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Health Matters

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Optimizing Use of Inhaled Medications in COPD
(Chronic Obstructive Pulmonary Disease)

Proper use of inhalers is essential for adequate delivery of the medication to the site of action in the lungs. Despite the importance of proper technique, many patients still make errors in using inhaler devices. GOLD (Global Initiative for Chronic Obstructive Lung Disease) 2017 guidelines report **more than two thirds** of patients make at least one error when using an inhaler device.[1]

Consequences of improper inhaler use include:

- inadequate symptom control & increased exacerbations
- increased risk of side effects (such as oral thrush from inhaled corticosteroids or increased systemic side effects from medication deposited in mouth and swallowed)
- unnecessary increases in dose or addition of medications (See below the step-wise management of COPD based on 2008 Canadian Thoracic Society guidelines).[2]

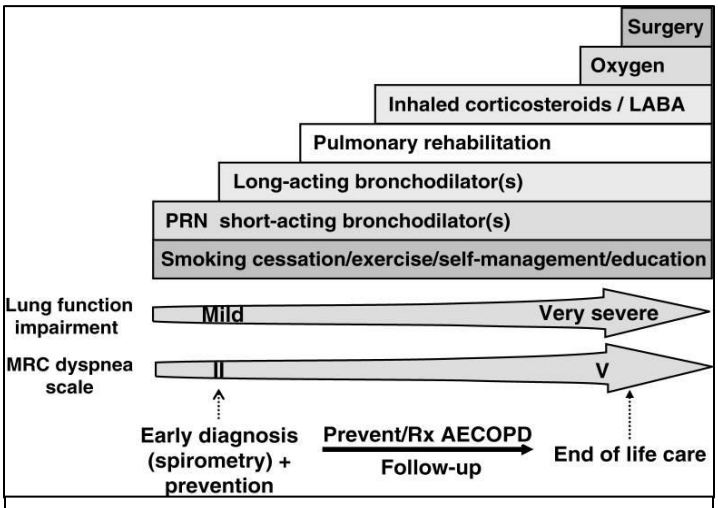

Image: *Canadian Thoracic Society* - COPD Recommendations – 2008 Primary Care Update[2]

Before progressing to a subsequent step, inhaler technique should be assessed to determine if intensification of therapy is truly required or if incorrect technique more likely accounts for lack of disease control. In the latter case, switch the inhaler to a more suitable device or provide further training on technique. While inhaled corticosteroids (ICS) may reduce exacerbations and symptoms in severe COPD, they increase the risk of pneumonia.[1] Thus it is imperative to ensure the patient is using their current long-acting bronchodilator inhaler(s) correctly before adding an ICS (ICS is always used with a LABA [long-acting beta2 agonist] in COPD), to avoid exposing the patient unnecessarily to an increased risk of pneumonia.

Categories of inhalers available include metered dose inhalers (MDI), soft mist inhalers (SMI: *Respimat*) and dry powder inhalers (DPI: *Diskus, Turbuhaler, HandiHaler, Breezhaler, Ellipta & Genuair*). In general, common errors in use of inhalers include[1]:

- Inadequate exhalation before inhaling dose- the patient should breath out fully away from the device prior to inhalation
- Not holding breath after inhalation- the patient should hold breath for 5-10 seconds after inhaling the dose otherwise some medication will be lost from breathing out right away
- Incorrect rate of inhalation- DPI require a forceful, deep inhalation, while SMI & MDI work best with a slow, deep inhalation
- Improper coordination of dose actuation and breath- a concern with MDI & to a certain extent SMI, but not DPI

Errors may be due to inadequate training on correct technique or comorbidities that make it difficult for the patient to use the device properly. Such health concerns can include cognitive impairment, arthritis, or lack of adequate inspiratory force (i.e. not able to produce a strong enough inhalation). It has not been shown in randomized controlled trials that one inhalation device is better than others.[1] The best device is one that a patient is able to use properly.

The following chart compares lung vs. oropharyngeal deposition (as a percentage of administered dose) for the various inhalers as per *Fink et al.*[3] It is desirable to have a high lung (>20%) and low oropharyngeal deposition. There can be variation in the deposition percentages achieved with each device depending on technique. A device that is more efficient in achieving high lung deposition is not necessarily better for disease control, as this would be accounted for in the initial dose given. For example, *Spiriva HandiHaler* (DPI) has a lower lung deposition and uses a dose of tiotropium 18 mcg daily, whereas *Spiriva Respimat* (SMI) has a higher lung deposition and thus uses a lower dose of tiotropium 5 mcg (2 x 2.5mcg) daily. For more detailed information on the specific features and instructions for use for the various inhalers please refer to the September 2015 newsletter and/or the product monographs.

Inhaler Device	Deposition % (3)		Comments
	Lung	Oro-pharynx	
Nebulizer	6-20%	10-20%	-Low lung deposition as aerosol is continually produced; only reaches lungs when patient inhales (significant loss to external environment). -Current guidelines state there is no benefit of nebulizer over other inhaler devices if the patient able to use the device correctly. -Useful for those with very low inspiratory flow, the very young, the very old, or patients in severe respiratory distress.
MDI	4-55%	30-85%	-Medication released as a spray over 0.2 seconds, so must closely coordinate inhalation with dose actuation. -Using MDI with a spacer greatly decreases oropharyngeal deposition and reduces the need for “coordination”.
DPI	10-40%	50-80%	-Adequate inspiratory force is needed to deliver the dose from the inhaler to the lungs and it can be difficult to determine which patients are capable of this (advanced age & disease severity may correlate to poorer inspiratory force). Thus, it is advantageous to have a DPI with a feedback mechanism indicating the full dose was received.
SMI	46-57%	15-24%	-Medication released as soft mist over 1.5 seconds, so does not require as much coordination between dose actuation & breath as MDI

Overview of Inhalation Devices for COPD:

Adapted based on RxFiles COPD Drug Comparison[4] & Lung Association Respiratory Medications[5]

SABA (Short-acting Beta2 Agonist)	**SAMA** (Short-acting Muscarinic Antagonist)	**LAMA** (Long-acting Muscarinic Antagonist)	**LABA** (Long-acting Beta2 Agonist)	**LAMA+ LABA**	**ICS** (Inhaled Corticosteroid)+ **LABA**
Ventolin salbutamol  MDI	Atrovent ipratropium  MDI	Spiriva tiotropium  HandiHaler (DPI)/ Respimat (SMI)	Serevent Salmeterol  Diskus (DPI)	Inspiolto tiotropium + olodaterol  Respimat (SMI)	Advair fluticasone propionate + salmeterol  Diskus (DPI)
Bricanyl Terbutaline  Turbuhaler (DPI)		Seebri glycopyrronium  Breezhaler (DPI)	Onbrez indacaterol  Breezhaler (DPI)	Ultibro glycopyrronium + indacaterol  Breezhaler (DPI)	Symbicort budesonide + formoterol  Turbuhaler (DPI)
SAMA+ SABA		Tudorza aclidinium  Genuair (DPI)	Foradil formoterol  Aerolizer (DPI)	Duaklir aclidinium + formoterol  Genuair (DPI)	Breo fluticasone furoate + vilanterol  Ellipta (DPI)
Combivent ipratropium +salbutamol  Respimat (SMI)		Incruse umeclidinium  Ellipta (DPI)		Anoro umeclidinium + vilanterol  Ellipta (DPI)	

References:

1. Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2017. Available from: http://goldcopd.org.
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3. Fink JB, Colice GL, Hodder R. Inhaler Devices for patients with COPD. *COPD 2013;* 10:523-535.
4. Crawley A, Jensen B, Regier L. COPD Drug Comparison Chart. RxFiles. Mar 2017
5. The Lung Association. Respiratory Medications Currently Available in Ontario. Available at https://www.on.lung.ca/pcap-intranet/asthma-and-copd-medication-table