Appropriate Technology

The cardiologist in the Third World

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Unlike his contemporaries in developed countries, the cardiologist in the Third World needs to adapt his specialised knowledge to compensate for the absence of sophisticated equipment, trained staff, and expensive drugs. He must make full use of the information obtained from the history, clinical examination, and basic investigations and must learn to manage with a small number of inexpensive drugs which are available locally. In addition, he may have to develop a working proficiency in allied disciplines such as radiology and pathology. By such practice he should be able to diagnose and manage most cardiac conditions. This article is based on our experience of working in Umtata Hospital, which is the referral centre for Transkei (in southern Africa), a country with a population of three million where the prevailing diseases—rheumatic heart disease, tuberculous pericarditis, hypertension, and dilated cardiomyopathy—are similar to those encountered in many developing countries. We are general physicians with an interest in cardiology and believe that in many developing countries the cardiologist is more likely to be a general physician than a specialist.

Patients in developing countries often present late, with advanced disease and obvious clinical signs that may enable the clinician to make a diagnosis without recourse to investigations. A knowledge of the prevailing diseases in the area is important and may best be obtained from reference to local publications, since descriptions of disease in Western texts are not always applicable to a developing country.

Equipment

When buying equipment it is important to ensure that an after sales service, with a supply of major spare parts, is guaranteed. It is a good idea to order spares when the equipment is purchased because normal wear and tear will necessitate replacement of certain minor parts—for example, rubber limb cuffs of an electrocardiograph, stethoscope tubing and ear pieces, ophthalmoscope bulbs, etc. The addresses of the companies listed at the end of this article are the head offices in Britain, but they will be able to provide information about overseas services.

A good stethoscope is essential; this should have a bell and diaphragm preferably incorporated in one piece—for example, the Littmann combination. Mercury sphygmomanometers (such as the Accoson model 125) with solid cases and folding lids are more robust than aneroid devices and easier to repair.

In addition to the standard adult cuff, a larger cuff for obese adults and a smaller cuff for children and thin adults should be available. Wrap around bandage cuffs are more durable than Velcro or hook ones. A sturdy, battery operated interchangeable ophthalmoscope and auroscope is useful, particularly if it may be used with rechargeable batteries. The Welsh Allyn 3.5 V halogen diagnostic set, supplied with charger unit, from Seward Medical is a good example. Assessment of fluid balance by change of weight is usually more reliable than trying to keep accurate fluid balance charts, so a good set of weighing scales is necessary.

In the laboratory

Simple equipment such as a fridge, microscope, staining reagents, and colorimeter allow basic laboratory tests to be carried out that help to provide circumstantial evidence of cardiac disease—for example, leucocytosis, anaemia, microscopic haematuria, uraemia, etc. If the facilities for bacteriological culture are not available Gram or Ziehl-Neelsen staining of pus or sputum may identify the causative organism, and this simple test may be done by the doctor. When it is possible to forward blood culture bottles to a nearby laboratory for processing a supply should be kept for patients with suspected endocarditis.

The antistreptolysin O titre and Venereal Disease Research Laboratory test are important in the diagnosis of rheumatic fever and cardiovascular syphilis. They may be measured with simple and inexpensive kits such as those obtainable from Wellcome Reagents Ltd. Similar kits are available for the measurement of prothrombin time (Ortho Diagnostics Ltd).

X ray equipment

In many hospitals the x ray equipment is the most valuable piece of equipment—and the one that is most easily, and frequently, rendered inoperable. Because of this the cardiologist should have a working knowledge of the machinery and also be able to take, and therefore instruct others in taking, a posteroanterior chest film of adequate diagnostic quality. (The details and specifications of x ray equipment have been discussed in an earlier article in this series (12 May, p 1435)).

A radiograph of the chest gives information about heart size, enlargement of the chambers, the pulmonary circulation, and coexistent parenchymal lung disease (fig 1). In the absence of specialised techniques to demonstrate mitral valve calcification a penetrated left lateral x ray film is helpful. Where there are facilities for fluoroscopy and barium swallow these may provide additional information to assess the suitability of a patient for closed mitral valvotomy.

The electrocardiograph

The single channel Fukuda FJC 1000 is a cheap, robust, and reliable machine that is easy to operate. Although this particular

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FIG 1—In mitral valve disease it may be difficult to distinguish secondary pulmonary haemosiderosis from active or inactive tuberculosis. In ill patients or when contemplating surgery, it may be necessary to give a therapeutic trial or operative cover with antituberculous drugs.

model has been discontinued, the Fukuda Denshi FK-11 (Cardiacare Instruments (UK) Ltd) is very similar and can run off the mains or a rechargeable battery, dry cell batteries, or a car battery. Standard lubricant jellies,¹ or even tap water,² may be used instead of expensive electrode jelly.

Before ascribing any abnormal tracing to underlying heart disease the physician must be familiar with the patterns of normal variants. These are usually ST segment and T wave changes, which may occur in otherwise healthy black people³ and may be confused with patterns seen in conditions such as acute pericarditis. The tracing invariably becomes normal after exercise.⁴ An electrocardiogram is also useful in the detection of hypokalaemia and hyperkalaemia if a flame photometer to measure plasma potassium concentrations is not available.

Specialist equipment

If the hospital has facilities for cardiac surgery echocardiography is helpful in deciding which patients would benefit most from surgery. Although M mode echocardiography provides information about cardiac function as well as structure—and may thus obviate the need for cardiac catheterisation⁵—two dimensional echocardiography is simpler to use. (It may also be used by other specialists, such as obstetricians.) We use an ATL 100 sector scanner (Squibb Medical Systems Ltd) and find that it saves time and unnecessary investigation with less informative tests (fig 2). With this machine the physician can confirm, or refute, the presence of a mobile non-calcific valve in mitral stenosis and detect the presence of left atrial thrombus. It is also helpful in the diagnosis of endocarditis and the investigation of heart failure or cardiomegaly of unknown cause. We have found it particularly helpful in differentiating cor pulmonale, dilated cardiomyopathy, occult valvular disease, pericardial effusion, and constrictive pericarditis.

A spare scan head should be ordered when buying the machine, and it is worth knowing how to remove the key-

board in case it develops a fault, as paying for a company engineer to travel to the machine will add to the expense of repairs. If cardiac surgery is undertaken a simple cardiac monitor and a defibrillator should be available. We use a portable DC defibrillator with a built in monitor (Philips B D 500, now replaced by the Philips E D 420; Honeywell Medical Electronics Division) for operative and postoperative monitoring. It is unusual to see patients with ischaemic heart disease, so the defibrillator is rarely required after a cardiac arrest due to ventricular fibrillation. Conditions requiring cardiac pacing are similarly uncommon, and so, if necessary, patients are referred to a centre in neighbouring South Africa.

Management of patients

Drug regimens must take into account the fact that many hospitals in the Third World have limited resources and that patient compliance may be poor. Characteristics that are important in deciding which drug to use include low cost, availability, once daily dosage, and patient acceptability. Additional measures—for example, weight reduction and reduction of salt intake in the treatment of hypertension—may be worth trying but are often impractical because of the patient's way of life. We base our treatment on the following selection of drugs:

FIG 2—(a) Subacute constrictive pericarditis showing thick fibrocaseous inflammatory tissue (Po="porridge") in the pericardial sac of a man who presented with congestive cardiac failure of unknown cause. Surgery is unlikely to help at this stage because this tissue cannot be adequately stripped. (b) Moderately large pericardial effusion (E) with thickened visceral and parietal pericardium (P): many fibrous strands can be seen. Pericardiocentesis may not help the haemodynamic abnormality which is due to visceral constriction.

digoxin, a thiazide and loop diuretic, a vasodilator such as hydralazine, hypotensive drugs such as reserpine and methyldopa, emergency trolley drugs (adrenaline, atropine, and calcium), anticoagulants and aspirin, penicillin, and four antituberculosis agents including streptomycin, isoniazid, and pyrazinamide. Morphine, salbutamol, and chlorpromazine⁶ have useful cardiovascular effects, and these three are also stocked. These drugs provide effective treatment for cardiac failure and hypertension, treatment and prophylaxis of rheumatic fever and bacterial endocarditis, treatment of tuberculous pericarditis, and the essentials for dealing with cardiac emergencies. Thiazide diuretics are the best first line treatment for hypertension in southern Africa,⁷ and this coupled with the infrequency of ischaemic heart disease explains the absence of β blockers from the list.

An intravenous infusion of salbutamol (10 mg salbutamol in 200 ml 5% dextrose) given eight hourly is used to treat patients with refractory cardiac failure. It is safe and easy to monitor, and the most important side effect—hypokalaemia—can be anticipated. Our need for antiarrhythmic drugs is limited because the only arrhythmia that we commonly see is atrial fibrillation, which may be controlled with digoxin. If reversion to sinus rhythm is likely to be successful quinidine is used.

Thromboembolism complicating heart disease is an important cause of morbidity and mortality and so heparin and warfarin must be available. It may be impossible to monitor anticoagulation—for example, if a patient comes from a remote area—and in this instance we prescribe either warfarin 5 mg or aspirin 300 mg daily. While not ideal, this is part of the reality of a developing country.

The most effective prophylaxis against recurrent rheumatic fever is intramuscular benzathine penicillin 1.2 megaunits monthly.⁸ Infective endocarditis may be treated simply and usually successfully with the combination of penicillin and streptomycin. Ideally rifampicin should be included in any treatment regimen for tuberculosis but is expensive and may be difficult to obtain. In its absence triple and preferably quadruple initial treatment is advisable.

Cardiac surgery

In our practice the only operations that can be undertaken safely and give good results are closed mitral valvotomy, pericardiectomy and ligation of a patent ductus arteriosus. Apart from a rib spreader, periosteal elevator, and Tubbs transventricular dilator (available from Thackray's), no specialised equipment is necessary. We obtained two Tubbs dilators from friends at cardiothoracic centres in Britain and recommend such places as a source of equipment. Despite a need for valvular replacement surgery it cannot be considered a priority because of its high cost, the frequent necessity for further replacement of the valve in children,⁹ and the difficulties of postoperative follow up. On the rare occasions when ischaemic heart disease occurs and requires surgery the patient usually belongs to a section of society that can afford to send him to an appropriate centre for treatment.

Pericardiocentesis may be performed safely using an intravenous plastic cannula with integral chamber that fills immediately on striking fluid. The metal trocar is then removed and aspiration continued through the relatively soft plastic cannula (fig 3). Myocardial biopsy may establish a specific cause of heart muscle disease, but in the absence of effective treatment for most of these conditions this investigation is of limited use. Biopsy of the pericardium in the presence of an effusion may be helpful and may be performed with standard surgical equipment. Although biopsy specimens may have to be sent away for examination, a tissue diagnosis is usually definitive, so in the long run it may be cheaper and quicker than carrying out less invasive investigations. (A histopathology service for developing countries has been established in London at the department of morbid anatomy, School of Medicine, University College London, University Street, London WC1: contact Dr S Lucas for information.)

FIG 3—In most cases a pericardial effusion can be confidently diagnosed by clinical examination supported by typical changes on the chest x ray and electrocardiogram. Pericardiocentesis is best performed via the subxiphisternal route, avoiding the pleura and entering the most dependent part of the sac.

Conclusion

Thus with a minimum of equipment and drugs the cardiologist may reduce the impact of cardiovascular disease, which is a major cause of morbidity and mortality in the Third World. Provision of cardiological care must also include the effective application of medical resources to reduce the incidence of cardiovascular disease. The feasibility and effectiveness of a community programme in the control of rheumatic heart disease have been shown,¹⁰ and similar benefits may be expected from the community control of tuberculosis. Recent advances in the production of an antistreptococcal vaccine are encouraging and if successful could lead to the elimination of rheumatic heart disease.¹¹

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Companies listed in article

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- Cardiacare Instruments (UK) Ltd, 882 Eastern Avenue, Newbury Park, Ilford, Essex IG2 7HY.
- Honeywell Medical Electronics Division, Honeywell House, Charles Square, Bracknell, Berkshire RG1 1EB.
- Littmann, 3M House, PO Box 1, Bracknell, Berkshire RG12 1JU.
- Ortho Diagnostics Systems Ltd, Denmark House, Denmark Street, High Wycombe, Buckinghamshire HP11 2ER.
- Seward Medical, 31 New Cavendish Street, London W1M 7RL.
- Squibb Medical Systems Ltd, Blackhorse Road, Letchworth, Hertfordshire SG6 1HL.
- Thackray's, 69 Weymouth Street, London W1.
- Wellcome Reagents Ltd, Temple Hill, Dartford DA1 5AH.