Stroke Mimics in the AMU

Dr Joe Harbison
St James’s Hospital &
Trinity College Dublin
My inspiration
48 year old male.

Admitted to AMU with dysphasia and dysarthria.

Onset on waking

NIHSS 3

No motor loss, no other cortical signs

Only obvious risk, smokes 30/day

Urgent CT Normal

Sent to another hospital for MRB: Result pending
Doppler carotids L ICA stenosis 80%
Speech problems persist.
Scheduled for Endarterectomy.

MR report arrives: Normal
CT angio reviewed ≈50% stenosis.
Questions.

Is it a stroke or a stroke mimic?

What do we do next?

Do we operate on him tomorrow?
What is a stroke mimic?

- Patients presenting with symptoms mistakenly thought to be due to stroke on initial assessment.
  
  - Assessment by who?
  
  - How early in the diagnostic process?
Non-strokes.

- About 15-20% of 'strokes' are not.
- >50% of 'TIAs' are not.

Acute onset focal neurological deficit of vascular origin.

Remember the ROSIER Scale.
ROSIER Scale
Stroke Assessment

The aim of this assessment tool is to enable medical and nursing staff to differentiate patients with stroke and stroke mimics.

Assessment Date □□□□□□□□ Time □□□□□
Symptom onset Date □□□□□□□□ Time □□□□□

GGS E= □ M= □ N= □ BP □□□□ □ BM □

* If BM < 3.5 mmol/l treat urgently and reassess once blood glucose normal

Has there been loss of consciousness or syncope?
Y (-1) □  N (0) □

Has there been seizure activity?
Y (-1) □  N (0) □

Is there a NEW ACUTE onset (or on awakening from sleep)?

I. Asymmetric facial weakness
   Y (+1) □  N (0) □

II. Asymmetric arm weakness
    Y (+1) □  N (0) □

III. Asymmetric leg weakness
     Y (+1) □  N (0) □

IV. Speech disturbance
    Y (+1) □  N (0) □

V. Visual field defect
   Y (+1) □  N (0) □

*Total Score _____ (-2 to +5)

Provisional diagnosis: □ Stroke  □ Non-stroke (specify) ____________________

* Stroke is likely if total scores are > 0. Scores of <= 0 have a low possibility of stroke but not completely excluded.
### Causes

**Causes of Stroke Mimics (n=109)*, Subdivided by Time to Presentation**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Total Number (%)†</th>
<th>Mimics Presenting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Within 6 Hours</td>
<td>After 6 Hours</td>
</tr>
<tr>
<td>Seizure</td>
<td>23 (21.1%)</td>
<td>18 (29.0%)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>14 (12.8%)</td>
<td>6 (9.7%)</td>
</tr>
<tr>
<td>Toxic/metabolic</td>
<td>12 (11.0%)</td>
<td>6 (9.7%)</td>
</tr>
<tr>
<td>Space occupying lesion</td>
<td>10 (9.2%)</td>
<td>3 (4.8%)</td>
</tr>
<tr>
<td>Syncope/presyncope</td>
<td>10 (9.2%)</td>
<td>9 (14.5%)</td>
</tr>
<tr>
<td>Acute confusional state</td>
<td>7 (6.4%)</td>
<td>3 (4.8%)</td>
</tr>
<tr>
<td>Vestibular dysfunction</td>
<td>7 (6.4%)</td>
<td>3 (4.8%)</td>
</tr>
<tr>
<td>Acute mononeuropathy</td>
<td>6 (5.5%)</td>
<td>4 (6.5%)</td>
</tr>
<tr>
<td>Functional/medically unexplained symptoms</td>
<td>6 (5.5%)</td>
<td>4 (6.5%)</td>
</tr>
<tr>
<td>Dementia</td>
<td>4 (3.7%)</td>
<td>2 (3.2%)</td>
</tr>
<tr>
<td>Migraine</td>
<td>3 (2.8%)</td>
<td>2 (3.2%)</td>
</tr>
<tr>
<td>Spinal cord lesion</td>
<td>3 (2.8%)</td>
<td>- (0%)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (3.7%)</td>
<td>2 (3.2%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>109 (100%)</strong></td>
<td><strong>62 (100%)</strong></td>
</tr>
</tbody>
</table>

*Includes the 65 brain attacks definitely attributable to a mimic and the 44 brain attacks labeled as possible stroke/TIA in which there was a highly plausible alternate diagnosis.

There were 4 presentations diagnosed as possible stroke/TIA with no plausible alternate diagnosis (these patient episodes have not been included).

†Expressed as a proportion of the 109 mimics; ‡expressed as a proportion of those presenting within or after 6 hours.
## Table 1. Thrombolysed Strokes versus Mimics

<table>
<thead>
<tr>
<th>Demographic variables</th>
<th>Strokes, N (%)</th>
<th>Mimics, N (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline characteristics</td>
<td>243 (100)</td>
<td>7 (100)</td>
<td></td>
</tr>
<tr>
<td>Demographic variables</td>
<td>67.9 (±14.6; 18–94)</td>
<td>66.1 (±13.3; 53–89)</td>
<td>0.96*</td>
</tr>
<tr>
<td>Male gender</td>
<td>143 (58.8)</td>
<td>4 (57.1)</td>
<td>0.66†</td>
</tr>
<tr>
<td>Risk factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arterial hypertension</td>
<td>151 (62.1)</td>
<td>4 (57.1)</td>
<td></td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>54 (22.2)</td>
<td>1 (14.3)</td>
<td></td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>52 (21.4)</td>
<td>2 (28.6)</td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>30 (12.3)</td>
<td>3 (42.9)</td>
<td></td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>61 (25.2)</td>
<td>2 (28.6)</td>
<td></td>
</tr>
<tr>
<td>Smoking (current)</td>
<td>52 (21.4)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Antiepileptic medication</td>
<td>5 (2.1)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Clinical findings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke severity: mean NIHSS (±SD; range)</td>
<td>13.67 (±5.4; 1–31)</td>
<td>9.9 (±4.1; 6–18)</td>
<td>0.06*</td>
</tr>
<tr>
<td>Clinical syndrome§</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TACS, n (%)</td>
<td>145 (59.7)</td>
<td>2 (28.6)</td>
<td>0.13†</td>
</tr>
<tr>
<td>PACS, n (%)</td>
<td>73 (30.0)</td>
<td>5 (71.4)</td>
<td></td>
</tr>
<tr>
<td>LACS, n (%)</td>
<td>17 (7.0)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>POCs, n (%)</td>
<td>8 (3.3)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Left hemispheric, n (%)</td>
<td>123 (50.6)</td>
<td>6 (85.7)</td>
<td>0.12†</td>
</tr>
<tr>
<td>Global aphasia without hemiparesis§</td>
<td>8 (3.3)</td>
<td>3 (42.9)</td>
<td>0.002‡</td>
</tr>
<tr>
<td>Systolic blood pressure, mm Hg (±SD)</td>
<td>153.8 (±25.3)</td>
<td>156.9 (±23.4)</td>
<td></td>
</tr>
<tr>
<td>Brain imaging post-IVT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solely CT</td>
<td>88 (36.2)</td>
<td>1 (14.3)</td>
<td>0.42†</td>
</tr>
<tr>
<td>MRI (±CT)</td>
<td>155 (63.8)</td>
<td>6 (85.7)</td>
<td></td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intracranial hemorrhage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>43 (17.7)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Symptomatic‡</td>
<td>13 (5.3)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Orofingual angioedema</td>
<td>3 (1.2)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Functional 3-month outcome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean mRS (±SD)</td>
<td>2.7 (±2.0)</td>
<td>1.0 (±1.7)</td>
<td>0.05*</td>
</tr>
<tr>
<td>Favorable (mRS 0–1)</td>
<td>86 (35.4)</td>
<td>6 (85.7)</td>
<td>0.01†</td>
</tr>
<tr>
<td>Death (all causes)</td>
<td>34 (14.0)</td>
<td>0 (0)</td>
<td></td>
</tr>
</tbody>
</table>

* t test.
† Fisher exact test.
Safety of tPA in stroke mimics and neuroimaging-negative cerebral ischemia
Swift or sure?
The acceptable rate of neurovascular mimics among IV tPA–treated patients

In the interim, we suggest a reasonable target based on prior series of patients and current practice: sites should seek to achieve average door-to-needle times \( \leq 60 \) minutes, with neurovascular mimic patient treatment rates \( \leq 3\% \) at centers using noncontrast CT alone and \( \leq 1\% \) at centers using multimodal imaging.
Stroke mimics and age

<table>
<thead>
<tr>
<th></th>
<th>&lt;50 y (total 87)</th>
<th>≥50 y (total 583)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>69 (79%)</td>
<td>568 (97%)</td>
<td></td>
</tr>
<tr>
<td>Conversion disorder</td>
<td>6 (7%)</td>
<td>7 (1%)</td>
<td>.002</td>
</tr>
<tr>
<td>Migraine</td>
<td>12 (14%)</td>
<td>3 (1%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>0</td>
<td>4 (1%)</td>
<td>.63</td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>0</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

Percentages mentioned are percentages in the age group that has the particular disorder. P values are based on Chi-square statistics for 2 × 2 table of separate nonstroke diagnosis versus stroke compared between two groups.
### TABLE 3. Number of Nonstrokes and Diagnoses, Admitted by Rapid Ambulance Protocol, Primary Care Doctors, and Emergency Room Doctors

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>RAP</th>
<th>PCDs</th>
<th>ER</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total nonstrokes (% of admissions)</td>
<td>41 (23)</td>
<td>63 (29)</td>
<td>27 (29)</td>
<td>131 (27)</td>
</tr>
<tr>
<td>Seizures</td>
<td>15 (37)</td>
<td>6 (10)</td>
<td>6 (22)</td>
<td>27 (21)</td>
</tr>
<tr>
<td>Infections/sepsis and confusion</td>
<td>5 (12)</td>
<td>9 (14)</td>
<td>6 (22)</td>
<td>20 (15)</td>
</tr>
<tr>
<td>Cardiovascular collapses</td>
<td>6 (15)</td>
<td>5 (8)</td>
<td>1 (4)</td>
<td>15 (11)</td>
</tr>
<tr>
<td>Malignant tumor</td>
<td>5 (12)</td>
<td>7 (11)</td>
<td>1 (4)</td>
<td>13 (10)</td>
</tr>
<tr>
<td>Psychiatric causes</td>
<td>3 (7)</td>
<td>3 (5)</td>
<td>4 (15)</td>
<td>10 (8)</td>
</tr>
<tr>
<td>Deteriorating dementia</td>
<td></td>
<td>6 (10)</td>
<td>1 (4)</td>
<td>7 (5)</td>
</tr>
<tr>
<td>Subdural hemorrhage</td>
<td>2 (5)</td>
<td>5 (8)</td>
<td></td>
<td>7 (5)</td>
</tr>
<tr>
<td>Alcohol/drugs</td>
<td>1 (2)</td>
<td>3 (5)</td>
<td>2 (7)</td>
<td>6 (5)</td>
</tr>
<tr>
<td>Hyponatremia and collapse</td>
<td>3 (5)</td>
<td>1 (4)</td>
<td></td>
<td>4 (3)</td>
</tr>
<tr>
<td>Peripheral neuropathy</td>
<td>3 (5)</td>
<td></td>
<td></td>
<td>3 (2)</td>
</tr>
<tr>
<td>Migraine</td>
<td>1 (2)</td>
<td>2 (3)</td>
<td></td>
<td>3 (2)</td>
</tr>
<tr>
<td>Deteriorating Parkinson’s disease</td>
<td>1 (2)</td>
<td>2 (3)</td>
<td></td>
<td>3 (2)</td>
</tr>
<tr>
<td>Labyrinthine disorders</td>
<td>3 (5)</td>
<td></td>
<td></td>
<td>3 (2)</td>
</tr>
<tr>
<td>Subarachnoid hemorrhage</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td></td>
<td>2 (1.5)</td>
</tr>
<tr>
<td>Tension headache</td>
<td>2 (3)</td>
<td></td>
<td></td>
<td>2 (1.5)</td>
</tr>
<tr>
<td>Transient global amnesia</td>
<td>1 (2)</td>
<td>1 (4)</td>
<td></td>
<td>2 (1.5)</td>
</tr>
<tr>
<td>Hypoglycemic collapse</td>
<td>1 (2)</td>
<td>1 (4)</td>
<td></td>
<td>2 (1.5)</td>
</tr>
<tr>
<td>Cervical spondylotic myelopathy</td>
<td>1 (2)</td>
<td></td>
<td></td>
<td>1 (1)</td>
</tr>
<tr>
<td>Meningococcal meningitis</td>
<td>1 (2)</td>
<td></td>
<td></td>
<td>1 (1)</td>
</tr>
</tbody>
</table>

Values in parentheses for total nonstrokes are percentage of admissions. All other values in parentheses are percentage of nonstrokes.

*p=0.003

2x3 Fishers exact test
‘I can’t completely explain the cause of your funny turn, but I’m pretty sure it wasn’t a TIA or Stroke. In any case, your secondary prevention therapy is fairly comprehensive and I don’t think pursuing the episode with a bunch of scans would necessarily change things at the moment, but get back to me if you have another one and we’ll think again.’
Remembering a differential: Surprisingly succinct, simple strategy.

- Seizure
- Syncope
- Infection
- Tumours
- Metabolic
- Migraine
- Alcohol / Drugs
- Functional
- Subdurals

- Seizure
- Syncope
- Sepsis
- Space occupying lesions
- Sugar or salt
- Spasm of artery
- Substance misuse
- pSychological
- Subdurals

• Social
The Sacred Disease.

- Partial Seizures.
- Todd’s Paresis.
Partial Seizures

- Commonly young or middle aged adults.
- Following previous cortical stroke.
- May have antecedent symptoms.
- Onset seconds-minutes.
- Positive neurological symptoms.
- March of symptoms
- Resolution over few minutes.
- Amnesia for the event.
- Stereotypical attacks, reduce with antiepileptic treatment.
Seizure

Robert Bentley Todd: 1849
Todd’s Paresis

- ≈ 15% of seizures.
- Most common after GTC especially after clonic activity.
- Usually causes a hemiparesis.
- Can cause aphasia, sensory loss or visual field defect (uncommonly)
- Usually lasts minutes but can last hours or even days.
But.

- 2% of patients have a seizure at stroke onset.
- TACS & PICH / SAH.
- 25% incidence in ICH/SAH.
- 5% patients will have a seizure within the first two weeks post stroke.
- Thrombolysis – ICH; Up to 36 hours.
- EEG can be difficult to interpret.
Admitted in partial status...
Migraine.

Hemicrania
↓
‘Migraigne’
↓
Migraine
Migraine

• Affect 25% women, 8% men.

• ≈25% Migraine with aura.

• 50% of US Neurologists

• > 80% of US female headache neurologists.
Migraine forms.

- Hemiplegic Migraine.
- Acephalgic Migraine.
- ‘Benign recurrent vertigo’.
- Prolonged Aura.
- Status migrainosus.
Hemiplegic Migraine

- First described in 1893 by Living
- 4 subtypes (FHM 1-4) + sporadic forms.
- Ion channelopathies
- Migraine with aura with hemiplegic features, usually familial with one first degree relative with attacks.
- Hemiparesis may alternate from side to side.
- 30 – 60 minutes duration followed by severe headache
- Familial forms Autosomal Dominant
  - FHM1: Ch 19p, FHM2: Ch1p,
  - FHM3: Ch 2p, FHM4: Ch 1p
Migraine aura.

- Gradual Onset.
- Positive symptoms.
- Symptom spread over several seconds to minutes.
- Gradual resolution over 20-60 minutes
- Headache
- Recurrent Stereotyped attacks.
- Typically young.
Migranous Stroke

T2 FLAIR

DWI B1000
Reversible Cerebral Vasoconstriction Syndrome.

- One or a group of disorders
- Sudden ‘Thunderclap’ headache.
- Cerebral vasoconstriction on MRA Brain
- Resolve in days-weeks.
- High (>50%) risk of stroke (14%, ICH).
- Can be managed by CCBs
- Beware in puerperium or pregnancy.
Consequences

5th August

27th September
‘Unusual’ non-ergonomic gait.
Inconsistent neurology.
Pain at onset (be careful).
Positive Hoover’s sign (be very careful).
History of previous episodes.
Beware ‘la belle indifférence’.
Check plantars and fundi.
Sensory, visual, or speech problems also occur.
?when to stop investigating?
Ministry of silly walks.
Functional weaknesses.

- Not the same as ‘malingering’.
- Characteristic fMRI changes (reduced activation).
- ‘Software’ not a ‘Hardware’ problem.
- Benefit from CBT, neuropsychiatric evaluation.
Functional weakness?
Amyloid angiopathy

• Doesn’t appear on any differential.
• ‘Multiple PICHs’ typically posterior.
• Dementia, Alzheimer’s pattern.
• Stereotyped transient neurologic events.
  – Focal weaknesses.
  – Parasthesia.
  – Focal Numbness.
• Can be precursor to large bleed.
Amyloid Angiopathy.

- Stereotyped transient neurologic events.
- Symptoms spread to contiguous body parts over 2-10 minutes.
- May involve areas in several vascular territories.
- Probably due to small cortical petechial hemorrhages that lead to focal seizures.
- The rate of spread similar to migraine.
- ?? Spreading depression of neuronal activity.
- Can present with transient confusion or episodes of visual misperceptions.
- Diagnosis T2* MRI (gradient echo)
Intermittent Dysphasia
Amyloid angiopathy
Hypertensive angiopathy
Stroke Mimics & Chameleons

- Posterior Reversible Encephalopathy Syndrome.

1 week post chemo

6 days later
Stroke Chameleons

Strokes with positive symptoms.

• Limbic and orbitofrontal strokes.
• Subthalamic Nucleus stroke
• Thalamic stroke
Confusion post PTCA
Beware.....

- Some ‘mimics also cause strokes, given the right circumstances.
Syncope.
Radiological Mimics
Radiological Mimics
MR Clearer.
Transient Right Hemi and Confusion
CT Following Syncope

Virchow Robin Space
Conclusions

• Stroke Mimics are common and can be difficult to diagnose.

• Rarely stroke mimics can be causes of stroke.

• Occasionally stroke can present more like a mimic than a true stroke.
Repeat MR & MRA