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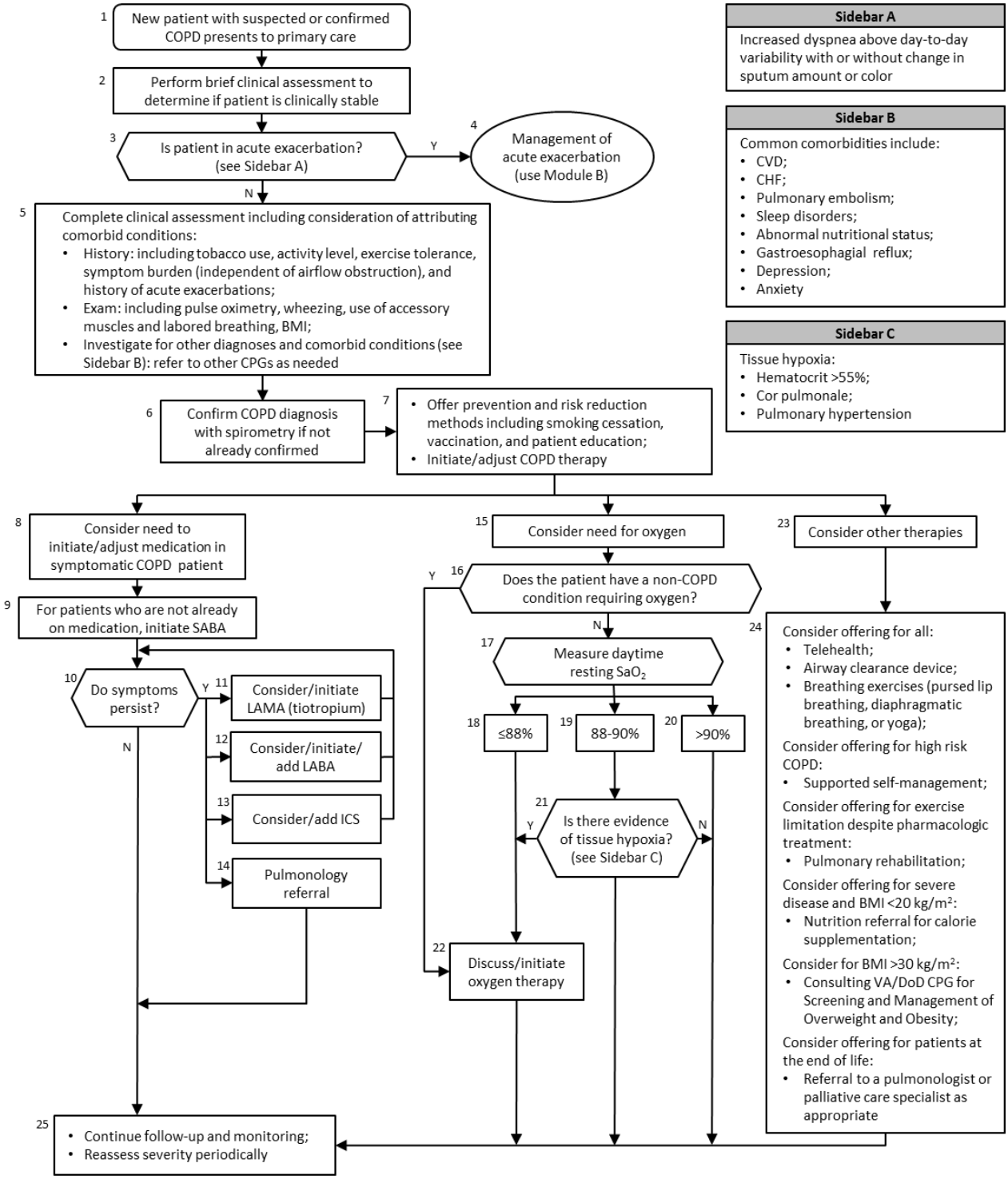
Algorithm A: Management of COPD in Primary Care



Abbreviations

BMI: body mass index; CHF: congestive heart failure; COPD: chronic obstructive pulmonary disease; CPG: clinical practice guideline; CVD: cardiovascular disease; ICS: inhaled corticosteroid; kg: kilogram; LABA: long-acting beta 2-agonist; LAMA: long-acting antimuscarinic agent; m: meter; SABA: short-acting beta 2-agonist; SaO_2: peripheral capillary oxygen saturation; VA/DoD: Department of Veterans Affairs/Department of Defense

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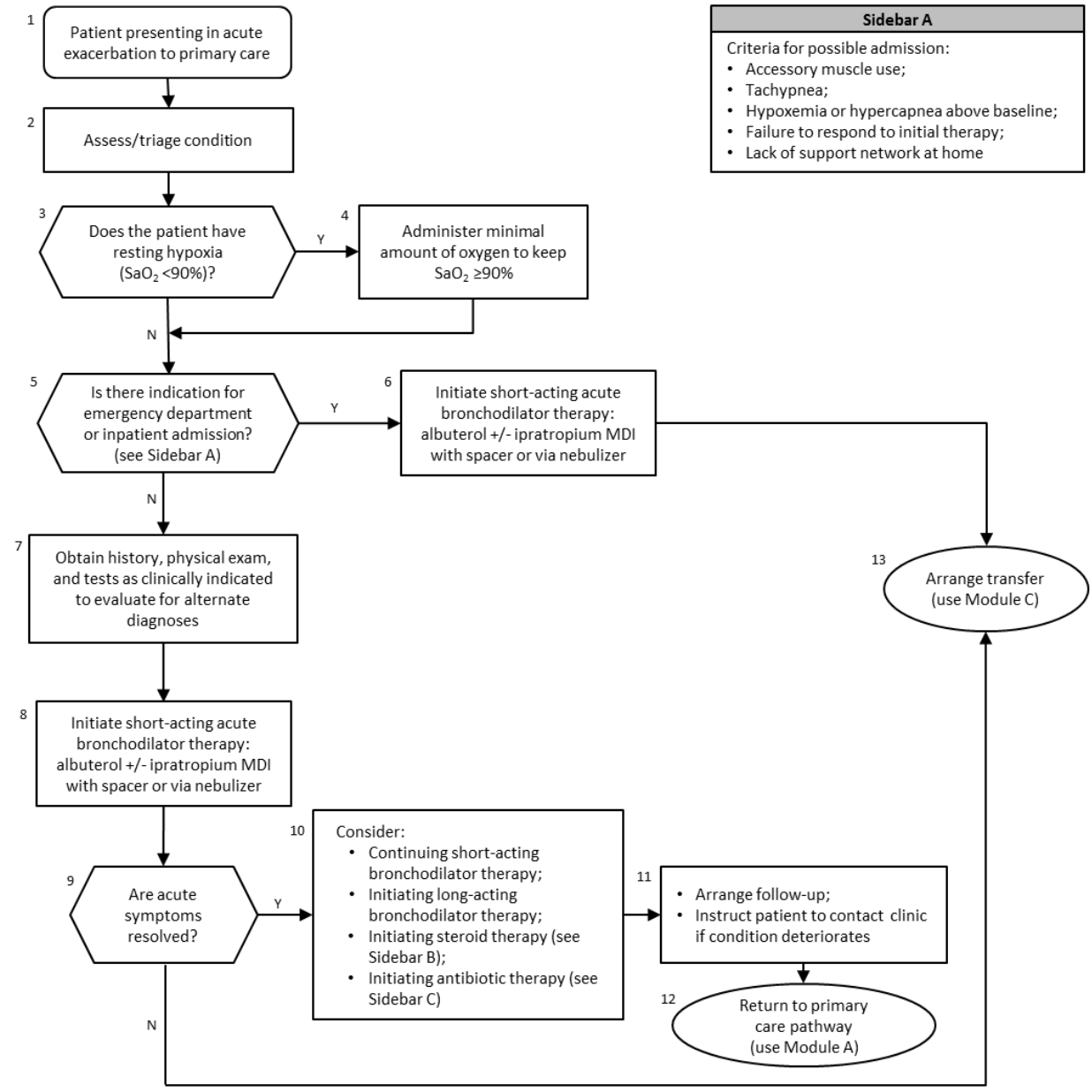
Algorithm B: Management of Acute Exacerbations of COPD



Abbreviations
COPD: chronic obstructive pulmonary disease; MDI: metered-dose inhaler; mg: milligram; SaO_2: peripheral capillary oxygen saturation

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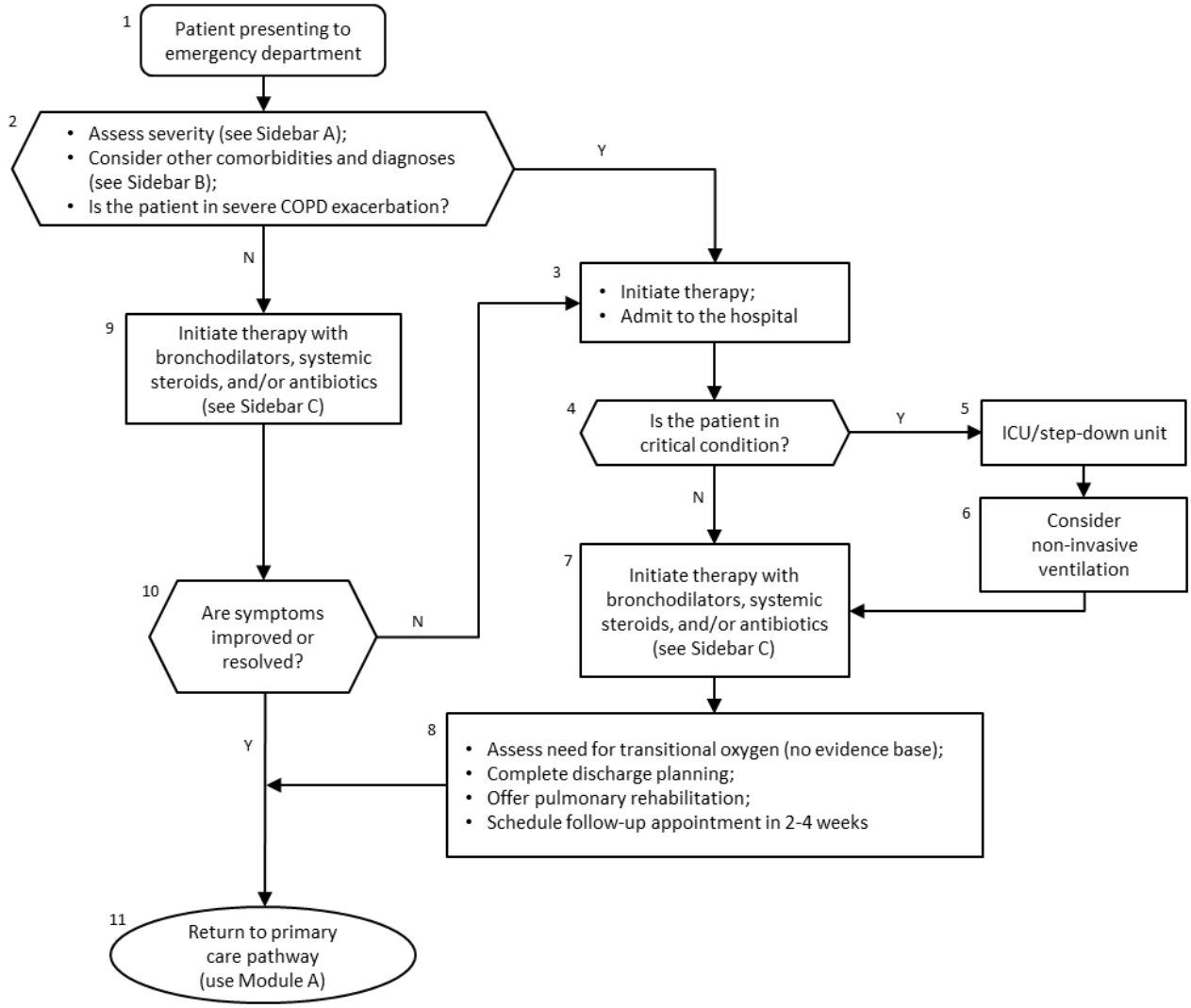
Algorithm C: Management of COPD in the Hospital or Emergency



Sidebar A

Indicators of severity include:
- Accessory muscle use;
- Tachypnea;
- Hypoxemia or hypercapnea above baseline;
- Failure to respond to initial therapy;
- Lack of support network at home;
- Other acute comorbid conditions presenting while patient is in acute exacerbation

Sidebar B

- Oximetry +/- ABG/VBG;
- Chemistry;
- BNP;
- EKG;
- CXR;
- D-Dimer;
- Troponin

Sidebar C

- Albuterol +/- ipratropium MDI with spacer or via nebulizer;
- Prednisone 40 mg or IV equivalent;
- Antibiotic choices:
  - Doxycycline;
  - Trimethoprim/sulfamethoxazole (TMP-SMX);
  - Second generation cephalosporin;
  - Amoxicillin;
  - Amoxicillin/clavulanate;
  - Azithromycin;
  - Reserve broader spectrum antibiotics for severe or specific risk (see text)

Abbreviations

ABG/VBG: arteriole or venous blood gas; BNP: B-type natriuretic peptide; COPD: chronic obstructive pulmonary disease; CXR: chest X-ray; EKG: electrocardiogram; ICU: intensive care unit; IV: intravenous; LTOT: long-term oxygen therapy; MDI: metered-dose inhaler; mg: milligram

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Measures for Diagnosis and Assessment of COPD

Step in Diagnosis/Assessment	Tool/Measure
Confirm initial diagnosis of COPD	obstructive spirometry (post-bronchodilator FEV1/FVC <70%, with age adjustment for more elderly individuals)
Determine subgroup classification based on exacerbation frequency	frequent exacerbations is ≥2 exacerbations/year (defined as prescription of corticosteroids, prescription of antibiotics, hospitalization, or emergency department visit)
Investigate comorbid diagnoses using appropriate testing	cardiac ischemia (troponin, electrocardiogram), congestive heart failure (BNP, pro-BNP), pulmonary embolism (D-dimer plus clinical decision rule), and gastroesophageal reflux
Special cases	for patients with signs or symptoms of a sleep disorder, refer for diagnostic sleep evaluation
	for patients with early onset or family history of COPD, test for AAT deficiency

Abbreviations: AAT: alpha-1 antitrypsin; BNP: B-type natriuretic peptide; FEV1/FVC: forced expiratory volume in one second/forced vital capacity

Options for Pharmacologic Therapy

Consider…	for patients with...	in the…
SABA	confirmed COPD	outpatient setting*
long-acting bronchodilator	confirmed, stable COPD who continue to have respiratory symptoms (e.g., cough, dyspnea)	
LAMA (tiotropium)		
combination therapy (LAMA, LABA)	confirmed, stable COPD who are on one of these medications alone and have persistent dyspnea on monotherapy	
triple therapy (LAMA, LABA, ICS)	confirmed, stable COPD who are on combination therapy with LAMA and LABA and have persistent dyspnea or COPD exacerbations	
antibiotics (5-day course)	COPD exacerbations who have increased dyspnea and increased sputum purulence or volume	outpatient setting, hospital, or emergency department^
systemic corticosteroids (5-7 day course)	acute COPD exacerbations	

Note: See Tables 1-3 for additional information on pharmacologic therapy
*See Algorithm A, boxes 9-14
^See Algorithm B, Sidebars B and C for information related to treatment in the outpatient setting and see Algorithm C, Sidebar C for information related to treatment in the hospital or emergency department
Abbreviations: LABA: long-acting beta 2-agonist; LAMA: long-acting antimuscarinic agent; SABA: short-acting beta 2-agonist; ICS: inhaled corticosteroid

Options for Non-Pharmacologic Therapy

Consider…	for outpatients with...
long-term oxygen therapy	chronic stable resting severe hypoxemia (PaO_2 <55 mm Hg and/or SaO_2 ≤88%)
	chronic stable resting moderate hypoxemia (PaO_2 of 56-59 mm Hg or SaO_2 >88% and ≤90%) with signs of tissue hypoxia (hematocrit >55%, pulmonary hypertension, or cor pulmonale)
evaluation for need for long-term oxygen therapy in 30-90 days after discharge	acute transitional oxygen therapy who have recently been discharged home from hospitalization
brief consultation or e-consult with a pulmonologist	COPD and hypoxemia and/or borderline hypoxemia (SaO_2 <90%) who are planning to travel by plane
referral for pulmonary consultation	confirmed, stable COPD and hypercapnea
supported self-management	high-risk COPD
telehealth	COPD (any patient)
pulmonary rehabilitation	stable COPD and exercise limitation despite pharmacologic treatment
	a recent hospitalization for an acute exacerbation
breathing exercise	dyspnea that limits physical activity
referral to a dietician	severe COPD with undernutrition (BMI< 20 kg/m^2)

Abbreviations: BMI: body mass index; mm: millimeter; PaO_2: partial pressure of oxygen in arterial blood; SaO_2: peripheral capillary oxygen saturation

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Options for Non-Pharmacologic Therapy in Acute COPD Exacerbations

Consider…	for patients with…	in the…
airway clearance techniques	acute COPD exacerbations and difficulty expectorating sputum	hospital or emergency department
non-invasive ventilation	acute COPD exacerbations	
	need for weaning from invasive mechanical ventilation or earlier extubation	

Additional Information on Pharmacologic Therapy

Table 1. Delivery, Strength, and Dosing of Pharmacologic Agents for COPD

Drug	Delivery	Strength	Dosing
SABAs			
albuterol*	MDI	90 mcg	1-2 inhalations every 4-6 hrs PRN
levalbuterol*	MDI	45 mcg	1-2 inhalations every 4-6 hrs PRN
SAMAs			
ipratropium*	MDI	21 mcg	2 inhalations every 6 hrs
Combination SAMA/SABA			
ipratropium/albuterol*	SMI	20/100 mcg	1 inhalation four times daily
LABAs			
formoterol*	DPI (capsule)	12 mcg	1 inhalation twice daily
salmeterol	DPI	50 mcg	1 inhalation twice daily
indacaterol	DPI (capsule)	75 mcg	1 inhalation once daily
olodaterol^	SMI	2.5 mcg	2 inhalations once daily
LAMAs			
tiotropium	DPI (capsule)/SMI	18 mcg/2.5 mcg	1 inhalation (DPI)/2 inhalations (SMI) once daily
aclidinium	DPI	400 mcg	1 inhalation twice daily
umeclidinium^	DPI	62.5 mcg	1 inhalation once daily
Combination LAMA/LABA			
umeclidiniun/vilanterol^	DPI	62.5/25 mcg	1 inhalation once daily
Combination ICS/LABA			
budesonide/formoterol	MDI	160/4.5 mcg	2 inhalations twice daily
mometasone/formoterol	MDI	100/5; 200/5 mcg	Not approved for COPD
fluticasone/salmeterol	DPI	250/50 mcg	1 inhalation twice daily
fluticasone/vilanterol^	DPI	100/25 mcg	1 inhalation once daily

*Available as a solution for nebulizer use

^These newer agents may not have been included in meta-analyses and systematic reviews used to develop the VA/DoD COPD Clinical Practice Guideline.

Abbreviations: DPI: dry powder inhaler; hrs: hours; ICS: inhaled corticosteroid; LABA: long-acting beta 2-agonist; LAMA: long-acting anticholinergic; mcg: microgram; MDI: metered-dose inhaler; PRN: as needed; SABA: short-acting beta 2-agonist; SAMA: short-acting anticholinergic; SMI: soft mist inhaler; VA/DoD: Department of Veterans Affairs/Department of Defense

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Table 2. Antibiotic Choices and Recommended Doses for Acute Exacerbations of COPD [1,2]

Antibiotic	Recommended Oral Dose
doxycycline	100 mg PO every 12 hrs
trimethoprim/sulfamethoxazole	1 DS tab PO every 12 hrs
Second generation cephalosporins: cefuroxime cefprozil	 250-500 mg PO every 12 hrs 500 mg PO every 12 hrs
amoxicillin	500-875 mg PO twice daily
amoxicillin/clavulanate	875 mg PO every 12 hrs
azithromycin	500 mg PO day 1, then 250 mg daily x 4 days
Fluoroquinolones:* levofloxacin moxifloxacin	 500 mg PO daily 400 mg PO daily

*Reserve use for patients with severe disease or specific risk
Abbreviations: DS: double strength; hrs: hours; mg: milligram; PO: orally

Table 3. Information for Pharmacologic Agents for COPD, by Drug Class

Comments by Drug Class
Beta 2-agonists
• LABAs increase the risk of asthma-related death; do not use as monotherapy in asthma • May cause palpitations, chest pain, rapid heart rate, increased blood pressure, tremor, nervousness • Decreases in potassium levels have occurred • SABAs are used for acute treatment of bronchospasm, LABAs used for chronic treatment of bronchospasm • Formoterol and indacaterol: capsules are for oral inhalation only; capsules should not be swallowed; administer using supplied inhalation device only
Antimuscarinic Agents
• Use with caution in patients with narrow angle glaucoma, prostatic hyperplasia, or bladder neck obstruction • Caution patient to getting product in eyes; temporary blurred vision may result • For relief of dry mouth, suggest use of saliva substitute, practice of good oral hygiene, or rinsing of mouth after inhalation; instruct patient to take sips of water frequently, suck on ice chips or sugarless hard candy, or chew sugarless gum • Tiotropium: capsules are for oral inhalation only; capsules should not be swallowed; administer using supplied inhalation device only
Inhaled Glucocorticoids
• Rare instances of glaucoma, increased intraocular pressure, and cataracts have been reported • Advise patients to rinse mouth after inhalation to reduce risk of oral fungal infections (e.g., oropharyngeal candidiasis)

Table not intended as a comprehensive list of all warnings, precautions, and risks.

Note: Each drug class has agents available in a dry powder formulation. Dry powder formulations contain lactose and small amounts of milk proteins; do not use in patients with severe hypersensitivity to milk proteins.
Abbreviations: LABA: long-acting beta 2-agonist; SABA: short-acting beta 2-agonist

References

1. Sethi S, Evans N, Grant BJ, Murphy TF. New strains of bacteria and exacerbations of chronic obstructive pulmonary disease. *N Engl J Med.* Aug 15 2002;347(7):465-471.
2. Lexi-comp online. Lexi-Comp, Inc. Accessed 2014.