Appropriate Technology

The respiratory physician in a Third World district hospital

JOHN MACFARLANE

Respiratory diseases are the commonest cause of hospital attendance and also death in many parts of the Third World. They resulted in 22% of adult admissions to one hospital in Uganda,¹ 23.5% of paediatric admissions in Zambia,² and up to 25% of all hospital cases in Papua New Guinea.³ Respiratory infections, particularly pneumonia and tuberculosis, are the most common conditions, but asthma and non-infectious chronic lung diseases are also common in some areas.³ Nearly half of the patients seen with a respiratory illness at a medical centre in the southern Maldives were diagnosed as having asthma.⁴ After pulmonary tuberculosis, asthma was found to be the most common chronic chest disease in African children in Ibadan, Nigeria.⁵

Thus the main workload of a physician with an interest in respiratory medicine working in a district hospital in the Third World includes pneumonia and its complications such as empyema and lung abscess, other acute respiratory infections, pulmonary tuberculosis, asthma, and (to a lesser extent) other chronic lung disorders. Most of these can be managed without recourse to expensive or complex equipment (table).

Respiratory infections

Respiratory infections are common, and acute pneumonia is responsible for many paediatric and adult admissions. Many patients will not have received antibiotics before they present to the hospital, so a Gram stain of the sputum and sputum culture will often be helpful. A side room equipped with Gram stain kit, slides, and a microscope permits immediate examination of sputum and may also be useful for examining samples of urine and cerebrospinal fluid. Blood cultures should always be taken. Most pneumonias are caused by pneumococcal infections and will respond to simple, cheap antibiotics such as penicillin and ampicillin.^{6,7}

Most physicians with an interest in respiratory medicine will adopt the role of the tuberculosis doctor. Many district hospitals have a separate tuberculosis ward or annexe, and a special clinic should be organised if this is not already available. This is helpful because it provides the opportunity to train nurses and interpreters to manage and educate patients with tuberculosis (fig 1). Many patients have little idea of the duration of their illness, but occasionally help will be obtained by, for example, gauging the age of cuts performed by the local doctor (fig 2). Useful advice on organising a tuberculosis service is given in a book by King.⁸ Diagnosis depends on the appearance of the chest radiograph and examination of the sputum for tubercle bacilli. Facilities for culture of the tubercle bacilli may not be available, so if there is no information about the local pattern of sensitivity of *Mycobacterium tuberculosis* to drugs it is a good idea to send a consecutive series of smear positive sputum samples to the nearest laboratory that can undertake culture and

Details of special equipment mentioned in text

	Approximate price in United Kingdom (excluding VAT)	United Kingdom supplier
Heaf multiple puncture gun Mark 5 (20 spare needles)	54.30 8.05	Eschmann Bros and Walsh Ltd, Peter Road, Lancing, West Sussex BN16 8TJ
Heaf multiple puncture gun Mark 7 with magnetic head (spare 6 point plates, box of 50)	43.45 17.10	"
Wright peak flow meter	180.00	Clement Clarke International Ltd, 15 Wigmore Street, London W1H 9LA
Standard Wright mini peak flow meter (spare plastic sterilisable mouthpieces)	9.96 0.40	"
Vitalograph R model spirometer (200 spare recording charts)	550.00 13.00	Vitalograph Medical Instrumentation, Maids Moreton House, Buckingham MK18 1SW
Porta-Peak peak flow gauge	30.00	Medic-Aid Ltd, Pollard House, Lake Lane, Barnham, Surrey PO22 0AD
Porta-Neb 50 Multivolt nebuliser pump	86.50	"
Aerolyser electric nebuliser pump CFIR	119.69	Aerosol Products Ltd, 680 Garratt Lane, London SW17 0NP
Intersurgical nebuliser chamber + tubing (supplied in boxes of 20)	0.93 each	Intersurgical Ltd, Charwell House, Lincoln Way, Sunbury on Thames, Middlesex TW16 7HJ
Abrams pleural biopsy needle	35.30	NI Medical Ltd, PO Box 3, 26 Thornhill Road, Redditch B98 9NL
Trocar and cannula for intercostal tube insertion	18.39	Rocket of London, Imperial Way, Watford WD2 4XX
Roberts suction pump	237.82	GU Manufacturing Co, Plympton Street, London NW8 8AB
Olympus OES bronchofibrescope BF10	4865.00	Key Med, Key Med House, Stock Road, Southend on Sea SS2 5QH
Keymed Keylight MS-A Coldlight source	336.00	"

VAT = Value added tax.

sensitivity testing. If only a small number of patients are seen Ziehl Neelsen staining of fresh samples of sputum may be carried out in the clinic. Larger numbers may warrant the use of fluorescence microscopy in the hospital's laboratory.

Tuberculin skin testing is of little diagnostic value in teenagers and adults but aids diagnosis in children and is helpful for checking the immunity of staff working closely with patients with tuberculosis. A Heaf gun and Evans undiluted purified protein derivative (shelf life three years at 4°C) is a well tried method for the skin tests.⁸ The end of the Heaf gun should be soaked in spirit and flamed between each use, or the end plate may be changed on the magnetic version.

Drug treatment will depend on what is available locally, but, if possible, the standard guidelines of modern antituberculosis chemotherapy should be followed.^{9,10} Ideally, treatment protocols should be agreed on nationally to minimise problems with drug resistance and to allow bulk purchasing to reduce costs. Regular

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FIG 1—Advice for patients with tuberculosis displayed prominently on wall of the tuberculosis clinic in Zaria, Nigeria.

FIG 2—The age of the scars from the native doctor's cuts may be useful in timing the duration of the illness. This man with pleurisy has fresh cuts only a few days old, but older, healed scars suggest a similar illness in the past.

weighing is one of the best ways to assess response to treatment, and a set of scales should be kept in the clinic. Compliance may be checked by looking at the colour of the urine if the patient is taking rifampicin; testing for other drugs is more complicated and needs to be done in a laboratory.⁹ In some areas rifampicin commands high prices on the black market for the treatment of gonorrhoea and other conditions—this may be a problem when patients are given several weeks' supply at one time.

Asthma

Asthma is the major non-infectious respiratory problem. The history is crucial in making the diagnosis, and education of the patients is most important in the management of the condition. It may well be worth setting up an asthma clinic. A special nurse(s) or interpreter may be trained to take reliable respiratory histories and to provide explanations and advice to the patients. A duplicated standardised questionnaire using local terminology is useful. The symptoms of chronic asthma may be mistaken for tuberculosis by patients and their relatives, so careful but simple explanations will be needed. The clinic may be a good way to follow up patients with other non-infectious respiratory problems—for example, alveolitis or pulmonary shadowing of unknown cause.

Complicated equipment to test lung function is not required, but a peak flow meter is essential for both diagnosis and management of asthma (fig 3). The best buy is the robust and accurate Wright peak

flow meter. Plastic mouthpieces are better than disposable cardboard ones because they may be cleaned and reused. Ideally, each medical ward should have at least one peak flow meter and there should be one in the outpatient area. The Porta-Peak peak flow gauge is an alternative, and is lightweight, strong, washable, and cheaper than the Wright peak flow meter. Bronchodilator pressurised aerosols should be kept in the clinic to assess reversibility of airways obstruction.

FIG 3—A Wright peak flow meter, plastic reusable mouthpieces, and a β_2 stimulant pressurised inhaler are essential for managing asthma.

It is useful but not essential to have a spirometer to measure simple lung volumes—for example, forced expiratory volume in one second and vital capacity. These measurements help in the diagnosis and monitoring of restrictive and obstructive forms of lung disease. Although expensive and cumbersome, the Vitalograph dry spirometer model R is very satisfactory. Special paper charts are needed, but with care many recordings can be made on each chart. Predicted values for lung function results vary for different ethnic populations, and guidance may be obtained from standard sources of references.¹¹

Carrying out skin prick tests may add interest to patient investigations but rarely influences management. Hyposensitisation or avoidance of allergens is usually impracticable. Patterns of positive prick tests have been reported from many developing countries and published in *Clinical Allergy* (Blackwell Scientific Publications). If no published information can be found for a particular area a simple collection of prick test solutions could include glycerosaline control, house dust, *Dermatophagoides farinae* or *Dermatophagoides pteronyssinus*, grass pollen, mixed animal hairs, cockroach, mixed threshings, ascaris, and *Aspergillus fumigatus*. These may be obtained from Bencard or Dome/Hollister-Stier. Solutions have a shelf life of two years at 4°C. Blood lancets, cleaned between use, may be used for pricking the skin.

TREATMENT

The treatment of asthma will depend on the local availability of drugs and their price. Ideally, β_2 stimulant bronchodilators and prophylactic treatment such as steroids or sodium cromoglycate should be given through pressurised inhalers¹²—unfortunately, such treatment is often expensive and scarce. Patients will need repeated instruction on how, when, and why to use the different inhalers. If inhaled prophylactic treatment is not available long term management of asthma is difficult and will depend on the use of oral

bronchodilators and the judicious use of oral steroids. Although short courses of steroids are safe, long courses carry appreciable risks in tropical climates.¹³

If possible the management of severe acute asthma should be standardised and displayed on wall charts in the outpatient area and medical wards. Remember that intravenous steroids are expensive and that oral steroids are cheap and work almost as quickly. Although intravenous aminophylline is a cheap and readily available bronchodilator, intermittent nebulised β_2 stimulants (for example, salbutamol, terbutaline) are safer and as effective. If solutions of bronchodilator are available at an affordable price they may be given through a nebuliser chamber driven by an oxygen or air cylinder at a flow rate of 8 l/min. Chambers such as the Intersurgical nebuliser are cheap but robust enough for several uses after cleaning. If oxygen and air cylinders are unavailable, consider buying one or two electric nebuliser compressors such as the heavy duty Aerolyser CFIR or the more fragile Porta-Neb 50 Multivolt that may be operated off a 12 volt DC source. A useful discussion of the problem of managing asthma in the tropics is given elsewhere.¹³

The diagnosis of respiratory failure will be clinical as measurement of arterial blood gas tensions will almost certainly be unavailable. Assisted ventilation for anything apart from a very short time is impracticable in most medical wards in Third World district hospitals because of difficulties in supervising the patient and obtaining (and maintaining) suitable equipment.

Pleural disease

To investigate the cause of pleural effusions by pleural aspiration a large glass syringe, three way tap, and needles for aspiration together with Abrams pleural biopsy needles are needed. Pleural biopsy specimens should be sent for culture for tuberculosis as well as histological examination. Intercostal drainage of pneumothoraces, effusions, and empyemas requires a selection of Malecot red rubber intercostal drains, an introducer, trocar, and cannula, and a simple underwater drainage system. It is useful but not essential to have at least one cheap and sturdy Roberts low volume electric suction pump for stubborn pneumothoraces and to ensure that the pleural fluid is removed completely. Simple pneumothoraces and empyemas may be managed by repeated needle aspiration in the outpatient department.¹⁴

Bronchoscopy

A fiberoptic chronoscope is indispensable for respiratory physicians in developed countries, where its major use is in the diagnosis of lung cancer. In this respect its use is limited in the Third World because lung cancer is less common and when it is diagnosed effective treatment is seldom available. Furthermore, fiberoptic bronchoscopes and the accessory equipment are expensive and easily damaged and require specialist servicing. Nevertheless, thought should be given to buying a fiberoptic bronchoscope so that an endoscopy referral centre may be set up to serve several local hospitals. This centre should, in turn, link up to a thoracic surgical centre. If your hospital already has a gastrointestinal fiberoptic endoscopy service it is important to ensure that all endoscopes and equipment are from one manufacturer who can provide good local service facilities. The new range of Olympus endoscopes have the advantage that the whole endoscope is resistant to water and may be totally immersed in sterilising fluid without damage. The Olympus OES bronchofibrescope model BF-10 together with the basic Keymed MS-A cold light source is a good general purpose system. A suction machine will be required.

Although a fiberoptic bronchoscope is not essential, bronchoscopy is required from time to time in all district hospitals to look for foreign bodies, investigate large haemoptyses, manage patients with chest injuries, and aspirate retained secretions and plugs of sputum. In one hospital in Kuwait 250 aspirated foreign bodies were removed over 14 years (about three quarters of these were melon seeds).¹⁵ A set of rigid metal bronchoscopes—paediatric, small adult, and large

adult sizes—together with a light source and a simple Venturi jet ventilation system are necessary to undertake this investigation.

Additional points

It is essential to have ready access to the radiology department in the hospital. Complicated apparatus and developing are not needed: good quality posteroanterior and lateral chest radiographs will suffice in most cases. Tomography is rarely required. Bronchography needs no extra equipment except aqueous Dionosil contrast medium, a soft rubber catheter, and a local anaesthetic solution.

Respiratory problems related to work may well be encountered if there are local industries with inadequate safeguards to health. Even traditional crafts may be associated with pneumoconiosis—for example, grindstone cutting is associated with silicosis in northern Nigeria.¹⁶ Diagnosis will depend on taking a good respiratory history from the patient and a knowledge of the industrial process concerned.¹⁷ A small supply of standard mini Wright peak flow meters is useful for self monitoring at work and at home if work related asthma is identified as a local problem.

The importance of teaching special nurses and interpreters has already been mentioned, but the education process must be wider. Every effort should be made to set up lectures and discussion groups for doctors, nurses, and other paramedical staff (physiotherapists, health visitors, village dispensers, etc) to teach them about the common medical and respiratory conditions and their modern management.

Preventive medicine will have a major impact on the community's health, and the respiratory physician should play an active part in, for example, promoting and organising BCG vaccination and campaigning against smoking and cigarette advertising. The latter is particularly important otherwise smoking related disease will become as common in developing countries as it is in the West.

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Does the metal of toothpaste tubes contain any lead? Are the chemical constituents of any of the commonly used toothpastes known to contain any solvents of lead?

In the past toothpaste was often sold in "lead" tubing. Today the main producers use either aluminium tubing with a specification of "less than 5 ppm lead" or plastic tubing with a polyethylene liner. The toothpaste itself (normal commercial variety) contains no materials which would earn a chemical classification of "lead solvent." The market leader works to a "less than 2 ppm" specification for toothpaste emerging from the tube.—E KING, National Occupational Hygiene Service Ltd, Manchester.