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"James Mackenzie: Research in General Practice"

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Abstract
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In defining how this came about, three main factors seem to emerge as especially significant in his early years. As an apprentice to a Perth chemist, he found that his " natural bent lay in a practical rather than an academic direction". In his preclinical years at Edinburgh University,
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"JAMES MACKENZIE : RESEARCH IN GENERAL PRACTICE"

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From a dissertation read before the Society on Friday, 20th October, 1967.

Born the son of a Highland farmer in 1853, near Scone in Perthshire, James MacKenzie was destined to become a leader among medical men. He utilised the opportunities of a general practitioner to study the early symptoms of disease and the bearing of the disease on the patient's future life.

In defining how this came about, three main factors seem to emerge as especially significant in his early years. As an apprentice to a Perth chemist, he found that his "natural bent lay in a practical rather than an academic direction". In his preclinical years at Edinburgh University, he experienced some difficulty in passing examations, for they were contrived for the purpose of testing memory rather than the power of reasoning — MacKenzie had difficulty in remembering isolated facts, but if facts were "related in some consecutive manner, they could not only be remembered, but their bearing on one-another fully appreciated". Thirdly, MacKenzie studied in Edinburgh at a time when the medical school was undoubtedly the foremost in Great Britain — the "very vanguard of new ideas in medicine and surgery". Here MacKenzie's scientific outlook was nurtured and his inquiring instincts sharpened by his training in the midst of the controversies of the Listerian era, and further stimulated during his membership of the Royal Medical Society in 1878.

BANK PARADE, BURNLEY

In 1879, he entered the largest general practice in England at that time at 68, Bank Parade, Burnley. It has been commented that "there was nothing in his environment to stimulate him to do anything more than conscientious routine work in the diagnosis and treatment of cases" — but on the contrary, MacKenzie found inspiration in both his professional colleagues and the lot of his patients.

The senior partner in the firm was Dr. William Briggs, and it was his confident certainty about the outcome of his patients' illnesses that started MacKenzie off on his long study of prognosis. That such a study was vitally necessary became apparent to MacKenzie as he worked among the people of the Lancashire cotton town.

Burnley lay in the wake of the Industrial Revolution during which time it had become a "shocking mix-up of mills, foundries and pits", each surrounded by rows and rows of back-to-back houses. The lower-class population was outrageously exploited by the factory employers, wage disputes causing grim strikes and frequent unemployment; the widespread drunkenness and crime, plus an absence of adequate sanitation, further added to the misery of the inhabitants. Contagions abounded — epidemics of cholera, typhoid, smallpox, diphtheria and scarlet fever were commonplace, children under five years being particularly accursed.

As MacKenzie worked among the poorest families in the town, he soon came to recognise the need for accurate prognosis, for he would sense the fear that lay behind such questions as "What is going to happen to me?", or "When can I get back to work?" When the only means of employment involved strenuous labouring in mine, mill or foundry, his answers

to such questions became of critical import; for advising a patient to rest might condemn him to complete idleness and his family to poverty, the workhouse or starvation.

But upon what principles could he base an opinion? He did not have Dr. Briggs' "clinical instinct", and had neither learnt in Edinburgh, nor could find in the literature any indications as to the prognostic significance of the signs and symptoms which his patients presented; he was similarly disturbed to find that he knew nothing of the mechanism of these signs and symptoms.

MACKENZIE'S POLYGRAPH

Mackenzie is perhaps best known to undergraduates as the co-inventor, with a Padiham watchmaker, of the Ink Polygraph (the poor relation of the Electrocardiograph), with which he could simultaneously record arterial and venous pulsations. Yet I feel that a prolonged description of this and earlier instruments and discussion of interminable polygraph traces would not really be a fitting tribute to MacKenzie's work.

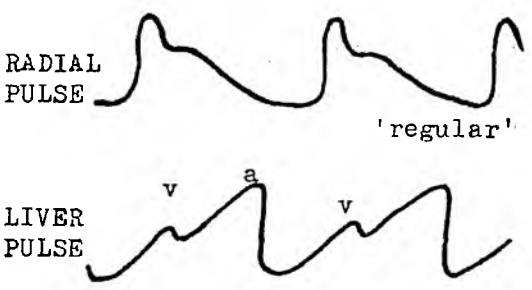
In his practice, MacKenzie saw a great deal of cardiac failure which was largely of rheumatic origin, and a single case history will serve to illustrate his experimental findings and his progression of thought concerning his patients and their traces. In 1892, he attended a woman of 42 years who had a history of four attacks of rheumatic fever; a presystolic murmur had followed and had become more pronounced, indicating progressive mitral stenosis. At this time, the woman suffered from weakness and some shortness of breath: on examination, her apex beat was in the 5th space, the neck veins were not raised and the liver was two finger-breadths below the costal margin and pulsating. Her Kymograph traces were largely normal:

(Figure 1)

This pattern continued for some years until in 1898, and with dramatic suddenness, she was seized with great breathlessness and distress, and was found to be in marked failure and extremely ill. On examination, her pulse was very rapid and irregular both in time and force; MacKenzie knew this pulse as the "Dangerous Type of Irregularity". The apex beat was in the 7th space, and the liver was three inches prominent and pulsating; there was a large J.V.P., and the ventricular form of the jugular venous pulse (showing absence of "a-waves") was recorded:

(Figure 2)

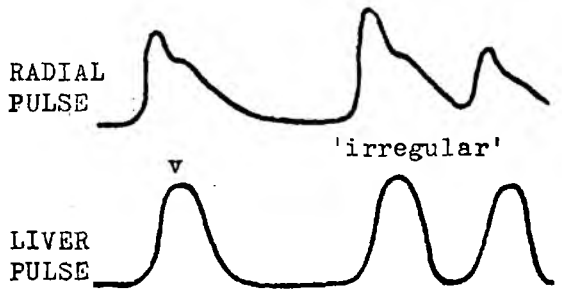
Fig. 1.



'a' = wave due to atrial systole.

'v' = wave corresponding in time to (late) ventricular systole.

Fig. 2.



N.B. no 'a'-waves.

However, on auscultation, MacKenzie was perplexed to find that the presystolic murmur, which had persisted in this heart for over 18 years, was absent! He discounted the possibility that the narrowed valve had opened up again, and dismissed the current view of the day that in failure, when the right ventricle dilated, it pushed the left ventricle away from the chest wall so that the murmur could no longer be heard.

Then the truth came to him; the absence of the 'a-wave' in the J.V.P. indicated that the auricles had ceased to contract, this contraction against the resistance of the stenosed valve having formerly produced the presystolic murmur. When the woman died a year later, MacKenzie found greatly distended, thin-walled atria at post-mortem. He considered that the

atrial distension precluded its rhythmical contractility and thus coined the term "auricular paralysis"; however, he could not explain the ventricular irregularity on the basis of such a paralysis: full elucidation came from Sir Thomas Lewis' studies of junctional tissues in the heart, and from E.C.G. findings was evolved the term "atrial fibrillation".

By such investigations, then, MacKenzie showed that the inability of the heart to maintain the circulation may be due to a disorder of any of the factors upon which normal heart action depends e.g. its rhythm, the condition of the valves, or inherent defects in the myocardium.

Now, MacKenzie's investigation of heart failure was an extension of his work in the busy Burnley practice; all who enjoyed his hospitality at Bank Parade, including Osler, Cushny and Wenkebach, marvelled how this hard-worked G.P. could fuse so successfully with the enthusiastic research-worker. His discoveries resulted from the collection of scientific experimental data and the employment of sound reasoning; he always insisted that it is the analysis and consideration of recordings that is important in research, and he would sit for hours thinking over his patients and their traces, often in the early morning after a cold bath, or in the evening while his wife played the piano to him.

WAIT AND SEE

In addition to recognising the meaning of signs and symptoms, MacKenzie appreciated the importance of knowing what bearing they may have on the patient's prognosis. He had been much impressed by Dr. Briggs' ability to foretell the outcome of his patients' illnesses, but was dismayed that this knowledge could not be passed on to new generations of doctors. It then occurred to him that Dr. Briggs' mysterious power was nothing more than accumulated experience — every time his senior partner considered a new case, he remembered hundreds of old cases and how they had fared. Thus MacKenzie began his "wait and see" method of defining prognosis i.e. in order to assess the prognostic significance of any symptoms, patients presenting the symptom would be watched over a period of years to determine what happened to them.

By this means, he began separating the dangerous from the benign forms of pulse irregularity; knowledge of the pulse had been "not merely imperfect, but chaotic", he said, for though these irregularities were easy to recognise, their "significance was completely misunderstood".

MacKenzie came across many children demonstrating the "Youthful Type of Irregularity" (sinus arrhythmia), where the heart rate varies with the phase of the respiratory cycle. His "wait and see" method proved to him that the condition was physiological — he found the irregularity distinct in perfectly healthy children, and in watching them grow into adulthood, noted that they never showed any signs of cardiac weakness. However, he was dismayed to find that outside his practice, such children were variously treated, and when these failed to remove the supposed affliction, the children were labelled as "incurables" and told to restrict all physical activities.

The benign nature of sinus arrhythmia is now a standard part of medical knowledge, yet the discovery of this is seldom attributed to MacKenzie's method; this 'negative aspect' of his work has been considered less valuable than his polygraph traces, but surely, as MacKenzie himself once remarked, his "greatest contribution was to have freed a large number of people from fear". Hence the saying — "Cupid never broke hearts so fast as MacKenzie mended them".

Similarly with regard to the "Adult Type of Irregularity", (the premature systole), he was again confronted with the "universal idea in the medical mind that something mysterious is very much amiss with the heart that presents an irregular rhythm". He demonstrated that the premature systole indicates ventricular stimulation prior to the termination of normal disastole, such stimulation being either momentary (giving rise to a single missed-beat) or lasting for longer period (producing a "stumbling" pulse). And after years of observation of hundreds of patients, his method of "wait and see" proved to him that "the irregularity is perfectly consistent with good health . . . and a sound heart". That is not to say that no significance should be attached to this sign: it is commonly present in patients who are dangerously ill e.g. with valvular heart disease or chronic nephritis, and who died from congestive failure, but "then it is only one of the many symptoms that testify to the weakness of the heart", he said, "and is of no serious significance in itself".

As a result of this work, he propounded his "law of associated phenomena" i.e. " a serious prognosis should not be given on the evidence of a single symptom or sign". Thus, the pre-

mature systole has no consequence when it is the only abnormal sign or occurs in mild cardiac failure.

BELOVED PHYSICIAN

Although MacKenzie's findings were very slow to be accepted (and on occasion were actively resisted) in the great centres of medical learning, the doctor was loved and revered by his patients in the Burnley practice. There was no "hush of self-importance" about him as he travelled about the town in the first motor car to be seen there, and he always explained his methods to his patients and the reasons behind his diagnosis. Above all he considered it a duty to tell every patient (or those responsible for him) the likely outcome of his illness. His colleagues marvelled at the confidence in him which the dying and distressed displayed; small wonder he came to be known as the "beloved physician".

PRINCIPLES OF PROGNOSIS

Although MacKenzie had defined the mechanism of various pulse irregularities — sinus arrhythmia, premature systoles and auricular paralysis — his wait and see method had only demonstrated that the former two were benign; of auricular paralysis, he knew that some patients die soon after the commencement of the irregularity while others go on for years with little trouble; he was thus still unable to recognise the earliest signs of heart failure, and thereby foresee danger in the patient's future.

About this time, he was pondering over the contrasting prognoses of a patient with premature systoles as the only abnormal sign, and another showing no abnormality on clinical examination yet who would be seized with a spasm of anginal pain on walking 100 yards. He conceived that the earliest symptoms of heart failure are shown in a response to effort, and thus evolved his great principle that "the first sign of heart failure is a diminution in the reserve force of the heart muscle". The extent of the response to effort offers the most valuable aid in judging the efficiency of the heart and circulation and hence in assessing the patient's prognosis.

He thus taught that attention must be paid to symptoms as a guide to prognosis, the "commonest being shortage of breath, occurring on such exertion as the patient was wont to undertake without discomfort".

Artificial tests like asking a patient to hop about a room and then counting his pulse or taking his blood pressure, are of little value; the information required to make an estimate of the amount of reserve force is obtained from the patient's own experience of responses to exertion e.g. walking up a hill after a meal or into a wind.

A story is told of a visit by MacKenzie to the Royal Infirmary of Edinburgh, during which he was asked to opine on the circulatory condition of a woman awaiting cholecystectomy. She had been found to have anomalous heart-sounds, and the surgeon doubted the wisdom of operating (for as with irregularities, murmurs, of whatever nature, were considered to be of serious significance at that time). MacKenzie talked to the woman before a crowd of onlooking staff and students, and soon learnt that she lived in a top flat and shopped for a family of six, finding no difficulty with the stairs. He straightaway told the surgeon to operate with confidence so far as the function of the heart was concerned. The crowd drifted away, disappointed at seeing nothing of the famous man's skill in examining a patient, and largely unappreciative of the important lesson which he had taught them.

CONCLUSION

So MacKenzie, hailed as the inventor of the polygraph and a leader among research scientists of his day, always maintained that bedside evidence, particularly the patient's history, was always of primary importance over instrumental and laboratory evidence at second hand. He taught that pulse irregularities and murmurs achieve significance entirely by virtue of their relationship to, or effect on, the heart's efficiency as a pump (as reflected by a patient's symptoms during responses to effort).

As a family doctor, MacKenzie knew his patients in health as well as disease; it was only while working among the people of Burnley that he learned the need for the information which his researches were to give him, and it was only in general practice that he could carry out these studies, for there he saw his patients throughout the whole course of their illnesses.

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