Please note – this learning resource has been produced by the GUMS Academic Team. It is possible that there are some minor errors in the questions/answers, and other possible answers that are not included below. Make sure to check with other resources.

**Key elements of the answers are bolded. Everything else is important but not the focus of BMB.**

**CASE 1 - Stroke**

You are an intern working in the Emergency Department. A 65 year old gentleman, Mr Tom Lysis, presents to ED with his wife at 7pm following new onset weakness in his face and arm on the right side of his body.

1. What do you immediately do?

* **Call a code stroke/contact neurology.**
* Check airways, stabilise breathing if required (ABCDE).
* **Order an urgent non-contrast CT and start wheeling the patient to the CT scanner whilst doing a brief history and examination.**
* **Investigations** - ECG, FBC, Chem20, finger prick glucose, coag profile, blood gas
* Cannulate the patient.
* Give aspirin IF appropriate ​
  + *(\*\*A swallowing assessment is mandatory in every stroke presentation prior to any oral therapy\*\* risk of aspiration)*
  + *Do not give aspirin for 24 hours if patient is undergoing thrombolysis*
  + *Do not give aspirin until brain imaging excludes intracranial haemorrhage*

**\*\*\* see flowchart at end of Case 1\*\*\*\***

1. What is the rationale for doing an ECG in stroke?

To check for atrial fibrillation (potential cause of stroke) and concomitant cardiac ischemia

1. List some differential diagnoses.

* TIA
* Migraine
* Tumour
* Subdural haematoma
* Seizures (e.g. post-ictal paralysis)
* Hypoglycemia

1. Take a brief history of the patient and his wife. State what you would examine. *[Mentor to provide answers to hx questions.]*

*Get the group to take a brief history and provide the following answers in relation:*

* ***Time Course:*** *M*​r *Lysis had sudden onset weakness on right side of body whilst walking his dog with his wife ~1h prior. His wife was immediately worried and drove him to ED.*
* ***Limbs affected:***​ *Right arm affected, not leg. Both motor (weakness) and sensory (deficit in all sensations).*
* ***Face:***​ *Wife notices that the right side of his mouth is drooping.*
* ***Speech:***​ *His wife says he is frustrated because he ‘just can’t get his words out’ – (expressive aphasia)*
* ***Eyes:***​ *Has left gaze preference (is looking to the left)*
* ***Past Medical hx:***​ *CT angiogram for his heart in the past with no complications. Hypertension for past 15 years*
* ***Medications:***​ *Perindopril for hypertension. No antiplatelet/anticoagulants.*
* ***Allergies****: NKDA*
* ***Surgical Hx:*** *nil*
* ***Considerations in relation to differentials…*** *nil headache, nil N+V, nil head trauma*

Key elements of the history

* **Time course; sudden onset weakness.**
* **Location of weakness and ask some specifics e.g. speech, limbs, eyes etc.**
* Check if allergy to contrast for CT and briefly if any contraindications to thrombolysis, ​**especially medications.**
* *Note: 3 most predictive findings in acute stroke are: facial paresis, arm drift/weakness and abnormal speech.*

Examination:

* Vitals
* **Primary survey on arrival – ABCDE**
* Secondary survey – including **neurological assessment**
  + *Often the NIHSS stroke scale is used to provide a measure of neurological impairment*
  + *Assessment includes: level of consciousness, gross orientation, ability to follow commands, horizontal eye movements, visual fields, drift of arms and legs, ataxia, pinprick sensation, language, extinction and inattention*
  + *This would not be assessable in BMB but it is important to be aware of*

1. Based on this information, state the most likely affected artery.

**Left MCA** is affected

1. What is the most important INITIAL scan to order and what is the SINGLE most important reason for this scan?

**Non-con CT head – rule out haemorrhage**

**Haemorrhage is a contraindication to thrombolysis**

1. Comment on the findings in the CT and state what you would look for in the plain CT.



**It is important to approach any imaging with a structure.**

Overall Imp for this CT: normal

Important in this case to look for: ischemia, hypo/hyperdensity, loss of grey-white differentiation, previous infarctions, **rule out haemorrhage**

Head CT: An Approach

Pt details (name, DOB, scan date)

Type of scan

For CTH, you may wish to comment on the following (may be limited by the level of the image):

* + Likely level of image
  + Symmetry, midline shift
  + Brain matter – masses, abnormal attenuation, mass effect
  + Subarachnoid space and ventricles – size, contents/abnormal attenuation, symmetry, effacement of sulci
  + Vessels (if visible) – hyperdensity, e.g. in MCA
  + Grey-white matter differentiation
  + Any subdural blood/collections
  + Soft tissues
  + Bony review
  + Overall impression

Adapted from: <https://radiopaedia.org/articles/ct-head-an-approach>

**\*\*see amboss - ischemic stroke (diagnostics) for some more interpretation with images\*\***

1. A picture containing map

   Description automatically generated*The next part is for interest:* What further imaging would you perform? An example is shown below.

* Do a **CT angiogram and a perfusion scan** (summarise - you do 3 scans - plain, angiogram, perfusion).
* Looking for a filling defect in angiogram
* The CT perfusion scan is shown. Its purpose is to differentiate the penumbra (salvageable ischaemic tissue) from the core (necrotic tissue).
  + Big penumbra to core = more potential for positive outcomes with intervention
  + Big core to penumbra = less likely to get a large benefit from intervention (must weigh pros and cons)

*(Note this image shows a R sided infarct.)* The patient’s CT perfusion scan shows a small core with a large penumbra.

*Note: this happens as part of the work up for stroke in established centers, but would unlikely be tested in BMB papers.*

1. If the patient’s scan had evidence of mostly necrosed tissue, would you lyse them?

**Lysis in this situation has the potential to cause more harm 🡪 increases the risk of haemorrhagic transformation.**

1. Which of the following is NOT a contraindication for thrombolysis?
   1. Intracranial haemorrhage on imaging
   2. Previous stroke within last 3 months
   3. Active bleeding *consider site and severity of bleeding*
   4. Uncontrolled Hypertension of 150/90 mmHg – ANSWER: only contraindicated if >185/110mmHg 🡪 can reduce then thrombolyse
   5. Hypoglycemia *correct first*
2. You decide to thrombolyse Mr Tom Lysis (why?). How do IV thrombolytic agents such as alteplase work?

Why? – no contraindications, CT NAD, symptom onset <4.5h ago

MOA: Recombinant tissue plasminogen activator 🡪 **converts plasminogen to plasmin** 🡪 lysis of fibrin 🡪 **clot breakdown**

* 1. What are the main complications?

**Bleeding** – intracerebral, internal, at injection sites

Allergic reactions including angioedema

* 1. What are the indications for a mechanical thrombectomy as a reperfusion option? What is it?

**Proximal large artery occlusion in anterior cerebral circulation** (although techniques are improving, particularly in large volume centres)

**Within 24h of symptom onset**

+/- IV tPA

Involves physical retrieval of the thrombus via a catheter (usually through the femoral artery)

IV thrombolysis is done, but the intern who did it was from UQ and accidentally gave them heparin instead. They infarct. ☹

To summarise, their signs are:

* Paralysis of right lower face and arm
* Sensory loss to right side of face and right arm
* Can’t look right (looks towards the side of the lesion i.e. can only look left, but not right)
* Can’t get words out but understands commands

1. Name the precise MCA branch involved.

**Left MCA superior division**

1. What structures have been affected? What else does the examiner have to look for (although given that he has aphasia, he can’t tell you this sign!)? Assume the left hemisphere is dominant.

* Parietal cortex – contralateral sensory loss in face and UL (may be variable depending on individual supply)
* Primary motor area – Contralateral weakness in the arms, lower half of the face and lower limbs (not as pronounced)
* Frontal eye field – Gaze deviation toward the side of the infarction
* Optic radiation – contralateral homonymous hemianopia without macular sparing (may be difficult to assess clinically)
* Broca’s area – expressive aphasia

1. If it was a left inferior division infarct, what structures and signs could have been involved/seen? How about M1 infarct?

**Inferior Division**

* ***Motor signs usually absent.***
* **Wernicke’s area - receptive aphasia.**
* **Meyer’s loop - superior quadrantanopia OR hemianopia (if large)**
* **Conduction Aphasia - lesion to supramarginal gyrus**

**M1**

* ***MASSIVE infarct involving cortex and internal capsule.***
* **Contralateral hemiparesis involving lower face, UL and LL equally.**
* **Contralateral hemisensory deficit.**
* **Homonymous hemianopia.**
* **Ipsilateral gaze preference and global aphasia.**

**WHAT IF’S …..**

1. **What if** the patient had evidence of swelling and ipsilateral mydriasis? What other signs could they develop if this was not treated?

Likely they have an ​**uncal herniation:** ​stroke → inflammation → swelling → increased supra-tentorial pressure → brain herniates down because of the Monro-Keille hypothesis → the part that herniates is the uncus, because it closest to the tentorium → compresses the ​**ipsilateral oculomotor nerve → causes mydriasis.**

**If prolonged, will also have down and out gaze and complete ptosis (late signs in compressive CNIII palsy)**

**High mortality**

1. **What if** Mr Tom Lysis came in with a sudden onset severe headache and he was also vomiting?

High suspicion for subarachnoid haemorrhage

Features:

* Sudden onset severe headache, “worst headache” ever
  + May have had minor headaches in lead up (warning leaks)
* Altered level of consciousness
* Neck stiffness
* Nausea and vomiting

Often due to ruptured aneurysm

* 1. What risk factor does Mr Lysis have for this?

Hypertension

* 1. List other possible causes/risk factors.

**Trauma**

**Neoplasms**

**Haemorrhagic transformation of ischemic stroke**

Vasculitis

**Coagulopathies, anticoagulant use**

Cerebral amyloid angiopathy

Stimulant use, e.g. cocaine and amphetamines

1. **What if** it was an ACA stroke? List clinical features.

* **Contralateral weakness and sensory in the Lower limbs >> upper limbs**
* **Abulia**​ - an absence of willpower or inability to act decisively
* **Urinary incontinence**​ - more likely in a bilateral infarction
* **Dysarthria**

1. **What if** this a stroke caused by atrial fibrillation…
   1. How do you decide if you need to anticoagulate the patient?

CHADS-VASc Score

Graphical user interface, text, application

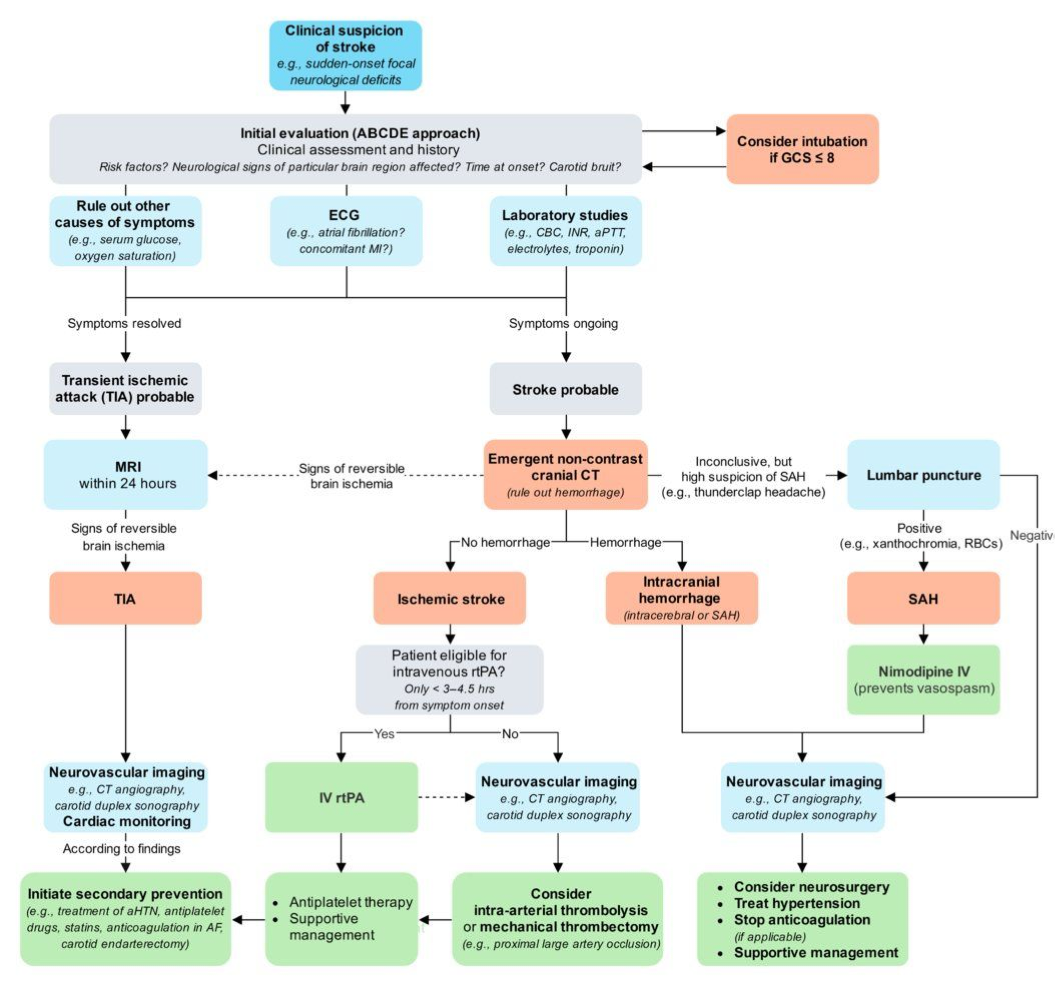
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Also consider: patient’s concerns, risk/benefit (increased risk of bleeding e.g. from falls)

* 1. Complete the following table in relation to options to anticoagulate a patient with Atrial Fibrillation.

|  |  |  |
| --- | --- | --- |
|  | Warfarin | DOACs |
| MOA | **Vitamin K antagonist** 🡪 inhibits synthesis of clotting factors II, VII, IX, X as well as protein C and S | *Dabigatran****:* direct thrombin inhibitor** 🡪 prevents conversion of fibrinogen to fibrin 🡪 prevents thrombus formation  *Rivaroxaban, apixaban:* **factor Xa inhibition** 🡪 blocks thrombin production 🡪 prevents conversion of fibrinogen to fibrin |
| Use in AF | **Valvular** **AF** – target INR 2.5-3.5 | **Non-valvular AF** |
| Advantages | - **Well-known effects and side effects**  - Low costs  - Can be **reversed** in cases of life-threatening bleeding: direct reversal by replacement (e.g., prothrombin complex concentrate, FFP) or indirect/delayed reversal by increasing production of coagulation factors (e.g., vitamin K) | Easily manageable (similar to heparins) when administered orally   * **Regular monitoring of coagulation parameters not required → improved patient compliance**   Antidotes available or being researched in the case of life-threatening bleeding (emergent area)   * Dabigatran: idarucizumab (monoclonal antibody) |
| Disadvantages | - Difficult to manage   * **Regular monitoring of the PT/INR required** (blood test) = decreased patient compliance   **- Broad range of interactions**  - Not suited for acute therapy of pulmonary embolism or deep vein thrombosis  **- Requires bridging**  - Requires extensive patient education and compliance to ensure effective anticoagulation | - Costly  - Limited clinical experience with these drugs (more research with warfarin)  - **Consider renal function** |

*Reference from above:*



**CASE 2 - Head Injuries**

24 year old Rona Vires is brought into the ED after getting into a fight over toilet paper outside his local Woolworths. He appears to be disoriented, and there are cuts and bruises all over his face and he is bleeding. The Paramedics give you a handover which reveals he was punched in the jaw several times before he fell onto the cement face first.

1. What are the first steps in managing this patient?

* Primary survey – ABCDE
  + **Acute stabilisation is the priority!**
  + Stem any active bleeding
  + **GCS**
* Secondary survey – emphasis on the neurological assessment (particularly cranial nerves)
  + Don’t forget to look in the ears
  + Comprehensive review for other injuries
* Investigations as indicated by history/exam – **cranial CT likely**
* Take a history (if possible – note patient is disoriented) or obtain a collateral hx

1. What are you looking for in a cranial CT in head traumas?

* **Skull fractures – simple vs compound**
* **Rupture of dura mater**
* **Midline shift**
* **Haemorrhage and haematomas**
* **Diffuse axonal injury (DAI)**

Rona is taken in for a CT scan (image shown). Upon further physical examination you notice that he has bruising around the eyes (show below), has rhinorrhea and there is staining on the bed sheets (see below).

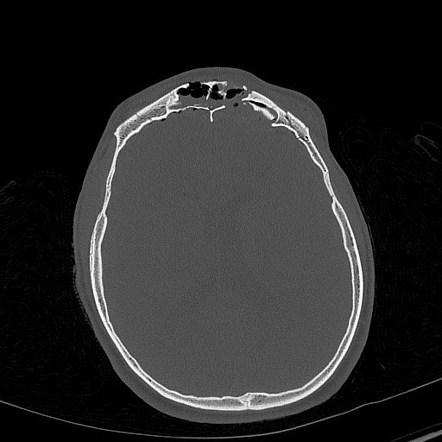
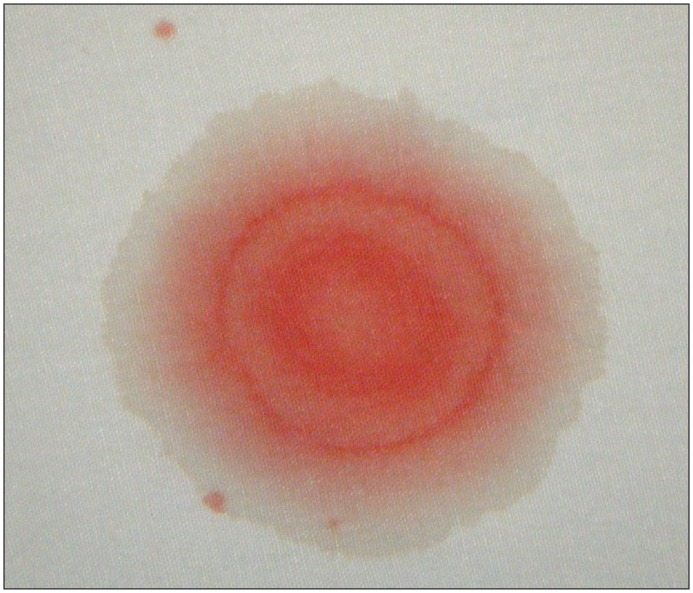


Image from: radiopedia - base of skull fractures

1. Describe the findings on the bed sheet (see image). What is its significance?

**Double ring ‘halo’ sign**

Suggests the ​**leakage of CSF**​ in head injuries

* *It uses the principle of chromatography: different components of a fluid mixture will separate as they travel through a material, therefore in this case blood and CSF will separate*

1. What is the anatomical reason behind him getting the racoon eyes?

**The**​ ​**loose areolar tissue space of the scalp is continuous into the eyelid therefore collection of blood here can track down to the eyelid**

1. What fracture does Rona most likely have?

Anterior cranial fossa fracture (basilar)

1. Describe the difference between simple and compound fractures and its significance.

Simple fractures

* **Not exposed to the exterior**

Compound fractures

* **Exposed to the exterior**
* **Increased risk of infection**
* **Can occur with intact scalp/skin (involve air sinuses or petrous bone and middle ear)**

**What Ifs**

1. **What if** Rona presented with dysphagia, loss of gag reflex, weakness of the sternocleidomastoid and trapezius muscles?

* He is more likely to have a ​**posterior cranial fossa fracture**
* **Cranial nerves IX to XII can be affected**
* The dysphagia and loss of gag reflex can be explained CN IX and X (glossopharyngeal and vagus) injury
* Weak sternocleidomastoid and trapezius muscles can be explained by CN XI
* (accessory) nerve damage
* Can also present with battle’s sign and cerebellar signs
* Rare but may be rapidly fatal

*Resources:*

* *Radiopaedia*
* *Amboss*
* *eTG*
* *UpToDate*
* *Lecture material*

**Please provide feedback for this case at:** [https://forms.gle/R64a83Cf7UgRYc168](https://forms.gle/R64a83Cf7UgRYc168?fbclid=IwAR2IJMsL2N2nkuJ3T7Dh-1XAPZthHc-uun2qlesNUR0AaT4lPut1r5BKg6E)