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EC PULMONOLOGY AND RESPIRATORY MEDICINE

Review Article

Inhalers and Asthma

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Received: December 24, 2024; **Published:** February 13, 2025

Abstract

We have three categories of inhalers for asthma and COPD: Dry powder inhaler (DPI), pressurised meter dose inhalers (PMDI), and nebulizer.

PMDI is the most important: However mastering Inhaler technique is crucial, use of spacer make it better than DPI and nebulizer for severe attacks and in children under 5 years.

The discovery of pMDI in 1956 changed lives of asthma patients. pMDI becomes first line method of treatment for asthma, pMDI helped to deliver the inhaled medication directly to airways. Avoiding side effects of systemic treatment.

We can reduce the need of OCS if we optimize asthma care as following: good inhaler technique, adherence to ICS-LABA daily treatment in moderate and severe asthma.

Also in GINA track 1 the use of as needed anti-inflammatory reliever (ICS-Formoterol), was proved to reduce the risk of exacerbation requiring OCS when compared to as needed SABA reliever alone. SABA Reliever alone should only be used in case there is no access to ICS, because it leads to a higher risk of morbidity and mortality.

Unfortunately, in many LIC we treat only with SABA as needed and OCS [3,5]. We need a WHO resolution for ICS to be available for all, like which was done for Diabetes.

Inhaler recycling programs should be established to reduce environmental harm of inhalers. And consider to prescribe higher strength puffs, which should permit lower numbers of puffs.

Keywords: *Dry Powder Inhaler (DPI); Pressurised Meter Dose Inhalers (PMDI); Nebulizer; Asthma*

History of Inhaled therapy for asthma

The famous Greek physician, Hippocrates (460-377 BC), describes a device for enabling the inhalation of various vapors for the treatment of a number of diseases. It was composed of a pot with a lid which had a hole through which a reed was placed to permit the inhalation of vapors. These vapors generated from herbs and resins were inhaled through the reed after being boiled in vinegar and oil [1].

The first reported in the literature on aerosol-therapy, was the ancient Egyptian papyrus scroll (Ebers papyrus) in 1554 BC, which purportedly was discovered between the legs of a mummy in the Assassif district/Theban necropolis [1] papyrus reported that patients

were comforted after inhalation of the vapor formed when black henbane (*Hyoscyamus niger*) plants were placed onto hot bricks. After placing the herbs onto the stone, a jar with a hole was placed over the herbs and the patient inhaled the fumes through a stalk of reed that was placed into the hole. The instructions consisted of collecting 7 stones and heat by the fire [1], it was an atropine effect.

In 1025 AD, the Persian physician, Avicenna, reported the use of opium for a variety of medical purposes, including treatment of severe cough. Methods of administration, included smoking and nasal inhalation. Avicenna stressed on the toxicity of opioids and discouraged their use except if there is non other remedy' [1]. In this case he recommended to monitor the pulse of the patient to detect overdosing.

Asthma aerosol-therapy was described by Indian physicians, Charaka and Sushruta, dating back to 600 BC. They gave detailed instructions for preparing herbal remedies, including Datura that could be smoked in a pipe to treat asthma attacks" [1].

Dry powder inhaler (DPI) was invented in 1889 to trait many cases including nasal and pulmonary symptoms. Newton recommended potassium chlorate powders to treat lung diseases with DPI, unfortunately it was not successful, because potassium chlorate was lung irritant.

Pressurized meter dose inhaler (PMDI) was introduced in 1956. In April of 1955, a young girl named Susie Maison was displeased with her squeeze bulb nebulizer that she used to treat her asthma and asked her father, George Maison, MD, President of Riker Laboratories, the question, "Daddy, why can't they put my asthma medicine in a spray-can like they do hair spray?" This deep question highlighted the opportunity of new innovative inhaler treatment, the pressurized meter-dose inhaler (pMDI).

The discovery of pMDI changed lives of asthma patients [1]. pMDI becomes first line method of treatment for asthma, pMDI helped to deliver the inhaled medication directly to airways. Avoiding side effects of systemic treatment.

Inhalers gave the opportunity to control asthma. and enable patients to enjoy daily normal active life [2-4].

The discovery of pMDI inhalers in 1956, had been a relief and promise of new life for asthma patients and their families.

Before that, it was oral corticosteroids resulting in cushing, obesity, osteoporosis, cataract, hypertension, psychiatric and mood change [2-4].

We can reduce the need of OCS if we optimize asthma care as following: good inhaler technique, adherence to ICS-LABA daily treatment, also in GINA track 1 the use of as needed anti-inflammatory reliever (ICS- Formoterol) (AIR), this was proved to reduce the risk of exacerbation requiring OCS when compared to as needed SABA reliever alone [3-6]. SABA Reliever alone should only be used in case there is no access to ICS.

According to GINA we recommend the same treatment for adults and adolescents 12years and older [3].

Unfortunately, in many LIC we treat only with SABA as needed and OCS [3,5]. We need a WHO resolution for ICS to be available for all, like which was done for diabetes [3-8].

What we have as inhalers

We have pMDI, DPI. But PMDI is the practical best choice, because if we use spacer (Aero chamber) we can give it to children under5 and in the emergency room replacing nebuliser, which is not the case for DPI, and more interesting we can use a plastic bottle to make a spacer when aero-chambers are not available, like in many developing countries [3,8].

Medications delivered

Preventers: For long term daily treatment

First of all, inhaled corticosteroids (ICS): Beclomethasone, fluticasone, budesonide, mometasone, ciclesonide. At low, middle and high doses.

We can combine it to long acting Beta2 agonists (LABA): Salmeterol and formoterol, this way we will have better therapeutic outcomes, and this way we can use middle dose of ICS instead of high dose for daily treatment in severe uncontrolled asthma to avoid side effects of corticoids at high dose ICS [3,4,8].

And relievers

Short acting beta2 agonists SABA, ICS combined to formoterol which is short and long acting beta 2 agonist [9]. We should keep on mind that, ICS/formoterol reliever is superior to SABA reliever in moderate and severe asthma [3].

What to take as home message

Reversibility test and bronchial provocation, after inhaler of SABA for the first and acetyl choline for the second are important for asthma diagnosis [3,9].

According to GINA same treatment for adults and adolescents 12 years and older.

GINA track 1: Steps 1+2 mild asthma is treated with low dose ICS-Formoterol as needed (AIR).

Which lead to asthma control, non-inflammation, reduce severe exacerbations compared to SABA alone, it cannot be done with other ICS-LABA because only formoterol have short and long action. Step 3: give low dose ICS-Formoterol: Morning and evening then as needed (Maintainer and reliever therapy MART). If symptoms every day, or smoking, or recent exacerbation or waking at night by asthma. Step 4 give daily and as needed medium dose ICS-Formoterol. For step 5, you could give high dose ICS with LABA and refer to specialist.

GINA track 2: GINA recommend against SABA only since 2019. New recommendations are for mild asthma to take ICS with SABA as needed and never SABA alone which will impact on bad control and mortality [2].

ICS/formoterol reliever is superior to SABA reliever in moderate and severe asthma. ICS/formoterol reliever is superior to SABA reliever whatever is the step of asthma severity [3] when ICS/LABA are taken together with the same maintenance and reliever dose. In moderate and severe asthma, they reduce the risk of severe exacerbation by 32% (risk ratio (RR) 0.68, 95% CI 0.58 to 0.80) compared to SABA reliever [3,8].

We have three ways of inhalation: Dry powder inhaler (DPI), PMDI, and nebulized.

PMDI is the most important: Doses, inhaler technique, spacer make it better than nebulizer.

DPI could not be used for in children less than 5 neither for severe attacks [3].

Technique of inhaler for PMDI [10] is to be cheque several times, even by WhatsApp's video exchange [7] use of spacer or plastic bottle if the patient could not master the technique [3,4,8,10]. The inhaler technique questionnaire (InTeQ): Has been validated [10].

Technique of pMDI [10]:

- Shake the inhalers
- Breathe out fully before use

- Always Close lips tightly around the mouthpiece
- Breathe in deeply through the mouthpiece while pressing inhaler
- Hold breath for at least 10s after breathing
- Breathe out very slowly after use
- Repeat after 2 minutes.

Side effects: ICS high doses could give systemic corticosteroids side effects, including mood change and other mental issues [2,3,11].

Especial cases [3]

Cough variant asthma is treated like asthma by ICS and could need OCS too.

In pregnant women we can use inhalers, preferably non LABA, but ICS and SABA.

If allergic rhinitis with asthma give nasal corticosteroids inhalers.

Two puffs of SABA combined to ICS before exercise if exercise induced asthma.

Consider co-morbidities.

Finally: It is of concern to report the reality, that asthma pMDI are contributing to air pollution. More CO_2, and global warming [12,13].

The carbon dioxide (CO_2) equivalent of prescribed inhalers in the UK in 2019 alone was estimated to exceed 1.3 megatons. However, although chlorofluorocarbons in medical inhaler devices were replaced by hydrofluoroalkanes in the 1990s, hydrofluoroalkanes still have a global warming potential (GWP) of over 1000 times more than that of CO_2. There is a worldwide initiative to phase out the production of hydrofluoroalkanes and to find alternative compounds [12,13].

Environmental impact has to be considered in evaluations of medical programs and health technologies. Calculations of harm must include the entire product lifecycle from production to disposal. Manufacturers of inhalers are required to report systematically on environmental effects, especially on carbon emissions, and to advice patients on safe disposal of used devices. Inhaler recycling programs are recommended. Research is requested to design new inhalation devices, for patients who are not able to benefit from available dry-powder inhalers, such as young children and the elderly. Research is before all needed to develop less pollutant inhalers.

Finally, we highlight, asthma is a common chronic disease that is estimated by the Global Burden of Disease collaboration in 2019 to affect 262 million people worldwide. Asthma is causing a concerning burden of disease, either for premature death or reduced quality of life, in all people around the world. Universally, asthma is mentioned as the 24th cause of years lived with disability and 34th leading cause of burden of disease, as cited by disability adjusted life years (DALYs). Asthma continues to be a major source of global economic burden in terms of both direct and indirect costs. Strategies to make asthma inhalers (ICS, LABA, SABA) available for all asthma patients, and adherence to daily preventive therapies, will be effective in reducing the economic burden of asthma in both developed and Low-Middle income countries. About 1000 people per day die from asthma. These fatalities are of serious concern because many of them are preventable. Although age-specific asthma mortality rates have fallen in many countries over the last decade, the number of deaths certified as asthma has changed little, due to ageing of the population. Avoidable asthma deaths are still occurring due to inappropriate management of asthma, including over-reliance on reliever medication, rather than preventer medication, and this needs to be rectified. Effective treatments for asthma are often unavailable or unaffordable Many governments have overlooked asthma in their plans to address non-communicable diseases (NCDs) and have made little progress in improving access to asthma management and medicines, especially the ICS crucial for the long-term control of asthma [4].

Conclusion

All adolescents and adults with asthma should receive a combination inhaler: Inhaled corticosteroids (ICS) and rapid onset of action long-acting beta2-agonist (LABA) such as budesonide-formoterol), where available, to be used either as-needed (for mild asthma) or as both maintenance and reliever therapy, for moderate to severe asthma; Inhaled short acting beta2 agonists (SABA) alone is not recommended as it leads to a higher risk of morbidity and mortality. It should only be used where there is no access to ICS [8].

Finally, we should stress on the following: Calculations of harm must include the entire product lifecycle from production to disposal. Inhaler recycling programs should be established to reduce environmental harm of inhalers. And consider to prescribe higher strength puffs, which should permit lower numbers of puffs [13].

Bibliography

1. Stein SW and Thiel CG. "The history of therapeutic aerosols: a chronological review". *Journal of Aerosol Medicine and Pulmonary Drug Delivery* 30.1 (2017): 20-41.
2. Asthma. WHO.
3. Global Initiative for asthma.
4. The Global Asthma Report. *International Journal of Tuberculosis and Lung Disease* 26.1 (2022): S1-S104.
5. Global Alliance against Chronic Respiratory Diseases (GARD). WHO.
6. Mortimer K., *et al*. "Asthma management in low and middle income countries: case for change". *European Respiratory Journal* 60.3 (2022): 2103179.
7. Mohammad Y., *et al*. "Improving the quality of hospital care provided for asthma out-patients in a country in turmoil: a report from Syria". *Journal of Thoracic Disease* 11.3 (2019): 1047-1055.
8. S Jayasooriya., *et al*. "Clinical standards for the diagnosis and management of asthma in low- and middle-income countries". *International Journal of Tuberculosis and Lung Disease* 27.9 (2023): 658-667.
9. Beasley R., *et al*. "The evidence base for ICS/formoterol maintenance and reliever therapy in severe asthma". *European Respiratory Journal* 63.6 (2024): 2400523.
10. Catalina Lizano-Barrantes., *et al*. "The Inhaler Technique Questionnaire (InTeQ): Development and Validation of a Brief Patient-Reported Measure". *International Journal of Environmental Research and Public Health* 19.5 (2022): 2591.
11. F A Stuart., *et al*. "Adverse psychological effects of corticosteroids in children and adolescents". *Archives of Disease in Childhood* 90.5 (2005): 500-506.
12. Mark L Levy., *et al*. "Inhalers and air pollution: Global access and patient safety in the transition to environmentally friendly respiratory inhalers: the Global Initiative for Asthma perspective". *The Lancet* 402.10406 (2023): 1012-1016.
13. Will D Carroll., *et al*. "Saving our planet: One puff at a time". *The Lancet. Respiratory Medicine* 10.5 (2022): e44-e45.

Volume 14 Issue 3 March 2025