Observations

ON

THE NATURE AND SYMPTOMS OF CARDIAC
INFECTION IN CHILDHOOD.

BY

F. J. POYNTON, M.D., F.R.C.P.LOND.,

PHYSICIAN TO UNIVERSITY COLLEGE HOSPITAL; SENIOR PHYSICIAN TO
OUT-PATIENTS, THE HOSPITAL FOR SICK CHILDREN,
GREAT ORMOND STREET.IV.—MYOCARDITIS, OR NEURO-MUSCULAR
CARDIAC AFFECTIONS.*

THIS section undoubtedly contains the most difficult clinical cases of rheumatic heart disease, for the structure of the myocardium is more complex than that of the pericardium or endocardium, and the physical signs that point to its injury are more difficult to appreciate.

A brief allusion to the pathological changes will be helpful in illustrating these points. In general terms we have to consider the *muscular tissue* of the heart wall and the *fibrous framework* in which it is set—which contains blood vessels, lymphatics and nerves. An objection to the term "myocarditis" is that rheumatism may damage the muscle fibres without producing any degree of inflammation, for experiment shows that a virulent infection may produce fatty change in the muscular fibres, and yet no evidence of inflammatory changes be forthcoming in the connective tissue framework. On the other hand, there is no doubt that myocarditis may also occur and be followed, as in other organs, by a fibrosis. The minute focal lesions in the interstitial tissues I described and showed at a meeting of the Royal Medical and Chirurgical Society in 1899, and, later, under the name of Aschoff's nodules, they received general attention. I am not prepared, however, to go to the length that some have gone who hold that it is essential to show the presence of these nodules in order to prove the rheumatic nature of a myocarditis. I look upon them as a particular phase of infection which is frequent in the rheumatic because the lesions do not, as a rule, cause suppuration, but it is possible, nevertheless, for a case to be rheumatic and these nodules not to be demonstrable. In the more chronic forms of myocarditis a perivascular fibrosis will be seen in the region of the small blood vessels. Should these local foci of change affect the regions of the auriculo-ventricular bundle it will be apparent that special disturbances will occur, and unduly irritable areas of cardiac tissue may be produced in their neighbourhood. Extensive fibrosis is, however, much more suggestive of cardiac syphilis than rheumatism.

The areas of fatty degeneration in the cardiac muscle in virulent rheumatism I pictured in the *Lancet* in 1900, and later, with Paine, demonstrated the experimental production. Thus both the two cardinal changes have been established, and are, I think, generally accepted as occurring in so-called rheumatic myocarditis; and, further, cardiac research also points to our attaching importance to both types of lesion. The changes are, then, complex, and the clinical symptoms are also complicated, and, as stated above, in this group we meet with some of the most difficult problems in heart disease. One fact stands out: we have to rely much upon symptoms because of the lack of such signs as pericardial friction and valvular bruits. Experience also shows that in this group we meet even in childhood with nervous disturbances which are apt to be embraced in the dangerous term of functional, and which are likely to cause confusion. It is in this group that we look in the future for great assistance from the modern methods of cardiac observation, but patience is very needful in an inquiry of such difficulty.

Numerous investigations have been made in the last ten years, and an analysis of these shows that transitory heart-block, auriculo-ventricular extrasystole, auricular fibrillation, auricular tachysystole, and paroxysmal tachycardia, have all been observed, and in some instances autopsies have been made which have proved the presence of myocarditis. Paul White, in 1916, described a case in an adolescent of 18 years in which heart-block was the first indication of a

rheumatic attack; but this must be, I believe, a remarkable event. The building of observations of these phenomena into the practical structure of clinical medicine must be a gradual process. One general impression that appeals to me is that as a rule these disturbances are transitory in childhood, and have less practical significance than some other factors already well known. The interpretation I have ventured to put upon this impression is that the damage to the muscular fibres is of greater significance than that of the interstitial tissues in this early rheumatism. The interstitial lesions, if they occur in connexion with the auriculo-ventricular bundle, will undoubtedly cause various disturbances in rhythm, dependent upon their site, but the parenchymatous changes weakening the muscle must also give rise to symptoms which are of greater importance, unless the interstitial lesions are exceptionally severe. In other words, I believe that in childhood the muscle of the heart suffers more in proportion in rheumatic heart disease than do the fibrous tissues.

A. *Acute Fatal Dilatation.*

These fulminating cases are very rare, but both theoretically and pathologically they are of particular interest because they show the possibility of death from myocardial disease alone, and are important evidence of the infective nature of the disease. In two cases I have seen, the damage to the myocardium of the right ventricle over a small area was so great that no tissue was left between the blood and the visceral pericardium, which had yielded from the strain into a small aneurysm; the rest of the ventricular wall was grossly diseased.

Fatal acute dilatation presents a clinical picture of death from cardiac asystole. The pulse is rapid and running, the cardiac sounds are faint, short, and approximated; the cardiac dullness is much increased, and no definite impulse is visible. The face is ashen grey; there is intolerable restlessness, with vomiting, rapid breathing, and extreme muscular feebleness. The liver rapidly enlarges; there is pulmonary oedema, and some moderate oedema of the lower extremities. The temperature usually rises in the early part of the illness, but may become subnormal before death, which is eventually sudden. There is no reaction to remedies for combating the rheumatic toxæmia, or for supporting the heart.

B. *Subacute and Chronic Dilatation of the Heart.*

This group, I venture to think, requires more attention than it has received in childhood, for I believe it to be an important cause of "weak hearts" in young adults, and to form one section of the group of cases which later is so difficult to deal with in connexion with military service.

The usual course of such a case is as follows: A child has a definite but not severe attack of acute rheumatism, and the heart is found to be dilated, and a mitral lesion is suspected. The heart remains enlarged, the murmur disappearing or becoming apparent on exertion. The child is pale and languid, short of breath on exertion, and easily fatigued. The pulse is rapid and easily influenced by movement and emotion. Fainting attacks may occur in a close atmosphere. There is nervousness, and there may be complaint of palpitation.

Such a condition is very stubborn and requires great patience in its management. If there is over-exertion the symptoms rapidly increase and any ground that has been gained will be lost and recovered with difficulty.

Should the dilatation be overlooked there is obviously great danger of missing the true meaning of this lesion. We must recognize the rapid feeble action of the heart, poor first sound and general circulatory feebleness, and ascertain the presence of the usual signs pointing to cardiac dilatation.

Subacute dilatation appears to me to be not at all uncommon in adolescents and adults who have had acute rheumatism in childhood, and produces the following results: When these individuals are able to go at their own pace and do a moderate amount of physical or mental work in the day they appear to be normal beings, but when they are put under pressure, and more particularly continuous pressure, their hearts become irritable and their nervous and digestive systems begin to fail. They behave precisely as children do when overstrained during convalescence from a subacute rheumatic dilatation.

Again, where this dilatation occurs in adolescence a very unsatisfactory condition may result, in which the nervous

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symptoms become predominant, and extreme examples, more frequent in my experience in females, may result in invalidism of the most trying kind.

Exceedingly emotional and unbalanced, they are troubled by severe palpitation and syncopal attacks complicated with nerve storms. An unusual exertion or severe emotion will bring on attacks of great severity with pain, tachycardia, and nervous disturbances that alarm all around them. In bed, carefully nursed and dieted, they become quiet and happy, and the heart improves; but when they return to daily life and attempt any useful occupation a relapse is almost certain. No one will doubt that there is a very large functional element in such cases, but those who have studied them must be equally convinced that there is some organic neuro-muscular fault which dates from the attack of rheumatism and probably represents, if we only knew the truth, some specific effect of the disease upon patients of a peculiar constitution. I am convinced of this, that it is quite useless to treat such cases as entirely functional, for there is conclusive clinical evidence that physical over-fatigue will at once produce alarming symptoms of cardiac disturbance.

In some cases frequent attacks of cardiac pain occur which suggest angina pectoris, and during which the pulse may either be much increased in rate or hardly at all altered. These attacks are not peculiar to simple cases of dilatation, but also occur in patients suffering from mitral and aortic lesions, and one such case was of a particular interest because it illustrated the flux of opinion of the many observers who saw the girl.

At first, the patient having aortic disease, the attacks were looked upon as certainly anginal; later they were thought to be largely functional, and finally they were looked upon as entirely functional. Treatment adapted to the last hypothesis resulted in decided improvement, but eventually this patient died in an attack brought on by a fit of temper. The necropsy showed no obvious disease of the aorta itself and no condition of the heart unlike that which is met with in a fatal aortic disease in which no anginal symptoms have occurred. This patient had suffered from hundreds of these attacks in eighteen months.

It is difficult to escape from the view that a vasomotor disturbance was an important factor, particularly when we bear in mind the remarkable Raynaud conditions of the hands that may follow an acute attack of rheumatism, examples of which I published in the *Lancet* in 1914.

I have followed a considerable number of cases of chronic dilatation in childhood through several years and believe that they eventually recover, though I do not feel sure that this recovery means a true restoration of complete cardiac vigour.

This group concludes the cardinal lesions with which space permits me to deal. The final stages of rheumatic heart disease are the eventual results of one or more of these lesions, themselves the results of recurrent carditis, and though a knowledge of the terminal stages is of practical value no new principles are involved and their clinical study is frequent in our hospitals. Unusual events, such as multiple serositis and extreme pericardial adhesions, cannot claim consideration here, for my chief purpose has been to try to illustrate how valuable an introduction to cardiac disease is a careful study of infective heart affections in childhood, and to indicate how clearly such a study points to the prevention of their occurrence, or arrest of their advance in the early stages.

PROGNOSIS.

There can be no doubt, I think, that the study of rheumatic carditis as an infective disease helps us very considerably in prognosis, for not only do we learn much from a study of its life-history, but we are led to take the essential view in such questions—the outlook as it concerns the child's life and future rather than the narrower consideration of the child's heart.

So imperfect is our control of rheumatism that we are compelled to qualify our views on the prognosis in any particular case by the warning that another attack may entirely alter our present opinion—and the younger the child the greater is the possibility of such a change in our view. Virulent attacks of carditis, experience amply proves, do irreparable damage, and attacks of less severity continually exacerbating are very grave events in fragile children. The type of pericarditis is of far more importance than the actual physical signs. If the

associated myocardial symptoms are severe or the inflammation spreads far into the surrounding tissues the outlook is grave—in the first instance because of the damage to the cardiac muscle, and, in the second, because the after-result of external adhesions will be serious.

The sclerotic forms of endocarditis are incurable on account of the pathological processes that produce them, and the prognosis greatly depends upon whether or not we find evidence that the rheumatism is still showing periods of activity. Thus, for example, if a child with early mitral stenosis is suffering each year from attacks of chorea, it is very probable that the stealthy process in the mitral valve is also advancing, and if this is the case, symptoms of cardiac disability must develop.

If mitral incompetence is under consideration, it is not the murmur that will guide us but the evidence that tells us how much the cardiac muscle has been damaged by carditis. If a child after a first attack of rheumatism lives in an unsuitable house, however favourable the outlook may be when he first returns home, it will be entirely altered in a few years.

I think there is little doubt that there is still overmuch tendency to dwell upon the existence of a bruit rather than to take the broader view of the case, and regard the child as suffering from the results of a cardiac infection.

The malignant form of endocarditis must be of the gravest prognosis, for the pathology of the infective process shows us precisely what is happening, and we have no reliable method of treating the results, which are essentially due to a continual injection of the micrococcal infection into the general systemic circulation.

TREATMENT.

At the present time the treatment of rheumatic heart disease appears to me to be at a standstill, and to be in an unsatisfactory position.

This I attribute largely to the widespread teaching, so clearly reflected in examination answers, that we possess in the salicyl compounds a specific remedy. Medical literature abounds with examples of the hypnotic influence of words, due, perhaps, to the natural desire to find some firm areas in the morasses of its study. It is only natural that a student believing he has a specific drug will eventually use it confidently and persistently. I have seen these drugs used in small, large, enormous, and persistent doses, and no one is more desirous to see good results; yet, after years of observation, I am left cold, and if it were not so pitiful it would be laughable to apply the term "specific" to the results we obtain in rheumatic heart disease. No one could deny the value of these drugs in rheumatism, but a valuable remedy is far removed from a specific one, and if our profession would boldly face what I honestly believe to be the truth, they would, I feel sure, be much more inclined to seek another direction for attacking the problem of the treatment of rheumatic heart disease.

This direction is toward *prevention*, and in a brief outline I venture to indicate my own views upon this problem.

1. When time and circumstances permit this should be a national effort.
2. The topographical incidence of the disease in the country should be reconsidered from the standpoint of an infective process.
3. To live in well built houses should be a duty we owe to children.
4. Special convalescent homes in touch with the large hospitals should be established.
5. The education of the public, and in particular of those connected with educational institutions, in the broad outlines of the disease should be perseveringly undertaken.
6. The supervision of children during the school age has already been undertaken, and this supervision should be extended to the proper choice of employments for those with hearts damaged by the disease.
7. The scientific study of the disease should be conducted in an institution or institutions in order to ensure an *unbroken* record of research on the broadest lines. Individual effort would not be interfered with, but the unavoidable break in continuity associated with individual research must in my opinion be rendered impossible in the future by a permanent centre for investigation of rheumatic diseases.

The two great essentials appear to me to be these:

1. The establishment of organizations by which the rheumatic child can be assisted and guided through life, and thus a sound

knowledge of cardiac infection from its earliest days be acquired by our profession.

2. The establishment of some permanent organization for the study of rheumatism upon the broadest lines.

The treatment of the individual child with rheumatic heart disease has been written upon repeatedly by abler pens than mine. I shall only venture upon a few observations which are in no sense intended to be either new or startling discoveries, but which may be helpful to those who have had fewer opportunities of seeing these cases.

First, with regard to the tonsils—I believe that there are cases in which enucleation is of great value, though it must be confessed that those which are the most successful are scientifically inconclusive. A child, for example, has recurrent attacks of tonsillitis, with arthritic pains and other symptoms, which suggest—not more—the early invasion of the rheumatic infection. The tonsils are enucleated and health greatly improves. We cannot say that if the operation had not been done this child would have developed acute rheumatism, though we may feel convinced that we have warded off danger. More conclusive but less satisfactory are those cases in which a cardiac infection has already occurred, and which after operation remain free from further attacks and in good health. For such cases I can vouch. It is, however, certain that recurrences may take place, and I have conclusive records upon this point, but no statistical evidence to calculate the proportion. This investigation requires a very large number of cases, and should be a feasible undertaking of great practical value. Operations upon the tonsils in the active phase of inflammation may be promptly followed by an attack of acute rheumatism, upon which occurrence also I have conclusive notes.

There remains another group in which the tonsils are evidently unhealthy and giving trouble, but the child has a degree of heart disease which renders one anxious as to the operative risk. Each case is a matter for judgement, but in general these children take anaesthetics well. It is clear that we have no right to assure parents that enucleation of the tonsils will free a child from acute rheumatic attacks, but I am convinced that as a preventive measure it is of first importance.

It is very essential for the treatment of the individual that the public should have a clearer understanding of the disease, for a practical difficulty in obtaining success in convalescence lies in the fact that a child who is making a good recovery from a cardiac attack may appear to be "quite well," and unless the parents understand that the heart is softened by the disease they will be inclined to worry or even suspect the doctor. Again, if a boy is athletic the schoolmaster is sometimes an offender, for he knows the glory of school games and despises the fads of doctors. Nevertheless, what does it profit a boy if he wins the school hundred yards and dilates a convalescent rheumatic heart?

The question of diet in the rheumatism of childhood is somewhat mysterious. There is a widespread idea among the laity that meat is injurious, and I presume such an idea would not have arisen unless based originally upon medical opinion. In all acute febrile illness there is general unanimity that a light diet is the best, but when one turns for evidence that there is any particular danger to rheumatic children in a nitrogenous diet, that evidence is not forthcoming. I can see no more reason for this dread of meat for rheumatic children than for the tuberculous, and believe it to be a fallacy. The disease is very common in children of a class who are not in a position to obtain an excess of meat foods, and I have failed to obtain any history of an excessive love of them. When the acute illness is over, these children often remain pale and feeble for long periods of time, and if during this stage we curtail the diet I think we lose an opportunity. If any one can produce trustworthy observations showing that meat foods given during this stage with the discretion needed for the convalescence from any lowering illness are harmful, it would be a practical service. I cannot myself find any such evidence, and have not felt myself bound in any way by the vague statements which are in existence upon this point.

Turning to more detailed considerations, some of the points that have struck me are the following:

1. The salicyl compounds—preferably, I think, the salicylates—are of value in relieving rheumatic pains, but if

faith is pinned upon their specific value, we are logically driven in severe cases to large doses, and these are dangerous, particularly to fragile delicate children. No specific result will follow their use, though death may occur from drug poisoning.

2. Patience and dogged perseverance with excellent nursing are still the most valuable aids to recovery, and though rest will not prevent an acute attack (I have seen two attacks of pericarditis in a child kept in a Phelps box under a mistaken diagnosis), its value is attested to by all.

3. Pericarditis very rarely indeed will need operative interference.

4. Continued disturbance of a child with severe heart disease by external applications and drugs does more harm than good. We do not know how to cure the disease, and are therefore not justified in preventing Nature from having a share in the attempt.

5. Vomiting, digestive disturbances, and sleeplessness require prompt and early measures for their relief.

6. The leading principle during convalescence is not passive rest but cautious progress, and the ideal is to make the interval between absolute rest and a return to everyday life an inclined plane.

7. No forward movement is indicated while the area of cardiac dullness is still diminishing and the impulse improving in strength. A gain in weight and colour may be of even more value than slight changes in the physical signs. The aim is to obtain a steady level in the cardiac condition. This level must be dependent upon the condition of the heart before the particular attack, and, if the heart is already damaged, this must necessarily be but of relative efficiency. When we get a clear idea of this cardiac level then we can commence the cautious progress forward, testing each step as we go by the general condition of the child, the temperature, the pulse, and cardiac physical signs.

8. Small doses of digitalis are often, I think, helpful during the early forward steps in convalescence, but a rash or sudden over-exertion may delay recovery for weeks, and is the great danger in this stage.

9. The nervous element, so marked in aortic disease and myocardial affections, requires cautious handling and sympathetic attention.

10. When care has been exercised we find that the great cause for a failure in the cardiac power in childhood is a recurrence of rheumatism.

PRELIMINARY NOTE ON THE ASSOCIATION OF RICKETTSIA BODIES IN LICE WITH TRENCH FEVER.

BY

J. A. ARKWRIGHT, M.D., A. BACOT,

AND

F. MARTIN DUNCAN.

(From the Lister Institute, Chelsea.)

IN connexion with the War Office Committee on Trench Fever, under the chairmanship of Sir David Bruce, F.R.S., we have had access to the trench fever clinical material at the New End Hospital, Hampstead. We are very much indebted to Major Byam and all the medical staff at the hospital for their constant help, and especially to Lieutenant Lloyd, who has been in charge of the entomological work at the New End Hospital.

Small bodies resembling diplococci or bipolar bacilli have been described in the blood of patients and in the insect vector in Rocky Mountain spotted fever by Ricketts (1909),¹ in typhus fever by Ricketts and Wilder (1910),² and in trench fever by Töpfer (1916).³ The morphology and behaviour of the forms found in these different diseases are very similar, according to those who have had the opportunity of working at more than one of these diseases. To the bodies occurring in connexion with typhus fever da Rocha-Lima (1916)⁴ gave the name *Rickettsia prowazeki*, in memory of two prominent workers who died of this disease, contracted in the course of their researches. The form found in lice believed to be uninfected or from trench fever patients he called *R. pediculi*. Rickettsia bodies are of very small size—0.3 by 0.3 to 1.5 microns—are non-motile, and are best demonstrated by staining for sixteen