Tutorial of the week – cerebral challenge.

This has previously been published in "Update in anaesthesia". Examples of investigations demonstrating typical appearances of commonly encountered conditions are given. A brief discussion of each case can be found on the following pages. These cases are for your own use - please do not send in answers! If you have images of your own that demonstrate a useful learning point related to anaesthesia or critical care, please send them to editor@worldanaesthesia.org.

Case 1

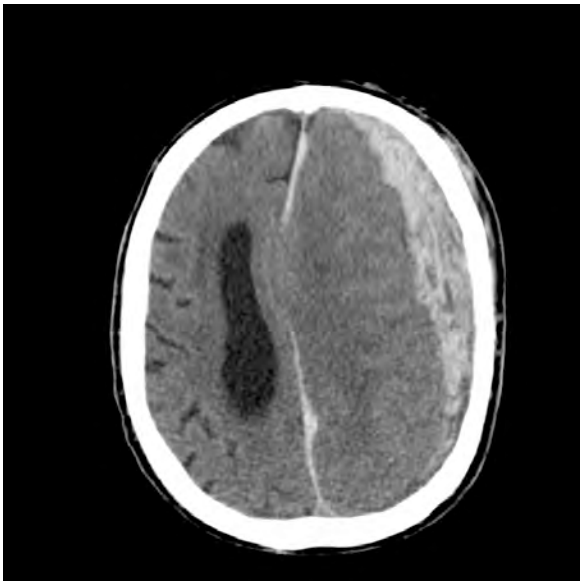


Figure 1: *A 20-year-old male is found collapsed outside the gates of a football stadium shortly after the home team have been defeated. On arrival in the Emergency Department he localises to pain with his left arm but no movement is elicited from his right side. He groans and his eyes remain closed on painful stimulation. His left pupil is slightly dilated and the response to light is sluggish.*

What does the CT scan show? How would you manage this patient*?* Discussion overleaf.

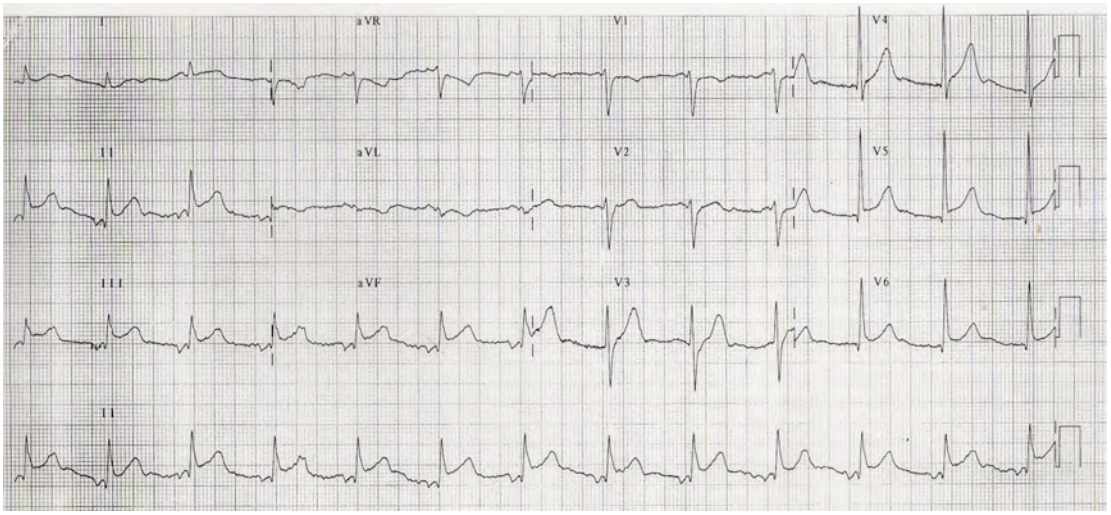
Case 2

Figure 2: *A 34-year-old man suffered a spinal injury 24 hours ago. The sensory level is C4/5 and he has paradoxical breathing. Until now he has maintained his oxygen saturations above 95% on air with a $PaCO_2$ between 5 and 5.8 kPA (high-normal). Over the last 2 hours his respiratory rate has increased to 32/minute and he appears distressed. His SaO_2 has fallen to 87% despite 10l/min oxygen by facemask. His chest xray (CXR), taken 20 minutes ago, is shown.*

What does the CXR show? How would you manage this patient? Discussion overleaf.

Case 3.

Figure 3: *A 46-year-old man is booked for an elective hernia repair. He complains of chest pain that doesn't sound typically cardiac and he has no risk factors for ischaemic heart disease. He has had the pain for a week and describes it as sharp and worsened by moving. He has had a dry cough for 6 months, has lost weight and has frequent episodes of sweating. The ward nurse has done an ECG.*



What abnormalities are shown on this ECG and what are possible causes in this man? Discussion overleaf.

Discussion
Case 1

CT scans are viewed as if we are looking up through the patient's body from their feet, so as the patient lies looking upwards their right side is on the left as we look at the scan. Bone is bright white, fresh blood appears white, cerebrospinal fluid is black and brain parenchyma is varying shades of grey.

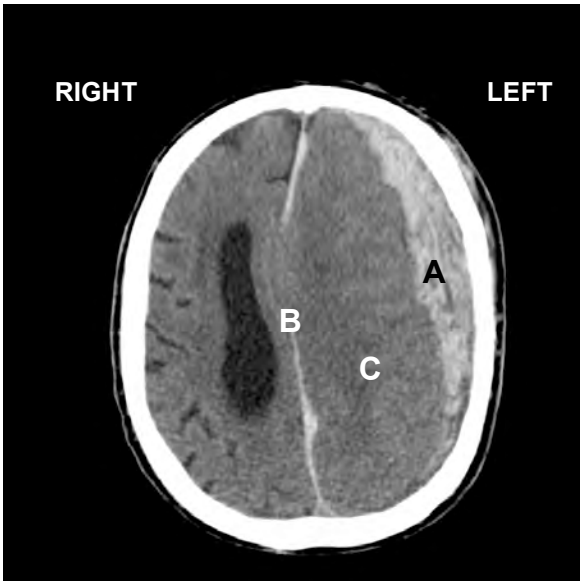
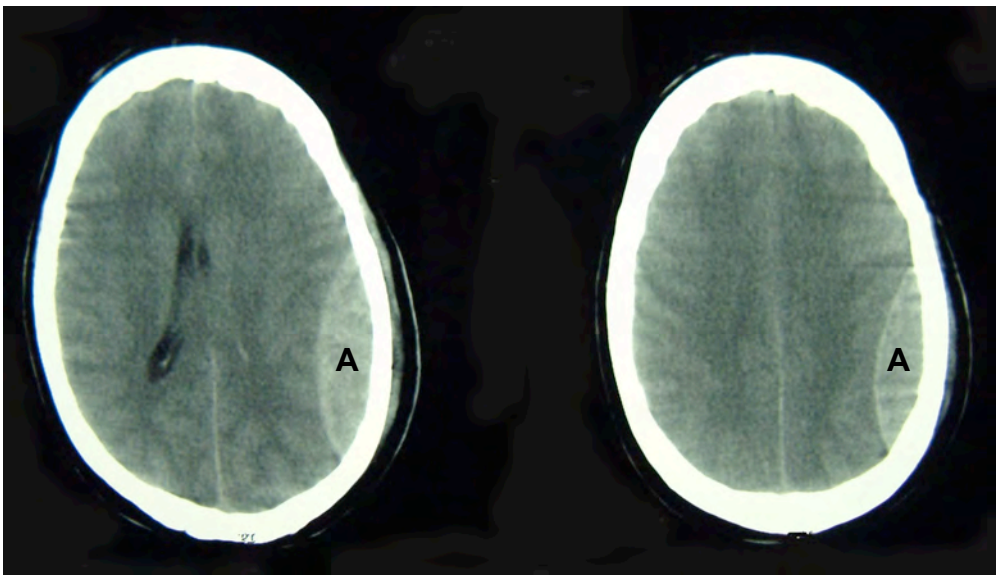


Figure 4: The CT scan shows a large left-sided, subdural haematoma (A). There is also left-to-right midline shift (B), due to the haematoma and oedema of the left cerebral hemisphere (C). Subdural haematomas lie under the dura mater and so tend to form an inner border that is concave (curved inwards) towards the brain. They may be differentiated from extradural haematomas, that track outside the dura mater and form an inner border that is convex (curved outwards) towards the brain (see Figure 5).

Figure 5: An extradural haematoma (A) on a CT scan



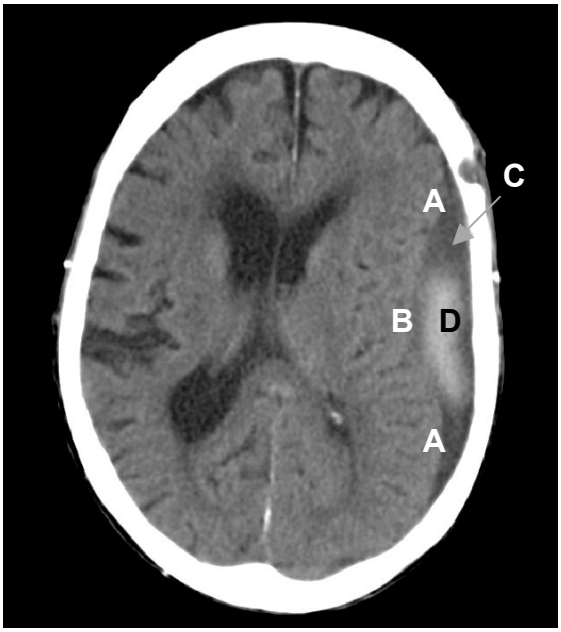


Figure 6: The appearance may be hard to interpret. This CT scan shows a haematoma that has an inner border that is both concave (A) and convex (B) towards the brain in different areas. This CT shows an old subdural (the old blood is dark on the CT rather than white - C), but there has been a recent rebleed of fresh blood into the haematoma (D).

Our patient (Figure 1) requires an emergency burr hole or craniotomy for drainage of the haematoma. While this is arranged, give oxygen and address the airway, breathing and circulation. This man's Glasgow Coma Score is 8 (eyes 1, speech 2, motor 5) and so, where possible, his airway should be secured by intubation. The priorities are to optimise his oxygenation and blood pressure. Anaesthesia for patients requiring neurosurgery will be covered by an article in *Update 23*.

Case 2

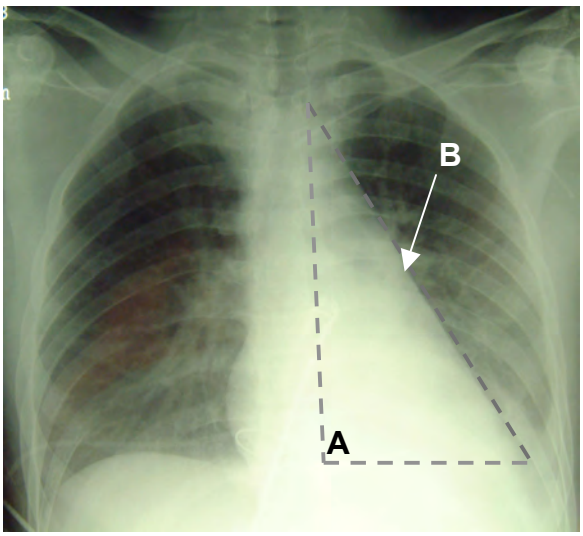


Figure 7: The CXR shows left lower lobe collapse. The left hemi-diaphragm cannot be seen. This implies that the lung overlying the left hemi-diaphragm is consolidated or collapsed. (Compare this to the right side where there is a clear line where the air-filled lungs meet the solid tissue – the diaphragm and liver). In this patient the CXR shows the 'sail sign' (A), since we are viewing the oblique fissure - B - (between the upper and lower lobes of the left lung) straight on, so the contrast between the inflated upper lobe and the collapsed lower lobe is accentuated.

This man has developed respiratory failure. His spinal injury has left his intercostal muscles paralysed and he is reliant on his diaphragm for ventilation. Diaphragmatic breathing manifests clinically as 'paradoxical breathing' – as the diaphragm contracts and moves down during inspiration, the abdomen moves out and the chest wall is sucked in. This is opposite (paradioxical) to conventional breathing, where the intercostal muscles are active.

His ability to cough is reduced since paralysis of his chest wall and accessory muscles means that forced expiration is markedly impaired. It is likely that retention of respiratory secretions has contributed to the left lower lobe collapse. His ability to self ventilate was borderline (as indicated by the high/normal $PaCO_2$ level), and lobar collapse has caused him to decompensate.
Where available he should be intubated and ventilated. Application of high PEEP (12 to 15 cmH_2O), physiotherapy, suction, fibrescope-guided bronchial toilet may all help to resolve the problem, but it is likely to recur. Weaning from the ventilator is likely to be prolonged and he may spend several weeks ventilated. Early tracheostomy should be considered.

Case 3
The ECG shows sinus rhythm with a rate of 75 beats per minute (300 divided by the number of big squares between complexes).
There is ST segment elevation in leads II, III and aVF (reflecting the activity of the inferior part of the heart) and also in leads V5 and V6 (reflecting the activity of the lateral aspects of the heart). The ST segments are 'saddle-shaped'.
This man is at low risk of ischaemic heart disease and gives a history that is more suggestive of musculoskeletal pain or inflammation of the pleura or pericardium.
The history and saddle-shaped ST elevation shown in this ECG is characteristic of percarditis. An additional point to note is that the ST changes associated with pericarditis are usually widespread across most of the ECG leads and cannot be readily explained by ischaemia of a single coronary artery.
Common causes of pericarditis are: TB, viral infection, connective tissue diseases, post-myocardial infarction. With this man's history of a chronic cough, TB should be considered and a chest xray performed, with sputum sent for TB microscopy and culture.
His elective hernia repair should be delayed pending the results of his investigations and commencement of treatment.

Compiled by Nicky Bosley and Bruce McCormick