acute exacerbations of chronic obstructive pulmonary disease-education

Dr. Haleh Mikaeili
pulmonologist, intensivist
Tabriz university of medical siences,
TLDR center

GOLD defines an exacerbation of (COPD)

an acute increase in symptoms beyond normal day-to-day variation
includes an acute increase in one or more of the following cardinal symptoms:

- *Cough increases in frequency and severity*
- *Sputum production increases in volume and/or changes character*
- *Dyspnea increases*

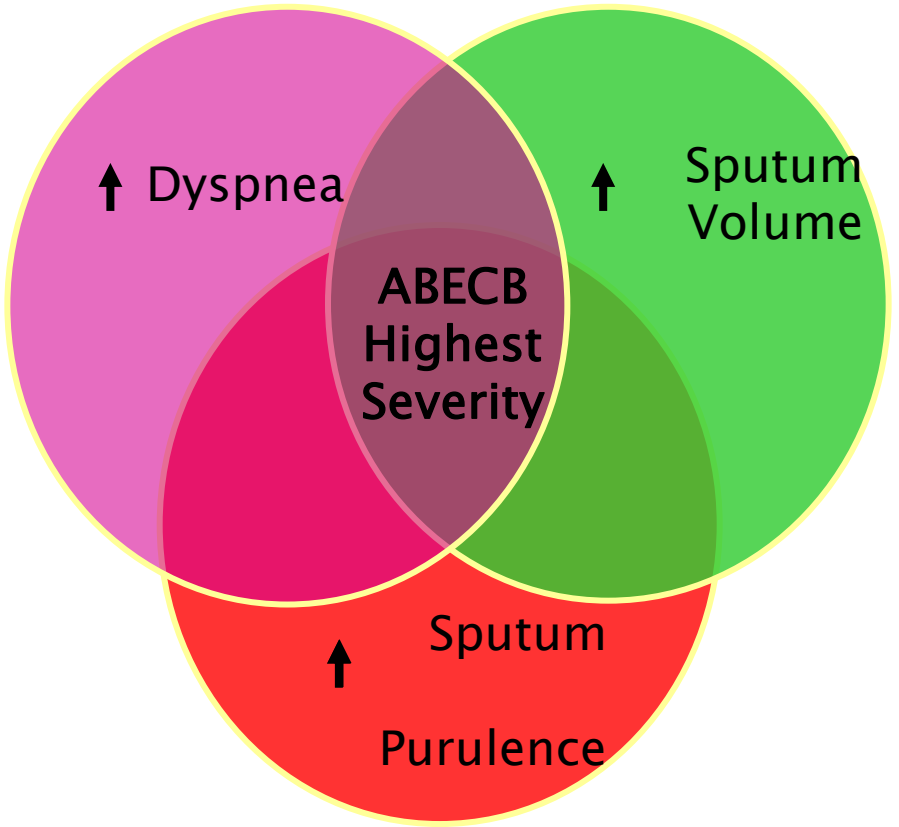
❑**severe cases can lead to respiratory failure and death.**

Clinical Assessment: ABECB

Key Assessment Factors

- Age
- Triggers
- Comorbid diseases
- Response to previous medical therapy
- Overall pulmonary function
- Oxygenation
- Character and severity of previous exacerbations
- Bacterial colonization status
- Previous need for mechanical ventilation local antimicrobial susceptibility pattern

Three Cardinal Symptoms



Brunton S et al. *Am J Managed Care.* 2004;10:689-96.

PRECIPITANTS

1-70 to 80 percent

respiratory infections

Viral and bacterial infections cause most exacerbations

whereas atypical bacteria are a relatively uncommon cause

2- 20 to 30 percent

environmental pollution or have an unknown etiology

The most common viruses associated

rhinoviruses

Influenza
parainfluenza
Coronavirus
adenovirus

are also common during exacerbations

Respiratory syncytial virus
human metapneumovirus

were more recently associated with exacerbations

Identification of a virus is relatively common and does not necessarily mean that this is the cause of the exacerbation

- ✓ found in **up to 15 percent** of asymptomatic individuals with stable COPD
- ✓ ***Influenza virus is an exception*** since asymptomatic carriage is unusual.

The Principle Pathogens

Organism	Sinusitis	AECB	CAP
Streptococcus pneumoniae	>30	20	50*
Haemophilus influenzae	20-25	>40	10
Moraxella catarrhalis	15	15-20	<5
Mycoplasma pneumoniae			20+
Chlamydia pneumoniae			25*
Legionella pneumophila			<5

* Mixed etiology reported in>25% of patients

Responsible for 94% of all bacterial infections

unknown etiology :

other medical conditions

1-myocardial ischemia

2- heart failure

3-aspiration

4- pulmonary embolism

- prevalence of pulmonary embolism :20 percent
- among those hospitalized :25 percent

RISK FACTORS

a) advanced age
b) productive cough
c) duration of COPD
d) history of antibiotic therapy
e) COPD-related hospitalization within the previous year
f) chronic mucous hypersecretion
g) theophylline therapy
h) having one or more comorbidities (eg, ischemic heart disease, chronic heart failure, or diabetes mellitus
i) Gastroesophageal reflux disease (GERD): may be

RISK FACTORS

The single best predictor of exacerbations was **a history of exacerbations, regardless of COPD severity**

high (FEV1) is associated with a lower risk of COPD exacerbation

INITIAL EVALUATION

a) medical history

b) physical examination

c) chest radiograph

d) routine laboratory studies

e) arterial blood gas analysis (assess the severity of the exacerbation and to establish a baseline from which improvement or deterioration can be measured)

f) sputum examinations

following initial evaluation

patient's triage to inpatient or outpatient management

Several criteria for hospitalization (ATS/ERS)

a) Inadequate response of symptoms to outpatient management
b) Marked increase in dyspnea
c) Inability to eat or sleep due to symptoms
d) Worsening hypoxemia
e) Worsening hypercapnia
f) Changes in mental status
g) Inability to care for oneself (ie, lack of home support)
h) Uncertain diagnosis
i) High risk comorbidities including pneumonia, cardiac arrhythmia, heart failure, diabetes mellitus, renal failure, or liver failure
j) acute respiratory acidosis

Risk factors for relapse after discharge from the emergency department:

A. a greater number of doses of nebulized bronchodilator required in the emergency department

B. use of theophylline in the emergency department

C. use of supplemental oxygen at home

D. an emergency department visit within the past week

E. prior relapse after an emergency department visit

F. prescription of glucocorticoids, antibiotics, or both at the time of emergency department discharge

DIFFERENTIAL DIAGNOSIS

- heart failure
- pulmonary thromboembolism,
- pneumonia

in an autopsy study of 43 patients with COPD who died within 24 hours of admission for a COPD exacerbation

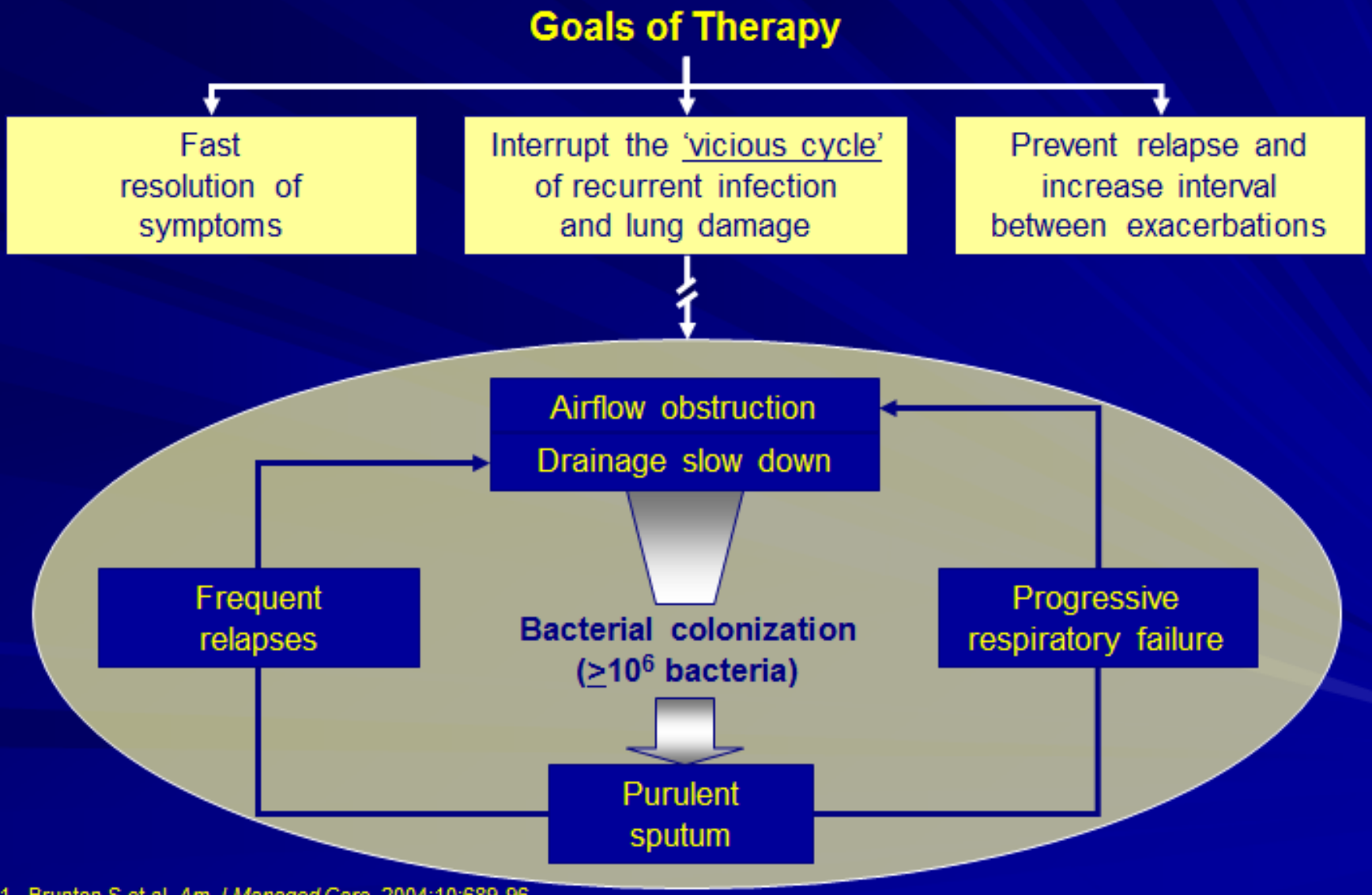
The primary causes of death were heart failure, pneumonia, pulmonary thromboembolism, and COPD in 37, 28, 21, and 14 percent, respectively

TREATMENT GOALS

Successful management requires

1. Identifying and ameliorating the cause of the acute exacerbation, if possible
2. Optimizing lung function by administering bronchodilators and other pharmacologic agents
3. Assuring adequate oxygenation and secretion clearance
4. Averting the need for intubation, if possible
5. Preventing complications of immobility, such as thromboemboli and deconditioning
6. Addressing nutritional needs

Successful Management of ABECB



1. Brunton S et al. *Am J Managed Care*. 2004;10:689-96.
2. Mensa *Clin Microbiol Infect*. 2006;12(Suppl 3):42–54.

OXYGEN THERAPY

target :

PaO2= 60 to 70 mmHg

oxyhemoglobin saturation =90 to 94%

OXYGEN THERAPY

numerous devices :

1. **Venturi masks** :preferred
   permit a precise delivered FiO2
   can deliver an FiO2 of 24, 28, 31, 35, 40, or 60 percent
2. **Nasal cannula**
   flow rates **up to 6 L per minute with FiO2 of approximately 40 percent**
   more comfortable and convenient especially during oral feedings
3. **simple facemasks**
   FiO2 up to 55 percent using flow rates of 6 to 10 L per minute.
   - Variations in minute ventilation and inconsistent entrainment of room air affect the FiO2 with nasal cannulae or simple facemasks
4. **Non-rebreathing masks** with a reservoir, one-way valves, and a tight face seal can deliver an inspired oxygen concentration **up to 90 percent.**

Inability to correct hypoxemia with a relatively low FiO2

consideration of

1. pulmonary emboli
2. acute respiratory distress syndrome
3. pulmonary edema
4. severe pneumonia as the cause of respiratory failure

Inability to correct hypoxemia with a relatively low FiO2

consideration of

- Adequate oxygenation even leads to acute hypercapnia

- Hypercapnia is generally well tolerated in patients with chronically elevated PCO2

- mechanical ventilation :if hypercapnia is associated with depressed mental status, profound acidemia, or cardiac dysrhythmias

Effects of supplemental oxygen

ventilatory drive 1-patients with COPD rely on their hypoxic

"removal" of hypoxic drive : reduction in alveolar ventilation

ARF were given supplemental O2

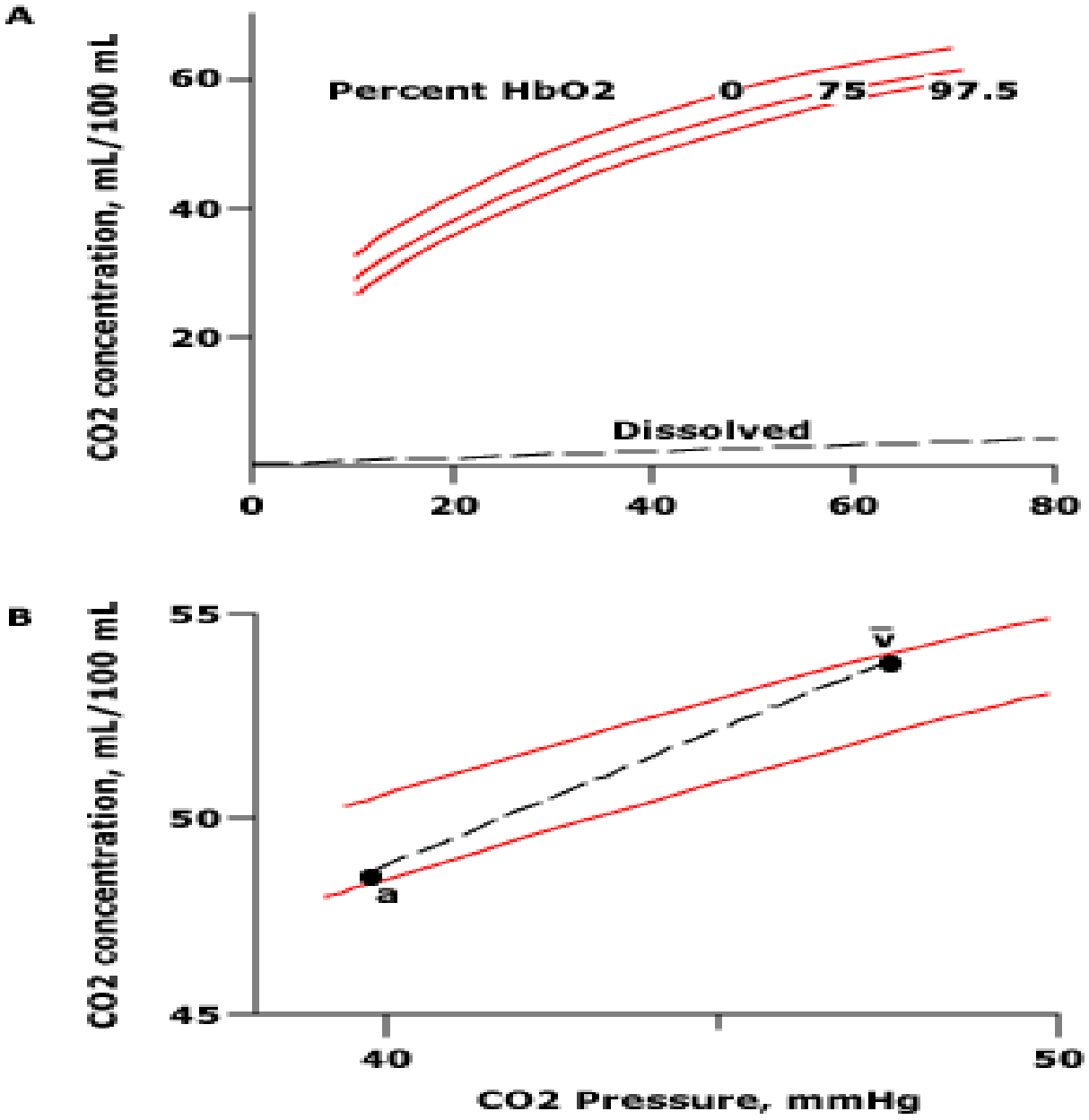
minute ventilation dropped by 14 percent, due to a small decrease in respiratory rate without a compensatory change in tidal volume.

Ventilatory drive, as measured by mouth occlusion pressure, decreased, but remained three times greater than in normal controls.

- slight reduction in ventilatory drive is actually one of the goals of treatment with oxygen.

2-decreased hemoglobin affinity for CO2 (the Haldane effect)

- The Haldane effect refers to the rightward displacement of the CO2-hemoglobin dissociation curve in the presence of increased oxygen saturation.
- This occurs because oxyhemoglobin binds CO2 less avidly than deoxyhemoglobin, thereby increasing the amount of CO2 dissolved in blood, which in turn determines PaCO2
- The Haldane effect is most pronounced when the arterial oxygen saturation (SaO2) changes most per mmHg of PaO2, ie, on the steep part of the oxygen-hemoglobin dissociation curve, which is between a PaO2 of 20 and 60 mmHg.


A
CO2 concentration, mL/100 mL
60
40
20
Percent HbO2
0
75
97.5
Dissolved
0
20
40
60
80
B
CO2 concentration, mL/100 mL
55
50
45
v̄
a
40
50
CO2 Pressure, mmHg

3- increase in dead space ventilation

The largest component of acute hypercapnia (48 percent)
worsening of V/Q matching due to a loss of hypoxic pulmonary vasoconstriction (HPV)

hypoxic pulmonary vasoconstriction and the Haldane effect, both of which are more prominent at lower partial pressures of oxygen.

Response to oxygen administration

There are three possible outcomes when administering uncontrolled oxygen therapy to a patient with COPD and respiratory insufficiency

1. The patient's clinical state and $PaCO_2$ may improve or not change

2. The patient may become drowsy but can be roused to cooperate with therapy: the $PaCO_2$ generally rises slowly by up to 20 mmHg and then stabilizes after approximately 12 hours

3. The patient rapidly becomes unconscious, cough becomes ineffective, and the $PaCO_2$ rises at a rate of 30 mmHg or more per hour

The risk for developing severe hypercapnia and CO_2 narcosis is greater in patients with a **low initial pH and/or PaO_2**

Effect of withdrawing oxygen

The major danger facing patients who develop hypercapnia during treatment with oxygen is that the abrupt removal of supplemental oxygen may cause the PaO2 to fall to a level lower than when oxygen therapy was begun.

The development of hypoxemia in this setting is more rapid than the resolution of hypercapnia, and subsequent tissue hypoxia can potentially worsen the **patient's acidemia**.

PHARMACOLOGIC TREATMENT

The major components of managing an acute exacerbation of COPD include

1. inhaled short-acting bronchodilators (beta adrenergic agonists and anticholinergic agents)
2. glucocorticoids
3. antibiotics

Beta adrenergic agonists

Inhaled SABA(eg, albuterol) :the mainstay of therapy

1-rapid onset of action
2- efficacy in producing bronchodilation

- nebulizer or (MDI) with a spacer
equal efficacy during acute exacerbations of COPD

- many clinicians prefer nebulized therapy on the presumption of more reliable delivery of drug to the airway

albuterol

2.5 mg (diluted to a total of 3 mL) by nebulizer every one to four hours as needed
or 4 to 8 puffs (90 mcg per puff) by MDI with a spacer every one to four hours as needed

Anticholinergic agents

- Inhaled **short-acting anticholinergic agents** (eg, ipratropium bromide) with inhaled SABA

- combination therapy produces bronchodilation in excess of that achieved by either agent alone in patients with a COPD exacerbation, an asthma exacerbation, or stable COPD

Combivent (ipratropium+salbutamol) ,

Atrovent Comp **(ipratroium+fenotrol)**

- ipratropium :500 mcg by nebulizer every four hours as needed
- Alternatively, 2 puffs (18 mcg per puff) by MDI with a spacer every four hours as needed

Glucocorticoids

Efficacy

Systemic glucocorticoids, added to the bronchodilator

1.improve symptoms

2.improve lung function

3.decrease the length of hospital stay

Route

Oral glucocorticoids

rapidly absorbed (peak serum levels achieved at one hour after ingestion) with virtually complete bioavailability and appear equally efficacious as intravenous glucocorticoids

intravenous glucocorticoids

1. severe exacerbation
2. respond poorly to oral glucocorticoids
3. unable to take oral medication
4. impaired absorption due to decreased splanchnic perfusion (shock)

inhaled glucocorticoids

has not been studied
should not be used as a substitute for systemic glucocorticoid therapy

Dose

using a moderate, rather than high dose of glucocorticoids

- less ill patients were more likely to receive oral treatment
- **(GOLD) guidelines**

equivalent of prednisone 30 to 40 mg once daily for 7 to 10 days

- impending or actual **ARF** **intravenous formulation at a higher dose,**

equivalent of methylprednisolone 60 mg intravenously, one to four times daily

although outcomes data to guide this practice are not available

Duration

- not clearly established
- depends on the severity of the exacerbation and the observed response to therapy
- **As a rough guide** :full dose therapy (eg, prednisone 30 to 40 mg daily) for 7 to 10 days

Then discontinued, if the patient has substantially recovered

Alternatively, the dose is tapered over another seven days, as a trial to determine whether continued glucocorticoid therapy is required

- Tapering solely because of concerns about adrenal suppression is not necessary if the duration of therapy is less than three weeks (a duration too brief to cause adrenal atrophy).

ANTIBIOTIC THERAPY

Treatment of COPD exacerbations often includes antibiotic therapy

GOLD guidelines:

1-ABs for patients with a moderate to severe COPD exacerbation

at least two of the three cardinal symptoms

a) increased dyspnea
b) increased sputum volume
c) increased sputum purulence
d) requiring hospitalization

2-NOT initiate ABs in mild exacerbation

a) define as having only one of the three cardinal symptoms
b) not requiring hospitalization or ventilatory assistance (either invasive or noninvasive).

Choice of antibiotic

broader antibiotic regimen for patients who have risk factors for a poor outcome

Risk factors :

1. older age (>65 years)
2. comorbid conditions (especially cardiac disease)
3. severe underlying COPD (defined as FEV1 <50 percent)
4. frequent exacerbations (three or more per year)
5. antimicrobial therapy within the past three months

target likely bacterial pathogens

H. Influenzae
M. Catarrhalis
S. pneumoniae

account local patterns of antibiotic resistance

P. aeruginosa and Enterobacteriaceae can occur in patients with severe COPD

first-line antibiotics :
doxycycline,
trimethoprim-sulfamethoxazole

amoxicillin is no longer considered a first-line agent because it is inactive against most nontypeable H. influenzae and M. catarrhalis.
second-line antibiotics
logical choices for outpatients that is comparable, but usually not superior
amoxicillin-clavulanate
Azithromycin
Cefpodoxime
Cefprozil
Cefuroxime
loracarbef,
fluoroquinolones
complicated COPD and risk factors for Pseudomonas who do not have indications for hospitalization

ciprofloxacin

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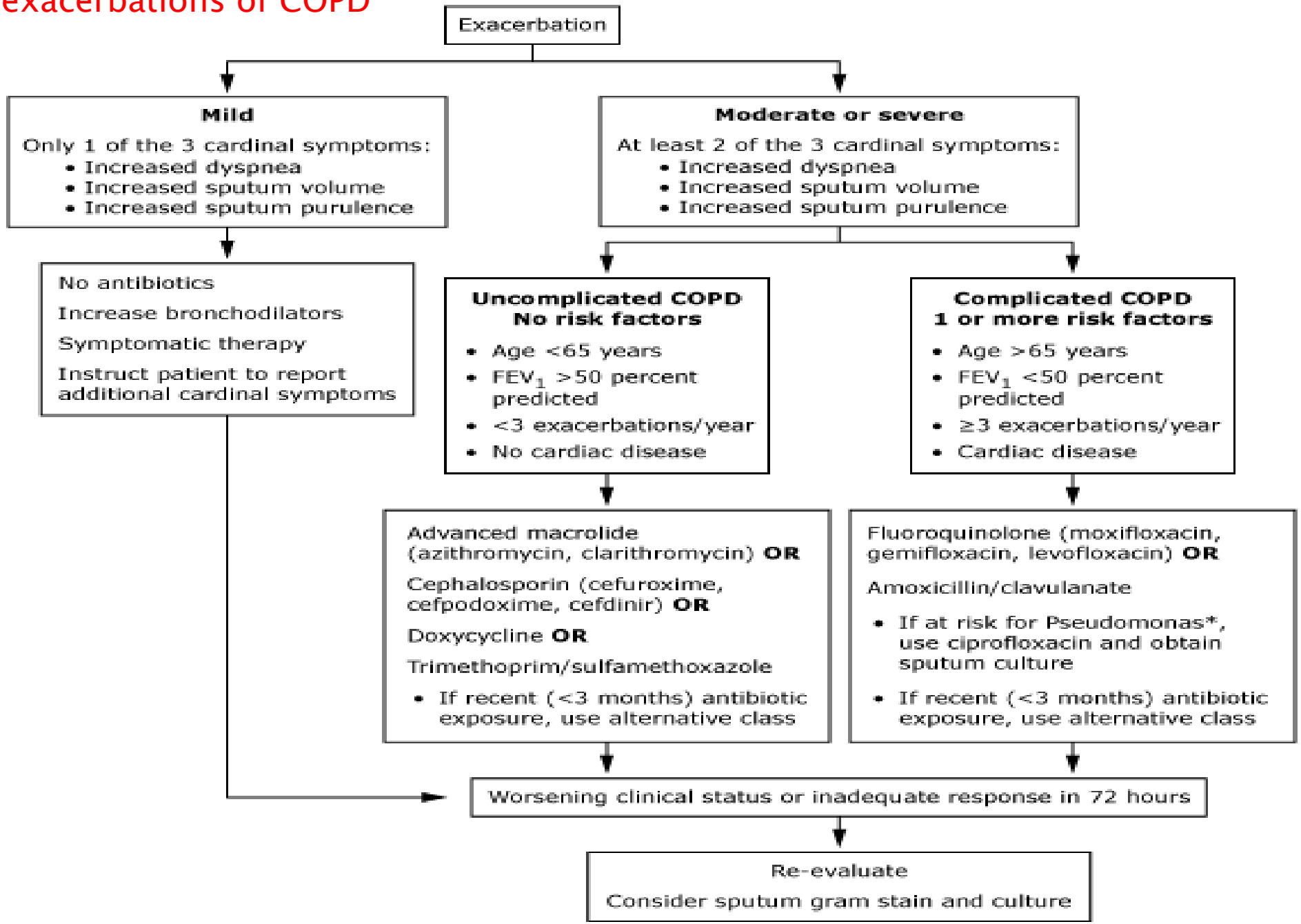
Duration

three to seven days, depending upon the response to therapy.

Patients who are initially started on parenteral antibiotics should be switched to an oral regimen when able to take medications orally.

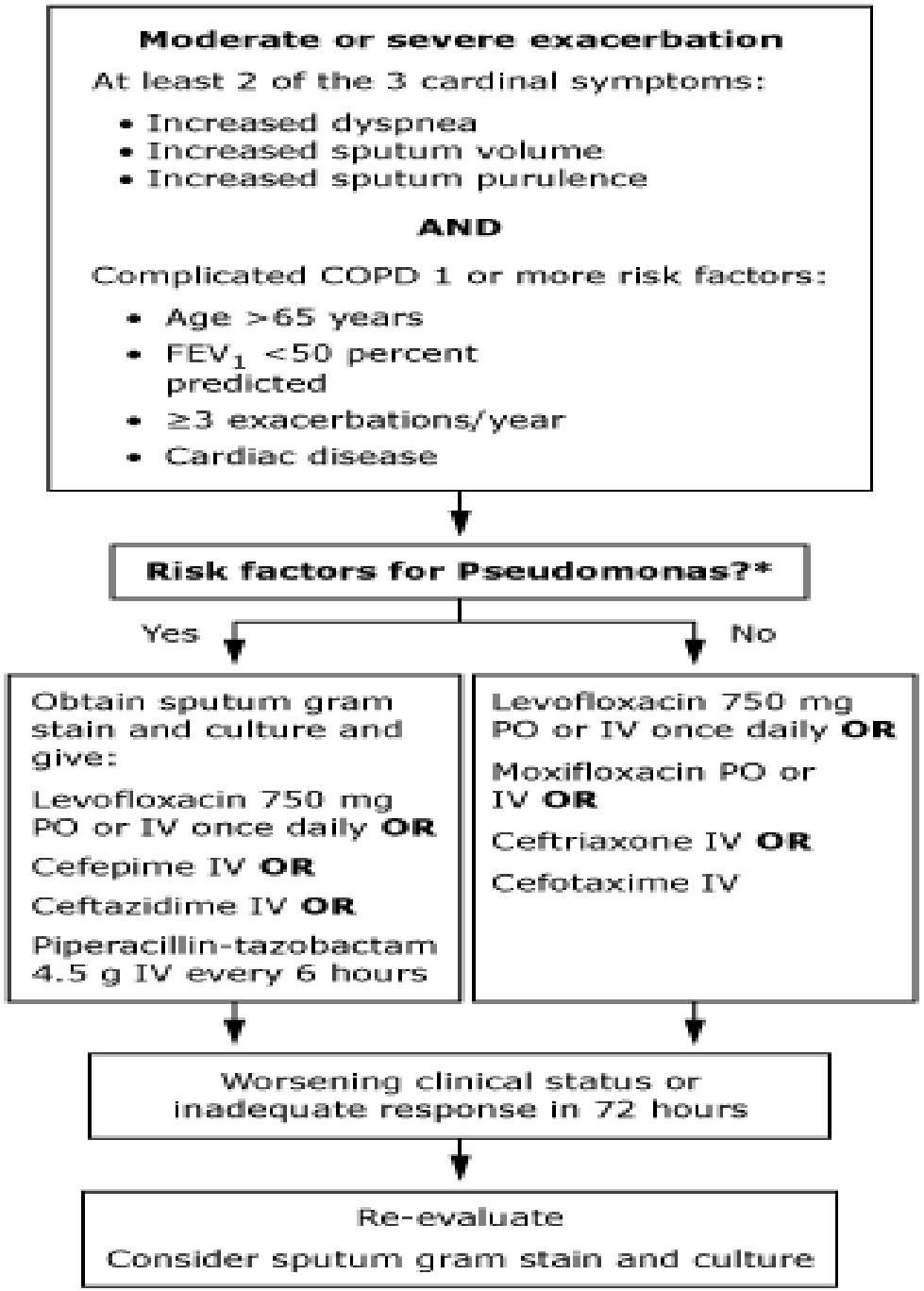
Outpatient management of acute exacerbations of COPD



Pseudomonas risk factors:

1. – Frequent administration of antibiotics (4 or more courses over the past year)
2. – Recent hospitalization (2 or more days' duration in the past 90 days)
3. – Isolation of Pseudomonas during a previous hospitalization
4. – Severe underlying COPD (FEV1 <50 percent predicted)

Antibiotic treatment of acute exacerbations of COPD in hospitalized patients



CHEST PHYSIOTHERAPY

Mechanical techniques to augment sputum clearance, such as

1. directed coughing
2. chest physiotherapy with percussion and vibration
3. intermittent positive pressure breathing
4. postural drainage

have not been shown to be beneficial in COPD and may provoke bronchoconstriction

Their use in acute exacerbations of COPD is not supported by clinical trial

PROGNOSIS

- ✓ **14 percent** of patients admitted for an exacerbation of COPD will **die within three months** of admission
- ✓ Even if the acute exacerbation resolves, many patients never return to their baseline level of health
- ✓ Among patients with an acute exacerbation and a $PaCO_2$ of 50 mmHg or more, **the six- and 12-month mortality** rates are approximately **33 and 43 percent**, respectively

Mechanical ventilation in AECOPD

NIPPV in patient with respiratory failure,
defined $PaCO_2 > 45mmHg$ results in:

1. Reduction in mortality rate
2. Need for intubation
3. Complication of therapy
4. Hospital length of stay

Contraindication to NIPPV

1. Cardiovascular instability
2. Impaired mental status
3. inability to cooperate
4. Copious secretions or inability to clear secretions
5. Craniofacial abnormalities or
6. trauma precluding effective fitting mask
7. Extreme obesity
8. Significant burns

Invasive ventilation

- Fio2=? so2>92%
- Tv=6-8ML/kg COPD+ARDS 4-6 mL
- PEEP= 5-10 cmH2o
- flow rate=60 L/min
- Triger -1 to -2cmH2o OR 2L/min
- Ventilator rate=10-16/min

PREVENTION

measures to prevent future exacerbations

1. smoking cessation
2. pulmonary rehabilitation
3. proper use of medications (including MDIs technique)
4. vaccination

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Medication reduce AECOPD

- LAMAs
- LABAs but LAMAs>LABAs
- Inhaled ICS
- Roflumilast
- Prophylactic Azithromycin >2 exacerbations
- NAC??
- Vitamin D??

Not effective

- systemic glucocorticosteroids
- Selective beta blocker
- 532 patient metoprolol did not decrease

- Statins simivastatin40mg 36 months

- از توجه تان متشکرم