Cerebral challenge

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Case 1

A 70-year-old man is scheduled to have bilateral inguinal hernia repair under general anaesthetic. He had a myocardial infarction 5 years ago but has no cardiac symptoms and walks his dog 5 miles every day without trouble.

- What does this ECG show?
- What precautions would you take when giving this man an anaesthetic?

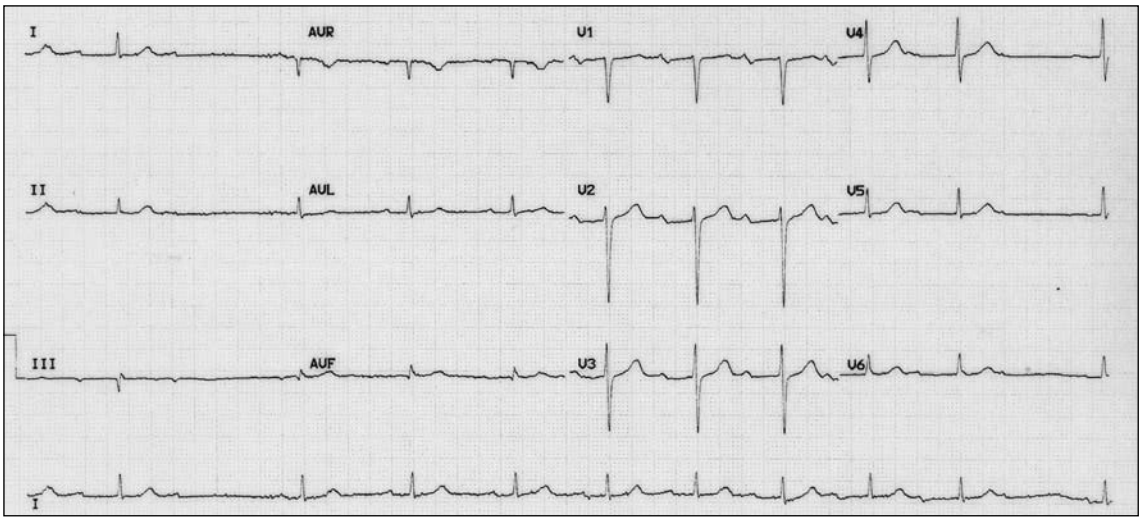

Figure 1. *Preoperative ECG*

Case 2

You are asked to see a 72-year-old man on the surgical ward. He underwent an elective right hemicolectomy for a bowel tumour seven days previously. His initial postoperative recovery was good, but the surgeons have become increasingly concerned about him over the last 12 hours. He is confused, his respiratory rate is 28 per minute, temperature 37.8°C, oxygen saturations are 91% on air, his pulse is 110 per minute (regular) and his blood pressure is 95/46. He is oliguric, passing 5-10ml urine per hour for the last 4 hours, and has been given fluid boluses. The surgeons are concerned that he is developing pulmonary oedema.

On examination his chest is clear but there is decreased air entry at both bases. You request an urgent chest X-ray (CXR).

- What does the CXR show?
- What is the differential diagnosis?
- Describe how you would manage this patient.

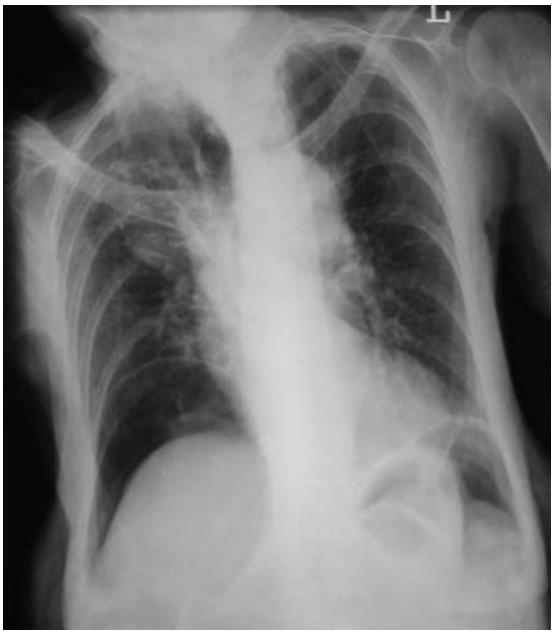

Figure 2. *Erect chest X-ray*

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Figure 3. *CT head without contrast*

Case 3

A 50-year-old woman is brought to the Emergency Department by her husband after becoming unsteady on her feet and increasingly drowsy. He says that she had a sudden onset of severe headache 12 hours ago, which has persisted. She has been getting increasingly confused and becoming more difficult to rouse. On examination her eyes will only open to pain, she is groaning but still localises to pain on both sides. Her pupils are equal and reactive. The ED team have requested a CT head scan.

- What does the CT scan show?
- How would you manage this patient?

DISCUSSION

Case 1

This man has Wenkebach phenomenon (Mobitz type I, second degree heart block). This means that the P-R interval lengthens with each beat until a QRS complex is dropped (circled on the rhythm strip in Figure 4). The ECG also shows Q waves in lead III and AVF, suggesting that the patient may have had an inferior myocardial infarction in the past. Rhythm disturbances are more common with inferior myocardial infarctions because the right coronary artery generally supplies the atrioventricular node as well as the inferior part of the heart.

There is a small possibility that Mobitz type I block could progress to complete heart block under anaesthetic. However, this man has no cardiac symptoms, in particular no history of syncope or presyncope, and has a good exercise tolerance.

As a precaution, where available, an external pacing defibrillator should be in theatre and temporary pacing pads could be attached to his chest (back and front) prior to induction.

Figure 4. *The PR interval gradually increase until a QRS complex is lost*

Case 2

This man underwent a major surgical procedure seven days ago and, having initially made the expected recovery, there has clearly been deterioration in his clinical state in the last twelve hours. Many hospitals have started using early warning scores (EWS) to increase the rapidity and reliability of detection of patients with a significant change in their clinical status. Using the score system shown in Figure 5, this man's EWS is 8. He should be resuscitated immediately, with attention to his airway, breathing and ventilation, while a cause for his deterioration is sought. The CXR shows bilateral air under the diaphragm (Figure 6). The area immediately under the diaphragm is usually opaque (white) since the upper part of the abdomen contains solid structures such as the liver and the spleen. It is normally only possible to discern the upper surface of the diaphragm on a CXR, since it is seen in contrast to the air-filled lung tissue above it. In this CXR

Early Warning System Observations Score (EWS) Parameters

Score	3	2	1	0	1	2	3
HR per minute		< 40	41-50	51-100	101-110	111-129	>130 (>180*)
BP Systolic	<70 (<60*)	71-80	81 - 100	101 - 199		> 200	
Resp per minute		< 8*		9 - 14	15 - 20	21 - 29	> 30
Central nervous system				Alert	Drowsy/ rousable to voice or newly confused	To pain	Unresponsive*
Temperature		<35		35.1-37.5	>37.5		
Urine output	Nil	< 20ml/hr for 2hrs or has not voided within 4hrs of admission	20-50ml/hr for 2hrs or has not voided within 4hrs of admission	>50ml/hr for 2hrs			

Figure 5. *An example of an Early Warning Score, where a score of 3 or more should trigger the on-call doctors to attend to the patient immediately*

there is a clear gap between the diaphragm and the structures below, indicating the presence of air. The most likely cause is a perforated abdominal organ, in this man suggesting that the bowel anastomosis has leaked.

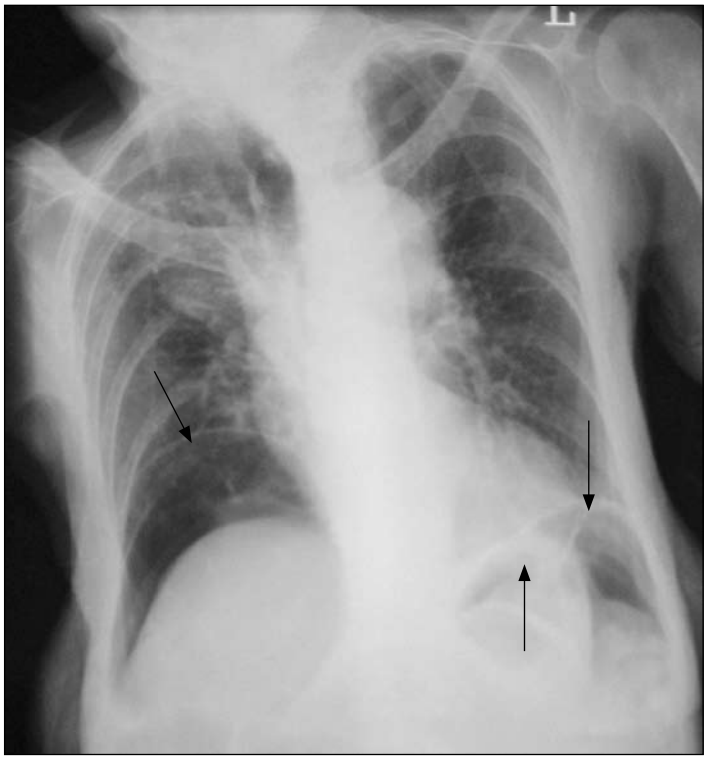

Figure 6. *Chest X-ray showing gas under the diaphragm. The white arrows indicate the raised left and right hemidiaphragms. The gastric bubble is indicated by the black arrow*

Other causes of gas under the diaphragm on a CXR include:

- recent laparotomy, however this would have been expected to have dispersed by seven pays postoperatively, or
- recent laparoscopic surgery. During laparoscopic surgery gas (normally CO_2) is used to inflate the abdominal cavity to allow visualisation of organs and structures.

It is sometimes difficult to differentiate air under the diaphragm from the normal stomach bubble. The following can help distinguish between the two:

- Look at the length of the air bubble. If it is longer than half the length of the hemidiaphragm it is more likely to be free air since air in the stomach is restricted by the anatomy of the stomach.
- Look at both hemidiaphragms. If air is present bilaterally it is likely to be free air in the abdomen.
- Look at the thickness of the diaphragm. If free air is present then the white line visible on the CXR will consist of the diaphragm only. If the air is in the stomach it will consist of the diaphragm, stomach wall and lining and therefore be much thicker. In general if the white line is less than 5mm thick there is likely to be free air in the abdominal cavity.

This patient should be managed with an 'ABC' approach. High flow oxygen should be delivered (15l.min^{-1}). This patient was transferred to the operating theatre and an emergency laparotomy revealed anastomotic breakdown with associated faecal peritonitis. Postoperatively, the patient was transferred to the Intensive Care Unit and remained intubated and ventilated for 3 days. He developed severe sepsis and multiorgan failure. He survived, being discharged from the ICU two weeks later.

Case 3

The blood in the third ventricle has caused hydrocephalus, blocking the normal CSF drainage pathway, causing dilated lateral ventricles and a raised intracranial pressure (See Figures 7 and 8). This has led to her progressive symptoms and decreasing conscious level. It is unclear how much of her neurological deterioration is due to the bleed, or the secondary hydrocephalus. Therefore this patient needs urgent CSF drainage via an extra-ventricular drain (EVD), which generally requires transfer to a neurosurgical centre.

Under general anaesthesia, she will have a burr hole made in her skull, through which a tube will be passed into the lateral ventricle to drain CSF into a drainage bag.

The rate of drainage is modulated by the height of the collection bag above the patient's foramen magnum at the base of the skull. (See Anaesthesia for Neurosurgery in Update 23, December 2007). Her Glasgow Coma Score is 9 (E2, V2, M5) and she will require frequent

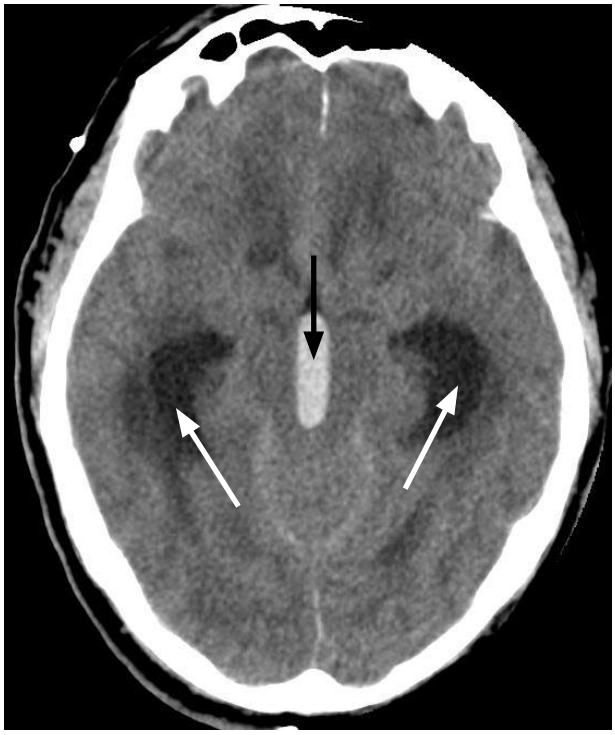

Figure 7. *This CT scan shows obstructive hydrocephalus secondary to a third ventricular haemorrhage. The white area in the centre is fresh blood within the third ventricle (black arrow) and the dark areas on either side are dilated temporal horns of the lateral ventricles (white arrows). It is unusual to see the temporal horns this clearly at this level of the brain and temporal horns greater than 2mm are diagnostic of hydrocephalus.*

neurological observations in case she deteriorates and needs intubation to protect her airway. If transport to another centre is required, where

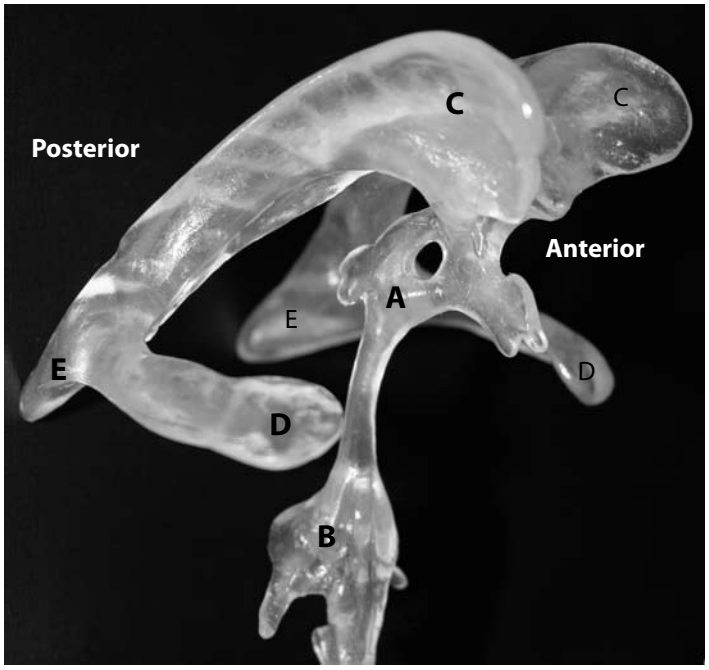

Figure 8. *The anatomy of the ventricular system of the brain showing: A – the third ventricle; B – the fourth ventricle; C – the right and left lateral ventricles with, D – their temporal and, E – occipital horns*

the facilities exist it would be sensible to sedate, intubate and ventilate her for the journey. After EVD insertion, where available, she should have a CT angiogram to look for berry aneurysms in her cerebral circulation. It may be possible to reduce the patient's risk of having a further bleed by either coiling (inserting tiny coils of wire under radiological guidance) or clipping any aneurysms at operation.