Acquired Heart Disease in Ugandan Children*

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The many excellent reports from East Africa on the obscure cardiopathies, endomyocardial fibrosis (EMF) and heart muscle disease, might suggest that these are the most important cardiac disorders encountered there; relatively little has been written on the other cardiac disorders of childhood. This communication presents results of a one-year clinical survey of acquired heart disease in Ugandan children conducted to learn the nature and relative importance of certain acquired heart lesions in the African child of Uganda.

SUBJECTS AND METHOD

The study was conducted as a joint effort by members of the Departments of Paediatrics (J. C. and A. W.), Medicine (P. D'A. and J. B.), and Pathology (D. H. C.) at the Makerere Medical College in Kampala, Uganda, from November 1962 to November 1963. Five of the children were studied at the Mengo Mission Hospital. The children were from 12 days to 12 years of age. Appropriate studies were made, including hæmograms, virus studies, antistreptolysin titres, bacterial cultures, electrocardiograms, and X-rays. Most of the children were reviewed by 2 or 3 of the investigators. Although many types of acquired cardiac problems were encountered, those associated with protein-calorie malnutrition, severe electrolyte imbalance associated with gastroenteritis, severe anæmia, acute glomerulonephritis, and pneumonia are excluded from this study. Most of the diagnoses were made by clinical means; 4 were confirmed at necropsy.

RESULTS

The clinical diagnoses of 50 African children with acquired cardiac disease are presented in

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the Table. A brief comment on the list follows, with deliberate emphasis on rheumatic fever.

Rheumatic Fever Series. Rheumatic carditis was diagnosed in 23 children and was thought to be the diagnosis in 5 children with both mitral insufficiency and mitral stenosis. Five more African children were admitted to hospital with rheumatic fever without carditis: 3 had rheumatic polyarthritis and 2 had Sydenham's chorea. Four Indian children not included in the survey are mentioned because of the severity of their rheumatic pancarditis.

Nine African tribes were represented in the group with rheumatic carditis; 13 came from the local Buganda tribe. Seven were male and 16 were female. The age range of the children with acute rheumatic carditis was 3 to 11 years with a mean of 6.7 years. The age range of those with chronic carditis was 7 to 10 years with a mean of 9.1 years.

All the children in whom a diagnosis of rheumatic carditis was made had mitral insufficiency. In addition, 4 had mitral stenosis, 4 had aortic insufficiency, and 3 had tricuspid insufficiency. One child had a pericardial friction rub and 2 had pericardial effusions.

TABLE
CLINICALLY DIAGNOSED ACQUIRED HEART DISEASE
IN UGANDAN CHILDREN, 1962-1963

Diagnosis	No.
Rheumatic heart disease	23
Acute	15
Chronic	8
Cardiomegaly with mitral insufficiency	5
Cardiomegaly with mitral stenosis and insufficiency	5
Pericardial effusion with no mitral insufficiency	5
Probably associated with pulmonary tuberculosis	2
Unknown aetiology	3
Cardiopathy without evidence of MI	8
Endomyocardial fibrosis, predominantly of RV	6
Heart muscle disease	2
Cor pulmonale	1
Pericarditis without effusion, unknown aetiology	1
Myo-pericarditis of the newborn	1
Pyogenic pericarditis (<i>Staphylococcus aureus</i>)	1

FIG. 1.—Electrocardiogram of a 10-year-old Ugandan girl with a history of chorea and repeated sore throats with clinical evidence of mitral stenosis and mitral insufficiency. Note the P mitrale, and the pattern of left ventricular hypertrophy and strain. (B) Lead II of ECG of a 9-year-old Muganda boy with rheumatic mitral insufficiency and mitral stenosis. Note atrial flutter and a ventricular ectopic beat.

The criteria upon which a diagnosis of rheumatic fever was based, were as follows: carditis, 23; arthritis, 6; previous or concomitant chorea, 5; subcutaneous nodules, 1; erythema marginatum, 1.

Less credence was placed on the minor manifestations, largely derived from the patient's history: arthralgia, 13; fever, 12; previous sore throat, 12; abdominal discomfort, 6; præcordial pain, 4. Erythrocyte sedimentation rates were significantly raised in the 13 acutely ill patients in whom the test was done. Antistreptolysin titres were between 333 and 1250 Todd units in 11 children, but unfortunately some of the blood specimens were lost.

The only electrocardiograms analysed were those taken on 18 children with a Cambridge portable battery-run transistorized machine, the Transrite

III. Left ventricular hypertrophy was present in 9 (Ziegler, 1951) (Fig. 1A), atrial flutter and premature ventricular beats in 1 (Fig. 1B), wandering pacemaker and premature ventricular beats in 1, first degree heart block in 3, and normal sinus rhythm in 13. The electrical axis was balanced in 15 and deviated to the left in 2. P mitrale was marked in 4 patients.

X-rays revealed cardiothoracic ratios ranging from 50 to 79 per cent. Most of those in the children with acute carditis were within normal limits; 2 of the children with chronic rheumatic carditis had a "mitral" configuration; 1 had evidence of pulmonary tuberculosis.

Virus diagnostic tests were performed on about half of the patients and no significant findings were

FIG. 2.—Aschoff bodies were found in the epicardium, myocardium, and endocardium of an 8-year-old girl with rheumatic pancarditis. She had biventricular hypertrophy; diffuse exudative pericarditis; mitral and tricuspid valvulitis; and was in severe bilateral cardiac failure. (1×240 .)

reported. Tuberculin bacilli were isolated in 1, and the Heaf test was positive in 2 others. Positive blood cultures for *Salmonella typhosi* and *Streptococcus faecalis* were found in 2 suspected of having subacute bacterial endocarditis.

Severe rheumatic pancarditis was demonstrated at necropsy in 2 patients (Fig. 2).

Cardiomegaly and Mitral Valve Lesions. Five children had cardiomegaly and mitral insufficiency, and 5 had cardiomegaly and mitral insufficiency and stenosis. Available antistreptolysin titres ranged from 12 to 166 Todd units. Electrocardiograms revealed balanced electrical axes in 8; left axis deviation in 2; P mitrale in 6; and left ventricular hypertrophy in 7. X-rays revealed cardiac enlargement, with the cardiothoracic ratio between 69 and 86

per cent. Three with associated mitral stenosis had a "mitral" configuration.

Pericardial Effusion. Five children were found to have pericardial effusion, but no aetiological factor was isolated. The electrocardiograms revealed typical dwarfing of the QRS complexes in 2, and the amplitude was within the lower limits of normal in 3. The cardiothoracic ratio before pericardial tapping ranged from 77 to 89 per cent in 3 children, and after about 1 month of therapy was from 63 to 72 per cent, representing a reduction of between 14 and 17 per cent in each child. Tuberculous pericarditis was strongly suspected in 2 children, one of whom had proven pulmonary tuberculosis and the other a positive Heaf test, and it improved on anti-tuberculin therapy.

FIG. 3.—The left side of the heart in biventricular EMF is shown. The heart weighed 178 g. The atria and both ventricles were dilated. An ovoid plaque 0.3×0.5 cm. was found immediately above the mitral ring, over the posterior mitral leaflet. Microscopical sections through this plaque revealed slight fibrous thickening. Elsewhere the atrial endocardium was normal. The posterior leaflet of the mitral valve was shortened, thickened, and fixed to the posterior wall of the left ventricle. The patient was a 10-year-old Ruanda girl.

The Cardiomyopathies. Six children were thought to have endomyocardial fibrosis, predominantly of the right ventricle, and four of these also had mitral insufficiency. In one, this was demonstrated at necropsy (Fig. 3). Right heart failure, abdominal ascites, hepatomegaly, and absence of dependent oedema were prominent findings. The electrocardiogram usually revealed a normal electrical axis, P mitrale, normal or diminished QRS complexes, and low amplitude or distorted T waves. Cardiac enlargement was the predominant X-ray finding.

Two children appeared to satisfy the diagnostic requirements for the somewhat vaguely defined entity, "heart muscle disease": both had massive cardiomegaly and severe congestive cardiac failure.

Other Lesions. Cor pulmonale, purulent pericarditis, fibrinous pericarditis, and myopericarditis were each diagnosed once.

DISCUSSION

Rheumatic Fever in the Tropics and Subtropics. Rheumatic fever, once thought to be rare in the

tropics, has more recently been recognized as an important illness in Northern Nigeria (Beet, 1956), Singapore (Muir, 1958), and Hawaii (Rosenblatt and Stokes, 1963).

Some investigators living in the tropics have remarked that rheumatic heart disease is common in their countries, but that the acute syndrome is rarely observed (García-Palmieri, 1962). Acute rheumatic fever has been observed in Ethiopia (E. Mannheimer, 1964, personal communication), and has been described as a particularly severe disease that rapidly causes severe carditis in young children in Jamaica (Back and DePass, 1957), Senegal (Payet and Père, 1955), and Egypt (Girgis and Baragan, 1953). Lotfy Abdel Rahman *et al.* (1953) reviewed 100 cases of active rheumatic fever in Egypt and found that all of the major criteria were represented; nodules were found in 16 patients.

Problems in Diagnosis. There are excellent discussions on the diagnosis of rheumatic fever (Report of the Committee on Standards and Criteria for Programs of Care, 1956), of endomyocardial fibrosis (Davies, 1948; Ball, Williams, and Davies, 1954;

Abrahams, 1959, 1962), of heart muscle disease (Edington and Jackson, 1963), and on the possibility of confusion of EMF with tuberculous pericarditis, a common problem in Africa (Turner and Manson-Bahr, 1960). Despite well-defined diagnostic criteria, it is sometimes impossible to reach an exact clinical diagnosis.

Lack of critical judgement could lead to an over-diagnosis of acute rheumatic fever. Back and DePass (1957) pointed out that the arthritis associated with sickle cell anaemia might be confused with rheumatism. Fever and malaise are nonspecific where malaria is endemic. Any murmur may develop in severe anaemia (Nadas, 1963). Antistreptolysin titres are helpful diagnostic aids (Wannamaker and Ayoub, 1960).

Making the diagnosis of chronic rheumatic carditis is even more difficult. A child is often seen for the first time in congestive cardiac failure and the history is usually too vague and confused to be helpful. Rheumatic carditis with mitral insufficiency must be distinguished from left ventricular EMF with mitral insufficiency. In EMF, low voltage QRS complexes or ventricular hypertrophy may be found (Williams and Somers, 1960). The pansystolic murmurs of mitral insufficiency are indistinguishable in the two lesions (Somers and Williams, 1960). Cockshott (1965) has demonstrated angiocardigraphic findings in established left ventricular EMF: the left ventricle is often small with apical filling defects, its volume changes little between systole and diastole, and the left atrium is enlarged. The left ventricular hypertrophy, contractility, and the absence of filling defects in rheumatic mitral disease help to differentiate the two conditions. Abrahams (1959) pointed out that the presence of mitral stenosis or an aortic valvular lesion favours the diagnosis of rheumatic fever, because neither of these typical lesions occurs in EMF. Evidence of atrial hypertrophy in the absence of mitral stenosis suggests the diagnosis of EMF (Ball *et al.*, 1954).

The differential diagnosis between tuberculous pericarditis, Ebstein's anomaly, constrictive pericarditis, and right ventricular EMF with effusion may be difficult in certain cases. Tuberculous pericarditis is often associated with pulmonary or other forms of tuberculosis (Spodick, 1956), but the illness may be symptomatically dormant in the child (White, 1951). A diagnostic pericardial tap can be safely accomplished through the subxiphisternal route (Boyle, Pearce, and Guze, 1961) and may be definitive. Replacing some of the pericardial fluid with air helps to define the parietal pericardium, which remains normal in EMF and becomes thickened in tuberculous pericarditis (Turner and

Manson-Bahr, 1960). The combination of tricuspid incompetence and pericardial effusion is thought to be pathognomonic of right ventricular EMF (Abrahams and Parry, 1963).

There may be difficulty in making clear clinical distinctions between the various cardiomyopathies. In general, right-sided EMF presents with a high central venous pressure, a dilated right atrium, decreased right ventricular function, tricuspid insufficiency, and right heart failure. In left ventricular EMF, there is pulmonary hypertension and mitral incompetence. A combination of these signs is found in bilateral EMF, though if the right ventricular lesion is severe, the low right ventricular output might preclude all signs of mitral insufficiency (Abrahams, 1962). The term, heart muscle disease, as it is used in medical reports from Africa, implies congestive cardiac failure of undetermined cause. The classical findings are cardiomegaly—often with left ventricular hypertrophy, a gallop rhythm, no significant murmur, and congestive cardiac failure. Necropsy reveals myocardial hypertrophy with little or no fibrotic changes in the endocardium. Mural thrombi have been found near the apex of the left ventricle, and emboli from these have led to visceral infarction. The valves and pericardium appear normal (Gillanders, 1951; Edington and Jackson, 1963).

There appears to be less distinction between the various cardiomyopathies than was first recognized (McGregor *et al.*, 1957). Edington and Jackson (1963), for example, have raised the possibility that heart muscle disease and endomyocardial fibrosis might be stages of a single pathological process.

Importance of these Observations. It may be difficult to make a definitive clinical diagnosis in chronic advanced carditis, and it is often impossible to help such a patient appreciably. The emphasis must be on prevention. This implies further research to determine the exact aetiology of the cardiopathies and a greater emphasis on health education to prevent rheumatic fever.

Potassium and magnesium deficiency resulting from chronic gastro-enteritis and malnutrition occur together in the same low income groups in which EMF is a problem (Montgomery, 1960; Caddell, 1965), and Selye (1958) has found that K^+ and Mg^{++} are effective in protecting the rat heart against necrosis in experimental stress situations, whereas rats deprived of these cations may develop EMF-like lesions. When treating children who are K^+ and Mg^{++} deficient, both cations must be given, because K^+ alone will not even correct K^+ deficiency (MacIntyre and Davidsson, 1958). Persistent K^+ and Mg^{++} deficiency may therefore

contribute to the development of endomyocardial fibrosis, and the administration of these substances to children with prolonged gastro-enteritis might help to protect the heart from scarring.

There must be increased awareness of rheumatic fever as an important source of morbidity and mortality in certain regions of the tropics and subtropics. Steps to prevent the disease should include alerting rural health officers and nurses to the necessity of early eradication of β -haemolytic streptococcal infections (Stollerman, 1964). Adequate doses of penicillin are required to prevent the initial attack of rheumatic fever following a streptococcal infection. Rheumatic fever patients should receive small daily doses of sulphonamides or an adequate substitute (Stollerman, 1964) during a long follow-up period to prevent recurrent episodes of illness. Such a programme, though expensive and inconvenient, is clearly indicated.

SUMMARY AND CONCLUSIONS

Acquired heart disease is a major paediatric problem of the tropics and subtropics. Excluding the commonest aetiological factors that may lead to heart disease in children—severe electrolyte imbalance, protein-calorie malnutrition, anaemia, and acute nephritis, 50 instances of acquired cardiac disorders were seen in a one-year period in African children in Kampala, Uganda. Although the exact diagnosis was not made clinically in many of the patients with chronic carditis, it was established beyond question that the most prominent aetiological factor was rheumatic fever, which was diagnosed in 23 of the 50 patients, suspected in 5 who had both mitral insufficiency and mitral stenosis, and might also have been the aetiological factor in some of those with pure mitral insufficiency. This was an unexpected finding, since most of the published cardiology reports from Uganda have emphasized endomyocardial fibrosis.

The aetiology of endomyocardial fibrosis is not known, but correction of the potassium and magnesium deficiency that commonly occur during prolonged gastroenteritis among children of the lowest income group in the tropics might help to protect the heart from scarring.

The prevention of initial and recurrent episodes of rheumatic fever requires an increase in health education, clinic facilities, and adequate supplies of penicillin and the sulphonamides.

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