

MSRA Clinical Problem Solving: Question Examples

Cardiovascular

- A. Marfan's syndrome
- B. Turner's syndrome
- C. Patent Ductus Arteriosus
- D. Rheumatic Fever
- E. Infective endocarditis
- F. Ruptures Chordae Tendinae
- G. Congestive Cardiac Failure

For each patient below, what is the most likely **diagnosis**? Select **ONE** option only from the list above. Each option may be selected once, more than once or not at all.

Question 1: A teenager presents with chest pain at rest and palpitations. Echocardiography reveals increased aortic root width. He says his father had a similar problem at his age.

Correct Answer: A

Explanation: Marfan's syndrome is caused by an autosomal dominant mutation of the fibrillin 1 gene which is essential for the formation of cellular microfibrils and leads to dilation of the vasculature (including the aorta) and often mitral valve prolapse. The fact that his father has a similar problem suggests an inherited disorder.

Marfan's syndrome should be monitored with annual echocardiograms to assess the functioning of the myocardium and heart valves. Invariable decrease in function will result in the need for treatment, which increasingly is surgical with aortic root graft replacement.

Question 2: A 57-year-old woman is concerned that she is no longer able to climb a flight of stairs without stopping to catch her breath. Auscultation finds bilateral basal end-inspiratory crackles.

Correct Answer: G

Explanation: Slow progressive decrease in fitness (commonly first presenting as difficulty walking up-stairs or up-hill) and evidence of pulmonary oedema (bilateral basal crackles) is highly suggestive of congestive cardiac failure (CCF). CCF is classified by the New York Heart Association based on the extent of limitation to physical activity. Pulmonary oedema can also result in orthopnoea, the sensation of breathlessness when lying flat. This is due to the fact that the fluid in the lungs 'spreads out' when horizontal making gaseous exchange more difficult. Patients may report the need to prop themselves up with pillows when sleeping.

Question 3: A 12-year-old comes to the GP with a red swollen tender knee. She recently attended for a sore throat and a health check after recently moving to the UK. Auscultation reveals pan systolic murmur.

Correct Answer: D

Explanation: Recent streptococcal infection and recent migration from abroad are both risk factors for rheumatic fever. Rheumatic fever results in a cross reaction between the infecting streptococci and the valve tissue 2-4 weeks after pharyngeal infection, causing permanent damage to the heart valves. The mitral valve is most commonly affected. This in turn causes a pan systolic murmur.

Question 4: A 62-year-old man presents to A+E with a 45 minute history of unilateral arm weakness and slurred speech and a one week history of fever, loss of appetite and poor appetite. Examination reveals a new heart murmur.

Correct Answer: E

Explanation: A febrile illness and a new murmur should always raise suspicion of infective endocarditis. Infection of the myocardium and the heart valves results in vegetation build up on the tissue. This achieves two of Virchow's triad – damage to the endothelium and blood stasis – predisposing to cardiac emboli. Infective endocarditis most commonly affects the mitral valve meaning that the emboli enter systemic circulation. In this case causing a transient ischemic event.

Question 5: Examination of a newborn reveals a harsh ejection systolic murmur. Low set ears and a short webbed neck is seen.

Correct Answer: B

Explanation: Turner syndrome is loss of the second X chromosome in females. It can cause a variety of cardiac conditions including coarctation of the aorta, aortic stenosis and mitral valve prolapse. A harsh ejection systolic murmur is indicative of aortic stenosis. This is common in older age groups due to calcification but in patients under the age of 50 years old should trigger further investigation looking for congenital malformation such as Turner's or bicuspid aortic valve.

Turner's presentation varies by age. At birth it can be recognised due to the resulting dysmorphic features: low set ears, short webbed neck, micrognathia, low hairline. There is also a predisposition to lymphoedema of the hands and feet, and short stature.

Dermatology, ENT and Eyes

- A. Irritant contact dermatitis
- B. Guttate psoriasis
- C. Allergic contact dermatitis
- D. Atopic dermatitis
- E. Pompholyx
- F. Asteatotic eczema
- G. Erythrodermic psoriasis
- H. Pustular psoriasis

For each patient below, what is the most likely **diagnosis**? Select **ONE** option only from the list above. Each option may be selected once, more than once or not at all.

Question 1: A 34-year-old woman presents with a rash on her hands, 3 weeks after starting a new job as a cleaner. On examination, there is erythema limited to the pulps of the fingers and thumbs, red with some weeping and dry fissures.

Correct Answer: A

Explanation: Irritant contact dermatitis is a non-immunologic reaction to an irritant, often affecting cleaners, bar staff and healthcare staff. Common irritants include detergents, soaps, oils, solvents, alkalis.

- Signs: Erythematous rash ± weeping and dry fissuring, usually affecting the hands.
- A common cause of nappy rash.
- Management: avoiding the irritant, e.g. by wearing gloves.

Question 2: A 10-year-old girl is brought to the GP by her mother due to crops of itchy, vesicular rash on her palms.

Correct Answer: E

Explanation: Pompholyx/Dyshidrotic Eczema is a vesiculo-bullous dermatitis, commonly seen on the fingers, palms and soles. The blisters can peel, resulting in dry fissures, which can become infected.

- It's commonly found in young adults and children and is associated with excessive sweating.
- Triggers include irritants e.g. cleaning products, stress, fungal infection, reaction to nickel.

Most cases are self-limiting and will resolve within weeks. It can be a one-time condition, but patients often experience recurrence. Conservative measures such as emollients are advised as first-line. Patients should also be told to avoid irritants and not to burst the blisters.

Question 3: A 26-year-old man has become extremely worried as he has recently noticed some small “rain-drop” shaped plaques on his chest, abdomen and arms. The lesions are raised, erythematous and scaly. He is otherwise fit and well, the only recent problem he can think of is an episode of sore throat and fever 3 months ago.

Correct Answer: B

Explanation: Guttate psoriasis occurs in young adults, usually after an episode of streptococcus mediated upper respiratory tract infection.

It is characterised by many small, round, scaly, erythematous lesions over the trunk and limbs.

Most cases resolve spontaneously within 2-3 months and only require topical treatment if it is symptomatic. Topical treatments would include steroids, coal tar, and calcipotriol.

Question 4: A woman attends the emergency department with a sudden eruption of a pink pustular rash all over her body. She reports no known triggers and was well yesterday. Her only medical history of note is bipolar affective disorder, currently controlled by Lithium.

Correct Answer: H

Explanation: Pustular Psoriasis is characterised by salmon-pink plaques covered with yellow-brown sterile pustules, which then become brown macules before healing. Key points include:

- Localised (palmoplantar) pustular psoriasis is contained to the palms and soles
- Generalised (erythrodermic) pustular psoriasis is widespread and accompanied by severe systemic upset, including fever and dehydration – this is a dermatological emergency!
- More common in women.
- Lithium is a known trigger. Other drugs that can cause the development of pustular psoriasis include indomethacin and iodide.
- Only 10% of patients have a history of plaque psoriasis.
- Management: refer for urgent dermatology review.

Question 5: A 3-year-old boy is brought to the GP by his father. He has noticed some red, itchy patches on the interior of the toddler's elbows, which are very irritating. There is a family history of asthma and hay fever.

Correct Answer: D

Explanation: Atopic Dermatitis is the most common type of eczema, occurring in 10-20% of children.

It is a Type 1 hypersensitivity reaction (IgE-mediated mast cell degranulation) in response to pruritic stimuli. It is often accompanied by other atopic diseases, such as asthma, allergic rhinosinusitis and allergy, which tend to run in families.

- Exacerbating factors: Topical irritants, soap, house dust mite, animals, moulds, food allergies (e.g. milk, although this is rare), secondary infection (e.g. staph, HSV, molluscum, tinea).
- Signs: Erythematous, dry rash on flexor surfaces. There may be scratch marks or lichen plexus chronicus.
- Tests can be considered although diagnosis is usually clinical.
- Important to explain that management involves control, not cure. Avoidance of exacerbating factors. Emollients are first-line.

Endocrinology and Metabolic

A 19-year-old male is being investigated for Type 1 Diabetes Mellitus (T1DM). His fasting venous glucose on 2 separate occasions was 5.7mmol/l and 6.6mmol/l.

What do the investigation results suggest?

Select the **SINGLE** most appropriate option from the list below. Select **ONE** option only.

- A. Diabetes mellitus
- B. Impaired fasting glucose
- C. Impaired glucose tolerance
- D. Glucagonoma
- E. Normal result

Correct Answer: B

Explanation: Venous glucose on 2 separate occasions is a suitable investigation in helping to diagnose diabetes mellitus. A normal result is <5.6mmol/l, impaired fasting glucose in 5.6-6.9mmol/l and diabetes mellitus is >7mmol/l. This patient's results both fell between the range of 5.6-6.9mmol/l, therefore suggesting impaired fasting glucose.

Gastroenterology and Nutrition

A 23-year-old man with no past medical history presents to the Emergency Department with a 1-day history of mild right lower quadrant pain and tenderness. His white blood cell count is within normal limits and his CRP is 10. He is afebrile and feels generally well in himself. He has no other symptoms and there are no other findings on examination.

What imaging modality would be most appropriate?

Select the **SINGLE** most appropriate option from the list below. Select **ONE** option only.

- A. Computed tomography (CT)
- B. Magnetic resonance imaging (MRI)
- C. Ultrasound scan (USS)
- D. X-ray
- E. Positron emission tomography (PET)

Correct Answer: A

Explanation: This patient's age and RLQ tenderness makes appendicitis a differential diagnosis. His Alvarado score would be less than 4, however this could be due to the early stage of the presentation. A CT scan is the recommended imaging modality in suspected appendicitis (where there are no contra-indications).

Infectious Disease, Haematology, Immunology, Allergies and Genetics

A 1-year old girl with suspected sickle cell syndrome has had a peripheral blood smear taken. If she has HbSS, what would her blood smear show?

Select the **SINGLE** most appropriate option from the list below. Select **ONE** option only.

- A. Leukocytosis
- B. Heinz bodies
- C. Sickle cells
- D. Bite cells
- E. Teardrop cells

Correct Answer: C

Explanation: Blood smear of a patient with sickle cell anaemia can show the following: sickle cells, target cells, reticulocytosis and potentially Howell-Jolly bodies.

Musculoskeletal

A 14-Year-old boy presents with signs and symptoms that are clearly consistent with a diagnosis of Osgood-Schlatter's disease.

From the options below, which is the most appropriate investigation to determine the progression of disease in this boy?

Select the **SINGLE** most appropriate option from the list below. Select **ONE** option only.

- A. X-Ray imaging
- B. MRI imaging
- C. Ultrasound imaging
- D. Knee joint fluid aspiration
- E. FBC & blood film

Correct Answer: A

Explanation: X-ray imaging is indicated in cases where the diagnosis is unclear, where symptoms are not resolving as expected, or where it is necessary to establish the progression of disease.

In the early stages of Osgood-Schlatters disease, the only X-Ray finding might be soft-tissue swelling surrounding the tibial tuberosity.

In late stages, X-ray images may show:

- an enlarged tibial tuberosity
- irregular ossification of the tibial tuberosity
- fragmentation of the tibial tuberosity
- formation of a separate ossicle within the tuberosity

Paediatrics

A 6-week-old boy is brought into hospital as his parents were worried that he has been feeding poorly and not gaining weight for the past fortnight. On examination, he is wheezy, is tachypnoeic, has a palpable thrill and an audible pansystolic murmur suggestive of a ventricular septal defect.

Which of the following medications should be started to manage his symptoms?

Select the **SINGLE** most appropriate option from the list below. Select **ONE** option only.

- A. Diuretics
- B. NSAIDs
- C. Calcium channel blockers
- D. Intravenous beta-agonist
- E. Penicillin

Correct Answer: A

Explanation: Diuretics are used to manage symptomatic heart failure caused by congenital heart defects. The other options are not indicated as first-line management options in this patient. Inhaled beta-agonists should be tried in the first instance.

Pharmacology

A 14-year-old boy is seen by his general practitioner with ongoing symptoms of asthma. Despite having been on various inhalers and increasingly potent steroids, his symptoms are still not controlled. A referral to secondary care is made, who decide to start the patient on theophylline.

When should the plasma-theophylline concentration be measured after starting oral treatment?

Select the **SINGLE** most appropriate option from the list below. Select **ONE** option only.

- A. After 3 days
- B. After 5 days
- C. After 1 week
- D. After 2 weeks
- E. After 1 month

Correct Answer: B

Explanation: Theophylline is indicated in the treatment of asthma if adequate symptom relief is not achieved after stepwise trials of inhaled corticosteroids, short-acting beta-agonists, long-acting beta-agonists, and leukotriene receptor antagonists (at suitable doses and combinations). If high-dose therapies and fourth line agents (such as theophylline) are required, specialist advice should be sought.

The plasma-theophylline concentration should be measured five days after starting oral treatment and at least three days after any dose adjustment. The blood sample should be taken 4-6hours after the last dose. A concentration of 10-20mg/litre is required for satisfactory bronchodilation. Adverse effects can occur within this range, but the severity and frequency of these will be greater at concentrations over 20mg/L.

Psychiatry and Neurology

A 19-year-old man with a history of anorexia nervosa has been admitted to hospital following a collapse at home. He was found to be significantly bradycardic, extremely low in body weight, and malnourished. He consented to artificial feeding to supplement his nutritional intake, and a nasogastric tube is sited with feeding commenced. Several days later, he becomes unwell, presenting with confusion and bilateral pitting oedema to the knees.

What complication has occurred?

Select the **SINGLE** most appropriate option from the list below. Select **ONE** option only.

- A. Refeeding syndrome
- B. Nephrotic syndrome
- C. Fluid overload
- D. Sepsis secondary to infection associated with the nasogastric tube
- E. Congestive cardiac failure secondary to arrhythmia

Correct Answer: A

Explanation: Refeeding syndrome occurs when individuals who are starved or malnourished have their nutritional intake corrected. It is often seen in the context of anorexic patients being artificially fed or in patients who have had long periods in intensive care. It commonly presents with the metabolic abnormalities of hypokalaemia, hypomagnesaemia and hypophosphataemia, and clinically most obviously manifests as peripheral oedema due to fluid and salt retention.

Refeeding has a variety of cardiac, pulmonary and neurological complications and may be fatal – and hence it is vital to be vigilant for it in the management of malnourished patients, with prevention being the primary management strategy.

Renal and Urology

A 15-year-old boy is brought into A&E after waking suddenly in the night with severe pain in the right scrotum. He was too embarrassed to tell his parents, but when his mother found him still vomiting, looking generally unwell and in pain in the morning, she immediately called an ambulance. The boy gives a history that the pain started about 8 hours ago. He says he has had a few episodes of similar pain that lasted only a few minutes in the past. On examination, the scrotum is swollen, erythematous and tender. A diagnosis of testicular torsion is made, and he is referred for urgent surgical exploration. In surgery, the testicle appears necrotic.

What management would be required?

Select the **SINGLE** most appropriate option from the list below. Select **ONE** option only.

- A. Orchiectomy of the affected teste
- B. Orchiectomy of the affected teste and orchiopexy of the contralateral teste
- C. Orchiectomy of the affected teste with prosthesis insertion and orchiopexy of the contralateral teste
- D. Bilateral orchiopexy
- E. Partial orchiectomy of the necrotic part of the teste

Correct Answer: B

Explanation: Unfortunately, the teste is not salvageable in this case and needs to be removed. In addition, the contralateral teste will need to be secured in place to prevent future torsion of the remaining teste. Testicular prosthesis surgery is most often performed around 6 months after the orchiectomy once any inflammation has resolved. Partial orchiectomy is reserved for special cases in testicular cancer where radical orchiectomy is undesirable.

Reproductive

A 28-year-old lady has just delivered her first baby three hours ago and is currently in the delivery suite.

Which **ONE** of the following options is **NOT** recommended in her care for preventing puerperal pyrexia? Select **ONE** option only.

- A. Lactation consult with a lactation nurse
- B. Prophylactic antibiotic use for lower segment caesarean sections (LSCS)
- C. Immediate treatment of perineal tears during delivery
- D. Encourage urinary catheterisation to prevent acute urinary retention
- E. Early mobilisation after delivery

Correct Answer: D

Explanation: A lactation consult serves to help new mothers acquire the necessary skills for successful breastfeeding, thus reducing the risk of mastitis.

Prophylactic antibiotics and immediate treatment of perineal tears are generally recommended post-LSCS to reduce the risk of wound site infection.

Early mobilisation of delivered mothers helps protect against venous thrombosis. Urinary catheterisation is avoided as much as possible as the foreign body increases the risk of urinary tract infection, and its use discourages mobility of the patient, thus promoting venous thrombosis.

Respiratory

A patient who was awaiting investigation in the emergency department for acute breathlessness is transferred urgently to ITU. When you enquire why you are told that he had suffered a "massive" pulmonary embolism.

Which of the following correctly describes the criteria for diagnosis of a haemodynamically unstable or "massive" pulmonary embolism?

Select the **SINGLE** most appropriate option from the list below. Select **ONE** option only.

A saddle embolus

A large-sized clot

An embolus arising from the large proximal lower limb veins e.g. iliac

An embolus with a high probability of death

An embolus which results in systolic hypotension of less than 90 mmHg or a drop in systolic blood pressure of ≥ 40 mmHg for a period of >15 minutes

A. A saddle embolus

B. A large-sized clot

C. An embolus arising from the large proximal lower limb veins e.g. iliac

D. An embolus with a high probability of death

E. An embolus which results in systolic hypotension of less than 90 mmHg or a drop in systolic blood pressure of ≥ 40 mmHg for a period of >15 minutes

Correct Answer: E

Explanation: A haemodynamically unstable or "massive" pulmonary embolism is an emergency condition defined by systolic hypotension. It is important that they are recognised and managed promptly and correctly due to their high mortality rate.