

Table 22.1 Medications Used in Respiratory Rehabilitation

Medication	Indications	Dosing, onset, and duration	Side effects affecting rehab	Other side effects or considerations
Short-acting beta-2 agonists				
Albuterol (Ventolin) Pirbuterol (Maxair) Levalbuterol (Xopenex)	Used as rescue therapy for acute symptoms of shortness of breath.	1-2 puffs every 4-6 h as needed. Onset is immediate; lasts 3-4 h.	Cog: ++ S: 0 A: ++ Motor: ++ D: + Com: 0 F: ++	Tachycardia, arrhythmia, nervousness, anxiety, insomnia, hallucinations, dizziness, tremor, increased blood pressure, paradoxical bronchospasm, hypokalemia, muscle pain, cough. Avoid combining with other sympathomimetics such as the decongestants pseudoephedrine and phenylpropanolamine; may potentiate side effects. May be helpful before physical exercise to control symptoms; keep on hand during exercise.
Long-acting beta-2 agonists				
Formoterol (Foradil) Salmeterol (Serevent)	Used for continuous bronchodilation to prevent acute symptoms of shortness of breath.	1 puff inhaled every 12 h. Delayed onset of at least 2 h; use as scheduled doses in maintenance therapy, not as rescue inhaler for immediate effects.	Cog: ++ S: 0 A: ++ Motor: ++ D: + Com: 0 F: ++	Tachycardia, arrhythmia, nervousness, anxiety, insomnia, hallucinations, dizziness, tremor, increased blood pressure, paradoxical bronchospasm, hypokalemia, muscle pain, cough. Avoid combining with other sympathomimetics such as the decongestants pseudoephedrine and phenylpropanolamine; may potentiate side effects.
Short-acting anticholinergics				
Ipratropium bromide (Atrovent)	Used as bronchodilator with beta-2 agonist to enhance bronchodilator effects.	2-4 puffs every 6 h. Delayed onset makes this less desirable for rescue inhaler; beta-2 agonist is preferred for immediate treatment of acute symptoms. May be combined with short-acting beta-2 agonists.	Cog: + S: 0 A: ++ Motor: + D: + Com: 0 F: +	Tachycardia, nervousness, paradoxical bronchospasm, dry mouth, nausea, vomiting, tremor, sinus irritation. Avoid combining with other anticholinergics such as antihistamines that potentiate dry mouth and sympathomimetics that can potentiate tachycardia and nervousness.
Long-acting anticholinergic				
Tiotropium (Spiriva)	Used for continuous bronchodilation to prevent acute symptoms of shortness of	1-2 puffs every 24 h. Delayed onset of at least 2 h; use as scheduled doses in	Cog: + S: 0 A: ++ Motor: + D: + Com: 0	Tachycardia, nervousness, paradoxical bronchospasm, dry mouth, nausea, vomiting. Avoid combining with other anticholinergics such as antihistamines that potentiate dry mouth and sympathomimetics that can potentiate tachycardia and nervousness.

From L. Carl, J. Gallo, and P. Johnson, 2014, *Practical Pharmacology in Rehabilitation: Effect of Medication on Therapy* (Champaign, IL: Human Kinetics).

Medication	Indications	Dosing, onset, and duration	Side effects affecting rehab	Other side effects or considerations
	breath.	maintenance therapy, not as rescue inhaler.	F: +	
Corticosteroids				
Combination steroids and long-acting bronchodilators for inhibition: Fluticasone–salmeterol (Advair) Budesonide–formoterol (Symbicort) Mometasone–formoterol (Dulera)	Used to reduce chronic inflammation in air passages and improve oxygen and carbon dioxide exchange; combined with long-acting beta-2 agonist therapy to reduce inflammation and prevent shortness of breath.	1-2 puffs twice/day. Inhaled administration preferred and effective only when used on scheduled basis.	Cog: + S: 0 A: + Motor: + D: + Com: 0 F: +	Side effects are minimized with inhaled use instead of oral steroids. Always rinse out the mouth after inhaled steroid administration to reduce the risk of mouth infections.
Oral Steroids: Prednisone, methylprednisolone	Used for short-term treatment of acute exacerbations.	Dose every other day rather than every day when possible to reduce adrenal gland suppression and associated symptoms.		Personality changes, insomnia, euphoria, muscle weakness or wasting, thinning of the skin, glaucoma, hyperglycemia, cataracts, depression of immune function, lipodystrophy (e.g., moon facies, truncal obesity). Avoid abrupt discontinuation of long-term or high-dose oral therapy; may cause severe depression and acute adrenal insufficiency.
Parenteral steroids: Methylprednisolone dexamethasone	Used for short-term treatment of acute exacerbations.	Treat with lowest effective dose; parenteral steroids are used only on a short term emergency basis.		
Leukotriene inhibitors				
Zafirlukast (Accolate)	Used to reduce inflammation of air passages by inhibiting effects of leukotrienes, improving oxygen and carbon dioxide.	20 mg twice/day, either 1 h before or 2 h after meals. Onset is delayed and requires chronic dosing. Dose every 12 h to reduce chronic	Cog: ++ S: ++ A: ++ Motor: + D: ++ Com: + F: +	Sleep disorders, behavioral changes. Most common: Sinusitis, nausea, pharyngolaryngeal pain. Common: Fever, headache, pharyngitis, cough, abdominal pain, diarrhea. Less common: Agitation, aggressive behavior or hostility, anxiousness, depression, disorientation, dream abnormalities, hallucinations, insomnia, irritability, restlessness, somnambulism, suicidal thinking and behavior, vasculitis paresthesias, swelling

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		inflammation; do not use on intermittent basis.		of the sinuses. May increase levels of theophylline, cimetidine (Tagamet), amiodarone (Cordarone), and fluconazole (Diflucan). Monitor liver enzymes to monitor for rare instances of hepatotoxicity. Monitor for changes in behavior.
Montelukast (Singulair)	Used to reduce inflammation of air passages by inhibiting effects of leukotrienes; used on chronic basis to reduce inflammation associated with asthma, allergic rhinitis, and chronic obstructive pulmonary disease; can be used on as-needed basis for acute symptoms of allergic rhinitis or as a preventative for bronchospasm in asthmatic patients.	10 mg/day. Onset is 2 h. When used to prevent exercise-induced asthmatic symptoms, take 2 h before exercise.	Cog: ++ S: ++ A: ++ Motor: + D: ++ Com: + F: +	Sleep disorders, behavioral changes. Most common: Sinusitis, nausea, pharyngolaryngeal pain. Common: Fever, headache, pharyngitis, cough, abdominal pain, diarrhea. Less common: Agitation, aggressive behavior or hostility, anxiousness, depression, disorientation, dream abnormalities, hallucinations, insomnia, irritability, restlessness, somnambulism, suicidal thinking and behavior, vasculitis paresthesias, swelling of the sinuses. No known drug interactions.
Zileuton (Zyflo, Zyflo CR—sustained release)	Used to reduce inflammation of air passages by inhibiting effects of leukotrienes, improving oxygen and carbon dioxide; also used 2 h before exercise to prevent exercise-induced asthma and for acute treatment of allergic rhinitis.	600 mg 4 times/day with meals and at bedtime. Zyflo CR: 1200 mg twice/day. Onset is 2 h. Short-acting product lasts 6 h; long-acting product lasts 12 h. Use on scheduled, not intermittent, basis.	Cog: ++ S: ++ A: ++ Motor: + D: ++ Com: + F: +	Sleep disorders, behavioral changes. Most common: Sinusitis, nausea, pharyngolaryngeal pain. Common: Fever, headache, pharyngitis, cough, abdominal pain, diarrhea. Less common: Agitation, aggressive behavior or hostility, anxiousness, depression, disorientation, dream abnormalities, hallucinations, insomnia, irritability, restlessness, somnambulism, suicidal thinking and behavior, vasculitis paresthesias, swelling of the sinuses. Can increase levels of warfarin (Coumadin), propranolol (Inderal), and theophylline.
Theophylline				

Medication	Indications	Dosing, onset, and duration	Side effects affecting rehab	Other side effects or considerations
Theophylline (Theo-24—sustained release, Theo-Dur—sustained release)	Methylxanthine used to improve respiratory muscle function, stimulate the respiratory center, promote bronchodilation, and reduce inflammation; may also improve contractility of diaphragm muscle in patients with COPD.	Theo-24: Once/day. Theo-Dur: Twice/day. Sustained-release products: Onset is 4 h; lasts 12-24 h.	Cog: ++ S: ++ A: ++ Motor: ++ D: + Com: + F: ++	Levels <20 mg/L: Diarrhea, irritability, tachycardia, restlessness, tremors of fine skeletal muscle, and transient diuresis may occur. Levels >20 mg/L: Life-threatening arrhythmias and seizures may occur. Take product on consistent basis with meals or fasting. Not effective in treatment of acute bronchospasm. Adjust dosing to maintain levels of 5-10 mg/L; recheck blood levels with addition of new medications listed in table 22.2.
Theophylline and aminophylline liquid immediate release		Immediate-action products: Onset is 2 h; lasts 6 h.		
Theophylline intravenous infusion		Immediate-action products: Onset is 2 h; lasts 6 h.		

Mucolytics

Acetylcysteine (Mucomyst) 10%-20% solution	Used to break up mucus to facilitate removal by coughing or suction.	Administered by nebulizer or tracheal installation 3-4 times/day.	Cog: 0 S: 0 A: 0 Motor: 0 D: + Com: 0 F: 0	Stomatitis, rhinorrhea, nausea. Respiratory irritant that can result in bronchospasm; administer with bronchodilator to counter bronchospasm.
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Expectorants

Guaifenesins (Robitussin—immediate-acting liquid, tablets, dissolving granules, capsules; Mucinex—extended-release tablet)	Used to thin mucus in air passages to make it easier to cough up mucus and clear airways.	Immediate-release product: Take every 4 h as needed. Extended-release product: Take every 12 h.	Cog: 0 S: 0 A: 0 Motor: 0 D: + Com: 0 F: 0	Headache, nausea, vomiting.
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Cog = cognition; S = sedation; A = agitation or mania; Motor = discoordination; D = dysphagia; Com = communication; F = falls; COPD= chronic obstructive pulmonary disease.

The likelihood rating scale for encountering the side effects is as follows: 0 = Almost no probability of encountering side effects. + = Little likelihood of encountering side effects. +/++ = Low probability of encountering side effects; however, probability increases with increased dosage. ++ = Medium likelihood of encountering side effects. +++ = High likelihood of encountering side effects, particularly with high doses. ++++ = Highest likelihood of encountering side effects; best to avoid in at-risk patients.