

RHEUMATIC CARDITIS IN CHILDREN.

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by

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### Introduction.

The word rheumatism, has in the past been applied to such a number of differing pathological conditions that an attempt must be made to indicate, at the outset, which group is under consideration.

In the adult symptoms are of such a character as to impel him to seek treatment for their relief; in the child however, acute rheumatism seldom manifests itself by any obvious symptom. Pain does not predominate, and, in consequence, the importance of rheumatic conditions in the young is often not appreciated.

In childhood acute rheumatism is, in fact acute heart disease, and an acceptance of this view by both the profession and the general public is essential if any progress is to be made toward limiting the immediate and ultimate mortality and suffering from disease.

Having accepted the fact that rheumatism in the child is a condition of carditis it is essential that the patients' guardian should be made to appreciate that the rheumatism of the child is of greater importance

than, say, a transitory muscular rheumatism from which the parent may have suffered and with which the so-called growing pains of the child might otherwise be confused.

The early signs of rheumatism are varied and often indefinite. In the acute form the disease may be as obvious as in the adult, but more frequently the onset is insidious and in a subacute form. The child is 'out of sorts' and listless but not considered sufficiently ill to be kept in bed or even from school. Months later something definitely amiss appears -- pain; nervousness or cardiac symptoms, and leads the parent to seek advice. From the established cardiac lesion then discovered it is easy to look back through the symptoms to the initial infection, but, when viewed from the commencement it presents a problem for diagnosis the solution of which is of the greatest importance to the patient.

A succession of such experiences comes as a forceful reminder that cardiac infection is

as liable to occur in the subacute as in the acute form of the disease, and the former assumes greater importance since the accompanying symptoms may be so trivial as to be in danger of being overlooked.

Many views are held as to the aetiology of this condition. Treatment is difficult and made more so by the confusion in the public mind between the various types of rheumatism and a failure to appreciate that carditis in a child demands patient treatment coupled with a long period of after-care and supervision.

It is on account of these difficulties with an appreciation of the large number of cardiac cripples which follows neglect of adequate treatment that an attempt has been made in this thesis to gather together some of the outstanding features of the disease.

In the past the condition has not received the attention it deserves, but recent investigations have been directed towards aetiology

and much has been done to develop the microbic theory of disease. Consideration has been paid to its relation to climatic conditions, elevation, humidity, home conditions, general nutrition, diet deficiency and antecedent illness. It is felt that much more has yet to be done on these latter lines and that, in addition, the co-ordination of the work carried-out by school and health officers with that of general practitioners would add to the value of prophylactic measures directed against infection.

The question of incapacity resulting from carditis in childhood is not a personal one only; collectively it is a heavy national burden.

This is a disease of early school-life. Education is incomplete. The child, as a result, will suffer when he seeks employment some years later. Large numbers of cardiac cripples break down under the strain of unsuitable work and of the others the expectation of life is affected adversely.

Rheumatic carditis therefore presents problems of aetiology and treatment. It has a high mortality rate and is responsible for much personal suffering and national loss.

In view of the importance of the condition from these varied aspects an attempt will be made, in the following thesis, to consider some of the recent work on the clinical aspects of the disease together with observations on a number of cases under the writer's care in an industrial area in which the general standard of living has of late been much reduced owing to depression of trade. The relative frequency of the disease in this district, standing as it does at a considerable altitude and with the prevailing economic state, as compared with the rarity of the condition noted some years previously in rural practice in a marshy district, stimulated an enquiry into the importance of such predisposing factors as damp housing conditions, nutrition, financial status of the patient etc. with a view

to comparing them with the experiences published by other observers collecting their materials from other districts under other conditions.

### Historical Outline.

Before considering the varied views held at the present time on the causation of rheumatism and its relation to heart disease it is of interest to note the various steps which have led to our conception of this disease.

Pain in the region of the joints was collectively known as rheumatism and many pathologically dissimilar conditions have been covered by this term.

Osteoarthritis first dissociated itself from this group-name by its chronic nature and the naked eye changes observed in the articular surfaces involved.

SYDENHAM separated acute rheumatism from gout by stressing the differences in age incidence and the presence or absence of pyrexia. Nevertheless the acute inflammatory changes in joints, followed in neither case by suppuration, formed the basis on which was formulated the chemical theory of the cause of rheumatism.



Lactic acid by PROUT and lactic with uric acid by HAIG were held responsible for the disease. The first was stated to act as an irritant to nerve centres and the second by precipitation in the joints. Excess of these acids has not been demonstrated in tissues or urine during an acute rheumatic attack.

MITCHELL first put forward the nervous theory, but this failed to gain support in the light of subsequent investigation. Trophic changes in joints following spinal degeneration or nerve section do not resemble the transitory inflammation found in rheumatic fever.

It is apparent that the Humoral, Chemical and Nervous theories were advanced to explain the most arresting feature of the disease in the adult -- the inflammation in joints.

The characteristics of the fever and perspiration, the tendency to relapse, the accompanying anaemia and the associated involvement of the endocardium and other serous surfaces lead to a com-

parison being made with pyaemia. The frequency of the disease at certain periods of the year especially in certain houses and families gave support to the theory that it was of an infectious nature.

Further advances have been made on these lines with the development of bacteriology.

MANTLE (1886) discovered a diplococcus in the blood in cases of rheumatic fever.

ACHALME (1891) described an anaerobic bacillus in such cases, but failed to produce articular lesions in inoculated animals.

Staphylococci were isolated by a number of observers from cases of suppurative arthritis, and LANZ (1893) produced suppurative polyarthriti~~s~~<sup>s</sup> by intravenous injections of a bacillus.

Diplococci and Staphylococci were isolated from a case of rheumatic fever which, however, terminated in septicaemia. Either suppuration in joints or abscess formation in the tissues was a feature in all these cases and was produced by these experimental inoculations.

SINGER (1894) drew attention to the presence of the staphylococcus pyogenes aureus in the urine during the acute phase of the disease and formed the opinion that the condition was one of attenuated pyaemia due to the association of certain staphylo- and streptococci.

TRIBOULET (1898) isolated a diplococcus which produced a serous pericarditis, but not arthritis, in the inoculated rabbit. Many observers have since described various types of streptococci which they believed to be the causal organisms.

POYNTON and PAYNE (1899) described a diplococcus obtained in culture from the blood of a patient, shown at subsequent autopsy to have suffered from rheumatism, and with it produced arthritis, pericarditis and endocarditis in the rabbit and recovered an identical diplococcus from the synovial fluid and heart valves of the inoculated animal.

Further experimental work by these and other observers goes to support this claim, while investigation on similar lines by others has not led to

such definite results.

This summary of theories held on the causation of rheumatic fever shows how investigator's minds were first concentrated on the arthritis, and that it was not until the general effects of the disease were more fully recognised that any advance was made towards elucidating the difficult problem of aetiology.

The views held on the relationship between rheumatism and heart disease have evolved along parallel lines.

JENNER (1789) demonstrated lesions in the heart following acute rheumatism and these were subsequently recognised as possible complications of the disease.

BOVILLAUD (1836) laid stress on the frequency of cardiac inflammation in this condition, and that the endocardium might be involved with resultant valvular lesions in many cases.

Up to the end of the last century, rheumatic fever might be said to have been regarded as a

condition displaying multiple non-suppurative arthritis accompanied by pyrexia and complicated at times by inflammation of the endo and pericardium and other serous surfaces.

Since then many observers, including BARLOW, CHEADLE, CARROD, POYNTON and COOMBS have, by their clinical histological and bacteriological study, relegated the arthritis of rheumatism to its proper place -- to that of a complication, and have shown that:-

(1) Acute rheumatism is primarily a pericarditis in which the myocardium suffers always; the peri and endocardium often, not infrequently leaving the heart embarrassed mechanically; other serous surfaces e.g. joints frequently; and the brain and subcutaneous tissues at times.

(2) The relative frequency of arthritis, chorea and other rheumatic manifestations is more a question of the age and sex of the patient than an indication of the severity of the infection, and that overshadowing all these rheumatic symptoms is the certain involvement of cardiac tissues.

### Aetiology.

Current opinions on this subject group themselves under two general headings.

Bacteriological and histological research points in the direction of the exciting cause of the disease, whilst clinical study of the patient in the surroundings in which the condition first manifests itself suggests a number of factors which predisposes to the incidence of the infection.

### Exciting Cause.

There is general agreement that the rheumatic state in childhood is the result of bacterial infection but there is not the same uniformity of thought on the question of the identity of the causal organism or its mode of entry into the body. Of the numerous micro-organisms already mentioned the following survive to receive support as evidence by the proceedings of the Royal Society of Medicine and of the Conference of Rheumatic diseases at Bath in 1928.

- i A protozoon or spirochaete carried by the rat flea. 1.
- ii An anaerobic bacillus as described by Achalme thirty years ago. 2.

- iii The streptococcus cardioarthritidis. Use of a vaccine in selected cases is reported to have given good results. 3.
- iv Diplo-streptococcus first described by Poynton and Payne in 1900. 4.

The last mentioned is not accepted by all investigators and its differentiation from the normal streptococcal inhabitants of the intestinal tract presents difficulties, but all available evidence points to the conclusion that acute rheumatism is due to a streptococcal infection and that the particular strain involved is probably that described and named the Diplococcus Rheumaticus by Poynton and Payne.

It is felt that this difficulty in isolating the particular strain of streptococcus is likely to make direct treatment of the disease by vaccines and antistreptococcal serum as disappointing as it has been, for example, in puerperal fever.

In the latter condition the site of entry is not open to doubt and the type of infecting organism can be discovered by bacteriological examination,

but treatment of the established infection has remained unaltered by this addition to our information on the condition, and the present campaign to reduce maternal mortality is rightly therefore being directed against conditions which predispose to, and sites permitting the entry of, the infection.

Again, the demonstration of the causal bacterium in tuberculosis marked an advance in the study of the pathology of this condition, but the practical application of this discovery has been on the lines of prevention of spread of the disease and as a guide to diagnosis and prognosis rather than as a remedial agent.

The writer feels then, that having accepted an infection, probably streptococcal in nature, as the exciting cause of the rheumatic state, the line of enquiry for the general practitioner at all events, is an investigation of the weak spots in a child's defence against the infection with a



view to their consolidation, and of the conditions which favour the onset of the attack, so that a child, already the subject of a smouldering rheumatic infection, may be placed in surroundings inimical to its further development.

#### Predisposing Factors.

Examination of the analysis of CHEADLE'S POYNTON'S and others cases shows that there is a definite relationship between the incidence of rheumatic infection and such factors as the age, sex, race and hereditary tendencies of the patient the season of the year and environmental and climatic conditions. This relationship in some cases is demonstrated by definite statistics, in others is supported by recent investigation, while the remainder are put forward hypothetically.

Accepting the well-known selectivity of the infection for the heart of the female child, there has been a tendency to summarise the other predisposing conditions in two words -- Damp and Poverty.

Statistics in support of this attitude have been based largely on patients attending hospitals and rheumatic clinics and the marked infrequency of the disease in the practice of the consultant physicians.

The general practitioner is at a disadvantage in assessing, for example, the importance of the social and economic status of the patient in relation to the infection from the fact that his practice is probably confined largely to one class of patient. This latter difficulty does not arise in rural areas but it is in the very districts in which it would be ideal to examine this particular factor that rheumatic carditis in childhood is least in evidence.

The writer found himself surrounded by a mass of rheumatic material in a small town showing a variation in elevation from 300 to 700 feet, in which some 1,000 heads of families out of a total population of 9,000 provided for medical treatment for their families by a system of deducting from

the weekly wages. Pauper cases also came under his notice. Experience showed that this contract system resulted in advice being sought very readily by those who, for financial reasons would otherwise not have come under observation.

It was decided to attempt, by an analysis of the material thus afforded, to determine what relationship the general environment of the child bore to the occurrence of the rheumatic infection.

Forty cases of rheumatic carditis which have been under observation in an initial or second attack during the past three years have been investigated from this point of view, and in order to remove any doubt as to the cause of the cardiac lesions which have been confirmed by repeated examination, all patients showing chorea as the only accompanying symptom as well as probable and observation cases have been excluded.

This selection has, of course, invalidated deductions regarding age and sex incidence, but their relative positions have been made clear by

the clinical experience of several generations whereas the inclusion of cases of pure chorea might still, with some, raise the question of the true rheumatic nature of the cardiac lesions observed.

Forty cases of Rheumatic Carditis with special reference to Environment

The experience of a number of observers whose cases have not been confined to patients without a nervous infection will be compared with these selected cases in the light of relationship between age, sex etc. and the rheumatic infection

Sex In these selected cases      MALE 60%  
FEMALE 40%

This is almost exactly opposite to that found in 500 unselected cases in which POYNTON 5 gives females 64% and merely confirms the frequency of chorea in girls as compared with boys.

Age. Ranges between  $3\frac{1}{2}$  and 14 years.

Statistics show that the initial rheumatic infection occurs in 80% of all cases between

the ages of 4 and 9 years. Three-fifths of these between 4 and 6 and two-fifths between 7 and 9.

Heredity. 42% gave a history of rheumatic fever in parent or grandparent. No reliable information regarding other rheumatic manifestations could be obtained.

<sup>6</sup>  
CHEADLE shows nearly 80% of his private cases as giving a family history of some rheumatic condition whilst POYNTON has 35% in a series of hospital patients.

Climate. Cold winds and marked alterations in humidity are stated to favour infection.

In the area under review the average annual rainfall is 55.68 inches, and it is, by its position, unprotected from easterly winds.

Season of the year.

For the reasons given above early spring and late autumn are the times in the year in which the disease is most common. The percentage incidence was

First quarter of year	5%
Second " " "	55%
Third " " "	30%
Fourth " " "	10%

Deaths Five cases terminated fatally -  $12\frac{1}{2}\%$  -  
all female children.

Colouring. Children with fair hair and complexions  
have been observed to be more frequently  
attacked than dark ones. Difficulty was  
experienced in grouping the patients who  
showed

Fair 57%

Dark 43%

7

MACKINTOSH offers an explanation of  
the infrequency of rheumatic infection in  
certain damp areas in the South and East of  
England and the author himself noted the  
extreme infrequency of cases in a district  
embracing the Pevensey Marsh. The explan-  
ation is that although blondes preponderate  
in the whole area they are rare in damp and  
marshy districts. No suggestion is offered

as to the cause of this peculiar distribution.

Antecedent Illness. An association between the rheumatic infection and a preceding attack of scarlet fever and to a less degree diphtheria has long been recognised.

12 $\frac{1}{2}$ % of these cases give a history of scarlet fever.

5% of diphtheria.

The suggestion is made that the predisposition is due to the effect of these diseases on the child's tonsils. One case in this series followed upon an attack of mumps in which, however, oral and tonsillar sepsis were not apparent.

Environment. The town in which the children under consideration live is situated on the sides of a mountain. Three quarters of the population reside at an altitude of 400 to 500 feet in houses built from 40 to 50 years ago when the population in-

creased from 500 to 9,000 at the opening of the local colliery. The remaining quarter live around the river banks at an elevation of 330 feet in houses which constituted the original village and others erected on adjacent sites when the main part of the town was built.

Distribution of Cases in relation to Elevation and Site.

Elevation	No. of Cases	% of Total	Remarks
300-400ft.	18	45%	14 on River Bank.
400-500ft.	2	5%	
500-600ft.	15	37% $\frac{1}{2}$	Elevation of $\frac{3}{4}$ of town.
600-700ft.	5	12	

Only one family moved during the period under review and this was done in the interests of the patient. In cases seen in second or subsequent attacks no change of house had been made since the initial illness.

Housing. Dampness.

25 houses -  $62\frac{1}{2}\%$  - were obviously damp - walls,



flooring and woodwork showing definite evidence of its presence. The number was made up of:-

12 houses situated on river banks.

6 end houses of long rows showing damp on exposed wall.

2 wooden huts.

2 houses with streams running under floor boards.

2 houses with roof defects.

1 a cellar dwelling.

There are four cellar dwellings in the town. No houses have basements, but are of the two storey type and all patients had living accommodation on the ground floor and sleeping accommodation on the first floor.

#### Age of Houses.

Age	No. of houses.	% of Total.	% Damp.	Remarks.
over 60 yrs.	7.	17½%	100%	All on river banks.
over 50 yrs.	2	5%	100%	"Temporary" sinkers huts.
over 40 yrs.	27	67½%	35%	Age of $\frac{3}{4}$ of town.
over 20 yrs.	2	5%	nil	

### Overcrowding.

Only 3 cases -  $7\frac{1}{2}\%$  - occurred in the congested area of the town and 60% were found in families of five or fewer persons.

The rarity of cases in the crowded district lead to further enquiry which showed that 27% of cases belonged to families not dependent on colliery workers - a very high percentage in a town in which 1,000 heads of families in a total population of 9,000 find their employment underground.

This fact together with the smallness of the families to which cases belonged accounts for the relatively high income per head shown.

### Financial position of Families.

Gross income per head.	No. of Families	Percentage of Total.
5/- to 7/6	7	$17\frac{1}{2}\%$
7/6 to 10/-	8	20%
10/- to 15/-	11	$27\frac{1}{2}\%$
over 15/-	13	$32\frac{1}{2}\%$

One family only was in receipt of parish relief. No other fell below the 5/- standard.

Summary of enquiry into Environment of Cases.

i Dampness of the house, particularly a damp site is an important factor.

62½% of the houses were obviously damp.

45% were found at river level where only 25% of total population live.

ii Poverty is not a factor.

Cases occur largely in the smaller families and those of the better paid workers in the town only one case was found in a family receiving parish relief in an area in which such relief is applied for very readily.

Compared with these figures are these of VINCENT COATES and R. E. THOMAS<sup>8</sup> who investigated 50 Bath School-children in 1925 and which show in a less marked degree the significance of damp housing. They report:-

40% of houses damp.

42% gross income per head 5/- to 7/- with the remainder over this figure.

<sup>9</sup>REGINALD MILLER in a series of 150 cases

seen at Paddington Green Rheumatic Centre in 1927 reports:-

57.5% of houses damp.

Commoner in the upper rather than lower strata of the working class.

Conditions in the Child predisposing to Rheumatic Infection.

Among predisposing factors there remain for consideration a number of conditions peculiar to the individual patient which may determine the occurrence of infection, such as:-

Weak lymphatic defence, both tonsillar and intestinal.

Irritability of the nervous system.

Previous states of ill-health.

Digestive disorders, unbalanced diets and vitamin deficiency.

The dysfunction of certain endocrine glands.

Tonsillar Infection.

Many generations have recognised the frequency in rheumatic fever of a preceeding or

accompanying attack of tonsillitis, and as the bacterial theory of the disease has been developed this has been stressed as indicating the possible site of entry of the infection.

This tonsillitis does not appear in one form only -- all varieties are found and lend weight to the suggestion that the inflammation of the throat in both scarlet fever and diphtheria is the explanation of the number of children that develop a rheumatic infection after these conditions.

In the series of cases reviewed the following facts regarding the tonsils were noted.

- i 30 cases - 75% gave a history of past throat trouble.
- ii 9 cases - 22 $\frac{1}{2}$ % had been treated for tonsillitis.
- iii 16 cases - 40% had received treatment for tonsillitis within the three years prior to the rheumatic attack recorded and on examination, presented tonsils in an unhealthy condition.

iv Three cases out of five giving a history of scarlet fever had had subsequent attacks of tonsillitis.

Cases which had received operative treatment before the onset of rheumatism numbered four of which 1 had tonsils "cut" after Scarlet Fever. Septic tags remained 3 had tonsils enucleated and had had no throat trouble since or during the rheumatic attack.

7 patients had had tonsils enucleated after the rheumatic attack recorded. There have been no relapses, but no deduction can be made from this observation as the operations are not sufficiently remote.

In view of the high percentage of cases giving a tonsillar history it must be stated that no comparison with control children has been made and that tonsillar sepsis is prevalent among the children from whence these cases have been selected.

The frequency of cases of simple goitre in the district has been noted and is of interest in view of recent contributions of LANGDON BROWN<sup>10</sup>

and others to the endocrine theory of predisposition to this disease. His suggestion is that tonsillar sepsis plays an important part in the production of both goitre and rheumatism, of the latter possibly indirectly as the result of the former, as both the states of hypo and hyperthyroidism result from iodine deficiency and both favour the development of the rheumatic infection.

Both rheumatism and simple goitre are prevalent in the area under consideration and a high percentage of these cases show gross tonsillar sepsis.

#### Nervous and Digestive Diseases.

Instability of the nervous system combined with digestive disorder are stressed by FORDYCE "as important contributory factors in the production of the "pre-rheumatic child." In the course of investigating this series of rheumatic patients no marked digestive disorder was noted and it is felt that a history of nervous instability is in many cases, a history of the early stages of chorea.

#### Nutritional Disturbance.

A condition brought about by excess of carbo-

hydrate over protein in the diet either alone or in conjunction with deficiency of vitamin B has recently had the support of VINING<sup>12</sup> and others. These suggestions indicate a desire to define the "pre-rheumatic" state met with in childhood.

That some grave metabolic disturbance precedes infection both the history and state of the child suggest most clearly, but in our present state of knowledge a definition of the pre-rheumatic state is impossible.

If, for example, one credits tonsillar sepsis with the main responsibility, is this sepsis more likely to occur in children showing thyroid abnormality or who receive an imperfectly balanced diet; or do the tonsillar and thyroid conditions themselves result from a metabolic disturbance produced by diet or vitamin deficiency, or from some cause as yet imperfectly appreciated or explored?

To summarize the facts at our disposal regarding the aetiology of rheumatic carditis, it may be said to result from an infection, probably



streptococcal, attacking children of the upper working class more frequently; that its incidence is associated with damp housing conditions but that the latter are inoperative in the absence of certain other and less easily defined contributory factors; that tonsillar infection plays a definite part in determining its occurrence and that this tonsillar sepsis is itself often associated with damp housing, evidence of abnormality in the function of the thyroid gland and the general metabolism of the child, the cause of which remains obscure.

### Pathology and Morbid Anatomy.

A study of the predisposing factors in this infection leads next to a consideration of the pathological changes resulting from its dissemination, with particular reference to its seat of election -- the heart.

As with other infections, the virulence and number of the causal organisms and the resistance of the tissues attacked produce a wide variation in the clinical picture observed.

Recently as much investigation has been carried out regarding the exact structure of rheumatic lesions as in the past was devoted to the valvular lesions determined by clinical examination.

Both are matters of great importance but should not detract from a study of the soil in which the infection flourishes or fails, for, from this quarter we must look for an explanation of the differing types of the disease presented by individual patients.

The changes occurring in a rheumatic focus

are readily examined in the Subcutaneous Tendinous Nodule observed by HILLIER (1868), described as "oval semitransparent fibrous bodies like boiled sago grains" by BARLOW (1881) and emphasised as a diagnostic sign by CHEADLE (1889).<sup>13</sup>

Subsequent investigators, notably CAREY<sup>14</sup> COOMBS, have shown that, the characteristic interstitial lesion of rheumatic myocarditis is the Submilliary Nodule, that similar inflammatory foci are found in other tissues attacked by rheumatism, that they are of the same structure as the larger subcutaneous nodule, and that in all rheumatic lesions the essential features are the same. There occurs an inflammatory reaction in and around small blood vessels evoking a brisk proliferation of endothelial and connective tissue cells without marked polymorphonuclear leucocytosis, resulting in a central area of cell debris and fibrin surrounded by a fibroblastic reaction and resulting in healing with scar tissue formation.

This process is observed in all tissues of the

body which are involved being modified only by the structure of the tissue infected and its inherent resistance to the attack.

### Joints.

The synovial membrane is attacked more readily than any other tissue in the body, and shows the most complete recovery. There is hyperaemia with exudation of fluid both in the joints and adjacent tendon sheaths. The exudate may be bloodstained, at times fibrinous but never purulent and is reabsorbed as the acute phase passes. The capsule of the joint, periarticular fibrous tissue and adjacent periosteum may also be involved and in relation to these fibrous elements subcutaneous nodules may develop which also, at a later stage, are reabsorbed or reduced in size by cicatrical contraction. A similar process takes place in fascia surrounding nerves and muscles and has to be differentiated from the fibrositis found in older patients which may not be of a pure rheumatic nature.

### Nervous System.

Localised perivascular infiltration occurs in the meninges and probably elsewhere in the central

nervous system, but the main effect of the rheumatic infection so far as has at present been determined is an irritative one produced by toxins evolved in the course of the disease.

#### Respiratory System.

Pleurisy of the dry type appears in conjunction with pericarditis in the severer cases of carditis.

Bronchopneumonia and Pulmonary oedema occur in severe infections and were generally regarded as secondary to the circulatory depression.

<sup>15</sup>  
NAISH has recently drawn attention to some cases of pneumonia in which the proliferative process characteristic of rheumatism was found. In these the condition was found most commonly at the left base, was associated with a severe rheumatic carditis, and, except when the area involved was extensive, was unaccompanied by marked respiratory distress.

#### Alimentary System.

The pathological conditions arising here as well as in the kidneys are not characteristic of rheumatism and cannot be differentiated from those

which occur in the course of other general infections accompanied by a severe degree of toxæmia.

#### Cardio Vascular System.

Rheumatic lesions in all the systems considered, show a primary vascular origin in the peri- and endo-vascular infiltration of capillaries producing swelling and hyperæmia.

Both macro and microscopic examination of the heart of a child who has died of a severe rheumatic infection shows nothing in keeping with the clinical picture. Some cardiac enlargement will be present and possibly a slight interstitial fibroblastic reaction but the heart has been poisoned before the classic signs of rheumatism have developed in the endocardium and elsewhere

#### Myocardium.

Profound changes occur affecting the efficiency of the myocardium during the acute stage of the disease which are not apparent at post mortem examination, and the importance of this toxic action should be appreciated when dealing

with mild as well as severe cases of carditis.

Pathological examination shows in all cases some increase in the size of the ventricles and in the heart's weight. Cloudy swelling of the musculature may be present and the appearance of typical submilliary nodules in the fibrous tissue may be observed.

Even in oldstanding cases the fibrosis is seldom of a degree such as would interfere with cardiac function except sometimes in the left auricle in association with mitral stenosis. It is however possible that at times perivascular infiltration may be followed by a fibrosis which interferes with cardiac innervation or the conductivity of the a. v. bundle.

#### Pericardium.

Injury to the pericardium is frequently found in severe cases and in many milder infections in which it was not suspected during life.

As compared with the synovial changes described there is less fluid effusion and a

greater tendency to the deposit of fibrin. Both parietal and visceral layers are involved and adhesions with complete or partial obliteration of the pericardial sac may result. Healing with scar tissue formation is seen in the form of "milk spots." As has been mentioned, a coexisting dry pleurisy may be found and at times pleuro-pericardial adhesions develop.

#### Endocardium.

Inflammation of the mural endocardium is rare and the term endocarditis is confined to inflammation of the endocardial covering of the valve cusps. It should be remembered that both the chordae tendinae and the first part of the aortic arch may be involved in a similar process and that the changes produced may add considerably to the embarrassment of the heart's action.

In the acutely inflamed valve a thickening is observed. The process commences in the deep structures with proliferation of connective tissue cells and a fibroblastic reaction around existing blood vessels. This is followed by the appearance



of capillary buds which permeate and vascularise the inflamed valve and themselves show peri and endo-vascular proliferation.

The endothelium covering the cusps becomes devitalized by these changes and by toxic action and undergoes proliferative and degenerative changes particularly on the side exposed to the blood stream, and on this denuded surface fibrin and leucocytes are deposited from the intracardiac blood. The "vegetation" thus formed is invaded and vascularised by new vessels from the subjacent hyperaemic cusp and organisation with fibrosis and cicatricial contraction occurs with impairment of the function of the valve.

It is apparent therefore that the changes occurring in the peri endo and myo cardium are essentially the same -- a process of perivascular infiltration followed by fibrosis.

In the pericardium this healing process may result in cardiac embarrassment from adhesions between parietal and visceral layers and with

surrounding structures; in the myocardium late effects show themselves by nutritional changes in the musculature through possible interference with the integrity of the coronary circulation or its intrinsic or extrinsic innervation; in the endocardium healing with deformity of valve cusps and chordae tendineae may occur.

#### Valvular Lesions.

Mitral. In nearly all severe cases of infection this valve is damaged alone or together with one or more of the remainder.

<sup>16</sup>  
POYNTON in 150 fatal cases gives:-

98 Mitral alone involved.

32 Mitral, Aortic and Tricuspid

15 Mitral and Aortic.

4 All valves.

1 No valvular lesion detected.

<sup>17</sup>  
COOMBS, in a series of cases, draws attention to the more common appearance of a mitral systolic murmur in the earlier years of life -- before such factors as sclerosis of cusps and shortening of the chordae tendineae can be

operative, and that in severe sclerosis with narrowing of the mitral orifice this systolic bruit is frequently absent. He gives the age incidence in 474 cases in which this murmur was present from among 669 patients.

1-10 yrs.	125 cases.	80.6% of patients in age group.
11-20	213	74.4%
21-30	70	55.9%
31-40	43	55.8%
41-50	14	46.6%
50 onwards	9	50.0%

The myocardial factor in the production of mitral regurgitation is clearly shown.

Mitral stenosis is definitely the result of valvular deformity and is therefore more commonly found at a later stage. This is the lesion which reacts most heavily on the myocardium and by placing an excessive load on the left auricle often leads to a complete breakdown and total cardiac arrhythmia.

#### Aortic.

This valve is less commonly involved, but,

because of the pressure load it has to support, a slight lesion produces an incompetence which can be gauged by alterations in the peripheral circulation even in the absence of the characteristic regurgitant bruit.

Aortic disease is evidence of a severe infection. Occasionally a systolic murmur is noted and marked sclerosis of the cusps found after death, but it is never of a degree sufficient to produce symptoms of stenosis.

#### Tricuspid.

Rheumatic endocarditis is found here only in conjunction with widespread involvement of the other valves. Incompetence of myocardial origin is not infrequent, and follows upon dilatation of the right heart resulting from a rise in intrapulmonary pressure with mitral stenosis.

#### Pulmonary.

The rare occurrence of involvement of this valve is of importance only in affording post-mortem evidence of the complete failure of the endocardium to resist the rheumatic attack.

Clinically this pancarditis differentiates this pulmonary lesion from the not uncommon congenital defect of this valve, and the age of the patient with this and other congenital lesions of the heart affords additional help in differential diagnosis.

### Clinical Manifestations.

Although a number of signs point to the presence of a rheumatic infection it is important to remind ourselves that symptoms directly referable to the heart are rarely complained of by the patient. They appear in severe cases, rapidly fatal, and those whose hearts have been damaged at an earlier date and show signs of breaking down under excessive strain or reinfection, but they are seldom met with in mild or moderately severe infections.

These general symptoms, then, are of great importance as a guide to early heart disease and will be considered first.

General Indications	Pyrexia.
	Throat Inflammation.
	Growing Pains.
	Arthritis.
	Subcutaneous nodules.
	Skin conditions.
	Epistaxis.
Anaemia.	
Nervous System	Chorea.
	Disorders of Cardiac Rhythm
Cardio Vascular System	Rheumatic Carditis
	Acute            Mild
	Recurrent      Severe

Cardio Vascular System	Pericarditis	
	Endocarditis	Acute Chronic

Pyrexia.

A feature in adult cases, elevation of temperature is slight in childhood and may be entirely absent especially in children with chorea. Hyperpyrexia is almost unknown.

The absence of fever, then, cannot be regarded as evidence against a rheumatic infection but its presence may act as a warning of a recrudescence of the disease and as a guide in treatment of an established case.

An example of an afebrile onset followed by a relapse with fever illustrates this point.

EVANE -- aged 12 years. June 1925.

Complaint. Twitching of right arm and hand.

Examination. Chorea. T98.2 P112. Apex beat displaced slightly to left. Soft mitral systolic bruit. All symptoms disappeared with six weeks rest in bed. No rise of temperature After history. May 1926. A typical attack of

acute articular rheumatism with pyrexia. November 1927 when examined prior to his employment as a collier's boy he presented the picture of well compensated mitral incompetence.

Throat Symptoms.

The history of tonsillitis, scarlet fever and diphtheria in a high percentage of cases has been noted already. Sore throat may be the only complaint at the onset of rheumatism and in young children the pain may be referred to other areas, especially the head. An example of this which shows also an unusual combination of conditions is

MAIR J -- aged  $3\frac{1}{2}$  years. April 1925.

Complaint. Headache. Feverishness and an attack of shivering.

Examination. T 100.8 P 114. No cardiac enlargement or bruit. Inflamed tonsils and tender tonsillar glands which proved to be the site of the "headache."

Microscopic examination of the urine demonstrated the presence of a B. Coli pyclitis.



Under potassium citrate treatment the temperature but not the pulse rate fell.

One week later multiple arthritis appeared and later subcutaneous nodes over both elbows. and cardiac dilatation was noted.

After history. January 1926 dyspnoea and oedema of legs. December 1927 a diastolic mitral murmur was recognised in addition to the systolic bruit which had persisted since the attack of arthritis.

#### Growing Pains.

The repeated history of pain in the limbs, particularly the front of the shins and behind the knees, is remarkable. 72% of the cases quoted give such a history. In half it was one of the complaints when first examined; in the other such pains had been complained of during the preceeding year. In 16% of cases it was the reason for advice being sought.

Growing pains are not, as has been suggested a symptom in mild cases only, as is shown by --

ALICE D -- aged  $5\frac{1}{2}$  years. December 1926.

Complaint. Pain behind both knees.

Examination. T 99.4 P94. No cardiac dilatation or murmur. Ten days later while still in bed and temperature was normal there was an attack of acute tonsillitis followed by the appearance of subcutaneous nodes over the spine, and cardiac dilatation.

After History. Evidence of mitral disease appeared and she ran an irregular temperature.

Death occurred in December 1927.

#### Joint Manifestations.

Quite distinct from growing pains is the swelling and pain in joints similar to that found in adult rheumatic fever, though in some cases it was found that the child complained more of the growing pains than of the coexisting arthritis.

The older the child the more nearly does the condition resemble that of adult cases, except that in the first few days the arthritis may remain monoarticular and lead to difficulty in diagnosis.

In early infancy rheumatism is very rare and arthritis below the age of three years almost unknown. Below that age the condition may be simulated by an epiphysitis due to scurvy rickets and congenital syphilis or an arthritis of gonococcal or pyaemic origin.

At the age when rheumatism becomes common acute osteomyelitis has to be differentiated by its position in relation to the joint and the marked constitutional disturbance and absence of polyarthritis. Tubercular arthritis is differentiated by the latter reason and the absence of evidence of local or general inflammation.

Rheumatoid arthritis, Gout and Haemophilia as well as Synovitis as a late manifestation of congenital syphilis have all to be considered in cases of doubt.

A diagnosis of rheumatic arthritis in infants should be made only with the greatest caution. The youngest patient in the series studied was --

GWINITH J -- Aged 3-4/12 years. August 1925.

Complaint. Pain and swelling in left knee.

Examination. T 99.8 P 112. Heart's action tumultuous, apex beat diffuse, forceful and displaced to left.

After history. The arthritis moved from joint to joint, and the general condition of the patient deteriorated rapidly. Symptoms suggesting pericarditis developed in November and death ensued at the end of the month.

#### Subcutaneous Nodules.

The nature of these fibrous bodies, which are conclusive evidence of rheumatism, has already been described. They are best felt over bony prominences such as the elbows, malleolæ and spinous processes and are found also in relation to the insertions of tendons.

They are described as painless, but in a case of chorea with severe carditis at present under treatment, the appearance of a fresh crop of nodules has on each occasion been preceded by a few hours of severe localised pain as well as by marked constitutional disturbance.



These rheumatic nodules have to be differentiated from the minute embolic lesions of malignant endocarditis which are tender and appear at the finger tips.

Subcutaneous nodules can be taken as evidence of an active rheumatic infection and are of grave prognostic significance as they suggest the imminence of endocardial and possibly of pericardial involvement.

#### Skin Manifestations.

A variety of skin conditions has been described in relation to the rheumatic state. Sudamina occur in older children who show the same tendency as adults to profuse perspiration. Of the Erythemata the marginate type on the trunk is the most characteristic.

The position of Erythema Nodosum is still debated but the frequency with which it appears in patients with no signs of rheumatism and the fact that these cases show no tendency to develop the disease at a later date makes its claim to a

rheumatic relationship very weak. A history of erythema nodosum was obtained in two cases out of the forty cases received.

Epistaxis.

This is another common condition in childhood which is sometimes included among rheumatoid symptoms. In the two cases in the series in which it occurred it appeared to be due to venous engorgement brought about by impending cardiac breakdown.

Anaemia.

This symptom is one of very great importance because of the frequency of its occurrence with the rheumatic infection and the fact that it is a condition which is regarded as of little importance by the public, and the child is not brought for treatment until much valuable time has been lost.

Anaemia in childhood calls for an exhaustive examination of his general surroundings, habits and diet as well as a careful physical survey in which particular attention is paid to the heart and search made for septic foci.

In cases of acute carditis anaemia is often profound but the cause is here self-evident.

The difficult and common case is that of the child who is brought for examination because he is "not getting on". He is pale and languid, the appetite is poor and sleep broken. The mother fears that the child is consumptive.

Anaemia is usually well marked in such a child and a cause may reveal itself in some septic focus, faulty home conditions, or the state of the lungs. A remarkably high percentage of these children however show evidence of a smouldering rheumatic infection and a careful examination of the heart in all such cases is essential and should be repeated periodically in patients for whose anaemia there is no satisfactory cause to be found elsewhere.

With the anaemia in rheumatic cases a degree of wasting, out of all proportion to the illness of which a history is given, is a very constant sign and these two symptoms alone might well support a tentative diagnosis in indefinite cases.

Digestive disturbance is a regular feature in this type of child, but this should be attributed to the anaemia - which itself may be of rheumatic origin - rather than be claimed as a symptom of the rheumatic infection. An example of such a child is

JOHN L -- aged 6 years. September 1926.

Complaint. Failure to gain weight. Pallor.

Vomiting at night.

Examination. No abnormality in temperature or pulse. No cardiac dilatation detected. Well marked anaemia to which was attributed a soft mitral systolic bruit. The general condition was poor, teeth carious and tonsils septic.

The oral sepsis was corrected and the enucleation of tonsils postponed till the spring. The operation was followed in six weeks by multiple arthritis, cardiac dilatation and the reappearance of the mitral murmur. In December 1927 the murmur was more harsh in character. It was felt that the bruit discovered at the first examination had been credited to the anaemia instead of to a rheumatic state of which it was the result and that delay in dealing with the throat favoured reinfection in this case.

#### Chorea.

The relationship between chorea and rheumatic carditis is established beyond doubt by the appearance of undoubted rheumatic phenomena together or



alternating with the chorea. The numbers in which heart disease develops with chorea as its only accompaniment and of those with mitral stenosis who give a history of this nervous affection only, give support to this view. 35% of these cases of carditis gave a history of chorea or developed it while under observation. This is a high percentage in a series of cases of rheumatic carditis in which patients showing heart disease with chorea as the only other rheumatic sign were excluded.

In the writer's opinion evidence of nervous instability such as night terros, emotionalism, and excitability are not so much a sign of an hereditary tendency towards chorea as of the onset of that disease. An example of a common sequence is given by the case of

IVOR. D -- aged 7 years. June 1928.

Complaint. Pain behind knees. Night terros.

Examination. T 99.8 P94. Heart slightly dilated. Mitral systolic bruit present.

While under treatment subcutaneous nodules appeared at the left elbow accompanied by severe chorea.

After History. December 1928. Mitral murmur harsh in character and conducted to the axilla. Exercise tests showed imperfect compensation.

Cardiac Manifestations.

Presumptive evidence of rheumatic carditis is supplied, therefore, by a number of symptoms indicative of the general infection, but an attempt to collect direct evidence of the early stages of heart disease from the symptoms presented is remarkably unproductive.

A scrutiny of leading symptoms showed that only five among forty cases of well marked heart disease complained of any such definite cardiac symptom as dyspnoea, palpitation, precardiac pain, cyanosis, cough, oedema or haemorrhage due to peripheral stasis.

Of the two cases complaining of oedema

MARY L -- aged 9 gave a history of apparent rheumatic infection two years previously and had longstanding mitral disease.

DOREEN D -- aged 7 was a case of severe carditis and survived for only three months.

Of the two cases with dyspnoea as a leading

symptom

LILY W -- aged 13 had a history suggestive of a prior infection and had established mitral and aortic disease

NOEL. L -- aged 9 proved to be a case of pericarditis as did

JACK C -- aged 14 whose leading symptom was precordial pain.

Cardiac symptoms must not be expected in the majority of cases but are to be found in the fulminating type of the disease and among patients with oldstanding heart disease in which a further impairment of cardiac efficiency has followed a lighting up of the infection.

Cardiac involvement has, therefore, to be assumed in all children with signs of an active rheumatic infection until repeated examination over a long period establishes its absence.

Estimation of the area of cardiac dullness and observation of the pulse rate have to be relied upon in making an accurate estimate of the state of the heart muscle, and certain disorders of cardiac rhythm

must be considered before reliance can be placed upon deductions made from observation of the pulse.

#### Functional Tachycardia.

The pulse is regular but shows a temporary rise in rate. It is seen in nervous children under the influence of excitement and is accompanied by changes of colour and excessive perspiration. Exercise and change of posture do not increase the rate which drops to normal during sleep and differentiates this condition from tachycardia due to a rheumatic myocarditis.

The normal rhythm is maintained in both conditions as shown by electrocardiograms, but inversion of the T wave in lead II is seen in some cases of severe myocarditis.

#### Paroxysmal Tachycardia.

The onset is abrupt, frequently with signs of cardiac distress, and its cessation is as abrupt. There appears to be no relationship between the rheumatic infection and this condition which the electrocardiogram shows to be due to impulses arising in some abnormal part of the cardiac tissue

with auricle and ventricle contracting at the same rate.

#### Sinus Arrhythmia.

This is a common cause of irregularity in childhood and is not indicative of disease. It can be identified from the fact that it disappears when the patient holds the breath and also with exercise. No abnormality other than the arrhythmia is disclosed by the electro cardiogram.

#### Premature beats.

These are associated with an intermittent pulse and premature sounds which disappear as a rule with exercise. An electrocardiogram shows whether the abnormal stimulation arises in the auricle or ventricle.

Although common in the absence of cardiac disease it is more common still in children suffering from carditis.

They are usually attributed to some toxic state while RUSSELL AND HAMILTON<sup>18</sup> suggest an abdominal source of reflex irritation and COOMBS<sup>19</sup> the presence of a typical endovascular lesion with

occlusion of an arteriole as the cause of local hyperexcitability of the cardiac tissue.

Auricular Fibrillation is indicative of gross cardiac disease and is a late manifestation seldom met with in children. There is a total irregularity of the pulse with a marked increase in the rate of cardiac contractions. Electrocardiographic examination confirms the diagnosis by an absence of P waves and the extreme irregularity of the contractions shown.

#### Heart Block.

A slow irregular pulse which is seldom found in the child is associated with the toxic action of diphtheria and less frequently of rheumatism on the bundle of His. An electrocardiogram shows a prolongation of the p - R wave.

An alteration in the rhythm of the heart is not therefore found in the early stages of rheumatic carditis but an increase in rate is a constant feature of active disease. Both functional and paroxysmal tachycardia can, as a rule, be excluded by clinical observation but an electrocardiogram is of value in throwing light on obscure cases of

cardiac irregularity.

Symptoms and Signs of Rheumatic Carditis.

Having accepted the hypothesis that in every case of rheumatic infection the myocardium is involved irrespective of the presence or absence of endo or peri cardial signs the main objection to the usual classification of cardiac derangements is overcome.

From a practical standpoint various clinical types of the disease can best be considered by a series of case-pictures grouped according to the following simple classification.

- I Rheumatic Carditis
  - i Acute
    - (Mild
    - (Severe
  - ii Recurrent
- II Pericarditis
- III Endocarditis

Acute Rheumatic Carditis - Mild.

To this group belong the most important cases of carditis in children. From the fact that the constitutional disturbance is slight the condition may be neglected by the parent or overlooked at a single examination. Treatment at this stage is

essential to make any reduction possible in the present wastage from cardiac disease. A long period of rest and supervision is necessary so that as complete a recovery as possible may be made. A typical case history is that of

MAXWELL W -- aged 6 years August 1926.

Complaint. Growing pains and nervousness.

Examination. General condition poor; some anaemia; enlargement of tonsils and tonsillar glands. History of scarlet fever one year previously. No rheumatism. Slight choreic movements of the left arm were present. T 98.4 P 98. Cardiac action excitable with apex beat displaced to the left. The first mitral sound was shortened and a soft bruit present.

The chorea proved refractory but all symptoms subsided with rest.

After History. Enucleation of tonsils performed one year later when no cardiac abnormality could be detected.

#### Acute Rheumatic Carditis - Severe.

This type of case is characterised by the severity of the infection, the rapid failure of the



myocardium and the frequent absence of clinical signs of endocarditis revealed by post mortem examination. This condition has a high mortality rate and the younger the patient the graver the prognosis since young children seem quite unable to offer any efficient resistance to this attack upon the myocardium.

GWINITH J -- aged 3-9/12 years. August 1925.

Complaint. Pain in legs. Breathlessness.

Vomiting. Home conditions poor. House damp.

No family history of rheumatism.

Examination. T 100.8 P108. Apex beat diffuse and well to the left. First mitral sound short.

Oedema of legs.

After History. Cardiac dilatation was progressive accompanied by a soft mitral systolic bruit, accentuation of the pulmonary second sound, cough and moist sounds at both bases.

Death occurred in six weeks from the onset of the infection.

#### Recurrent or Relapsing Carditis.

This form of the disease is responsible for a high percentage of cases showing valvular disease in

early adult life.

A proportion give a history of a "feverish" or influenzal attack which would correspond with the initial infection and account for the valvular lesion discovered.

In a number of cases such a mild attack is followed by a reinfection or relapse which may run a very different course to the initial infection.

DAISY P -- aged 11. April 1925.

Complaint. Sore throat.

History of pains in joints with swelling four months ago.

Examination. No alteration in pulse rate or temperature. Tonsils and tonsillar glands inflamed. Heart not dilated. A well marked conducted mitral systolic murmur.

After History. September 1925. Rapid dilatation of the heart with accompanying articular rheumatism. The development of aortic disease was associated with myocardial failure of which the patient died in December.

### Pericarditis.

This is considered apart from its associated myocarditis and endocarditis because of its frequency in childhood as compared with adult life.

Although pericarditis is usually rheumatic it may result from a pneumococcal pyogenic or tubercular infection with evidence of the primary focus elsewhere.

The classic symptoms of its onset - pain over the heart, vomiting and dyspnoea are seldom observed in the child. Sudden enlargement of the area of cardiac dullness unless preceded by friction is more likely to be of myocardial origin than due to effusion which is rare in the young.

Friction moreover is heard in only a small proportion of cases in which pericarditis is discovered at autopsy. Its presence has therefore to be inferred in patients with a severe infection in which there is a sudden rise of temperature with an increase in cardiac dilatation together with dyspnoea and tumultuous action of the heart.

Endocarditis.

Inflammation of valves assumes its greatest importance in subacute and recurrent infections.

In mild infections mitral incompetence frequently clears up with appropriate treatment proving that a myocarditis rather than an endocarditis was present.

A consideration of endocarditis in the young resolves itself, from a practical point of view, into a study of mitral disease, as is shown by the lesions present in the forty cases examined which showed

25 Mitral Incompetence alone.

9 with Established (5) Mitral Stenosis  
Developing (6)

5 with Aortic Incompetence (3) Alone  
(2) with Mitral Stenosis

1 a rapidly fatal case of pericarditis.

In all the aortic cases there had been evidence of antecedent mitral disease.

The course followed by a case of rheumatic infection varies greatly with the resistance of the myocardium and the various combinations of valvular lesions which may develop. To recapitulate one may say that mild infections show an increase in the

heart's rate, a varying degree of cardiac enlargement and frequently a mitral murmur which disappears in many cases as the myocardium recovers tone. At the other extreme are cases which show rapid heart failure from overwhelming infection of the heart muscle.

Between these two types are cases following many different courses.

In some a mitral systolic bruit persists after the tachycardia and cardiac dilatation have subsided and proves that fibrosis of the valve cusps has occurred. Arrested at this stage, little inconvenience may be felt from the reduced cardiac efficiency unless intercurrent disease or prolonged physical strain add a further burden to the heart.

In less favourable cases the myocardium is slower to recover or the infection lights up again. An accentuation of the pulmonary circulation and in oldstanding cases the further burden on the auricle precipitate a breakdown culminating in fibrillation.

More commonly a middiastolic is followed by a

presystolic murmur without alteration of symptoms and not until years later a crisis arises from some trivial cause and complete disorganisation of the heart's action follows.

Rheumatic disease of the aortic valve is found in the severer types of carditis. It hastens death when gross **pari**carditis is present and leads to an earlier breakdown in the progressive cases of mitral disease, but presents no features distinctive of rheumatic heart disease.

Involvement of the other valves calls for no description as the clinical picture is of a severe **pari**carditis of which their involvement merely gives additional evidence.

### Treatment.

This disease is open to attack along three lines which may be directed respectively against

- i General Symptoms
- ii Cardiac Infection
- iii Conditions predisposing to its onset or recurrence.

This forms a convenient grouping of the subject, for general treatment leads to a consideration of the management of cardiac lesions in a number of cases while the after care can be discussed in conjunction with prophylaxis.

### Treatment of General Symptoms.

Opinions are almost unanimous that the condition should be treated on the lines of a general infection.

Rest in bed between blankets with attention to the fluid intake and elimination by bowels, kidneys and skin is essential.

Seclusion of severe cases of chorea is helpful and in articular rheumatism measures taken to keep the affected joints warm, steady and free from pressure, reduce discomfort.

Apart from general principles, however, there is great diversity of opinion on the value of drugs, vaccines and sera, local applications to joints, and the duration of rest in bed and of after care desirable in any given case. Rest. Absolute recumbency is the rule during active heart disease. The duration of treatment and after care of a given case is influenced by the importance which each individual attaches to the effect of the infection on the myocardium.

Regarding every case of active rheumatic disease as one of acute infection of the heart muscle leads to an insistence upon this treatment being continued for some weeks after all signs of activity have disappeared, whilst the rapidity of convalescence is controlled by systematic recording of the pulse rate.

#### Local Applications.

The relief given by the application of Lin. Methyl Sal Co. to inflamed joints justifies a continuance of its use in face of theoretical objections.

#### Diet.

The most suitable fluids in the febrile stage and nourishment for the convalescent, as well as the role of diet in the aetiology of the disease, have



been widely discussed.

A generation ago meat extracts were forbidden at the onset and meat was withheld for a long period, sugar was greatly reduced and a rigid milk diet enforced.

At the present time opinions are divided on this subject and two extreme views have recently been expressed by clinical observers.

<sup>20</sup>  
PEARSON and WYLLIE describe in detail two wide deviations from the normal in the "acid" and "lymphatic" child and suggest increased liability to certain diseases in these types. Rheumatism is regarded as a disease of the "acid" child and they advise strict limitation of milk given, reduction of meat to a minimum and the free use of a vegetarian diet.

<sup>21</sup>  
A.P. THOMSON quotes results obtained by the study of diet in 22 rheumatic children. Half were fed for five months on a rich protein diet and the other on one with a high starch content. The absence of alteration in the chemical condition of the blood and of variation in their clinical progress leads him to consider that diet is of no material importance

in the aetiology or course of rheumatism in children.

Until further evidence in support of one or other theory is forthcoming the diet which supplies sufficient nourishment in a palatable form is being used and consists, in the febrile stage, of fresh fruit drinks which act as a vehicle for cane sugar; meat extracts and diluted milk which is citrated if necessary.

For the convalescent a mixed diet containing a good proportion of fresh fruit is ordered while cases showing cardiac embarrassment are given small light meals as dry as possible. The importance of the limitation of fluids to avoid flatulence, restlessness and further cardiac distress has been noted by RUSSELL and HAMILTON<sup>22</sup> in a recent monograph and has not received the attention it deserves.

Small doses of cod liver oil and a good supply of fresh milk are useful in recovering cases and are therefore recommended inspite of the possible presence of an "acid state."

#### Drugs.

The use of salicylate of soda has been discussed from all possible angles. Extremists on the one hand would use it in all rheumatic manifestations because

it is found to control certain symptoms, while others, having found no drug which has a specific action on the infecting organism, consider valueless the use of this or any other drug.

It is true that the use of salicylates does not appear to limit the incidence of endocarditis, does not hasten the disappearance of subcutaneous nodules and by analogy is unlikely to assist in the repair of a damaged valve cusp should this be conceivable under any conditions.

Anti-sera have been disappointing presumably because of a failure to detect the type of streptococcus involved, and the "shot gun" use of mixed streptococcal vaccines has been reported as activating a smouldering infection.<sup>23</sup>

A return must therefore be made to the general principles of treatment to see in what way drugs may be of help in these cases.

The infected heart has to be protected from all unnecessary strain and much can be done in this direction by removing the causes of restlessness in the child.

Growing pains  
Acute Arthritis  
Pyrexia  
Tonsillitis

The above form a group of symptoms which cause much distress to the patient and which can be controlled by the use of salicylates.

Any patient with a rheumatic infection showing one of these symptoms: most of those with sore throat which is unassociated with the infectious fevers, and many cases of chorea with other rheumatic signs will benefit by the use of salicylate of soda for this reason.

10 grains - for a child of five years - should be given two hourly for six doses and then at four hourly intervals. Bicarbonate of soda is added to reduce digestive upset and not from fear of the toxic symptoms which have appeared with more heroic dosage.

Aspirin is of use in cases which do not show a rapid response. Dover's powder is strongly indicated to promote sleep for the first few nights.

Chloral hydrate for cardiac restlessness does

much good in soothing the patient as it does in severe chorea. This more than counterbalances its slight depressent action. It is used to supplement a course of aspirin followed by increasing doses of arsenic in chorea.

During convalescence iron is required for the anaemia together with cod liver oil and fresh fruit. Fresh air is of value in all stages and sunlight should be added as soon as practicable. In prolonged cases where this is not possible exposure to ultra violet rays has a stimulating effect.

#### Treatment of Carditis.

This will be considered in the light of a clinical grouping of cases under -

- i Acute Rheumatic Heart disease.
- ii Chronic disease with compensated valvular lesions.
- iii Chronic Heart failure.

#### i Acute Rheumatic Heart disease.

Application of the general principles of treatment discussed is indicated.

Mild cases without endocardial involvement call

for sufficient rest and careful after treatment.

Cases with endocarditis will receive little direct but much indirect benefit from the use of drugs to relieve the myocardium of strain.

Having appreciated the situation there is no excuse for withholding such drug treatment because it "masks the symptoms" of heart disease according to some objections.

34

STILL has tabulated the indications for absolute rest and this should be enforced for several weeks after the disappearance of all active signs. The indications for rest are

Cases of fresh endocardial involvement as indicated by the appearance or change in the character of bruit.

The appearance of rheumatic nodules.

The presence of much cardiac dilatation with little hypertrophy.

Where symptoms of failing compensation appear.

The use for cardiac "tonics" in acute carditis is limited. They are not called for when cardiac dilatation is slight. Tr. Nux. Vomica is useful at times as is Tr Digitalis although the latter is, by some, considered dangerous. Intramuscular

injections of camphor in olive oil may tide a child over a critical phase of the disease.

On the whole, however, severe cases of carditis showing acute ventricular failure derive most benefit from sedatives and among these Dover's powder is the most suitable.

#### ii Compensated Valvular Lesions.

Cases running a favourable course reach a stage in which improvement will not follow a prolongation of rest. Cardiac dilatation has been replaced by some hypertrophy the pulse steadies and all signs of active disease have disappeared.

The pulse rate then is the most useful guide to the amount of activity to be allowed. The transition should be gradual and in a mild case with well compensated mitral incompetence should occupy at least six months. During this period he should be under supervision, the pulse rate recorded and the child kept from school

Where compensation is less complete, the lesions multiple, or a relapse has occurred this period of

observation should be lengthened.

Such treatment is at present available to only a small number of patients and additional accommodation in convalescent homes and after-care schools is greatly needed.

The older the child the more important it becomes that he should be trained for a form of employment for which he is physically fitted so that there may be a reduction in the number of cases of myocardial breakdown occurring shortly after school leaving age and brought on by unsuitable work.

### iii Chronic Heart Failure.

While acute ventricular failure is not uncommon in young children who are the subjects of a massive infection, the chronic type is more rarely met with. It is seen in those who have survived such an initial attack but have failed to throw it off. The condition is progressive and shows little response to treatment which is directed towards lightening the ventricular load imposed by oedema, by the use of purgatives and diuretics, the limitation of fluids and the free use of sedatives.



Chronic auricular failure is found in the later years of childhood in patients whose initial infection may have been slight but in whom mitral disease has developed from incompetence to stenosis and who present a picture similar to that of the adult patient with auricular fibrillation.

Here digitalis to the extent of 2 or 3 drachms in the first twenty four hours is as beneficial as in older subjects and a dosage of half to one drachm may have to be given daily over a long period. Leeching may be of value in some cases but venesection is contraindicated in the child.

#### Prophylaxis and After-care.

A reduction in the number of cases of rheumatic carditis in children and its early detection can be made possible only by the co-operative of a public educated to appreciate the importance of the disease and to recognise danger signs when they appear.

Housing, in the experience of the writer, deserves a closer attention from local authorities. The danger of old or badly constructed houses, es-

pecially when they are on damp sites is a very real one to children.

Parents should have their attention drawn to the importance of protecting the body from damp and cold and should insist on the changing of damp stockings and boots.

The efficient ventilation of the home combined with temperature regulation is not an easy problem to solve in a small house, but its importance as well as the value of sunlight and a well-balanced diet as aids to a healthy development of the child should be stressed.

Immediate attention to dental caries and the enucleation of septic tonsils or those which are the site of recurrent inflammation should be the rule.

The importance of such signs as growing pains, stiff neck and nervousness should be explained to parents so that they are not disregarded through ignorance.

The after-care of rheumatic patients implies a period of observation of the patient, but attention to the points mentioned under prophylaxis

is essential to reduce the risk of relapse or re-infection. Treatment of tonsillar infection and correction of damp housing conditions are essential features of aftercare.

Sufficient emphasis has recently been laid on the importance of making increased provision for these children in convalescent homes and special schools. At present when a full period of treatment is possible in the home, education suffers; an early return to school curtails the observation period and involves risks, while the unhygienic home conditions of many patients makes a relapse almost as inevitable as the original infection.

#### Summary.

Investigation of a series of cases of rheumatic carditis with special reference to conditions favoring its onset has thrown little fresh light on a disease which has rightly been subjected to intensive study in recent years.

Conclusions cannot be drawn from a small number of observations but certain features are worthy of emphasis.

A clearer conception of the aetiology of this condition is necessary for advances in prevention and

and treatment to be made.

There is ample support for the view that the exciting cause is a bacterial infection and much research has been carried out to discover the causal organism.

Equal importance should be attached to conditions in the patient and his surroundings which predispose him to this infection for we cannot with safety presume that the successful completion of this bacteriological study will place at our disposal methods of prevention and treatment of greater value than it has, for example, in tuberculosis, "infective" endocarditis and puerperal sepsis.

The nomenclature of the condition still presents a stumbling block as it has been demonstrated that heart symptoms are no more to be expected now that it is called "rheumatic carditis" than were joint symptoms when it was termed "rheumatic fever."

Among environmental conditions, damp housing has been shown conclusively to be an important predisposing factor. Nearly half the cases recorded lived under damp conditions on a river bank in old houses and were found in an area in which less than one quarter of the population of the town resided.

Poverty was not a factor in these cases which are collected from a district in which the economic state is bad. It was found in homes which were kept above the poverty level only by sustained effort, and the children affected usually reflected the alert and active nature of the parents.

Diet did not seem to enter directly into the aetiology though dietetic errors leading to a state of malnutrition is a fruitful source of many diseases of childhood.

In the child's general condition the frequency of a history of throat inflammation and the presence of tonsillar sepsis among these cases lends strong support to the theory that the throat is the site of entry of infection and an unhealthy state of the nasopharynx predisposes to the disease.

The occurrence of carditis after complete removal of the tonsils does not invalidate this deduction but emphasizes the importance of the removal of the septic focus before the infection becomes generalized.

Experience has shown the danger of regarding symptoms of nervousness in the child as a predis-

posing factor only, as these, when marked, are frequently the signs of the onset of the infection.

The group of symptoms presenting the greatest difficulty in diagnosis consisted of anaemia, wasting and lassitude, and the fact that an unappreciated rheumatic infection was subsequently demonstrated in a number of cases of this kind leads to emphasis being laid upon it.

Of equal importance with the correction of defects in environment and general health of the child is the early detection of the infection.

The child most liable to the disease is one to whom the general practitioner is seldom called until the disease is advanced.

He is, however, subjected to periodic medical inspection at school and were it possible to ensure that the advice recommended to be sought as the result of these examinations was obtained, and a method could be devised of linking up the completed school medical history with the blank medical record issued when the child enters national health

insurance more benefit would result to the patient from existing state medical services.

During the years in which there is most danger of the rheumatic infection gaining a footing the child is under trained supervision in school. The cooperation of members of the teaching profession in the reporting of cases of growing pains, repeated sore throats and restlessness as well as deficiency in clothing and boots would be of great value as these conditions are often disregarded by parents and may not be obvious at the time of routine school medical inspection.

Stress has been laid on the importance of various branches of state service because such a number of these patients do not reach the general practitioner till a later stage on account of the financial status of the families involved. This does not relieve the practitioner of the responsibility of taking every possible step to ensure a betterment of the general health and home conditions of these patients the necessity for which is appreciated by those working in a district in which

medical service is supplied under contract, and who, in consequence, have a larger number of such cases under observation in the earlier stages.

The general lines of treatment are well recognised but the value of salicylate of soda in relieving symptoms and so promoting the necessary rest requires emphasis as this important action is in danger of being lost sight of in the discussion of its specific or non-specific action on the infecting organism.

The free use of sedatives such as chloral hydrate and Dover's powder is urged for the same reason.

After care implies educational and vocational training in favourable surroundings as well as medical supervision and this can be made possible for a large number of patients only by an increase in accommodation in suitable convalescent institutions.



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