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Nebulisers for the elderly

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Asthma mortality in England and Wales is slowly rising with about 2000 deaths per annum.[1] If these figures are examined with respect to age, corrected for population size, mortality in patients over the age of 65 is rising significantly and deaths in those aged over 80 is increasing exponentially.[1] Some "asthma deaths" may be explained by changing patterns in death certification with chronic obstructive pulmonary disease (COPD) being certified as asthma. There is a need to ensure that older patients are diagnosed accurately and treated in the most appropriate manner.

Nebulisers in the elderly are largely used to administer inhaled bronchodilators to patients with bronchial asthma and COPD with reversibility. There is a lack of published data on the efficacy and use of nebulisers in this age group, and clinical decisions tend to be based on results from studies in younger patients. Some studies in COPD have included patients up to the age of 75 but the results have rarely been examined with respect to age.

This paper will consider some of the special features of asthma in the elderly which might modify nebuliser use. In addition, some of the risks of high dose β agonists and anticholinergic drugs will be discussed.

Use of metered dose inhalers

One of the most challenging problems in managing elderly patients with asthma is the delivery of treatment to the lungs. Armitage and Williams[2] showed that age was a major factor when assessing whether patients were able to use a metered dose inhaler correctly, with patients under the age of 65 doing significantly better than older patients. The older patients were significantly less likely to learn an inhaler technique than the younger patients. The study also showed that many metered dose inhalers currently available in the UK require considerable strength in the index finger and thumb to activate aerosol release. The force required could not be achieved by a large proportion of elderly patients studied. Buckley[3] assessed inhaler technique in relation to age in patients with asthma and COPD. Those with COPD were older and less likely to be able to use an inhaler correctly than asthmatic patients, but age was not an independent factor in predicting inability to use an inhaler.

Age and strength might predict problems with competence in inhaler technique in the general asthmatic population, but in an elderly cohort of patients age becomes much less important than cognitive function. In a group of patients aged over 75 years who had previously been taught to use their inhalers correctly,[4] cognitive function or memory, as assessed by the Hodgkinson's mini mental test,[5] was the best predictor of inability to use a metered dose inhaler. In a further study a breath activated and metered dose inhaler was shown to be the only inhaler that some patients with moderately severe memory loss could use.[6] As 20% of patients over the age of 80 are significantly cognitively impaired, assessment of cognitive function becomes an important aspect in the management of patients in whom inhaled therapy is being considered. For patients who are cognitively impaired a nebulised bronchodilator would seem a useful option, but a well trained carer might be able to administer bronchodilators satisfactorily with a metered dose inhaler and a spacer or a dry powder inhaler.

The relative paucity of evidence to show that nebulisers are better than metered dose inhalers, particularly when used in high dose with spacers, necessitates all types of metered dose inhalers and dry powder inhalers being available and considered for each patient. The only inhaler device which has been shown to give a significant benefit to the elderly and patients with poor inhaler technique is the Autohaler.[7 8] Many patients inhale well from the Autohaler but they have considerable difficulty in spring loading the device. In a number of uncontrolled studies the Turbohaler is popular with patients although elderly patients frequently complain that they are unaware whether they are receiving the drug when they inhale from the device. The risk of inhalation from an empty Turbohaler is not inconsiderable.

Having exhausted trials of various inhaler devices including instructing patients and, if necessary, carers on the use of large spacer devices, a nebuliser needs to be considered if patients are not adequately treated. Special consideration must be given to the drugs and the dosage that are conventionally used in nebulisers.

β agonists

The incidence of ischaemic heart disease rises with age and this may be asymptomatic. Care should be exercised when administering a nebulised β agonist to a patient with known ischaemic heart disease and the first dose should be given in the lung function laboratory, ideally with an ECG recording before drug administration. The incidence of dysrrhythmias following nebulised β agonists is well recognised[9 10] and has been reported to be as high as 65% in patients with acute bronchial asthma. No significant difference in the incidence of dysrrhythmia was seen in a group of patients who were studied in the acute and

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convalescent phase of their illness, but the risk of a serious dysrrhythmia was significantly increased in those who had had a previous myocardial infarction.[9]

Hypokalaemia[11] is a recognised complication of nebulised β agonist therapy and baseline potassium levels should be measured, particularly if patients are on a diuretic or have a poor dietary intake. The combination of theophylline with β agonists has been reported to increase myocardial damage in some animal studies[12] and the hypokalaemic effects of nebulised β agonists are increased in patients receiving oral theophylline.[13]

A further complication of treatment with high dose β agonists is hypoxaemia which may be responsible for increasing asthma mortality.[14] In a group of patients with asthma and COPD,[15] some of whom were hypoxic and hypercapnoeic, no serious fall in oxygen levels (Po_2) occurred when patients received salbutamol for 15 minutes from a nebuliser driven by air. A proportion of patients who were hypercapnoeic developed further rises in carbon dioxide (Pco_2) when the nebuliser was driven by oxygen. All patients returned to their pre-nebuliser (baseline) blood gas levels shortly after drug administration. In a similar study in an older group of 22 subjects[16] with severe COPD (mean FEV_1 0.54–0.87 l) nebulised terbutaline (4 mg) driven by air caused a rise in Po_2 even in those patients who were hypoxic. Transcutaneous Pco_2 fell in the normoxic and hypoxic group and the changes in oxygen saturation were attributed to mouthpiece induced hyperventilation. The conclusion from both these studies was that nebulisers could be driven by air.

Anticholinergic drugs

Ipratropium bromide and oxitropium bromide have a good safety profile. There are no long term studies of ipratropium in the elderly, but short term studies in normal subjects and patients with normal angle glaucoma have shown that intraocular pressure, pupil diameter, and accommodation are not affected by ipratropium bromide given in doses up to four times that which is recommended.[17] Prolonged pupillary dilatation can occur if the drug is sprayed directly into the eye, and particular care needs to be taken if the drug is given through a nebuliser when the face mask needs to fit well. An alternative is to use the nebuliser with a mouthpiece attached to a T piece.[18 19] There is no evidence that inhaled ipratropium given in the short term has any effect on urinary flow in men aged 50–70,[20] but long term data on high dose nebulised ipratropium is required.

Treatment

The choice of bronchodilator in the elderly poses additional clinical problems. Two studies[21 22] have suggested that the bronchodilator response to inhaled β agonists declines with age, but the studies could be criticised as lung volumes were not adequately corrected for age. Connolly, however,[23] has shown that the return to baseline FEV_1 following methacholine challenge and subsequent β agonist administration is considerably impaired in elderly patients with asthma compared with younger patients.

This evidence, and the relative lack of side effects from inhaled anticholinergics, suggests that anticholinergic drugs should always be considered in a nebuliser assessment of an elderly patient. The overlap between bronchial asthma and COPD is less easy to define in the elderly and the proven efficacy of anticholinergic bronchodilators in COPD would further justify their use. There is no evidence to support a trial of anticholinergic drugs before β agonists or vice versa, and both should always be tried.

Assessment

The lack of published data in the elderly will necessitate a degree of pragmatism in deciding who should be issued with a nebuliser. Our preference is to measure FEV_1 and FVC in the laboratory after bronchodilators have been given by metered dose inhaler and nebuliser on separate occasions. This is followed by a four week assessment period when peak expiratory flow rate is measured four times a day. The patient uses high dose inhaled bronchodilators with an inhaler device for the first two weeks, and a nebuliser for the second two. Peak flow recordings and symptoms are then discussed with the patient before it is decided whether to supply him or her with a nebuliser.

There is increasing evidence that the bronchodilator response to anticholinergic agents is less age dependent than the response to β agonists[21–24] and, on this evidence, we always recommend a combination of a β agonist and ipratropium bromide in our elderly patients.

In conclusion, nebuliser treatment for the elderly needs further evaluation and should be reserved for those patients who are symptomatic despite treatment with conventional metered dose inhalers or dry powder inhalers which they are using ineffectively but to the best of their ability. After first checking potassium levels the patient should be given a nebuliser trial for at least two weeks. It is our clinical practice to assess peak flow and symptoms before prescribing nebulisers and we routinely use combined β agonist and anticholinergic therapy.

The potential risks of cardiac side effects of high dose inhaled β agonists need to be evaluated in well controlled clinical trials.

1 Office of Population and Census Studies. London: HMSO, 1991.
2 Armitage JM, Williams SJ. Inhaler technique in the elderly. *Age Ageing* 1988;**17**:275–8.
3 Buckley D. Assessment of inhaler technique in general practice. *Ir J Med Sci* 1989;**158**:297–9.
4 Allen SC, Prior A. What determines whether an elderly patient can use a metered dose inhaler correctly? *Br J Dis Chest* 1986;**80**:45–9.
5 Hodgkinson HM, Coll JR. Mental impairment in the elderly. *J Coll Phys Lond* 1973;7:305–17.
6 Allen SC. Competence thresholds for the use of inhalers in people with dementia. *Age Ageing* (in press).
7 Diggory P, Bailey R, Vallon A. Effectiveness of inhaled bronchodilator delivery systems for elderly patients. *Age Ageing* 1991;**20**:379–82.

8 Newman SP, Weiz AWB, Talaee N, Clarke SW. Improvement of drug delivery with a breath-actuated pressurised aerosol for patients with poor inhaler technique. *Thorax* 1991;**46**:712–6.
9 Lim R, Walshaw MJ, Saltissi S, Hind CRK. Cardiac arrhythmias during acute exacerbations of chronic airflow limitation: effect of fall in plasma potassium concentration induced by nebulised beta agonist therapy. *Postgrad Med J* 1989;**65**:449–52.
10 Brashear RE. Arrhythmias in patients with chronic obstructive pulmonary disease. *Med Clin North Am* 1984;**68**: 969–81.
11 Smith SR, Ryder C, Kendall MJ, Holder R. Cardiovascular and biochemical responses to nebulised salbutamol in normal subjects. *Br J Clin Pharmacol* 1984;**18**:641–4.
12 Joseph X, Whitehurst VE, Bloom S, Balazs T. Enhancement of cardiac effects of beta-adrenergic bronchodilators by aminophylline in experimental animals. *Fundam Appl Toxicol* 1981;**1**:443–7.
13 Lai CKW, Legge JS, Friend JAR. Air-driven nebulised high-dose salbutamol in severe chronic obstructive airways disease: is it safe? *Respiration* 1991;**58**:249–54.
14 Sears MR, Rea HH, Fenwick J, Gillies AJD, Holst PE, O'Donnell TV, *et al*. Seventy five deaths in asthmatics prescribed home nebulisers. *BMJ* 1987;**294**:477–80.
15 Gunawardena KA, Patel B, Campbell IA, MacDonald JB, Smith AP. Oxygen as a driving gas for nebulisers: safe or dangerous? *BMJ* 1984;**288**:272–4.
16 Higgins RM, Cookson WOCM, Chadwick GA. Changes in blood gas levels after nebuhaler and nebuliser administration of terbutaline in severe chronic airways obstruction. *Bull Eur Physiopathol Respir* 1987;**23**:261–4.
17 Ruffin RE, Wolff RK, Dolovich MB, Rossman CM, Fitzgerald JD, Newhouse MT. Aerosol therapy with Sch 1000: short-term mucociliary clearance in normal and bronchitic subjects and toxicology in normal subjects. *Chest* 1988; **93**:739–41.
18 Kalra L, Bone M. The effect of nebulized bronchodilator therapy on intraocular pressure in glaucoma. *Chest* 1988; **93**:739–41.
19 Shah P, Dhurjon L, Metcalfe T, Gibson JM. Acute angle closure glaucoma associated with nebulized ipratropium bromide and salbutamol. *BMJ* 1992;**304**:40–1.
20 Molkenboer JFWM, Lardenoye JG. The effect of Atrovent on micturition function, double blind cross-over study. *Scand J Respir Dis* 1979;**103**(Suppl):154–8.
21 Ullah M I, Newman GB, Saunders KB. Influence of age on response to ipratropium and salbutamol in asthma. *Thorax* 1981;**36**:523–9.
22 Barros MJ, Rees PJ. Bronchodilator responses to salbutamol followed by ipratropium bromide in partially reversible airflow obstruction. *Respir Med* 1990;**84**:371–5.
23 Connolly MJ, Crowley JJ, Charan N, Nielson CP, Vestal RE. Impaired bronchodilator response to albuterol in healthy elderly men and women. *Chest* 1995;**108**:401–6.
24 Van Schayck CP, Folgering H, Harbers H, Mass KL, Van Weel C. Effects of allergy and age on responses to salbutamol and ipratropium bromide in moderate asthma and chronic bronchitis. *Thorax* 1991;**46**:355–9.