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Sir James Mackenzie

W. S. Uttley

Abstract

Based on a Dissertation read before the Royal Medical Society on Friday, 21st October 1960

Picture, if you can. a dark grim valley of smoke and chimneys, outlined by a ring of light appearing over the hills. In the streets a clatter of horses' hooves and wooden clogs. In a dingy room the oft repeated scene of a girl in labour surrounded by old women in shawls. The ubiquitous, anxious husband is being solemnly reassured by the confident young doctor newly fledged from Edinburgh University. Her grip tightens on his hand as another instalment of pain is to be paid. Suddenly it is limp and tranquillity passes over her sweating brow. Sudden cardiac failure-the year 1880-and the realisation by that doctor in Burnley, James Mackenzie, that nothing was known about cardiac disease which might have warned him of such an outcome.

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Sir James Mackenzie

AN INTRODUCTION TO CARDIOLOGY

By W. S. UTTLEY

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Picture, if you can, a dark grim valley of smoke and chimneys, outlined by a ring of light appearing over the hills. In the streets a clatter of horses' hooves and wooden clogs. In a dingy room the oft repeated scene of a girl in labour surrounded by old women in shawls. The ubiquitous, anxious husband is being solemnly reassured by the confident young doctor newly fledged from Edinburgh University. Her grip tightens on his hand as another instalment of pain is to be paid. Suddenly it is limp and tranquillity passes over her sweating brow. Sudden cardiac failure—the year 1880—and the realisation by that doctor in Burnley, James Mackenzie, that nothing was known about cardiac disease which might have warned him of such an outcome.

Mackenzie was born in 1853, the second son of Robert Mackenzie, a farmer of Scone, near Perth. Here he was educated by that notorious system in which the honours fall to those who remember rather than to those who think, and inevitably he failed to distinguish himself. Leaving school at the age of fifteen he became apprenticed to a local chemist. He apparently soon forgot his experience of educational systems since he entered Edinburgh University Medical School when his apprenticeship was completed. His was a frugal existence, common to many other students at that time. He lodged with a joiner and his family and shared a room with his brother, living off oatmeal, butter and scones from their own farm. Preclinical classes were a repeat in kind of school at Perth—didactic and depressing. Clinical years however brought delight, three gold medals and a house job. Yet his experiences were stored for an attack against that very system of medical education, to be launched many years later.

Following his term of residency in the Infirmary, Mackenzie was invited to an assistantship in the practice of Dr William Briggs and Dr John Brown in Burnley. Now he found himself in a town much removed from the academic atmosphere of Edinburgh. Rough and busy, grim yet vital, the only standard was the standard of achievement. The problems of this busy practice which immediately presented themselves were the same as those we have to face today. In the majority of patients presenting themselves for the first time a firm diagnosis was impossible. Moreover the question was not so much "What exactly is wrong with me?" but rather "How long will it be before I'm well?" or "What is going to happen to me?" The purchase of a large medical encyclopaedia, and the perusal of text-books and notes did not supply the required answers. His senior partners might have been able to produce some of the answers from the wealth of their experience, but Mackenzie had to admit to himself that he did not understand the mechanism or meaning of a single symptom.

Accordingly, within a few years of entering practice Mackenzie had defined his aims:

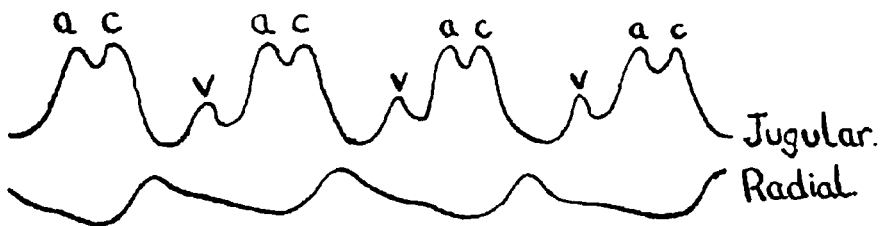
- (1) to understand the mechanisms of symptoms;
- (2) to understand their prognostic significance.

To effect this he began to make note of every sign and symptom detectable in every case under his care, and to "wait and see" what would be the outcome. These words "wait and see" are to be emphasised as they form one of the main pillars of his thought. The sheer magnitude of this task soon became apparent, and obviously it had to be limited to only certain groups of symptoms. It was incidents like that which is recorded in the introduction to this article, which directed his endeavours into the field of cardiac disorders. He determined to study the common symptoms of fatigue, dyspnoea and pain and to learn their significance by noting their clinical course over a number of years.

The frequent occurrence of irregularity in rate and rhythm of the heart in pregnancy soon attracted his attention. Searching the medical literature of that time he found such statements as "her heart became irregular and she sank and died," yet nowhere did he find any information as to the real nature or meaning of this sign. Many women in pregnancy developed pulse irregularity and delivered their babies normally, so why should others develop heart failure?

Thus began the most classical example of general practitioner research of all time. By employing the Dudgeon Sphygmograph to record the radial pulse, Mackenzie soon realised that there were several types of irregular heart action, but was unable at first to differentiate them. Then he remembered the obscure waves which could be seen in the necks of many patients which were explained as "backwash from the heart," and he attempted to record them.

Once having obtained a recording of these waves, by means of a re-invention of Marey's tambour, the difficulty lay in their interpretation. It was evidently necessary to obtain recordings of some standard movement taken at the same time in order to recognise the relationship of the waves in the jugular vein to the movements of the heart. Mackenzie made a tambour out of a pill box and added this onto the Dudgeon Sphygmograph, thus employing the radial pulse as standard. Two straws were used to trace the jugular and radial pulses on the same piece of smoked paper, and this simple instrument, the so-called clinical polygraph, was used in



domiciliary practice by its inventor for many years. Later this prototype was replaced by a more convenient machine, the ish-polygraph whereby long continuous tracings could be taken on roll paper. This machine was to enjoy widespread use until the introduction of the E.C.G.

A standard tracing consists of the three waves of the jugular pulse (a, c and v), and the radial pulse.

From such tracings Mackenzie correctly deduced the "a" wave to be

due to right atrial systole, the "c" wave to be due to left ventricular systole via the carotid pulse, and the "v" wave to be due to the termination of right ventricular systole. Thus he could now to some extent observe the behaviour of three of the four chambers of the heart, and having obtained a means of differentiating the irregularities, he collected a large number of cases. An analysis of such factors as wave-type, age of the patient and their actual state of health showed that the vast majority fell into one of three distinct groups.

The first form occurred mainly in young persons. All four chambers of the heart participated and the irregularity varied with respiration. The most important observation of all was that the patients remained fit and well. MacKenzie called this the "Youthful Type" of irregularity; we know it now as sinus arrhythmia.

Here was one of his most outstanding advances since, in their ignorance, the consultants of the day created a cardiac cripple out of any healthy child who happened to exhibit this normal and harmless feature.

The second form was that in which the ventricles contracted prematurely, sometimes with and sometimes without initiation by the atria. These premature beats could occur with varying frequency and if they alternated with a normal beat pulsus bigeminus was created. They occurred seldom in the young, occasionally in the middle-aged and frequently in the elderly. To these "extra systoles" was applied the name "Adult Type of Irregularity," and again the pulse was recognised as being of itself harmless.

The third form was found mostly in adults showing distinct evidence of heart failure. The radial pulse is completely irregular in time and force, the "a" wave is missing from the jugular pulse and the vein distends during ventricular systole instead of becoming flaccid.

The reasons for this phenomenon were not immediately apparent but Mackenzie was able by his observations to relate it to a bad prognosis. He therefore at first named it the "Dangerous Type of Irregularity" and described the jugular pulse as being of the ventricular type rather than the normal auricular form. Records further revealed this type to occur most frequently in old people and those patients giving a previous history of rheumatic fever. It was also found to occur in at least 80% of patients suffering from heart failure with the signs of oedema and enlarged liver. As a consequence he gave special attention to those patients in whom the irregularity might be expected to occur, and sure enough one such woman suddenly developed gross dyspnoea with a rapid and irregular pulse.

This classical case was first seen at the age of 31 in 1880, giving a history of rheumatic fever nine years previously, and a pre-systolic murmur was detected. Further attacks of rheumatic fever were experienced, and by 1892 symptoms of angina pectoris were present and an enlarged liver could be felt. Thus in 1898 the onset of the "dangerous" type of irregularity was observed coincident with the disappearance of the pre-systolic murmur. Mackenzie considered that this state was due to the absence of normal atrial systole and because of the post-mortem evidence of dilated and thin walled atria he called it atrial paralysis. The modern term for this state is, of course, atrial fibrillation.

Having obtained data sufficient to recognise the condition as a distinct clinical entity, Mackenzie set about studying its effects on the efficiency of the heart. At the turn of the century the universal theory which was held with regard to cardiac failure was that of "back pressure." By this was meant that valvular damage and incompetence allowed blood to be forced back into the lungs by a contraction of the left ventricle, and ultimately through the right side of the heart into the liver and the great

veins. He noted from his cases that signs of failure followed soon after the onset of fibrillation, and in one particular patient, periodic attacks of fibrillation were coincident with the onset of failure on each occasion. Paradoxically another patient also suffering from similar periodic attacks remained well at all times. However, his heart rate remained about sixty whether the atria were active or not. This suggested that the excessive rate in other cases caused ventricular exhaustion or inefficiency. Thus in 1899 came that flash of inspiration which is now one of the most fundamental facts of medicine. That is . . . *the power of the heart depends on its efficiency and the unimpeded action of its muscular walls.*

Furthermore these observations gave the basis for a sound prognosis to fibrillation, depending on the heart rate, and again a rational treatment could be introduced i.e. any drug which would reduce the ventricular rate to about 80 beats per minute. Mackenzie employed digitalis and tried to find in each case just how much of the drug was required to keep the heart in check. The success of these measures served to establish the use of digitalis in chronic heart failure whereas previously it had only been employed in acute cases.

Finally the true significance of the much feared pre-systolic murmur of post-rheumatic cases could now be judged, not by the severity of the murmur, but by the response of the heart to effort i.e. by observing its efficiency. Mackenzie once said "For want of a guiding principle I spent years and years in muck-raking." In fact the answer to his original quest

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of how to foretell danger in cardiac cases, lies not in the detection of an irregularity or murmur *per se*, but in the study of the RESPONSE OF THE HEART TO EFFORT, as indicated by the presence or absence of breathlessness or pain.

This was the "guiding principle," and serves to complete the triad of Mackenzie's philosophy regarding the study of symptoms:

- (1) It is necessary to detect the mechanisms of symptoms.
- (2) By recording symptoms wait and see their ultimate prognosis.
- (3) Try to find a guiding principle.

What of the man himself? He remained in Burnley until 1907, a period of some twenty-seven years and built up a considerable reputation in local medicine. Scottish in appearance, he had a kindly, bearded face, and was well loved if not completely understood by his patients. The novelty and mystery of his polygraph must have savoured of the occult to their simple souls, yet they could well realise his early poverty from the makeshift leather patches sticking to the soles of his shoes. With the publication of his book *The Study of the Pulse* in 1902, came recognition from abroad, mainly from Germany and America. Visitors such as Osler, Ritchie and Wenckebach went to the Burnley practice, but his teachings remained unknown to the leaders of medicine in the South. So, at the age of fifty-four, Mackenzie abandoned his safe and honoured position in the North to impose his views on a reluctant audience in London. His first year there was lean and expenses were high, but during this time he completed the writing of the book destined to bring success. Published in 1908 *Diseases of the Heart* was not merely a good account of disease but an exposition of disorders hitherto unrecognised by medical science, which was accompanied by the proof of instrumental and clinical verification.

Prosperity in practice and profession followed rapidly: a consultancy and department of cardiology at the London Hospital, election to Fellowship of the London College of Physicians and ultimately a knighthood. But insidiously the man was being stifled. He was now regarded as the father of the new school of cardiology, the Neo-cardiologists or Mackenzie School. This latter was regarded as the epitome of scientific observation, and it soon became apparent that all this accord was to his polygraph rather than to his methods. Cardiology might well be split into certain eras, those of the murmur, the polygraph and irregularity, the E.C.G. and infarction, and now maybe the haemodynamic era. Each has its own masters and when thinking of Mackenzie many could see no further than the polygraph. Here is the man who voyages to fresh continents in a new kind of boat, and on his return is hailed only as the inventor of the boat.

At the end of World War I, at the age of sixty-five, he disappeared from London almost as silently as he had arrived and returned to general practice in St Andrews. Space forbids a full description of his work there, or even of his other investigations in London and Burnley. These included investigations into the nature of pain, especially that experienced in angina pectoris from which he himself died in 1925. He also studied the treatment of soldier's heart in conjunction with Thomas Lewis, and his final observations in symptomatology resulted in an attempt to formulate certain basic laws in the book of *The Basis of Vital Activity*.

What now can be learned and gained from the study of this man's life? A philosopher might well think that his methods of work are better than his results. Of general practice Mackenzie wrote "Who is the man that has the opportunity to see the early phases of disease and the circumstances which favour its onset? There is only one such person and that is the

general practitioner." Professor John Hay of Liverpool wrote of Mackenzie, "He is the great example of what can be done and accomplished, not in spite of the burdens of general practice, but in the virtue of the very opportunities afforded by such a position."

It can be seen that these opportunities, and the need to approach them in the Mackenzie manner, are still of vital importance despite the undoubtedly changing face of medical practice. One only has to remember the investigations of Dr Pickles in Wenslydale, or the recent clinical trials carried out in several practices to find support for this. Reduction in practitioner load, availability of the services of a statistician and more widespread facilities for general practice investigations might be required before anything of any great consequence can be done in this field. Yet the truth remains that if we are to achieve the twin goals of finding the early symptomatology of disease and earlier diagnoses, such an approach is necessary.

Sir James Mackenzie placed cardiology on a firm and accurate foundation. He left a demand for the study of symptoms and the elucidation of their prognostic significance; and a study of his principles would lead to the reappraisal of much that has passed for progress in the last thirty-five years.

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