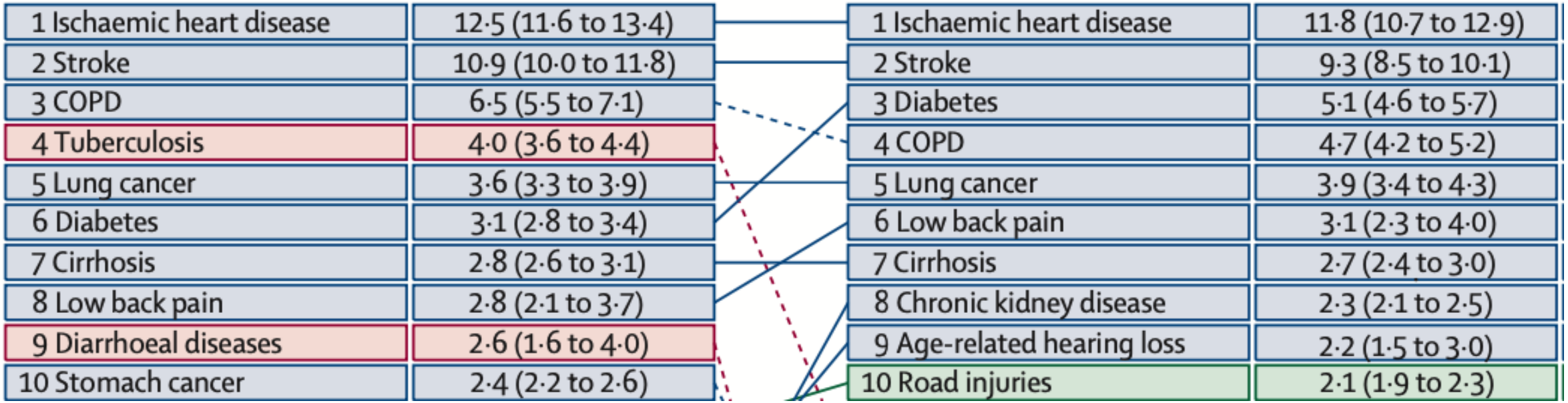
**E** 50–74 years



| Leading causes 1990 | Percentage of DALYs 1990 | Leading causes 2019 | Percentage of DALYs 2019 |
|---|---|---|---|
| 1 Ischaemic heart disease | 12·5 (11·6 to 13·4) | 1 Ischaemic heart disease | 11·8 (10·7 to 12·9) |
| 2 Stroke | 10·9 (10·0 to 11·8) | 2 Stroke | 9·3 (8·5 to 10·1) |
| 3 COPD | 6·5 (5·5 to 7·1) | 3 Diabetes | 5·1 (4·6 to 5·7) |
| 4 Tuberculosis | 4·0 (3·6 to 4·4) | 4 COPD | 4·7 (4·2 to 5·2) |
| 5 Lung cancer | 3·6 (3·3 to 3·9) | 5 Lung cancer | 3·9 (3·4 to 4·3) |
| 6 Diabetes | 3·1 (2·8 to 3·4) | 6 Low back pain | 3·1 (2·3 to 4·0) |
| 7 Cirrhosis | 2·8 (2·6 to 3·1) | 7 Cirrhosis | 2·7 (2·4 to 3·0) |
| 8 Low back pain | 2·8 (2·1 to 3·7) | 8 Chronic kidney disease | 2·3 (2·1 to 2·5) |
| 9 Diarrhoeal diseases | 2·6 (1·6 to 4·0) | 9 Age-related hearing loss | 2·2 (1·5 to 3·0) |
| 10 Stomach cancer | 2·4 (2·2 to 2·6) | 10 Road injuries | 2·1 (1·9 to 2·3) |

GBD 2019. Lancet 2020;396:1204-22

# Stroke burden by 2019 in people older than 75 years

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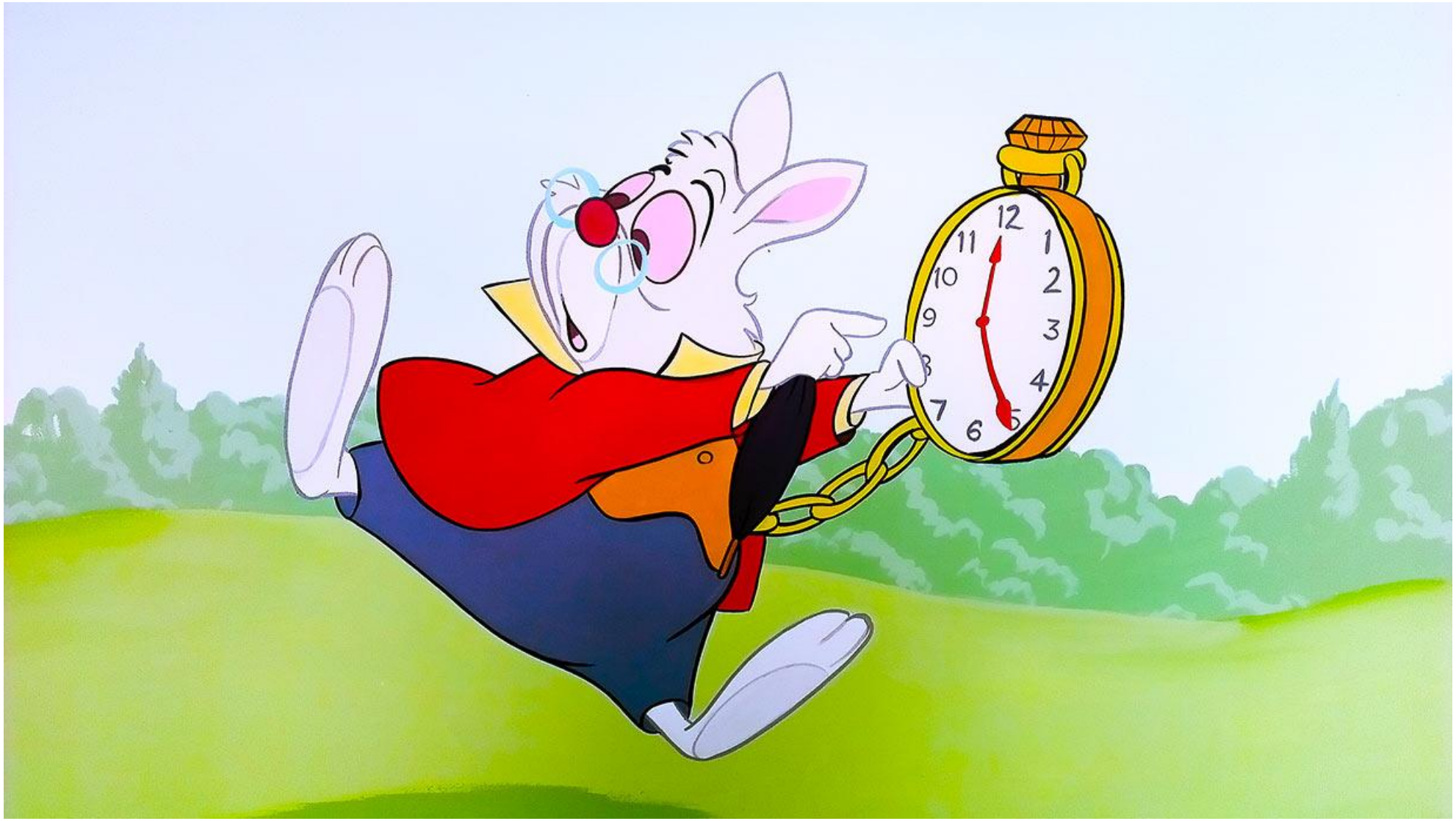
**F** 75 years and older

| | Percentage of DALYS 1990 | | Percentage of DALYS 2019 |
|---|---|---|---|
| 1 Ischaemic heart disease | 18·6 (17·1 to 19·7) | 1 Ischaemic heart disease | 16·2 (14·6 to 17·6) |
| 2 Stroke | 15·5 (14·3 to 16·7) | 2 Stroke | 13·0 (11·7 to 14·0) |
| 3 COPD | 9·9 (8·6 to 10·7) | 3 COPD | 8·5 (7·5 to 9·2) |
| 4 Alzheimer's disease | 3·8 (1·7 to 8·6) | 4 Alzheimer's disease | 5·6 (2·6 to 12·2) |
| 5 Lower respiratory infections | 3·3 (3·0 to 3·6) | 5 Diabetes | 4·0 (3·6 to 4·3) |
| 6 Diarrhoeal diseases | 3·1 (2·0 to 4·5) | 6 Lower respiratory infections | 3·3 (2·9 to 3·6) |
| 7 Diabetes | 2·6 (2·4 to 2·9) | 7 Lung cancer | 2·6 (2·3 to 2·8) |
| 8 Hypertensive heart disease | 2·3 (1·9 to 2·5) | 8 Falls | 2·6 (2·2 to 2·9) |
| 9 Age-related hearing loss | 2·0 (1·5 to 2·7) | 9 Chronic kidney disease | 2·5 (2·3 to 2·7) |
| 10 Lung cancer | 1·9 (1·8 to 2·0) | 10 Age-related hearing loss | 2·5 (1·9 to 3·3) |

GBD 2019. Lancet 2020;396:1204-22


12
1
2
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11

# Time to reperfusion and functional outcomes in IMSIII

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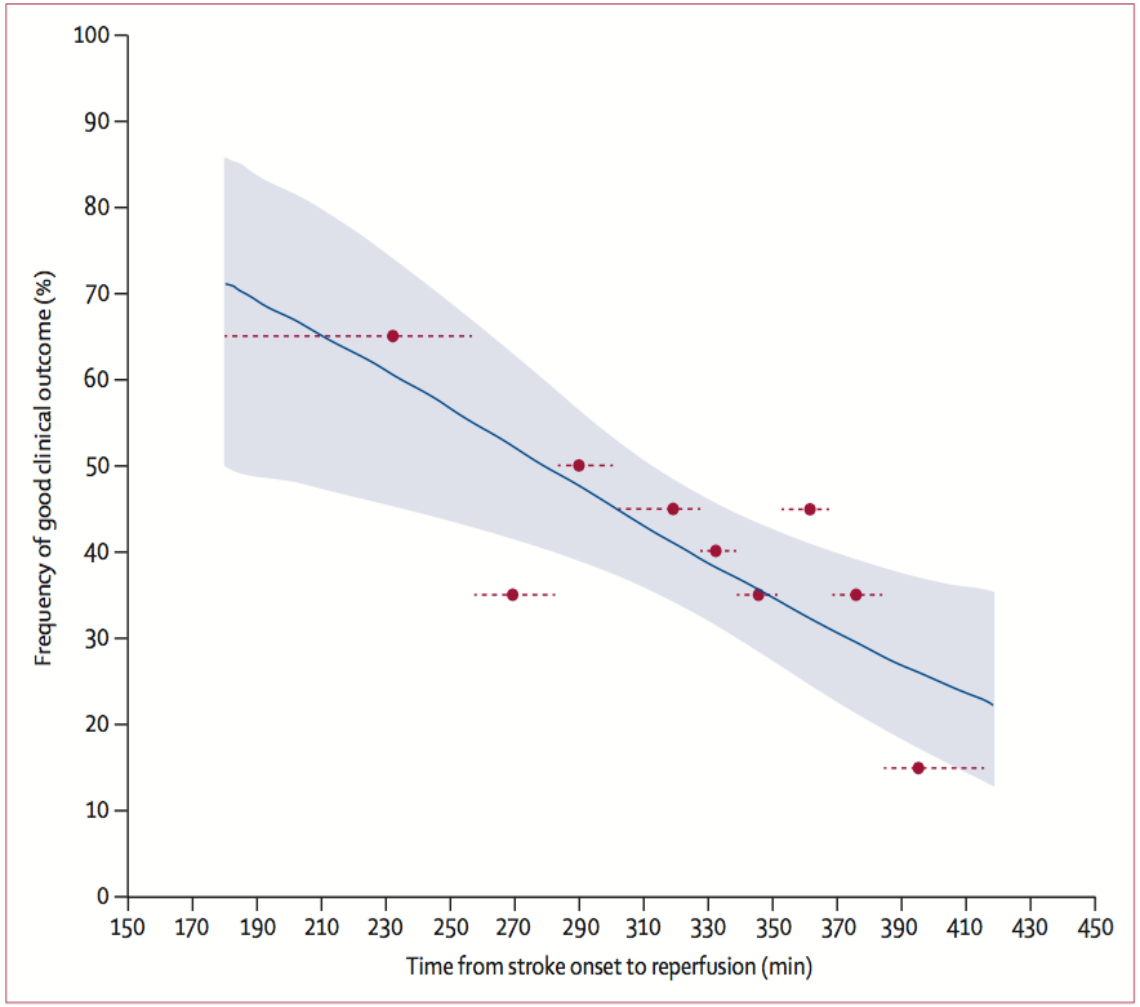


Every **30 minute delay** in recanalization

**reduces by 12%** the chances of a favourable outcome in the presence of large vessel occlusion.

Khatri, Yeatts, Mazighi, et al. Lancet Neurol 2014;13(6):567-574

# OTT and NNT for mRS 0-1

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| OTT (minutes) | NNT |
|---|---|
| 0 – 90 | 4.5 |
| 91 - 180 | 9 |
| 181 – 270 | 14.1 |

NNT increases by 1 for every 20 minutes of extra delay

Meretoja A. et al. Neurology 2012; 79: 306-313

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# Why is identifying stroke mimics important?

- To avoid inappropriate use of expensive and potentially harmful medications acutely and long-term.
- To appropriately allocate and manage patients within pressurised medical teams.

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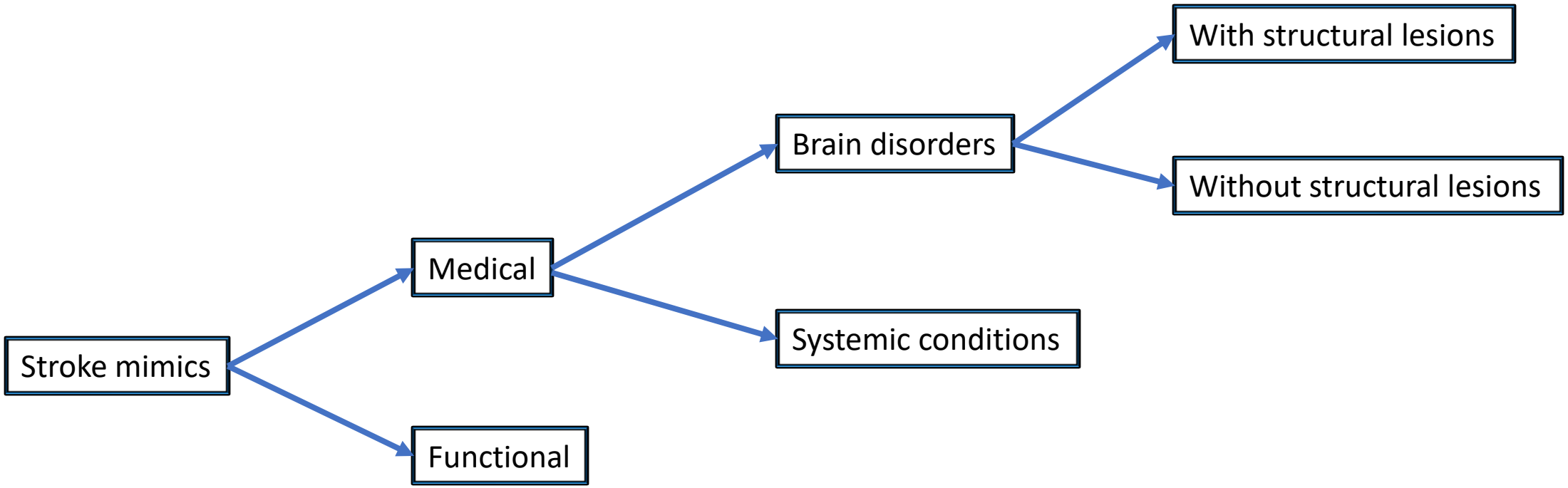


Buck et al. Ann Med 2021; 53 (1): 420-436

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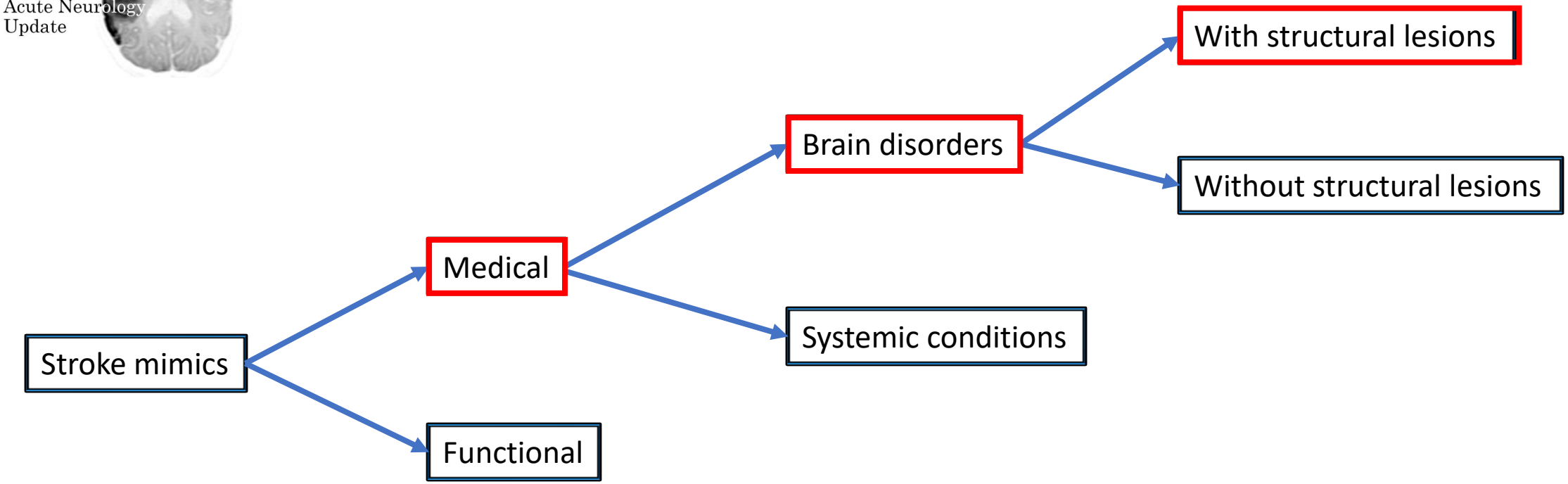


Buck et al. Ann Med 2021; 53 (1): 420-436

# Stroke mimics; brain disorders
## With structural lesions

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- Seizures*
- Brain tumours
- Subacute/acute bacterial endocarditis
- PRES
- Channelopathies
- Epidural/subdural haemorrhage
- Hypertensive crisis
- MS and other demyelinating disorders
- Encephalitis
- AVMs
- Arnold-Chiari malformation
- Stroke-like migraine attacks after radiation therapy (SMART)

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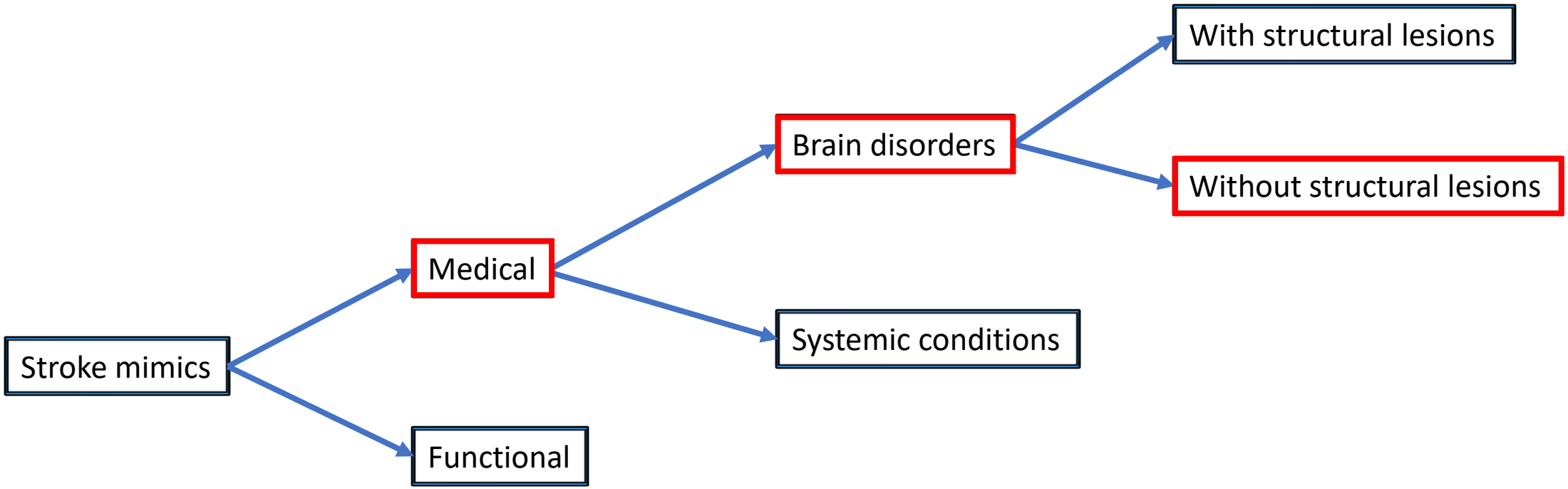


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# Stroke mimics; brain disorders
## No structural lesions

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- Migraine
- Seizures
- Peripheral vertigo
- Transient global amnesia
- Bell's palsy
- Focal neuropathies

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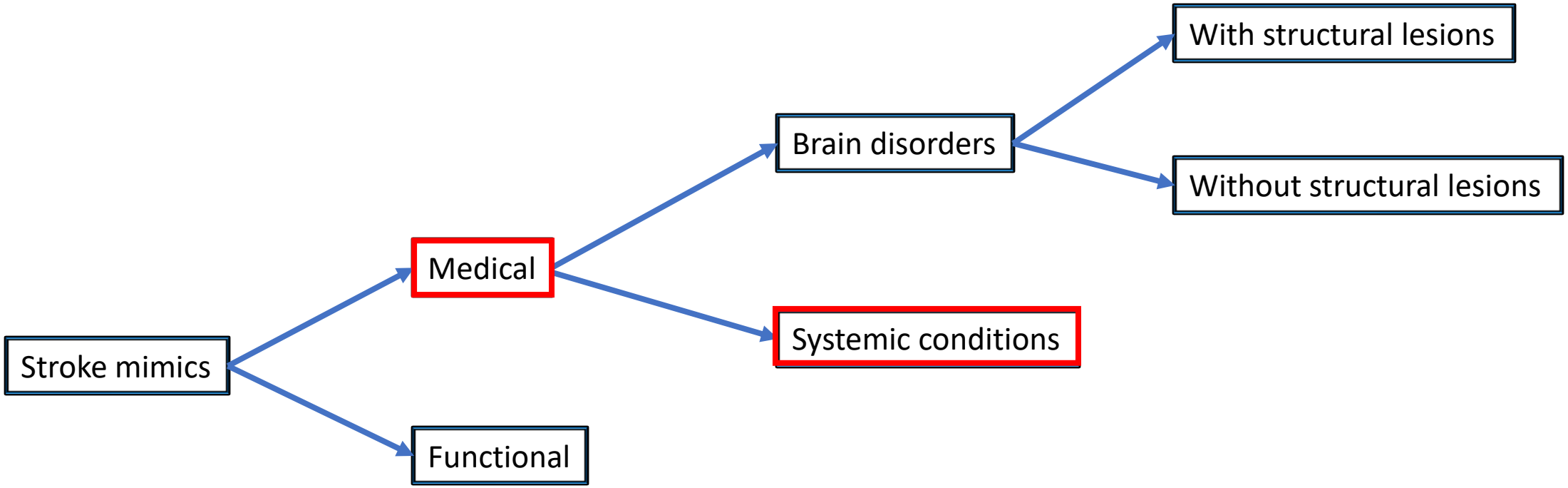


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# Stroke mimics; medical, systemic conditions

- Sepsis
- Electrolyte disorders
- Toxic/metabolic
- Alcohol-related
- Acute liver failure
- Hypo/hyperglycaemia

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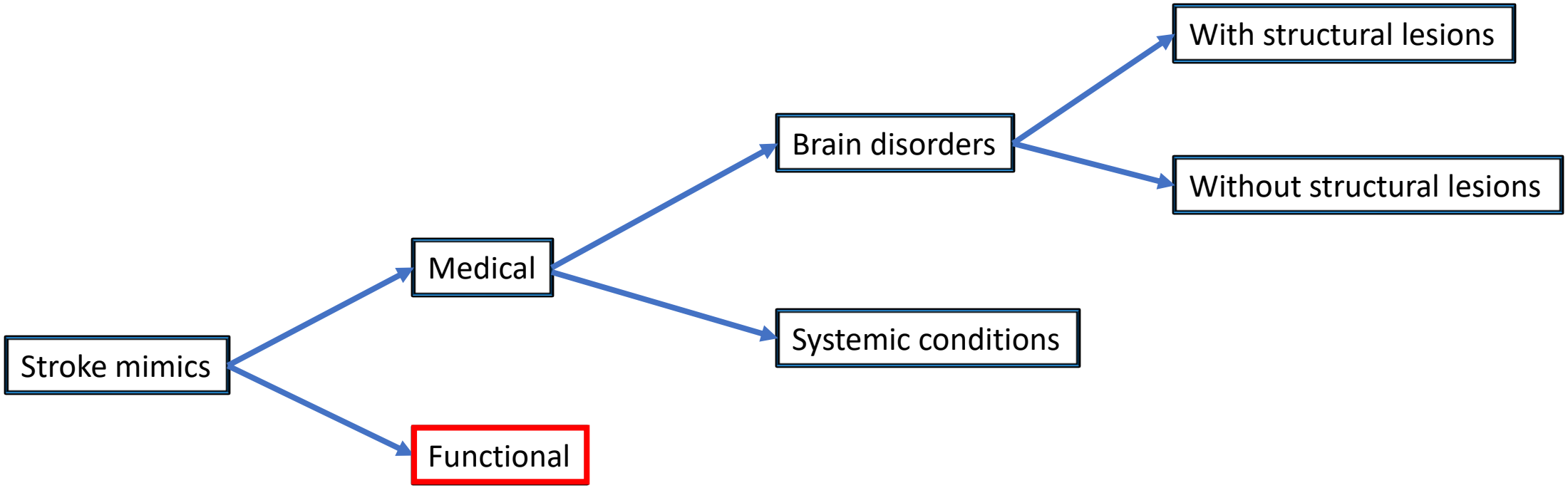


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# Stroke mimics; functional disorders

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Which may be associated with:

- Depression
- Anxiety disorder
- Chronic pain syndromes
- Psychiatric complications on neurological conditions

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Journal of Clinical Neuroscience 93 (2021) 174–182

Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

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,*]

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[b] Department of Laboratory Medicine, Medical School, University of Pecs
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[e] Hospital of Komlo, Komlo, Hungary
[f] Neurology Outpatient Clinic, EÜ-MED KFT, Komló, Hungary

61 studies, 62664 participants

# Aetiology of stroke mimics

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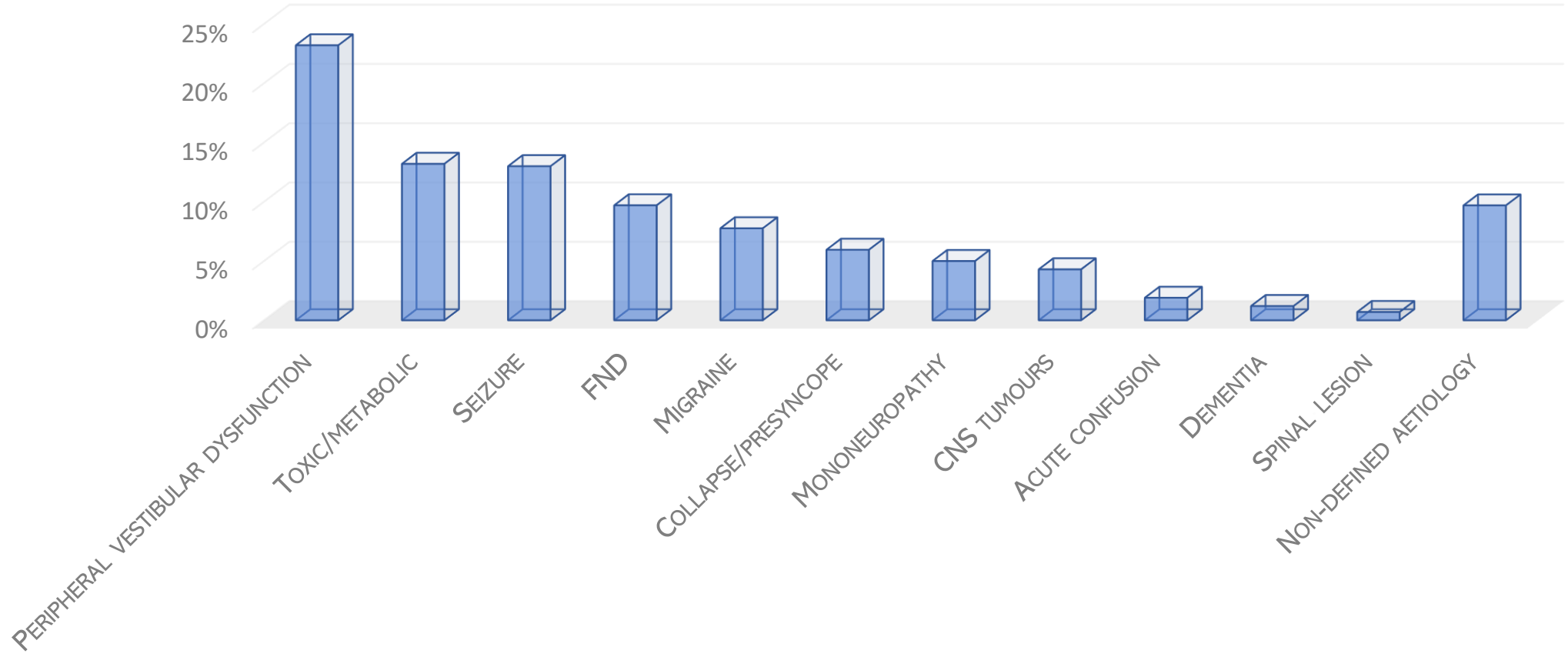


Adapted from Pohl et al. J Clin Neurosc 2021; 93:174-182

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Clinical findings in the examined subgroups.

| | Stroke | Stroke mimic | p value |
|---|---|---|---|
| *NIHSS (points)* | 8.06 ± 6.37 | 4.99 ± 5.65 | <0.001 |
| *Age (years)* | 68.4 ± 9.7 | 60.9 ± 10.4 | <0.001 |
| *Female gender (%)* | 56% | 68% | <0.001 |
| *Median time* (min) | 134.45 ± 58.27 | 116.75 ± 53.03 | 0.5 |
| *Blood pressure (Hgmm)* | 153.75/86.45 | 140.25/83.1 | <0.001 |
| *Unrevealed atrial fibrillation (%)* | 24.6 | 15.6 | 0.06 |

Pohl et al. J Clin Neurosc 2021; 93:174-182

# Clinical presentation

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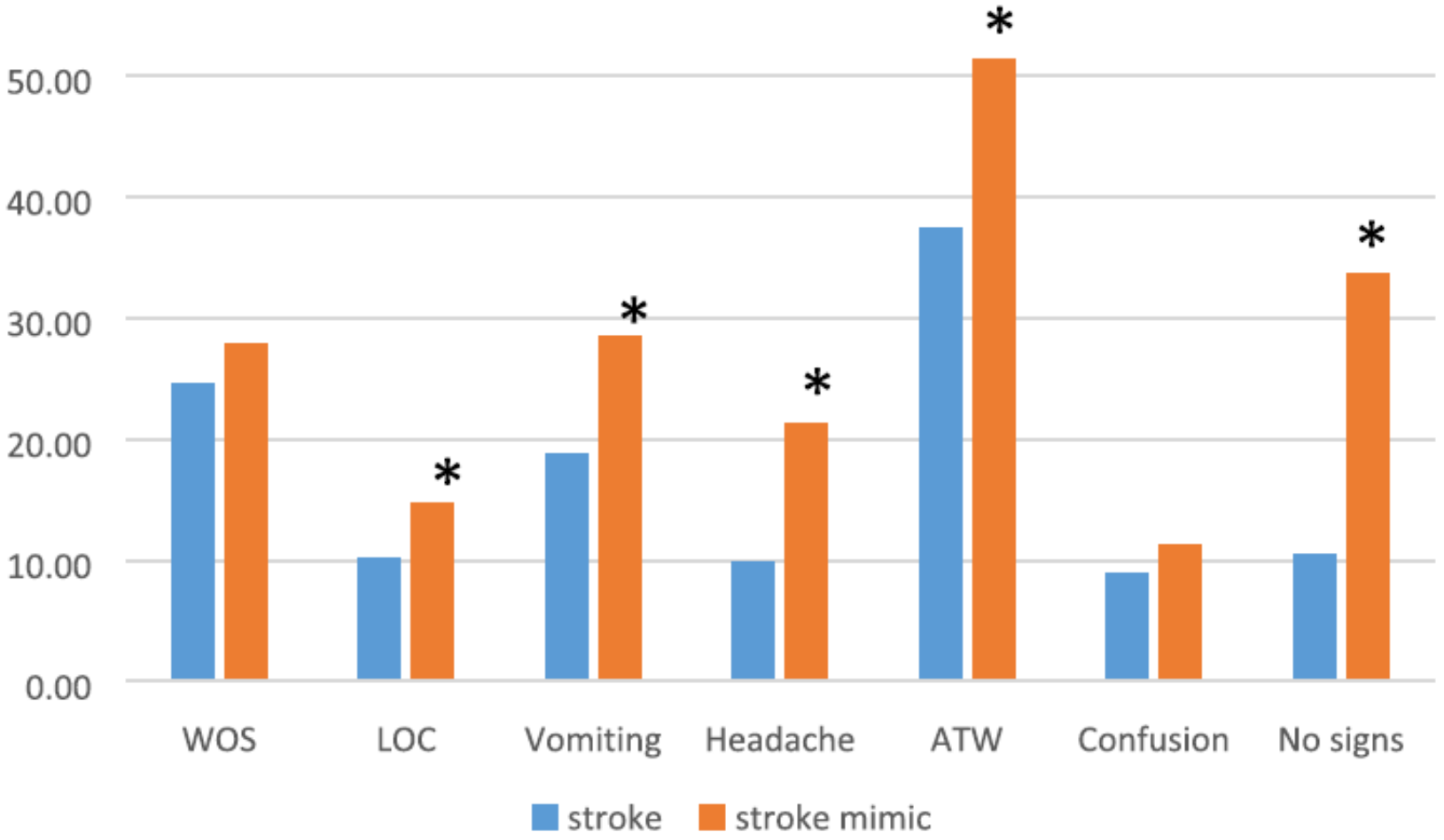


*** p<0.05**

Pohl et al. J Clin Neurosc 2021; 93:174-182

# Thrombolysis in stroke mimics

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| | Ischaemic stroke | | Stroke mimics | | P values |
|---|---|---|---|---|---|
| | % | N | % | N | |
| IV thrombolysis rates | 61.7 | 10232/16586 | 26.3 | 635/2407 | p<0.001 |
| Thrombectomy rates | 12.2 | 140/1150 | 0 | 0/607 | |
| Overall ICH | 9.4 | 786/8403 | 0.7 | 4/524 | p<0.001 |
| Death | 11.3 | 955/8472 | 1.9 | 15/789 | p<0.001 |
| Excellent outcome (mRS 0-1) | 41.8 | 3806/9095 | 68.9 | 646/937 | p<0.001 |

Adapted from Pohl et al. J Clin Neurosc 2021; 93:174-182

# Clinical features that may help in differentiating stroke from mimics

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| Characteristic | Stroke | Mimics |
|---|---|---|
| Age and sex | Older age (male = female) | Younger age (females > males) |
| Level of consciousness | Awake | Altered level of consciousness |
| Onset and progress | Acute and sudden | Gradual in onset |
| Symptoms severity | Severe at onset | Fluctuations in severity are common |
| Risk factors | Vascular risk factors | Migraine, seizure, systemic illness |
| Vascular territory | Vascular syndromes | No vascular distribution |
| Blood pressures at presentation | Increase blood pressure at onset is common | Blood pressure usually not increased |
| Signs and symptoms | Weakness (pyramidal distribution), aphasia and visual filed defects | Sensory, vertigo (dizziness) and visual |
| Involuntary movements | Uncommon | May have involuntary movements |
| Imaging | Imaging shows ischaemic lesions | Imaging helpful in diagnosis |
| EEG | EEG may show slowing over the affected area | May show spike and wave in seizures |
| | | Unilateral facial twitching and lip-smacking |
| | | Giveaway weakness |
| | | Arm drift/abrupt fall without pronation |

Buck et al. Ann Med 2021; 53 (1): 420-436

# Distribution of risk factors

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| | Stroke | Stroke mimic | P values |
|---|---|---|---|
| *Smoking* | 25.7 | 22.2 | <0.001 |
| *Hypertension* | 66.8 | 41.1 | <0.001 |
| *Dyslipidaemia* | 38 | 23.6 | <0.001 |
| *Diabetes* | 24.3 | 17.8 | <0.001 |
| *IHD* | 15.9 | 9.1 | <0.001 |
| *AF* | 23 | 8.4 | <0.001 |
| *PVD* | 9.9 | 6.7 | <0.001 |
| *Previous stroke* | 19.3 | 19.7 | 0.42 |
| *Cognitive impairment* | 11.1 | 25.4 | <0.001 |
| *Migraine in anamnesis* | 11.3 | 16.5 | <0.001 |
| *Seizure in anamnesis* | 1.5 | 2.3 | 0.23 |
| *Known malignancy* | 8.7 | 9.1 | 0.88 |

Buck et al. Ann Med 2021; 53 (1): 420-436

# Case 1

- 60 year old female
- BIBA c/o left arm numbness and visual disturbance

- Describes difficulty seeing out of the left and numbness of left arm
  - Shimmering patterns on left field of vision that evolved for around 10 minutes, followed by a tingling sensation in left arm which is still present

- GCS 15/15
- Visual fields now normal, VA normal
- Tone normal, power normal, reflexes symmetrical, altered sensation left arm

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# Migraine vs Stroke

- ? Any history of Migraine - is this different to previous episodes, if so, how?
- On History:
  - Positive phenomena = migraine (tingling, lights/patterns in vision)
  - Negative phenomena = stroke (loss of function)
- On Exam: Look for “hard” neurological signs
- Note those with migraine have increased risk of stroke. Can be difficult to distinguish - have a low threshold for treating and arranging MRI

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# Case 2

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- 76yo, male
- BIBA re: right hemiparesis and aphasia
- NOK: “It’s just like when he had the stroke 3 years ago”. Unwell for 3 days, no fever, “chesty”
- PMH: HTN, ex-smoker, COPD, previous L MCA infarct 3 years prior, AF on Apixaban.
- OE: apyrexial, respiratory crackles right hemithorax, wheezing
- NE:
  - Bradylalia, language blocks
  - Mild R central facial paresis
  - R spastic hemiparesis 2/5 UL> 3/5 LL, R Babinski

# Case 1

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- FBC: WCC 14.5, N 89%
- CRP 88
- ALT 66
- eGFR 64 mL/min
- Na-K normal.

# Case 1

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- Started antibiotic treatment as per local guidelines
- 24hs after treatment initiation, partial improvement in language and power.
- 48hs later, some bradylalia, RUL 3+/5,  RLL 4/5 (baseline), improved movements in right hand.

# Post-stroke recrudescence syndrome

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JAMA Neurology | Original Investigation

## Recrudescence of Deficits After Stroke
## Clinical and Imaging Phenotype, Triggers, and Risk Factors

Mehmet A. Topcuoglu, MD; Esen Saka, MD, PhD; Scott B. Silverman, MD; Lee H. Schwamm, MD; Aneesh B. Singhal, MD

Editorial

**IMPORTANCE** Reemergence of previous stroke-related deficits (or poststroke recrudescence [PSR]) is an underrecognized and inadequately characterized phenomenon.

**OBJECTIVE** To investigate the clinical features, triggers, and risk factors for PSR.

*JAMA Neurol*. doi:10.1001/jamaneurol.2017.1668
Published online August 7, 2017.

# Post-stroke recrudescence syndrome

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- Usually occurs after/within 4 years of index stroke
- Mild worsening of post-stroke deficits that usually resolve within 1 day
- Triggers:
  - Infection
  - Hyponatremia
  - Hypotension
  - Insomnia or stress
  - Benzodiazepine use

doi:10.1001/jamaneurol.2017.1668

# Case 3

- 40 year old female
- BIBA c/o left arm and leg weakness

- Describes onset since waking this morning of left arm and leg weakness and numbness

- GCS 15/15
- Cranial nerve examination normal
- Left arm held in midflexed position
- Tone normal
- Power 4/5 throughout arm with giveway weakness
- Seemingly 1/5 at hip flexion on the left but Hoover's sign positive, and patient can stand
- Reflexes symmetrical
- Reduced sensation left arm and leg and torso to the midline

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# Functional Neurological Disorder

- Common
- Structurally normal, but **subconscious** functioning of the brain is abnormal
- Associated with previous life stresses and co-morbid mental health disorders

- Treat with empathy, educate patient, encourage to mobilise early, consider if needs mental health support.

FND Guide
neurosymptoms.org

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# Case 4

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- 65 yo man
- Admitted due to “recurrent TIAs”
- In last 2 days, 3 episodes of isolated speech arrest, ~5 mins, no subsequent symptoms.
- PMH: HTN, T2DM, Hchol.
- OE: Pulses present in 4 limbs, normal heart sounds.
- NE: On admission. Normal.

# Case 4 Ix.

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- CT head: no acute findings.
- ECG: NSR
- Glucose 7.3
- MR brain without acute infarcts.
- Carotid US: <30% stenosis

# Case 4 cont.

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- Whilst in the ward, acute witnessed episode of speech arrest, mild perioral clonus, 3 minutes duration → brief disorientation for 5 minutes and return to baseline
- EEG: focal spikes, spike-and-slow wave complexes and polyspikes in left frontotemporal region.
- Started treatment with Oxcarbazepine, no more events.

# Case 5

- 65 year old male, BG: ex-smoker, nil regular meds
- BIBA c/o sudden onset vertigo

- What to look for on examination?

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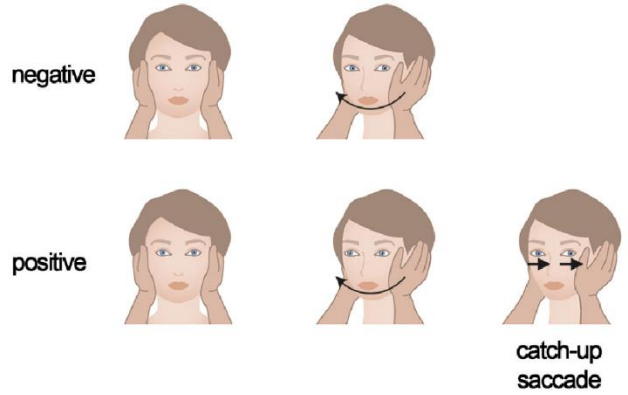
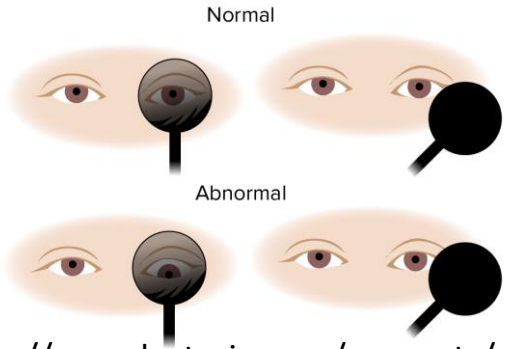
# HINTS

- **H**ead **I**mpulse
  - Pt looks at examiners nose. Quickly rotate head away.
  - **Peripheral** vestibular abnormality on affected side if eyes can be seen to correct afterwards.
- **N**ystagmus
  - Vertical or bi-directional nystagmus = **central** brainstem pathology
- **T**est of **S**kew
  - Pt looks at examiners nose - cover / uncover eyes one at a time – refixation of eyes / vertical misalignment suggests **central** pathology




Tarnutzer 2019 DOI:10.1177/2514183X19886158




https://www.lecturio.com/concepts/vertigo/

**More sensitive than MRI in the first 48hrs at detecting acute stroke in acute vestibular syndrome (100% Sensitive, 96% Specific)**

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# Case 6

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- 50yo, male
- BIBA re: aphasia
- 2 days prior: woke up with intense headache, left hemicranial, nausea.
- Intense weight lifting session in gym day before
- PMH: HTN
- OE: symmetrical pulses 4 limbs, HS normal
- NE: anomia, cannot repeat, language blocks, ideomotor apraxia

# Case 6

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# Case 6

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- Suspected L ICA dissection
- Called to the ward on day of admission:
  - Temp 38
  - 4 hours later: status epilepticus
    - IV Lorazepam + IV Keppra

# Case 6

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- FBC on admission: WBC 15.2 and neutrophilia, CRP <4.0
- LP: CSF colourless, transparent, proteins 0.76 g/L, glucose 2.5/?, leukocytes 67 (100% lymphocytes)
- CSF virology:
  - Enterovirus RNA not detected by PCR
  - Parechovirus RNA not detected by PCR
  - HSV type 2 DNA NOT detected by PCR.
  - HSV DNA type 1 DETECTED by PCR
  - VZV DNA NOT detected by PCR

# Herpes simplex virus encephalitis

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- Most common cause of sporadic fatal encephalitis.
- HSV-1
- Only 10% due to HSV-2
- Temporal lobe necrosis
- >24 hs: fever, seizures de novo, focal neurological deficits:
  - Cranial mononeuropathy
  - Hemiparesis
  - Dysphasia/aphasia
  - Ataxia

# Herpes simplex virus encephalitis

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- Behavioural syndromes:
  - Hypomania
  - Klüver-Bucy syndrome: apathy, visual agnosia, hyperorality, hypersexuality. Usually due to bitemporal lesions.
  - Amnesia
- Dx:
  - MR
  - CSF: pleocytosis, erythrocytes, ↑proteins, normal glucose
  - CSF PCR: Sens 98%, Spec 99%, from early in the clinical course.
- Treatment
  - IV Acyclovir 10mg/kg q8hs for 14-21 days.

# Case 7

- 65 year old male, BG: ex-smoker, nil regular meds
- BIBA c/o sudden onset double vision

- Tells you he was driving home from a holiday and he developed double vision

- O/E
- Left ptosis, pupil normal
- c/o double vision in all ranges of eye movement – complex ophthalmoparesis which seems to change as you examine him


Liu and Chen 2016
DOI: 10.1056/NEJMicm1509523

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# Myasthenia Gravis

- Fatigable weakness
- Complex ophthalmoparesis
- Ice pack test improves ptosis


Liu and Chen 2016
DOI: 10.1056/NEJMicm1509523

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# Case 8

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- 38yo, female.
- BIBA to A&E b/c of left hemihypoesthesia and mild UL weakness
- “Feeling very tired”, fatigue in previous weeks.
- Symptoms started 2 days prior, gradual onset, pins and needles in left UL, hemiface and LL. On the day of admission, noted mild weakness in LUL.
- PMH: active smoker 10 cigs/day, no recreational drugs, OCT microdosis.

# Case 8

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- OE: pulses present in 4 limbs, normal heart sounds.
- NE:
  - LUL paresis 4/5
  - Left patchy hemihypoesthesia involving arm>face>leg
- CT head on admission: no acute abnormalities.
- ECG NSR
- FBC, U&Es, ESR, LFTs, glucose, normal.

# Case 8

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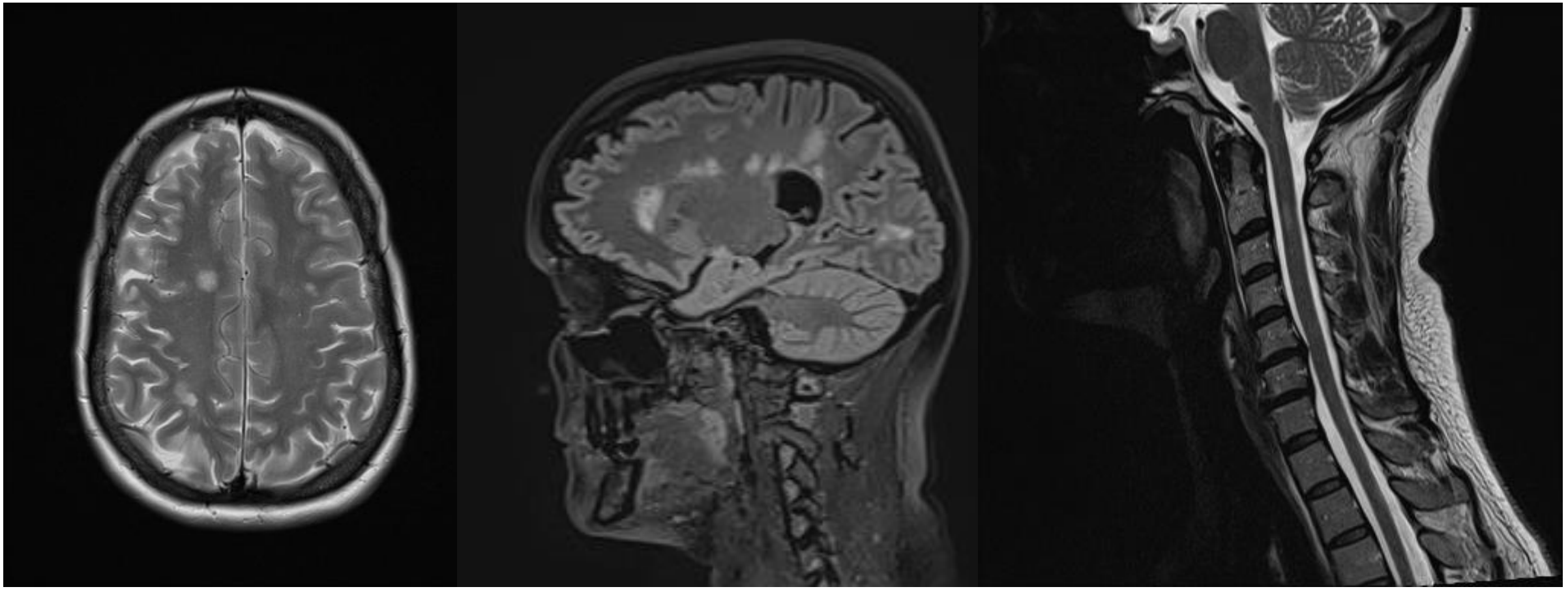
Update



# Case 8

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Update

- LP: normal CSF cytochemical analysis.
- IV methylprednisolone 1g IV for 3 days.
- Weeks later as outpatient: CSF oligoclonal bands were positive (2 or more oligoclonal bands unmatched in serum)
- Relapsing multiple sclerosis diagnosis confirmed.
- Started now on DMT

# Case 9

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Acute Neurology
Update

- 55 year old gentleman
- Presents with new right arm weakness, like this when he woke up
- O/E
  - Cranial nerves normal
  - Tone normal
  - Weakness of right wrist and finger extension, proximal power is normal
  - Numbness over the dorsum of the right hand

# Case 9

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Acute Neurology
Update

- On further questioning…
- He had drunk 8 pints last night and fallen asleep in his chair

# Radial nerve palsy


https://charmssingapore.com/saturday-night-palsy/

# Case 10

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Acute Neurology
Update

- 67yo male
- Woke up normally. During videocall with NOK, sudden speech arrest, shaking right arm, right facial droop, 5 mins.
- BIBA 5:30am, b/c speech difficulties and right hemiparesis UL>LL
- PMH:
  - HTN, IHD (stents), T2DM, Hchol

# Case 10

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Acute Neurology
Update

- OE:
  - Pulses present 4 limbs
  - Rhythmic heart sounds
  - Chest clear
  - Abd soft, no pain, no masses or megalies
- NE:
  - Mild dysarthria
  - Mild right central facial paresis
  - RUL pronator drift
  - NIHSS 4

# Case 10

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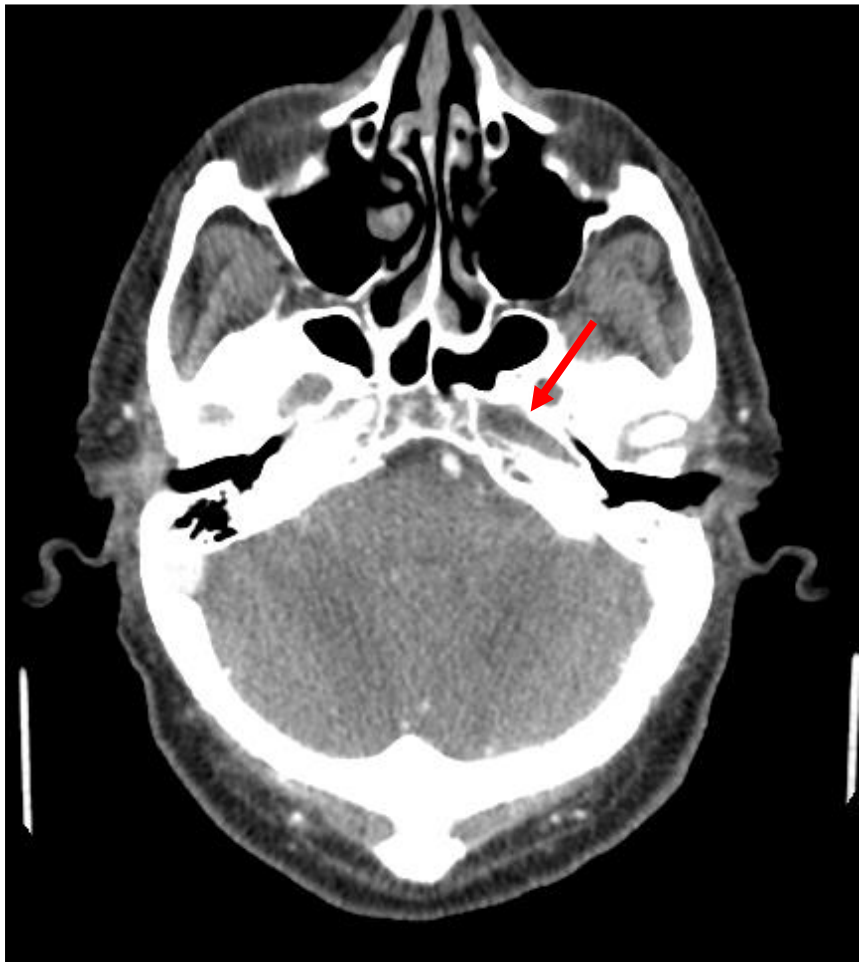
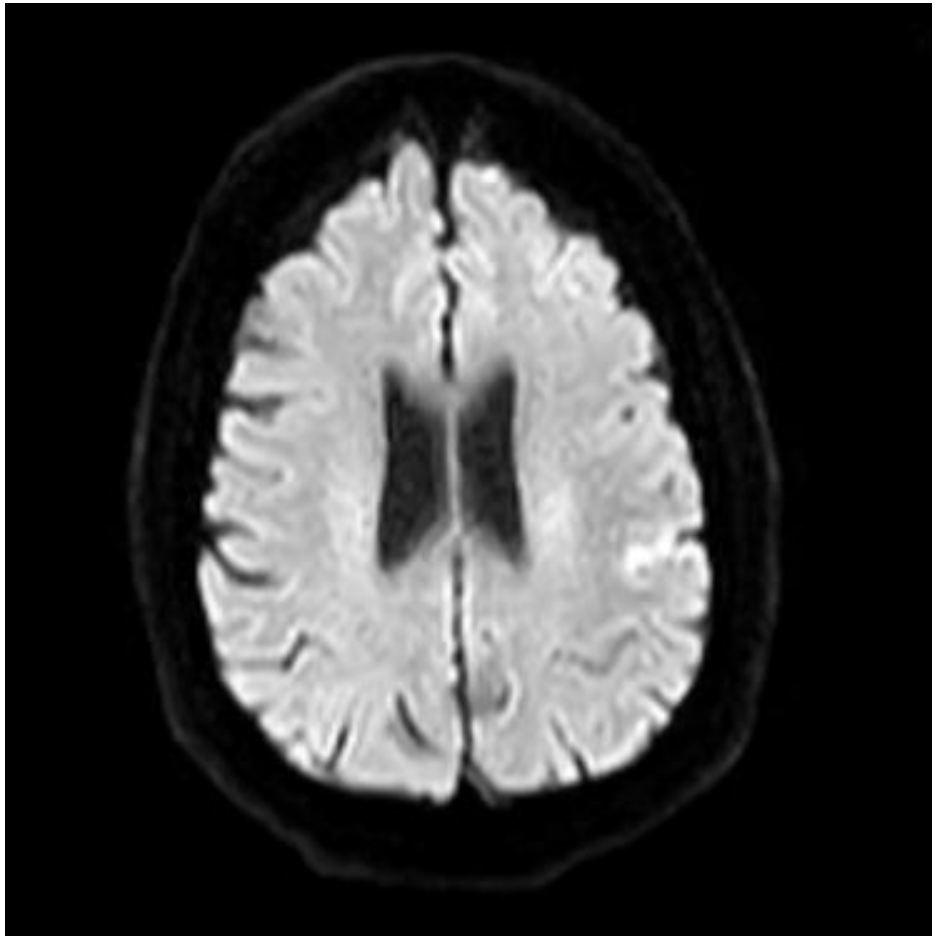
Acute Neurology
Update



# Case 10

NEANU
North of England
Acute Neurology
Update



- Clinical conclusion
  - Small left cortical frontal infarct secondary to L ICA occlusion.

# Case 10: 5 months later

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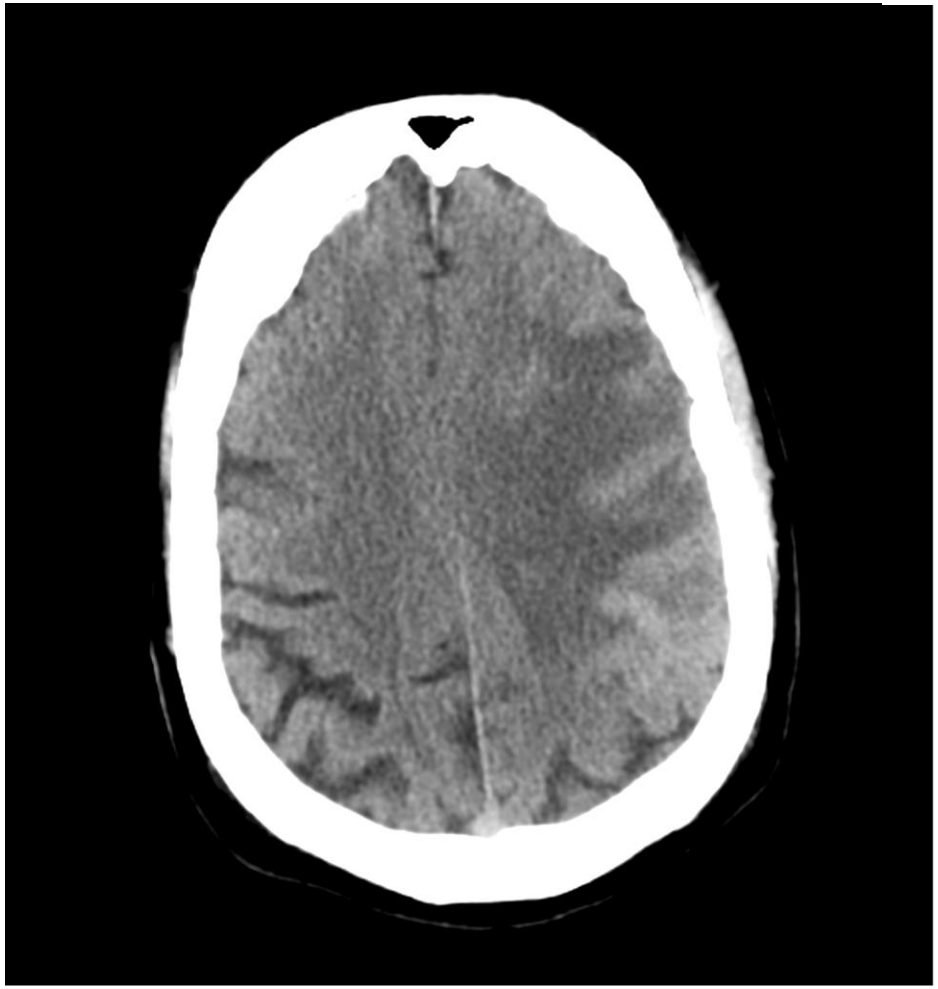
Acute Neurology
Update

- Woke up normally
- Collapsed ~20 mins.
- BIBA
- No VFDs
- Homogeneous right hemihypesthesia
- RUL 3/5, RLL 4/5



# Conclusions

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Update

- Stroke mimics may affect ¼ of patients presenting to A&E as an acute neurovascular syndrome.
- Careful clinical assessment is able to confirm their presence most of the time.
- Systemic medical conditions or neurological disorders may be common causes
- SMs usually have better prognosis than strokes
- Most SMs are treatable, hence proper diagnosis is necessary
- Even if thrombolysed, SMs have low risk of complications.


Thank you