

1. Lead examiner

Candidate Number:

2. Co-examiner

Final Mark:

SCENARIO

The ambulance has brought in a 65 year-old man with severe dyspnoea. The patient has a history of Chronic Obstructive Airway Disease (COAD), with regular use of bronchodilators. He is still a heavy smoker, but has no other relevant past history. On arrival, he is sweaty, distressed and peripherally cyanosed.

Vitals signs:

RR 45/min, with inter-costal recession

Temp 38⁵ deg C

BP 180/90 mmHg

Heart rate 125/min

Upon arrival, arterial blood gases are taken (on 12L / min of O₂):

pH	7.15		(7.35 – 7.45)
pO ₂	80	mmHg	(80 – 95)
pCO ₂	95	mmHg	(35 – 45)
HCO ₃	42	mmol/L	(22 – 28)
Base Excess	+17		(-3 – +3)
SaO ₂	90	%	

Question 1: Describe and interpret the ABG.

(included in stem)

1 min

Expected Response	Details & Comments	
Moderate acidaemia with borderline hypoxaemia in CO ₂ retainer. Probable infective exacerbation of COAD.		
Acute respiratory acidosis	Very high pCO ₂ and low pH suggest acute primary respiratory failure.	
Metabolic alkalosis	Raised bicarbonate and base excess indicate chronic CO ₂ elevation and metabolic compensation.	
Borderline hypoxaemia	Probably assisted by supplemental O ₂ . Expect usual pO ₂ to be lower, even without acute illness. High risk of abolishing usual hypoxic drive. However, at risk of excessive hypoxaemia with acute impairment of O ₂ exchange.	
Low O ₂ saturation	O ₂ dissociation curve is rightward, as this is lower than expected for given pO ₂ . Is the key determinant of tissue oxygenation.	
Relevant negative(s)	Expect pO ₂ to be lower. Comparison with patient's previous ABGs would help.	
Interpretation Prompt: what do you think is the cause	Borderline fever suggests infective exacerbation. Indication for non-invasive PPV, bronchodilators, immuno-stabilisation, emp Abx.	

Question 2: You opt to treat the patient with BiPAP ventilation, what things would you consider when initiating this therapy. 2min

Indications	Acute respiratory failure with high risk of abolishing native respiratory drive. May avert invasive PPV.	
Risks / Caveats	Barotrauma, Declining consciousness and risk of aspiration. May impair venous return and BP, although BP currently OK, and no cardiac Hx. Poor compliance with mask.	
Ventilation settings	Monitor F _i O ₂ to maintain respiratory drive Initial IPAP 10-15 cmH ₂ O; EPAP 5- 8 cmH ₂ O; differential greater than 4cmH ₂ O	P/F
Titrate to clinical and physiological response	Initial response should be rapid. Requires O ₂ sats and ABG monitoring.	
Adjunct Rx	Bronchodilators, corticosteroids, emp Abx	

Question 3: Discuss the options for bronchodilator therapy in this patient.

2min

Expected Response	Details & Comments	
Considerations	Optimal drug and mode of delivery without excessive SEs, esp tachyarrhythmias (this pt is already tachycardic). Routes of delivery: parenteral, inhaled, oral. Metered dose inhalers may be pumped into BiPAP circuit. Nebulised options carry infection risk. Rx of trigger (ie infection) and adjunctive steroids are synergistic.	
Salbutamol	May be given as nebulised form into BiPAP circuit. May be given IV. Titratable. Easily available and familiar to staff. Tachy-arrhythmias and tremors are SEs. The latter interfere with ECG monitoring. Low K+, lactic acidosis	
Ipratropium bromide	Proven benefit in moderate to severe exacerbation COAD, as in this case. Some SEs similar to those of salbutamol.	
Xanthines	Aminophylline, theophylline. (? Also assists spontaneous respiratory efforts?) Evidence for efficacy more debatable in this setting. Narrow therapeutic window. Oral theophylline of no acute value. Parenteral aminophylline may be considered if bronchospasm refractory to first line agents. Vomiting, seizures	
Magnesium	Evidence for efficacy as per xanthines. But less SEs. Typically reserved for refractory cases in those with normal serum Mg. Hypotension, dec muscle tone	
No bronchodilators	Poor option in this patient! Has reversible component despite chronic disease.	
other	Adrenaline, ketamine	

Question 4: Despite your initial efforts, the patient deteriorated, and required endotracheal intubation. Outline the principles of invasive ventilation in this patient.

2min

Expected Response	Details & Comments	
Anticipate difficult mechanical ventilation due to auto PEEP; high mean & peak airway pressures; high risk barotrauma. Apply principle of permissive hypercarbia. Note also options may be limited by unsophisticated, portable ED ventilator.		
Controlling airway pressures	Pressure at no more than 35 cmH ₂ O. If only volume-controlled option available, set tidal volume < 7ml/kg Sedate, paralyse, bronchodilate. Tracheal toilet to clear upper airway. Insert NGT to decompress stomach. Incline chest at 45 deg up if no contra-indications. Set low inspiratory : expiratory (I:E) ratios.	
Permissive hypercarbia	Permit low minute ventilation and consequent high pCO ₂ . Low ventilation rate (less than 10/min)	
Oxygenation	High F _I O ₂ to optimise tissue oxygenation. Patient's respiratory drive now irrelevant.	
Intensive Care	Mandates intensive monitoring. Check serial ABGs, CXR. All settings to be titrated to response. Anticipate >24 hours before suitability to wean off invasive PPV.	

Comments: (if you fail the candidate, please state why)**If the candidate fails the exam overall, what feedback would you suggest CIC provide for this SCE?**

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