A COMPARISON OF THE TURBOHALER* WITH 
A STANDARD METERED DOSE INHALER IN 
ELDERLY SUBJECTS WITH NORMAL AND 
IMPAIRED COGNITIVE FUNCTION

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Summary
We studied the ability to learn metered dose inhaler (MDI) and Turbohaler techniques in 30 inhaler-naive elderly subjects with normal, borderline or abnormal scores on the abbreviated mental test (AMT)(10 in each group). All of those with a normal AMT (>7) were able to learn the Turbohaler technique and 8/10 reached a competent MDI standard. None of those with an abnormal AMT (<7) was able to learn the MDI method and only 3/10 could master the Turbohaler. However, of those with a borderline AMT of 7 only 2/10 learned the MDI method while 9/10 were able to use the Turbohaler (p<0.05). In a parallel study of 16 elderly patients with asthma or COPD and normal AMT scores we showed that the Turbohaler technique was generally better retained than the MDI method at follow up. Furthermore, in a group of seven elderly asthmatic subjects with an AMT of 6 or 7 (mild or borderline impairment) who were unable to use an MDI, all were able to learn to use the Turbohaler with standard training and reinforcement, four retained an adequate technique on follow up and a further two improved with additional training. We have demonstrated that the Turbohaler is a suitable choice of inhaler device for elderly patients with a normal or mildly impaired AMT score.

Keywords: elderly, inhaler, asthma, cognitive function

Introduction
Many elderly asthmatic patients are unable to learn to use standard metered dose inhalers (MDIs), particularly people with evidence of cognitive impairment on the abbreviated mental test (AMT). This creates difficulties in the long term management of their asthma, potentially leading to suboptimal treatment and sometimes a need to resort to treatments with more potential side-effects, such as oral corticosteroids, or cumbersome arrangements with home nebuliser therapy. Some patients with minor degrees of cognitive impairment have been shown to be able to use less complex delivery systems, that is those which require a shorter coordinated sequence, such as a large volume spacer (LVS) or inspiration-activated inhaler (IAH). The majority of patients with an AMT of 7/10 or less were unable consistently to grasp the techniques. Though the LVS requires less hand-lung coordination than the MDI, it does nevertheless entail a four steps operation. The IAH is probably easier to learn than the LVS and can be viewed as a three steps inhaler. However, loading the spring causes some patients difficulty and we observed a tendency for some patients to be unable to overcome the reflex to stop inspiring when the propellant jet entered the mouth and upper airway. The Turbohaler (Astra) is a dry powder (pellet and scraper) inhaler which delivers particles of a consistently appropriate size, even at inspiratory airflows as low as 1 litre per second. It requires only a two step operating sequence and has no need for fine manual dexterity. Furthermore, the Turbohaler has been shown to be preferred by patients in studies comparing it with other dry powder inhalers and MDIs. Therefore, we performed a study to determine whether elderly subjects with AMT evidence of borderline or mild dementia can learn to use the Turbohaler, using a standard MDI for comparison. Also, we conducted a follow up study of technique retention in patients requiring long term inhaler therapy who were cognitively intact or mildly impaired.

Patients and methods
Part 1. We studied 30 inhaler-naive patients (18 women) with a mean age of 84 years (range 68-94). All were inpatients in geriatric rehabilitation wards,
and fulfilled the following inclusion criteria:
- stable AMT, measured twice over 4-7 days, and no evidence of an acute confusional state
- able to read newsprint
- able to hear at conversational level in a quiet room
- no focal neurological symptoms or signs
- never used any type of inhaler
- willing to take part in the study
- age > 65 years

Exclusion criteria
- non-compliance with inclusion criteria
- medication causing sedation
- weak or painful hands

Having applied these criteria, patients were entered into the study consecutively until the target number was reached in each of three groups of ten patients as follows: AMT 8-10 (no evidence of cognitive impairment), AMT 7 (borderline), AMT 5 or 6 (definite cognitive impairment). Subjects were only entered if their AMT score was stable, that is, the same on two occasions 4-7 days apart. Within one day after the second AMT a second observer, unaware of the AMT score, gave each subject training in the use of the Turbohaler and MDI, one on each of 2 consecutive days in random order, using the UK National Asthma Campaign training guidelines. He also scored the patient as competent or not at the end of that training session by reference to criteria used in previous studies.1,2

Part 2. A separate group of 16 newly diagnosed elderly patients (9 female, mean age 79, range 74-88) with asthma (6 patients) or chronic obstructive pulmonary disease (COPD), all of whom had a stable AMT of 8 or more and fulfilled the above criteria were allocated, in paired random order a Turbohaler or MDI for maintenance therapy after standard training. All achieved a competent score at the time of instruction; a separate observer checked and scored their inhaler technique on the following day, approximately 1 week and 1 month later and gave further instruction when needed.

Part 3. A third group of seven asthmatic patients (5 female, mean age 81, range 76-90) with AMT scores of 6 or 7 (borderline or mild cognitive impairment) was similarly followed up after standard training and reinforcement in the use of the Turbohaler. All had previously used MDIs for long term maintenance therapy with inhaled corticosteroids and had been noted to have an unsatisfactory MDI technique.

Statistical analysis was performed using Fisher’s Exact Probability test.

Results
In the first part of the study we found that all of the subjects with a normal (>7) AMT were able to achieve a competent standard with the Turbohaler by the end of the training session, and 8/10 were able to learn the MDI technique (Fisher’s test, not significant). The two subjects who did not grasp the method both failed to continue to inhale after actuating the MDI. Conversely, those with an abnormal AMT (<7) all failed to reach the minimum competent MDI technique, with the commonest errors being failure to continue to inhale after actuation, actuation at the end of inspiration and actuation while exhaling. Only 3/10 in the abnormal group learned the Turbohaler method consistently (Fisher’s test, not significant); the commonest errors in those who did not reach the standard being failure to operate the scraper correctly and exhaling through the device. Interestingly, only 2/10 of those with a borderline AMT of 7 learned the MDI method while 9/10 reached a satisfactory technique with the Turbohaler (Fisher’s test, p<0.05). The errors observed in those who did not succeed were similar to those in the other groups.

In the second part of the study we found that all eight subjects retained a satisfactory Turbohaler technique when tested the next day and at one week. Yet 2 subjects had developed the minor error of failing to turn the scraper in both directions before inhaling when tested at one month. This error results in a patient only receiving a dose on alternate inhalations. Of the eight patients allocated to an MDI, five retained a satisfactory technique when tested the next day and the three who showed errors were able to correct their technique after further instruction. However, the same three subjects again showed significant errors (very late actuation) when tested at one week and one month despite further instruction. In addition, one other patient developed the error of end inspiratory actuation by the one month assessment.

In the third part of the study three of the seven asthmatic subjects with evidence of mild cognitive impairment needed further instruction with the Turbohaler after testing the following day (two were not inhaling deeply and one failed to operate the scraper). At one week and one month two patients (the same individuals on both occasions) exhibited the minor error of one-way scraper use.

Discussion
We have shown that elderly patients with a normal AMTS can usually learn to use relatively
simple inhaler devices, such as the Turbohaler, and can often learn a satisfactory technique with a standard MDI. This finding is in agreement with results of previous studies\textsuperscript{1,2}. Retention of technique by elderly patients with a normal cognitive screening test, as tested in part 2 of the study, appeared to be more likely with the Turbohaler. On the other hand, those with strong evidence of cognitive impairment are usually unable to master any of the inhaler devices; these findings also concur with the results of previous studies and reinforce the value of cognitive function testing in elderly patients who are being considered for inhaled therapy\textsuperscript{2}. Furthermore, we have shown that subjects with a borderline AMT score are significantly more likely to be able to learn to use the less complex Turbohaler than an MDI, and that a reasonable Turbohaler technique can be retained, with reinforcement when necessary, in such patients. We conclude that the Turbohaler is a suitable inhaler device for elderly subjects with normal cognition or mild cognitive impairment, though follow up and reinforcement of the inhaler technique is recommended. As has been shown in our earlier studies, patients with more severe cognitive loss (AMTS<6) are unlikely to learn to use any inhaler reliably. Taking into account the findings in this and previous work it appears that the main barrier to learning a satisfactory inhaler technique is a multiple step operating sequence. In particular when there is a need for precise ordering of the steps and close hand-chest coordination, as is the case with standard MDIs. Fewer steps and less requirement for timed coordination is the main advantage of the Turbohaler in providing inhaled therapy for elderly patients with normal or mildly impaired cognitive function.

**References**


* Note - Turbohaler (Astra) is a trademark

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