COPD Case Scenario by

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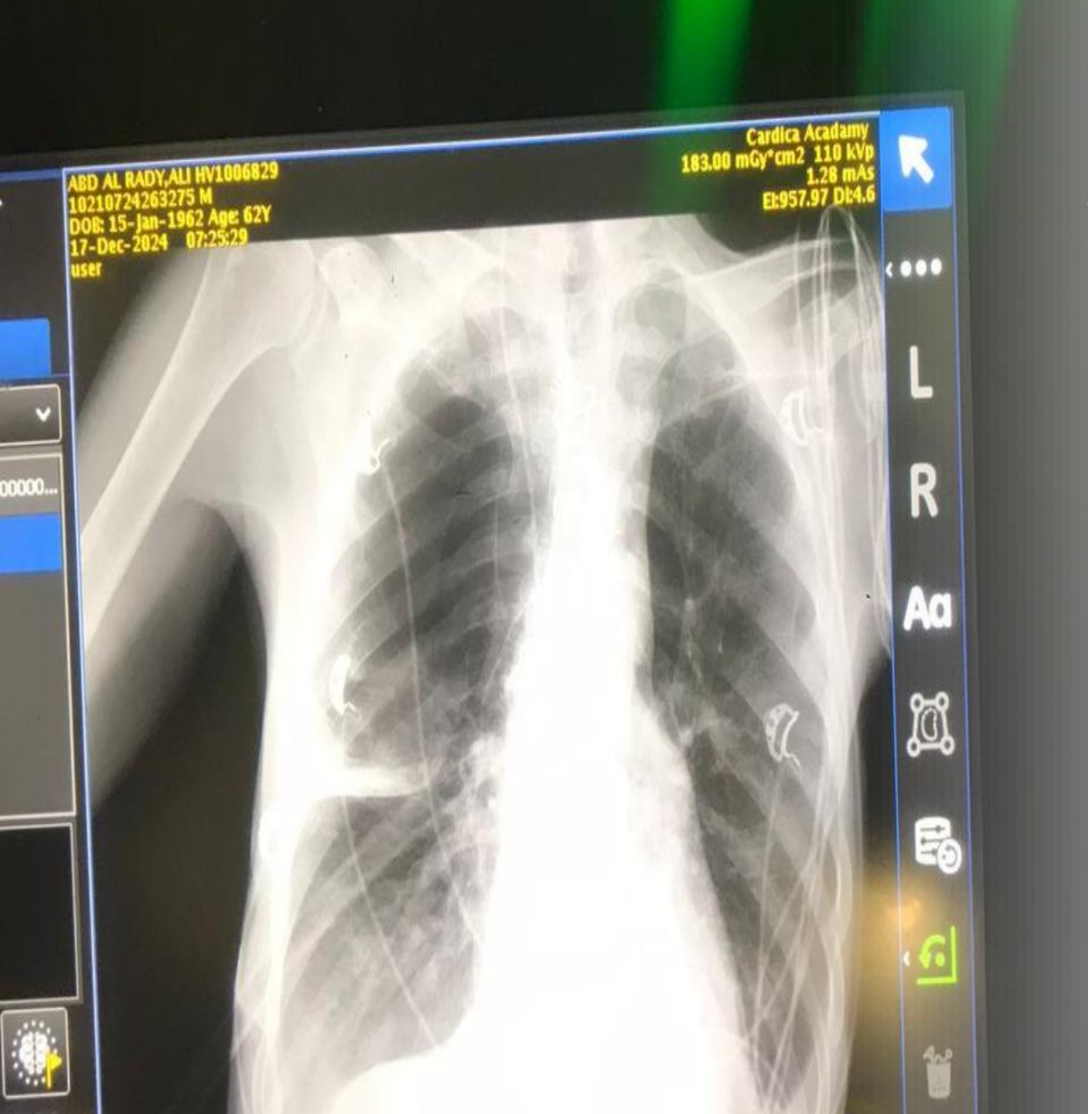
- Male patient 66 years old diabetic hypertensive for 40 years 2 packs per day
- Presented to ER with fever 37.8c, dyspnea, RR 30, Spo2 80%
- HR sinus 120 bpm blood pressure 110/60

- ER physician

Send CBC, ABG ordered CXR and sputum culture

He ordered non rebreathing mask on 15 litres

After which spo2 become 99%-100%



Measured (37.0C)		
pH	7.55	
pCO2	38	mmHg
pO2	96	mmHg
Na+	137	mmol/L
K+	3.7	mmol/L
Ca++	0.88	mmol/L
Glu	114	mg/dL
Lac	1.5	mmol/L
Hct	23	%

BK
IG

Derived Parameters		
nCa++(7.4)	0.94	mmol/L
HCO3-	33.2	mmol/L
HCO3std	32.8	mmol/L
TCO2	34.4	mmol/L
BEecf	10.8	mmol/L
BE(B)	10.0	mmol/L
sO2c	98	%

Patient then become sweaty and drowsy

RBS checked :130

ABG re-extracted showing :

PH 7.18, pco2 72 , HCO3 (28)

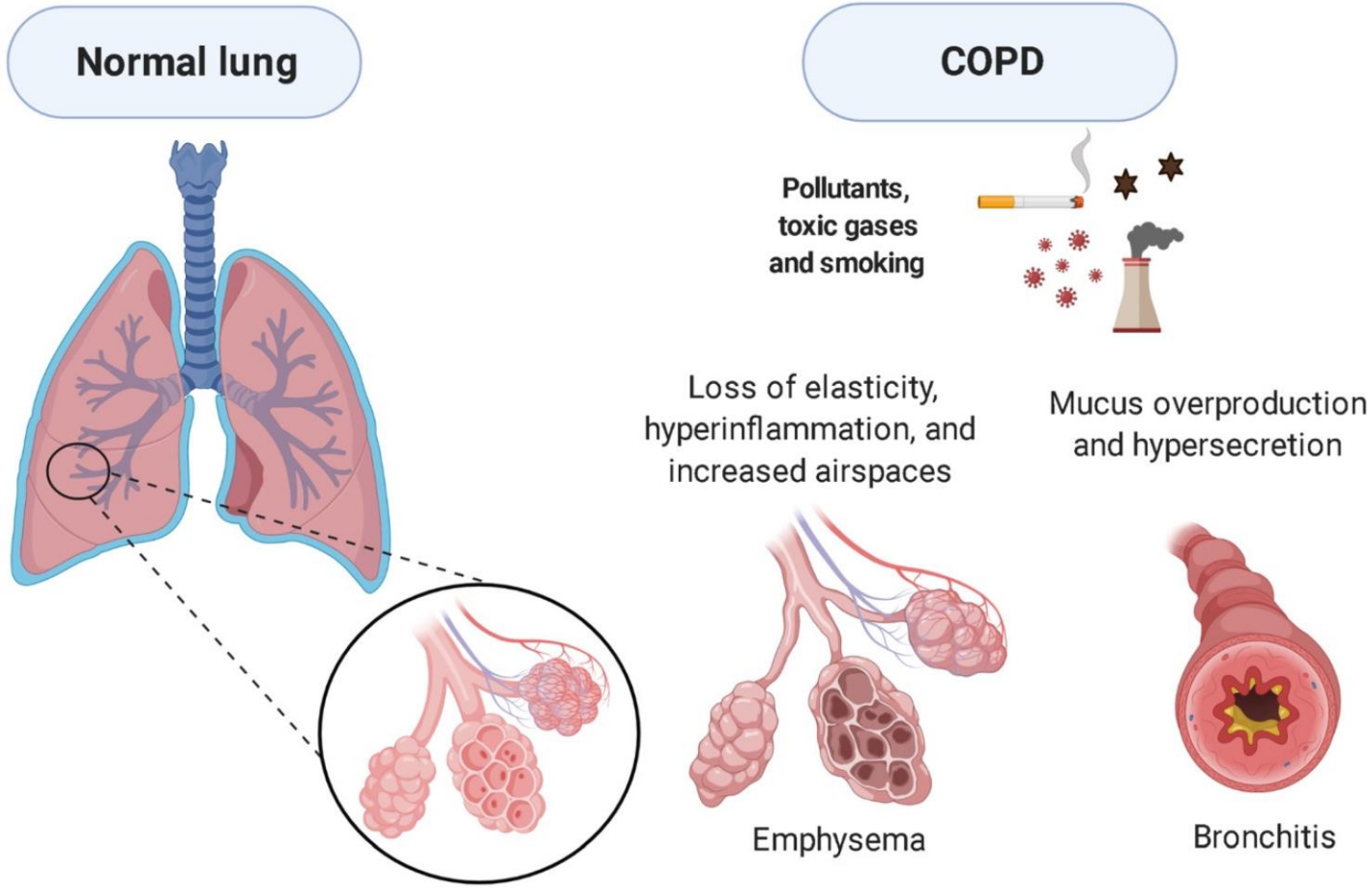
CPAP applied to patient, and bronchodilators administered

On parameters:

After 2 minutes patient reassessed, and he became DCL

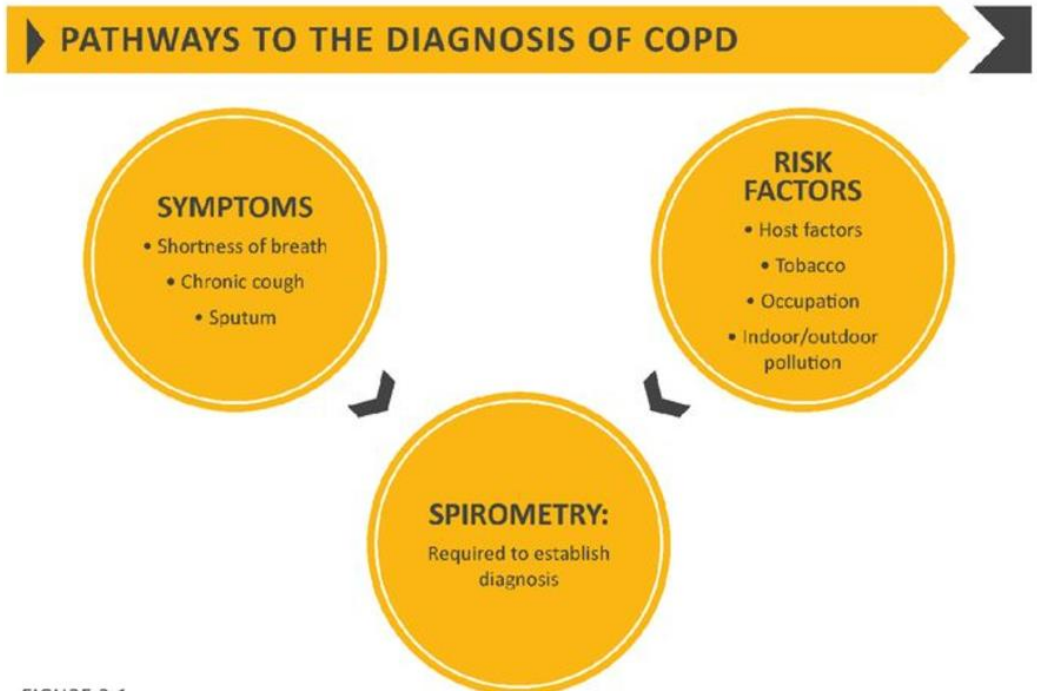
- So, decision of intubation and invasive mechanical ventilation

pathophysiology



Diagnosis of COPD

Diagnosis and Initial Assessment



Severity assessment

Post-bronchodilator FEV_1

CLASSIFICATION OF AIRFLOW LIMITATION SEVERITY IN COPD (BASED ON POST-BRONCHODILATOR FEV_1)

In patients with FEV1/FVC < 0.70:

GOLD 1:	Mild	$FEV_1 \geq 80\%$ predicted
GOLD 2:	Moderate	$50\% \leq FEV_1 < 80\%$ predicted
GOLD 3:	Severe	$30\% \leq FEV_1 < 50\%$ predicted
GOLD 4:	Very Severe	$FEV_1 < 30\%$ predicted

Severity assessment

COPD Assessment Test (CAT™)

CAT™ ASSESSMENT

For each item below, place a mark (x) in the box that best describes you currently.
Be sure to only select one response for each question.

EXAMPLE: I am very happy	1	X	3	4	5	**I am very sad**	**SCORE**
I never cough	1	2	3	4	5	I cough all the time	
I have no phlegm (mucus) in my chest at all	1	2	3	4	5	My chest is completely full of phlegm (mucus)	
My chest does not feel tight at all	1	2	3	4	5	My chest feels very tight	
When I walk up a hill or one flight of stairs I am not breathless	1	2	3	4	5	When I walk up a hill or one flight of stairs I am very breathless	
I am not limited doing any activities at home	1	2	3	4	5	I am very limited doing activities at home	
I am confident leaving my home despite my lung condition	1	2	3	4	5	I am not at all confident leaving my home because of my lung condition	
I sleep soundly	1	2	3	4	5	I don't sleep soundly because of my lung condition	
I have lots of energy	1	2	3	4	5	I have no energy at all	

Reference: Jones et al. ERJ 2009; 34 (3); 648-54.

TOTAL SCORE: ◯

Severity assessment

Modified MRC dyspnea scale

MODIFIED MRC DYSPNEA SCALE[a]

PLEASE TICK IN THE BOX THAT APPLIES TO YOU | ONE BOX ONLY | Grades 0 - 4

mMRC Grade 0.	I only get breathless with strenuous exercise.	☐
mMRC Grade 1.	I get short of breath when hurrying on the level or walking up a slight hill.	☐
mMRC Grade 2.	I walk slower than people of the same age on the level because of breathlessness, or I have to stop for breath when walking on my own pace on the level.	☐
mMRC Grade 3.	I stop for breath after walking about 100 meters or after a few minutes on the level.	☐
mMRC Grade 4.	I am too breathless to leave the house or I am breathless when dressing or undressing.	☐

[a] Fletcher CM. BMJ 1960; 2: 1662.

Severity assessment

ABCD assessment tool

THE REFINED ABCD ASSESSMENT TOOL

Spirometrically Confirmed Diagnosis → Assessment of airflow limitation → Assessment of symptoms/risk of exacerbations

Post-bronchodilator $FEV_1/FVC < 0.7$

Grade	FEV_1 (% predicted)
GOLD 1	≥ 80
GOLD 2	50-79
GOLD 3	30-49
GOLD 4	< 30

Moderate or Severe Exacerbation History

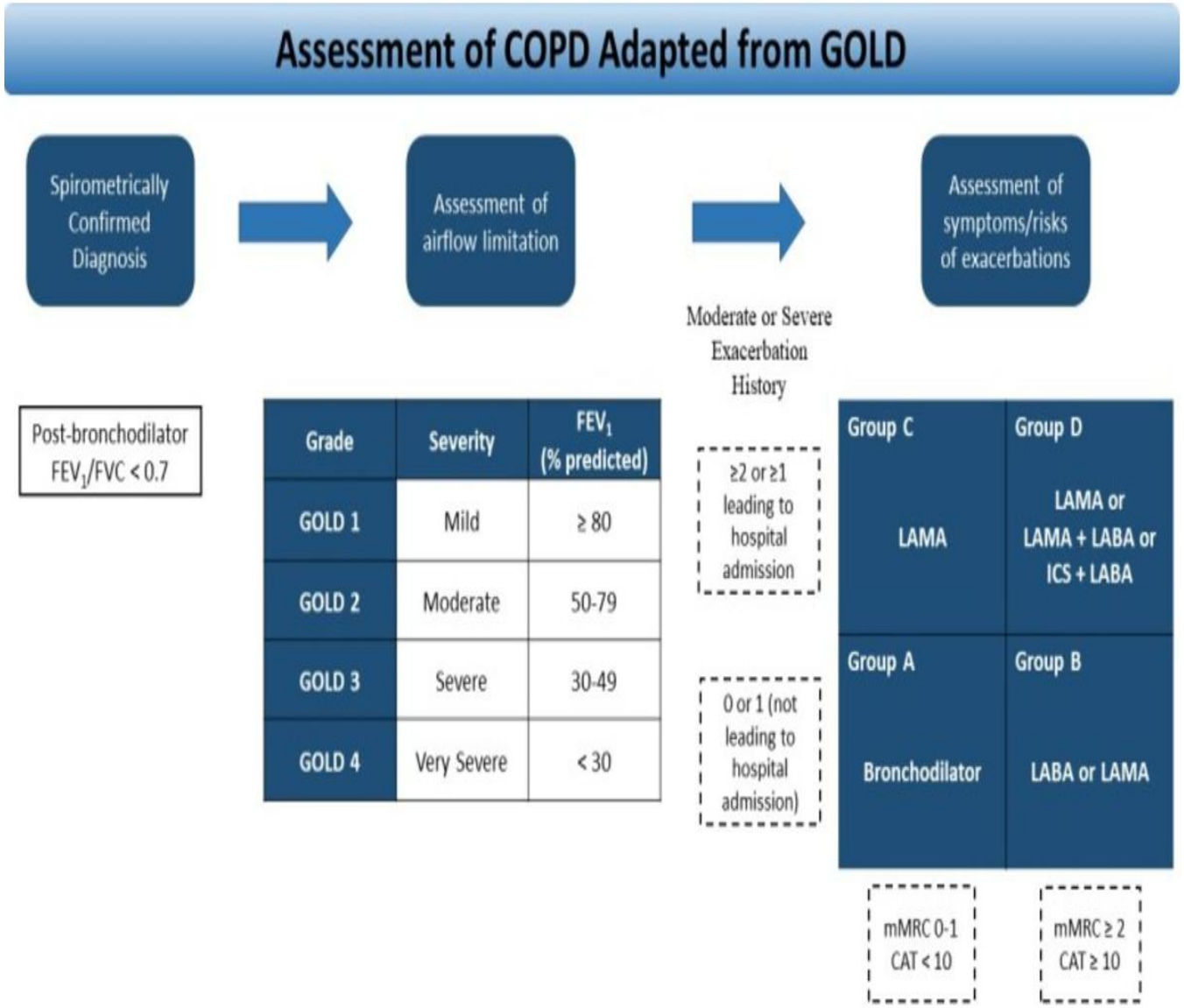
- ≥2 or ≥ 1 leading to hospital admission
- 0 or 1 (not leading to hospital admission)

C	D
A	B

mMRC 0-1 CAT < 10 | mMRC ≥ 2 CAT ≥ 10

Symptoms

Medications according to severity



Nonpharmacological treatment of COPD

Non-Pharmacological Treatment

- Education and self-management
- Physical activity
- Pulmonary rehabilitation programs
- Exercise training
- Self-management education
- End of life and palliative care
- Nutritional support
- Vaccination
- Oxygen therapy

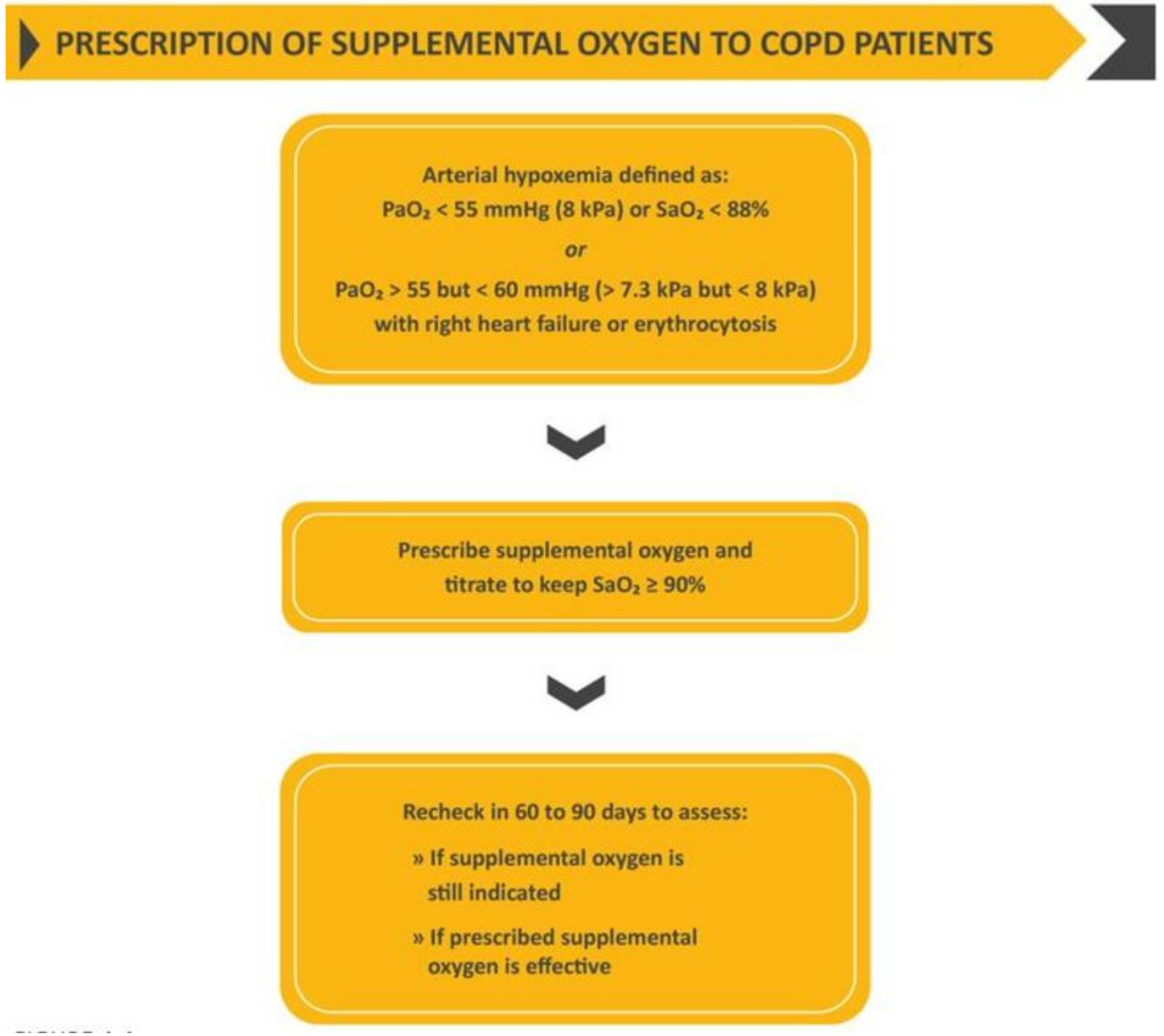
Nonpharmacological treatment of COPD

NON-PHARMACOLOGIC MANAGEMENT OF COPD

PATIENT GROUP	ESSENTIAL	RECOMMENDED	DEPENDING ON LOCAL GUIDELINES
A	Smoking Cessation (can include pharmacologic treatment)	Physical Activity	Flu Vaccination Pneumococcal Vaccination
B-D	Smoking Cessation (can include pharmacologic treatment) Pulmonary Rehabilitation	Physical Activity	Flu Vaccination Pneumococcal Vaccination

When to add oxygen therapy?

Non-pharmacological treatment



COPD Exacerbation

Management of Exacerbations

OVERALL KEY POINTS (1 of 3):

- An exacerbation of COPD is defined as an acute worsening of respiratory symptoms that results in additional therapy.
- Exacerbations of COPD can be precipitated by several factors. The most common causes are respiratory tract infections.
- The goal for treatment of COPD exacerbations is to minimize the negative impact of the current exacerbation and to prevent subsequent events.
- Short-acting inhaled $beta_2$-agonists, with or without short-acting anticholinergics, are recommended as the initial bronchodilators to treat an acute exacerbation.

COPD Exacerbation

Management of Exacerbations

OVERALL KEY POINTS (2 of 3):

- Maintenance therapy with long-acting bronchodilators should be initiated as soon as possible before hospital discharge.
- Systemic corticosteroids can improve lung function (FEV_1), oxygenation and shorten recovery time and hospitalization duration. Duration of therapy should not be more than 5-7 days.
- Antibiotics, when indicated, can shorten recovery time, reduce the risk of early relapse, treatment failure, and hospitalization duration. Duration of therapy should be 5-7 days.
- Methylxanthines are not recommended due to increased side effect profiles.

COPD Exacerbation

Table 1. Anthonisen classification of AECOPD

Type I (most severe)	Type II	Type III
All three symptoms (i.e., increased sputum volume, increased sputum purulence and increased dyspnea).	Any two symptoms present	One symptom present plus at least one of the following: • An upper respiratory tract infection in the past 5 days • Increased wheezing • Increased cough • Fever without an obvious source • A 20% increase in respiratory rate • Heart rate above baseline

COPD Exacerbation

Management of Exacerbations

COPD exacerbations are defined as an acute worsening of respiratory symptoms that result in additional therapy.

- They are classified as:
  - **Mild** (treated with short acting bronchodilators only, SABDs)
  - **Moderate** (treated with SABDs plus antibiotics and/or oral corticosteroids) or
  - **Severe** (patient requires hospitalization or visits the emergency room). Severe exacerbations may also be associated with acute respiratory failure.

COPD Exacerbation

Management of Exacerbations

OVERALL KEY POINTS (3 of 3):

- Non-invasive mechanical ventilation should be the first mode of ventilation used in COPD patients with acute respiratory failure who have no absolute contraindication because it improves gas exchange, reduces work of breathing and the need for intubation, decreases hospitalization duration and improves survival.

COPD Exacerbation

Management of Exacerbations

INDICATIONS FOR RESPIRATORY OR MEDICAL INTENSIVE CARE UNIT ADMISSION*

- Severe dyspnea that responds inadequately to initial emergency therapy.
- Changes in mental status (confusion, lethargy, coma).
- Persistent or worsening hypoxemia ($PaO_2 < 5.3$ kPa or 40mmHg) and/or severe/worsening respiratory acidosis ($pH < 7.25$) despite supplemental oxygen and noninvasive ventilation.
- Need for invasive mechanical ventilation.
- Hemodynamic instability - need for vasopressors.

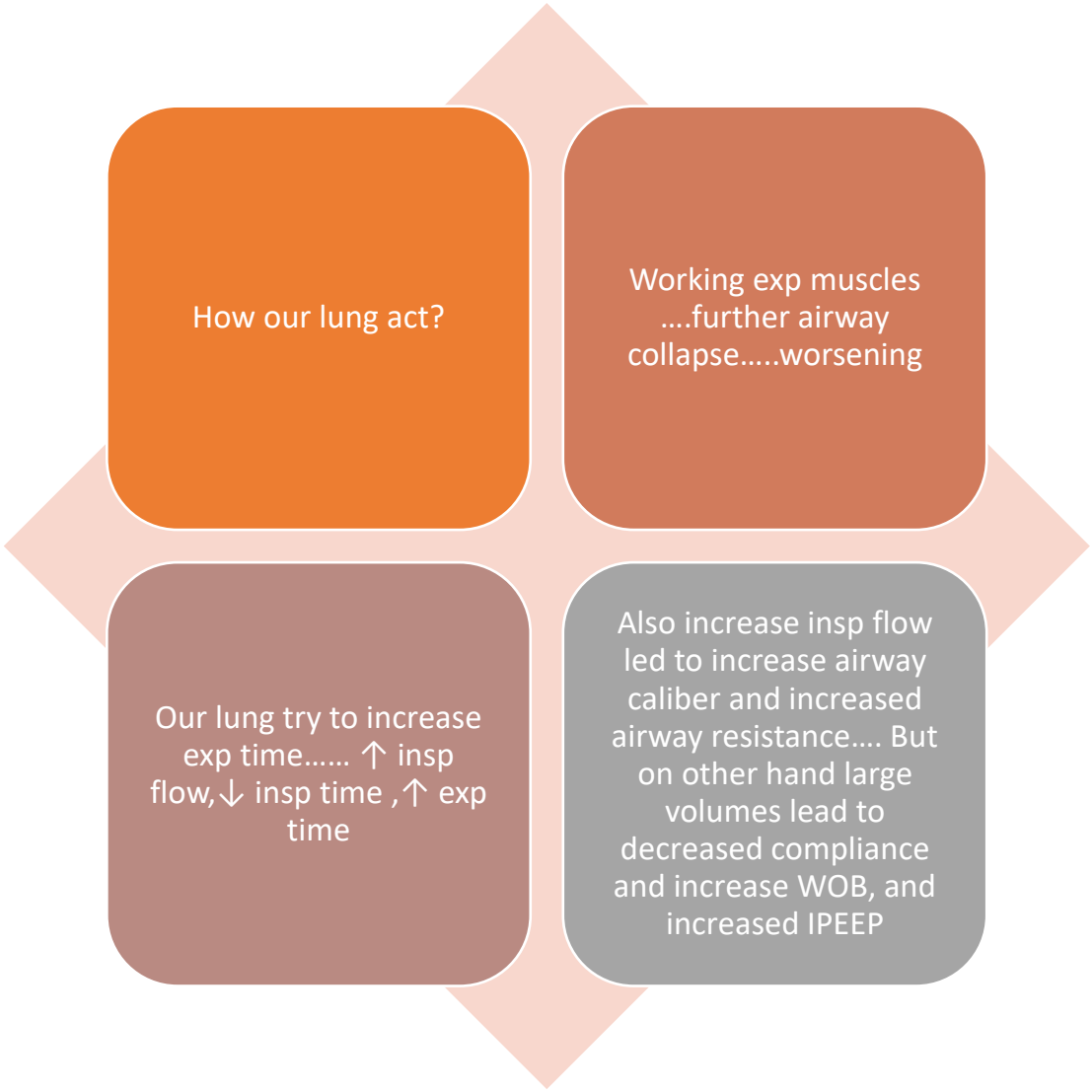
COPD Exacerbation

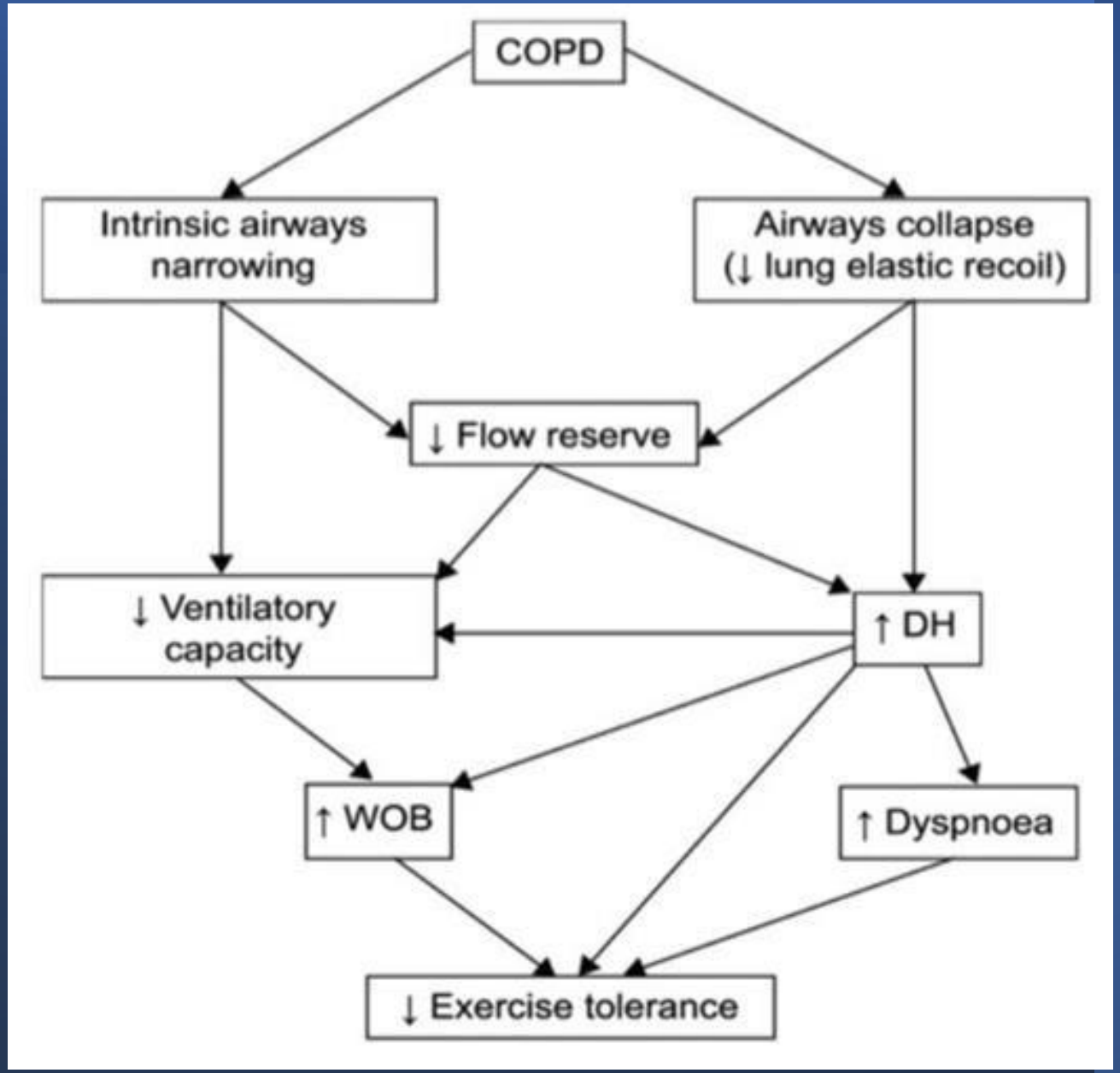
Management of Exacerbations

INDICATIONS FOR INVASIVE MECHANICAL VENTILATION

- Unable to tolerate NIV or NIV failure.
- Status post - respiratory or cardiac arrest.
- Diminished consciousness, psychomotor agitation inadequately controlled by sedation.
- Massive aspiration or persistent vomiting.
- Persistent inability to remove respiratory secretions.
- Severe hemodynamic instability without response to fluids and vasoactive drugs.
- Severe ventricular or supraventricular arrhythmias.
- Life-threatening hypoxemia in patients unable to tolerate NIV.

During exacerbation




COPD
Intrinsic airways narrowing
Airways collapse (↓ lung elastic recoil)
↓ Flow reserve
↓ Ventilatory capacity
↑ DH
↑ WOB
↑ Dyspnoea
↓ Exercise tolerance

CO_2 in COPD Exacerbation

- In COPD cases increase CO_2 level due to alveolar destruction
- Increase WOB lead to increase CO_2 production
- Increase Dead space needs higher minute ventilation to eliminate CO_2
- Increased iPEEP lead to Lower COP and resp muscle fatigue

Hazards of increased CO_2:

❖decrease anaerobic metabolism

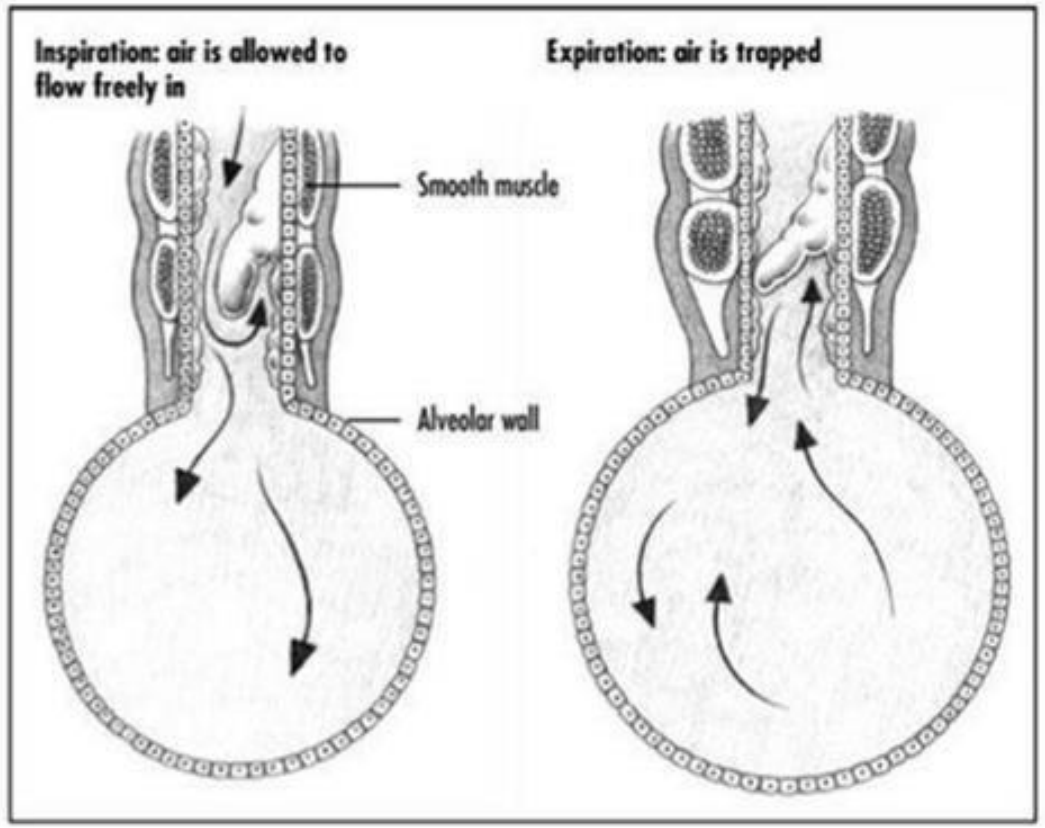
❖Decrease ATP stores

❖Decreased glycogen stores

Dynamic Hyper Inflation (DHI)

- **Def: Increased relaxation volume** of the respiratory system at the end of a tidal expiration.

- **Mechanism**: Alveolar outflow partial obstruction → Expiratory flow limitation (EFL) + Loss of passive elastic recoil of alveoli at end of expiration (emphysema) → incomplete alveolar emptying → Faliure to return to FRC (**physiological inflation**) at end of expiration → alveolar volume changes → alveolar gas trapping (**pathological hyperinflation**)
- Mostly this extra alveolar **VOLUME** will increase alveolar **PRESSURE** at end of expiration above Patm = INTRINSIC PEEP = **Auto PEEP**



DHI Consequences:

- **Consequences** of DHI (**pulmonary** vs **extrapulmonary** problems!)
  1. Gas exchange disturbances (impaired alveolar flow)(Inc WOB / RF)
  2. Local alveolar barotrauma and injury
  3. During MV: Increased effort or Difficult to trigger a breath (during weaning)
  4. Hemodynamic and heart-lung disturbances (*acute*; Hypotension *longterm*; pulmonary hypertension / corpulmonal!)

Goals of mechanical ventilation:

- Correct acid base imabalnce
- Resting respiratory muscles
- Patient support during pharmacological TTT

What parameters?

Parameters of mechanical ventilation:

Tidal volume

Respiratory rate

Inspiratory flow

PEEPe

Triggering

Tidal volume

- Adjust to target preset CO2 level and to decrease DHI
- IF INCREASED DHI:

Volume mode	Pressure mode
Decrease TV	Decrease insp pressure
Decrease RR	Decrease insp time
	Decrease RESP rate

Respiratory Rate

- NO Need for rapid normalization of PCO_2
- Increased Resp Rate leads to decrease EXP time
- In VCV adjustment of RR should be cautious not to affect exp time
- If patient become agitated and tachypnic ….. More sedation needed to decline RESP Rate to avoid increase in DHI

Inspiratory flow:

Appropriate insp flow rate ….. Leads to adequate TV and resp ms rest

Low flow……. Air hunger…….increase WOB and RR

HIGHER INSP PRESSURE:

Less insp time …..more exp time

More uniform distribution across alveoli

Higher insp flow cause higher PEAK Pressure

Mostly it is dissipated in high pressure zones not alveoli

Over time it will decline with declining DHI

RAMP is better than square flow (better gas exchange, lower peak pressure but may increase insp time)

Prolong expiratory time (Te):

- Flow: Using a higher PIFR (70–100 L/min)
- Ramp pattern better
- Flow triggering better than pr triggering
- Apply shorter Ti (0.8 - 1.2 sec)
- Eliminating inspiratory Pause time (volume targeted modes)
- Decreasing RR
- Decreasing I:E ratio (1:3..)
- During CPAP weaning: early switch to expiration (Flow cycling time >25%)

Add PEEP or not?

PEEP in COPD patient

PEEP stent collapsible air way….. Increase exp flow

Easier for triggering…..lower WOB

Target PEEP….<75% of PEEPi

Trigger

Sensitivity according to magnitude adjusted

Flow trigger is better and less WOB

Pressure trigger….delayed…increased WOB

Modes of ventilation:

AC mode allow more resp muscle rest than SIMV modes

CPAP and BIPAP modes allow resp ms rest through their PS

PRESSURE SUPPORT mode allow patient to control TV and insp time

Allowing more ms rest and decreased DHI

If assynchrony in PSV think of declining PS??

Targets :

adequate TV

accptable RR (<30)

Monitoring

- Peak pressure:

Sum of elastic recoil and pr across air way (flow*resistance)

Plateau pressure:

During insp hold reflect compliance

More than 30-35 (barotrauma and worsening DHI)

- Patient become hypotensive and congested neck veins??

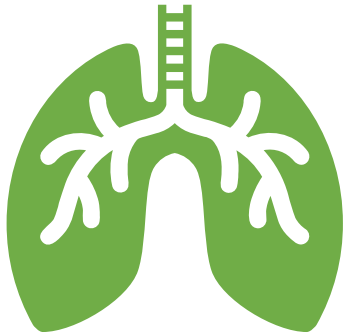
- DD

On weaning

- Tpiece
- PSV

- Role of NIV

HFNC in COPD patient



Pros: better tolerated - No interface with speech and eating - humidification enhances ciliary clearance and secretion removal - decrease dead space → improve WOB / partial CO2 washout

Cons: unmeasurable PEEPe (may worsen DHI in AECOPD?) - Blunting Hypoxic drive in COPD patients?


Questions?

Thank you