

Probe to Pass: High Yield US for the Fellowship Exam



SHORT ANSWER QUESTION EXAMINATION

QUESTION 1 — Lung Ultrasound

A 72-year-old woman presents with acute dyspnoea and hypoxia. You perform bedside lung ultrasound as part of your assessment.

a) List SEVEN (7) features of B-lines on lung ultrasound.

b) Apart from cardiogenic pulmonary oedema, list THREE (3) other recognised causes of B-lines on lung ultrasound.

c) The patient is subsequently found to have a right lower lobe consolidation. List FIVE (5) ultrasound features that support a diagnosis of pneumonia.

QUESTION 2 — RUSH Protocol

A 70-year-old male is brought in by ambulance following a syncopal episode. He remains hypotensive (BP 80/50) following an initial fluid bolus. You elect to perform a RUSH (Rapid Ultrasound for Shock and Hypotension) protocol as part of your evaluation.

a) Complete the table below: for each of the FIVE (5) components of the RUSH protocol, name the component AND provide one (1) finding that would explain or help manage this patient's hypotension.

#	Component (letter + name)	Finding explaining / helping manage hypotension
1		
2		
3		
4		
5		

QUESTION 3 — Cardiac Tamponade

A 55-year-old male presents with progressive dyspnoea, hypotension, and elevated JVP. You perform a bedside echocardiogram and identify a moderate circumferential pericardial effusion.

a) List FOUR (4) specific ultrasound signs that suggest tamponade physiology (not simply the presence of an effusion).

b) State the TWO (2) Doppler findings that indicate exaggerated ventricular interdependence in tamponade, including thresholds.

c) What is the sensitivity and specificity of right atrial systolic collapse for tamponade, and what duration criterion must be met?

d) Describe the IVC finding that supports tamponade physiology and how useful is it in isolation?

QUESTION 4 — Massive Pulmonary Embolism

A 62-year-old woman presents in haemodynamic collapse. CT pulmonary angiography confirms bilateral massive pulmonary emboli. You perform a bedside echocardiogram.

a) List SIX (6) sonographic signs that may be present with massive pulmonary embolism.

b) Describe McConnell's sign: its definition and its approximate sensitivity and specificity for PE.

c) Describe the 60-60 sign and explain its clinical utility.

QUESTION 5 — Acute Cholecystitis

A 46-year-old woman presents with 12 hours of right upper quadrant pain, nausea, and fever. She has a positive Murphy's sign. You perform a bedside gallbladder ultrasound.

a) List SIX (6) ultrasound features that support a diagnosis of acute cholecystitis.

b) List TWO (2) sonographic features suggest gangrenous cholecystitis or gallbladder perforation?

QUESTION 6 — Acute Appendicitis

A 24-year-old man presents with 10 hours of worsening right lower quadrant pain, nausea, anorexia, and fever. You perform a bedside ultrasound.

a) List SIX (6) ultrasound features that support a diagnosis of acute appendicitis.

b) What outer diameter measurement is considered diagnostic and how does this compare to CT measurement?

c) What does loss of wall stratification indicate, and what feature on USS suggests gangrenous appendicitis?

ANSWER KEY

For examiner / self-directed learning use. Accept equivalent wording where clinical content is correct.

QUESTION 1 — Lung Ultrasound

a) B-line features (1 mark each, any 7): (7 marks)

- Comet-tail artefact appearance
- Arising from the pleural line
- Hyperechoic and well-defined
- Extending > 15 cm (reaching the far field of the screen)
- Erasing A-lines
- Moving in concert with lung sliding (when sliding is present)
- Three or more per intercostal space = pathological (accept as additional feature)

b) Other causes of B-lines (1 mark each, any 3): (3 marks)

- ARDS
- Pulmonary contusion
- Viral or bacterial pneumonitis
- Pulmonary fibrosis
- Any form of interstitial lung disease

c) USS features of pneumonia (1 mark each, any 5): (5 marks)

- Spine sign (continuation of vertebral column shadow above the diaphragm due to consolidated lung)
- Shred sign (irregular border between aerated and consolidated lung)
- Tissue/hepatisation sign (lung parenchyma with liver-like echogenicity)
- Sonographic air bronchograms (hyperechoic branching structure within consolidation)
- Colour Doppler showing pulmonary arterial and venous flow within consolidation
- Parapneumonic effusion with or without echogenicity

QUESTION 2 — RUSH Protocol (10 marks)

2 marks per row (1 for correct component name, 1 for acceptable finding):

Component	Acceptable finding (examples)
H — Heart	Severe LV dysfunction / Pericardial tamponade / Hyperdynamic LV / RV strain, clot in transit, McConnell sign (massive PE)
I — IVC	IVC < 1.5 cm + collapsible (hypovolaemia) vs > 2.5 cm + non-collapsing (obstructive/cardiogenic)
M — Morrison's Pouch (RUQ/LUQ)	Free fluid in right or left upper quadrant (intra-abdominal haemorrhage)
A — Aorta	AAA with free fluid / pseudoaneurysm / thrombus (ruptured AAA)
P — Pulmonary	Absent pleural sliding (pneumothorax) / pleural effusion (haemothorax)

QUESTION 3 — Cardiac Tamponade

a) Signs of tamponade physiology (1 mark each, any 4): (4 marks)

- Right atrial systolic collapse (> one-third of cardiac cycle)
- Right ventricular diastolic collapse
- Transmitral E wave peak velocity variation > 25% with respiration
- Transtricuspid velocity variation > 40% with respiration
- Distended, non-collapsing IVC
- Exaggerated ventricular interdependence on Doppler

b) Doppler / ventricular interdependence (3 marks): (3 marks)

- Transmitral E wave peak velocity variation > 25% with respiration (1 mark)
- Transtricuspid peak velocity variation > 40% with respiration (1 mark)
- Pulsed wave Doppler gate placed just apical to leaflet tips of the AV valve (1 mark)

c) RA collapse sensitivity/specificity and duration criterion: (2 marks)

- Sensitivity 94%, specificity 100% (1 mark)
- Must persist for > one-third of the cardiac cycle to be significant (1 mark)

d) IVC finding: (1 mark)

- Distended, non-collapsing IVC — non-specific finding, but its absence strongly argues against tamponade (1 mark for either component)

QUESTION 4 — Massive PE

a) Sonographic signs of massive PE (1 mark each, any 6): (6 marks)

- McConnell's sign: akinesia of the RV mid-free wall with preserved motion at the apex
- RV dilatation: RV/LV ratio \geq 1:1
- Flattening of the IV septum causing D-shaped LV in PSAX view
- Dilated IVC with lack of respiratory variation / collapse
- Clot in transit (IVC, RA, RV, pulmonary artery)
- 60-60 sign: RVOT acceleration time < 60 ms and PASP < 60 mmHg

b) McConnell's sign: (2 marks)

- Definition: akinesia of the RV mid-free wall with paradoxically preserved or hyperdynamic motion at the apex (1 mark)
- Sensitivity ~77%, specificity ~94% for PE (1 mark)

c) 60-60 sign: (2 marks)

- RVOT acceleration time < 60 ms AND PASP < 60 mmHg (1 mark)
- Clinical utility: distinguishes acute massive PE from chronic pulmonary hypertension (where PASP is usually > 60 mmHg); helps confirm acute aetiology (1 mark)

QUESTION 5 — Acute Cholecystitis

a) USS features of acute cholecystitis (1 mark each, any 6): (6 marks)

- Sonographic Murphy's sign (probe tenderness over visualised gallbladder)
- Impacted stone in the gallbladder neck or cystic duct
- Tensile fundus sign (indentation of abdominal wall — 74% sensitivity, 96% specificity)
- Gallbladder wall thickening > 4 mm
- Gallbladder distension: > 4 cm transverse diameter or > 8 cm in length
- Wall hyperaemia on colour Doppler
- Pericholecystic fluid

b) Features of gangrene or perforation (1 mark each, any 2): (2 marks)

- Loss of mucosal sonoreflectivity / mucosal discontinuity

- Gas in the gallbladder wall
- Mucosal sloughing
- Interrupted gallbladder wall with adjacent complex collection
- Pericholecystic fluid in the bare area (between liver and GB) — specific for perforation

QUESTION 6 — Acute Appendicitis

a) USS features of acute appendicitis (1 mark each, any 6): (6 marks)

- Aperistaltic, non-compressible, blind-ending tube
- Outer diameter > 6 mm
- Wall thickening \geq 3 mm
- Target (bull's eye) sign on transverse section: fluid-filled hypoechoic centre, echogenic submucosa, hypoechoic muscularis propria
- Hyperechoic appendicolith with posterior acoustic shadowing
- Periappendiceal hyperechoic indurated fat (> 10 mm)
- Mural or extramural hyperaemia on colour Doppler
- Periappendiceal complex fluid collection / reactive lymphadenopathy

b) Diameter and CT comparison: (2 marks)

- Outer diameter > 6 mm on USS is considered diagnostic (1 mark)
- USS measurements are typically 1–2 mm less than CT measurements of the same appendix (1 mark)

c) Wall stratification and gangrene: (2 marks)

- Loss of wall stratification implies necrosis; normal 5-layer pattern implies non-necrotic (catarrhal) appendicitis (1 mark)
- Gas locules within the appendiceal wall indicate gangrenous appendicitis (1 mark)