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<tr>
<td>Stroke Unit</td>
<td><strong>Adults presenting at an A&amp;E department with suspected stroke are admitted to a specialist stroke unit within 4 hours</strong></td>
<td><strong>direct admission of patients with acute stroke to a hyperacute stroke unit providing active management of physiological status and homeostasis within 4 hours of arrival at hospital</strong></td>
</tr>
</tbody>
</table>
| Brain imaging | **Immediate brain scan (next slot, but definitely within one hour)**  
- Due thrombolysis or early anticoagulation  
- On anticoagulant treatment  
- A known bleeding tendency  
- GCS < 13  
- Unexplained progressive or fluctuating symptoms  
- Papilloedema, neck stiffness or fever  
- Severe headache at onset of stroke symptoms  
**Otherwise as soon as possible (within a maximum of 24 hours after onset of symptoms)** | **Patients with suspected acute stroke should receive brain imaging urgently and at most within 1 hour of arrival at hospital.** |
CT venogram
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<tr>
<td>Cerebral venous sinus thrombosis</td>
<td>People diagnosed with cerebral venous sinus thrombosis (including those with secondary cerebral haemorrhage) should be given full-dose anticoagulation treatment (initially full-dose heparin and then warfarin [INR 2–3]) unless there are comorbidities that preclude its use.</td>
<td>Patients with cerebral venous thrombosis (including those with secondary cerebral haemorrhage) should receive full-dose anticoagulation (initially full-dose heparin and then warfarin with a target INR of 2–3) for at least three months unless there are comorbidities that preclude their use.</td>
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</table>
Overnight...

- GCS e2 m4 v1 = 7
- Pupils: R 7mm, L 4mm (both unreactive)
- Protected airway, B/C stable
Cerebral Venous Sinus Thrombosis

- Overall CVT to arterial stroke ratio 1:63 but 1:8 for ages 15-45. 1M:3F

- Presentation
  - Acute, subacute or chronic
  - Headache (75%), papilloedema (50%), seizures (50%), focal deficits (50%), altered consciousness (33%)
  - Complications: pulmonary embolism
Cerebral Venous Sinus Thrombosis

**Predisposing conditions**

- Hypercoagulable states
  - Anticoagulant deficiency
    - Protein C/S deficiency, antithrombin III
    - Hereditary, Acquired – liver disease, nephrotic syn, pregnancy, post-partum, oestrogens
  - Dysfunctional coagulation
    - Activated protein C resistance, prothrombin mutation
  - Hyperhomocysteinaemia
  - Antiphospholipid antibody syndrome
  - Thyrotoxicosis (↑ fVIII levels)
  - Heparin induced thrombocytopenia
  - Inflammatory bowel disease
Cerebral Venous Sinus Thrombosis

- Low flow states
  - Iron def anaemia
  - Diabetic ketoacidosis
  - Polycythaemia
  - Hyperviscosity syndromes
- Vessel wall abnormalities
  - Infectious phlebitis (eg. mastoid infection)
  - Non-infectious phlebitis (eg carcinoma, behcets)
  - Trauma
Clinical evidence

- **Anticoagulation**
  - 2 RCTS (n=79): Cochrane ‘probably safe, but not conclusive’ – is widely used
  - LMW lower mortality than UFH

- **Decompressive hemicraniectomy**
  - Multicentre registry 2011
    - 57% independent
    - 16% died
    - 33% with bilateral fixed pupils recovered completely

Ongoing trials

- Thrombolysis or Anticoagulation for Cerebral Venous Thrombosis (TO-ACT) trial
|----------|---------------------|------------|
| Decompressive hemicraniectomy for malignant middle cerebral artery infarction | People with middle cerebral artery infarction who meet all of the criteria below should be considered for decompressive hemicraniectomy. They should be referred within 24 hours of onset of symptoms and treated within a maximum of 48 hours.  
  • Aged 60 years or under.  
  • Clinical deficits suggestive of infarction in the territory of the middle cerebral artery, with a score on the National Institutes of Health Stroke Scale (NIHSS) of above 15.  
  • Decrease in the level of consciousness to give a score of 1 or more on item 1a of the NIHSS.  
  • Signs on CT of an infarct of at least 50% of the middle cerebral artery territory, with or without additional infarction in the territory of the anterior or posterior cerebral artery on the same side, or infarct volume greater than 145 cm³ as shown on diffusion weighted MRI. | Patients with middle cerebral artery (MCA) infarction who meet the criteria below should be considered for decompressive hemicraniectomy. Patients should be referred to neurosurgery within 24 hours of stroke onset and treated within 48 hours of stroke onset:  
  • pre-stroke modified Rankin Scale score of less than 2  
  • clinical deficits indicating infarction in the territory of the MCA  
  • National Institutes of Health Stroke Scale (NIHSS) score of more than 15;  
  • a decrease in the level of consciousness to a score of 1 or more on item 1a of the NIHSS;  
  • signs on CT of an infarct of at least 50% of the MCA territory with or without additional infarction in the territory of the anterior or posterior cerebral artery on the same side, or infarct volume greater than 145 cubic centimetres on diffusion-weighted MRI. |
Un-enhanced CT head
ToF MRA

Normal
DW MRI
Clinical features of BAO

- The location and length of the vascular occlusion determines the clinical picture, ranging from mild motor deficits to tetraplegia
  - Vertigo, nausea, vomiting 54-73%
  - Bulbar, pseudobulbar weakness 74%
  - Hemiparesis, tetraparesis, facial weakness 40-67%
  - Dysarthria 30-63%
  - Headache 40-42%
  - Visual disturbances 21-33%
  - Altered consciousness 17-33%
  - Abnormal movement (shivering, twitching, shaking or jerking on the relatively spared side)
Difficulties in diagnosis – Stroke

- ED presentations with ‘dizziness, vertigo or imbalance’ 4-6% cerebrovascular event
  - Kerber et al. Stroke 2006 37(10) 2484-7

- FAST less sensitive for posterior circulation stroke
  - FAST ≥ 1 in 61% posterior vs 92% anterior strokes (p<0.0001)

- MRI DWI can often be negative especially small brainstem infarcts

Markus et al. JNNP 2012 83(2): 228-9
Clinical tools to use to aid differentiation of ‘acute vestibular syndrome’

“continuous vertigo”

- **ABCD2**
  - 902 pts with AVS presentations to ED
  - 219 (24%) had ABCD2≤2 - none had stroke as cause

- **HINTS** - Head Impulse, Nystagmus (fast-phase alternating), Test of Skew
  - ‘Stroke’ referrals : 56% confirmed stroke
  - HINTS +ve sensitivity 97%, specificity 84%

Navi et al. Stroke 2012 43:1484-1489
HINTS testing in continuous vertigo

- Head Impulse, Nystagmus, Test of Skew
- Think central cause stroke if:
  - Nystagmus direction-changing
  - Skew deviation present
  - Head impulse R & L normal
People with continuous vertigo

<table>
<thead>
<tr>
<th>Test element</th>
<th>Peripheral cause</th>
<th>Central cause</th>
</tr>
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<tbody>
<tr>
<td>Head impulse test</td>
<td>Abnormal</td>
<td>Normal</td>
</tr>
<tr>
<td>Nystagmus</td>
<td>Unidirectional horizontal</td>
<td>Rotatory, vertical or direction-changing horizontal</td>
</tr>
<tr>
<td>Alternate eye cover testing</td>
<td>Skew deviation absent</td>
<td>Skew (vertical) deviation present</td>
</tr>
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</table>
‘Time IS brain’

- a typical large vessel acute ischemic stroke
  - Each minute
    - 1.9 million neurons
    - 14 billion synapses
    - 12 km (7.5 miles) of myelinated fibers
  - Each hour
    - 120 million neurons
    - 830 billion synapses
    - 714 km (447 miles) of myelinated fibers

‘Time IS brain’

Intravenous thrombolysis with alteplase for acute ischaemic stroke
Individual patient data analysis, n=2775

Odds ratio for a complete recovery (at 3 months)
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<tr>
<td>Thrombolysis</td>
<td>Alteplase is recommended for the treatment of acute ischaemic stroke when used by physicians trained and experienced in the management of acute stroke. It should only be administered in centres with facilities that enable it to be used in full accordance with its marketing authorisation. Alteplase should be administered only within a well organised stroke service with: staff trained in delivering thrombolysis and in monitoring for any complications associated with thrombolysis, level 1 and level 2 nursing care staff trained in acute stroke and thrombolysis, immediate access to imaging and re-imaging, and staff trained to interpret the images.</td>
<td>Patients with acute ischaemic stroke, regardless of age or stroke severity, in whom treatment can be started within 3 hours of known onset should be considered for treatment with alteplase.</td>
</tr>
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</table>
ASPECTS Criteria

- A normal CT scan receives ASPECTS of 10 points.
- To compute the ASPECTS, 1 point is subtracted from 10 for any evidence of early ischemic change for each of the defined regions of MCA territory.
Stent Retrievers

- 3rd Generation endovascular stroke treatment
- Immediate flow restoration
- Trap thrombus within stent struts and retrieved

Solitaire

Trevo
Thousands 'miss out on stroke treatment'

By Smitha Mundasad
Health reporter

29 November 2016 | Health | 19

In the UK, nearly 90,000 people each year are admitted to hospital following a stroke

About 9,000 stroke patients a year are missing out on a treatment that can prevent disability following a stroke, say UK experts.

Clot retrieval can restore blood flow to the brain, preventing some lasting damage, but currently only 600 patients a year get this therapy, they estimate.
What to bleeding do?
|----------|-------------------|------------|
| Acute intracerebral haemorrhage – **anticoagulant reversal** | Clotting levels in people with a primary intracerebral haemorrhage who were receiving anticoagulation treatment before their stroke (and have elevated INR) should be returned to normal as soon as possible, by reversing the effects of the anticoagulation treatment using a combination of prothrombin complex concentrate and intravenous vitamin K. | Patients with intracerebral haemorrhage in association with vitamin K antagonist treatment should have the anticoagulant urgently reversed with a combination of prothrombin complex concentrate and intravenous vitamin K.  
Patients with intracerebral haemorrhage in association with dabigatran treatment should have the anticoagulant urgently reversed with idarucizumab.  
Patients with intracerebral haemorrhage in association with factor Xa inhibitor treatment should receive urgent treatment with 4-factor prothrombin complex concentrate. |
|----------|-------------------|------------|
| Acute intracerebral haemorrhage – blood pressure | | Patients with primary intracerebral haemorrhage who present within 6 hours of onset with a systolic blood pressure above 150mmHg should be treated urgently using a locally agreed protocol for blood pressure lowering to a systolic blood pressure of 140 mmHg for at least 7 days, unless:  
– the Glasgow Coma Scale score is 5 or less;  
– the haematoma is very large and death is expected;  
– a structural cause for the haematoma is identified;  
– immediate surgery to evacuate the haematoma is planned. |
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<tbody>
<tr>
<td>Acute intracerebral</td>
<td>Previously fit people should be considered for surgical intervention following primary</td>
<td>Patients with intracranial haemorrhage who develop hydrocephalus should be</td>
</tr>
<tr>
<td>haemorrhage - surgery</td>
<td>intracranial haemorrhage if they have hydrocephalus</td>
<td>considered for surgical intervention such as insertion of an external</td>
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<td></td>
<td>People with any of the following rarely require surgical intervention and should</td>
<td>ventricular drain.</td>
</tr>
<tr>
<td></td>
<td>receive medical treatment initially:</td>
<td>Most patients with primary intracerebral haemorrhage do not require</td>
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<tr>
<td></td>
<td>• small deep haemorrhages</td>
<td>surgical intervention and should receive monitoring and initial medical</td>
</tr>
<tr>
<td></td>
<td>• lobar haemorrhage without either hydrocephalus or rapid neurological deterioration</td>
<td>treatment on a hyperacute stroke unit, such as those with</td>
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<tr>
<td></td>
<td>• a large haemorrhage and significant comorbidities before the stroke</td>
<td>• small, deep haemorrhage</td>
</tr>
<tr>
<td></td>
<td>• a score on the Glasgow Coma Scale of below 8 unless this is because of hydrocephalus</td>
<td>• lobar haemorrhage without hydrocephalus, intraventricular haemorrhage</td>
</tr>
<tr>
<td></td>
<td>• posterior fossa haemorrhage.</td>
<td>or neurological deterioration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• large haemorrhage and significant co-morbidities before the stroke</td>
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<td></td>
<td>• those with supratentorial haemorrhage with a Glasgow Coma Scale score</td>
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<tr>
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<td>below 8 unless this is because of hydrocephalus.</td>
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</tbody>
</table>
66. An 82-year-old woman presented with a history of self-limiting left-sided facial droop and associated mild left upper and lower limb weakness.

She had started feeling non-specifically unwell earlier in the day. Her daughter then noticed that her speech was slurred and commented on the facial asymmetry. Over the next half an hour, the patient then noticed her left leg became numb and started dragging while walking and her left arm felt heavy. The symptoms improved over the subsequent half an hour. When she arrived in the ED she had a persistent unilateral headache with associated nausea and photophobia.

On examination she was apyrexial. Kernig’s sign was negative. Power, tone, co-ordination, sensation, and reflexes were intact throughout. Blood tests were unremarkable.

**Which of the following is the most likely diagnosis?**

A. Encephalitis  
B. Glioblastoma multiforme  
C. Migraine with aura  
D. Right middle-cerebral artery territory stroke  
E. Transient ischaemic attack

Answer: C
Question 1

A 65-year-old right handed woman developed a sudden inability to speak properly while she was talking to her neighbour. Her husband brought her to hospital immediately and described the problem as if she were talking “double Dutch”. Her past medical history comprised hypertension and osteoarthritis. She was taking bendroflumethiazide 2.5mg od and prn codeine.

On examination, there was obvious word-finding difficulties and problems correctly naming objects. Understanding appeared to be intact. Her blood pressure was 190/100 mmHg. There was no other abnormality on examination.

What is the next best step in management?

A  Amlodipine 5mg orally
B  Ateplase 0.9 mg/kg intravenously
C  Aspirin 300mg orally
D  Clopidogrel 300mg orally
E  Tenecteplase 50mg intravenously

(Remember in the exam the “correct” answer is the NICE guideline answer, followed by specialist society guidelines, followed by consensus).

Answer: B
A 75-year-old man developed sudden left sided numbness and weakness which was still present at the time of assessment in the Emergency Department. He had been given 300mg aspirin orally by paramedics. His past medical history comprised paroxysmal AF which had been DC cardioverted. He was not taking any regular medication. He was a right handed driver with no other past medical history.

On examination, he had objective reduced power on the left side of his body (4/5) but no other abnormality. He was alert and orientated. His NIH Stroke Score was calculated to be 3. An urgent CT scan of the head was normal.

In which part of the brain has this stroke occurred?

A  Clinically impossible to say
B  Left internal capsule
C  Pons
D  Right MCA territory
E  Thalamus

Answer A