Advanced Inhaler Technique

Learning Outcomes

• Describe the mechanism of different inhalers
• Explain how inspiratory flow can effect drug delivery for different inhalers
• Counsel a patient on the correct use of all inhalers
• Check a patient’s metered dose inhaler technique using the Aerosol Inhalation Monitor (AIM)
• Select the appropriate inhaler for a patient using the In-check device

Disclosure

Jon Bell:
Director of a commercial organisation that investigates inhaler devices and their use.
(Canday Medical Ltd.)

Jon Bell / Canday Medical Ltd. do not receive any remuneration or commission based on the use of products manufactured by other companies.

Belgian Chocolate, French Champagne and Inhaled Medication: Too Good To Waste?

……… in 2002

……… in 2010

Poster presentation at British Thoracic Society Annual Meeting, Winter Scientific Meeting British Thoracic Society 2010
From the hit TV Series House MD on Fox NBC. Video clip from Season 5 Episode 11 - when Dr. House asked patient how she uses her inhaler. http://www.youtube.com/watch?v=dMAS2S51bM8

**“Poor Technique”**

1. Lower than expected delivery to target site
2. Reduced benefits
3. Increased deposition in regions outside target site
4. Increased risk of side-effects

- Target site
- Unnecessary Waste

**“How would you inhale” challenge**

Quick test of how you would inhale through commonly-used devices
- pMDI measurement first
- DPI measurement second

Need to:
1. Simulate resistance of device
2. Measure speed of inhalation

How you would instruct the patient to inhale using that type of inhaler

Single measurement

Results later ......

**UK: MDI and DPI Inhalation technique:** inhalation too fast for pMDI, or too slow for DPI

<table>
<thead>
<tr>
<th>Inhaler</th>
<th>Too Fast</th>
<th>Too Slow</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDI</td>
<td>59.5 %</td>
<td></td>
</tr>
<tr>
<td>Accuhaler</td>
<td>4.9 %</td>
<td></td>
</tr>
<tr>
<td>Turbobuhaler</td>
<td>14.2 %</td>
<td></td>
</tr>
<tr>
<td>HandiHaler</td>
<td>57.0 %</td>
<td></td>
</tr>
</tbody>
</table>

163 COPD patients average age 72.5 years
FEV1 47.9% predicted

Initial presentation – before training


**What type of Inhaler is this?**

How does the aerosol get made?

**What type of Inhaler are these?**

How does the aerosol get made?
What type of Inhaler is this?
How does the aerosol get made?

What type of Inhaler are these?
How does the aerosol get made?

Mean resistance of various DPIs

How changes in inspiratory flow affect output

Fate of inhaled drugs – Good Technique

Fate of inhaled drugs – Poor Technique

Webpage:  http://www.aarc.org/education/aerosol_devices/
Adapted from Barnes et al. AJRCCM 1998;157:S1‐S53
How changes in inspiratory flow affect output

- Inspiratory flow
  - Low
  - High

<table>
<thead>
<tr>
<th>Aerosol made for you (e.g. DPI)</th>
<th>Inhalation creates aerosol (e.g. DPI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low inspiratory flow</td>
<td>Low inspiratory flow</td>
</tr>
<tr>
<td>High inspiratory flow</td>
<td>High inspiratory flow</td>
</tr>
</tbody>
</table>

Lung deposition from pMDIs is influenced by inspiratory flow

- Total lung deposition (% of inhaled dose)
  - Metered Dose Inhaler (MDI)
  - 30L/min
  - 10 second breath hold
  - 50% VC
  - 80% VC
  - 90L/min

- Metered Dose Inhaler (MDI)
  - 10 second breath hold
  - 20% VC
  - 50% VC
  - 80% VC

Aerosol Deposition at varying Particle Size

- Micron size
- Deposition

<table>
<thead>
<tr>
<th>Micron size</th>
<th>Deposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Pharynx/larynx/upper respiratory tract</td>
</tr>
<tr>
<td>5</td>
<td>Optimal tracheobronchial deposition</td>
</tr>
<tr>
<td>2</td>
<td>Optimal alveolar deposition</td>
</tr>
<tr>
<td>0.5</td>
<td>Particle Exhaled if &lt;0.5 micron</td>
</tr>
</tbody>
</table>

Lung deposition from Turbohaler is influenced by inspiratory flow

- Total lung deposition (% of inhaled dose)
- Drug

Spacer Devices – How they help

1. Capture aerosol avoiding coordination problems
2. Reduces particles deposited in oropharynx

Spacers
Lung deposition from HFA-Beclometasone provides equivalent lung deposition with or without add-on spacers


Please tell me the right inhalation technique for each of the inhalers below……

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Assessment & Training Devices
Monitoring inspiratory flow rate through the device

- Vitalograph’s Aerosol inhalation Monitor (AIM)
- Candey Medical’s 2-Tone” Trainer (www.2Tonetrainer.com)
- Allen & Hanburys’ Accuhaler Trainer
- Schering-Plough’s Twisthaler Trainer
- AstraZeneca’s Turbohaler Usage Trainer & Turbokesters
- Clement Clarke’s In-Check and In-Check DIAL
- Fyne Dynamic’s MagFlo

Isle of Wight Inhaler Technique Project – Strategy

1. Patients to receive consistent inhaler technique training from GPs, Nurses, Pharmacists etc.
2. HCPs to MEASURE patients ability to use inhaler (In Check DIAL)
3. Targeted patients for maximum early benefit
4. Following training, MDI patient to be supplied with a free 2Tone
5. Strategy employed across primary and secondary care
6. Directed MURs for CPs
7. Enhanced service (MUR plus) for children offered by CPs
8. Train a trainer, including outside NHS
9. Extend to Schools, care homes, housebound etc.

Aerosol produced for you – inhale GENTLY

Press and Breathe MDI

Spacer 29%
Spacer 33%
Mouth 29%
Lungs 53%
Lungs 45%
Lungs 51%
0 25 50 75
Deposition (% of inhaled dose)
P&B + Aerochamber P&B + Volumatic P&B Alone

You create aerosol – inhale FORCEFULLY
Baseline – Respiratory Medication status

- Annual spend: Inhaled corticosteroids > £1.7M
- Highest in Southern England
- Trend increasing

Outcomes – Respiratory Medication status

- 2007: Annual spend: Inhaled corticosteroids > £1.7M
- 2007: Highest in Southern England
- 2007: Trend increasing

Points to take away

1. **Internal resistance** affects speed of inhalation
2. Speed of inhalation affects DPI device **efficacy** (little effect on MDI)
3. Speed of inhalation and **particle size** affect how much drug is **deposited** in the lungs – and how much in the mouth and throat
4. Before initiating a new therapy, practitioners should check inhaler technique. Inhalation should be targeted** for a device that creates the aerosol for you (e.g. MDI), but **sustained** for those that rely on the energy of inhalation (e.g. DPI)
5. **NMR / CDS / MURs** and **Asthma Reviews** present unique opportunity to identify poor inhaler technique – but HCPs need to know good technique first!
6. Evidenced by IOW project: NICE reference: [http://tinyurl.com/6j9s5zv](http://tinyurl.com/6j9s5zv)

Outcomes – Effects on patients

- Data collected over 9 month period
- No other interventions took place in Respiratory Medicine

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