RHEUMATIC HEART DISEASE: ITS NATURE, COURSE AND PREVENTION.*

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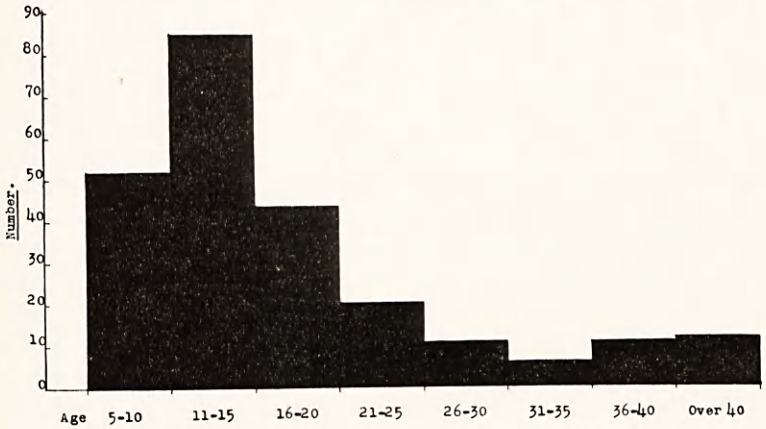
IT is fitting that this year our thoughts should turn to rheumatic heart disease, because 1935 is the centenary year of Bouillaud's [3] recognition of the direct connection between rheumatism and endocarditis. I propose to consider some of the problems concerning the nature and course of rheumatic heart disease,



ACUTE RHEUMATISM.
Age at onset of clinical manifestations in 244 cases.

indicate the morbidity and mortality it causes, and offer suggestions for lessening its ravages.

1. **Acute Rheumatism.**—The initial phase is that of acute rheumatism. The basis of my communication is furnished by 244 cases (including 60 cases of chorea) admitted to the Wards of the Royal Infirmary under my charge during a period of ten years ending in 1932. The age at onset of the first manifestations of the disease in these 244 cases is represented in the Figure, which shows that acute rheumatism is first revealed, not in infancy, but usually in children of school

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age, less often in adolescents, and still less often in adults. Rheumatism is a disease—often protracted, at times acute, at others latent, quiescent, subacute, or chronic—of which the chief clinical manifestations are carditis and chorea in children of school age, acute polyarthritis in adolescents and young adults, chronic heart disease and fibrositis in later adult life. I refrain from any discussion as to whether rheumatoid arthritis is a form of rheumatism or whether the two diseases are distinct.

Theories as to Nature and Causation.—We are still remarkably ignorant concerning the nature and causation of acute rheumatism. Apart from the theory, still current in France, which regards the disease as a tuberculous manifestation, there are two chief schools of thought. According to one, acute rheumatism is a *specific infective disease.* This concept is strongly upheld by those who, like Gross and Ehrlich,[9] claim as indubitable signs of rheumatism those small inflammatory lesions in the myocardium and elsewhere, first described by Goodhart [8] in 1879 and now termed Aschoff [2] nodules. The first stage in the development of these nodules, according to Klinge,[10] is a fibrinoid degeneration of connective tissue fibrils. This is followed by proliferation of connective tissue cells and perhaps of endothelial cells, thereby forming nodules which may contain multinucleated giant cells. The nodules eventually heal, but do not invariably leave scars. The specificity of Aschoff nodules is widely, but not universally, accepted. Rheumatic nodules similar to those in the myocardium may also be found in the walls of the aorta, peripheral arteries and coronary arteries, in the connective tissue of the pharynx, larynx, trachea, and œsophagus.[14] In some cases the tissues are studded with rheumatic nodules; in others, and especially in infants, nodules cannot be found. Further, Aschoff nodules may be seen in the myocardium although there had been no clinical manifestations of rheumatism. The rheumatic carditis, it is assumed, had been entirely latent. There is no essential difference between rheumatic nodules in the myocardium and those in subcutaneous connective tissues, peri-articular tissues, synovial membranes, and tendon sheaths. The latter nodules are usually about the size of millet seeds, may be as big as peas, but are rarely larger. They consist of a central fibrinous core, an intermediate zone of actively proliferating connective tissue cells, and an outer zone of

newly-formed fibrous tissue and capillaries. Successive crops of these nodules on elbows, knuckles, knees, and elsewhere often indicate a severe rheumatic infection, but they also occur in subacute or chronic cases that are pursuing a mild clinical course. The histological similarity of the nodules in acute rheumatism, rheumatoid arthritis, and subacute bacterial endocarditis is often regarded as an indication that these three diseases are not separate, distinct, pathological processes, but are all three manifestations of one common disorder due to a virus not yet identified.

If we adhere to the conception of acute rheumatism as a specific infective disease we do not necessarily consider sodium salicylate as a specific anti-rheumatic remedy. Admittedly, it lowers the febrile temperature, relieves pain, and may lessen arthritic swellings, but, as has recently been shown by Wyckoff [16] and others, the fever of acute rheumatic polyarthritis tends to subside spontaneously. The absence of any specific action of salicylate in the treatment of acute rheumatism is borne out by its failure to confer benefit in chorea, and its complete inefficacy in acute rheumatic carditis.

Rheumatism an Allergic State.—The specific infective nature of acute rheumatism is doubted or denied by many authorities. They draw attention to the similarity between certain manifestations of acute rheumatism and those of diseases which are now regarded as allergic. An acute rheumatic illness is likened to the Arthus phenomenon in a sensitised animal.[1] In such an animal an acute inflammatory reaction occurs at the initial site of injection of foreign serum when injections of serum are subsequently made elsewhere. The animal has acquired a state of hypersensitivity or allergy, in which inflammatory processes arise as reactions to an antigen-antibody complex. An allergic state may have been induced experimentally; it may develop during the course of disease or in response to treatment designed to cure disease, for example, in response to injections of foreign protein. Both in serum sickness and acute rheumatism there may be acute polyarthritis, fever, erythema, and other cutaneous eruptions. Erythema nodosum—an allergic manifestation—may be tuberculous, rheumatic, or frankly streptococcal in origin. The latent period between the onset of scarlet fever—a streptococcal infection—and the development of post-scarlatinal nephritis and arthritis is usually three weeks.

There is often a similar latent period of about a fortnight between an acute streptococcal tonsillitis and the development of acute rheumatic polyarthritis. During this latent period the individual is thought to be developing hypersensitivity to hæmolytic streptococci, and the resultant inflammatory changes in articular and peri-articular tissues, in heart and elsewhere, are thought to be allergic. Among the chief exponents of the allergic origin of acute rheumatism are Coburn [4] and Swift [15] in America, and Klinge [10] in Germany. The allergic basis of rheumatism, though widely accepted, is not finally established; and the researches undertaken by Gibson and Thomson [7] on the skin reactions to hæmolytic streptococcal extracts, which formed the subject of a communication to this Society two years ago, did not add much support to this theory. The tonsils are often chronically inflamed, but they may be healthy in rheumatic patients, even in those proceeding to a fatal issue. Our knowledge regarding the prevalence of septic sinusitis in rheumatic patients, and its association with rheumatic fever and rheumatic heart disease, is still most imperfect. The exact relation between streptococci and rheumatism is still in doubt. A streptococcal infection may perhaps pave the way for, accompany, or follow in the train of, infection with a specific virus.

Like tuberculosis, rheumatism is not an hereditary disease, but several cases may occur in any one family. Moreover, although the first obvious manifestations of rheumatism, like those of tuberculosis, may appear in the school-child or adolescent, the pathological process almost certainly begins at an earlier age. The child's parents are usually of the artisan class, living in an urban community. But they may be in comfortable, even affluent, circumstances, and the hygiene of the home may be excellent. The incidence of rheumatic heart disease, however, is lower among adolescents of ample, than among those of moderate, means. At Yale the figures are 5 per thousand in the former; 12·5 per thousand in the latter.[12]

2. **Acute Rheumatic Carditis**—the second phase—was observed in 114 of the 244 cases (46 per cent.) of the present series, there being acute endocarditis in 40 per cent. (rheumatic fever, 89; chorea, 15). Of the 109 cases of acute endocarditis, 43 per cent. arose during the first acute rheumatic illness

(rheumatic fever, 41 ; chorea, 6). Neither the liability to carditis nor its severity bear any direct relation to the intensity of the arthritis. The endocarditis affects the mitral valve, seldom the aortic or other valve.

Systemic Manifestations.—The clinical course of acute rheumatic carditis is exceedingly variable. Neither the beginning nor end of the acute phase is clearly defined ; its duration is usually measured by months rather than weeks. Among the systemic manifestations are fever of remittent type, tachycardia, and leucocytosis. Some virulent cases develop a purpuric eruption comparable to that in subacute bacterial endocarditis. Blood cultures are consistently negative.

Of focal signs, the most frequent and significant is a mitral systolic murmur, but the heart-sounds may remain pure throughout the two, three, or four months while the patient is under observation for chorea or rheumatic fever. Nevertheless a latent endocarditis may be developing ; the proof is afforded some months or years later by the detection of the ultimate *valvular* lesion.

Pericardial Signs.—Pericarditis, much less frequent than endocarditis, developed in only 35 of my 244 cases. The end-results of acute rheumatic pericarditis are not serious, unless there is concomitant endocarditis. When our hospital patient leaves the Astley Ainslie Institution, five or perhaps six months after his acute illness began, no signs of any disability attributable to the pericardium can be detected.

Myocardial Signs.—Gross dyspnœa, pallor and cyanosis, tachycardia and low blood pressure point to myocardial failure. The development of cardiac dropsy in a child who is suffering from rheumatic endocarditis indicates profound myocardial weakness which will almost certainly prove fatal within a few months.

The cardiac rhythm usually remains perfectly regular throughout the acute illness. Nevertheless there is often a minor degree of temporary damage to the myocardium, as revealed by undue prolongation of the time (*P-R* interval) needed for each impulse to pass from auricles to ventricles. Seldom is this conduction defect more severe whereby occasional impulses to the ventricles are blocked ; there is partial heart-block and the pulse becomes " intermittent," even although digitalis has not been administered.

Prognosis.—The immediate prognosis in acute and subacute rheumatic carditis is almost always favourable. The illness may be protracted for many months, fresh exacerbations of fever and arthritis may occur, the aortic valve may become incompetent, the patient's condition may appear hopeless. A few years later, however, we may hear of the patient being at the theatre, or she asks if she may marry and, if so, is pregnancy contra-indicated. Whereas a rheumatic case, no matter how grave it may appear, seldom fails to survive the actual illness, a streptococcal case, yielding a positive blood culture, will end fatally within two years, indeed often within six or twelve months. About 5 per cent. (13 of 244) of cases which at the start were rheumatic, ultimately developed a terminal streptococcal endocarditis. Of 35 patients suffering from the latter disease, 20 (57 per cent.) had suffered from antecedent acute rheumatism or chorea.

3. **Chronic Valvular Heart Disease.**—The patient gradually passes into the third phase—that of chronic valvular heart disease without myocardial failure. Mitral stenosis with incompetence is the usual lesion. In some, the inflammatory process subsides and heals, leaving a scar—usually fibrous, sometimes calcified—which causes a passive hindrance to the circulation. The heart adapts itself to the chronic valvular lesion ; compensation is established ; the woman may experience no particular difficulty either in her housework or during pregnancy and parturition ; the man may be fit for his ordinary duties and to take part in outdoor games and athletic sports. In other cases the inflammation becomes quiescent but does not " heal " ; the smouldering inflammation flares up in activity from time to time and ultimately leads to a fatal issue.

4. The **Cardiac Cripple** is the last phase. The heart that has remained efficient for ten, fifteen, or twenty years after being damaged by rheumatism often begins to fail at about the age of forty. Approximately one-half or two-thirds of all young subjects who contract acute rheumatism will become cardiac cripples before the age of fifty. The failure is often thought to be inevitable because of compensatory hypertrophy having reached its limit, and this in turn, perhaps, because of advancing years. Other potent causes of myocardial failure in chronic valvular disease of the heart are excessive physical stress, intercurrent infective disease, either acute or chronic,

acute exacerbation of chronic carditis, reinfection of a damaged valve, and the development of an abnormal cardiac mechanism, notably auricular fibrillation with congestive heart failure as an almost invariable sequel. In a series of 500 fibrillators 35 per cent. had mitral valvular disease of rheumatic origin. These are the chronic cardiac cripples who drift in and out of hospital again and again. It is they who benefit above all others from digitalis. Each successive stay in hospital becomes longer, and the intervals between readmission become shorter.

Statistics.—Rheumatic fever alone is not a frequent cause of death. In Scotland during 1933 there were only 171 deaths from rheumatic fever; in England and Wales during the same year the crude death-rate from this disease was 32 per million living. We do not yet possess any exact statistics concerning either the morbidity or mortality of rheumatic heart disease in Great Britain. It has been estimated that in England 10 to 15 per cent. of children at twelve years of age are affected with rheumatism.[11] But rheumatism is not a compulsorily notifiable disease. In Edinburgh, where voluntary notification of the disease in patients under sixteen years of age is permissible, only 53 cases of acute rheumatism were notified in 1932, 72 in 1933, and 75 in 1934. But evidently only those doctors who are specially interested in rheumatism notify the disease, because nearly one-quarter of the notifications during 1934 were made by one medical practitioner.

Carey Coombs [5] estimated that 12,000 persons per annum die of rheumatic heart disease in Great Britain, and 60,000 are disabled by it in any given year. The School Medical Service in Edinburgh, examining 12,082 children during the year ending 31st July 1933, found that, whereas 36 children presented tuberculosis or suspected tuberculosis, 74 were affected with acquired heart disease. Of 463 pupils attending special schools and classes in Edinburgh, 87 had heart affections, a figure exceeded only by "lung disease (bronchitis and pre-tubercular cases) 113." During the year 1932 in thirteen hospitals in Great Britain, from Aberdeen in the north to Bristol in the south, 38·4 per cent. of all cardiac cases were of rheumatic origin.[13] During the same year, 654 cases of heart disease, Dr H. L. Wallace informs me, were admitted to the Royal Infirmary of Edinburgh. Of these, 52·8 per

cent. were of rheumatic origin. On a given day last month there were 99 cases of rheumatic heart disease in the Edinburgh hospitals. In four of the larger hospitals, one in eight of all the medical patients was suffering from rheumatic heart disease. It therefore appears that in this country rheumatic heart disease is a most potent cause of sickness and death.

Treatment.—What can be done to lessen the loss of life from rheumatic heart disease? Acute rheumatic carditis may be arrested but cannot be cured. Many remedies have been tried—sodium salicylate, anti-streptococcal sera of various kinds, including an "anti-rheumatic" serum which has now been withdrawn from the market and scarlet fever antitoxin, fresh horse serum, colloidal silver intravenously and subcutaneously, quinine and acriflavine (10 c.c. of 0·25 per cent. solution). I have never felt justified in attributing a favourable result to any of these preparations; some may do actual harm.

Acute cases probably derive more benefit from prolonged rest than from any other line of treatment. By resting the heart we hope to limit the extent of the inflammatory process within it. Complete recumbence may have to last for six months or a year. This used to be as difficult to attain in hospital as to enforce in private practice, but the requisite facilities are now obtainable in Local Authority hospitals. In Edinburgh the benefits of fresh air, sunshine, nutriment, and rest, followed in appropriate cases by graduated exercise and occupational therapy, are afforded by the Astley Ainslie Institution.

In acute rheumatism without any cardiac complication the same general principles will guide us, but the period of complete recumbence need seldom last for more than three months and convalescent treatment for another three months. Whether or not the case has been complicated by carditis, the subsequent removal of restrictions on physical activity must be slow. The treatment of patients who are suffering from acute rheumatism, even although they have not developed carditis, ought to be continued for a long time. The duration of the treatment should be comparable to that of tuberculous and syphilitic patients.

In order to guard against the danger of valvular reinfection,

all focal infections should be eradicated. I do not advise enucleation of tonsils, dental extractions, or active treatment of sinusitis or otitis during the acute phase of rheumatic fever, chorea, or carditis; such treatment should be deferred until the patient is convalescent. In chronic valvular heart disease, focal infections should be eradicated if the general health and circulatory state permit.

If the rheumatic valvular lesion is quiescent or healed and the myocardium is still efficient, the prognosis depends upon economic factors rather than medical skill. In the struggle for existence, these patients, particularly those who have to work, are gravely handicapped. The leisured few last longer, but on attaining the age of about forty or fifty they too begin to fail.

In the cardiac cripple, bodily and mental rest, by lowering metabolism, eases the burden of a failing heart; a generous diet nourishes the myocardium; digitalis slows and strengthens the ventricles and improves the circulation. A salt-free diet lessens dropsy; purine derivatives, urea, organic mercurial compounds, and other diuretics promote elimination of water. By the aid of such measures, cardiac cripples may regain a fair measure of health, but in them the rheumatic disease has reached an end-stage at which all treatment is merely symptomatic, not curative.

Prevention.—All efforts to cure rheumatic heart disease being doomed to failure, can the disease be prevented? This is a problem compared with which the prevention of tuberculosis, syphilis, and a host of other diseases is a simple matter. The fundamental difficulty is that we do not know what acute rheumatism is, nor why it arises in one person and leaves another unscathed. Acute rheumatism is almost certainly infective, and streptococcal infection is an important, if not the leading, factor. Acute rheumatism is not a self-limiting disease, but like acute pneumonia may occur in epidemic form, for example, in a closed community; but even if the infection were transmitted by carriers, we should not know how to recognise them. We know of no measure of active immunisation which would stamp out acute rheumatism like smallpox, or would even confer a considerable degree of protection for a limited period as against enteric fever.

The onset and evolution of acute rheumatism have some features in common with those of tuberculosis. In the former, as in the latter disease, the chief portal of entry of infection is probably the upper respiratory tract and the infection is apparently disseminated by the blood stream; the cellular reaction within the connective tissues may lead to the formation of well-defined nodules, which may ultimately heal. Bad environment and malnutrition are known to be important factors leading to tuberculosis; the same factors are thought to play a considerable part in the development of acute rheumatism.

To combat acute rheumatism the same general principles should be adopted as in the fight against tuberculosis. I wish to lay stress upon the virtue of a physiological life as a basic means of warding off rheumatism. The public conscience needs to be awakened concerning the insanitary, unhygienic state of those slum dwellings which abound, not only in large cities, but also in smaller burghs. If our people were better housed there would doubtless be less rheumatic disease in early life. Our children need more fresh air and sunshine. The prevalence of infections in the upper respiratory tract, and particularly in the tonsils, is closely linked with that of acute rheumatism. A healthier mode of life, it is hoped, would lessen the frequency of these focal infections.

At present all preventive efforts are individualistic, incoordinate, and spasmodic. Against this scourge an intensive, co-ordinate, and sustained campaign is needed. In an antirheumatic campaign, Local Authorities will play an important part. Many organisations, *e.g.*, Child Welfare Service, School Medical Service, and health visitors, are doubtless even now doing much to prevent acute rheumatism in children; but there is as yet no active, co-ordinated campaign against rheumatism comparable to that against tuberculosis or syphilis. We have tuberculosis medical officers and V.D. medical officers, each with his department staff, but we have no similar organisation to combat rheumatism. Instructed and guided by wise medical officers of health, our Local Authorities have long since freed the community from the menace of cholera, relapsing and typhoid fevers. In Scotland the death-rate from pulmonary tuberculosis per 10,000 of the population, fell from 17 in the year 1900 to 7 in 1930. To-day we do not even know the death-rate from rheumatic heart disease. If

acute rheumatism were compulsorily notifiable we might gradually acquire exact information regarding the frequency of the disease, its distribution in the community, and the age at which it first becomes manifest. The community should be educated as to the serious extent to which the disease disables, cripples, and kills. While the public was being educated, its interest might be aroused. There are no flag days or wireless appeals on behalf of incurable rheumatic cripples, nor are any charitable funds specifically devoted to their relief. But as public interest became aroused, benefactions would be given, it is hoped, not only for the relief of the rheumatic cripple, but also for the elucidation of the disease. More ample and better facilities for the after-care of acute rheumatic cases are needed. A short residence in a convalescent home or hospital is of little, if any, value.[6] Prolonged residence in a good environment, of children and adolescents who are convalescing from acute rheumatism, should be given a fair trial. These measures will lay an additional financial burden upon all who pay rates and taxes. The health of a community should take priority of its educational needs, but we now are paying more for education than for health. In Edinburgh our bill for education is nearly thrice that for public health (£534,000 as against £182,000). In other areas, *e.g.*, in the Royal Burgh of Elie and Earlsferry, nearly four times as much public money is spent on education as on public health (£3556 as against £947). No sudden and dramatic improvement in respect of morbidity or mortality from rheumatism is to be expected, even though the State, Local Authorities, parents, and public make common front against the disease. So very little is known about it. But we know more about it to-day than we knew ten or even five years ago, and have no reason to suppose that we have reached the confines of knowledge. When so many attempts are being made to lessen the toll exacted by tuberculosis, syphilis, cancer, and industrial diseases, it is fitting that we should begin to take active measures to lessen the ravages caused by acute rheumatism.

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