Primary Care Respiratory Society UK - Opinion No.20

Opinion

Inhaler devices

A range of inhaled drugs, both bronchodilators and inhaled corticosteroids (reliever and controller/preventer drugs respectively) are licensed for use in the United Kingdom.

Traditionally, inhaler devices are classified as follows:

i) **Pressurised Metered Dose Inhalers (pMDIs)***
   - Press and breathe inhalers
   - Breath actuated inhalers
   - pMDI used in combination with small and large volume spacer devices

ii) **Dry Powder inhalers (DPIs)****
   - Single dose inhalers
   - Multidose inhalers

iii) **Nebulisers** (not dealt with in this opinion sheet)

Given the evidence on the difficulty and varying ability of patients and health professionals in mastering inhaler technique, a more practical classification,[1] could divide inhalers into "Inhalation-Independent" Aerosol Devices (those marked with * and the Soft Mist Inhalers eg the Respimat) and "Inhalation-Dependant" Aerosol Device (marked with **).

For inhaled medication to reach the airways:

i) The drug needs to be delivered from an inhaler device in a format suitable for inhalation and deposition in the lungs; and

ii) The person taking the medication must be able to use the inhaler device effectively.

The least-cost effective inhaler device is the one that patients cannot use. In deciding which device and drug formulation to prescribe: determine the patient's ability to use the prescribed device correctly.

Many people cannot use inhalers optimally, particularly in the case of pMDIs,[1-7] therefore specific instructions for each device are necessary.

Inhaler use assessment checklist
[see also http://www.admit-online.info/]

- Able to prepare the device for use?
- Adopts correct posture?
- Exhales fully (away from device) before use?
- Demonstrates appropriate effort and duration of inhalation for the particular device? Holds breath for 10 seconds after inhalation?

Checking inhaler technique

While the general method for using each group of inhaler devices is similar (slow inhalation for pMDIs, and forceful for DPIs), clinicians should familiarize themselves with the features and instructions on the manufacturers Summary of Product Characteristics (SPC) and patient information leaflet (PIL) for each device/drug prescribed.[8] When prescribing a new inhaler, or reviewing patients progress, inhaler technique should be demonstrated by the clinician, followed by the patient - many people forget how to use them, and this is likely to affect clinical outcomes.[1,9,10]

The patients' ability to inhale at the appropriate rate for a device can be assessed by using the In-Check® device. There are a range of teaching aids available including the Vitalograph AIMS® machine or the 2 Tone® Trainer for pMDI[11,12,13] and the Mag-flo® for DPIs.

Inhaler device characteristics

The term 'aerosol' is broadly applied to any suspension of solid or liquid particles in a gas, usually air. Particle diameters may range from about 0.001 to about 100 micrometres.

Two key factors influence what proportion of the dose will reach the lungs:

- **Size:** Large particles will be deposited in the mouth and throat; very small ones (under 0.5 microns[14]) will be exhaled without ever getting to the airways.
- **Speed:** Inhaling too fast through any inhaler results in greater unwanted deposition in the upper airways.

An important characteristic of all inhaler devices is its internal resistance. Devices such as spacers and pMDIs have a low internal resistance that allows air to flow through them with very little difficulty. Other devices, such as some of the DPIs, have a high internal resistance.

To maximise lung deposition and minimise upper airway loss, the patient should be encouraged to inhale with appropriate effort for the resistance of each device. For example, the low-resistance pMDI requires a slow inhalation speed - so the patient should be encouraged to inhale very gently. High-resistance DPIs deliver more drug to the lungs at faster respiratory flows - so a strong and forceful inhalation should be encouraged.

The change from CFC propellants to HFA formulations in pMDIs and BA pMDIs raises several issues. Some HFA formulation products produce ultra-fine aerosol particles, resulting in greater lung deposition and less oropharyngeal deposition. Therefore, all beclometasone inhalers must be prescribed by brand name as a lower dose is required in the case of Qvar® and Fostair®).

Some pMDI formulations include alcohol, and this is clearly important knowledge when prescribing for patients not wishing to ingest alcohol.[15]

Using a pMDI

As the emitted drug is delivered over just a fraction of a second, it is important that the patient starts inhaling **slowly, before** actuating the device. Inhalation rate is ideally around 30 litres per minute.

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pMDI inhalation technique
(read the PIL for each device)
[See also http://www.admit-online.info/]

- Remove cap and check mouthpiece is clear
- Shake inhaler and exhale fully
- Place inhaler in mouth, grip gently between teeth, and seal lips around it
- Start breathing in very slowly and deeply
- Then, just after starting to inhale, press the canister
- Continue to breathe in slowly and deeply
- Hold breath for 10 seconds
- Then exhale and place the cap back onto the inhaler device

Patients should be instructed to wait 30 seconds between doses, if they need to use their pMDI or BA pMDI twice. Most guidelines suggest the use of a spacer device where patients are unable to co-ordinate the use of a pMDI; this removes some of the larger particles, reduces the need for perfect timing and reduces potential side effects by reduced drug deposition in the throat.

Breath actuated pMDIs

Similar in many respects to a standard pMDI, these are helpful for patients unable to co-ordinate pressing the canister with inhaling. Release of aerosol from these devices only occurs when the patient achieves a minimum inspiratory flow rate through the mouthpiece (set at, or about, the ideal speed of inhalation for a pMDI). This device also ensures the patient starts breathing **before** drug is released.

- Autohaler
- Easibreathe

Soft Mist inhalers (SMIs)

Introduced in 2007, these devices use stored mechanical energy to force a solution of drug through two fine nozzles, creating a slow moving aerosol. Like the pMDI, the patient needs to coordinate inhaling and actuating the device, and as the aerosol duration is approximately 1.5 seconds, a slow inhalation technique is very important. The internal resistance of this device is low, so patients must be encouraged to inhale very gently.

- Respimat

Using a Dry Powder device

Drug emission from a dry powder device is wholly dependent on the inspiratory flow rate generated by the patient. Therefore a forceful inspiration is needed in order to ensure drug de-aggregation into respirable particles, to ensure release of the full measured dose, to achieve good lung deposition.

Lactose is frequently added to dry powder formulations to improve aerosolisation - and reducing the energy required for de-aggregation. Some patients can taste the lactose.

DPI inhalation technique
(read the PIL for each device)

- Prepare device according to manufacturers instructions
- Exhale fully (not into the inhaler)
- Place inhaler in mouth, grip gently between teeth, and seal lips around it
- Inhale forcefully and deeply until your lungs are full
- Hold breath for 10 seconds
- Then exhale and place the cap or cover back onto the inhaler device

Breath Actuated Dry Powder Inhalers (DPI)

Inhaling through DPI requires a forceful inspiration in order to ensure de-aggregation into respirable particles. An example, the Novoliser® only releases drug when the inspiratory flow rate is sufficient to ensure good de-aggregation occurs.

Dry Powder Devices

- Accuhaler
- Aerohaler
- Aeroliser
- Breezhaler
- Clickhaler
- Cyclohaler
- Diskhaler
- Easyhaler
- HandiHaler
- Pulvinal
- Spinhaler
- Turbohaler
- Twisthaler

Breath Actuated Dry Powder Device

- Novolizer

The emitted dose of drug is different to the nominal dose on the package and this in turn is different to the dose which reaches the lungs; the latter is very dependent upon the device/drug/patient interaction.

Useful Resource:

ADMIT website: http://www.admit-online.info/

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