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ON

PROGNOSIS IN CARDIO-VASCULAR DISEASE.*

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THE veil which has dimmed for so long the vision of the clinician when called upon to forecast with any degree of accuracy the future of the patient with structural disease of the heart is gradually lifting. The advance in knowledge in recent years of the physiology of the heart has directed clinical observations in the right channel. The progress in our understanding of the pathological changes in cardio-vascular disease has not been so rapid. Such knowledge as we possess enables the physician to estimate structural damage of the heart from the clinical signs with a fair measure of exactness. The interpretation of symptoms involves problems of so great a complexity that it may be a long time before they are solved. In a patient with signs of structural disease of the heart there are few symptoms that cannot arise from other causes than disease of the cardio-vascular system. Breathlessness on exertion is a symptom of myocardial insufficiency; it can, however, arise from pulmonary tuberculosis. Pain that is anginal in character and distribution can vanish when a focus of infection or toxic absorption in some part of the body has been removed. The recognition of structural damage of the heart rests mainly upon clinical signs. Signs are a better index of the progress of the disease than symptoms in the large majority of cases. A simple clinical examination of the cardio-vascular system, without recourse to special instrumental examination, should, when completed, give all the information required for a correct diagnosis of the pathological changes and a fairly accurate forecast of the course of the disease.

The method employed in the examination of the cardio-vascular system at Sir Thomas Lewis's clinic at University College Hospital has proved highly satisfactory in both diagnosis and prognosis. It is a method the undergraduate student easily learns to apply, and post-graduates in medicine without expert knowledge or special experience find helpful in general practice. It is particularly useful in dealing with hospital cases, either in the wards or in the out-patient department, for all patients with cardio-vascular disease can be classified by a simple index system. It can easily be determined by referring to the index cards whether there has been improvement in the condition of the patient, or, if the disease has progressed, how great the disablement is likely to be.

The physical examination rests upon those signs which indicate heart failure, the degree of cardiac enlargement, the valve defect, the rhythm, infection, etiology, and the state of the arteries. It also includes an exercise tolerance test. These signs reveal all that is essential in the diagnosis and prognosis of disease of the cardio-vascular system.

There are two main types of heart failure: heart failure with congestion, and heart failure with angina. The signs of failure with congestion are those of engorgement of the venous system. Distension of the veins of the neck with the head raised above the body in the recumbent position, or such elevation as is given by two pillows under the head, is a certain sign of dilatation of the right side of the heart, and an early sign of heart failure. A greater degree of venous engorgement is indicated by enlargement of the liver, cyanosis, crepitations over the bases of the lungs, dropsy, and diminished output of urine. Venous engorgement is always associated with breathlessness. Without further examination we may—except in occasional cases of paroxysmal tachycardia of many days' duration—safely diagnose advanced myocardial disease, and at once give a grave prognosis. In heart failure with angina

signs of venous congestion are, as a rule, absent. There is always disease of the myocardium in these cases and the outlook is unfavourable.

The determination of the degree of cardiac enlargement is the next step in the examination. Increase in the size of the heart is best ascertained by palpating the maximal impulse of the heart. The left border of the heart lies near the outer margin of the maximal thrust of the heart. Such an impulse felt definitely to the left of the nipple line is a sign of slight cardiac enlargement. It is often associated with a diffuse cardiac impulse or a lifting of one or more ribs. If the left border of maximal thrust is felt two or three fingerbreadths to the left of the nipple line or extends to the anterior axillary line, then it is safe to consider the heart as moderately enlarged. There is great enlargement when the left border of the heart extends beyond the anterior axillary line. Percussion of the left border of the heart should confirm palpation; otherwise it is of doubtful value. It is not necessary to map out the right border of the heart. No added information is given in determining the size of the heart by percussion to the right of the sternum, except in cases of cardiac displacement. Submanubrial dullness is a valuable sign of aortic dilatation; if associated with it there is lifting of the sternum, and pulsation easily palpable to the right or left of the sternal margin in the second or third interspace, the dilatation is probably aneurysmal.

Increase in the size of the heart indicates myocardial disease. As a measure of myocardial damage the degree of cardiac enlargement is a valuable and reliable diagnostic sign. As a working rule, although there will be exceptions, it is safe to give a grave prognosis when there is considerable cardiac enlargement. With slight increase in the size of the heart, the risk is not great, provided all other signs favour a good prognosis, if a gloomy outlook is withheld from the patient.

The main object of examination with the stethoscope is the detection of gross valvular mischief. It is in reality the least important part of the examination of the cardio-vascular system. By auscultation we determine at the mitral area the presence or absence of mitral stenosis, and at the base whether or not there is disease of the aortic valve. A presystolic murmur or diastolic rumble heard at the apex is a sign of structural damage of the mitral valve, and a diastolic murmur heard at the pulmonary or aortic cartilages indicates incompetence from disease of the aortic valve. I am not here concerned with congenital valve disease or other congenital cardiac anomalies. They are rare conditions, and it would serve no useful purpose to digress from acquired structural disease.

Mitral stenosis may be classified as developed or early. When developed the murmur is heard in all positions and at all times, and is accompanied by a thrill felt over the mitral area. It indicates considerable narrowing of the mitral orifice. If a short presystolic rumble or early diastolic murmur is heard at the apex only when the patient is recumbent or lying on the left side, or if to make the murmur audible it is necessary to increase the heart rate by exercise, then the valve defect is slight, and it can be classified as early mitral stenosis. Aortic incompetence is graded by the character of the pulse and not by the intensity of the murmur. When a diastolic murmur is heard at the base of the heart, and associated with such a murmur a pulse that is collapsing in character, the diagnosis of free aortic regurgitation may be made. It is safe to consider the regurgitation as slight if the pulse is not collapsing. Aortic stenosis should be diagnosed when a systolic and diastolic murmur at the aortic cartilage is accompanied by a systolic thrill felt over this area, and the pulse is slow-rising, anacrotic in type, and of low tension.

A systolic murmur, wherever heard, is an unreliable sign of valve disease. At the mitral area it may indicate mitral regurgitation from slight crumpling of the valve; at the aortic or pulmonary cartilages, as an isolated sign, it is of little diagnostic value and of no prognostic importance. Such a bruit, wherever heard, should make the observer listen carefully for a murmur in diastole. In the diagnosis of chronic valvular disease it has no other value than this. As a prognostic sign it may be neglected. The stethoscope enables us to recognize gross valve disease, and for this

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reason is a valuable diagnostic aid. It reveals little concerning the future course of the disease that cannot be more easily determined by other means.

A step further in the examination is the consideration of the heart's rhythm. The irregularities may be classified in two main groups: irregularities that are serious and indicate structural damage, and irregularities that are of no prognostic importance. It is possible with our present knowledge to make this division clinically without the aid of the polygraph or electro-cardiograph.

There are two types of irregular heart action which are frequently observed, but do not indicate structural damage of the heart. One is sinus or respiratory arrhythmia, often noticed in childhood and adolescence, and not infrequently in adults. It is an irregularity which is related to breathing. The heart rate quickens in inspiration and slows during expiration. This type of irregularity is phasic and completely disappears when the breath is held. An arrhythmia of this sort should in no circumstances be considered a disability.

Extra-systoles are easily recognized, and with a little practice can be distinguished without difficulty from other types of cardiac arrhythmia. When an irregularity is present with the patient at rest, and the heart rate between 60 and 100, extra-systoles may be suspected. If this irregularity disappears when the heart rate is raised above 120 by effort or other means, such irregularity is nearly always due to extra-systoles. In the absence of signs of heart failure they may be neglected as a prognostic sign. Apart from the discomfort complained of by some patients they may be disregarded in the management of the patient with cardio-vascular disease.

An irregularity which does not disappear when the heart rate is increased to 120 or more is due to auricular fibrillation. It is a sign of structural disease of the heart, and is the commonest type of irregular heart action associated with heart failure. The high ventricular rate which usually accompanies auricular fibrillation adds to the work of a heart already damaged. For this reason auricular fibrillation is of great diagnostic significance and a valuable prognostic sign. Auricular fibrillation is an indication for digitalis therapy, and when untreated the outlook is unfavourable.

The other types of cardiac arrhythmia are rare; they are recognized by special instrumental examination, and if they are not understood little harm will be done to the patient. Auricular flutter will be mistaken for auricular fibrillation; the treatment is much the same, and the prognosis equally unfavourable. Heart-block will always be suspected when the ventricular rate is very slow.

Signs of infection should next be looked for. When present they are easily recognized and indicate a grave prognosis. There are certain signs which denote an active and progressive infection of the endocardium, and with the aid of these the diagnosis of subacute infective endocarditis may be made with certainty. The reliability of these signs is beyond question—as I propose to demonstrate to you from an analysis of cases which I have had under observation.

Subacute infective endocarditis may be diagnosed when chronic valvular disease is associated with pallor, clubbed fingers, splenic enlargement, pyrexia, and signs of embolism. Pallor which is conspicuous should at once arrest your attention and lead you to think of infective endocarditis. A sallow muddy complexion, or a toxic appearance, or the so-called *café au lait* colour of the skin, ought to put you on your guard. Do not in dealing with aortic disease attribute the pallor which we are accustomed to associate with aortic regurgitation to the valve defect. The relationship of pallor and aortic regurgitation is not an absolute one, but is to be explained by the relatively high incidence of infective endocarditis in this type of valve disease.

If the finger-tips are examined in structural heart cases, a certain number will present definite signs of clubbing. There will also be found accompanying the clubbed fingers in a relatively large percentage of cases other signs of infection. In some this finger deformity is striking, in others it will not be observed unless looked for carefully. The clubbed fingers associated with chronic valvular disease are not in appearance quite like that seen in congenital

heart cases. The finger-tips are less bulbous in the infective cases; there is in these an increase in the antero-posterior diameter at the base of the nails, with a lateral widening of the nail, from an overgrowth of the subcutaneous tissues. The nails are curved in both, but the skin covering the ends of the fingers in the infective case is pale, with a complete absence of venous stasis, which gives to the clubbed fingers in congenital heart disease a congested appearance. Subacute infective endocarditis should always be suspected when chronic valve disease has associated with it clubbed fingers and pallor, for in most cases with these signs the spleen will be found enlarged. The clinical observations upon which this statement is based were reported in *Heart* (vol. ix, No. 4). With the object of inquiring into the relation between clubbed fingers and infection in chronic valvular disease I analysed a large number of structural heart cases which we had under observation at the special Heart Clinic at University College Hospital. Table I displays the relative frequency of signs of infection in two groups of cases—those with clubbed fingers, and those in whom this sign was absent. The following is a summary of these observations:

TABLE I.

	Infective Endo- carditis.	Infective Endo- carditis.	Suspected Infective.	Not Infective.	Total.	No Clubbing.
Number ...	17	27	4	15	63	735
Clubbing ...	17	27	4	15	63	0
Pallor ...	17	22	3	3	45	2
Palpable spleen ...	17	27	1	4	49	6
Petechiae ...	13	21	2	0	36	0
Emboli ...	10	18	0	0	28	0
Pyrexia ...	16	15	0	0	31	0
Autopsy ...	17	0	0	0	17	0
Deaths ...	17	25	2	5	50	27
Duration (months) ...	17	10	10	18		

In 798 cases of structural disease of the heart in pensioners of the recent war clubbing of the fingers was noted in 63 instances.

This group of 63 cases was subjected to careful and prolonged examination, and the after-histories of the individuals were followed until death, or for periods in no case less than eighteen months from the date of diagnosis.

Of the 63 cases, 44 cases proved at the time of the first examination, or subsequently, to be perfectly clear instances of subacute infective endocarditis. These cases without exception died within seventeen months of the first diagnosis of the infection, and in the seventeen where *post-mortem* examinations were available the original diagnosis was completely confirmed.

Of the remaining 19 cases, 4 others presented signs of infection, which were regarded as doubtful but not conclusive; 2 of the 4 died within a short period and were almost certainly infected cases. The remaining 2 are still alive, and are almost certainly not cases of infective endocarditis.

Of the 15 cases remaining out of the 19, subacute infective endocarditis has in no case been suspected. In 2 of these 15 the patients stated that their fingers had been clubbed for periods of very many years. In a number of others the clubbing consisted of thickening of the nail-bed, and this was associated with small breaks in the skin of the lunula of the nail and a process of chronic superficial irritation. In none of the 15 cases were there physical signs of disease of the lungs. Of the 15 cases, 4 succumbed during the period in which the after-histories of the infected cases were followed.

From these observations one may conclude that in cases of structural disease occurring amongst adults, clubbing of the fingers is usually associated with subacute infective endocarditis. Although clubbing of the fingers is not to be regarded in these cases as a conclusive sign of infection, it is nevertheless one of the most valuable signs we possess in coming to a correct diagnosis.

A palpable spleen when associated with chronic valvular disease is a sign of infection. I know of no evidence which supports the view that splenic enlargement is due to venous congestion from a failing heart. The spleen in appearance

is not unlike the swollen spleen of typhoid fever. It differs of course in this respect, that splenic infarction is common in infective endocarditis and rare in typhoid fever. The spleen is not always soft; it may be hard and of such a size that it occupies a large part of the abdominal cavity.

With the object of determining the relation between infection and splenic enlargement in chronic valvular disease, I have made use of the same clinical cases, and in the review of them I have employed the same methods of inquiry as for clubbed fingers. Table II displays the relative frequency of signs of infection in the two groups—those with a palpable spleen, and those in whom this sign was absent. It also shows the relative incidence of death within a period of three years of all cases.

TABLE II.

	Infective Endo- carditis.	Infective Endo- carditis.	Suspected Infective.	Not Infective.	Total.	Spleen not Palpable.
Number	18	29	2	18	67	731
Palpable spleen ...	18	29	2	18	67	0
Pallor	18	24	1	6	49	2
Clubbing	18	28	1	3	50	14
Petechiae	14	22	0	0	36	0
Emboli	11	19	0	0	30	0
Pyrexia	17	16	0	0	33	0
Autopsy	18	0	0	0	18	0
Deaths	18	29	2	2	51	85
Duration (months) ...	21	22	18	36	36	36

There are 18 cases with *post-mortem* confirmation of infection. The diagnosis of subacute infective endocarditis rests upon the following signs: chronic valvular disease associated with pallor, clubbed fingers, pyrexia, petechiae, and other embolic signs. In one of these pyrexia was absent, and in others embolic signs were not recorded. A *post-mortem* examination was made in all, and in every case the structural changes found were typical of subacute infective endocarditis.

In 29 cases there were manifest signs of infections, or sufficient signs to make the diagnosis of subacute infective endocarditis certain. All in this group are known to have died within a period of twenty-two months from the date of diagnosis of subacute infective endocarditis. A *post-mortem* examination was not possible in any of these, but the clinical evidences of infection are sufficiently distinctive of the disease.

There were 2 cases of suspected infective endocarditis. In one of these there was clubbing of the fingers, and in the other the pallor was striking. In both the spleen was palpable. Both died within eighteen months.

Subacute infective endocarditis was not suspected in 18 cases. The signs of infection were considered insufficient.

This table also shows the relative incidence of death within a period of three years of all cases. Within a period of three years, 51 cases of a total of 67, or 80 per cent., are known to have died. The after-histories of the remaining cases of structural disease of the heart without an enlarged spleen show that 85, or 11 per cent., died within the same period. It will be seen that signs of infection are rarely observed in the group without a palpable spleen. The fingers were clubbed in 14 cases, and pallor was noted in 2. No other signs of infection were recorded. The death rate is very high in those with a palpable spleen—80 per cent., as compared with 11 per cent. in the group without this sign.

One is justified in concluding from this table that in cases of structural heart disease occurring in adults a palpable spleen is usually associated with subacute infective endocarditis.

Pyrexia is not of the same order of importance in the diagnosis of subacute infective endocarditis. Throughout the course of the disease there may be long and frequent apyrexial periods. The presence of fever is helpful when associated with other signs of infection; its absence, unless the observations extend over a period of weeks, should not make you less certain of the diagnosis.

Signs of embolism are not always present at a single examination. If looked for carefully, one or more petechiae can usually be found. The front of the chest, the mucous

membranes, and the conjunctivae are the places where these small haemorrhages are most likely to occur. Small dull red painful and tender spots which appear on the tips of the fingers and toes and fade in a few days—first described by Sir William Osler and known as Osler's nodes—are pathognomonic of the disease. A few red blood cells in a centrifugized specimen of urine with a trace of albumin is a sign of renal embolism. Other embolic signs depend upon the seat of the embolus.

Other signs of infection will aid in forecasting the course of the malady. Any focus of infection or toxic absorption, acute or chronic, tends to make the cardiac lesion progressive, and with the removal of the infecting or toxic agent the advance of the disease may be arrested. Oral sepsis, septic tonsils, chronic appendicitis, or an acute, subacute, or chronic pulmonary lesion—all influence unfavourably the prognosis in structural disease of the heart.

All structural heart cases may, according to their etiology, be placed in one of three groups: Those with a history of rheumatic fever or chorea; those with a history or signs of syphilis; and a third indefinite group where there is a complete absence in the history of a causative agent which could produce the signs of disease which the patient presents. In aortic disease the indefinite group is as large as the rheumatic and syphilitic groups combined. In this type of valve disease the relative incidence of rheumatic fever is highest under the age of 40, and in men over 40 syphilis is more common than rheumatic fever as an infecting agent. I am not convinced that, because of the peculiar susceptibility of the walls of the aorta to spirochaetal invasion, and the greater tendency of the coronary and other arteries to be damaged by the virus of this disease, the prognosis in the syphilitic group is more unfavourable than in the rheumatic or indefinite group. The prognosis in the rheumatic group in mitral or aortic disease, because of the liability to recurrence of a rheumatic infection, with added damage to the valves and myocardium—all other conditions being equal—may be more unfavourable than in the indefinite group. I have no evidence from the study of the after-histories of patients in these two groups that this is true. Information will be forthcoming within a few years, as the result of a research which is now in progress at University College Hospital, which should reveal the true value in prognosis of etiology in structural disease of the heart.

The information obtained from the signs of structural disease of the cardio-vascular system is ended with the examination of the arteries. When combined with hypertension and cardiac enlargement, thickened radial, brachial, and temporal arteries are a fair index of general arteriosclerosis and indicate pathological changes in the interstitial tissues of the kidneys. The prognosis depends upon the extent of myocardial damage, together with the degree of functional renal impairment. With advanced myocardial disease the prognosis rests more on the state of the heart than on the condition of the kidneys, unless the renal disease is equally serious. With slight signs of myocardial disease the prognosis may depend upon the functional state of the kidneys. Cardio-renal disease, as its name implies, requires a cardio-renal prognosis.

The examination is not completed until the exercise tolerance has been determined. It is the patient's response to effort which enables us to ascertain the cardiac reserve which remains in a heart damaged by disease. The exercise should be a simple one, such as the lifting of dumb-bells or hopping on each foot. Undue breathlessness sometimes associated with pallor and an anxious expression and anginal pain are the signs of distress which one looks for in estimating the exercise tolerance. If signs of failure are present, signs of distress may be observed with the patient at rest. The more advanced the disease, the poorer will be the response to physical effort, and, conversely, the better the exercise tolerance, the more favourable will be the prognosis.

This completes the examination of the patient. The information which the signs have revealed has enabled us to diagnose and prognose, so that at the end of the examination there is placed before us a clinical picture which gives a clear view of the condition of the patient—past, present, and future.