

Electrocardiographic Service for General Practitioners

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For just over five years a full laboratory, radiological and electrocardiographic service has been offered at the Northern General Hospital, Sheffield, for the use of general practitioners. This provision is in line with the recommendations of the Annis Gillie Report. Careful records have been kept of the patients referred for electrocardiography and a note of the diagnosis made whenever a report was requested so that the general practitioner's clinical assessment could be compared with the assessment of the patient's electrocardiogram.

The medico-legal implications of providing the electrocardiographic service were considered by the Regional Hospital Board. In order to provide a viable service, it was clearly necessary that patients coming to the hospital for electrocardiography would not normally be seen by a qualified medical practitioner. The service envisaged would be comparable to that provided for patients on the ward, in that the technicians would be entirely responsible for the recording of the electrocardiogram. With some hesitation, it was accepted that this arrangement should be put into effect. Three measures were adopted to protect the service from possible medico-legal repercussions. On the printed forms provided for requesting an electrocardiogram, it was clearly stated that the patients would not normally be seen by qualified medical staff at the hospital. It was also stated that the report on the electrocardiogram would be given by a consultant, and on the folder in which the electrocardiogram was returned to the doctor, in bold type the following sentence was printed, 'A normal electrocardiogram may be found in patients with serious heart disease'. It was felt that these measures would protect the hospital against possible litigation arising either out of the death of the patient attending for an electrocardiogram or a misplaced reliance on the report that the electrocardiogram was normal.

The possible demand on a general practitioner service was quite unknown, and in order to prevent the hospital service suffering, two measures were planned. The first was a telephone appointment system for out-patient electrocardiograms. This was intended to protect the technical staff from a rush of patients at times when they were not able to cope. After three years

this appointment system was abandoned as the referrals caused only minor pressure on the service, and the time spent in answering the telephone was thought to be greater than that saved by making appointments. Patients are now asked to come at any time convenient to them between 9.0 a.m. and 4.30 p.m. on weekdays.

The second factor protecting the hospital was the delay in reporting the electrocardiograms. If a general practitioner was prepared to interpret the electrocardiogram himself, it was given to the patient to take back to him. If a report was requested, it was invariably returned by post with one to three days' delay. This delay was introduced after careful consideration. It seemed that electrocardiography would be requested under two quite different circumstances. In one case, the patient's symptoms or past history might suggest that an electrocardiogram would provide a useful indication as to the possibility of a cardiac disorder, and such a patient could reasonably be sent up to hospital for an electrocardiogram at leisure. In other circumstances, an electrocardiogram could be needed urgently to establish a diagnosis. This latter use of electrocardiography is primarily met either by domiciliary visits or referral of the patient in an ambulance for admission to hospital as an emergency. It was thought that the delay in supplying reported electrocardiograms would make the use of the out-patient ECG Service unsuited for the diagnosis in emergencies. This, in general, has proved to be the case.

PROVISION OF TECHNICAL SERVICE

Printed forms were provided for the general practitioners to request electrocardiograms. The secretariat of the Cardio-Thoracic Unit issued the forms on request by post. On one side the details of the doctor requesting the electrocardiogram and the patient for whom the record was required were filled in by the doctor. On this side also was the printed warning that the patient would not be seen by a doctor at the hospital, and the statement that a report would be issued, if required, by a consultant. It was also intimated that if a report on the electrocardiogram was required, the other side of the form should be filled in completely and that the electrocardiogram would be returned by post after a few days. The reverse side was printed so that a brief history could be given with the least amount of writing. Spaces for the patient's age, sex, whether or not on digitalis or other drugs, blood pressure, clinical history and diagnosis were to be filled up if a report was required. In general, these forms have been completed very carefully by doctors requesting a report. On odd occasions, inadequately completed forms have been found to coincide with patients whose electrocardiogram was outside normal limits. In such cases, the report has been limited to the statement that the electrocardiogram is

abnormal but the inadequate clinical data makes the reason for this abnormality obscure.

Reporting on these electrocardiograms has rarely presented any difficulties. There are well-defined limits of normality described in textbooks on electrocardiography and internationally accepted patterns of abnormality. However, some psychological adjustment in the physician reporting on these electrocardiograms is necessary. Cardiologists are primarily clinicians, and it is necessary for anyone embarking on a service of this kind to accept limitations similar to those experienced by a laboratory worker. Thus, the cardiologist reporting on occasional electrocardiograms has to wonder in a somewhat frustrated fashion whether the patient has had a cardiac infarction, a pulmonary embolism, or perhaps some congenital abnormality affecting the heart, or even some disease of the lung. It is very evident from published work in this field that some clinicians relinquish this aspect of their art with great reluctance.

The growth of the service has been of considerable interest. In Table 1 the referrals from 1965 to the present time are shown analysed by quarters of the year. Over the past eighteen months the rate with which patients are being referred for electrocardiography by general practitioners has settled down to a little over 1,000 a year. Graphing of the results shows that there is now a gradual upward trend of 10 to 15 per cent per annum. This is likely to indicate that we have now reached saturation point, as a similar trend can be seen in any routine laboratory service in which the number of patients and the number of doctors requesting investigations are constant. There has been a

TABLE 1. Numbers of Patients referred for Electrocardiography

	1965	1966	1967	1968	1969	1970
January to March	—	91	273	185	254	264
April to June	39	94	257	172	262	286
July to September	50	149	213	221	266	
October to December	77	125	133	318	252	

similar change in the numbers of doctors for every 100 referrals to the Department. In the first year, for every 100 referrals there were 33 doctors referring patients; in 1970, the corresponding figure is 57 doctors referring patients. There are 220 registered general practitioners in the area served, and analysis shows that, at present, about 80 per cent make use of the service.

PATIENTS REFERRED FOR ELECTROCARDIOGRAPHY

To provide some idea of the sort of patient referred for electrocardiography, an analysis was made of the reported electrocardiograms. This was done by extracting the original request form on which had been written the diagnosis made on the electrocardiogram. The first 250 patients referred for electrocardiography (1965), were compared with 150 referred in May and June 1970. This analysis is necessarily incomplete as it could not include any patients referred to the Department in whom a report was not requested as no clinical information was given on these patients by the doctors. The first thing that emerged was an interesting change in diagnostic label. In the first 250 patients the cases thought to have coronary artery disease were diagnosed either as coronary thrombosis or angina of effort, with virtually no exceptions. In May and June 1970, however, coronary thrombosis remained as a diagnosis but angina of effort had been virtually replaced as a diagnostic label by ischaemic heart disease. This suggests an increasing caution in attaching a firm diagnostic label to a patient with chest pain, resulting from five years' acquaintance with electrocardiography. A further change that could be regarded as educative was the complete disappearance in the second group of patients of a request 'To exclude heart disease'. This phrase occurred very occasionally in the first 250 requests and had been met on each occasion with a referral on the back of the ECG folder to the printed statement that a normal electrocardiogram did not exclude severe heart disease.

The most frequent clinical diagnoses are shown in Table 2. As has already

TABLE 2. The Most Frequent Diagnosis in Patients Referred for Electrocardiography

Diagnosis	1965 %	1970 %
Coronary thrombosis	40	18
Angina of effort	15	57
Functional	5	3
Muscle strain	1	3
Paroxysmal tachycardia	4	3
The diagnosis 'Ischaemic heart disease' has been included under 'Angina of effort'.		

been mentioned, the most significant change is in the diagnosis of coronary artery disease, where there is a notably more cautious approach. A surprising rarity is the very occasional request for an electrocardiogram in an established irregularity. The remaining diagnoses all occurred in less than 3 per cent of

the patients referred and have not been given in detail. They ranged from myocarditis to aortic stenosis..

The incidence of abnormal electrocardiograms in patients referred with a clinical diagnosis of coronary artery disease is given in Table 3. In patients

TABLE 3. The Incidence of Abnormal Electrocardiograms in Patients Referred with a Clinical diagnosis of Coronary Artery Disease

Clinical diagnoses		Normal	Infarct	Ischaemia	Abnormal Total
Coronary thrombosis	1965	31	62	8	70
	1970	33	52	14	66
Angina of effort	1965	49	22	11	33
	1970	78	11	7	18

Results are expressed as a percentage of those referred with the diagnosis considered. 'Angina of effort' includes the diagnosis 'Ischaemic heart disease'.

on whom a firm diagnosis of coronary thrombosis was made, an abnormal electrocardiogram was found in 70 per cent in 1965 and 66 per cent in 1970. If only these patients referred for an electrocardiogram after domiciliary treatment of an illness believed to be coronary thrombosis are considered, the percentage with abnormal electrocardiograms rises to over 80 per cent in both years. These figures are necessarily minimal since an electrocardiogram indistinguishable from a normal tracing will be recorded in a number of patients 4 to 6 weeks after a coronary thrombosis. The conclusion must be that many patients are successfully treated at home for coronary thrombosis and that the general practitioner is usually correct in making the diagnosis.

When the patients referred with a diagnosis of angina or ischaemic heart disease are considered, the numbers with positive electrocardiograms are much smaller. In 1965, 33 per cent were abnormal electrocardiograms, in 1970 only 18 per cent. The most likely explanation of the great rise in the percentage of normal electrocardiograms in this group is that patients with non-specific chest pain were more readily referred for an electrocardiogram.

EMERGENCIES

No patient referred for an electrocardiogram by a general practitioner has died within the hospital grounds. Three patients are known to have died between the recording of an electrocardiogram in the Department and the return of a reported electrocardiogram to the general practitioner. The electrocardiogram was inspected in each case; two were within normal

limits and the third showed moderate ischaemic changes. Ventricular fibrillation occurred in one patient during the recording of an electrocardiogram. The technician making the recording immediately applied external cardiac massage and called for medical help. The patient was resuscitated, treated in hospital for three weeks for a small cardiac infarct, and is now back at work. Severe angina has occurred on a number of occasions during the patient's attendance at hospital and has accounted for approximately six admissions to hospital each year. Electrocardiographic evidence of recent infarction has been observed about as frequently, and reported to the medical staff by the technician making the recording. These patients have been interviewed and in most cases consented to admission to hospital. Two patients have refused admission. Their doctors were informed by telephone and no ill-effects appear to have followed.

This aspect of the service is undoubtedly its weakest part. The safe advice given to patients depends entirely upon the capacity of the technician making the recording to recognise worrying changes in the electrocardiogram and to consult a doctor in the Department. All technicians are trained in external cardiac massage and most have at least seen the technique in use. The successful running of this service is largely dependent on the high level of training achieved.

CONCLUSIONS

The value of a service of this kind is very difficult to assess. The number of electrocardiograms performed currently for general practitioners is just over 1,000 each year. In Sheffield as a whole about 25,000 electrocardiograms are recorded annually, and of these 8,250 are recorded at the Northern General Hospital. It is unlikely that the 1,000 odd patients sent for electrocardiography by their general practitioners would all have had an electrocardiogram recorded if it had involved an out-patient appointment for them to see a physician. In this respect, at least, the patient has benefited from the service. The number of patients referred who have been found unexpectedly to have evidence of coronary artery disease has been surprisingly low, less than 1 per cent in both series analysed. It also seems reasonably certain that the load on the out-patient department has been reduced. Referrals of patients to the hospital following an illness treated at home used to be fairly common in the 'Cardiac Out-patients'. The reason for referral was basically a retrospective diagnosis, and making it was a singularly unrewarding exercise in most cases since a normal electrocardiogram did not exclude a previous infarct, and an abnormal one viewed six to eight weeks after the infarct had little relevance to the purpose of the out-patient department. Since the

introduction of the service for general practitioners this type of referral has virtually disappeared, with benefit to the patient, the general practitioner, and the hospital.

The service for general practitioners has not replaced the need for domiciliary electrocardiography. With rare exceptions the general practitioner has distinguished between the ill patient requiring a diagnosis at home and the doubtful history requiring an electrocardiogram as a small part of the clinical assessment of the case.

One fact emerges with some prominence. There is a clear need for prospective study of the results of the domiciliary treatment of cardiac infarction. If the electrocardiographic pattern is taken as a reasonable index of the size of the infarct, it is clear from the records seen that major infarctions have been treated at home in patients who had subsequently reached the Cardio-Thoracic Unit on foot for an electrocardiogram. Statistics for the hospital mortality in the treatment of cardiac infarct range from 10 to 40 per cent, depending on what patients are included in the analysis. It is a reasonable assumption that the domiciliary mortality for the treatment of infarction is well under 25 per cent since no general practitioner is likely to continue to treat at home an illness with a risk of this kind. Any investigation into this very interesting aspect of the treatment of coronary artery disease will have to attempt some kind of balance of the advantages of the Intensive Care Unit against the benefits derived from the tranquility of a domestic environment.

It seems reasonable to conclude by attempting to assess the value of this service to the general practitioner. Hospital medicine has been changing over the last quarter century as specialisation has increased. This trend is likely to continue. The hospital is likely to become increasingly a place for highly specialised investigation and treatment, of which coronary care and the elucidation of dangerous arrhythmias are but two examples. This type of activity is very costly, but it seems likely that the provision of services of the kind described here will reduce costs by permitting a high degree of selection by general practitioners before patients are referred to hospital. It is possible that the service provided for the general practitioner will ultimately become redundant in that groups of general practitioners will have their own electrocardiographs and be competent to interpret their own tracings. We provide in Sheffield regular courses in the interpretation of electrocardiograms, and an increasing number of Health Centres run by general practitioners have their own machine. We have now reached a stage where certain practices in Sheffield, instead of having patients referred for electrocardiography, send occasional difficult electrocardiograms to the Cardio-Thoracic Unit for interpretation.