

Running a domiciliary nebuliser service

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The range of conditions to be treated needs to be identified and selection criteria determined. These should be made widely known to clinicians both within the hospital and in general practice. A specimen list is shown in table 1.

Organisation of the service

Nebuliser services throughout the UK serve different populations and vary considerably in their organisation.¹ Clearly there cannot be a set of guidelines to satisfy the needs of everyone, but it is important that there are guidelines in place that satisfy local needs and lead to a standardised, effective, and efficient service which encompasses within it nationally recognised standards.

The service is best organised and administered centrally for any given trust, catchment area, or district¹² and should be under the supervision of a designated consultant or a group of consultants with a consensus view. Day to day management of the service should be under the control of a named individual who could, for example, be a respiratory liaison sister/nurse, a physiotherapist, or a physiological measurement technician. A mechanism for assessment and education is essential. Patients should be assessed by a physician or nurse specialist for suitability using a standard protocol. This should, in the case of long term nebulised bronchodilators, be followed by a “trial” of nebuliser therapy at home compared with high dose bronchodilators via a spacer or dry powder device (see papers by O’Driscoll and Webb and Dodd on pp S49–52 and S69–71). Peak flow measurements, symptoms, and patient preference should then be taken into account when deciding whether to provide a nebuliser unit.²³

Local guidelines should be in place for the provision of nebulisers, a loan service, emergency provision, and a system for repair, servicing and maintenance.

Provision of equipment

General practitioners usually do not have the resources to provide an adequate nebuliser service for the few patients in a practice for whom long term treatment is suitable, and it is recommended that these patients are referred to a hospital for assessment and provision of equipment.

It is the responsibility of the NHS to provide nebuliser equipment if the prescribing physician decides that it is a necessary part of NHS treatment.⁴ It is also the responsibility of the NHS to provide a repair and maintenance service for the equipment it provides, including electrical safety checks.⁵

As yet, not all trusts or districts provide an adequate nebuliser service.¹ In many cases the provision of equipment relies heavily on voluntary donations. This is clearly an unsatisfactory situation.

The cost of a nebuliser service can be considerable. Dodd *et al* estimated that, in a district of about 300 000 in which about 450 patients were issued with a compressor, replacing, repairing and maintaining the equipment costs about £8000 per annum, averaging the cost over a 10 year period.⁶ The alternative strategies of repairing once only and replacing, replacing and never repairing, or conducting regular annual service and assuming no repair or replacements are required increased the cost from an estimated £10 200 to £13 600 to £17 625 per annum, respectively.

It is important to provide a “back up” service for emergencies and breakdowns. This requires additional compressors to be available while repairs are made and equipment to be available at named sites such as accident and emergency departments or a ward where patients can obtain a replacement out of hours in an emergency.

Compressors

Compressors should be certified by a recognised testing authority to conform to British Standard 5724 (1989) or European Standard IEL 601-1 (1988). A compressor is required to be sufficiently powerful to drive the nebuliser to deliver adequate medication in an acceptable period of time. For bronchodilator therapy compressors need to provide a flow rate of more than 6 l/min through the nebuliser unit to achieve this.¹² Compressors should pre-

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Table 1 Conditions suitable for treatment by nebuliser systems

Asthma (a) Children: Unable to use hand held inhalers and who require intermittent bronchodilators and/or regular preventative medication. (b) Adults: Unable to use hand held inhalers or not benefiting from maximal therapy from them. Nebulisers can be used intermittently for acute episodes with bronchodilators, or for regular treatment with preventative medication. In chronic asthma nebulisers may be used for regular bronchodilators if it can be shown that this is beneficial and superior to high dose bronchodilators from hand held inhalers.
Chronic obstructive pulmonary disease Nebulisers can be used intermittently for acute episodes with bronchodilators. They may be used for long term treatment with high dose bronchodilators providing they can be shown to be superior to high doses given by hand held inhalers.
Cystic fibrosis/bronchiectasis Nebulised bronchodilators may be beneficial but need to be shown to be superior to high doses given from hand held inhalers. Nebulised antibiotics can be given when indicated clinically.
HIV/AIDS Nebulised pentamidine can be given when indicated clinically.
Palliative care For intractable cough lignocaine may prove beneficial.

ferably be light, relatively quiet, reliable, robust, and easy to maintain. A stock of footpump, battery driven or car (12 volts DC) compatible compressors is advisable for loan to patients for occasional and emergency use, for days out, and holidays.

For nebulising drugs other than bronchodilators such as antibiotics or pentamidine it may be necessary to use either a higher powered compressor with a conventional nebuliser unit or a standard compressor with a breath-assist unit. It is important to use a combination which has been shown in previous studies to perform adequately.⁷⁻¹¹

Nebuliser units

There are many units available which vary in terms of output over time and particle size profile. When used for usual doses of bronchodilator medication there is little evidence that one unit is better than another. Ideally, however, the nebuliser unit should be matched with a compressor that will deliver an adequate output in an acceptable period of time, with sufficient particles under 5 µm in diameter to give a therapeutic response. For bronchodilators an output of 75% of fill volume over 10 minutes with over 50% of particles under this diameter would seem to be acceptable to patients and give an adequate therapeutic response.¹² Most of the commonly used compressor/nebuliser combinations will achieve this with volumes of 2-3 ml. The unit must be acceptable to the patient and easy to use and clean. It is also important that it has few detachable parts because this reduces the risk of loss during cleaning and the possibility of inhalation of small parts by an inquisitive child.

Mouthpiece or face mask

There is no evidence that either is overall a better method of delivery than the other so patients can choose.¹³ Mouthpieces and face masks should be replaced regularly at 3-6 monthly intervals.

System performance

It is important that a service uses combinations of nebulisers and compressors which are matched to give a desired performance.¹⁴⁻¹⁹ The service should also be able to recommend and provide suitable compressor/nebuliser combinations for special requirements such as corticosteroids, antibiotics, and rhDNase.

Servicing and maintenance of equipment

The prescribing physician is responsible for ensuring that the compressor is checked regularly for performance and safety. The Department of Health⁵ and British Thoracic Society asthma guidelines suggest six monthly servicing but this would impose a considerable burden on hospital resources. There is evidence that a policy of repairing and replacing compressors "as necessary" would not be disadvantageous.⁶ A possible compromise might

be to provide full servicing and safety checks annually with efficiency checks six monthly using a pressure gauge. In a district general hospital unit over 300 compressors have been serviced within a three year period since an annual servicing policy was introduced. No unsafe compressors were identified and all were working satisfactorily. This suggests an annual service is adequate (R D Steventon, personal communication, 1995). Servicing and repairs are most economically done locally in an electrobiochemical engineering or clinical physics department; the alternative is to use the equipment supplier.

Record keeping is best done on a computer system which allows both patient and compressor details to be identified and enables compressors to be recalled for an annual service. There may be a need to identify clerk or secretarial time for this task.

Patient education

When patients are started on nebuliser therapy they should be trained and educated about why the treatment is being given, what it is, and how it should be administered. Patients need to know how the equipment works and how to recognise a malfunction.

Instructions should include:

- (1) How to connect the nebuliser to the compressor and mouthpiece/face mask.
- (2) How much medication to put into the nebuliser unit and how frequently it should be used.
- (3) How long to run the nebuliser. Dryness is an unreliable end point and it is probably more accurate to run nebulisers for a given period of time. This will depend upon the system used, the fill volume, and the medication characteristics. Having taken these factors into consideration, patients should be instructed to nebulise for a specific time. The two options are: (a) running until residual volume is reached, or (b) running until the nebuliser begins to splutter and adding one minute.²¹
- (4) Ability to identify malfunctions.
- (5) Nebulisers can become contaminated with bacteria and need cleaning.²² The nebuliser unit should be washed daily with washing up liquid and water each night, rinsed, and allowed to dry overnight. The nebuliser should be attached to the compressor and air should be blown through before use. If desired it can be sterilised with sodium hypochlorite (e.g. Milton) once a month, but it must be rinsed and dried thoroughly before use. Special instructions are needed when filters are used with antibiotics.
- (6) The name and address of who to contact in an emergency should be given to patients.
- (7) Patients should be made aware of any expected side effects from drug treatment.¹⁶
- (8) For asthmatic subjects who are using intermittent nebulised bronchodilators for acute episodes a peak flow meter should be issued with written instructions about any additional measures that may be needed.²³
- (9) Written information including these instructions should be provided for all patients.

Summary

A nebuliser service should be provided locally, according to local needs. It should be centralised and administered by a designated consultant or consultants and written guidelines should be provided for medical and paramedical staff. The service should: (1) provide compressor/nebuliser units suitable for the prescribed treatment, (2) provide a system for equipment replacement, repair and maintenance, and (3) show patients how to use the equipment and give them comprehensive written instructions.

1 Hosker HSR, Teale C, Greenstone MA, Muers MF. Assessment and provision of home nebulisers for chronic obstructive pulmonary disease in the Yorkshire region of the UK. *Respir Med* 1995;**89**:47–52.

2 Hall P, Callow IM, Evans SA, Johnston IDA. Audit of a complete home nebuliser service provided by a respiratory nurse specialist. *Respir Med* 1994;**88**:429–33.

3 Goldman JM, Teale C, Muers MF. Simplifying the assessment of patients with chronic airflow limitation for home nebuliser therapy. *Respir Med* 1992;**86**:33–7.

4 NHS Management Executive. Provision of NHS Equipment. EL [92] 20, 1992.

5 Department of Health. Safety of electrical, medical and laboratory equipment. *Safety Action Bulletin* 1991;**74**: SAB[91]57.

6 Dodd ME, Hanley SP, Johnson SC, Webb AK. District nebuliser compressor service: reliability and costs. *Thorax* 1995;**50**:82–4.

7 Ilangovan P, Pederson S, Godfrey S, Nikander K, Noviski N, Warner JO. Treatment of severe steroid dependent pre-school asthma with nebulised budesonide suspension. *Arch Dis Child* 1993;**68**:356–9.

8 Nikander K. Drug delivery systems. *J Aerosol Med* 1994;**7**(Suppl 1):19–24.

9 Hurley PK, Smye SW, Cunliffe H. Assessment of antibiotic aerosol generation using commercial jet nebulisers. *J Aerosol Med* 1994;**7**:217–28.

10 Hung JCC, Hambleton G, Super M. Evaluation of two commercial jet nebulisers and three compressors for nebulisation of antibiotics. *Arch Dis Child* 1994;**71**:335–8.

11 Waldrep JC, Keyhani K, Black M, Knight V. Operating characteristics of 18 different continuous-flow jet nebulizers with beclomethasone dipropionate liposome aerosol. *Chest* 1994;**104**:106–10.

12 O'Callaghan C. How to get drugs into the respiratory tract. *Arch Dis Child* 1993;**68**:441–3.

13 Kendrick AH, Smith EC, Denyer J. Nebulisers, fill volume, residual volume and matching of nebuliser to compressor. *Respir Med* 1995;**89**:157–60.

14 Steventon RD, Wilson RSE. Face mask or mouthpiece for delivery of nebulised bronchodilator aerosols? *Br J Dis Chest* 1981;**75**:88–90.

15 Smith EC, Denyer J, Kendrick AH. Comparison of 23 nebuliser/compressor combinations for domiciliary use. *Eur Respir J* 1995;**8**:1214–21.

16 Steventon RD, Wilson RSE. A guide to apparatus for home nebuliser therapy. Allen and Hanburys Ltd, 1986.

17 Smye SW, Shaw A, Norwood HM, Littlewood JM. Some factors influencing the efficiency of a jet nebuliser system. *Clin Phys Physiol Meas* 1990;**11**:167–75.

18 Hurley PK, Smye SW. Performance of a range of commercial jet nebulisers. *Tech Health Care* 1994;**1**:209–14.

19 Faurisson F, Dessanges JF, Grimfield A, Beaulieu R, Kitzis MD, Peytevin G, *et al.* Nebuliser performance: AFLM study. *Respiration* 1995;**62**(Suppl 1):13–18.

20 British Thoracic Society. Guidelines on the management of asthma. *Thorax* 1993;**48**:S1–24.

21 Malone RA, Hollie MC, Glynn-Barnhart A, Nelson HS. Optimal duration of nebulised albuterol therapy. *Chest* 1993;**104**:1114–8.

22 Barnes KL, Rollo C, Holgate ST, Murphy D, Comber P, Bell E. Bacterial contamination of some nebulisers. *BMJ* 1987;**295**:812.

23 Gregson RK, Warner JO, Radford M. Assessment of the continued supervision and asthma management knowledge of patients possessing home nebulizers. *Respir Med* 1995;**89**:487–93.