

RHEUMATISM AND THE CHILD.

THESIS SUBMITTED FOR THE

M.D. GLASGOW.

by

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Introduction.

The term rheumatism, though sanctified by centuries of usage, so far as is known it was first used in 1642, (1) is one which is very difficult to define concisely and scientifically and moreover, in the light of present knowledge, is a misleading one. Early in last century Babbington (1802) (2) described rheumatism as a "Denomination of disease including affections which though connected with and often changing into each other yet differ considerably both in their respective assemblage of symptoms and methods of cure".

In my opinion the term rheumatism should be restricted to the condition known as "acute arthritis", "acute rheumatism" or "rheumatic fever" in adults, but as used by the laity, rheumatism covers a multitude of different conditions with the common factors of pain in the muscles and or in the joints.

The clinical picture of rheumatism, as presented in childhood, is somewhat different from that in adults. In the early years of life rheumatism is not characterised by the joint symptoms so typical of this disease in adults, though towards puberty the joint manifestations are of more frequent occurrence. In children rheumatism

is very prevalent in its minor forms associated with tonsillitis, nervousness and fidgetiness and "growing pains" and in its severer forms with chorea, carditis, subcutaneous nodules and the typical rheumatic fever. The importance of these manifestations of the rheumatic infection in children, though now generally realized by the medical profession, is not fully appreciated by the general public.

There is no essential difference in the aetiology of acute rheumatism in children and adults but, whereas rheumatism may be of little significance in the adult, in children the results of the rheumatic infection may be disastrous owing to the special tendency of this disease to attack the heart in childhood.

With regard to the frequency with which the heart is affected in childhood by the rheumatic infection, Church (3) quotes Sir Thomas Watson as saying "I have known only three persons to pass through acute rheumatism with an untouched heart, prior to the age of puberty, and in two of them I am by no means certain that the articular disease was true rheumatism".

Cheadle, (4) in this connection, makes the

following remark "If the picture of acute rheumatism had been drawn originally from the disease as it appears in children, when it arises under simpler conditions, the articular affection would not have been regarded as representative: endocarditis, pericarditis and possibly chorea would have been looked upon as the primary essential phenomena and arthritis as a complication".

From the above quotations it will be understood that rheumatism in children means acute heart disease and, until the medical profession as well as the public realise this, little or no headway will be made in the campaign against this disease, a disease which in later life is the cause of great suffering, considerable incapacity and mortality.

As J.R.Kerr (5) (Lancet 1924 ii. 1217) has suggested, the term rheumatism in children is misleading and a danger to the patient. This danger is exemplified when, on telling a parent that her child is suffering from rheumatism, the child probably being anaemic and wasted, she remarks "I am so relieved as I thought it was something really serious". Yet there are few diseases more serious, not from the immediate outlook perhaps, than rheumatism in the child.

Cardiac disease is frequent in this country and much of the heart disease of later life dates from acute illness in childhood, the chief cause being rheumatism. From the results of the examination of school children in Norwich during the years 1926 and 1927, 93 children out of roughly 25,000 examined were found to have organic lesions of the heart. These figures are most certainly an underestimate as they do not take into account the number of children who are unable to attend school, or are absent at the time of the examination, owing to illness. The causes of absence among school children are many but it is well known that the rheumatic infection is responsible for a considerable proportion of cases of prolonged absence from school. I have notes of cases, occurring in my own practice, of chorea causing absence from school for periods varying from 2 months to 9 months.

From the point of view of National Welfare and Efficiency few diseases are of greater importance than rheumatism. It is known that approximately, £5,000,000 were paid as sickness benefit to insured persons suffering from rheumatic diseases during the year 1927 and it has

been estimated that £12,000,000 were lost in wages from the same cause in that year alone. Thus it is seen that the rheumatic infection, in insured persons alone, causes a large financial outlay in addition to a great amount of suffering and pain.

The special tendency of the rheumatic infection to attack the heart in childhood has long been recognised by medical men and when it is realized that a great proportion of organic heart disease in adults is due to the results of rheumatism in the early years of life, it has been computed by Carey Coombs (Rheumatic Heart Disease) (8) that about two thirds of the cases of rheumatic heart disease in adults commence before the age of fifteen, the importance of the prevention and the early treatment of rheumatism cannot be too strongly emphasised.

Owing to the serious nature and frequency of the disease it is to be expected that the number of deaths from rheumatic heart disease will be high. Various authorities have made calculations as to the number of deaths per annum in this country due to rheumatic heart disease and taking the annual number of deaths in this

country as roughly 500,000 I have calculated, from figures given by Dr. W.G.Pugh (Lancet 1926, 1. 151) (7) that there are roughly 31,000 deaths per annum due to rheumatic heart disease and of this number in over 20,000 the disease began in childhood. These figures point to the necessity of combating the disease in its early stages.

Rheumatic carditis, like tuberculosis, begins during the school age and it is then that preventive measures should be taken. The campaign against tuberculosis has caused a considerable reduction in the death rate from that disease, and I see no reason why, if the rheumatic infection is tackled with the same energy, its incidence should not be considerably lessened and the dire results of its occurrence in children greatly minimised.

Unfortunately, the uncertainty as to the aetiology of the condition greatly hampers our efforts at prevention and treatment and there is at present no specific test, comparable to the Widal for Typhoid, the Wassermann for Syphilis or the finding of K.L.B. in a case suspected of diphtheria, to aid us in the diagnosis of a case suspected to be suffering from the rheumatic

infection. In childhood the disease is frequently so insidious in its onset that considerable damage may be done to the heart before the condition is recognised.

The aetiology, the varied clinical manifestations, the overlooking of cases and the difficulties met with in treatment are sufficient justification for my attempting a thesis on this subject.

Recent investigations have thrown considerable light on the aetiology of the disease and the work, among others, of Poynton and Paine, (9) Carey Coombs, (10) Tawara, (11) Aschoff, (12) and Coates, (13) has increased our knowledge of the pathology of the condition. The microbic theory of the disease has been developed both clinically and experimentally by various workers both in this country and on the Continent.

Owing to the possible association of housing conditions and environment with the disease, and its occurrence chiefly amongst the poorer, though not the poorest, classes of the community, rheumatism is of great importance from the Public Health point of view. As regards treatment, the Public Health Authorities are also interested, as

any special type of institution or school which may be developed for the treatment of these cases will be under their supervision. At present Local Authorities have the necessary powers, under the Education Act 1921, to carry out whatever steps they deem essential both for prevention and treatment. I am given to understand that the reason so little has been done up to the present is lack of finance, and until recently, the non-recognition of the seriousness and frequency of the condition..

With the facilities already available, in the urban centres at least, a great deal could be done. Infant Welfare Centres, School Clinics, Medical Examination of school children and special schools for cripple and tubercular children are already in being. With these as a foundation there is no reason why this disease, a disease which, from the figures I have given, causes a death rate at least comparable with tuberculosis upon which so much money has and is being spent, should not receive the attention it deserves with little further expenditure. Fortunately the public are beginning to realize the importance and the extent of the evil and its cost to the State and to Industry.

Rheumatism is now receiving the attention it deserves, and the interest of the Medical Profession in this subject is shown, by the formation of a sub-committee of the British Medical Association to consider the best means to combat it. The Medical Research Council is also investigating the condition in children, and the recent Conference on Rheumatic Diseases at Bath, also indicates that the Profession is alive to the importance of the disease.

The scope of this thesis is to give some account of recent work on this subject, with special reference to the clinical manifestations and treatment, and to put together a few observations on the condition as met with among cases under the author's observation and to bring these phenomena into their appropriate relation with one's view of rheumatism as a whole.

History.

Ballonius (De rheumatismo et pleuritide 1642) (1) is generally credited with being the first to use the term rheumatism. The term, as used by the older writers, included such diseases as osteo-arthrititis, gout and gonorrhoeal rheumatism, diseases which are now recognised as having no relationship to the condition known as rheumatic fever or acute arthritis.

Edward Jenner (1789) (14) noted the occurrence of heart disease with rheumatism and was apparently the first to draw attention to this association. Later Bouillaud (1836) (15) published a paper in which he stressed the frequency of rheumatism as an association of heart disease. He pointed out that the heart, when affected in association with rheumatism, was affected as a whole, the condition being one of carditis. In this connection later workers, Poynton (1899), Aschoff(1904) and Coombs, have demonstrated that not only is the heart affected as a whole, but that the type of cardiac inflammation in rheumatism is peculiar to this disease. They have described a particular lesion, known as Aschoff's Bodies or sub-miliary nodules, which, so far as at present known, is pathognomonic of rheumatic carditis and occurs in the myocardium. The sub-miliary nodule will be described in the section on pathology and morbid anatomy.

The observations of Jenner and Bouillaud, on the association of rheumatism and heart disease, have for long been recognised, but we now realise that it is more than an association, as rheumatism has been definitely proved to be the chief cause of valvular disease of the heart.

As to the cause of rheumatism various views have been held at different periods but in recent years rheumatism has generally come to be recognised as an infective disease, though the aetiology of the condition is still unknown. One of the first theories, as to the causation of rheumatism, was advanced by Mitchell in 1831. (16) His hypothesis was that rheumatism was due to lesions in the spinal cord, the lesions being due to the exposure of the cutaneous nerves to wet and cold. Cullen (1784) (17) also recognised the factor of exposure to wet and cold as a cause of rheumatism. He attributed the disease to the effects of cold on the joints which, as he pointed out, were open to attack owing to their thin covering of tissues.

Another hypothesis which had a vogue for a time was originated by Prout (1848) (18) the cause in this case being attributed to lactic acid. In this connection it is of interest to note that

Richardson and Rauch (19) stated that they produced lesions, in the endocardium and pericardium, by injections and also by the internal administration of lactic acid. Foster(20) and Kulz(113) also made the observation that they had noticed swelling and pain in the joints of diabetic patients under treatment with lactic acid. Other investigators have failed to confirm these findings.

Uric acid, first detected in the blood by Garrod (1848) (21) in cases of gout, has also been cited as the cause of rheumatism and Latham,(22) Haig(23), and Garrod supported this view. Haig stated that in his opinion articular rheumatism was due to the presence of uric acid in the joints of patients suffering from pyrexia. When discussing the chemical theories as to the causation of rheumatism it is of note that Sir A. Garrod(B.M.J. June 30th 1928) (24) gives it as his opinion that "The liabilities of certain individuals to or their immunity from, certain maladies - what may be termed their diathesis - have chemical origins".

Chorea, now known to be a manifestation of rheumatism, was investigated by several of the older writers, and their theories of it's causation will now be considered.

Bright in 1839 (25) attributed chorea to a reflex stimulus from a concurrent pericarditis. Kirkes (1863) (26) noted the frequent occurrence of vegetations on the cardiac valves in this complaint. He suggested that chorea might be caused by the irritation of the nerve centres in the brain by fine particles of fibrin carried thence by the blood stream. In the following year Hughlings Jackson (27) stated that in his opinion chorea was caused, in the majority of cases, by embolism, the area of the brain chiefly affected being the Corpus Striatum. Sir William Broadbent(114), a few years later, arrived at much the same conclusion and in 1867 Tuckwell (28) published a case of chorea in which the post-mortem showed an extensive area of superficial softening of the convolutions the result of embolism.

W.H.Dickinson (1876) (29) explained the occurrence of the disease as due to hyperaemia and it's sequelae, and Bastian (1877) (30) stated that he was of the opinion that an altered state of the blood, frequently associated with anaemia, was the predisposing cause in individuals of a certain age and nervous temperament.

Sir William Gowers (31) considered that chorea was due to a toxic change of a chemical nature rather than due to the effects of invasion by a micro-organism.

The investigations of Dana (1894) (32), Poynton and Paine (1899) (33), and Beattie (1904) (34) amongst others, have demonstrated the presence of a diplococcus in the pia mater and brain in cases of chorea and, by experimental inoculations of this organism, choreiform movements have been produced in rabbits. The changes in the nerve cells have been described by various workers including Poynton and Abrahams (35).

In 1880 Fowler (36) published a series of cases of acute rheumatism ushered in by tonsillitis and Trousseau (37) pointed out that tonsillitis is commonly the initial manifestation of rheumatism. Cheadle (38), in his "Rheumatic State in Childhood", mentions the frequent association of tonsillitis and rheumatism in children and Hill (39) found that, in cases that had died from rheumatic fever, the tonsils were frequently very unhealthy. In recent years the connection between septic tonsils and rheumatism has received a great deal of attention from many writers, and Coombs(40) is

definitely of the opinion that they are the chief portal of entry of the bacterial cause of rheumatism.

Writing on the frequency of rheumatism in Malta, Dalton in 1890 (41) attributed the cause to faecal and sewer emanations but recent investigation by the Medical Research Council into "Social Conditions and Acute Rheumatism" has failed to prove that there is any connection between rheumatic incidence and bad sanitary arrangements. In Glasgow, comparing the non-rheumatic families with the rheumatic a larger number of the latter lived in houses with poor sanitary arrangements. In other centres where investigations have been carried out there is apparently no evidence that mal-sanitation causes a higher incidence of rheumatism.

The researches of the earlier workers Mantle (42), von Leyden (43) and Litten (45) paved the way for later investigations into the cause of the disease, and from 1880 onwards a considerable amount of work has been done, both clinically and experimentally, in investigating the microbic theory of the causation of rheumatism.

Mantle in 1886 described a diplococcus which he found in the blood of a case of rheumatic fever. Popoff (44), working in Russia a year later, produced rheumatic lesions by inoculations of a diplococcus. As the result of his researches into the aetiology of rheumatism Mantle came to the conclusion that this disease was due to bacterial, or rather microbic, infection.

In 1892, Sahli (47) found the staphylococcus pyogenes citreus in the synovial membranes of a case of rheumatic fever. His theory of the cause of rheumatic fever was that it was due to an infection by staphylococci. Maragliano (1894) (48) in investigating a case, which simulated rheumatic fever, found diplococci and staphylococci and in the same year Singer (49) found staphylococci in the urine of cases of rheumatic fever. Singer's theory was that rheumatic fever was due to an attenuated pyaemia and he made the observation that the number of staphylococci in the urine decreased as the disease defervesced.

Achalme (50), working on this subject, between 1891 and 1897 discovered a bacillus in the blood of rheumatic fever cases. This bacillus grew anaerobically, stained well with faintly alkaline methylene blue and, in form, was rather similar to anthrax. His experimental inoculations with this organism did not produce the typical lesions

of rheumatism. This bacillus has received a good deal of attention from other workers on this subject and Thiroloix (51) confirmed Achalme's results. Thiroloix, in his experimental inoculations with this bacillus, apparently obtained the typical clinical picture of acute rheumatism. Triboulet (52) and Bettencourt (1898) (53) also found a bacillus, similar to that isolated by Achalme, in the blood of rheumatic fever cases.

Triboulet and Coyon in 1898 (54) discovered a diplococcus, which was frequently associated with a bacillus, in severe cases of rheumatic fever. They argued from this finding that simple rheumatism was due to the diplococcus alone and that the severe cases were due to a combined infection by the diplococcus and the bacillus. Triboulet and Apert (55) in the later part of this year found a micrococcus, in the blood of a case of rheumatic fever, which, on being isolated and injected into a rabbit, produced cardiac and pericardial changes but no evidence of changes in the joints. The organism isolated by Triboulet and Coyon was apparently the same as that first found by von Leyden, and later by Wassermann (1899) working in association with Westphal and Malkoff.

The latter, in their experimental inoculations, obtained arthritis and endocarditis in a large series of inoculations of the organism into rabbits.

About this time (1900), Poynton commenced his prolonged study of the bacteriology of the disease and, in association with Paine, isolated an organism from the vegetations on the valves, from pericardial effusions and from the blood of rheumatic fever cases. They also demonstrated the organism, a diplococcus or as Poynton has called it a diplo-streptococcus, in the subcutaneous nodules, in the cardiac valves, in the synovial membranes of joints and muscle. As already mentioned they have also demonstrated the diplococcus in the pia mater and the brain in cases of chorea.

This organism, on inoculation into rabbits, has produced endocarditis, pericarditis, polyarthritis and at least in one instance choreiform movements. Later (1904), Beattie (34) also produced choreiform movements in a rabbit inoculated with a diplococcus, isolated from the joint effusion in a case of rheumatic fever.

Poynton did not claim that the diplococcus was the sole cause of rheumatism or that it was invariably present in cases of acute rheumatism.

More recently he has stated (B.M.J. Nov. 29th, 1924) that he does not consider the diplococcus a complete explanation of rheumatism but he does not think that another organism will be found. The characteristics of the organism isolated by Poynton and Paine will be described in the section on aetiology.

A considerable amount of work has been done on rheumatism in recent years, in America, and Small in 1927 (57) described an organism which he has called the streptococcus cardio-arthritis and which he isolated from the blood of cases of rheumatic fever. He has also found it in throat cultures in cases of acute rheumatism and chorea. He mentions that this organism has a peculiar property in that it is able to ferment inulin, an unusual property in streptococci. Barlow (58) in this country has recently isolated a similar organism from throat cultures.

Having reviewed the outstanding researches into the microbic theory of the causation of rheumatism we have now to consider the method of entry of the organism into the circulation.

Sacaze (59) promulgated the theory that the organism might gain access to the system by means

of an external wound in much the same way as the organism of tetanus or any of the pyogenic streptococci.

Buss (60), many years ago, came to the conclusion that the organism possibly entered the systemic circulation through the tonsils and in many cases by the intestines. Recently Carey Coombs has expressed the same opinion only stressing the importance of the tonsils as the main portal of entry.

I have mentioned that in America rheumatism is now receiving a considerable amount of attention, and in the opinion of some of the workers there, rheumatic fever is due to a hypersensitiveness of the individual to the invasion of streptococci, and not to the results of the attack on the tissues of any one particular organism.

That nutritional disturbance may also be a cause of rheumatism in children has recently been stated or rather that the nutritional disturbance may so lower the child's resistance that the streptococci are permitted to gain access to the tissues.

In conclusion I may add that the most generally accepted theory at the present time is that rheumatism is the reaction of the tissues, the nature of

their reaction depending on the virulence of
the organism and their resistance to it's attack,
to an invasion of a streptococcus which is
normally present in the alimentary track, but
which, under certain conditions may change it's
harmless nature and become pathogenic.

Aetiology.

In this section I shall attempt to give some account of the principle views on the aetiology of rheumatism.

The aetiology of this condition is still largely unknown but there are certain factors which are recognised as having an influence on the incidence of rheumatism and these will be first considered.

Age. Rheumatism is now regarded as an infective disease and therefore its higher incidence in children, like other infective diseases, is not unexpected. The occurrence of rheumatism before the age of two is rare and uncommon before the age of five. Poynton (61) has quoted the occurrence of rheumatic endocarditis in a child forty eight hours old and Miller (1899) (62) of Philadelphia found, in medical literature, notes of nineteen cases of rheumatism in the first year of life.

According to Voelcker (Garrod, Batten and Thursfield's Diseases of Children) (64) the first attack of rheumatism occurs in 80% of cases between the ages of four years and nine, 48% between the fourth and sixth years and 32% between seven and nine. Coombs (8), speaking from his own ex-

perience, states that in 600 cases of rheumatism the onset, in over 75%, occurred prior to the age of fifteen. After the age of puberty the liability to the disease is diminished and, if contracted, the heart is not so frequently affected as in childhood. In my own series of cases the first attack of rheumatism appears to have occurred at the average age of seven. The difficulty in fixing the date of the first attack is obvious when one sees a child, with no history of any rheumatic manifestation, and yet who has a definite endocarditis and that the cardiac condition is rheumatic is proven by the appearance later of nodules or arthritis. The lack of symptoms in the early stages, due to the insidious onset of the disease in many cases, makes the fixing of the date of onset frequently impossible.

Heredity. Heredity is generally admitted to have some effect on the incidence of rheumatism, but in my own experience the influence of heredity, judged by the obtaining of a history of rheumatism in either or both parents, is not so potent as some authorities have stated. In over forty cases of the rheumatic infection in children occurring in my own practice I have been able to obtain the

parents' history in twenty eight cases. In four cases I was unable to obtain a satisfactory family history as in two of them the fathers were dead, in one the mother was dead and in the other the child had been adopted and nothing was known of its parents. In the other cases I did not make notes of the family history at the time of the examination and for various reasons I have been unable to obtain it since.

In the twenty eight cases in which I have notes of the family history, I obtained a history of parental rheumatism in eight, or roughly 28.5%.

I limited my enquiries to cases occurring in children as I found that amongst my older patients a history of rheumatism was frequently forthcoming but, as I know many of these cases of so called rheumatism, I came to the conclusion that unless one was able to obtain a definite history of rheumatic fever or chorea from the parents themselves, the history obtained from their children was frequently misleading. The error occurs in the parents of older patients being often of an age when osteo-arthritis and other senile joint changes are common and by the general public these arthritic symptoms are all called "rheumatism".

As proving how even personal questioning of a parent may be of little value I will give an instance. One of my patients, a girl, who had had chorea was brought to me as she had been rather short of breath and was easily tired. She was aged fourteen and had just commenced work which the mother thought was the cause of the trouble. On examination she was found to be anaemic and there was mitral regurgitation. The mother stated that she herself had never suffered from rheumatism or any of the rheumatic manifestations but a few months later I had cause to examine her and found her suffering from mitral stenosis which, in my opinion, is always the result of the rheumatic infection.

Though there may be no actual history of rheumatism in either parent I am definitely of the opinion that the children of nervous parents are more prone to rheumatism, particularly chorea, than the children whose parents are of the more stable type.

As individual experience, on a question like this, is of necessity limited I will quote figures given by various authorities. Cheadle (63) has estimated that 20%, Holt (65) 66%, Goodhart (66)

57% and Garrod (67) 35% of rheumatic cases showed heredity influence. On the other hand Church (68) states that he has not found that heredity has any definite effect on the occurrence of rheumatism and Symes (69) states that the children of parents who have suffered from rheumatism are peculiarly liable to the disease.

The Medical Research Council found no definite evidence of heredity being a potent influence in the causation of rheumatism but found that there was evidence of family incidence. That there is a family incidence I am quite convinced as in several families I have attended two or more children with acute rheumatism or other manifestation of the disease.

Coombs (70), when discussing the question of heredity, states "It is some imperfection in the bodily resistance, biochemical or anatomical or both, that is handed on but nothing is as yet known of its actual nature". That the disease may be actually acquired in utero has been proved by Poynton (61) finding vegetations on the cardiac valves in a child forty eight hours old whose mother had suffered from rheumatic fever during pregnancy. Owing to the rarity of rheumatism in

the first two years of life I do not think that direct transmission of the disease in utero can be considered of any importance as a factor in the causation of the disease in later life.

Sex. From my own experience I am of the opinion that females, particularly in childhood, are more liable to the disease than males. As Cheadle has pointed out, the higher incidence of chorea in girls than in boys between the ages of ten and fifteen may account for the excess numbers of females affected in childhood. In his "Rheumatic State in Childhood" he states that from one to five years of age boys predominate, from five to ten the sexes are equally affected and from ten to fifteen girls are affected in the proportion of two to one. In a series of fourteen consecutive cases of chorea in my own practice only three were boys. Coombs (72) states that probably females are slightly more liable to attack all through life than males whereas Symes (Rheumatic Diseases) (69) states that statistics show that the disease is twice as common in males and he attributes their liability to suffer from the infection as being due to mechanical strain on the joints in the course of their work. In his opinion the only period when

females predominate is from the age of ten to fifteen years.

The type of child who is predisposed to the rheumatic infection, has interested me as recent investigations have proved, contrary to my own experience, that apparently the medium coloured, neither dark or fair haired, are the most liable to the disease. In my experience the fair haired and the red haired are the most liable to suffer from the rheumatic infection. In one family of five there are three girls and two boys. Two of the girls and one of the boys are red haired (like the mother). All three have had manifestations of rheumatism. One of the girls has had rather severe chorea the other acute rheumatism, and the boy recurrent attacks of sore throat with muscular pains. The two dark haired children in the family have escaped any symptoms of rheumatism.

An explanation, of the supposed higher incidence of rheumatism in the blonde type, has been given by MacKintosh(73). He states that the blonde type is of Nordic descent and, as their evolution took place in a dry climate, they may react unfavourably in districts where there is a heavy rainfall.

The rheumatic child is bright, intelligent, rather nervous and highly strung and as Poynton has remarked " The most alert and engaging of all our patients".

Environment. Rheumatism may be called a disease of cities as its incidence in rural districts is much lower than in urban areas. The density of population may have some bearing on its occurrence and its prevalence amongst a well defined class, the skilled artisan class, (such as foremen in shoe factories and engineering shops and bricklayers), of the community also suggests that environment plays an important part in its causation as the members of this grade of society live under much the same conditions as to food and housing.

No locality is exempt but certain localities appear to favour the development of the disease. In London, rheumatism in children appears to be very prevalent and of a very severe type and Senator has stated that it has the highest incidence of the disease of any European city. A clay soil with poor drainage probably prolongs the attacks but in itself is not a causative factor. The altitude above sea level has apparently some effect on the occurrence of the disease. Coates and Thomas

(Lancet Aug. 15th 1925) have investigated this point and they found that in a series of forty four cases 61.3% were living in houses situated not higher than a hundred feet above sea level. The proximity to water courses is also said to favour the occurrence of rheumatism but in Norwich, where there are two rivers which almost surround the City, I have not found that families who live near the rivers are more frequent sufferers from the malady than those whose homes are in the higher parts of the City.

Housing. When considering the aetiology of rheumatism housing is a factor which must be considered. The frequent overcrowding in the houses of the poorer families, though not the poorest families, may possibly explain the higher incidence of the disease in this class as direct contagion may be a factor in the spread of this condition. That there must be other factors in addition to overcrowding is shown by the fact that the disease is less common in the very poorest class than in the class a little better off though both classes may live in overcrowded houses. In houses where several people sleep in one bedroom droplet infection would occur, and as an unhealthy condition of the tonsils is frequently found in those suffering from rheumatism the dis-

tribution of the infective organism from this focus can be easily understood and would explain the family incidence of the disease. That direct infection does occur is very difficult to prove. I have notes of two cases where one child in a family developed chorea following the occurrence of this disease in the mother during pregnancy. In both cases the chorea occurred in the children about two months after its onset in the mother. In another family of seven children four of them suffer from rheumatic manifestations. A boy J. K. first suffered from V.D.H. in 1924 and there was no history of an attack of rheumatism. This year (1928) compensation broke down and there was oedema of the legs and some ascites. At the time when his heart broke down his older sister D. K. had her second attack of chorea and another sister E. K. had recurrent attacks of sore throat. The other member of the family who suffers from rheumatism has recently been discharged from the army suffering from V.D.H. The fact that these illnesses all followed the lighting up of the cardiac condition in the boy is, to my mind at least, suggestive of some common source of infection. This family has recently removed to one of the new houses built by the Corporation and since their removal their health has greatly improved.

That damp houses are a cause of rheumatism has frequently been stated but I have not been able to convince myself that this is so as in Norwich there is a large number of houses which would be termed damp yet families who live in them do not seem to suffer unduly from rheumatism. Dr. R. Miller (B.M.J. 1923, 11. 703) quotes the case of a damp basement occupied in turn by three families and the children in each family developed rheumatism. In his investigations he also found that the houses from which cases of rheumatism came were frequently reported as being damp and were often basements.

Exposure. Exposure to wet and cold is generally believed to have an effect on the occurrence of rheumatism and the frequency with which one obtains a history of exposure before an attack of rheumatism bears out this belief. In my opinion chill alone is not the main cause but chill combined with fatigue. As an example of the kind of history which one often obtains I will give the history of one of my cases of chorea. C. T. a girl aet. 11 had been playing hockey and while wet and cold and tired stayed on to watch another game. On arrival home she felt shivery and went to bed. Fourteen days later, having been rather languid and irritable in the interval, she developed chorea and in spite of

all treatment has now a progressing mitral stenosis. Another case, following on exposure to wet during games, occurred in a girl aet. 13. After getting wet she returned to school and had to sit in her wet clothing for the rest of the afternoon. The next day she complained of sore throat and pains in the limbs. As in the course of a few days there was no improvement in her condition her mother took her to the school medical officer at the clinic where she was found to be suffering from cardiac dilation. She was referred to me for treatment. As this child had been examined only ten days previously and been found to be healthy I think that the chill and fatigue after games can be looked upon as initiating the train of events.

In cases of chorea I am of opinion that fatigue, either bodily or mental, is of considerable importance in causing its onset. This disease usually occurs in excitable children. Fright may be a cause of onset due to the exhaustion of the nerve cells, much the same as occurs in over-work and worry, and the lowered vitality of the cells reduces their resistance to the infection. The chorea of pregnancy can be explained in the same way, the strain of pregnancy lowering the patient's resistance and allowing the infection to obtain a hold.

Climate. Rheumatism is a disease chiefly of temperate climates and is more prevalent in those countries where there are considerable alterations in the temperature and humidity in short periods. The incidence of rheumatism varies in different years and during the autumn of 1928, at least in Norwich, there has been a decided increase in the number of cases particularly in young adults and I have attended many more cases of fibrositis in adults than usual. We had a very fine summer and the good weather continued into October. During this month the weather broke down and there were some very cold and wet days, and it was during this period that there was an increase in the number of cases of rheumatism. At this time I also saw more than the usual number of school children whose mothers had brought them to me on account of their being fidgety and restless.

In my opinion the effects of climate on the incidence of rheumatism are very difficult to estimate as we have also to consider the individual and his environment.

Seasonal Influences. Rheumatism is more prevalent in the months of September, October, November and December and Church (Albutts System of Medicine vol. 3.) (75) shows charts demonstrating the incidence of the disease in the various months and states that the seasonal variations of the disease is in favour of an infective agent as its causation. Coombs (76) has also noted that a sustained drop in the rainfall has appeared to be followed by an increase of fatal carditis. The occurrence of cold dusty weather is frequently followed by an increase in the number of cases of tonsillitis and as the association of tonsillitis and rheumatism is well known the same factors as cause tonsillitis may be factors in causing rheumatism.

Diet. Professor Vining of Leeds (77) believes that in children the digestive tract is a factor to be considered in the aetiology of rheumatism. He states that " Rheumatism in childhood is primarily a disease based upon nutritional disturbance brought about by prolonged dietetic deficiency either in vitamin B or in protein in conjunction with a relative excess of carbohydrate or possibly both these factors". "Secondarily rheumatism is a streptococcal infection the organism passing through

the weakened lines of defence and producing the toxaemic element of the debility".

Dingwall Fordyce (B.M.J. May 19th, 1928) (78) states that there are three predisposing factors; irritability of the nervous system, digestive disorder and weakness of the lymphoid defence.

That there are frequently digestive disorders in children who are the subjects of rheumatism there can be no doubt. These children often suffer from attacks of vomiting which their mothers term biliousness and I have notes of cases where an acute attack of rheumatism was ushered in by vomiting of a bilious character. That diet is a factor to be considered in the investigation of the aetiology of rheumatism I have been unable to obtain any definite evidence, and in my opinion the kind of diet, provided it is sufficient, has no effect on the incidence of the disease.

Having discussed the predisposing factors we have now to consider the microbic cause of rheumatism. No organism yet isolated from cases of rheumatism has fulfilled Koch's postulates, but that rheumatism is due to infection by an organism is now generally accepted. Some workers on this subject claim that the organism is a streptococcus,

others that it is a bacillus and lastly there are those who state that rheumatism is not a disease, sui generis, but is simply the reaction of the tissues to various infections.

In this country I think that the micrococcus rheumaticus is most generally accepted as being the cause, but not the sole cause, of rheumatism. The work of Poynton and Paine, Ainley Walker (79), Shaw (80) and Beattie (34) has proven that in many cases of rheumatic fever a short chained streptococcus or a diplococcus can be isolated from the blood and in a few cases from the arthritic exudate. On the Continent, von Leyden (43), Triboulet and Coyon (54) and Wassermann(56) and his co-workers have also isolated a similar organism.

In two of my own cases a short chained streptococcus has been isolated from the blood and recently a similar organism was found in the enucleated tonsils, from one of my patients, a girl, who was suffering from rheumatic carditis. The finding of this organism in the tonsils is not of great account as the organism is probably present in the tonsils even in healthy subjects.

The micrococcus rheumaticus is a small organism about .5 m. in diameter. In the blood it generally

is found as a short chained streptococcus but in the tissues as a diplococcus.

This organism is Gram + but does not retain the stain well. With carbol thionin it stains a deep blue. It grows best anaerobically and in an acid medium. The best culture medium, according to Poynton, is bouillon and milk with lactic acid added. The organism can also be grown in the pericardial effusion which in cases of rheumatic fever is acid. It also grows well on blood agar.

At 37° C. in bouillon there is turbidity in twenty four hours and after seventy two hours there is a deposit.

On blood agar, small whitish colonies are seen after twenty four hours. The colonies are discrete and the colour of the blood is altered to a rusty brown.

In the medium recommended by Poynton, there is coagulation of the milk after twenty four hours.

In a gelatine stab minute colonies are seen after forty eight hours but there is no liquefaction.

The view that rheumatism is caused by a bacillus has received no support, in this country, from workers on this subject. The bacillus isolated by Achalme (50) and others, Thiroloix (51),

Bettencourt (53) and Rosenthal (82), on the Continent has not been found by workers here. It is of interest to note that this bacillus may occur in diplococcal forms and that the diplococcus isolated by Poynton and Paine may assume bacillary forms when grown in certain media.

The theory that rheumatic fever is not a disease, *sui generis*, but is due to the reaction of the tissues to various infections is difficult to uphold when one considers the constancy of the symptoms in this disease. If various infections can cause rheumatic fever one would expect variations in the symptoms and the course of the disease. Homer Swift (New York) (81) is of the opinion that rheumatic fever is the reaction of the tissues, not to one specific streptococcus, but to streptococci of different types. He considers that those people, who are liable to suffer from the rheumatic infection, suffer from a hypersensitiveness to infection by streptococci, the manifestations of the disease being allergic in nature.

Having considered the various factors which are recognised as having an effect on the causation of rheumatism and realising the particular

liability to the disease of one section of the community, its much higher incidence in towns than in the country and its liability to recur in patients who return to their own homes after being successfully treated in an institution, I have come to the conclusion that rheumatism must be regarded as an environmental disease. What the circumstances are which so alters the patient's resistance that a streptococcus, which almost certainly is a normal inhabitant of the intestinal tract, is permitted to invade the tissues and cause disease is a matter for further investigation and research.

Pathology and Morbid Anatomy.

As a means of gaining a knowledge of the effects of the rheumatic poison on the tissues, the study of the subcutaneous nodule is of the greatest help. For histological examination the subcutaneous nodule has the advantage of being easily obtained, and can be studied during the life of the patient. Coates (B.M.H. 1. 550, 1925) (83) has described a simple method whereby these nodules can be removed for microscopical examination. He recommends that a hypodermic needle be inserted under the nodule to fix it thus enabling it to be cut down upon and removed.

The importance of understanding the nature of the nodule is seen when one realises that the lesions of rheumatism are the same in all the tissues of the body and that microscopical examination of sections of the pericardium and of the valves in rheumatic pericarditis and endocarditis show changes similar to those seen in the subcutaneous nodule.

Macroscopically the subcutaneous nodules appear as " oval semitransparent fibrous bodies like boiled sago grains".

When sections of a young nodule are examined under the microscope it is found that there is a

central area of fibrinous exudate and necrosed tissue and surrounding this area there is leucocytic infiltration. In older nodules, in addition to these areas, you have towards the periphery, the formation of fibrous tissue. The nodules are highly vascular and the arterioles are dilated and show proliferation of their endothelial lining.

Poynton (84) has demonstrated the presence of the diplococcus rheumaticus in the central area of the most recent nodules which are only visible under the microscope. In the older nodules the diplococcus is not found as, owing to the reaction of the tissues, the organism is rapidly destroyed.

When a series of rheumatic nodules, commencing with the very recent ones and finishing with the old nodules of long standing, are examined under the microscope, we are able to trace the various stages of development. From such examination we come to the conclusion that in the formation of a subcutaneous nodule we have (1) a vascular dilatation, (2) a fibrinous exudation, (3) a cellular infiltration and finally a fibrosis.

Joints. The affected joints in acute rheumatism are swollen, hot and tender. The synovial membrane is swollen and shows irregular areas of congestion.

It is covered by a fibrinous exudate. The synovial fluid may be clear or slightly turbid and is frequently blood-stained. The arthritic exudate is usually sterile but Beattie (85) isolated a streptococcus from the joints in a case of acute rheumatism. The capsule of the affected joint is swollen and infiltrated by exudate.

Pericardium. In cases of recent pericarditis there is a roughening and reddening of the serous surfaces. In late cases the surfaces have patches of fibrinous exudate on them. These patches may appear shaggy and have been likened to the appearance seen when two pieces of buttered bread are applied together and then separated. If organisation occurs in the patches of exudate you get a whitish area of fibrous tissue formed. These whitish areas are known as milk spots or soldiers' spots.

The amount of fluid in the pericardium in cases of rheumatic pericarditis is never great and is usually about from two to five ounces in quantity. If there are any adhesions present the fluid may be found in loculi. The pericardial exudate is turbid and is acid in reaction.

The adhesions found in pericarditis are due to the injury of the endothelial lining of the

sack by the invasion of the diplococcus rheumaticus. The fibrinous exudate which occurs on the opposing surfaces of the pericardial sack may join together and if fibrosis should take place the parietal and visceral layers become firmly united.

The pericardium may show no changes to the naked eye but if examined under the microscope it frequently shows the usual reaction to the rheumatic poison. The visceral layer is much more frequently affected than the parietal. If the pericardium is involved in rheumatism then the myocardium is also involved but the converse does not hold good.

Cheadle was of the opinion that the changes in the pericardium and the myocardium were concurrent but Poynton and Theodore Fisher (now of Norwich) are of the opinion that there can be changes in the myocardium without any change in the pericardium.

In severe cases of pericarditis you frequently have adhesions of the pericardium to the surrounding tissues, pleura, mediastinum etc. a condition which is of the greatest importance clinically. The diplococcus has frequently been isolated from the pericardial exudate.

Heart. In fatal cases of rheumatic carditis the heart is found to be enlarged, the enlargement being

due to the increase in size of the ventricles. The heart is also increased in weight and the walls of the ventricles are increased in thickness especially those of the left ventricle. In adults, in cases of mitral stenosis of long standing, the wall of the left auricle may be thickened but this condition is not found in children.

The auriculo-ventricular rings are enlarged, in correspondence with the increase in size of the ventricles. In cases with pericardial adhesions the cardiac dilatation is frequently very marked. As we have seen, the amount of fluid in rheumatic pericarditis is very small so clinically it is of importance to remember that the increase in cardiac dulness is not due to the effusion but to cardiac dilatation and that the introduction of an aspiration needle into the pericardial sack is not only fruitless but attended with danger.

In rheumatic carditis there is valvulitis. The mitral valve is damaged in all cases, the aortic in roughly one half of the cases, the tricuspid in one third and the pulmonic extremely rarely.

Myocardium. The changes in the myocardium are probably due to the direct action of the rheumatic poison. To the naked eye the myocardium may look

paler than normal and be pinkish red in colour instead of the normal reddish brown. In many cases however the myocardium, macroscopically, looks perfectly normal.

Microscopically, foci of inflammation are found throughout the myocardium and cloudy swelling and fatty changes are observed. The muscle fibres are swollen and striation is lost or at least is less marked than usual. The nuclei may show karyorrhesis and in their neighbourhood vacuolisation may be observed. Globules of fat are also seen in the muscle fibres.

The blood vessels are dilated and frequently show a proliferation of the endothelial cells. This proliferation may cause an almost complete obliteration of their lumina. In some of the vessels thrombosis may also be seen.

Histologically, the lesion of most interest in the myocardium is the submiliary nodule. These nodules have been described by Aschoff, (12), Tawara (11), and Carey Coombs (10). So far as at present known the submiliary nodules are only found in the myocardium in cases of rheumatism. They are rounded areas found lying between the muscle fibres and are usually in association with a capillary. There is

a matrix of fibrin and cellular remains. Certain large cells, giant cells, varying in size and shape but most often spindle-shaped and multinucleated, are found in the nodules. These large cells are supposed to be developed from the vascular endothelium. In the area of the nodule are also fibroblasts, plasma cells and white cells, chiefly lymphocytes.

The nodules may, by pressure, displace and damage the already swollen muscle fibres. The damaged fibres may disappear and be replaced by fibrous tissue. The nodules are found throughout the myocardium but occur chiefly in the left ventricle wall and at the base of the inter-ventricular septum.

Endocardium. In attacks of acute rheumatism the endocardium, at least in children, is nearly always affected. The inflamed valves show areas of fibrinous deposit, are swollen and pink in colour. The fibrinous deposits occur in a line about $\frac{1}{4}$ inch from the edge of the valve. In early cases these deposits are small but in the more advanced cases are larger. In infective endocarditis the valves have cauliflower vegetations.

Microscopically the valves show changes similar to those described in the subcutaneous nodule.

Where the disease is of long standing fibrosis occurs and there may be deposits of lime salts found in the valve segments.

The chordae tendineae also suffer from the effects of the rheumatic poison and are frequently found to be shortened. This shortening is the result of the inflammatory process and is due to the fibrosis which occurs with the resulting contraction of the fibrous tissue. As the formation of scar tissue is a slow process the results of its occurrence in the cardiac valves are not often seen in children and mitral stenosis is rarely seen in children under the age of twelve.

The view that the infecting organism gained access to the valves from the blood passing through them is not now accepted. As Poynton and Paine (86) and Carey Coombs (10) have shown, the endothelium of the valves is undamaged, in cases of simple endocarditis, in the early stages. They have demonstrated the diplococci in the substance of the valve chiefly in the region of the valve ring. Later when there has been tissue necrosis the organism may be found on the surface of the valves and the endothelium is then found to be damaged. The view now held by workers on this

subject is that the diplococcus reaches the valves via the coronary circulation. This view is supported clinically as one of the first signs of cardiac involvement in rheumatism is dilatation of the heart due to the effects of the rheumatic poison on the myocardium, its blood supply being the coronary arteries. If the valves were invaded from the blood passing through them, and all the blood in the body must pass through them, surely they would be much more quickly affected than the myocardium and you would have a valvulitis without any sign of myocardial involvement, in the early stages of the disease.

As a possible explanation of the cause of the lighting up of the cardiac condition in cases which have apparently done well Poynton gives it as his opinion that, in the areas of necrotic tissue in the valves, the diplococcus may lie dormant for long periods and under the effects of strain may again become active.

Nerve Tissue. In cases where chorea proves fatal hyperaemia of the brain is commonly found and there may be also found areas of softening due to minute emboli. Perivascular cellular exudates and small haemorrhages have also been demonstrated

in the brain tissue.

The nerve cells show chromatolysis and haziness and swelling of the pyramidal cells occur. The occurrence of chromatolysis may be simply due to the exhaustion of the nerve cells as a result of the strain of the constant movements which occur in chorea. Chromatolysis has been shown to occur in other conditions which impose a strain on the nerve cells so is not due to the effects of the rheumatic poison alone.

The diplococcus has been found in the brain tissue and in the pia mater in fatal cases of chorea. Kidneys. The kidneys may be affected in acute rheumatism and Beattie "Rheumatic Fever and Amyloid Degeneration" (B.M.J. Nov, 24th, 1906) (87) has recorded the occurrence of amyloid degeneration in four cases of heart disease where the only aetiological factor was the rheumatic poison.

Microscopically there may be found to be cloudy swelling of the renal cells and some fatty degeneration. The convoluted tubules are chiefly affected and they show cloudy swelling and some desquamation of the epithelium. The occurrence of nephritis in scarlet fever is well recognised and the association of scarlet fever and rheumatism has been frequently

noted so the occurrence of changes in the renal cells in acute rheumatism is not unexpected.

Pleurisy may occur in acute rheumatism and is usually of the dry type. As proof of the rheumatic nature of the pleurisy the diplococcus has been isolated from the pleural exudate in cases of rheumatism.

The blood, in cases of rheumatism especially in children, shows a marked anaemia but it is of no special type.

Poynton (88) has noted changes in the appendix in rabbits inoculated with the diplococcus rheumaticus and is of the opinion that there can be a rheumatic appendicitis in the human subject. When discussing this subject he mentions the work of Kelynack (1893) (89) on the relationship of appendicitis to tonsillitis. Recently, when going through my panel record cards, I was struck by this same association, mostly in women. In many cases a "chronic" appendicitis had been preceded by a follicular tonsillitis and in a small number of cases was followed by attacks of arthritis or muscular pains.

In infective endocarditis there may be infarctions in the liver, kidneys, lungs and spleen.

There has been considerable controversy on the question of rheumatism being a cause of infective endocarditis. One view is that this condition only occurs in valves already damaged and that the diplococcus rheumaticus is unable by itself to produce the disease. That other organisms can, and do, cause infective endocarditis is admitted by all but that the organism of rheumatism can do so, without any other organism being present, is denied by many. From my own experience I am of the opinion that infective endocarditis can result from the rheumatic infection alone. In support of this I will give notes of a case which occurred recently in my own practice.

C. B. a male, aet. 27, manager of a milk depot, first came to consult me during 1920. He gave a history of rheumatism at 12 and of definite rheumatic fever at 16. At that time he was told by his doctor that he had a "blowing heart".

In 1920 there was a double mitral murmur and cardiac dilatation but compensation was good and he was able to carry on his work in a quiet way. I attended him for minor complaints until 1928. In April of this year he complained of not feeling fit and of being easily tired. On examination there

was found to be a diastolic murmur at the aortic area. The murmur was difficult to detect and varied in loudness but was always soft. He refused to give up work but promised to "take things easily".

In May I was called in as he was suffering from attacks of diarrhoea and abdominal pain. His blood pressure was 140/60 and the aortic murmur was louder. He was running a temperature (up to 101). The attacks of diarrhoea ceased but in June he had a slight haematuria but this did not persist for more than two days. Towards the end of this month the spleen became palpable and tender, and there was a progressive anaemia. Towards the end of June there was increased fever, reaching 103, and the blood pressure was 152/45.

On July 5th. he was seen by Dr. Starling who advised his removal into Hospital. There a blood culture was done and a short-chained streptococcus was isolated and a vaccine was prepared. Mercury salicylate was also given intravenously. In spite of all treatment he went down hill and on 4-9-28 he died. As I was on holiday I was unable to be present at the post-mortem but the pathologist sent me a copy of his report, which stated that the heart weighed 25 ozs. and that the aortic and

mitral valves had typical large cauliflower vegetations the aortic being more affected than the mitral. The spleen was enlarged and showed many infarctions. Cause of death infective endocarditis.

In the above case the only organism isolated was a short-chained streptococcus similar to the diplococcus or streptococcus rheumaticus. There was no history of pneumonia, gonorrhoea or typhoid, (early in the case I had a Widal done and it was negative on two occasions), so the only reasonable deduction in this case is that it was a case of infective endocarditis caused by the streptococcus rheumaticus, as the only aetiological factor here was rheumatism.

Clinical Manifestations.

In young children we do not have the disease characterized by the typical arthritic symptoms as in the adult but towards the age of puberty the joint manifestations of the disease become more frequent. On the other hand the cardiac manifestations tend to become less frequent in adult life than in children, and if they do occur they are, in my experience, of much less severity.

This tendency of the rheumatic poison to attack the heart in childhood is of the utmost importance as, though the other clinical manifestations of the disease may be cured by appropriate treatment and leave no trace, when once the heart is affected the damage may be permanent and the consequences to the child of the utmost gravity.

As the occurrence of carditis is the most serious result of the rheumatic infection in childhood, in fact the heart may be the first and only organ to be affected, I will first discuss the cardiac manifestations of the disease. Later in this section the other clinical manifestations such as arthritis, chorea, subcutaneous nodules and tonsillitis will be discussed in the order of their importance.

Cardiac Manifestations.

In the clinical examination of the circulatory system in children certain points of difference, as compared with the adult, have to be remembered. In the adult the normal pulse rate is about 72 per minute. In children, the normal rate varies with the age of the child. At the age of one year the rate is usually about 110 per minute, at five years old 100 and at ten years old between 70 and 80 per minute.

The heart's action, even in perfectly healthy children, may be slightly irregular and the position of the apex beat is also subject to variation according to the age of the child. In children, up to the age of about six years, the apex beat may be found in the nipple line or just external to it and in the fourth interspace. Gradually the site of maximum impulse falls lower until it is found in the fifth space and about three quarters of an inch internal to the nipple line. In infants the left border of cardiac dulness is outside the nipple line but by the age of seven it is usually in the nipple line or just internal to it.

The methods of examining the heart in children are the same as those employed in the adult, but

the electro-cardiograph and the sphygmomanometer are not of the same utility in them as in the adult. The x-rays are of assistance, and may be of considerable value, as an aid to diagnosis, for instance in pericarditis.

The first sign of cardiac involvement in rheumatism is an increase in the pulse rate and this is usually followed by dilatation and possibly dyspnoea. O.H.Mavor (Glas. Med. Journal, March 1926) (90) has described a syndrome which he states "is common in rheumatism in all stages including the earliest and that it is in many cases the precursor of carditis". The syndrome described by him consists of the presence of Friedreich's sign of adhesive pericarditis and Wenckenbach's sign of chronic pericarditis, with palpable pulsation in the second and third left interspace, a diastolic shock being also felt in this area. The pulse is rapid and on exertion there is tachycardia. There is a relatively dull note, in an area about one and a half inches from the left border of the sternum, from the first space to the base of cardiac dulness. There are also alterations in the breath sounds in this area. He also describes a bruit which is heard over an area, the size of

a double flurin, in the neighbourhood of the second left space close to the sternum. This bruit commences at the close of the first sound, is rasping and runs crescendo up to the second sound.

If the heart is attacked by the rheumatic poison dilatation occurs and may develop rapidly. The clinical signs of cardiac dilatation are an increase in the pulse rate, an increase in the area of praecordial dulness, shortness of breath and usually some degree of pallor. The apex beat is displaced outwards. On auscultation, in an acute case of dilatation, the first sound at apex is muffled and short and the second sound at the pulmonic area is accentuated. Frequently there is a soft blowing systolic murmur heard at the apex and this bruit may or may not be conducted into the axilla. In my own experience, those cases in which the murmur is definitely conducted into the axilla are those in which the mitral valve ultimately proves to have been damaged early in the course of the disease. In this case the murmur does not disappear, as the cardiac muscle regains its tone and the area of cardiac dulness returns to normal, though it may do after prolonged rest in bed. When the bruit is due to actual damage

to the mitral valve, and not simply due to dilatation of the mitral ring, it becomes louder as the cardiac muscle regains its power.

That the cardiac muscle can recover from dilatation and a systolic murmur disappear is shown by the following case.

Kenneth S. aet. 12, a ruddy cheeked boy with fair hair was first seen by me in January 1927. I was in attendance on his mother and was asked to examine his left thumb as it was rather painful owing to his having "stubbed" it a few days previously. I know both the parents and neither has ever suffered from rheumatism and there was no history of any manifestation of rheumatism in the boy.

On examining the thumb the first metacarpophalangeal joint was found to be swollen, rather discoloured and tender. Its appearance was quite in accordance with the injury stated as having been the cause. The thumb was put up in a splint and he was advised to rest the hand. The following day he complained of sore throat and his temperature was found to be 102.2. I am afraid I did not on this occasion associate the sore throat with the condition of the finger. He was put to bed, and

on the second day after the development of the throat condition there was an arthritis of the right knee and the condition was now recognised as being rheumatic.

There was quite a rapid development of cardiac dilatation and a systolic murmur was audible at the apex. This bruit was not conducted into the axilla but was audible over a considerable area of the praecordium with the point of maximum intensity just internal to the apex beat. He was kept in bed and sod. sal. and sod. bic. were prescribed, being preceded by a purgative. The sod. sal. grs. 10 with grs. 20 sod. bic. were given every three hours and temperature quickly fell to normal. After about eight weeks in bed the left border of cardiac dulness was in the nipple line and the murmur had disappeared. Pulse rate was 100 but on little exertion went up. Progress continued satisfactory and he was allowed up. At the end of the tenth week the left border of praecordial dulness was inside the nipple line and pulse rate at rest was 84.

Though this boy had lost weight while in bed he started to put on flesh soon after he was allowed up. He made good progress and he was able

to return to school after Easter. In April 1928 I examined this boy and apart from having fainted twice, once after vaccination, he stated he had felt perfectly well during the last year. The heart was normal and there was no evidence of the rheumatic infection.

This case illustrates how easily a rheumatic arthritis in one of the small joints can be overlooked, especially if there should be some injury to the joint and the non-recognition of the nature of the condition may have very serious consequences to the child.

Unfortunately, the happy result, in the case just quoted, is not always obtained and in spite of all treatment, either in their own homes or in hospital, the great majority of children who have had an attack of rheumatism are left with some permanent damage to the heart. In others, though the heart may ultimately recover, there is a long period of convalescence and it is the treatment and care which the child receives during convalescence which decided the final condition of the heart. From the domestic and financial point of view there may be considerable difficulty in the child obtaining the requisite care and supervision during the

period following an attack of acute rheumatism. The question of treatment will be considered in the next section of this thesis.

In carditis an enlargement of the area of cardiac dulness means an increase in the size of the left ventricle, an increase in size of the right ventricle and an enlargement of the left auricle either alone or together. In children there is probably an increase in all three. The increase in the area of praecordial dulness may persist for years after all signs of the rheumatic infection have disappeared.

If in addition to dilatation there is hypertrophy, and in children both dilatation and hypertrophy can develop quickly an increase downwards of the praecordial dulness occurs. When the dulness is increased upwards it is a bad sign as this means a carditis of marked severity. Coombs (91) has explained the increase upwards of cardiac dulness in these cases as being due to general cardiac dilatation and, in part, to the exposure of the conus arteriosus. If dulness is increased to the right it means an increase in size of the right auricle and you may have dulness in the third, fourth and fifth right interspaces.

When endocarditis is present the valve which is first, and I may add always, affected is the mitral. The common lesion is incompetence but in older children who have had several attacks of rheumatism mitral stenosis may be found. In my own experience mitral stenosis is more often associated with chorea than with any other manifestation of rheumatism.

In mitral incompetence there is a systolic murmur audible at the apex and conducted towards the axilla. This bruit varies in quality. In the early stages it is a soft blowing murmur but as the myocardium recovers from the effects of the rheumatic infection and is able to contract more powerfully the murmur becomes louder and higher pitched. The muffled character of the first sound, which is found in early dilatation, is lost and it becomes louder and longer. The systolic murmur in addition to being conducted towards the axilla is frequently well heard at the lower angle of the scapula.

The other lesion of the mitral valve is stenosis but, as I have already pointed out, this lesion is not frequently found in young children. Mitral stenosis takes a long time to develop and it is quite unusual to find it in the first attack of rheumatic carditis.

I may here state that in my opinion mitral stenosis is always the result of the rheumatic infection though certain Continental writers, amongst whom are Duroziez and Teissier, consider that mitral stenosis may be the result of the tubercular infection.

The typical murmur of mitral stenosis is a presystolic, crescendo in character running up to the first sound and is best heard just internal to and above the site of maximum impulse. The first sound is banging and there may be a presystolic thrill felt at the apex. This description applies to mitral stenosis in the adult but in children the typical banging first sound is not usually heard.

In the early stages of mitral stenosis the presystolic murmur is not heard. There is usually a systolic murmur at the apex and both heart sounds are well defined. The first sound then becomes shortened and sharpened and there is frequently reduplication of the second sound at the apex, or possibly there may be reduplication of the first sound. Cheadle (92) has pointed out that reduplication of the second sound at the apex is an early sign of mitral stenosis, in children suffering from carditis. From my own limited experience I am of the

opinion that a more reliable sign of commencing stenosis is the shortening and the sharpening of the first sound at the apex.

When the second sound is reduplicated the second part of the reduplication may become a short blow but this bruit may develop without any previous reduplication of the second sound having been heard. This soft mid-diastolic bruit is often difficult to hear and may vary from day to day being easily heard when the heart's action is slow but be quite inaudible if the action is rapid. When the condition is progressive the mid-diastolic becomes a pre-systolic and later may become early diastolic.

The following are the notes of two of my cases, one of mitral stenosis and the other mitral incompetence.

I was called to see this child, Cecile T. aet. 11, on Nov. 9th, 1926. I had previously attended her for minor complaints and she had had tonsillotomy in 1921, when six years old. In the section on aetiology I have given the history of the onset of her illness.

When seen by me in Nov. 1926 she had slight chorea. The temperature was normal but the pulse was 100. The movements were not severe and were

limited to the right side of face, right arm and right leg, with occasional twitchings of the muscles of the left side of the face.

She was put to bed and sod. sal. grs. $7\frac{1}{2}$ with double the dose of sod. bic. was prescribed every two hours. This was increased to 10 grs. but owing to nausea and severe headaches had to be reduced. On several occasions there was a slight rise of temperature but never at any time was it higher than 99.5. In spite of rest in bed during November and December the movements became more violent and insomnia was troublesome. The salicylate was discontinued and arsenic and bromides were administered with occasional doses of chloral for the insomnia. Towards the end of December a systolic murmur was heard at the apex and there was slight cardiac dilatation. Early in January 1927 she had an attack of sore throat and there was some cervical adenitis. Sod. sal. was again exhibited grs 10 every two hours, and on this occasion there were no symptoms of salicylism.

After the throat condition settled down the movements were not so severe, but were still present, and the murmur had become distinctly louder. Towards the end of J anuary a crop of nodules appeared round

the right elbow and over the left patellar margins. None was found on the scalp or over the spine. During February the chorea improved but the cardiac condition remained unsatisfactory and on Feb. 27th. she was seen by Dr. Starling who advised her removal to Hospital for Tonsillectomy. This was done during March and thereafter her condition began to improve, and she was sent into the country. A mixture of iron and arsenic was then prescribed.

I saw her again in June when she was looking well and had gained weight. The systolic murmur was still present but the apex beat was now inside the nipple line. She returned to school in September and in October she had another attack of chorea which persisted until December. There was no further development of nodules but a soft diastolic murmur was heard during November and in December there was a presystolic at apex, in spite of her having been confined to bed. She was free from chorea until February of this year when she had another attack but this did not persist for any length of time. She is now residing with an aunt in the country so I have been unable to examine her recently but at the time of my last examination there was definite mitral stenosis.

The above case illustrates the association of chorea and mitral stenosis and also the prolonged absence from school for which this disease is often responsible. The above child attended school for less than one month from November 1926 until September 1928.

The case of mitral regurgitation occurred in a girl Joyce C. aet. 11, a child with black hair, and who was friendly with the girl whose case has just been quoted. This child was taken ill in September 1926 with acute arthritis. There was no history of rheumatism in either parent, both of whom I know personally, but in the child there was a history of vague muscular pains in the muscles of the thighs and I had attended her previously, on two occasions, for tonsillitis.

The joints chiefly affected were the shoulders, knees and wrists. During the second week of the illness a systolic murmur was heard at the apex but I was unable to be sure whether cardiac dilatation was present or not. If present it was not of any great extent. The arthritis was very resistant to treatment and as the tonsils were very unhealthy I advised their removal. This was done in Hospital and under colossal sulphur and aspirin the arthritis

cleared up but the systolic murmur was still present on her discharge. I examined her several months after and found the heart regular, no breathlessness on exertion of moderate degree, no cardiac dilatation but there was still the systolic murmur at the apex and a systolic at the pulmonic area. She returned to school and remained well until August of this year (1928) when she had an attack of acute arthritis in both knees which cleared up under colossal sulphur and aspirin. The heart was again affected and there was definite dilatation. She was kept in bed and left border of the praecordial dulness is now in the nipple line. There is also hypertrophy with accentuation of the second pulmonic sound, but so far no evidence of mitral stenosis, or other valvular lesion.

In children the aortic valve may also be attacked by rheumatism. An aortic valvulitis in children usually follows damage to the mitral valve, and it is rare to find a child suffering from an aortic lesion alone. The occurrence of multiple valve lesions in children is of grave significance and the prognosis of the cases in which it occurs is bad, if not immediately, cer-

tainly in early ^{adult} life when malignant endocarditis frequently supervenes.

In rheumatic carditis the usual lesion of the aortic valve is incompetence and in children with *this* lesion the usual diastolic murmur is heard over the aortic area. Aortic regurgitation is uncommon in children under twelve years of age. In childhood the murmur of aortic incompetence is frequently best heard, as pointed out to me by Dr. Starling, over the second left interspace close to the sternum and is conducted down the sternum. Usually there is a systolic murmur as well to be heard at the aortic area. This systolic bruit is not due, in the great majority of cases, to aortic stenosis and this is proven by the frequency with which it is heard and the infrequency of finding aortic stenosis at post-mortem examinations. Clinically, unless the murmur is definitely conducted into the vessels of the neck and the pulse tracing shows characteristics of aortic stenosis, the systolic murmur at the aortic area does not mean aortic stenosis.

The diastolic murmur at the aortic area is soft and there is frequently a difficulty in determining if it is present or not as in these

cases there is often difficulty in breathing and the breath sounds may mask the murmur. If there is free regurgitation the type of pulse may assist in the diagnosis and the sphygmomanometer shows a lower diastolic pressure than normal but in these cases there is usually no difficulty in hearing the murmur.

The following are the notes of a case of aortic regurgitation. George L. now aged 23, a red haired boy was first attended by my locum in August 1920. There is no history of rheumatism and apart from otitis at 8 years old and frequent attacks of epistaxis in childhood there is nothing of note in the history. In August he had an attack of colic and it was for this that my locum attended him when he discovered the cardiac lesion, mitral incompetence. Some time after my return from holiday I detected a diastolic murmur at the aortic. He was kept in bed until February 1921 when there was distinct aortic regurgitation. The heart was dilated and hypertrophied but his general condition had improved and he was allowed up but did not go out of doors until June. He remained fairly well and he was able to go about. On 20-4-23 he had a fairly severe attack of

epistaxis. There was a gradual increase in the praecordial dulness but he complained of nothing apart from shortness of breath on exertion and in the summer of 1927 he felt so well that he expressed the desire of going to work and was quite indignant when told that he was not fit for any kind of employment. On 9-3-28 he had an attack of rheumatism in the right shoulder and from this date he has gone down hill. Since then he has had attacks of vomiting and constipation has been troublesome. He now complains of pain in the praecordium and of a feeling of weight in the chest. The apex beat is well outside the nipple line and the cardiac impulse is heaving. The left border of praecordial dulness is in the anterior axillary line and there is dulness to the right of the sternum. There is bulging of the chest wall and the impulse is diffuse. The blood pressure is 140/50. A loud diastolic murmur is audible from the aortic cartilage to the apex beat and a systolic murmur is heard at the apex. Over the brachial artery a double murmur is heard. He complains of faintness on slight exertion and is very weak. There is no oedema and no signs of congestion of the lungs. So far there has been no evidence

of emboli though his temperature has been raised on several occasions. He is confined to bed and I am still attending him.

In the pulmonic area the second sound is accentuated in mitral disease and frequently reduplicated. In many cases there is a systolic murmur heard in this area but this murmur is rarely due to pulmonic stenosis as this condition, as proved by post mortem findings, is the rarest of all valvular lesions. A systolic murmur is heard at the pulmonic area in many diseases where there is anaemia and is probably due to some alteration in the blood.

There may also be incompetence or stenosis of the tricuspid valve but the latter is rare. In tricuspid incompetence there is usually a mitral lesion as well. The murmur of tricuspid incompetence is systolic in rhythm and is best heard at the lower end of sternum and between the sternum and the apex beat but is not conducted towards the axilla, beyond the apex beat. In cases of tricuspid incompetence the right side of the heart is enlarged and the area of cardiac dulness is increased.

According to Coombs (93) "The more the maximum impulse lies to the left of the area of pulsation the greater the share taken by the left ventricle in the cardiac enlargement. The more it lies to the centre of that area the greater the share taken by the right ventricle".

Pericarditis.

In children suffering from rheumatism, pericarditis usually follows endocarditis and when it occurs it is certain that the myocardium is also damaged. The myocarditis resulting from the rheumatic infection is accompanied by dilatation and this accounts, to a great extent, for the increase in the praecordial dulness in cases of rheumatic pericarditis.

With the onset of pericarditis the child complains of pain over the praecordium, is dyspnoeic, very restless and there is frequently vomiting. A dry cough is also frequently present. The pulse is rapid and there is fever in most cases. Delirium is also frequently present.

In the early stages of pericarditis friction can be heard. The rub may be heard over any part of the praecordium but is most often heard over the base of the heart near the sternum. It is to

and fro in character and appears to be just under the stethoscope. The heart sounds are feeble and may be distant or muffled in character and the heart's action is rapid and excited. The praecordial dulness is increased and there is, almost invariably, endocarditis.

The great danger in pericarditis, apart from cardiac failure in the acute stage, is adherent pericardium. When this occurs to any extent the heart is greatly embarrassed and ultimately the condition leads to death as, owing to the contraction of the fibrous bands, the pericardium gradually strangles the heart.

The diagnosis of adherent pericardium may be very difficult but if the following signs are present one can almost be certain that the pericardium is adherent. The signs are as follows: the heart sounds are not clearly heard, there is an increase in cardiac dulness, systolic retraction of the intercostal spaces with diastolic recoil of the chest wall and there may also be praecordial bulging. The presence of much oedema is also in favour of adherent pericardium.

In practice I have had only five cases of rheumatic pericarditis and three of them died, two

fairly soon after the onset of the disease and the other, two and a half months after. In none of these cases was death due to adherent pericardium but to cardiac failure and exhaustion. In all three cases I was impressed by the rapidity with which anaemia developed and the marked loss of weight which occurred in a short space of time.

As an illustration of the course of the disease I will give notes of one of these cases.

Daisy M. aet. 7 a fair haired child, had not been feeling well for some weeks but her mother had not thought it necessary to have medical advice. During the night previous to my seeing her she had vomited and in the morning she was obviously ill. There was a history of recurrent sore throats, bronchitis and pneumonia in infancy. The tonsils were enlarged but there was no tonsillitis.

The pulse was rapid and the temperature was 100.2. There was some dyspnoea and on looking at the child one would almost have diagnosed pneumonia, but there was no evidence of this on examination. The heart was dilated and there was a systolic murmur heard at the apex. On the third day she complained of pain over the lower end of the

sternum but stated it was not "too bad". It may only be coincidence but all three cases complained of pain in this region and not over the praecordium. At the base of the heart friction was heard and was only audible in a small area. In the three days the area of praecordial dulness had increased a little over half an inch in width. The pulse was very rapid and irregular and the temperature was now higher. At the end of a week the child was apparently better and no friction could be heard but the heart's action was still rapid and irregular. The friction sound was heard on and off during the next ten days and there was distinct wasting and marked anaemia. About this time nodules appeared over the left external malleolus and on the front of the left ankle. She complained that those on the anterior surface of the ankle were tender and if she had not complained of the pain I am afraid their occurrence would have been overlooked.

On the twentieth day she was delirious, pulse ?, temperature 103 and there was dulness at the base of the left lung. As the nurse, an aunt of the child, had been called away I advised her removal to Hospital. Later the house physician

reported that for a time there was an improvement, the lung condition clearing up, but ultimately, two and a half months after being taken ill, she died from heart failure and exhaustion.

The symptoms of cardiac disease in children may be slight though the physical signs show fairly advanced endocarditis. Apart from loss of weight, pallor and some breathlessness with a dry cough on exertion and possibly palpitation, there may be no symptoms of involvement of the heart. It is rare to see in young children evidence of cardiac failure but in older children oedema of the lower limbs, enlargement of the liver and ascites are not uncommon. When oedema, cyanosis and an enlarged and pulsating liver are found the prognosis is serious as these conditions mean that the heart muscle is severely damaged and lacks the power to maintain an efficient circulation.

Joint Manifestations.

In children the joints chiefly affected by rheumatism are the knee, shoulders, ankles and wrists and less frequently the hips, finger joints and elbows. The typical rheumatic arthritis is not so commonly seen in children as in adults and usually occurs in the older children.

The affected joints are swollen, red and hot to the touch. The swelling is due to effusion into the joint and also, to a certain extent, due to the involvement of the surrounding tissues in the inflammatory process.

The joints which are affected are kept in the position of greatest ease i.e. in the case of the knee joint in a position of flexion. The pain in the joints is severe and movement, owing to the swelling and pain, is limited. The pain, as in adults, is frequently worse at night.

The disease does not necessarily affect all the joints at once but flits from one joint to another. There is fever but it is not so high as in adults and under treatment with salicylate of soda the temperature drops, and after a longer or shorter period the swelling subsides and there may be only a certain amount of stiffness left

in the joint. Sir Thomas Horder (94) has stated that if the temperature does not fall within forty eight hours under treatment with salicylates there is grave doubt if the arthritis is rheumatic.

In the adult, with acute arthritis, a marked feature is the occurrence of sour smelling sweats. This sweating is not seen in children but there is usually some perspiration, or at least dampness, of the hands and feet. In a certain number of children who have suffered from rheumatism this clamminess of the hands and feet may persist long after all symptoms of rheumatism have disappeared.

Voelcker (Garrod, Batten and Thursfield Diseases of Children) (95) states that the more the stress of the disease falls on the joints the less serious the outlook. That there may be a severe arthritis in children without a clinically demonstrable cardiac lesion is shown by the following case, though in my own experience it is the exception for the heart to escape in rheumatic arthritis in children.

A boy, John W. aet. 14, was first seen by me on 1st. October 1924. He had acute arthritis involving the knees and wrists and, at a later

stage some of the finger joints. Under treatment with salicylate the temperature fell but the arthritis resisted treatment for some time.

On October 12th. he complained of pain in the left side of chest and on examination pleural friction was detected between the axilla and the lower angle of the scapula. There was no effusion and the rub was not heard after October 17th.

As sod. sal grs. 15 every two hours was not curing the arthritis he was put on colossal sulphur two teaspoonfuls every four hours, and aspirin grs. 10 four hourly and there was some improvement but the arthritis kept recurring in various joints until the first week in November.

At no time in the course of the illness was there any evidence of the heart being affected and he was allowed up on 19th November. I saw him occasionally during the next few months and he remained well, apart from being anaemic, and he has remained well to date.

Subcutaneous Nodules.

These nodules were noted by Hillier in 1863 (96) in a case of chorea with pyrexia and mitral disease. They were first described by Barlow and Warner (1881) (97) who pointed out their significance and association with rheumatism. The appearance of the nodules, microscopically and macroscopically, has been described in the section on pathology.

Subcutaneous nodules are most commonly found at the back of the elbow joint, over the malleoli and spine, at the edges of the patella, in the scalp and sometimes on the extensor aspect of the wrist and ankle joints. They vary in size, are not tender and the skin is freely movable over them. Nodules of the usual size are not visible but can be felt under the skin. They may occur singly or in crops, may develop rapidly yet may persist for months.

In my own experience, the occurrence of nodules is not frequent in rheumatic children and I have notes of only three cases in which a nodule or nodules were found. Coates (B.M.J. 21st Mar. 25) contends that nodules may be found in children with the rheumatic infection prior to any clinically demonstrable lesion in the heart. In one hundred

children, examined in Out-patients, he found nodules in twenty three children with symptoms of rheumatism, and none in the other seventy seven. Still (98) found that, in two hundred cases of severe rheumatism, twenty seven point five per cent had nodules.

I am of the opinion that the incidence of nodules varies in different districts as, when I have discussed this subject with other medical men, their percentage of cases with nodules is appreciably higher than in Norwich. In May this year I asked the consulting Physician to the Children's Hospital in Norwich to let me know when he had a case with nodules and up to the present, though I have frequently reminded him, I have not yet been shown a case. He states that in his experience nodules are not commonly found and when found, the case is usually one of severe carditis. Cheadle (99) considered that when the nodules were of large size they were equal to a death warrant and were usually associated with an active and uncontrollable cardiac lesion.

Subcutaneous nodules may be the only manifestation of rheumatism present and Coombs (100) has stated that they are "a most serious omen as a form of onset" of rheumatism. Bronson and Carr

(American Jour. Med. Science June 1923) quote cases illustrating that nodules are the outward sign of the presence of some active focus of rheumatism and that they disappear as the infection becomes quiescent, and Barlow (97) stated that "In themselves (nodules) were indicative of rheumatism, even in the absence of pain and although unimportant in themselves are nevertheless of serious import".

Notes of two cases which had nodules have already been given and the other will be described later.

Chorea.

This disease was first described by Sydenham in 1686, and is known as Sydenham's chorea as distinct from hereditary chorea (Huntingdons), post-encephalitic and post-hemiplegic chorea. That chorea can be caused by other means than rheumatism is recognised but that it is chiefly the result of the rheumatic poison acting on the central nervous system is generally admitted, and Barlow (102) quotes 60%, Cheadle (101) 75%, Still (103) 54.3% and Osler 21% of cases as showing evidence of rheumatism.

Chorea has been described as "insanity of the muscles" and is manifested by unpurposivē incoordinate movements, loss of muscular power and irritability. Warner has given the name of "Microkinesis" to the fidgetiness of the nervous child. The choreic child is frequently emotional and of highly strung and nervous temperament. As pointed out in a previous section, girls are more frequently affected than boys and this preponderance of the disease, in female children, is most marked between the ages of ten and fifteen years.

The greater number of cases of chorea in females may be explained by some difference in the female

metabolism causing them to be more resistant than the male to the rheumatic infection as chorea is probably due to an infection which the resistant tissues have been able to overcome, but which the brain, being a more delicate organ, has been unable to ward off.

The symptoms of chorea in a well defined case are involuntary inco-ordinate movements of the muscles of the face, body and limbs, loss of muscular power, irritability and lack of concentration. In milder cases there may be only fidgetiness, some alteration in the nature of the child and headache.

The movements in the arms and hands are characteristic. The wrist is frequently flexed and the movements are waving and rather jerky. The lower limbs are not so much affected as the upper but often there is some instability in walking and I have seen a choreic child with ulceration over the internal malleolus due to the knocking of the opposite heel against it when walking.

The muscles of the face are nearly always affected and cause the child to grimace and in severe cases speech may be altered or there may

even be aphasia. Speech when affected is hesitating and I have noticed a peculiar grouping of words i.e. the first part of a sentence is spoken quickly then there is a pause and the rest of the sentence is finished fairly slowly.

Muscular weakness and loss of co-ordination are always present and the child suffering from chorea frequently drops articles which it is holding. When asked to grip any object there may be a spasmodic flexion of the wrist and the fingers but the grip is not maintained. The knee jerks are active and may be unduly so. In other cases they cannot be elicited. In my own experience the knee jerks vary, at different times, in the same case.

As giving some idea of the frequency of the disease in London, Still (105) states that 13.3% of all admissions to Great Ormond Street and 3% of Out-patients at King's College Hospital are cases of chorea.

Many cases of chorea recover completely in a comparatively short time but in others, the disease is apt to recur and is often very lingering, in a mild degree. In cases of recurrent chorea the heart is more liable to be damaged than in those cases who have a short acute attack, and the older the

patient the less likely is the heart to be affected. When the heart is affected in chorea its action is rapid and there is dilatation. Frequently there is endocarditis and the valve which is most often affected is the mitral.

The following are the notes of a case of chorea which was rather prolonged and in which, to date, there are no evidences of heart disease and in which various methods of treatment had very little effect.

Clifford B. aet. 7, was first seen by me in July 1927. There was no history of rheumatism or sore throats but I have attended his father for rheumatism on several occasions. The typical movements were present but were not severe. The face muscles were only slightly involved, the left arm and hand being chiefly affected. On my mentioning that the left side was mostly affected the mother volunteered the information that the boy was left handed. (On two occasions I have attended children with the movements chiefly on the left side and both cases were left handed).

He was put to bed and sod. sal. with sod. bic. (grs $7\frac{1}{2}$ and 15) were prescribed two hourly. He remained in bed for three weeks and as at the end

of that time there was no improvement and his home conditions were unsatisfactory I advised his removal to Hospital where he was kept in bed for a further period of three weeks. On his discharge the movements were not so severe and he was advised to attend Out-patients. Bromides, iron and arsenic were all tried but the chorea persisted, and I then put him on tab. salicylate of quinine grs 3 and for a time he appeared to improve. He again attended O.Ps and I lost sight of him for several months. In June 1928 I attended him for an attack of tonsillitis and on questioning the mother she informed me that the chorea had persisted for ten months.

When he was in bed with the tonsillitis I took the opportunity of examining his heart and I was unable to detect any sign of cardiac disease. There was practically no loss of flesh and he was only slightly anaemic.

Throat Manifestations.

The throat condition which may precede an attack of rheumatism in children is of no special type. I have seen rheumatism follow a follicular tonsillitis but in my experience a pharyngitis and tonsillitis is the more usual condition, the whole fauces being involved in the inflammatory process and there is frequently some adenitis in the neck.

In the following case the throat infection was quickly followed by carditis without any other manifestation of rheumatism.

Willie Tracey aet. 9, was seen by me in February 1926. He was poorly nourished and the mother stated that he had been delicate from birth. As all the other members of the family were strong and healthy she attributed his ill health to his having been born during the war when she had difficulty in obtaining sufficient food and to her having had to wait in food queues in all weathers while she was pregnant.

On examining the throat the fauces were found to be inflamed and there was oedema of the uvula. The tonsils were enlarged and "angry looking". Adenitis was present in the neck. Temperature was

102 and pulse 120, when first seen. He was put on a diaphoretic and the throat was painted with glycerin and tannic acid. On the third day he complained of pain in the epigastrium and during the examination a systolic murmur was heard at the apex and at the pulmonic area. I have no notes as to the presence of cardiac dilatation only that progress was not good and that he was admitted to Hospital where he remained for 9 weeks, and then was sent to a convalescent home. I saw him on his return home when I made the following note, heart enlarged, V.S. bruit at apex, P.R. 86, states he feels well.

I have recently examined this boy and the heart condition is as follows. There is a forcible apex beat in the 6th space just outside the nipple line. The area of praecordial dulness is increased to the left. At the apex there is a systolic murmur which can be traced towards the axilla and the pulmonic systolic is still present. The boy now looks much better than he did when I first saw him. He attends the open air school, where he has the mid-day meal, and is periodically examined by one of the school medical officers so that any alteration in the cardiac condition should be noted before more serious damage occurs.

Growing Pains.

The muscular pains which occur in children are now recognised as being rheumatic in nature, in the great majority of cases. In my own practice a history of "growing pains" is seldom elicited unless specially and carefully enquired for.

Growing pains usually occur in the hamstrings and in the shins but may also occur in the muscles of the forearm. I do not think the pains are ever severe otherwise mothers would more frequently bring their children for this condition. On the other hand if the child should complain of pains in the lower limbs, and yet is apparently quite well, the average mother does not pay much regard to the complaint as the condition is put down to growing pains, a condition which the public regards as quite natural in children. This attitude towards the occurrence of growing pains is even noticed in the better classes but there, if the pains persist, the parents usually obtain medical advice.

That "growing pains" may be the only manifestation of rheumatism elicited in a case of endocarditis is shown by the following.

Marion Fields, aet. 8, was brought to me

suffering from mild bronchitis. On examining the chest there was a systolic murmur heard at the apex and conducted towards the axilla. In spite of careful enquiry into the history the only manifestation of the rheumatic infection obtained was "growing pains" and the mother was quite ignorant that the child's heart was affected. There was no cardiac dilatation and the child seemed to have been perfectly well until the onset of bronchitis.

That the cardiac condition was due to rheumatism was borne out by the development, two years later, of arthritis in the ankles and knees. The heart was not further involved and the arthritis, under treatment, quickly subsided. She is now 12 years old and her mother reports that she is well and has not "missed a day at school" since the arthritis.

Skin Manifestations.

My own series of cases has not shown any skin manifestations such as erythema marginatum or erythema exudativum. I have had cases of erythema nodosum but I am still doubtful if this can be regarded as a manifestation of rheumatism and I have notes of two cases in children, aged 13 months and 5 years respectively. In the child aged 5 the

erythema followed an attack of tonsillitis. The tonsils were unhealthy and were enucleated and to date there has been no other evidence of rheumatism. The child aged 13 months is now perfectly well but it is of interest to note that I attended her mother in 1925 for this same complaint.

The profuse sweats which occur in adult rheumatism do not occur in children.

Anaemia.

Goodhart (Diseases of Children) (106) states that in his opinion the children of rheumatic parents are habitually anaemic. Though I have found no evidence that this is so there is no doubt that rheumatic children are usually anaemic; and I have been impressed by the rapidity with which the anaemia may develop, especially in cases of severe infection.

The blood shows nothing special in the anaemia of rheumatism. Swift, of New York (81), has shown that there may be a moderate leucocytosis in these cases and that the leucocytosis may persist for a long time after all symptoms of the active disease have disappeared.

Personally I think that there is some connection between the anaemia and the gastric disturbances

which are frequently noted in rheumatic children, as those with a history of frequent "bilious attacks" are frequently the most anaemic, and the condition is not at all amenable to treatment with either arsenic or iron. As in adults there is often a hypochlorhydria in rheumatism I assumed that there might be a similar condition in children and have administered small doses of hydrochloric acid to these children and their condition has certainly improved.

Wasting.

In children, during the active stage of rheumatism, there is a rapid loss of weight, and in the adult, as Coombs has pointed out, it is the exception to find signs of mitral stenosis in a fat woman.

Parkes Weber (107) has described the condition of under-development sometimes found in mitral stenosis as "Mitral Dwarfism" and he attributes it to a very early acquired mitral stenosis causing an interference with the proper nutrition and the oxygenation of the growing tissues.

During convalescence I think that a steady putting on of weight is one of the best signs in

those children who have had an acute attack of rheumatism or any of its manifestations.

Nose Bleeding.

Epistaxis is quite common in children of all ages but when looking through my notes on rheumatic cases I was struck by the frequency with which I had noted its occurrence. It cannot be considered as a manifestation of rheumatism alone as its occurrence is not infrequent in influenza, whooping cough, typhoid and other infectious fevers, purpura and scurvy and in anaemia particularly if of a severe type.

The epistaxis, in my cases, was never severe and apart from the boy George L. required no special treatment, as the usual domestic remedies, application of cold water to the nose and cold to the nape of the neck, were sufficient to check it.

Pleurisy.

When due to the rheumatic infection pleurisy is usually of the dry type. It often occurs in cases of severe pericarditis when it may be due to direct extension of the infection from the pericardium but it may occur in acute arthritis and the case of John W. is an illustration of this.

That the pleurisy is due to the streptococcus rheumaticus is proven by this organism having been isolated from the pleura.

Gastric Disturbances.

In children who subsequently develop rheumatism there is often a history of gastric trouble over a long period. The mothers will tell you that the child has recurrent attacks of biliousness and no doubt many of these attacks are due to indiscretion in diet. On the other hand, as in the case of Jean B., there were attacks of vomiting, during several years, for which no explanation could be found. Her case will be quoted shortly.

These attacks of gastric derangement may be explained in the following way. The causal organism of rheumatism is most probably a normal inhabitant of the intestinal tract so it is feasible to argue that, when the resistance of the body tissues is slightly lowered, though not so lowered as to allow the organism to gain access to the general system, there should be some disturbance at the seat of invasion i.e. in the alimentary tract.

Fever.

The chart of a case of rheumatic fever is of no particular type. The range in children, apart from

tonsillitis and pericarditis, is usually from 99 to 100 degrees. In chorea, if the fever returns, after the temperature has been normal for some time, it usually portends further activity of the infection with damage to the heart, or if high, the onset of pericarditis.

Iritis.

This condition, though fairly common in adults, is not often seen in children. In children I have had only one case and as it illustrates several points of interest I will give rather full notes.

Jean B. aet. 13, a fair haired, very intelligent, well developed and athletic girl whom I have known and attended since she was 4 years old, was seen by me early in February of this year. On the day previous to my seeing her she had been sent home from school, where she is a day girl, as she had been sick. Her mother thought it was nothing serious as she had had attacks of vomiting on and off for several years and for which no explanation could be found. The same evening she complained of sore throat and next morning I was called in to see her, and I found her with a typical scarlet fever rash (one of the boarders had just returned to school after an attack of scarlet fever).

On the 4th day of her illness she developed an iritis which failed to yield to atropine and the usual remedies. Having recently had a similar case in an adult which had cleared up under treatment with sod. sal. I put J.B. on it and it cleared up very quickly.

The throat condition, I may here add that she had a tonsillotomy (supposed tonsillectomy) done in 1920, was rather troublesome and there was considerable adenitis in the neck.

The pyrexia was persistent and pulse rate remained high after the temperature was normal. The heart was carefully examined daily but there was no evidence of any lesion. There was a basal systolic murmur which I regarded as haemic. There was no nephritis.

At the end of the 5th week the temperature, which had been normal, rose and this recurrence of the fever was followed by an arthritis involving the left ankle, right elbow and several of the finger joints. There was tachycardia and the praecordial dulness was increased towards the left. During the 6th. week a systolic bruit was heard at the apex but was not conducted much beyond the apex beat. I discovered three subcutaneous nodules

over the extensor aspect of the ankle joint, one fairly large one and two small ones. They were not tender and she was quite unconscious of their presence.

By the end of the 8th week the apical murmur was no longer audible but the increase in cardiac dulness remained unaltered and the pulse rate was still high. During April there was little or no improvement and the salicylate appeared to have no effect on the arthritis, nor had aspirin and collosal sulphur. In May, the pulse rate having dropped to 90, she was allowed up and rested on a couch. She had lost weight, was very weak and complained of stiffness in the joints which had been affected.

The tonsils were unhealthy and, as I suspected they were delaying recovery, I advised their removal and this was done on 7th June. On 13th June for the first time the pulse rate was under 80 when resting, but on the least exertion there was tachycardia. From the date of her tonsillec-tomy she improved rapidly and in August she went to Buxton.

I have examined her on several occasions since August and she is making steady progress. The

pulse remains about 80, there is still some increase in the cardiac dulness, but no bruits are audible and the anaemia has greatly improved. In this case, though she had been having Parrish's food all the time she was in Buxton, there was very little improvement in the anaemia until she was put on acid tonic.

One of the points of interest in this case is the fact of her having unhealthy tonsils when 5 years old when she was supposed to have had them removed and there had been no trouble with the throat until the onset of scarlet fever. The question arises would she have developed rheumatism if the tonsils had been enucleated in the first instance as they were obviously delaying recovery, the improvement in her condition following, almost immediately, their complete removal. After one or two similar experiences I now make it a point of having all my tonsil cases operated on by a throat specialist and making sure that the tonsils are actually enucleated.

The iritis was probably rheumatic as it cleared up under sod. sal. and in all probability the administration of salicylates prevented, or at least delayed, the onset of arthritis which

usually occurs, in cases of scarlet fever, at the end of the first week. The occurrence of nodules in this case points definitely to the arthritis being rheumatic.

Why the administration of small doses of hydrochloric acid should help the anaemia I am unable to explain but in cases of carcinoma of the stomach in adults the same improvement with a sense of well-being, may also be noted. The same improvement is noted when HCl. is given in pernicious anaemia.

The above child's one regret this summer has been that she has been unable to swim as in 1927 she was Junior County Champion and she was naturally anxious to defend her title.

In this section I have attempted to show that the manifestations may occur either singly or in combination and the clinical picture presented by the disease in childhood is rather different to that in adult life where the arthritis is the dominant feature. A very apt simile is used by Voelcker (108) when he compares the rheumatic infection in children to "a mosaic, the various manifestations piecing themselves together and so completing the picture".

Treatment.

The treatment of the rheumatic infection in children consists of more than the mere prescribing of drugs and the medical man in charge of these cases should be prepared to advise as to diet, clothing, suitable climate and environment, amount and kind of exercise and possibly education and lastly, and of considerable importance, a suitable vocation when these children, having reached adolescence, have to go out and make their way in the world.

In this section I propose to deal with the treatment of the various manifestations of rheumatism, and to discuss the treatment of the rheumatic infection as a whole.

When once the heart is affected, be it ever so slightly, rest and usually prolonged rest, in bed is the only effective therapeutic measure. Rest in bed should be continued as long as there are any signs of activity of the disease, and for some considerable time thereafter, as rest enables the body to overcome the microbic invasion of the tissues.

The indications for rest in bed are a recent or active endocarditis, a heart which is much dilated and in which there is no evidence of hypertrophy,

and the presence of symptoms of cardiac failure.

The case where the heart is only slightly affected often presents difficulties in treatment as the parents or guardians of the child, owing to the lack of symptoms, may not realise the need of complete and prolonged rest and for domestic and financial reasons they may be anxious to have the child up and about. Even in these slight cases I would emphasise the need of rest and it is the duty of the practitioner in attendance to rigidly enforce it.

In my own cases I have made it the rule that there should be absolute rest during the active stage of the disease and for twenty eight days after the temperature is normal and the pulse rate is under 90 at rest.

When first allowed up the child must rest on a couch and gradually the amount he is allowed to do is increased. I do not think that, once all signs of activity have ceased, there is much to be gained by keeping the child in bed for a prolonged period, but if on being allowed up the pulse rate should increase and remain high then it is an indication for a further period of rest.

In the class of the community in which rheumatism is most prevalent the question of rest is always one of difficulty. In a small house, in which there are other children, it is next to impossible for the child to obtain the requisite amount of rest and adequate nursing and for this reason I think it is advisable that cases of rheumatic carditis should be admitted to Hospital. Unfortunately the pressure on Hospital accomodation is so severe, that the usual course of events is, that as soon as the child is over the acute stage he is sent home, to the same surroundings as those in which he contracted the infection or, if he is one of the fortunate few he may be recommended for a stay at one of the Convalescent Homes.

What happens to those who are sent direct home from Hospital is only too well known to those in general practice. Some of the children may improve for a time and in a considerable proportion of cases there may be no recurrence of the infection, at least for some long time, but in the great majority of cases, after a fairly short period there is a return of the rheumatism with further involvement of the heart and they are again admitted to hospital, their condition being worse than when

they were first admitted.

The futility of this method of dealing with cases of the rheumatic infection in children is now recognised and in various centres special institutions are being provided in order that their convalescence may be spent in ideal surroundings. In addition to these special homes, in London at least, (Paddington Green Children's Hospital and Great Ormond Street Sick Children's Hospital) special rheumatic clinics have been organised.

These rheumatic clinics are purely advisory and the staff does not actually undertake treatment though, as the clinics work in close co-operation with the Hospital to which they are attached, there is no difficulty in arranging treatment for those cases which require it. Though the time is still too young to judge what results will be obtained I think that the establishment of these clinics is a step in the right direction.

As I have stated in an earlier part of this thesis the class which suffers most from the rheumatic infection is the upper working class or what may be termed the Hospital Class of the community. As a considerable proportion of this

class relies on the General Hospitals for medical treatment, at least as regards children and non-insured members, it is to be expected that a considerable number of these cases will be seen in the Out-patient Departments but as is well known the results of treating these cases, probably first as in patients and then as Out-patients, have proved very unsatisfactory.

As an illustration of what may actually happen to a case seen in the ordinary O.P. department of a general hospital, take the case of a child with a sore throat and some pains in the joints. The physician possibly obtains a history of parental rheumatism or a history of recurrent sore throats or "growing pains" in the child and recognising the rheumatic nature of the illness prescribes sodium salicylate and orders the child home to bed with instructions to report again, at a longer or shorter interval. He may also advise the parents to call in a medical man but this class of parent is not always in a position to pay a doctor's fees and hesitate to call in a medical man unless there is some distinct alteration for the worse in the child's condition. As a rule, under the salicylate and a short rest in bed, the

throat condition and the pains clear up and the mother, finding the child so well, allows it to be up and about, when possibly an arthritis develops, and on the child's next visit to hospital the heart is found to be damaged.

The physician in the O.P. department has no means of supervising these cases in their own homes and it is here that the benefits of the rheumatic clinics become obvious, as the home conditions of all children attending the clinic are enquired into and in the great majority of cases the home is actually visited. As the clinics also work in co-operation with the Health Authorities arrangements can be made for the child to be under the supervision of one of the health visitors during treatment.

In addition to the provision of supervision of these cases in their own homes during treatment there are many other advantages to be derived from rheumatic cases attending special clinics. As the clinics are held in the O.P. departments facilities for bacteriological or other special examinations are readily available.

The collecting together of these cases in one

clinic would also give the staff the opportunity of comparing the results of different methods of treatment in similar stages of the disease. There would also be ample opportunity for investigating and keeping records of, the family histories, the mode of onset of the disease, the age at which the disease commenced, the type of home and the district in which the cases lived, the various manifestations of the disease and the final results of treatment. With regard to the last, owing to the lack of means of following cases up, the consultant who treats these cases in hospital very seldom knows what the final results of his treatment are and in my own practice I am frequently asked by the surgeons and the physicians at the hospital what happened to such and such a case. If full case sheets were kept, in the course of a few years, valuable records, which might help to throw some light on the causes which predispose to an attack of rheumatism, would be available.

As the clinics also work in co-operation with the school medical service, all cases attending the clinic being notified to the education authorities, a certain proportion of cases will be referred to

the clinic by the school medical officers. Owing to the insidious nature of the onset and the lack of symptoms in the early stages of rheumatism in children, many cases may never have been examined by a medical man until they are examined at school. Under the present system of medical examination of school children 2, 685, 739 children (in England and Wales) were examined once, and in addition 1, 719, 844 were re-examined, during the year 1927. From these figures it will be realised the opportunity the school medical officers have of detecting cases of rheumatism in children.

As the school medical officers do not undertake treatment they can only advise cases requiring treatment to be attended by their family doctor or failing that to attend a hospital. Many of the cases referred to the general practitioner will ultimately wend their way to the hospital as owing to the home conditions they are unable to be efficiently treated there. In other cases the practitioner will only be too glad to refer cases to the clinic for a second opinion.

A few cases would also be referred to the clinic from the Child Welfare Centre, but the numbers from this source would not be large as rheumatism before

the age of five is not so frequent as in the later years of childhood.

Thus we would find, in a district in which there was a special rheumatic clinic, that the cases would be referred in the greatest numbers from the hospital, in smaller numbers from the general practitioners and the school medical officers and a few cases might also be referred from the child welfare centre, and if there was co-operation between these various bodies it would mean that, in the course of years, a history of practically every case of rheumatism in the district would be available at the clinic and not only that but as the clinic has the means of following up and supervising these cases, either by voluntary workers or by the local health visitors, treatment would be much more efficient.

In the event of the home conditions being favourably reported on there is no reason why the child should not be treated at home but in many cases an adverse report would be received and there would need to be some provision made for the treatment of these cases in more suitable surroundings.

As we have seen prolonged rest is frequently necessary for cases of rheumatic carditis and I may add also for cases of chorea and as this is

unobtainable in the general hospitals and as the ordinary convalescent homes are unsuitable for this particular type of case the provision of suitable homes is necessary if the children suffering from this infection are to have the best chance of making a good recovery. There are already several of these homes in existence and as examples of such homes Baskerville near Birmingham, Saint Mary's Broadstairs, The County Home for Children at Heswell and Hartfield Hospital in Sussex may be mentioned.

The advantages gained by residence in these convalescent homes or special institutions for rheumatic cases, are many. When resident there they are removed from the environment in which they contracted the disease, they are under supervision as to diet and clothing, exercise is regulated according to their needs and at the same time facilities, in some of the homes, are available for continuing education. This last point is of some importance when it is realised the length of time a child may be absent from school owing to, for instance, chorea, yet under supervision and suitable surroundings there are no objections to the

choreic child continuing its education though to do so in the ordinary schools, with their rush and excitement, would be in the greatest degree detrimental. I have noted on one or two occasions that the return to school after the summer vacation has been the signal for another attack of chorea and in one case the mere changing from an elementary to a secondary school brought on an attack.

Another of the advantages of these special homes is that the inmates are under medical supervision so that if at any time there should be a recurrence of the rheumatic efflorescence it is immediately noted and the child can be admitted to hospital for treatment. I do not think that cases in the active stage of cardiac rheumatism should be treated in these homes, nor do I think they should be made available for advanced cases of cardiac disease in whom the chance of ever becoming useful citizens is almost nil.

Some idea of the results of treatment in these institutions is obtained from the paper by Dr. M.O. Raven (Lancet, Oct. 3rd 1925) (109). He states that in the course of three and a half years there was only one case of severe arthritis and chorea

recurred in only three cases in whom the movements had been abolished. During this period an epidemic of tonsillitis occurred and in two cases the heart appeared to suffer severely. The risk of an epidemic occurring in these homes should be borne in mind and there should be a block provided for isolation, as most of the residents will be of an age when their immunity to many infectious diseases will not have been established.

Dr. Raven's report refers to 92 cases of rheumatism and the results which he quotes, when compared with those we obtain in general practice, prove the efficacy of special institutional treatment. The average stay in the home was six months and on the examination of forty two cases who had returned to their own homes, rheumatism, chorea, or carditis was found to have recurred in fifteen.

The need of special convalescent homes applies only to those cases whose parents are not financially well off. In those in good circumstances there is no reason why cardiac rheumatism or chorea should not be treated efficiently in their own homes, but I would here add that the fond and doting mother, in such cases, is a factor to be reckoned with and it is my considered opinion that all cases,

irrespective of their social position, would do better in some form of special home. In private practice, unless one has the services of a competent nurse or the help of a sensible mother, I have found that all instructions as to rest etc. are not always carried out but when the management of the case is satisfactory the results obtained prove what can be achieved, in the treatment of rheumatic carditis, given suitable surroundings.

Pugh (Lancet Jan. 16th 1926) (7) quotes a letter from Sir A. Garrod in which he states that "An organisation which rendered it possible to give two or three months rest in bed to all children with rheumatic fever would reduce very materially the severity and frequency of what is commonly known spoken of as Heart Disease amongst the adults of the community" and with this expression of opinion I am in entire agreement.

It is advisable that each rheumatic clinic should be linked up with a convalescent home of the type described and in order that there would be continuity of treatment the physicians at the clinic should also supervise the cases in the home.

From what I have already said it will be understood that the successful treatment of the rheumatic infection in children, of the class chiefly affected, entails

- (1) Co-operation between the general practitioners, the school medical service, the staffs of the general hospitals and the local health authorities.
- (2) The establishment of special rheumatic clinics as adjuncts to the ordinary O.P. department.
- (3) The provision of special homes for rheumatic cases during convalescence.
- (4) The provision of an organisation for the following up and supervising of cases in their own homes.

The necessity for and the benefits arising from co-operation between the various bodies mentioned are obvious and need not be discussed further.

I have already attempted to discuss the value of the special rheumatic clinics and of the special homes. In some of these homes there are facilities for the education of the children being continued during their stay. Even in those centres in which no special home is available much could be done, with the facilities already present, to provide

those rheumatic children who are unable to stand the strain of attending the ordinary council schools with some education. In most urban districts there are special schools for cripples and mentally defective children and with a little re-organization many of these schools could be made suitable for the education of rheumatic children during their convalescence.

Recently in Norwich, a new open air school has been opened. The new building replaces three other schools, two for the education of tubercular children and the other for mentally defectives, which were badly situated. In the new school there will be plenty of fresh air, good food, tested milk, regular rest hours, plenty of play time and sufficient instruction to keep the childrens minds occupied, so that it should be well suited for the education of certain cases of rheumatism in children.

The provision of an organization for the following up of rheumatic cases on their discharge either from hospital or from the convalescent home to their own home is essential if the full benefits of any scheme for the treatment of this

disease are to materialise. It is well recognised how prone these cases are to relapse on their return home but if there was an efficient system of supervision much could be done to prevent the recurrence of acute attacks. The health visitors would be able to report any occurrence of ill health in the child and steps could be taken to provide treatment. In my own mind it is the occurrence of minor complaints that go untreated that so often causes a recrudescence of the complaint in these children.

The organization for supervising these children might consist of the health visitors, school nurses, the school attendance officers and members of voluntary bodies, such as the Invalid Childrens Aid Association and the Red Cross Society, who were willing to undertake the work.

The school attendance officers would co-operate with the health visitors by advising and persuading parents of the necessity of calling in a medical man in cases of illness and in cases where the provision of treatment cannot be made by the parents he could report the matter to the school medical officer.

As showing the possible value of the school attendance officer as a "health visitor", during the

smallpox outbreak in Norwich in 1928 several cases, of children absent from school, were reported by the officers as being suspected of suffering from smallpox. I personally attended one of these cases the parent, who thought the child was suffering from "waterpox", having been advised by the attendance officer to call in a medical man.

The above scheme does not take into account those cases who have advanced heart disease and are incurable. It is very difficult to know what method to advise in the care and treatment of these unfortunate children and young adults. The general hospitals are of little use to them as, even should they be admitted during an exacerbation, on their discharge they are still invalids. In some of my own cases where the child was not being looked after properly I have had it admitted to the Poor Law Infirmary where, though the surroundings are not ideal, they are at least made comfortable and are able to obtain the necessary nursing. In other cases, with the help of the Cavell Nurse (district nurse) it has been possible to make the child fairly comfortable at home, during the final stages of the disease.

Notification.

As a help in the treatment of this disease compulsory notification might be of some utility as it would enable the health authorities to get in touch with more or less all the cases of the disease, at least in the acute stages, in each area.

Owing to its varied manifestations, particularly in childhood, rheumatism is not a disease which readily lends itself to compulsory notification. In the early stages of the disease there is often, at least I have found it so in practice, a doubt as to any particular case being rheumatic. As an illustration take the case of a child with a history of sore throats and vague muscular pains. On examination there is no other evidence of rheumatism apart from the tonsils being unhealthy. Would one be justified in notifying such a case? In my opinion the answer is yes, as notification to be of the fullest utility must be early. On the other hand I quite realize, from experience in my own practice, that similar cases, at least during many years, may not develop symptoms of rheumatism such as carditis, chorea or arthritis.

In the few centres in which rheumatism in

children is compulsorily notifiable only the acute stages of the disease are covered and, from the Public Health Authorities' point of view, this is perhaps the only feasible plan as there is at present no serological or bacteriological test which can be applied to aid in the diagnosis of doubtful cases.

The question of expense entailed in making rheumatism a notifiable disease has also to be considered. I have no means of finding out what financial outlay would be incurred by the State but from the frequency of the condition I should imagine it would be considerable, as at the present time, in London alone, there are over 10,000 cases of cardiac rheumatism in children attending the Council Schools.

Compulsory notification would certainly make available records as to the extent of the disease, the season of maximum incidence and the districts in which the disease was most prevalent and possibly also the affects of climatic conditions on its occurrence.

By making the disease notifiable the Local Health Authorities would also have a more or less

complete list of all acute cases of the disease in their area and would be able to make arrangements for treatment and supervision in those cases which were unable to do so for themselves but, under present conditions, few Local Authorities have the means available for treating these cases and it would simply mean the referring of them for treatment to one of the general hospitals where the majority are already attended.

From the point of view of obtaining supervision of rheumatic cases I think that notification would be of some practical use but the same result, in children of school age, as would be achieved by notification is already obtained. The Medical Officers of Health of the various districts have already, through the school medical service, a list of the names and addresses of the great majority of rheumatic children in their area. I admit that there are some cases which would not be included, owing to absence from school when they were due for examination and if it is desirable that the Health Authorities should have information as complete as possible regarding rheumatic children then I think that compulsory notification is the only method of achieving this.

Another benefit of notification being made compulsory would be that it would enable the Health Authorities to get in touch with the parents of rheumatic children and persuade them to have the children properly treated. Many of these children require tonsillectomy but for some reason or other many parents refuse to allow their children to undergo the operation, and have great faith in the powers of a "bottle of medicine" achieving what only surgery can.

As a general practitioner, my own view is that, under present conditions, little would be gained either in treatment or prevention of the disease by making rheumatism compulsorily notifiable.

Regarding the use of drugs in the treatment of cardiac lesions resulting from the rheumatic infection, I do not think that, once the endocardium is definitely damaged, any drug will have any curative effect.

Should there be any symptoms of activity of the infection then I do think that certain drugs are decidedly useful. Of the remedies used to combat the rheumatic infection the most important is

sodium salicylate. This drug was introduced by Kolbe in 1876 and MacLagan (115) is generally credited with being the first to adopt its use in England.

When prescribing sodium salicylate certain precautions should be taken. It should be administered with double the quantity of sodium bicarbonate and it is always advisable to give an aperient before commencing treatment. It is also of importance during treatment to obtain a daily action of the bowels and, as an aperient, I prescribe calomel in these cases.

To be effective sodium salicylate must be administered in fairly large doses and for a child of ten years I prescribe grs. 10 every two hours. If this should not be effective or if the infection is severe, up to grs. 20 every two hours may be prescribed but personally I have not found the use of such a large dose necessary though Lees in cases of chorea prescribed up to 600 grs. in the twenty four hours. Some children are unable to stand even grs. 10 two hourly and the dose may require to be reduced or the exhibition of the salicylate may have to be stopped for a time. Should there be intolerance of sodium salicylate, salicin or aspirin

may successfully take its place.

Digitalis though of great utility in cardiac disease in adults is not of great assistance in children. In some cases where there is a persistent tachycardia digitalis may lower the pulse rate but, in my hands at least, any improvement in this respect has only been temporary. In the case of Jean B. who had a persistently quick pulse, tinct. digitalis had no effect in doses of m. 10 t.d.s.

If compensation should break down and oedema, cyanosis, orthopnoea, ascites and enlargement of the liver occur digitalis is then of distinct value. In combination with diuretin it may be of great assistance in removing the oedema and as in these cases there is often auricular failure its action is also beneficial.

Recently, in two cases of cardiac failure in children with marked dyspnoea, I have used ephedrine hydrochloride gr. $\frac{1}{4}$. I administered it orally and there was relief from the dyspnoea for a time. One of the children, a girl aged twelve, with pericarditis and in the terminal stages of lymphadenoma, frequently asked me for a "pill" as she always felt better after it, though the improvement was purely subjective.

I am in the habit of prescribing tinct. iodi (French Pharm) m.2 or m.3 mane ex lacte before breakfast in those cases where there are cardiac dilatation and some breathlessness on exertion but in whom there are no audible signs of endocarditis and I certainly think it does good.

Should pericarditis develop, and rest in bed does not prevent its occurrence, I think the application of blisters over the praecordium may help in relieving the distress. Small doses of pulv. ipecac. co. are also useful in these cases as it tends to allay the cardiac excitability and induces sleep. In rheumatic pericarditis I do not think that it is necessary to employ any special methods of treatment. Rest in bed is the essential and if adhesions should occur then the possibilities are that they will be on the posterior aspect and chiefly at the base.

When insomnia is troublesome I have found that chloral hydrate, either alone or in combination with potassium bromide, the most useful drug. Trional, in grs. 5 doses, also acts well as a hypnotic but in my experience is not so efficacious in cardiac cases as chloral hydrate with one of the bromides.

Since reading the article by Poynton (B.M.J. Oct. 31st 1925) (110) I have tried tolysin (Martindale). I used the grs. 5 tabloids and prescribed two six times a day but found it of no help in cardiac cases and certainly not so efficacious as sodium salicylate in arthritis.

When a stimulant is required I always administer brandy and in children, in whom the heart is affected and who develop an acute pulmonary condition such as bronchopneumonia or acute bronchitis, I firmly believe that brandy is of the greatest use in tiding them over the acute stage.

During convalescence I always prescribe an acid tonic containing tinct. nucis vom. and in several cases this mixture has been successful when the administration of iron and arsenic was showing very little improvement.

In three of the cases I have quoted, tonsillectomy was performed during the course of the illness and was followed by an obvious improvement. In two cases tonsillotomy had been done some years previously but the tonsil "stumps" were unhealthy. I am confidently of the opinion that if there is any suspicion of the tonsils being unhealthy they

should be enucleated as soon as circumstances permit. I do not think that the enucleation of unhealthy tonsils will prevent the occurrence of rheumatism, in fact I have notes of two cases where an acute arthritis followed tonsillectomy, and I have seen a similar result follow the extraction of teeth in adults, but there is little to be gained by fighting an infection if the source of the trouble is left undisturbed.

Arthritis.

During the acute stage the affected joints should be kept at rest and wrapped in cotton wool. If the pain becomes severe at night I have found that the application of antiphlogistine gives considerable relief.

Sodium salicylate is the most efficacious drug in the treatment of rheumatic arthritis. I prescribe it, as already explained, with double the dose of sodium bicarbonate. In those cases of arthritis which do not yield readily to sodium salicylate, and in my experience they are few in children, I prescribe colossal sulphur two teaspoonfuls every four hours with aspirin grs. 5 or grs. 10 and this combination has given excellent results.

In cases of rheumatic arthritis I regard sodium salicylate as almost a specific. Under its influence the joint inflammation subsides, the pain is eased and the pyrexia declines. So specific is the action of sodium salicylate regarded in rheumatic arthritis that some authorities have very grave doubts as to an arthritis being of a rheumatic nature if, within forty eight hours of the exhibition of sufficient doses, there is not a distinct improvement in the condition with reduction of the fever. As regards the quantity to be taken in the twenty four hours 60 to 120 grs. is sufficient for a child of ten years old but in some of my cases I have administered larger doses without any ill effects.

After an attack of acute arthritis massage is always beneficial and I make it a practice, where the position of the parents enables the services of a masseuse to be obtained, to commence the massage while the patient is still confined to bed. In others, if there should be stiffness in the joints, I send them to the hospital where they attend two or three times a week for treatment. If the muscles are painful radiant heat when combined with the massage is very beneficial.

Subcutaneous Nodulés.

Subcutaneous nodules call for no special treatment but as they indicate a severe infection the anti-rheumatic treatment should be very thorough and prolonged for some considerable time after all signs of activity have ceased.

Chorea.

In my experience chorea is the most unsatisfactory of all the rheumatic manifestations to treat and I know of no drug whose action may be termed specific in chorea. I have tried sodium salicylate, tolysin, bromides, iron and arsenic and on the whole, the best results have been with arsenic in the form of liquor arsenicalis. Quinine salicylate in grs. 3 doses apparently did good in one or two cases but as they had had other treatment the effects of the quinine salicylate were difficult to estimate.

In prescribing arsenic for children Still (111) recommends an initial dose, for a child of ten years, of 10 to 12 minims of the liquor arsenicalis and he continues this for four days and then reduces the dose by 2 minims every third day, the course of treatment lasting a fortnight. Personally

I have seen no advantage from this method of administering arsenic and I usually commence with a dose of 3 minims thrice daily and gradually increase the dose to 8 minims thrice daily, the maximum dose being only administered for two days when the quantity is reduced to 3 minims and maintained at this as long as required provided there are no symptoms of arsenical poisoning.

Rest in bed while the movements are at all severe is essential but when once the movements have quieted down and if there is no involvement of the heart, there is no advantage in keeping the child in bed. Freedom from undue exertion, worry and excitement is of great importance as the choreic child is naturally highly strung and of an excitable nature.

In chorea there is considerable weakness of the muscles and massage is a useful adjunct to treatment. In the local hospital there are classes in which remedial exercises are given and I have found that children derive great benefit from attendance there as the weakened muscles are strengthened and any inco-ordination disappears.

If during the course of the disease the move-

ments are so severe as to prevent sleep a combination of chloral hydrate and potassium bromide (grs. 10 and grs. 5 respectively) frequently allays the movements and allows sleep. If this dose proves ineffective I double the dose of the bromide.

When the child has recovered nourishing food, cod liver oil and malt and a change of air are decidedly beneficial but care should be taken that the surroundings are conducive to rest. A dry, bracing and sunny climate is the most suitable and locally, Lowestoft, during the summer months, is an ideal resort for rheumatic children.

Throat Manifestations.

For some years past I have treated sore throats and tonsillitis in children with the following prescription

R

Sod. sal. $\frac{30}{\text{gr}}$
Sod. bic. $\frac{30}{\text{gr}}$
Liq. ammon. arom. $\frac{30}{\text{gr}}$
Spt. aether nit. $\frac{30}{\text{gr}}$
Aq. chlorof. ad $\frac{30}{\text{gr}}$

Sig. Two teaspoonfuls 4tis hora.

and I have found it successful. If there is oedema of the uvula and the fauces, glycerin acid tannic should be used as a throat paint and a mixture containing Liq. ferri perchlor. m.5 and pot. chlor. grs. 5 per dose is frequently beneficial if the

swelling in the throat is severe.

The marked debility which often follows tonsillitis in children should be treated by fresh air, nourishing food and syr. ferri phos. co. or ferromalt. When the acute stage has subsided the child should be kept under observation for some time and if the tonsils are unhealthy or unduly enlarged enucleation should be strongly advised.

Growing Pains and Erythema.

Both these manifestations usually yield to treatment by sodium salicylate and arsenic. In one of the few cases brought to me for "growing pains" salicylates had no effect nor had collos. sulphur and aspirin. This child was seen by me in 1925 when he complained of pains in both thighs and relief was only obtained under treatment with radiant heat and massage. The after-history of this child is of interest as during 1927 he developed arthritis affecting the elbow, knee and hip on the right side. After months of treatment, both at home and in hospital, there was no improvement but ultimately the condition subsided. Owing, I suppose, to the lack of success attending my efforts to cure the condition, when the child was again taken ill one of my colleagues was called in and he informed me later

that the arthritis had recurred and was followed by endocarditis, pericarditis and death. During this child's stay in hospital a blood count was done and it was found that there was a distinct increase in the number of lymphocytes for which no explanation could be found.

Anaemia.

The anaemia and wasting which occur as a result of an attack of rheumatism are best treated with arsenic and iron and cod liver oil and malt. In some cases I have found that even under prolonged treatment with iron and arsenic there was but little improvement in the condition and in these cases I used the following prescription with some success.

R	Acid hydrochlor. dil.	℥ ⁱⁱ
	Tr. nucis vom.	ʒ ^{ss}
	Inf. gent. co.	ʒ ^{ss}
	Aq. menth. pip. ad.	ʒ ^{ss}

Sig. Two teaspoonfuls three times a day after meals.

Nourishing food of an easily digested nature should be taken and the child, weather permitting, should live as much as possible out of doors.

Having discussed the treatment of the various manifestations of rheumatism in children the question arises as to how long the treatment should

be continued. The answer to this is naturally until a cure is established but personally I have found great difficulty in being sure that any case is "cured". My own opinion is that if there is no pyrexia over a considerable period, the pulse is normal and there is a progressive increase in weight one is justified in assuming that the infection is at an end.

Bezancon and Weil (112) have demonstrated that in acute rheumatism the amount of fibrin in the blood is above normal, the normal being 10grms. per litre of plasma, and they state that the administration of sodium salicylate should be continued until the amount of fibrin is normal. Kahlmeter who has also done work on this subject is of the opinion that the sedimentation reaction is of use as a guide as to when treatment should cease.

The child who has suffered from any of the manifestations of rheumatism should always be warmly clad and the lower limbs well protected during damp weather. Their homes should be free from dampness and if possible they should live in a dry and bracing climate. Minor ailments should receive attention especially constipation or other disturbances of the gastro-intestinal tract. Exercise

must be limited to the needs of each child. In the past I think that the mere presence of a systolic murmur at the apex has caused unjustifiable restrictions to be placed on the activities of the child. If the endocarditis is limited to the mitral valve, and the myocardium has recovered, I do not think undue restriction of the child's activities is wise or necessary. I agree that the child should not indulge in strenuous sports such as racing or rowing but I see no reason why swimming or golf for instance should be prohibited provided that they are not indulged in to excess.

If the aortic valve is damaged then I do agree that great care is necessary to avoid further strain on the heart and in such cases I prohibit the participation in sports of any kind. The greatest asset is to be able to judge just what each case is able to do without incurring any risks to health.

Allied to the question of treatment is the problem of prevention but owing to the largely unknown aetiology of rheumatism its prevention is faced with many difficulties. Environment is generally regarded as having considerable influence

on the incidence of the disease so the first step in prevention should be the provision of a healthy environment for the class in which the disease is most prevalent. The question of environment is largely one of housing and any improvement in this respect is of necessity dependant on the various local authorities. In recent years considerable strides have been made in the provision of more suitable houses and under the better housing conditions the incidence of the disease in years to come will probably decline. The tonsils are generally regarded as the main portal of entry of the rheumatic infection therefore as a preventive measure I strongly recommend that all children, over the age of five years, whose tonsils are unhealthy should have them enucleated. As I have previously stated I do not think the tonsillectomy will alone prevent rheumatism but, from my own experience, I am of the opinion that they often act as a reservoir from which the rheumatic poison is fed into the general circulation. The improvement following the enucleation of tonsils in several of my cases of rheumatism has been so marked that I now, in all cases where the infection proves resis-

tant to treatment and in whom the tonsils are open to suspicion, advise tonsillectomy.

Attention to the teeth is advisable but in children I do not think that the condition of the teeth has any influence on the occurrence of rheumatism, though in adults, I am of the opinion that dental infection is a common cause of fibrositis. As an illustration I can quote my own case. For several years I suffered from lumbago. All my teeth were apparently sound and my tonsils had been removed. A tooth that had been stopped many years ago became rather troublesome and on having it x-rayed apical sepsis was detected and the tooth was extracted. There has been no recurrence of the lumbago to date.

The early detection of the disease and its efficient treatment are means of preventing the more serious results of the infection, but rheumatism in childhood is so insidious in its onset that there may be no evidence of its presence, apart from medical examination, until the disease is well established. As we have seen the disease is most prevalent between the ages of five and fifteen, that is during the school age.

By an extension of the present system of medical examination of school children it would be possible to have every child examined at fairly frequent intervals. Under the present system a child is usually examined three times during his or her school career and in my opinion this permits of much too long a period between examinations.

From my knowledge of the working class, I am of the opinion that the establishment of nursery schools, for children between the ages of 2 and 5 would be in the interests of these children's health. At present many children of three years of age attend the ordinary Council Schools but I do not think that this is satisfactory. From the mother's point of view, being able to send a child of three to school is frequently an advantage as it allows her to go out to work or, as is the case locally, to undertake certain operations in the boot and shoe industry in her own home.

For a child of three attending school there should be proper facilities, during morning school, for resting and these facilities are best obtained in the nursery schools. The children attending the nursery schools would also come under the school

medical officers and would be regularly examined. At these examinations, I am sure that many defects would be found which, though not rheumatic, tend, by lowering the child's resistance, to permit the entrance of the rheumatic virus.

The provision of nursery schools would also, by having the children under cover, prevent a certain amount of exposure. The majority of these children live in small houses and their only play-ground is the street or a back yard. This condition of affairs is being remedied as, on the new Housing Estates in Norwich, open air spaces with proper covered in shelters are being provided.

The matter of exposure of school children on their way to school might also receive attention. Some children have a considerable distance to go to school and I think that some provision for the drying of their clothes might be made by the Education Authorities. At present many of these children sit all morning in damp clothing. In another section I make the observation that one seldom comes across the fidgetty and nervous child in either private or preparatory schools. One reason for this may be that the children attending these schools are usually

of the better off class. Another may be that in most of these schools the children, on arrival have to change their shoes and, if the weather is inclement their stockings as well, and are not allowed to spend the morning sitting in damp footwear. In addition these schools usually have a regulation "dress" which includes long stockings whereas in the ordinary Council School it is quite common to see children, in the depth of winter wearing socks which offer little or no protection to the lower limbs.

After leaving school, usually at the age of fourteen, the child, in many cases, is again examined before entering employment. Many industrial firms employ a medical officer of their own and one of his duties is the examination of all persons prior to their entering into the firm's employ. This examination is of utility in preventing a girl or boy undertaking work for which they are unsuited and is also, now that many firms have their own pension and insurance schemes, a safeguard against the admission of an unhealthy person to the staff. In Norwich we have several firms who insist on their new employees being examined and on one or two occasions I have received a communication, from the medical man who did the examination, asking me to

arrange for treatment of a candidate in order that he might become eligible to enter the firm's employ. In most cases the boy did not realise that there was anything the matter with him and the defect would not have been recognised apart from medical examination.

The issue of pamphlets, such as recommended by Poynton (Researches on Rheumatism page 434) and by G.A.Allan (The Early Detection and Supervision of Rheumatic Infection in Children), to those who are in charge of children would undoubtedly be an aid in disseminating some knowledge of the rheumatic infection in children, as it is frequently the ignorance of the public as to the meaning of such symptoms as "growing pains" that permits the disease to become fully established before medical advice is sought.

In the case of rheumatic children and particularly those who had had chorea, I think that it would be an advantage if the school teacher in whose class the child is, was advised of the nature of the illness, on the child's return to school and requested to keep the child under observation. In my own practice, I have on one or two occasions,

had a child brought to me by the mother as she had been advised by the teacher that the child required medical attention. Fortunately many school teachers realize that the fidgetty, nervous, restless and frequently naughty child is probably an early case of chorea and take steps either to have the parents informed of the necessity of treatment or arrange for the child to attend the school clinic or be examined by one of the school medical officers.

The necessity for notifying the teacher is obvious when it is realized that in some of the classes in the council schools one teacher may have charge of any number of children up to forty or fifty so she cannot possibly be expected to detect the occurrence of any minor symptoms of illness in any individual child unless her attention has been drawn to the necessity of keeping him or her under particular observation.

Some Local Authorities are arranging for health lectures, by various well known authorities, to be given during the winter months. In Norwich these lectures have been very well attended, to date, by the general public. From the point of view of this thesis and the question of prophylaxis the lecture on rheumatism by Poynton is of the most interest.

After the lecturer has finished the audience is allowed to ask questions and I was surprised at the amount of interest taken and the intelligent and searching questions asked by lay people. These lectures are bound to disseminate knowledge and I am sure that it is only ignorance on the part of the public that has allowed, for example, "growing pains" in children to be treated as something quite natural and more or less inevitable and of no consequence to the child's health.

In conclusion I would add that the problem of the prevention and treatment of the rheumatic infection in children is one of considerable magnitude and to be successfully solved must not be attacked in any half-hearted manner. Co-operation, between the school medical officers, whose work entails the examination of large numbers of children with the possibility of the early detection of manifestations of the disease, the general practitioner, who, in the great majority of cases, is the first to be consulted when illness occurs, the staffs of the general hospitals who frequently have the treatment of the disease in the active stages, the public authorities whose duty it is to super-

vide housing etc. and whose duty it will be to provide the necessary institutions for the proper care of rheumatic cases during convalescence (or treatment), and lastly but by no means least the parents or guardians of the children affected, is essential if any permanent success is to be obtained.

Even with the necessary co-operation it will be years before results are obtained but, when one realizes the crippling effects of this disease on the life of the nation, great expenditure of time, effort and money will be justified by the gain to future generations.

Clinical Cases.

Muriel D. aet. $6\frac{1}{2}$ was first seen by me in December 1927. She then complained of pain in the muscles of the neck. Under sodium salicylate the condition quickly cleared up. A few months later, April 1928, the mother again brought the child to me because she was very fidgetty and restless.

There is no history of rheumatism in either of the parents but the mother is rather excitable. The only illnesses of note were chicken-pox and in 1927 scarlet fever.

On examination the child was found to be rather restless, irritable and complained of headache, frontal in character. There were no definite choreic movements. Heart and lungs were normal. Under sodium salicylate and ferri et ammon. cit. the general condition of the child improved and when last seen 10-12-28 she was in excellent health.

Beryl S. aet. 6, was brought to me for examination as she was off her food, restless, woke frightened at night, talked in her sleep, and as her mother said "was never at peace and could not even sit still". There was no history of rheumatism in the child but I had attended her father for rheu-

matism and the mother is of rather an excitable nature.

On examination she was found to be anaemic and of rather poor physique. Heart and lungs were normal. She was put on sod. salicylate on 17-11-28, having had ferri phos. co. for two months with no improvement in the restlessness and irritability. Within three weeks of the exhibition of the salicylate all restlessness had gone though she still had occasional night terrors for which chloral and bromide were prescribed successfully.

Leslie Fox, aet 13, was seen by me in February 1927. During the examination this boy was never still. He stood first on one foot then the other, his hands played about with the buttons on his coat and when being questioned he gazed all round the room and seemed unable to concentrate. There were no definite choreic movements. He was slightly anaemic, and the mother informed me that he frequently walked in his sleep.

There was no history of growing pains, sore throats or rheumatism but some years ago I attended his sister for chorea. Neither parent has suffered from rheumatism but the mother and the grandfather

are very nervous and highly strung. Pot. brom. was prescribed at night and the somnambulism practically ceased. At the time I did not recognise the rheumatic nature of the condition.

In October, 1928 I again saw this boy when all the symptoms had returned. He, though he had done quite well at school, had lost all confidence and would not attempt to do his home work unless his sister helped him. Under sod. salicylate and ferri et ammon. cit he quickly improved and when I last saw his mother she gave a good account of him and stated that he had received a good report from school.

The above three cases illustrate a type of case which is not uncommonly met with in practice. The cause of the fidgetiness, irritability, somnambulism and night terrors is frequently rheumatism and is usually successfully treated by the administration of sodium salicylate.

These children are usually of slight physique rather excitable and tend to be anaemic and recently I have treated them all with the following prescription.

R

Liq. arsenicalis m. 2.
Ferri et ammon.cit. grs. 5.
Sod. salicyl. grs. 15.
Inf. quassiae ad ℥j.

Sig. one tablespoonful three times a day.

As a cause of this nervous instability I attach some importance to the present day methods of education. These children usually attend the ordinary council schools where there is a strict routine and frequently over-crowding in the class rooms. I have been impressed by the frequency with which I have been told by mothers that the child is worried over lessons and in not a few cases the child has admitted that he or she is afraid of one of the teachers. In my experience the condition is rarely seen in children who attend private schools.

Possibly another explanation is the rigid enforcement of attendance, to obtain the necessary government grant, so that mothers, to avoid the unwelcome attention of the school attendance officer, send their children to school when they are suffering from colds, slight sore throats and other minor ailments. These minor ailments though not serious in themselves may, by lowering the resistance of the

tissues, permit of the rheumatic infection gaining a hold.

Another point of interest is that very frequently one or other of the parents is of a nervous and highly strung temperament. In the case of Leslie F. I attend several of his relatives. His mother is the eldest of thirteen children and in her childhood had a great deal of responsibility as her mother was in an asylum for some time and ultimately died there. Two aunts of this boy are at present in an asylum and one uncle suffers from epilepsy. His cousins, those whom I know, are all of the same type, rather emotional and excitable but well above the average in ability as judged by results at school. I have attended three of them for chorea and all in different families.

This state of fidgetiness is frequently the fore runner of well marked chorea and I will quote two cases as illustrations.

Ethel R. aet 8, seen by me in January 1921. She was fidgetty and had not been sleeping well and was brought to me for examination on the advice of her school mistress. She had been under my care for three weeks when I was called to see her late one evening, the message stating that she was in a

fit. On examination there was found to be marked twitching and spastic movements of the left arm and leg.

The story I was given was that her father had beaten her mother in her presence and that she had been greatly frightened and finally started to twitch on the left side. Under treatment with liq. arsenicalis the condition rapidly improved. This child has had chorea in 1921, 1922 and again in 1924. When in hospital in 1922 tonsillectomy was performed and was followed by an immediate improvement in the chorea. When last examined she had mitral stenosis but no definite cardiac enlargement.

Katie C. aet. 10, had been under my care as she had been "out of sorts" was anaemic, irritable, complained of frequent headaches and was rather restless and nervous. In the usual way she was a bright child whom I had known for some time and the change in her temperament was most marked. There was no history of rheumatism and there was no evidence of definite chorea until she received a fright caused by the ceiling in her bedroom falling during the night. This accident upset her and within two

days there was definite chorea. I treated her with phenazone grs. 10 t.d.s. and rest in bed and the condition responded to treatment. This child, on returning to school was knocked down and killed by a car.

The above two cases illustrate that there is often a period when the child complains of headache and is languid and irritable before the onset of chorea. In both cases a fright was the exciting cause and no doubt the occurrence of similar cases, where the pre-choreic state has been undetected, accounts for the theory that fright is a cause of chorea.

As I have previously remarked chorea is probably the most unsatisfactory of all the rheumatic manifestations to treat. The movements, in spite of all treatment may continue for long periods. Unless there is a definite history of rheumatism or there are signs of rheumatism present I do not think that sodium salicylate gives the best results, even when administered in large doses.

I have obtained good results from phenazone in grs. 10 doses but I have not treated sufficient cases by this drug to give a definite opinion on its value. Under this drug, the few cases in which I have tried it, showed rapid improvement as regards the movements and they looked better and put on weight.

I have also prescribed luminal gr. $\frac{1}{4}$ daily, in some cases of chorea, in combination with arsenic and I think that the addition of the luminal to the treatment has benefited the movements. Chloretone I have also found of benefit in these cases in which chloral and bromide has not helped the restlessness at night. I usually prescribe grs. 1 to 3 for a child of twelve years and in one case which had been very resistant to treatment improvement commenced immediately following the exhibition of chloretone.

That some cases of chorea do very well without treatment by drugs is shown by the following case.

Gladys C. aet. 16, first had chorea when 14. On leaving school she attended a school for the training of typists and did quite well. On completing her training she obtained a post in a very busy office and under the strain chorea again developed. She was put to bed and as there was no history or symptoms of rheumatism and as massage was available in her own home, her sister is a trained masseuse, treatment was commenced at once. Under one week's treatment with rest, massage and

exercises the inco-ordination was greatly improved and the movements were markedly less. She was allowed up and an iron and arsenic tonic was prescribed. The improvement was maintained and she returned to business at the end of a month. There was no evidence of cardiac involvement.

Arthur F. J. aet. 14, I have no notes of when I first attended this boy but I had examined him on some occasion and knew that he was suffering from valvular heart disease. On 10-9-28 I was called to see him as his mother thought that he was suffering from "sleepy sickness" (there had been a case in the same street). On examination he was found to be rather drowsy temperature 102° and pulse 110. There was facial paralysis and paresis of the left arm and leg. There was a systolic murmur audible at the apex and a diastolic blow at the aortic area. Heart slightly enlarged.

On 14-9-28 he was admitted to hospital and under electrical treatment and massage the facial paralysis cleared up and he was discharged on 13-10-28 and told to attend the O.P. department. When last examined by me there were enlargement of the heart, advanced diastolic, presystolic and

systolic murmurs at the apex, a diastolic murmur at the aortic, left fingers showed early clubbing and the spleen was palpable.

In children and young adults one of the most frequent causes of hemiplegia is cerebral embolism. In these cases there is almost always an endocarditis and the embolus may either come from the valves or from a thrombus in the auricle.

As showing the hopelessness of attempting to treat these cases in their own homes I ordered this boy to have rest in bed and explained that work was out of the question. The same evening his father and mother called to see me and I had great difficulty in making them realize that the boy was really an invalid, the father persisting in saying that the boy said he felt well and fit for work and that there was no need for bed when one felt well.

Megan J. aet. 9, has been attended by me since infancy. She has had chicken-pox, whooping cough, bronchitis and measles. There is no history of parental rheumatism but the father is a rather excitable Welshman.

From the age of 4 this child has suffered from

attacks of vomiting which came on at fairly frequent intervals. During the attack the tongue is coated and she complains of headache and pain in the epigastrium though on examination no tenderness could be detected. Various remedies were tried but the attacks continued.

Whilst on holiday in London last year she had a severe attack and the doctor who was called in referred her to one of the Childrens Hospitals for investigation. The physician under whose care she was wrote me and suggested that the attacks were probably a manifestation of rheumatism and advised the following prescription

R	Sod. sal. nat.	grs. \overline{XV}
	Sodii bicarb	grs. \overline{XX}
	Tr. gelsemii	m. \overline{iii}
	Tr. cimseifugae	m. \overline{X}
	Aq. carui ad	$\overline{3j}$

Sig. } \overline{p} t.i.d. \overline{pc} ex aq.

In his letter he also pointed out that the tonsils, though not large were unhealthy and that there was a history of vague muscular pains in the legs (? growing pains). She has since had her tonsils removed and a prolonged course of the mixture and during the last nine months, the mother informs

me, has had only one slight attack of vomiting.

Another child, Lily R. also suffered from recurrent attacks of vomiting for which I was unable to find any satisfactory explanation. She is of poor physique and her mother stated that she had always been "rather delicate". I put her on the same mixture with equally good results. This year she developed chorea and was in hospital for six weeks where tonsillectomy was done. When last examined she had mitral incompetence but the attacks of vomiting had ceased for some time.

These two cases and the case of Jean Bell already quoted illustrate one of the rheumatic manifestations which occur in children. The attacks of vomiting, which the mother often puts down to biliousness, recur at fairly frequent intervals. Usually no cause can be found for these attacks but occasionally there is a history of a "cold in the head" or of the child having had a "chill". The attacks are sometimes accompanied by fever, the tongue is coated and the child complains of feeling tired and "headachy".

A history of growing pains, recurrent sore throats, of parental rheumatism or of rheumatism

in a brother or sister helps one in making a diagnosis but, in many cases, I am sure I have overlooked the rheumatic element in the case and it is only in the light of subsequent events that I have realized the true state of affairs.

That vomiting, dizziness and headache may be a mode of onset of rheumatism is shown by the following case.

Edith G. aet. 14, was taken ill in February 1923. There was a history of "St. Vitus Dance" at the age of 7. No history of sore throats or of rheumatism in the parents was obtained. Fourteen days prior to the onset of acute arthritis she had been taken ill with dizziness and sickness at school and had to be taken home. She had not felt well since and had complained of headache, frontal in character, and of rather a severe nature. When seen by me temperature was 99.6, tonsils were red but not big, fauces were injected and there was some adenitis in the neck. The left wrist was swollen and the right ankle was painful on movement. She was admitted to hospital on 24-2-23 and tonsillectomy was performed on 2-3-23 after which there was a rise of temperature lasting several

days. On admission to hospital there was a systolic bruit at the apex but no definite cardiac enlargement. On her discharge from hospital I examined her and I was unable to detect any cardiac enlargement or any evidence of endocarditis.

In this case, the mother took no notice of the attack of vomiting and until the child complained of the pain in the wrist and ankle, had attributed her illness to biliousness and being "run down".

Jemima R. aet 18, was first attended by me in 1919 when she complained of stiff neck. I am afraid that I did not then realize the significance of this complaint in children and treated the case rather lightly as it cleared up quickly. For some time I did not see the child but I have since attended her for sore throats, (tonsillectomy refused) appendicitis, for which she was operated upon in 1924 and finally for acute arthritis in 1926, when she was 16 years old. I have recently attended this girl, who now has mitral stenosis, and on thinking over the sequence of events I feel rather guilty at not having recognised the significance of the stiff neck and sore throats earlier and of having failed to prescribe thorough

anti-rheumatic treatment.

The occurrence of pain and stiffness in the muscles of the neck in children is usually a symptom of rheumatism and should be treated as such. As a rule the administration of a diaphoretic containing sod. salicylate and the application of heat quickly clears up the condition, but it is important that the rheumatic nature of the complaint should be recognised and the parents warned to look after the child especially as regards sore throats, chills, constipation and other minor ailments. From my own experience of these cases I do not think that rest in bed is necessary but I do think that the child should be kept under supervision and the development of any signs of activity of the rheumatic infection should be promptly dealt with.

In children attending school, especially about the age of 8 to 10 years, there is sometimes recurrent attacks of headache. If the eyes have been attended to and any error of refraction corrected, and the headaches still persist I always suspect the presence of rheumatism. When sodium salicylate is prescribed for these cases there is frequently an immediate improvement. In addition to the headaches these children often suffer from conjunctivitis and blepharitis of a rather chronic nature, are

anaemic and usually under weight. As an illustration I will quote the case of Kathleen L. aet. 9, I confined the mother with this child in 1919. The mother was then a primipara, labour was prolonged & terminated with forceps. The child has never been robust and has always tended to be anaemic. During the last few years she has constantly complained of headaches and has had several attacks of conjunctivitis. Vision is quite normal.

As the mother suspected that the cause of the headaches was the instrumental delivery and was anxious to have the child examined in hospital I referred her to a neurologist. He reported that he could find no cause for the headaches in the nervous system but that the child appeared languid, nervous and rather difficult to manage. He suggested that the anaemia should be treated and that as her general condition improved no doubt the headaches would disappear. I may add that she had frequent courses of ferri. phos. co. prior to this without much improvement.

The child's condition remained in much the same state until May 1928 when she complained of pain in the right elbow. The joint was not swollen

but seemed tender on movement. She was put on sod. sal. and since then there has been a great improvement in her general condition. The eyes are better and most noticeable of all is that she is no longer the irritable, languid child she was. The mother has even remarked that her temper is not so trying as it was.

This child showed none of the usual manifestations of rheumatism and until the onset of pain in the elbow I had not considered rheumatism as a possible cause of her condition.

In the section on clinical manifestations I have quoted the case of Kenneth S. whose rheumatism commenced with an injury to one of the small joints. I have notes of two other cases in which the disease followed an injury.

Kenneth W. aet. 9, a red haired boy with good colour and clear complexion, was playing with fireworks in November 1927. Having lit a "rocket" he rushed backwards and sprained his ankle. He had had his tonsils enucleated when six years old. Early in 1927 he had had mild chorea. His sister aet. 6, had also had pains in several of the joints following an attack of tonsillitis.

This boy was seen by me on November 9th when temperature was 100.2 pulse 108. The ankle joint was swollen and tender. There was considerable discolouration of the skin round the joint. The tongue was coated and he had vomited twice during night previous to my seeing him. He also complained of pain in the knees and in the shoulder. Heart was not enlarged and I did not detect any bruits. Under colossal sulphur and aspirin the arthritis rapidly subsided and apart from tachycardia I was unable to detect any sign of disease. He remained in bed for six weeks when he was allowed up and he has remained well to date.

The other case occurred in a boy, Percy R. aet. 15, who, when attempting to crank up his father's car, had injured his right wrist. When seen by me on 13-8-27 wrist was swollen and painful with bruising and discolouration round the joint. Wrist was x-rayed but there was no fracture. Lot. plumbi cum opio was applied and the arm put up in a sling. I was called to see him on 20-8-27 when he had a typical attack of rheumatic fever, the arthritis having commenced in the injured joint.

The tonsils were septic, visible pus could

be expressed from the supra tonsillar fossa on the right side, but tonsillectomy was refused. The heart was dilated and there was a systolic bruit audible at the apex. He remained six weeks in bed when the cardiac enlargement had disappeared but the systolic bruit persisted. He went to the Convalescent Home for three weeks where the administration of sodium salicylate was continued.

He is now employed as a market gardener and I examined him during 1928 and there is definite mitral incompetence. He states he feels well and he is putting on weight. There is no shortness of breath unless on severe exertion.

In the case of Kenneth W. it was known that he was a rheumatic subject and the injury apparently allowed the causative organism to begin its attack. In the other case there was no history of rheumatism but the tonsils were septic and no doubt provided the focus from which the organism launched its attack.

In the above two cases the amount of discolouration and bruising was more than one would have expected from the nature of the injuries. I have frequently observed that the skin of rheumatic

children appears to be rather tender and bruises rather easily.

The rheumatic child is also, in my experience, more liable to suffer from chilblains than other children and, in the rheumatic children, calcium lactate does not give the good results so often obtained in treating this condition. I have found no benefit from treating chilblains with sodium salicylate. On the ^{other} hand liq. arsenicalis when combined with iron has proved beneficial in some of these cases whereas in adults suffering from chilblains these drugs have, in my hands had little or no effect.

Another point that I have observed in connection with rheumatic children is that the skin is not so resistant to infection as in the normal child. A small abrasion in the rheumatic child may cause considerable trouble and if ulceration should occur there is frequently difficulty in obtaining healing.

In an earlier part of this thesis I have quoted the good results which frequently follow tonsillectomy and I will now quote cases which the beneficial results derived from the enucleation of

diseased tonsils during the active stage of the disease.

Gilbert S. aet. 14, had rheumatic fever in 1924 and was 11 weeks in bed. His tonsils had been "cut" in 1915 but he had had sore throats on and off since.

During August 1924 the wrist and elbow joints of left arm were swollen and arthritis in right knee and ankle followed. The right tonsil was rather large and the left was small and red. The left border of cardiac dulness was in the nipple line, apex beat in 5th space, and there was a loud systolic murmur at the apex. He was admitted to hospital on 11-8-24 and the tonsils were enucleated and within three days from the date of the operation all swelling and pain had gone from the joints though he had been on sodium salicylate, with little improvement up to the date of the operation.

Ivy Shreeve aet. 13, was attended by me during September 1924 for rheumatic fever. Under treatment with sodium salicylate, two drs. in the twenty four hours, there was little improvement as the arthritis kept relapsing. The tonsils were large and red. The heart was dilated and during examination there was considerable dyspnoea. A systolic murmur, con-

ducted to the axilla, was audible at the apex. She was admitted to hospital where tonsillectomy was done and she was discharged at the end of a fortnight, with no signs of arthritis. This girl is now employed as a chocolate maker. She looks well, is stout and has good colour but the mitral systolic murmur is still audible and I think that there is possibly some cardiac enlargement as well.

Kate K. aet. 14, boot operative, after a party at Xmas 1925 suddenly developed chorea. At first the movements involved only the right arm and hand but later the legs and face were affected. The tonsils were enlarged and looked rather ragged. As the condition did not improve under treatment at home she was admitted to hospital where the tonsils were removed. Ten days after admission she was discharged free from movements. There was no cardiac involvement in this case.

The above cases, with those already quoted in the section on clinical manifestations, serve to illustrate the immediate improvement which may follow tonsillectomy in chorea and acute arthritis which had been resistant to treatment by drugs. If as Carey Coombs claims the tonsils are the main portal of entry of the infection and they are

obviously unhealthy then it is quite rational to have them enucleated as a curative measure.

That tonsillectomy does not prevent the occurrence of rheumatism is well known and I have notes of cases that had tonsillectomy in early childhood yet developed rheumatism. The fact that some children who had their tonsils removed in early childhood, later developed rheumatism is no argument against the enucleation of tonsils during the early active stage of the disease. The mere fact of tonsillectomy having been considered necessary at an early age suggests that they were already unhealthy and as Poynton has pointed out that the causative organism may lie dormant, for long periods, in the tissues, it is possible that the infective agent gained access to the tissues while the tonsils were still in situ, and remained inactive until some factor lowered the tissues resistance and allowed an attack of rheumatism to develop.

In the section on treatment I mention the absolute necessity of prolonged rest. Under the usual system of treatment, admission to hospital during the acute stage and then discharge to either their own home or one of the ordinary convalescent homes, many cases do badly. The following cases,

whose histories I have been able to follow for several years, illustrate what not infrequently happens.

Eric J. aet. 16, had rheumatic fever in 1922 when he was admitted to hospital and discharged with mitral incompetence. In January 1923 he developed chorea and was again admitted to hospital. In November 1925 he was in hospital with rheumatic fever and on his discharge my notes were as follows. Boy looks pale and anaemic. Heart, pulsation all over the praecordium, thrill at apex, apex beat diffuse and slapping 6th space, area of cardiac dulness 3rd rib above, 1 inch outside nipple line to left, no dulness to right of sternum, loud pre-systolic and systolic murmurs at apex, liver was not enlarged and there was no oedema of legs. A blood culture was sterile in hospital. From 1925 to 1928 he attended a school for cripple children and during the summer was an attendant at a bowling green. In December 1928 I was called to see him as he had had an attack of vomiting. There was then cardiac dulness to right of sternum and the left border was in the anterior axillary line. The heart's action was rapid and irregular and there was a suspicion of a diastolic murmur at the aortic

area. He suffered from dyspnoea and cough on slight exertion, such as moving about in bed. There was no enlargement of the liver or oedema of the legs. In January 1929 he was again admitted to hospital.

Violet G. aet. 18, first had rheumatism at the age of 12, when she was in hospital for 16 weeks. During 1924 she was taken ill in the "Pictures" being unable to move and had to be carried out and taken home. When seen by me she was suffering from vomiting and general malaise temperature 101 and later arthritis developed and she was again admitted to hospital. On her discharge there was a mitral valve lesion. In 1925 she was in hospital with rheumatism and had tonsillectomy. On her discharge this time there were mitral incompetence and stenosis. During 1928, owing to change of occupation the heart broke down and there were oedema of legs, shortness of breath and cough. She refused to go into hospital. She is now more or less of an invalid and only able to do very light work at home.

Jonathan M. had chorea when 8 years old when he was treated in the childrens hospital. He was an in-patient for 2 months and was discharged cured.

Two years later he had rheumatic fever and was discharged with a "diseased heart". He was first attended by me in 1919. There were then mitral incompetence and stenosis. In January 1920 he had another attack of arthritis and I noted the presence of aortic incompetence. Heart was considerably dilated. In spite of rest in bed the cardiac dilatation did not decrease. After 3 months in bed he was allowed up and went about for 2 years when oedema of ankles developed. He was again ordered to remain in bed but the liver became enlarged and the spleen was palpable. Under diuretin and digitalis he began to improve but during a fit of coughing he suddenly collapsed and died.

Jack K. when 7 years old had a severe attack of tonsillitis which, according to his mother, left him delicate. He was in the childrens hospital several times for heart trouble before 1924, when he was first attended by me. He had then a double mitral murmur, and some cardiac enlargement. In 1925 he was in hospital as oedema of the legs, cyanosis and cough had developed. He was discharged but a few weeks later was admitted with pericarditis and remained in hospital for 9 weeks.

He remained fairly well for a year when the oedema again recurred and he was again in hospital.

During 1928 ascites, oedema of the legs and enlargement of the liver occurred. The heart was now greatly dilated and there was marked aortic regurgitation. As his people were unable to look after him at home he was admitted to the Infirmary where he died a week after admission.

If we had in Norwich a special convalescent home where these cases could be admitted, on their discharge from hospital, I feel sure that much of the cardiac damage could be prevented. With the exception of Eric J. the homes of these cases were not good, with the result that further rheumatic infection occurred necessitating their readmission to hospital again and again. On each admission the heart was found to be further damaged. It is the attendance on these cases that makes one realize the urgent necessity of providing means for proper convalescent treatment. Some of my cases have been sent to the Lowestoft Convalescent Home on their discharge from hospital but as the period they spend there is usually about 14 to 21 days the benefit they derive is of very short duration. In any case the

ordinary convalescent home which may be quite suitable for a child convalescent from pneumonia or appendicitis is quite unsuited for rheumatic children.

Kathleen S. aet. 12, had chorea in 1925 and under treatment with liq. arsenicalis and sod. sal. she made a good recovery. She was seen by me in February 1926 when the right knee was swollen but not very painful except on walking. I may add that on the advice of the school medical officer the tonsils had been removed during 1925.

The heart's condition was as follows in February 1926. Apex beat was in the 4th space 1 inch outside the nipple line. There was a presystolic thrill at apex and presystolic and systolic murmurs were audible at the apex. She was admitted to hospital and I was surprised to hear that the knee had been x-rayed and that the diagnosis was Schlatter's Disease. She was discharged from the hospital in March but did not make much progress, the knee condition remaining stationary. In May she had several attacks of vomiting and epistaxis and was readmitted to hospital in June. Before admission the spleen was just palpable.

This case illustrates the advisability of having

an x-ray taken of any joint condition which is resistant to treatment. In this case the occurrence of chorea the previous year and the definite endocarditis made me have no doubt as to the knee condition being rheumatic, but the x-ray proved that the knee condition was in no way related to the rheumatic infection from which the child was suffering. This child's family has removed so I have been unable to obtain any information as to her present condition.

In the section on treatment I state that my best results have been obtained with sodium salicylate or with colossal sulphur and aspirin. Poynton has recommended the use of Tolysin and I have tried this drug in a few cases. I have not found it to be so effective as sodium salicylate and its price, 21/- per 100 tabloids is against using it freely as the financial status of the vast majority of cases suffering from rheumatism is not such as to be able to afford an expensive drug.

Though, in those children in whom I prescribed it, I was disappointed with the results obtained from Tolysin it has been successful in two cases of sciatica in adults. Both cases had been treated

in the private block of the hospital, with radiant heat and massage with little improvement. On their discharge, I prescribed tolysin 2 tabloids three times a day and in both there was an immediate improvement, the ankle jerk, which had been absent in one case, returning and the pain being much less severe. In over fifty per cent of the children and young adults, whom I treated with tolysin, sickness was troublesome and that the drug was the cause was proved by the sickness ceasing as soon as it was discontinued.

Marjory G. aet. 8, a child of slight build and of a rather nervous disposition was brought to me in June 1928 by her mother as she had been suffering from attacks of sickness for two weeks. There was a history of growing pains and the tonsils were large but not inflamed. I had attended her father for rheumatism which he stated first started during the war. The child's heart and lungs were normal. The tongue was slightly coated. There was no pain in the epigastrium but on deep pressure in the right iliac fossa there was tenderness. Temperature and pulse were normal. Constipation was troublesome at times. She was given a rhubarb and soda mixture but there

was no improvement in her condition. On seeing her again the mother happened to mention that she was not sleeping well and that she was becoming very restless and fidgety. This was not noticeable during the examination. Recognising from her history and the history of rheumatism in the father the possible rheumatic nature of the trouble I prescribed sodium salicylate and calomel as a purgative when required. The salicylate was continued for one month and the sickness ceased and the tenderness in the right iliac fossa disappeared. Recently, in January 1929, the pain in the right iliac fossa has returned and she is at present on sodium salicylate.

Poynton, by inoculation of the diplococcus in rabbits, produced an inflammation of the appendix. Considering the histology of the appendix there is no reason why it should escape the effects of the rheumatic infection but that this organ is rarely affected by rheumatism is shown by the results of my investigating the cases of rheumatism in children admitted into the Norfolk Hospital since 1919. In no single case was there any mention of there being any involvement of the appendix. In the case of children admitted to hospital for appendicitis there

was, in a few cases, a history of some rheumatic manifestation but no evidence to show that rheumatic children are more prone to appendicitis than other children.

In adults I have frequently utilised the period of waiting for admission to hospital for the removal of a "chronic appendix" by giving a course of anti-rheumatic treatment but in no single case have I been able to cause such an improvement as to make the operation unnecessary.

Though the records of the Norfolk and Norwich Hospital show that appendicitis rarely occurs in children admitted with rheumatism, I have seen several cases in practice which, though not suffering from a definite attack of appendicitis, have complained of discomfort in the right iliac fossa. Since I have become interested in the rheumatic infection in children, I have made enquiries, rather more searching than usual, into these childrens histories and I have occasionally found a history of parental rheumatism or of some of the rheumatic manifestations, such as sore throats or growing pains, in the child. Some of these cases which I treated simply as gastro-intestinal disturbances

have, by the development later of arthritis or chorea with or without endocarditis, proved to be cases of rheumatism.

The exhibition of sodium salicylate in this type of case is not always followed by improvement in the condition and on the whole I have obtained the best results from a mixture containing sod. bicarb. salol and bismuth salicylate.

Kate G. aet. 19, was seen by me in July 1927. I had previously attended her for sore throats and there was a history of vague muscular pains in the limbs. Both parents suffer from rheumatism and the father has had definite rheumatic fever for which he was admitted to hospital.

When examined by me in July this girl only complained of swelling and some discomfort in the abdomen. Tongue was coated and she was rather anaemic. On examining the abdomen it was found to be distended and contained free fluid. There was no rigidity, no enlargement of the liver or spleen and no masses were felt. There was dulness at both bases of the lungs, and vocal fremitus and vocal resonance were diminished. In the heart I was unable to detect any abnormality.

She was admitted to hospital on 29-7-27 where 8½ pints of fluid were withdrawn from the abdominal cavity. On pathological examination of this fluid a streptococcus, resembling in type the diplo-streptococcus, was found. The fluid from the pleura was sterile.

On discharge I received a note from the house physician giving me a resume of the treatment. In addition to the paracentesis 20 m. of T.A.B. vaccine containing 30,000,000 organisms had been injected resulting in a reaction with temperature 105 in the evening. Sodium salicylate in 20 grs. doses had also been given with the result that on 15-8-27 there was no fluid in the abdomen or the chest, and she was able to be discharged to her own home on 15-8-27. The diagnosis made in hospital was polyserositis.

From the history of rheumatism, in the above case, in both the parents and from the history of sore throats and "Cramp" in the girl herself I have come to the conclusion that the polyserositis was of a rheumatic nature. In support of this we have the presence of a streptococcus demonstrated in the abdominal fluid and the fact of the improvement of the condition under treatment with salicylate.

That rheumatism can be a cause of pleurisy is admitted and if one serous membrane can be affected by the disease there is no reason why, on occasion, other serous membranes should not be attacked.

Nellie S. aet. 15, a boot operative, was taken ill with pain and swelling in both knees. When seen by me there were pain and tenderness in both knees and ankles. Tongue was coated and the temperature was 101 and the pulse rate was increased. She also complained of headache of several weeks duration and stated that the knees had been painful for some time but that she had been able to go to work until the day previous.

The heart was dilated and there was re-duplication of the second sound at the apex but no bruits were audible.

As usual I prescribed sodium salicylate and sod. bicarb in double the quantity of the salicylate. Owing to vomiting she was unable to continue with this treatment as even small doses of the salicylate upset her. As I had heard good reports of diplosal in such cases I determined to try it. From the 7th day of her illness she was put on diplosal grs 15, 4 times daily and the

result was entirely satisfactory.

With rest in bed for six weeks and no other treatment apart from the diplosal she made a good recovery and when she was last examined by me I was unable to detect any sign of cardiac mischief. As I had a quantity of the diplosal tablets left I treated a case of acute arthritis in an adult with them and had equally satisfactory results. Recently I have had difficulty in obtaining the drug owing to, so I am informed, some difficulty with the Customs Authorities, as the preparation I used was of German manufacture.

In those cases, who are intolerant of sodium salicylate, the employment of diplosal is an advantage as it does not appear to cause any gastric disturbance. It is obtainable in grs. $7\frac{1}{2}$ tablets packed in tubes containing 20 tablets each.

In the treatment of rheumatism in children, where there is persistent pyrexia, I am of the opinion that liq. hydrarg. perchlor. may be of value when prescribed in addition to the sodium salicylate and I have tried it in two cases in which I found the administration of the liq. hydrarg. perchlor. of value.

George M. aet. 7, was attended by me during January of this year (1929) for arthritis of the left knee. The arthritis was of a mild degree and the left knee was the only joint involved. There was tachycardia and possibly some cardiac dilatation. The temperature ranged from 99 to 100 or occasionally a point or two above this, but never exceeded 101. Under sod. sal. the arthritis quickly cleared up but the pyrexia persisted until liq. hydrarg. perchlor. was prescribed in small doses (m. 2½).

The other case in which the pyrexia persisted was Joyce C (whose case I have already quoted) during her second attack of arthritis. Here the arthritis was rather resistant to treatment and the pyrexia remained after all signs of active infection had gone, in spite of the continued administration of sodium salicylate. On the third day after I added liq. hydrarg. perchlor. the temperature was normal and remained normal and her condition steadily improved.

In neither of the above two cases was I able to find any cause for the pyrexia apart from the rheumatic infection. In the case of George M. it is of interest to note that on his return to school after

the Easter holidays, he developed chorea and was referred to me for treatment by one of the school medical officers and is at present under my care. In his case, as I have so frequently noted, the return to school was the signal for the development of some manifestation of the rheumatic infection.

I admit that my experience of the utility of liq. hydrarg. perchlor. in cases of rheumatism in children with prolonged pyrexia is limited to two cases but I think that, certainly in the case of Joyce C., the result can be ascribed to the perchloride. In her case I went off on holiday leaving her in bed and running a temperature and my locum during my absence had prescribed various drugs without any improvement. On my return she was still in bed and the pyrexia persisted until, as quoted above, she was put on small doses of liq. hydrarg. perchlor. in addition to the sodium salicylate.

Summary of Clinical Cases.

Carditis Of the thirty seven cases quoted the heart was involved, to a greater or less degree, in twenty two. Four of these have died, death being due to the cardiac condition and in six the heart has completely recovered.

Chorea In the series there is a history of chorea, either alone or in addition to some other rheumatic manifestation, in twelve. Under chorea I have not included the three cases suffering from restlessness, irritability, fidgetiness etc. though in my opinion these symptoms represent a pre-choreic state.

Nodules These were detected in only three cases of whom one has died and one has a permanently damaged heart (mitral stenosis).

Arthritis There was a definite history of arthritis in seventeen of the cases and in only one case can I definitely state that there was no cardiac involvement. In the case of Kathleen L. who had pain in the elbow joint I am doubtful if it was a true arthritis.

Hemiplegia This occurred in two cases, Arthur J. and Eric J. the latter developing a hemiplegia soon after his discharge from hospital in February 1929.

Sore Throats In two cases the occurrence of sore throat was apparently the only manifestation of rheumatism prior to the onset of carditis. In many other cases a history of sore throats was obtained.

Gastric and Abdominal Symptoms In ten cases there were definite gastric or abdominal symptoms. In several cases an attack of vomiting occurred at the onset of a fresh attack of rheumatism.

Pleurisy Occurred in two cases and in one of them there was effusion.

Oedema This was a marked feature in only two cases, both cases died.

Conclusions.

- (1) The problem of acute rheumatism must now be tackled by educating the public, especially the teachers in the Elementary Schools, in its importance.
- (2) The education of the public in matters of health should be undertaken by the Local Authorities who should arrange popular "Health Lectures".
- (3) The parents of the rheumatic child should have impressed upon them the necessity of having minor ailments properly treated and of the danger to the rheumatic child of fatigue and exposure.
- (4) The establishment of nursery schools in densely populated areas would be an advantage.
- (5) School children should be examined at more frequent intervals than at present.
- (6) The occurrence in childhood of certain symptoms such as fidgetiness, irritability, insomnia, somnambulism, night terrors, recurrent headaches, lack of concentration and attacks of vomiting, for which no cause can be found, should be recognised as being frequently rheumatic in origin and should be treated on anti-rheumatic lines.
- (7) Efforts should be made to establish rheumatic clinics for out-patients with an efficient organisation for the following up and supervision of cases in their own homes.

- (8) Special Homes or Institutions, with educational facilities, must be established for certain rheumatic cases during convalescence.
- (9) Finally, in the crusade against rheumatism, co-operation between all medical men, who have to deal with children, and the Public Health Authorities is essential if success is to be attained.

Summary.

Rheumatism is to be regarded as a specific bacterial disease the infective organism being a short-chained streptococcus which is most probably always present in the alimentary canal and particularly in unhealthy tonsils. One attack of the disease confers no immunity against recurrence.

The streptococcus is probably not the sole cause of the disease, but as to what the other factors are, nothing is definitely known. Exposure to wet and cold, fatigue, environment and heredity are probably factors in the causation of the disease.

As regards treatment rest in bed, and in many cases, prolonged rest, is essential and the means for giving these cases the necessary rest during convalescence should be provided. This entails the provision of special institutions or homes.

With regard to the treatment of the disease by drugs, sodium salicylate, in sufficient doses, and combined with sodium bicarbonate is the most efficacious.

The question of prophylaxis is difficult owing to the lack of knowledge of the complete aetiology of the condition. Better housing, avoidance of exposure, the wearing of suitable clothing and the education of the public in matters of health would probably lessen the incidence of the disease and early and thorough treatment would prevent the development of the more serious manifestations.

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