

## Electrocardiography Misused

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“There are types of heart action upon which other methods are nearly, if not quite, silent; knowledge of these conditions is in the almost exclusive possession of electrocardiography.”

These words written by Sir Thomas Lewis thirty years ago are as true today as when they were written, but in the light of present trends it may well be asked whether electrocardiography is to be relegated to a minor station among the techniques to be employed by cardiologists? Is it to be regarded as a procedure that can be picked up by anyone in a few hours or days? Is it suitably applied daily to patients in whom there are not specific indications for this? Are electrocardiograms of indeterminate provenance and devoid of the hall-marks of competence to be accepted simply because they are heart records of a sort? Is it a good moment to slacken standards of technique for dubious supposedly time-saving methods when so many manifestly unacceptable records are circulating? How much longer must patients and those who seek life assurance have their prospects of health and economic security jeopardized by slipshod procedures and false interpretation of electrocardiograms?

No one would dispute that electrocardiography cannot be a substitute for history taking and clinical methods, or that elaborate intracardiac procedures can supplement the role of the electrocardiograph. However, taking a broad view of cardiology (not excluding the sometimes difficult diagnosis of a healthy heart), this instrument transcends in importance the catheter, the dye-dilution methods, ultrasound, and all the rest. Indeed it must be of crucial value and importance in scores of patients for every one in whom the “sophisticated” methods are required. Precision and security in the diagnosis of coronary heart disease are as important as the discovery of a shunt. It is worth while to consider some of these questions and issues in further detail.

Those who think that cardiography can be picked up in a few hours or days must understand that there are people who could never become trustworthy electrocardiographers, just as there are those who

could never become good doctors. Just as the overbearing, noisy, and self-centred can never be successful with the sick, so the nervous, the excitable, and the slapdash can never expect to take first-class electrocardiograms. The operator has not only to control calmly the patient, but also well-meaning attendants who chatter or cause distractions at or near the bedside. These are not fastidious requirements, they are vital for the production of secure records.

A false outlook on the place of electrocardiography in clinical medicine is becoming widespread. Mass production may mean and sometimes must mean that untrustworthy records are being produced; it may also show that needless demands are being made upon the service. Unnecessary tracings are only a waste of time and money, and may well erode the morale of the patient. Another false outlook is manifested by those clinicians, working perhaps from a casualty or out-patient clinic, who request an electrocardiogram “for exclusion of cardiac infarction and discharge if negative”. To allow a negative tracing to override the indications provided by the history and clinical state is a serious abuse of the method.

In recent years there has been an increasing tendency to dispense with methods that have stood the test of time in electrocardiography. This has been due in part to the development of machines of high input impedance that make elaborate preparation of the skin of some patients needless. But many operators do not possess such machines. Indeed in Great Britain the machines by far most widely used are the Cambridge Electrite and Transrite models, of which about 2000 are in operation. The electrical system of this equipment is such that preparation of the skin with electrolyte jelly is essential. The abandonment of absolute cleanliness of electrodes and of careful preparation of the skin is a very common cause of unsightly and misleading traces. It may be true that with a clean electrode applied to the skin without any inter-

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mediate electrolyte a tracing can be obtained after some delay, but why not save a few minutes by applying electrode jelly? In any case, whatever the machine, there are about 5 per cent of people in whom the skin must be well cleaned before the electrodes are applied; in them unsatisfactory records are likely to be obtained if electrolyte jelly is not used. Thus, in infants, coloured subjects, and those employed in greasy or dirty occupations scrupulous attention to detail in applying electrodes is essential. Lack of care in these respects may lead to tracings that are obviously abnormal but to the experienced eye not abnormal in any clinically recognizable way; this is one of the clues to a technically faulty record. Even more unfortunate is the production of a tracing that counterfeits myocardial ischaemia, as may well happen if the skin resistance is abnormally high. When the cardiologist recognizes any serious technical fault in a cardiogram that record must be discarded *in toto* and allowed no further part in deliberations.

The production of electrocardiograms should be restricted to two classes of operator: trained cardiographic technicians whether in hospital or private practice, and physicians who are in a position to recognize a technically faulty record and to interpret themselves acceptable records. To contravene this principle is to court serious mistakes. Thus it is unsuitable to put medical students to take electrocardiograms unless they have had more than haphazard instruction: as there is not room in the curriculum for proper training, medical student cardiography is a waste of time and material; and it may be a source of bad mistakes. It is just as undesirable for medical men to undertake cardiography if they have not the requisite understanding of the method and of cardiology to recognize technical imperfections and to interpret the records correctly. It must be within the experience of all cardiologists to be confronted by a complex case in which tracings constitute part of the evidence available, and to find that these have to be discarded on technical grounds, or that a technically passable record has been misinterpreted.

What are the main technical faults in electrocardiograms encountered by the consultant? Somatic tremor (due often to the lack of skill of the operator), an undulating or drifting baseline (due often to failure to exclude alternating current interference), lack of standardization marking before and during the record (due to ignorance or haste), damping of the curves (often due to inadequate preparation of electrodes or patient's skin), records that are grey and grey (instead of black and white), and, last but not least, traces that are defaced and obscured owing to careless handling or mounting.

Some of these technical faults are due to loss of voltage in dry cells that power the machine; this may result in complexes that are of too low voltage and in deformity of the QRST patterns. In relation to failure to control the patient and to secure a steady baseline, it may be remarked that some equipment is fitted with a device designed to reduce the effects of muscle tremor; the use of this reduces the amplitude of the curves and is an additional cause of damping. As mentioned above, dirty electrodes, faulty connexions, and inadequate preparation of the skin (when apparatus is of such a kind that this is important), are very common causes. An elementary mistake in cardiography is failure to keep discrete the areas of skin prepared for the application of chest electrodes, with the result that complexes from V4 to V7 are almost identical.

Now that, in the past ten years, it has become possible for coronary patients to acquire life assurance, electrocardiography has assumed greater importance in life assurance examinations. Indeed, the sums assured at risk in the Coronary Pool of the Mercantile and General Re-Insurance Company of London now exceed £1,900,000. Electrocardiography, properly used, may operate in certain ways: it may protect the Office from loss over substandard lives—proposers who are the subjects of ischaemic heart disease, perhaps unknown, perhaps undisclosed. It may be a turning point in the acceptance or otherwise of a life with a doubtful cardiac history. On the other hand, it must be within the experience of all who have had much to do with life assurance work that grave injustice may result from inexpert examination: cardiograms that are technically faulty may counterfeit coronary curves, with serious and unwarranted personal and financial detriment to the proposer who may in error be unjustifiably declined or have his premium severely loaded. Even if the record is technically correct, inexpert interpretation may have the same damaging effect. A common instance in point is the sickle-pattern so often thought to represent ischaemia but readily shown for its true innocent self by the expedient of a simple cardiographic exercise test. Other common causes of misinterpretation are the J-depression mistaken for ischaemia, the small T-waves in records taken after a meal rich in carbohydrate, and the Q-wave in lead III due to a transverse lie of the heart. Finally, too great significance is often attached to right bundle-branch block in the absence of other abnormalities.

Criticism of the methods of electrocardiography and of the records produced is not confined to hospital work or private practice. It is also justifiably levelled at some work that should be of the highest standard, namely, papers submitted for publication in cardiological journals. It might be

imagined that here at least the standard would always be high. But this is not the case and work may have to be declined largely on the score of unacceptable or unreproducible tracings. Many might feel that if there is not the grip or thoroughness to ensure accurate dependable cardiography, there cannot be the capacity to produce a work worthy of inclusion in a scientific journal. Greater force is lent to this conclusion when it is remembered that a contributor will be selecting his best records when publication is in view.

The writer concludes by making a plea for electrocardiography to retain its rightful important and eminent place in the procedures used for the analysis of cardiac function and the detection of disease and disorder. The circumstances that threaten its status have been reviewed. They amount to a misuse of the method. If cardiologists are to receive the benefit and information that correct cardiography can bring, they must be vigilant and ensure that the techniques used in their services are irrefragable.