ABG #2

WAMSS SGR 2022

Trigger

Archibald, a 74-year-old man with a long history of COPD presents with 4 days of worsening shortness of breath, productive cough, and increased sputum production. Archie has a 120 pack-year history. He can normally walk 150m on level ground but this morning he was struggling to make it to the door. He is also having difficulty sitting up.

On examination:

- Vitals: RR 32, HR 102, BP 136/88, SpO2 92% → 88%, temp 37.9°C
- Visible intercostal recession, tracheal tug and paradoxical abdominal movements
- Cyanosed
- Polyphonic wheeze throughout

The registrar asks you to take an ABG

Task: Interpret the results, provide a working diagnosis and list other investigations/things you would like to do.

Blood gas values			
↓ pH	7.27		[7.350 - 7.450]
↑ pCO_2	60	mmHg	[35 – 45]
pO_2	57	mmHg	[80 – 100]
$cHCO_3^-(P)_c$	26	mmol/L	[22.0 - 26.0]
↓ $cBase(B)_c$	0.5	mmol/L	[-2.0 - 2.0]
[redacted]			
sO_2	98.6	%	
FO_2Hb	96.2	%	
FCOHb	1.7	%	
FMetHb	0.7	%	
FHHb	1.4	%	
Electrolyte values			
cNa^+	138	mmol/L	[135 - 145]
cK^+	3.8	mmol/L	[3.5 - 4.5]
cCl^-	106	mmol/L	[98 - 107]
cCa^{2+}	1.13	mmol/L	[1.12 - 1.32]
Metabolite values			
cGlu	5.4	mmol/L	[3.9 - 8.0]
cLac	1.3	mmol/L	[0.4 - 2.2]

Results	• O_2 < 80 mmHg • pH < 7.35 • CO2 > 50 mmHg • HCO_3: WNL • Anion gap: 138 - 26 - 106 = 6 WNL • Electrolytes: WNL • Glucose: WNL This suggests **type II respiratory failure and respiratory acidosis**
Working diagnosis	My working diagnosis is a **COPD exacerbation** resulting in **type II respiratory failure** and **respiratory acidosis**
Further investigations and workup	Confirming a COPD exacerbation depends on being able to identify changes from the patient's baseline, therefore it is important to look at previous - Lung function tests - ABGs - Pulse oximetry saturations Also consider CXR, ECGs, and routine bloods (FBC, UEC, CRP)

Follow-up Questions

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1. What is the general management of COPD?

2. What is the management of a COPD exacerbation?

3. What are common causes of respiratory failure?

Advanced:

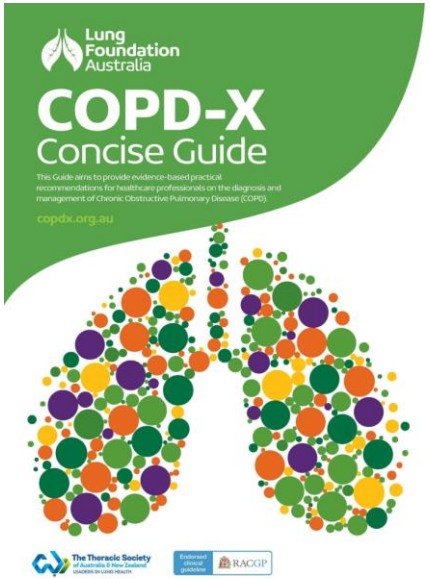
4. What are the indications for home O2 therapy in COPD?

5. The registrar looks at the ABG and tells you that the patient's respiratory failure is **acute** - how do they know this?

Question 1: COPD-X

Confirm diagnosis

1. Smoking history
2. History and examination
3. **Spirometry**: COPD is confirmed by persistent airflow limitation post-bronchodilator **FEV1/FVC < 0.7**
4. Dx requires regular assessment of severity
   a. Assessment of limitations
   b. FEV1 % of predicted
      i. 60-80% - mild
      ii. 40-59% - moderate
      iii. < 40% - severe



	Increasing COPD severity		
	MILD	**MODERATE**	**SEVERE**
Typical symptoms	○ few symptoms ○ breathless on moderate exertion ○ little or no effect on daily activities ○ cough and sputum production	○ breathless walking on level ground ○ increasing limitation of daily activities ○ recurrent chest infections ○ exacerbations requiring oral corticosteroids and/or antibiotics	○ breathless on minimal exertion ○ daily activities severely curtailed ○ exacerbations of increasing frequency and severity
Typical lung function	**FEV_1 ≈ 60-80% predicted**	**FEV_1 ≈ 40-59% predicted**	**FEV_1 < 40% predicted**

Question 1: C**O**PD-X

Optimise function

1. Continuous assessment of function
2. Optimise pharmacotherapy (uptitrate - see next slide)
3. Adherence to medications and inhaler technique
4. Pulmonary rehabilitation & regular exercise
5. Manage comorbidities

Question 1: C**O**PD-X

Optimise pharmacotherapy (stepwise until controlled)

SABA/SAMA →
- Short acting relievers as needed

add **LABA/LAMA** →

LABA + LAMA →
- Depending on symptomatic response to single LABA/LAMA

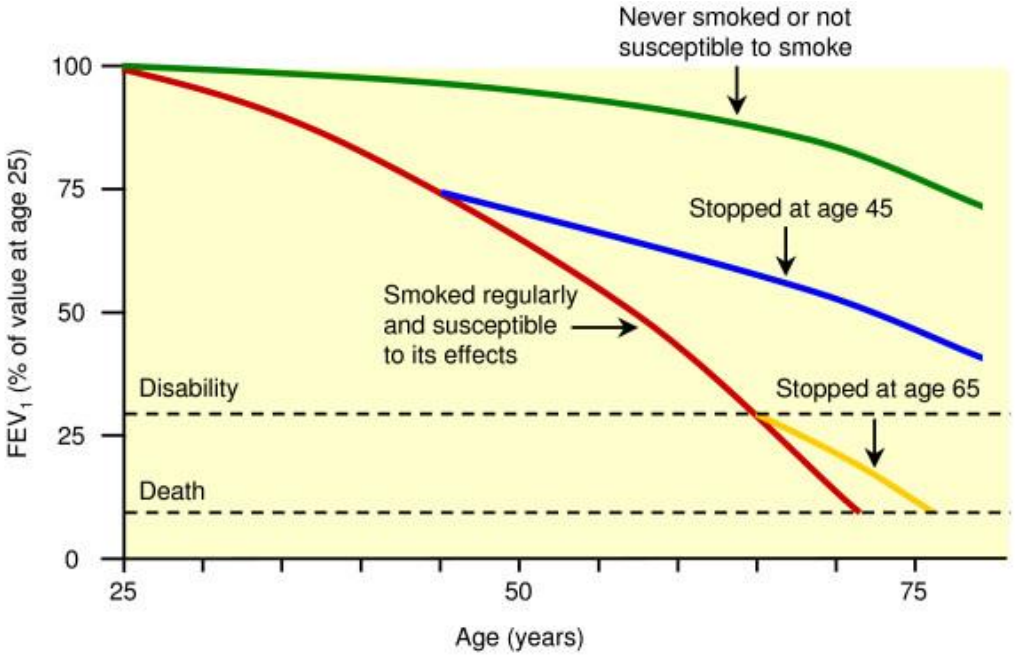
add **ICS** ⇒ **ICS + LABA** →

ICS + LABA + LAMA
- Triple therapy indicated if frequent exacerbations

Question 1: CO**P**D-X

Prevent deterioration

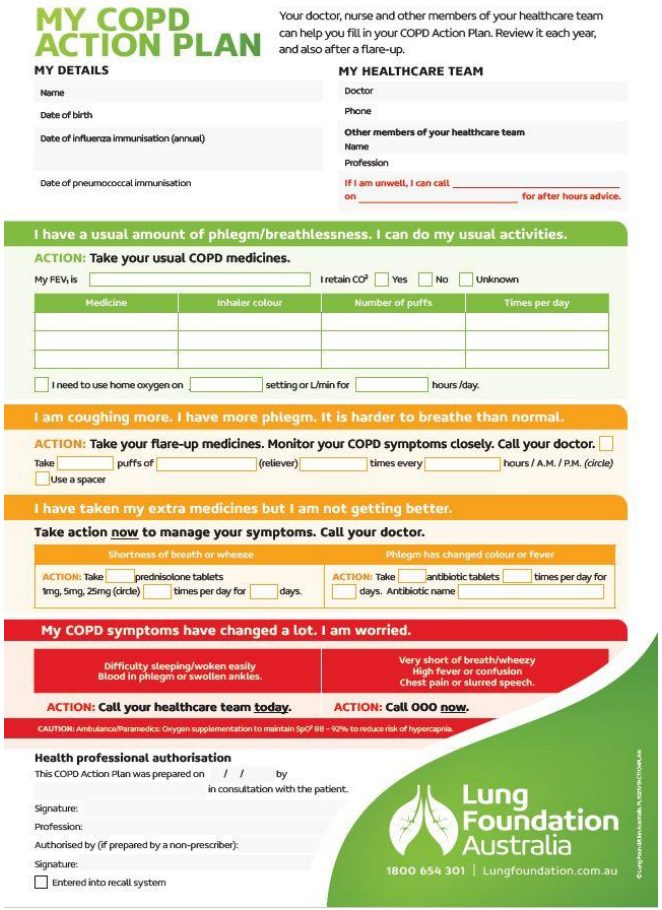
1. **Smoking cessation**
2. Prevent exacerbations
3. Vaccination: **COVID**, **influenza**, **pneumococcal**
4. Long term oxygen therapy



Question 1: COP**D**-X

Develop a plan of care

1. COPD action plan
2. GP management plan
3. Allied health



MY COPD ACTION PLAN

Your doctor, nurse and other members of your healthcare team can help you fill in your COPD Action Plan. Review it each year, and also after a flare-up.

MY DETAILS

Name

Date of birth

Date of influenza immunisation (annual)

Date of pneumococcal immunisation

MY HEALTHCARE TEAM

Doctor

Phone

Other members of your healthcare team

Name

Profession

If I am unwell, I can call _____ on _____ for after hours advice.

I have a usual amount of phlegm/breathlessness. I can do my usual activities.

ACTION: Take your usual COPD medicines.

My FEV$_1$ is _____ I retain CO^2 ☐ Yes ☐ No ☐ Unknown

Medicine	Inhaler colour	Number of puffs	Times per day

☐ I need to use home oxygen on _____ setting or L/min for _____ hours /day.

I am coughing more. I have more phlegm. It is harder to breathe than normal.

ACTION: Take your flare-up medicines. Monitor your COPD symptoms closely. Call your doctor. ☐

Take _____ puffs of _____ (reliever) _____ times every _____ hours / A.M. / P.M. *(circle)*

☐ Use a spacer

I have taken my extra medicines but I am not getting better.

Take action now to manage your symptoms. Call your doctor.

Shortness of breath or wheeze	Phlegm has changed colour or fever
ACTION: Take _____ prednisolone tablets 1mg, 5mg, 25mg (circle) _____ times per day for _____ days.	ACTION: Take _____ antibiotic tablets _____ times per day for _____ days. Antibiotic name _____

My COPD symptoms have changed a lot. I am worried.

Difficulty sleeping/woken easily Blood in phlegm or swollen ankles.	Very short of breath/wheezy High fever or confusion Chest pain or slurred speech.
ACTION: Call your healthcare team today.	ACTION: Call 000 now.

CAUTION: Ambulance/Paramedics: Oxygen supplementation to maintain SpO^2 88 – 92% to reduce risk of hypercapnia.

Health professional authorisation

This COPD Action Plan was prepared on / / by _____ in consultation with the patient.

Signature:

Profession:

Authorised by (if prepared by a non-prescriber):

Signature:

☐ Entered into recall system

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Question 2: COPD-**X**

Manage e**X**acerbations:

1. Temporarily uptitrate SABA
    a. 4-8 puffs of salbutamol (400-800 mcg) every 3-4 hours
2. Consider systemic steroids
    a. Oral prednisolone: 30-50 mg for 5 days is adequate (max 2 weeks)
3. Infective symptoms → oral antibiotics
    a. Amoxicillin or doxycycline
4. Consider O2 support if hypoxic
5. Hospital admission if the patient appears to be deteriorating

Question 3: Causes of respiratory failure

- **CNS** *(drugs, metabolic encephalopathy, CNS infections, increased ICP, OSA, central alveolar hypoventilation)*
- **Spinal cord** *(trauma, transverse myelitis)*
- **Neuromuscular system** *(polio, tetanus, multiple sclerosis, myasthenia gravis, Guillain-Barre syndrome, critical care or steroid myopathy)*
- **Chest wall** *(kyphoscoliosis, obesity)*
- **Upper airways** *(obstruction from tissue enlargement, infection, mass, vocal cord paralysis, tracheomalacia)*
- **Lower airways** *(bronchospasm, CHF, infection)*
- **Lung parenchyma** *(infection, interstitial lung disease)*
- **Cardiovascular system** *(cardiogenic pulmonary oedema)*

Question 4: Indications for home O2 therapy

PaO2 ≤ 55 mmHg

OR

PaO2 ≤ 59 mmHg + evidence of any of the following:

1) **Polycythaemia**
2) **Pulmonary hypertension**
3) **Right heart failure**

Question 5:

PaCO2 has increased from **40 mmHg → 60 mmHg**

- If this were an **acute** process we would expect HCO3 to rise by **1 mmol/L** from **24 mmol/L** for every **10 mmHg** increase

HCO3 has increased from **24 mmol/L → 26 mmol/L**

Thus we can confirm that this is in fact an **acute respiratory failure** and that Archie is not normally in type II respiratory failure

	HCO3 (Baseline 24 mmol/L)	
Every **10 mmHg** change in PaCO2 from *baseline* 40 mmHg	ACUTE	CHRONIC
↑PaCO2	**1**	**4**
↓PaCO2	**2**	**5**

Thank you!

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