that syphilis has been an antecedent in 90 per cent. of the cases. And because a symptom is present in, say, 80 per cent. of the cases of a certain disease, we must be careful not to exclude that disease because in the particular patient we are examining that symptom is not present. Rarely there is no tachycardia in Graves's disease; and although diarrhoea is only present in about 66 per cent. of cases of enteric fever I have seen the diagnosis excluded because of the absence of diarrhoea. Supposing for the sake of argument that by Cammidge's method the presence of cancer of the pancreas can be excluded in 75 per cent. of the cases tested, let us by all means use this information for what it is worth, but do not let it blind us to the fact that our particular patient may quite well be one of the 25 per cent. in which the reaction is of no account.

A further enormous drawback to the full use of the scientific method I have already alluded to, namely, the strict limitation of the method of experiment in practical medicine. And here I would like to enter a protest against totally uncalled-for methods of examination which may be painful to the patient. I have known of a case of far advanced general paralysis of the insane in which a well-known neurologist insisted on a lumbar puncture and an examination of the cerebro-spinal fluid before he would make his diagnosis.

Von Pirquet's reaction for diagnosing tuberculosis is to me worse than useless; it has so many fallacies that it cannot even be used as confirmatory evidence of phthisis. Once a strong medical man who had recently had an influenzal tracheitis, accompanied, as this often is, by slight haemoptysis, came to ask me where he had better go to live, as he was selling his practice immediately, because having obtained a positive von Pirquet's reaction he found he had phthisis. I told him what I thought of such a method of diagnosis, went into his recent history, his symptoms, and physical signs, gave him a more accurate diagnosis, sent him away for a short holiday, whence he returned to his work as well and strong as ever. Calmette's reaction is even worse, as it may be positively dangerous to the patient, and ought, I think, to be totally condemned as a diagnostic method.

Both in diagnosis and in treatment, one skilled clinician of long experience may be, and often is, much more accurate when not using elaborate scientific methods than is another who is using them. I have known hospital sisters of great experience, using no instrument but, the unaided eye, diagnose accurately a malignant endocarditis, a typhus fever, and an acute miliary tuberculosis, when the physician in charge could not satisfy himself of the ailment. The scientific physician in treating a case of pneumonia may pin his faith down entirely to the use of a vaccine, and perhaps deprecate the use of other methods; the more artistic physician may use the vaccine but will most certainly not rely on it only, but on many other means, some of which may seem trifles to the scientist. This want of faith may be due to the present imperfections of the vaccine treatment, which may or may not disappear with the increase of knowledge, but the necessity of the existence of the artist will still remain. In the use of drugs, again, the artist will shine. Take the case of opium; there is an art in knowing when to give it and when to refrain; it is said to be dangerous in cases of bronchitis and in Bright's disease, yet it is just in these two conditions in which an artist can use it with such enormous benefit; and it requires an artist to say which of the numerous hypnotics to the exclusion of all others should be given to any particular patient suffering from insomnia. All this, if you will, is in the nature of intuition or of mere empiricism; that is so, but it is not without enormous advantages to the patient, and it emphasizes the absolute necessity of learning medicine by the bedside as well as in the lecture-room or the laboratory. Medicine must be learnt from the experienced clinician rather than from the skilled scientist, and if I had my way I would allow no one to practise medicine unless he had first resided for at least twelve months in a general hospital.

I will give a few further examples of art in medical practice, and I will first allude to the art of cross-examination, which can only be learnt by personal experience. This art, in which I include the art of the detective, is an absolute necessity in the investigation of disease, and it is

because some men do not possess it that they are never a success in medical practice, and without it many blunders are made. I learnt such power as I possess in this direction from repeatedly, some years ago, listening to the cross-examinations of the late Mr. Sidney Smelt, the then coroner for the city of Manchester. It was an education to see him handling either an unwilling witness or an ignorant, stupid witness, or a too voluble witness; the patience he displayed, the way he sorted out the wheat from the chaff, the immediate use he made of a phrase dropped by accident, of the peculiar accentuation of a sentence or even a change of emotion shown by the voice or in the face: and having thus been put upon the track of some new truth, the way in which he followed it up until the truth was revealed was a pure delight to me. Of course, in cross-examination, knowledge of what you are looking for, or of what may be revealed, is necessary, and therefore it cannot be used to the full by the young student, who must learn, as I had to do, by watching the process used by those of greater experience. Scouting without knowledge is useless for obtaining information. If I were in a jungle, I might observe certain spoor, the footprints, the way vegetation was disturbed, the kind of animal droppings, but this would give me no information; it is only the trained shikari who can tell you that a tiger has passed that way.

Again, in the practice of medicine the art of the lawyer is frequently employed. The other day I was asked by one of the laymen on the infirmary board if in considering a certain question at the medical board the presence of a lawyer would be of any assistance to us. I declined the offer with thanks, telling him that we were giving legal advice to lawyers every day in the week. I cannot give instances, but you all know how in both diagnosis of cause of illness and also in the treatment it may be quite necessary that legal matters have to be gone into often with considerable detail.

And the doctor as priest; the man to whom confessions are made when they can be made to no one else, the man who has to blame, and often blame severely, the wrong-doer, and to give praise where praise is due, to encourage the patient in his efforts to reform, to sympathize properly (and what mischief the improper sympathy of the layman does is untold); and this sympathy must not only be for the sufferer in his bodily pain or his mental distress, but also for the relations and friends. And the physician must be able to make his patient believe in him, for without this faith his ministrations may be as nothing. And, finally, the power of instilling hope, even if there is but little left, for by this faith and hope many have reached the end with a feeling of pleasure, and known nothing of the agony of death.

But these things are not science; they are art, and they are fine art, for they require the hand, the head, and the heart.

A COMMON FORM OF HEART DISEASE (AURICULAR FIBRILLATION).

BY

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In the first place I desire to thank you for the honour you have conferred upon me in inviting me to read a paper before the Worcestershire and Herefordshire Branch of the Association.

Your invitation came to me when I happened to be reading the Schorstein lectures by Dr. James Mackenzie on auricular fibrillation,¹ and it occurred to me that this would be a good subject to bring before you, as I have been working at it for the past two or three years. Moreover, it is a subject of which every medical man must have some considerable knowledge and experience.

Auricular fibrillation is a clinical entity. We have all of us met it, although we may not have been aware of the fact. We are in the same position as Monsieur Jourdain in *Le Bourgeois Gentilhomme* when he discovered during his lessons in philosophy that he had been talking prose all his life without knowing it. Auricular fibrillation, for all practical purposes, is a paralysis of the auricles; yet it is not quite a paralysis, the auricles are in a state of

distension, and their power of performing a well co-ordinated act of contraction is entirely lost, yet the auricular walls are not stationary. On close scrutiny they appear to be alive with movement; rapid, minute, and constant twitchings are observed in a multitude of small areas upon their surfaces.

THE RECOGNITION OF AURICULAR FIBRILLATION.

Electro-cardiographic records give the most certain information. I only mention these to dismiss them, because the electro-cardiograph is a laboratory instrument and an extremely difficult one to manipulate.

A simpler method is by taking simultaneous records of the venous and arterial pulses by means of the Mackenzie ink polygraph, or with Mackenzie's modification of the Dudgeon sphygmograph.

Both these instruments I have used for the past two or three years; they require some practice and a little patience, but my house-physicians learn to make records for me in the course of a few weeks; their use, therefore, presents no great difficulty. Still neither of these instruments is an absolute necessity. Auricular fibrillation can be recognized by carefully feeling the pulse and listening to the heart sounds.

The pulse is characteristic. It is continually irregular, the *pulsus irregularis perpetuus*. The irregularity is of a disorderly kind; the strength of the beats and the pauses between the beats are continually changing in an irregular manner.

Rate.

The pulse is not always a true indication of the heart-rate, because frequently many beats are too feeble to be felt at the wrist. As a rule the pulse is rapid, and a curious feature is that the rate tends to be approximately double the normal rate (110-150). In many cases, however, the rate may be 70-80-90, and in patients under the influence of digitalis a rate of 40-50-60 is quite common.

Murmurs.

Auricular fibrillation occurs in cases of disease of the heart both with and without disease of the valves; that is to say, it is met with in valvular disease and in cases of myocardial degeneration (cardio-sclerosis or senile heart) apart from valvular disease. It is quite evident, therefore, that however common auricular fibrillation may be in connexion with valvular disease, the disease of the valve *per se* is of no importance as an etiological factor in the production of the fibrillation. Auricular fibrillation is due to myocardial degeneration and not to valvular disease. Nevertheless valvular disease is often present in these cases, and it is necessary to say a word about the modification of certain murmurs that accompanies this condition.

When a continuously irregular pulse occurs in a case of disease of the aortic valve the characteristic murmurs of aortic stenosis or aortic regurgitation are present and are not modified by the fact that the pulse is irregular.

The case, however, is quite different when there is disease of the mitral valve. If there be mitral regurgitation a systolic murmur conducted into the axilla is present, be the heart's action regular or irregular; but if there be narrowing of the mitral valve—that is, mitral stenosis—the murmur varies according as the heart's action is regular or irregular.

In a case of mitral stenosis if the pulse be regular the murmur is presystolic in time. It is the well-known rumbling, crescendo murmur brought to an abrupt termination by a loud first sound. If the pulse be irregular the murmur is diastolic in time, diminuendo in character, and there will always be a distinct interval between its termination and the first sound. This difference depends upon a change in the action of the auricle when the heart ceases to beat with a regular action and takes on a disorderly rhythm. It depends upon the fact that when the heart is working regularly the auricle is contracting normally, but when the heart becomes irregular the auricle is fibrillating and incapable of co-ordinate contraction.

Summary.

To sum up, for the recognition of auricular fibrillation no elaborate instruments are necessary. The physician has only carefully to feel the pulse and apply the stethoscope to the heart. He may go one step further and take a radial pulse tracing with any form of sphygmograph, and then the disorderly irregularity of the pulse becomes

obvious, and he is in a position to say the auricle is fibrillating.

Historical.

How has fibrillation of the auricle come to be regarded as the pathological basis on which depends a continuously irregular pulse?

To Dr. James Mackenzie we primarily owe our knowledge. Dr. Mackenzie first discovered that in venous or jugular pulse tracings a wave which was invariably present in all hearts with a regular rhythm, a wave due to the contraction of the auricle, was constantly absent in patients in whom the pulse was continuously irregular. The absence of the auricular wave in venous pulse tracings indicated that the auricle was not contracting—at all events, was not contracting at its proper position in the cardiac cycle, namely, about one-fifth second before the contraction of the ventricle, and in 1902 Mackenzie² assumed that the auricle was paralysed in all cases exhibiting a continuously irregular pulse. Subsequently, however, from autopsies in cases watched for a number of years, he found that the auricles were not infrequently hypertrophied. Such a condition was not compatible with paralysis extending over a period of years, and in 1908 Mackenzie³ assumed that the auricle was contracting synchronously with the ventricle in these cases of continuously irregular pulses, and he applied the term “nodal rhythm” to these cases, indicating that the stimulus for contraction arose in some place where the auricles and ventricles could be affected simultaneously, namely, in the auriculo-ventricular node.

In 1906 Cushman and Edmunds produced experimental fibrillation in the dog, and drew attention to the similarity in the irregular pulse tracings of the dog and the irregular pulse tracings of Mackenzie's patients. It was not until 1909, however, that Lewis brought things to a final issue. He produced experimental fibrillation in the dog and took graphic records of the jugular and radial pulses. These tracings were shown to Mackenzie, who recognized them as exactly similar to those obtained from his own patients with irregular pulses. Lewis then took electrocardiograms of the fibrillating auricles in the dog, and found certain oscillations were induced by the fibrillation. He then took electrocardiograms of cases similar to Mackenzie's, and found the same oscillations present. In his recently published *Mechanism of the Heart Beat* he very ably proves that in animals and in human beings in whom the pulse is totally irregular the auricles are fibrillating, and his results have been confirmed by other workers.

WHAT ARE THE SYMPTOMS OF AURICULAR FIBRILLATION?

There are practically no symptoms that are peculiar to continuous irregularity of the pulse—that is, to auricular fibrillation—apart, of course, from the symptoms due to the accompanying valvular disease or dilatation that may be present.

In other words, a patient with a continuously irregular pulse may be no more conscious of the irregularity than is another patient of the regularity of his pulse. There may be no symptoms at all, and the patient may be able to perform arduous labour, physical or mental, for many years though the heart remain permanently irregular.

The irregularity, however, hampers the heart's action, and though the favourable condition may persist for years, symptoms of heart failure arise sooner or later, insidiously or rapidly, the symptoms being dyspnoea on exertion, oedema, cyanosis, etc.

We may say, therefore:

If no heart failure—no symptoms of the irregularity of the heart.

If heart failure—symptoms in proportion to the amount of heart failure.

Just as certain patients are liable to sudden attacks of very rapid but regular heart action, attacks we speak of as “paroxysmal tachycardia,” so others are liable to paroxysms of very rapid but irregular heart action—that is, paroxysmal fibrillation. The study of cases in which the fibrillation is paroxysmal teaches us something about the symptoms peculiar to the condition apart from those due to heart failure.

As a rule, when the heart departs from its normal rhythm the patient becomes conscious of the change, but when the rhythm is fully established he may be oblivious of any abnormality.

The following case illustrates some of these points, and further shows that paroxysmal fibrillation may occur in a patient previously subject to paroxysmal tachycardia:

A. S., aged 21, electric wire tester, has well compensated mitral stenosis and regurgitation of rheumatic origin. The heart's action is quite regular. She was admitted into the Queen's Hospital on October 19th, 1911, with an attack of tachycardia, in which the pulse was continuously irregular with a rate varying between 120 and 160 per minute. The attack lasted four days, coming to an abrupt termination, leaving the patient quite comfortable with a regular pulse of 80 per minute. During the paroxysm, however, she felt very ill, and thought she was going to die. She had never suffered from shortness of breath, even after considerable exertion, nor from palpitations until January, 1911, when she fell downstairs. Ever since this accident she has been breathless on exertion, and, in addition, has been liable to attacks of "palpitations," similar, so she says, to the attack with which she came into hospital, but of shorter duration. These paroxysms were brought on by any excitement or by exertion. She was conscious of their onset and offset; in her own words: "The heart would give a hard thump and off it would go. Once started it stopped only of its own accord, giving another hard thump before it did so." At the onset of each attack she became excited and breathless, but during the paroxysm she felt quite comfortable so long as she lay down.

The paroxysms that occurred before she entered hospital differed from the one observed in hospital in two respects: (1) They were of shorter duration, varying from ten minutes to about twenty-four hours. (2) The heart's action, and consequently the pulse, was quite regular.

In a paroxysm that occurred on April 21st a sphygmographic tracing showed a regular pulse of 200 per minute during the attack and a rate of 72 per minute immediately afterwards.

THE ETIOLOGY OF AURICULAR FIBRILLATION.

The cases fall into two groups:

1. A rheumatic group. The patients are young; the average of 45 cases with a history of rheumatism was 34.
2. A non-rheumatic group. The patients are past middle age; the average of 22 cases was 53.

In the rheumatic group valvular disease may or may not be present, but if present, mitral stenosis is by far the most common form.

The non-rheumatic group includes that form of heart disease generally known as myocardial degeneration, cardio-sclerosis, or the senile heart. It may be associated with arterio-sclerosis, granular kidney, aneurysm, etc.

PROGNOSIS OF AURICULAR FIBRILLATION.

The prognosis of a case of heart disease with a continuously irregular pulse will be estimated in much the same way as though the pulse were regular. It will depend upon the age, occupation, and social position of the patient. Broadly speaking it will depend upon the amount of work the heart is capable of doing without the production of any symptom of heart failure.

The question is, Should the irregularity be taken into account in prognosis or may it be ignored?

To this the answer is: The condition of the heart responsible for the irregular pulse does of necessity embarrass the circulation, but the amount of this embarrassment differs within wide limits. Thus, Mackenzie has watched cases for over ten years, and on the other hand, he quotes cases in which death has occurred within a few weeks of the inception of the irregular rhythm.

The following is a case of auricular fibrillation which I have watched for seven years:

H. H., aged 58, fitter, first suffered from shortness of breath and oedema of the legs in December, 1904. In October, 1905, he was admitted into Queen's Hospital with oedema of the legs, shortness of breath, irregular pulse, enlarged liver, and ascites. Ever since he left the hospital he has been able to earn his own living, but has had to give up his work eight or nine times, though never for longer than a week.

He has had a continuously irregular pulse ever since his breakdown in 1904. He goes about three months at a time without drugs, and as soon as he feels his breath beginning to fail he comes to the hospital for a further supply of medicine, which in his own word "puts him right again in a few days." He takes tinct. strophanth. mx, tinct. nucis vom. mx, liq. trinitrini mj. He has had no oedema since 1905. His pulse is continuously irregular, its rate about 70 per minute. The lips are always somewhat cyanosed, he can walk for two to three hours at a time at about two miles per hour. The heart is considerably enlarged, there are no murmurs.

It is certainly remarkable that auricular fibrillation should have such a slight effect in disturbing the circulation, for, as we have said, patients with auricular fibrilla-

tion may continue in vigorous health and be capable of strenuous mental and physical effort for years.

Fibrillation of the ventricles is quite another matter. It rapidly brings the circulation to a standstill, and is probably the cause of many cases of sudden death. The fact is, the auricles are not indispensable to the circulation of the blood; they are but temporary reservoirs, which accommodate the blood flowing to the heart while the ventricle is in systole. We know that in animals and in human beings alike the auricle may contract synchronously with the ventricle, the contraction of the ventricle may precede that of the auricle, the ventricle may contract at a rate quite different to that of the auricle, and in all cases the circulation goes on unhindered.

TREATMENT.

This form of heart disease is the one which responds above all others to the action of digitalis and its allies and, indeed, it is for this reason that the recognition of the condition is of such importance. It matters not which preparation of digitalis is used. Personally, I use for the most part Nativelle's digitaline granules, $\frac{1}{2}$ grain, and following Mackenzie's advice, I push the drug till the pulse falls to about 50. I stop it, however, earlier if symptoms of excess of the drug occur. These are: Nausea, vomiting, headache, or a general feeling of malaise. When such symptoms arise the drug is omitted for a day or two and then continued in smaller doses, the object being to keep the pulse under 70 beats per minute. Sometimes, however, the patient feels most comfortable with a slower pulse—for example, 50 per minute—and then a sufficiency of the drug is given to keep it at this rate. In any case one must be guided by the patient's own sensations, and it is remarkable how he learns to know the amount of digitalis that suits him best. In a severe case of heart failure I start with one granule of Nativelle's digitaline every four hours, then when the pulse is slow or a reaction present, after stopping it for a day or two, I continue with two granules a day, and later with one, or sometimes with one every other day or one twice a week. It is very noteworthy how patients who have been admitted into hospital with acute symptoms will go to their work and continue at it for prolonged periods so long as they continue to take small doses of digitalis.

When using tincture of digitalis I substitute 15 minims for each granule, so that an acute case is treated at the start with $1\frac{1}{2}$ to 2 drachms a day—that is, 15 minims every three or four hours. It has been said that while marked reaction to digitalis occurs in rheumatic cases of auricular fibrillation, it does not occur in the non-rheumatic cases. It must be remembered that the rheumatic cases occur in younger patients, the average age being 34, while the non-rheumatic cases occur in older patients, the average age being 53. In the latter group, in addition to cardio-sclerosis, all the concomitant degenerations of arterio-sclerosis in other organs are present, and therefore we should not be surprised at the failure of any drug to relieve the symptoms of heart failure in these cases. Be it so or not, many cases of the senile group have responded remarkably well.

The following are two severe cases of mitral disease of rheumatic origin with auricular fibrillation which have responded well to digitalis:

R. A., aged 37, brassworker, had chorea twenty-seven years ago. He has been short of breath for years, but suffered no serious inconvenience till one day in August, 1908, when his breath suddenly failed while he was cycling. He was obliged to give up all work for nine months and spent three weeks of this time in the Queen's Hospital, when he was found to have mitral stenosis and regurgitation with fibrillation of the auricles and consequently a continuously irregular pulse. He has pursued his arduous occupation for nearly three years with three breaks, one of a week, one of a fortnight, and recently one of a month. In each breakdown he is very breathless and cyanosed, the liver is large and pulsating, and the pulse rapid, irregular, and hardly perceptible. During these three years he has taken digitalis more or less constantly, and attributes each breakdown to neglecting his medicine. Be this as it may, he soon recovers on tincture of digitalis 10 to 20 m three times a day.

G. D., aged 42, omnibus conductor, had three attacks of rheumatic fever thirty-four, twenty-seven, and twenty-one years ago. He has been short of breath for the last twenty-one years, but able to remain at work without interruption until three years ago. He then had a serious breakdown and was unable to work for fourteen months. He was told that he would never work again. He came into Queen's Hospital two years

ago and was found to have mitral stenosis and regurgitation with auricular fibrillation and a continuously irregular pulse. Since his discharge he has done two years' continuous work with one interruption of three months. His work involves standing for many hours a day and constantly running up and down the staircase of an omnibus. He has taken digitalis continuously during these two years and says that he is entirely dependent on the drug.

The following case of myocardial degeneration with auricular fibrillation responded well to digitalis, although the patient was a man of 70 years of age.

J. W., aged 70, metal smith, was admitted into the Queen's Hospital on June 7th, 1911, suffering from shortness of breath, cough, and expectoration of gradually increasing severity for the past four years. On admission there was orthopnoea, cyanosis of the lips and ears, oedema of the legs, a large pulsatile liver, an enlarged spleen, and a rapid, small, continuously irregular pulse. Both ventricles were of large size, but the emphysematous condition of the lungs made it difficult to define the exact boundaries. There was a systolic murmur at the apex, audible in the axilla and at the tricuspid area. After twelve days' rest in bed, without drugs, the oedema had disappeared, but the pulse remained at about 90 per minute. A week later, after taking two granules of Nativelle's digitaline per day, the pulse had slowed to 60 per minute. Coincidentally with this slowing the general condition of the patient greatly improved, and five weeks after his admission he left the hospital. All the cyanosis had gone, cough and expectoration had ceased, and the patient was able to mount stairs without any discomfort.

The following is a case of myocardial degeneration with auricular fibrillation in which the patient improved under digitalis in spite of the fact that he had cancer of the liver.

T. H., aged 56, bricklayer, was admitted into the Queen's Hospital on August 23rd, 1911, with carcinoma of the liver and a failing heart, evidenced by shortness of breath, cyanosis, oedema of the legs and back, ascites, and a continuously irregular pulse of very small amplitude, of about 100 per minute. Both ventricles of the heart were enlarged, but emphysema made an exact definition impossible. There were no murmurs. Rest in bed without drugs for six days did not improve the condition of the circulation, but six days later, after having taken 29 granules of digitaline, the pulse was 57 per minute, and of good volume, all cyanosis and oedema had disappeared, and the ascites had diminished. A month later still, on 1 granule of digitaline per day, all ascites had disappeared, and the patient could mount stairs without any discomfort. This improvement in the heart's action has been maintained until the present time, although the patient is losing strength and flesh as the result of malignant disease of the liver.

REFERENCES.

¹ BRITISH MEDICAL JOURNAL, October 14th and 21st, 1911. ² *Study of the Pulse*. ³ *Diseases of the Heart*. ⁴ Lewis, *Heart*, vol. i, p. 311.

THE MANAGEMENT OF CARDIAC FAILURE IN DIPHTHERIA.

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THE rational treatment of all forms of cardiac failure is to remove the cause or causes whenever possible; at the same time to consider the pathological changes in the cardio-vascular system with a view to amelioration of such changes; lastly, to consider the clinical aspect with a view to tiding the heart over the period of stress and preventing or relieving serious symptoms. With regard to the causal factor in diphtheria, it will generally be admitted that the action of the toxin on the heart muscle, resulting in certain degenerative changes, is the main cause of failure. The result of this action, though it can largely be prevented by the early, free administration of antitoxin, cannot be remedied once it has taken place. Unfortunately, in too many cases the antitoxin is not administered until the patient is admitted to hospital, often as late as the fourth or fifth day of the illness. The consequence is that valuable time is lost, and the main cause of cardiac failure may be beyond control. With reference to subsidiary causes, the early loss of appetite which so frequently occurs in diphtheria is a predisposing cause; whilst, on the other hand, the feeling of malaise probably exerts a beneficial influence, inasmuch as it necessitates rest, and so diminishes the heart work. That this point is of some importance seems evidenced by the fact that many patients who are conveyed by ambulance over considerable distances show on admission definite signs of cardiac depression, which pass away after a night's rest.

There are, of course, many other factors tending to cause cardiac failure which may come into play in the case of adults suffering from diphtheria, but the main cause is the specific toxin, and it is largely under our control if adequate treatment is commenced early enough.

PATHOLOGICAL INDICATIONS.

Seeing that the changes which occur in the heart muscle are degenerative in nature and are so rapid, they furnish few indications for treatment. It is important to note, however, that in those cases characterized chiefly by failure of tonic eliminative treatment by purgation and leeching is not only useless, but positively dangerous.

CLINICAL INDICATIONS.

Unfortunately we frequently see cases in which the causal factor has passed beyond our control, and we must rest content with expectant treatment. We therefore attempt to assist Nature in her efforts to promote resistance sufficiently prolonged for the patient to throw off the disease, at the same time guarding against possible complications—thus, by the rational administration of food and stimulant (if required), attention to sleep, and to the excreta, we endeavour to tide the patient over the crisis.

With reference to complications affecting the circulation, undoubtedly the most serious is that type of cardiac failure associated with persistent vomiting. It is so fatal and its early recognition so important that I append a note on its differential diagnosis. When a patient suffering from severe diphtheria begins to vomit after the seventh day of the illness, we must remember that there are several possible explanations; thus, it may turn out that the dreaded cardiac vomiting has supervened, whilst, on the other hand, the vomiting may be due to the onset of scarlet fever. It is not possible to exclude scarlet fever with certainty at the commencement, as it sometimes begins with vomiting, associated with a normal or sub-normal temperature. However, a few hours generally makes the diagnosis clear. Measles may also commence with vomiting, and the fact that it is frequently afebrile in its very early stages and not infrequently commences without even coryza or suffusion of the conjunctiva may mislead one, unless a sharp look-out is kept for Koplik's spots.

Serum reaction may commence with an attack of vomiting and cardiac depression (especially the urticarial type of serum rash), but here again the lapse of a few hours generally clears up the diagnosis.

"Cardiac" Vomiting.

The following signs indicate the probability of myocardial involvement:

1. *Certain Types of Faucial Attack.*—When the faucial attack is severe and is complicated by involvement of the naso-pharynx and palate, the probability that the onset of vomiting may indicate commencing cardiac failure is considerable.

2. *Rapidity of the Pulse.*—It is generally recognized that in simple febrile conditions, for every rise in temperature of 1° F. there is corresponding increase in the frequency of the pulse of 10 beats per minute. Whenever in diphtheria the pulse-rate increases out of proportion to the rise of temperature, involvement of the myocardium may be suspected. This sign, which was observed by Dr. Caiger many years ago, is one of the earliest and most reliable indications of threatened failure.

3. *Auscultatory Signs.*—The presence of the extra-systole with or without a consecutive intermission of the heart's action is also important evidence that the heart wall is involved in the morbid process. It carries with it a grave prognosis, when it first appears between the seventh and seventeenth days, but when it commences after the first three weeks its prognostic significance is more favourable. In addition to the above, reduplication of the first sound, followed by accentuated second, is a sign of advanced myocardial disease, as is also marked approximation. On the other hand, shortening of the first sound, accompanied by prolongation of the interval between it and the second sound, is an indication of less advanced disease. Lastly, in some cases in which the function of contractility is depressed, the heart sounds may become almost inaudible.