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.

I.—INTRODUCTORY.

THE study of cardiac infection in childhood has appealed to me as the best introduction to the problems of cardiac disease in man. It is, in my opinion, a drawback to our excellent manuals upon heart disease that they do not sufficiently throw into prominence this aspect, and lack that close analysis of the early stages of these infections which makes us realize their great significance and impresses upon us that rational treatment must lie in prevention. The result has been to lay overmuch emphasis upon mechanical problems and to place in the background the more important consideration of the behaviour of the heart in response to infection compared with the response of the other organs. In childhood we can study the commencement of a class of cardiac diseases which often leaves lifelong scars, and both histological and experimental investigations have made it possible to outline clearly the steps in its pathological progress.

From such an introduction as this the student can rapidly grasp the great principles involved, and thus more easily fit into their proper position the many difficult details of cardiac disorders in the adult. Some of these, no doubt, are not concerned with cardiac infection, but none the less they are seen more clearly when these processes are understood.

There are many kinds of cardiac infection, to mention only the rheumatic, tuberculous, septic, diphtheritic, and pneumococcal forms, but for my purpose none is so suitable as the rheumatic. It is in this country the commonest, it attacks all parts of the heart and produces every sort of cardiac disability. The fatality is sufficiently great to furnish accurate pathological knowledge of the injuries, and these have been confirmed by experiment. The student will accordingly start from a broad and solid basis of fact. From the outset two chief considerations will claim his attention: the cardio-vascular apparatus itself, the mechanism of which has been injured, and the correlation of the cardiac disorder with that produced in other organs by the same disease in its various stages.

In the first direction he will be continually acquiring special knowledge of the symptoms and signs of cardio-vascular injury; in the second he will be working on broader lines and studying the cardiac lesions as particular results of the general disease, and will consequently be led to inquire into the life-history of the infection as it concerns the entire system. Thus from the outset he will recognize that much heart disease is the result of the scars of healed infective processes.

During the years I have served as an out-patient physician at the Hospital for Sick Children I have accumulated a large number of clinical facts upon the early phases of cardiac infection, and have, I think, been able to keep them in their right perspective by a simultaneous experience of adolescents and adults in general hospitals. The point of view in these two institutions is not quite the same. In the hospital for adults it is heart disease which is predominant, if only for the valuable teaching it provides. In the children's hospital it is the particular infection that is dominant. Each aspect has its value.

The following examples will indicate the direction in which I am aiming. In this country there is, I suppose, no more serious affection of the heart than mitral stenosis. It is frequent in occurrence, incurable, and a common cause of death under 45 years. The suffering entailed is often extreme, and many married women of the poorer classes are rendered helpless invalids at an age when young families are dependent upon their activities. In a general hospital we usually see these cases with the symptoms well established, and they are looked upon as cases of primary heart disease—that is, as cases of mitral stenosis.

In a children's hospital we see the early stages and attendant circumstances, and we trace their evolution. Again, we may see a case of valvular disease which at the moment is of no particular interest, but if we have followed the history we may have noticed that the lesion followed upon clear evidence of a sore throat. We are thus led to recognize the relation of angina faucium and rheumatic heart disease, and get a glimpse of one of the most valuable lines for preventive treatment that modern medicine has established. Here I would emphasize the value of studying not only the cardiac signs but all the events that may coincide with a first attack of rheumatism in childhood. If we wish to prevent cardiac infection every detail concerning the lesions in other organs becomes important.

There is a warning concerned with nomenclature that should be given to a student who would follow along these lines. The disease is variously called rheumatic fever and acute rheumatism. Both these terms were in use before the disease in the young was understood, and they are sanctioned by long usage. Nevertheless they are misleading. If we consider for a moment tuberculosis in the child, we recognize an acute miliary form, rapidly fatal, acute bronchopneumonic forms, and a large group in which the invasion is so gradual that none can name the exact date of onset. So, too, with rheumatism, there are acute fulminating cases, acute cardiac cases in which the heart takes the position of the lungs in tuberculosis, and cases very gradual in onset.

The terminology of tuberculous fever, or acute tuberculosis, does not cover that disease in the young, and the same is true for rheumatism. This imperfection, however, is not academic in its drawbacks, for the faulty nomenclature leads to surprise being expressed by parent and student that a case of obvious rheumatic disease has never been acutely ill. Moreover, a false notion exists in the lay mind that rheumatic fever is dangerous and that insidious rheumatism is not. One of the difficulties in the prevention of rheumatic heart disease is the unobtrusive onset of some of these illnesses. We can best combat the difficulty by a careful study of the manifestations of rheumatism uninfluenced by the nomenclature.

MANIFESTATIONS OF RHEUMATISM.

There are many admirable articles upon the manifestations of rheumatism in childhood which must be looked upon as introductory chapters to the study of cardiac infection, and some of these manifestations I take here to illustrate what I mean by the correlation of cardiac symptoms with those in other organs. There is, however, one generalization to be made first: *The severity of the cardiac affections is dependent upon the virulence of the infection.* Severe valvular disease may certainly result from repeated attacks of rheumatism, but the deadly menace to the heart lies in the grave toxæmic forms which from the first irreparably damage the neuromuscular tissues. In such cases this element of virulence is of more importance than the physical signs of cardiac disease for arriving at the immediate prognosis.

A. The Throat and Nose.

In 1900 Dr. Paine and I isolated from the tonsils of a patient suffering from acute rheumatism and tonsillitis a strepto-diplococcus identical in characters with one we had already isolated from the blood, valves, pericardium, joints, and nodules of cases of rheumatism. This produced carditis, arthritis, and the various other experimental results we have fully described elsewhere. Some years later we continued these investigations in cases of recurrent rheumatism with diseased tonsils, and confirmed the accuracy of our observations.

The conclusion from these results is obvious—the infection may gain access to the body by way of the tonsils. These investigations were novel, but the inference had been suggested and commented upon by clinicians for over a century. As for the clinical evidence, I am convinced it is final. Over a period of nearly twenty years I have assured myself of its truth, and I can recall cases in childhood in which acute rheumatism has followed tonsillitis as clearly as it has followed an experimental intravenous injection in an animal.

Difficulties have been raised, but the chief of them appear to me dependent upon a too rigid interpretation of the processes of disease in man. It has been pointed out

that a sore throat is frequently absent, and this is certainly true. Does any one, however, suppose or claim that no other site of entrance is possible? Again, is it necessary that the throat should be painful? It would be clearly unscientific to claim the tonsils as the site of entrance when nothing points in this direction, but, on the other hand, it would be equally so to deny that structures of which we can only see the surface may not be diseased in their depths, or that a virulent infection may start from a minute and apparently painless local lesion.

When the treatment of infective cardiac disease is discussed, the operative indications in rheumatic tonsillitis require consideration; but here I would point out that with this question also an over-rigid view of human disease is liable to appear. No operation will altogether prevent a recurrence of active rheumatism, and we cannot expect that it would, seeing that we do not know all the various paths of infection or the possibilities of the lighting up of foci of previous infection within the body.

One lesson in the history of heart disease, however, can be safely learnt. *An acute tonsillitis in a child should always call for careful examination of the heart.* A second, equally important, is that recurrent sore throats in childhood are not only in themselves painful and disabling, but are a menace to the heart, and must be a consideration in advising upon operative measures.

In accord with our experience of other infections, there is no condition of the tonsils that can be claimed as specifically rheumatic. In various diseases we recognize clinical forms of sore throat which represent a classical type, but we also recognize that there are variants. In rheumatism we see the painful red glazed tonsils and fauces, and where the process has sunk deeper small follicular deposits; but we also find membranous tonsillitis, sometimes not very unlike the diphtheritic; and again, deep collections of unhealthy secretion in large tonsils which, except for their size, may show little change. It is reasonable to believe that the micrococci are present in the healthy and that they acquire their special virulence under circumstances of lowered resistance, particularly in those who inherit that peculiar constitutional tendency which we call the rheumatic.

These unhealthy conditions of the throat are, we know, often coupled with adenoid vegetations, and it is very probable that in these vegetations the micrococci may retain their virulence. Chronic nasal affections, too, I think, require more observations than are at present at our disposal. The nasal mucous membrane may well be another site of infection, as also the internal ear, and I am convinced there is a rheumatic otitis of acute nature. Enlargement of the cervical glands is common, as would be expected since tonsillar disease is so frequent in the rheumatic, and this must be looked upon as evidence of the entrance of infection into the system. I am a little surprised that more attention has not been directed to the glandular enlargement in rheumatic children, for, though it is naturally to be expected, it accords so closely with the history of other tonsillar infections that its occurrence strengthens our confidence in the infective nature of the disease.

B. Arthritis.

Arthritis in childhood, with which I associate muscular pains, is, as we know, very frequent in rheumatism, and on this account a very valuable danger signal. Although arthritis at this age is not usually severe, the value of it as a symptom is very great, particularly if it is realized that the pain may be considerable owing to implication of surrounding tendon sheaths, with no detectable changes in the joint affected. The rule has been long established that *obscure pain in the joints and muscles in childhood should call for a careful examination of the heart*, and it needs no labouring.

C. Chorea.

Chorea and the allied nervous symptoms deserve the closest attention. I believe there is much to be learnt from their study that has bearing upon some of the most difficult problems in cardiac disease. Later, when touching upon mitral stenosis, I shall illustrate the close association that exists between chronic and repeated chorea and the evolution of this lesion, but now I only wish to draw attention to the great influence that the rheumatic infec-

tion exerts upon the nervous tissues. Chorea is the classical and striking manifestation, but there are other remarkable results. The older clinicians realized that the rheumatic child was the nervous child of a family, and we may look upon this peculiarity from two aspects: The child of rheumatic parentage may have, as one evidence of the constitutional weakness, an unstable nervous system, or, on the other hand, a child who has been attacked by this infection may as a result become unduly nervous. Of this latter occurrence I have no doubt, and I have seen repeated examples in children who have never developed a frank chorea. Such children become prone to migrainous headaches, night terrors, emotional attacks, and general nervousness. They may develop a condition which in adults we might term neurasthenia. Again, striking evidence upon this point is sometimes given by rheumatic adults both male and female. They may volunteer the statement that they know they are highly nervous and have noticed this to increase so greatly when they have signs of active rheumatism that they are then almost unable to control themselves. Such patients possess often enough great will power, and are perfectly aware of their weakness, and their statements convince me of the powerful effect of the rheumatic poison upon the higher nerve centres, and I think it worthy of the careful attention of neurologists. It is well known that every case of chorea requires careful examination of the heart; but the point which I am anxious to insist upon here is that the peculiar effect of rheumatism upon the nervous system tends to produce disturbances of the heart, such as tachycardia, precordial sensations, irregularity of action, and even anginal symptoms. I believe that above all affections rheumatism is liable in the adult, under suitable circumstances, to produce a condition of the heart akin to that met with so often in the soldier, and that we must keep before us this difficult problem of the factor of nervous instability in the study of organic heart disease. We shall then realize how very difficult it is to distinguish between functional and organic disturbances of this organ, and how inadequate any set tests for the mechanical power of the heart must be in dealing with the practical issue. The problem involved is not only whether the heart is mechanically sound, but whether the individual possesses a heart which will answer to physical and nervous strain by a healthy and confident response.

I have met with rheumatic cases in which the heart has seemed to physical examination but little if at all damaged, and yet such is the neuro-muscular response to sudden physical strain or excitement that they are totally incapacitated for any prolonged exertion, speedily collapsing with palpitation, general prostration, and even syncope.

Rheumatism probably gives us the best clue to unravelling functional nervous disturbances of the heart that we at present possess.

D. Cutaneous Manifestations.

The various rashes and cutaneous manifestations of rheumatism are, I think, of particular interest in that they give us a hint as to the nature of the rheumatic poisons of which we have no accurate knowledge. The urticarial, erythematous, and purpuric lesions suggest an altered state of the blood producing undue fragility or permeability of the capillaries. So narrow is the margin that a hot compress placed over an area of erythema may cause it to become purpuric, and an erythema on the upper limbs may be followed by a purpura on the lower. I have seen an erythema, purpura, and early psoriasis in the same patient—and an erythematous patch with a nodule in its centre. The latter occurrence is of interest, for the nodule is a local infection.

Akin are Filatow's or Osler's spots—on the pads of the fingers or toes, on the dorsum of the hand, or even in the palms and on the wrists. These may be the first definite signs in childhood of a progressive or malignant endocarditis. They are very likely to be overlooked, for they are minute and often so little painful as to escape the child's attention.

In this section I am also inclined to place epistaxis, so frequent in the rheumatic child, as Dr. Sidney Phillips has observed. The attacks may be frequent and severe, but personally I have not met with a dangerous case. It may occur during an acute attack, or be a first warning, or be an isolated event between attacks of general rheumatism.

E. Abdominal Symptoms.

The occurrence of abdominal symptoms in the rheumatic is an obscure subject, but one of considerable interest in heart disease, for we recognize how gastric and other abdominal disturbances influence the action of the heart when it is organically diseased or functionally defective. Reliable evidence upon these symptoms is scanty, for in rheumatism, except in very unusual cases, they do not cause a fatal result. The exceptions are rare examples of acute gastric dilatation and appendicitis. Occasionally extreme pain and distension may be complained of in the line of the colon, producing great distress and embarrassing the damaged heart, and troublesome colitis may occur. Apart, however, from these, we repeatedly meet in rheumatic children with what are called "bilious attacks." The appetite fails, the sclerotics become icteric, and the tongue coated; the motions are pale and there may be vomiting, fever, and severe headache. Such attacks may usher in an exacerbation of rheumatism. Experiment has thrown a little light upon the subject. The diplococcus has been demonstrated in large numbers in the bile of infected animals. Recently, in an unpublished case of fatal chorea in a woman, Dr. Paine isolated the diplococcus from the gall bladder and cerebral tissues. Jaundice, too, is not very uncommon in rheumatic children, and it may complicate the course of a severe chorea.

The bearing of these few observations at present is, I admit, problematical, but we are well aware of the close connexion between hepatic disturbances and the nervous system, and it is quite possible that they take some part in the unstable nervous state of the rheumatic, and that the metabolism of the liver may have a closer relation to the cerebral processes than is realized.

My chief intention here, however, is to draw attention to the occurrence of this triad of symptoms in the rheumatic: *Instability of the nervous system, abdominal disturbances, and faulty action of the heart.* The student of heart disease will repeatedly meet with this combination of symptoms, and he will find it often enough difficult to decide which system is primarily at fault. Such cases are sometimes conveniently termed "neurasthenia," but we should try to search behind the mystery of this somewhat all-embracing term.

F. General Wasting.

This also is a symptom needing close attention. It is not very unusual for a child to be brought to hospital for wasting coupled with a history of indefinite illness, and to find the explanation an insidious rheumatism. Again, during a severe attack general wasting may proceed rapidly. Lastly, this symptom in a child with severe organic heart disease is of great significance, for it may mark the beginning of the last stage of the illness, and indicates failure of the circulation to maintain nutrition even when the child is carefully guarded.

The converse to this is also of value; it is a sign of good augury when a child with rheumatic heart disease begins to gain in weight although the physical signs in the heart may convey no such favourable impression.

A student intent on the study of the heart alone, is in danger of losing sight of such homely evidence as this unless he remembers that the heart cannot be considered apart from the frame to which it is supplying blood.

G. Anaemia.

Anaemia in rheumatism affords valuable evidence of the virulence of an attack. There are few more striking clinical signs than the ghastly greenish pallor of a deadly carditis.

I have always attached much importance to this sign both in children and young adults, and my experience has led me to believe that neglect of the treatment of anaemia in young rheumatic adults favours the development of the malignant form of endocarditis which is most liable to make its appearance in early adult life.

H. Fever.

Fever in rheumatism is generally agreed upon as a sign of activity of the process, but there are cases of great obscurity in which fever persists for weeks and yet no definite explanation is forthcoming. When there is active carditis we naturally suppose that there is progress in the lesions, but there are examples of mysterious fever which

seem to leave no indication of their meaning. I mention them here because they greatly perplex us in our arrangements for convalescence, and remind us that in forming a judgement upon this point we must fall back upon the general condition of the patient and not be swayed overmuch by one symptom.

I. Rheumatic Subcutaneous Nodules.

The last manifestation I shall consider here are the rheumatic subcutaneous nodules. Dr. Cheadle long ago properly insisted upon their grave significance as associated with severe cardiac lesions. There are exceptions—rare cases in which nodules are almost the predominant manifestations, and the heart little if at all affected—but these only serve to accentuate the value of the general rule. It would seem that the occurrence of nodules points to lowered power on the part of the cells to destroy the infective agent, and that the friction of exposed areas and of the movements of tendons suffices to enable the micrococci to overcome this lessened resistance and produce local lesions. It must be remembered that these lesions at one time in their life-history contain the infective agents, and also that the same changes may occur in the subcutaneous tissues without producing an actual nodule.

PATHOLOGICAL CHANGES IN RHEUMATISM.

One of the most useful things to be learnt from the rheumatic nodule is the light it throws upon the pathological changes in rheumatism which must now have some consideration. This is not the place for a minute pathological account, but there are some fundamental facts which are a necessity in the study of infective heart disease.

First of all, the human frame resists the infection with great energy; the tissue cells rapidly destroy great numbers of the micrococci. This can be observed most clearly in the tissues from experiment, but when once these have been studied it becomes equally apparent in the human tissues. When the micrococci escape from the blood vessels into connective tissue spaces, the leucocytes and tissue cells rapidly destroy them; the lesions in rheumatism are fundamentally local lesions, a general septicaemia being unusual. The nodule is of such value because it gives a picture of these local changes. The blood vessels are dilated, the connective tissue becomes swollen, leucocytes invade the damaged area in the centre of which are patches of necrosis. A fortunate section of an early nodule cutting through the margin of a necrotic area will show the micrococci. The lesions are so small and necrotic tissue is so sparse that healing often occurs without leaving any trace of the original swelling behind.

If we study the pericardium, the valves, or the joints, we find the same events happening and differing only in their anatomical surroundings, the extent of the areas of infection, and function of the damaged tissues. Wherever there is necrosis there must be scar formation, and wherever there is great virulence there must be great hyperaemia and rupture of fragile vessels with consequent multiple minute haemorrhages.

Where the tissues involved are secretory in function the exudations that result differ with the virulence—they are sometimes haemorrhagic, sometimes clear, and sometimes sero-fibrinous. Much difficulty has arisen over the question of pus formation, but this is in reality mostly artificial. The essential question is this: Are we to use pus as a specific term? For example, is the thick yellow fluid from a staphylococcal abscess to be called pus, and no other similar fluid to bear that name? If so, rheumatism is certainly non-purulent. No one, however, uses the term in this restricted sense, but, on the contrary, we speak of pneumococcal pus, of the thin pus of streptococcal infections, and so on. If we use the term thus, as a description of a phase in an infective process, then there is a rheumatic pus, and it is found in advanced cases of rheumatic pericarditis. It is not in nature identical with the fluid of a staphylococcal abscess, for the chemical changes are doubtless different, but it is probably akin to the pus in some cases of pneumococcal pericarditis.

SUMMARY.

Some further pathological details will be given in later articles under the individual cardiac lesions, but here the

essential points in this cardiac infection may be summarized as follows:

1. There is a great resistance by the tissues to the infection.
2. The general toxæmia varies greatly in different cases.
3. The tendency is to multiple focal lesions.

4. Hyperæmia with increased permeability or fragility of the blood capillaries is frequent.
5. There are swelling of connective tissue, cell proliferation, leucocytic infiltration, and necrosis.
6. Scar formation and adhesion follow necrosis.
7. Exudations vary in character with the virulence and nature of the surface involved.

THE USE OF A DIVIDED MATTRESS AND PELVIC ELEVATOR.

By SIR WILLIAM MACEWEN, C.B., M.D.,
GLASGOW.

WHEN we have so many seriously injured men as at present the following adjuncts to our surgical technique may be useful.

There are two simple contrivances which, on suitable occasions, if used together, or separately, will contribute to the comfort of the patients, to the ease of the nurse,

FIG. 1.—Mattress in four pieces.

and will facilitate the work of the surgeon. These are—(1) a mattress divided into four pieces, and (2) a pelvic elevator. They are of use for fractures of the lower limbs, excision of joints, in paraplegias, sacral bedsores, dressing of pelvic wounds, etc.

When fractures are plated the same necessity for rigid fixation of the parts above and below the fracture does not exist; but even here the comfort of the patient will be increased by the use of a divided mattress and elevator.

In cases of fracture of the femur where it is of importance to maintain the fractured bones in rigid apposition, elevation of the patient for cleansing of the back and pelvis and the introduction of the bedpan are seriously disturbing. This is especially so when treating patients placed on ordinary mattresses, as the pelvis has to be raised and lowered on each occasion, and consequently the fractured fragments, when not plated, are apt to be displaced.

DIVIDED MATTRESS.

For the purpose of keeping the pelvis on the same level with the femur a mattress is arranged divided into four pieces, an upper portion measuring 28 in. in length, a lower piece 34 in. in length, and two centre pieces, each measuring 12 in. in length, with a handle at each end (Fig. 1). (The two latter portions may be made in one piece, but this makes a long part, the breadth of the bed,

not so easily handled). The length of top and bottom pieces may vary according to the height of the patient to be provided for.

FIG. 2.—Pelvic elevator.

Quotation from Ward Sister.

"When preparing this mattress for a patient each of the two larger mattress pieces is covered with a separate sheet, and the small portions placed in position uncovered between the two larger ones. The binder, mackintosh, and draw sheet are then placed across the bed to cover the small portions of mattress, and the ends of the sheet, etc., are tucked in on either side underneath the mattress

as in an ordinary bed. When the bedpan is about to be introduced these two centre pieces are withdrawn, one from either side, and the under sheet adjusted."

The pelvis, however, is apt to sink somewhat when the supporting middle pieces are withdrawn, though a skilful nurse can prevent this. In order to prevent this sinking a pelvic elevator is used.

THE PELVIC ELEVATOR.

The pelvic elevator consists of two strong wire uprights,

which form a frame joined at the top by a piece of metal through which a screw passes supporting a cross piece, to which is attached a pelvic band (see Fig. 2).

When in use this elevator is put across the patient at the level of the pelvis, and, when it is used along with a cut mattress, one limb of the elevator rests on the lower segment of the mattress and the other limb on the upper. When not in use the pelvic band is detached and may be left *in situ*, lying flat under the patient.

When required, the pelvic band is attached to the cross bar of the elevator and the screw revolved until the desired

FIG. 3.—Pelvic elevator in position—the weight being now on pelvic band—preparatory to withdrawal of centre pieces of mattress.