Competence thresholds for the use of inhalers in people with dementia

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Abstract

Methods: the ability to learn three inhaler techniques of increasing levels of complexity was studied in 50 normal and demented inhaler-naive elderly people (mean age 81 years) with stable 10-point mini-mental test scores (MTS). There were 10 subjects in each of the following groups: MTS 8-10 (non-demented), MTS 7 (borderline), MTS 6 (mild dementia), MTS 5 and MTS 4 (2 moderate dementia groups). The techniques were taught on one day and reassessed on the following day on consecutive days in ascending order of complexity.

Results: those with an MTS of 4 were unable to learn any of the techniques, while all the non-demented people could learn all three techniques. For the five-stage technique (standard metered dose inhaler) the 0% threshold (i.e. when none of the subjects was able to learn) was MTS 6, the 50% threshold (at least half but not all could learn) MTS 7 and the 100% threshold (all could learn) MTS 8. For the four-stage technique (inhaler with large spacer) the 0% threshold was MTS 5, the 50% threshold MTS 6 and the 100% threshold MTS 8. For the three-stage technique (inspiration-triggered inhaler) the 0% threshold was MTS 4, the 50% threshold MTS 5 and the 100% threshold MTS 7. Conclusions: MTS can be used to determine the likelihood of a mild or moderately demented patient being able to learn a multiple-stage inhaler technique.

Keywords: asthma, competence threshold, dementia, inhaler use

Introduction

Asthma is a common condition in old age, and elderly patients can benefit from appropriate therapy [1-4]. Some elderly subjects have difficulty using standard metered-dose inhalers [5-7], and those with significant cognitive impairment [mini-mental test score (MTS) 6/10 or less] are unable to master an adequate technique. Although recent work has confirmed that large-volume spacers improve inhaler technique and are generally preferred by older patients [8], the study did not include people with cognitive impairment. As dementia is a common condition, clinicians frequently face the problem of deciding how to deliver inhaled therapy to an elderly asthmatic patient with overt or borderline impairment of cognitive function. To shed some light on this uncertain area of therapy, I have explored the relationship between cognitive function and ability to learn to use inhaler devices of increasing levels of complexity in elderly subjects.

Subjects and methods

The subjects were 50 people (36 women) with a mean age of 81 years (range 73-98), attending day hospital (one patient), outpatient clinic (three patients) or inpatient rehabilitation (46 patients). All had stable reproducible MTS (defined as an identical score on two occasions a week apart immediately prior to being studied) [9]. All were able to read newspaper and hear a normal voice. Subjects were excluded if there was evidence of an acute confusional state, stroke or other focal neurological lesion, Parkinson's disease or a painful condition of the hands. No subjects were included who had conditions likely to make breath-holding difficult, such as uncontrolled heart failure, pulmonary fibrosis, uncontrolled asthma or severe (FEV1 < 11) chronic obstructive pulmonary disease. The subjects were judged to be broadly similar to a frail elderly target group who might be considered for inhaler therapy. None had ever used any form of inhaler.

Only one patient had newly diagnosed asthma. The others took part in the study only to test the relationship between their MTS and inhaler technique. In every case, the purpose of the study was explained to the subject and the next of kin or carer, and consent was obtained. Ten patients were studied in each of the following groups: non-demented (MTS 8-10), borderline (MTS 7), mild dementia (MTS 6), and two moderate dementia groups (MTS 5 and 4 respectively). The mean
Table 1. Definitions of three-, four- and five-stage inhaler techniques

**Three-stage inhaler**
Inspiration-triggered MDI with cap removed (Aerolin Autohaler, 3M)
1. Load spring
2. Place in mouth
3. Breathe in deeply and hold breath for 10 s

**Four-stage inhaler**
MDI and large volume spacer (Nebuhaler, Astra)
1. Connect inhaler to spacer
2. Operate inhaler
3. Place in mouth
4. Breathe in deeply and hold breath for 10 s

**Five-stage inhaler**
Standard MDI with cap in place (Ventolin inhaler, Allen and Hanburys)
1. Remove cap
2. Place in mouth
3. Start breathing in
4. Actuate inhaler early in inspiration
5. Continue to inhale deeply and hold breath for 10 s

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MDI, metered-dose inhaler.

Age was between 82.4 years and 84.7 years in all groups and the spread of co-pathology such that inter-group bias was unlikely.

The subjects were studied on four consecutive mornings in a quiet room with minimal visual distractions. On days 1-3, the subjects were given 15 min of instruction and demonstration on the use of three types of inhaler, one on each day, in ascending order of complexity, using placebo canisters. The three-, four- and five-stage inhalers are described in Table 1. The study design is outlined in Figure 1. On days 2-4, the patient's ability to use the inhaler technique taught the day before was tested by an independent observer and scored 'yes' or 'no' using the criteria shown in Tables 1 and 2. Any errors in technique were recorded.

### Results

The results are shown in Table 3, expressed in terms of MTS competence thresholds for each of the inhalers. The 0% threshold was the MTS at or below which none of the subjects could perform the technique, the 50% threshold the MTS at which at least half but not all could perform the technique and the 100% threshold

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Table 2. Minor and major errors observed during testing; some errors appeared with more than one device, and some patients made two or more errors

**Minor errors allowed within the agreed criteria for a competent technique**
Holding breath for less than 10 s, providing an attempt at breath holding was made
Actuating a standard MDI later in inspiration, though not toward the end of inspiration
Taking two or three deep breaths from a spacer inhaler providing an attempt at breath holding was made on at least the first deep breath

**Major errors observed in the subjects who were not able to learn the technique**
Not inhaling after actuation
Actuating at the end of inspiration
Not actuating the inhaler at all
Not loading the spring on the inspiration-triggered inhaler
Not removing the inhaler cap
Not placing the inhaler in the mouth
Dismantling the device

MDI, metered-dose inhaler.
Use of inhalers by people with dementia

Table 3. Mini-mental test score thresholds at which 0, 50 and 100% of subjects were able to learn inhaler techniques of differing complexity

<table>
<thead>
<tr>
<th>Technique</th>
<th>0</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Five-stage</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Four-stage</td>
<td>5</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Three-stage</td>
<td>4</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

Figure 1. The study design.

the MTS at or above which all the subjects were competent.

All the non-demented people could perform three-, four- and five-stage techniques, while those with MTS 4 were unable to learn any of the techniques. Two out of 10 subjects had appeared to master the method during instruction but failed to retain it until the next day. For the five-stage technique the 0% threshold was MTS 6, the 50% threshold MTS 7 and the 100% threshold MTS 8. For the four-stage technique, the 0% threshold was MTS 5, the 50% threshold MTS 6 and the 100% threshold MTS 8. For the three-stage technique the 0% threshold was MTS 4, the 50% threshold MTS 5 and the 100% threshold MTS 7.

The major (unacceptable) and minor (acceptable) errors in technique observed are summarized in Table 2. Only three people had a perfect technique, and all of these were in the non-demented group.

Discussion

This study confirms previous finding [5] that elderly people with significant cognitive impairment (MTS 6 or less) are unable to learn to use a standard metered-dose inhaler. The findings also show that some old people with an MTS of 6 can learn to use adequately an inhaler attached to a large-volume spacer, and some with an MTS as low as 5 can operate an inspiration triggered inhaler. However, only those in the groups with an MTS of 7 or more were certain to learn even these 'simpler' four- and three-stage techniques, and all those with a perfect technique had an MTS of 8 or more.

It could be argued that a single training session is insufficient to detect all those capable of learning the technique and although there is some evidence that patients who have received reinforcement training do develop a better technique, this has not been studied and proven in elderly patients with differing levels of cognitive function. Moreover, a single training session probably reflects common practice, particularly in a community or out-patient setting.

The study design, by testing technique in ascending order of difficulty on successive days, could have introduced a learning effect which would not be present if the order of testing had been random, although this effect would not have been present when testing the three-stage device as this was the first in the sequence. Conversely, training and testing on successive days could have interfered with learning by confusing patients about which technique was to be remembered. Thus, the study design was a compromise which allowed me to apply the same sequence to all patient groups, although potentially introducing complex effects on learning must be kept in mind when interpreting the results.

There are clear clinical implications of these findings. Patients with mild to moderate dementia can, in some cases, use inhaler devices, although the 10-point MTS score can be used to help to identify patients who are likely to have difficulty learning the techniques. The minor errors which were allowed in this study have been shown to cause only small reductions in airway drug deposition or bronchodilator effect, so the lack of perfect technique is probably of no practical importance [8]. It would be clinically prudent to reinforce inhaler training in all patients. While the present study did not test the effect of reinforcement, the longer-term success of inhaler therapy in people with cognitive impairment might depend on
checking and correcting technique from time to time. This will need to be the subject of further research.

It is not known whether mild and moderately demented people can retain inhaler skills as their cognitive function declines. Therefore, planned regular review of technique should take place to test competence and change therapy if necessary.

Key points
- Mini-mental test scores (MTS) can be used to help determine the likelihood of mild or moderately demented people being able to learn a multiple-stage inhaler technique.
- Elderly people with significant cognitive impairment (MTS 6 or less) are unable to learn to use a standard metered-dose inhaler.

References

Revised version received 30 May 1996