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FAULTS IN THE DIAGNOSIS AND MANAGEMENT OF CARDIAC PAIN*

BY

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Pain over the chest is a common complaint, and a diagnosis implying its cardiac source has become common custom. If it were true that cardiac-like pain is often regarded erroneously as cardiac pain and so leading to unwarranted invalidism, and that the treatment of true cardiac pain is often mismanaged leading to unnecessary and protracted invalidism, the commercial and industrial life of a country could suffer appreciable dislocation, while discordancy would enter many homes and disrupt their customary calm. Here, therefore, lies a social problem of considerable magnitude.

FAULTY DIAGNOSIS

That diagnosis often miscarries in patients with chest pain receives emphasis from the fact that during a period when 1,000 consecutive cases of cardiac infarction were being assembled 370 others were found with chest pain which was indistinguishable from true cardiac pain in regard to place, character, and response to exercise and to rest. The electrocardiogram, however, was normal in these cases, and subsequent investigation and supervision proved that the pain arose from an extracardiac source. This erroneous interpretation of the cause of the pain stems from the sparsity of physical signs, which leads inevitably to the placing of undue reliance on the patient's history. Nothing is so calculated to mislead in diagnosis as the attitude so prevalent to-day that pain in the chest, especially if identified with effort, is *angina*.

The conditions that mimic cardiac pain are many, and included among them are fibrositis, pericarditis, disease of the mediastinum or pleura, involvement of nerve stem or roots, and even neurosis. These when added together, however, pale in significance compared with dyspepsia, which can so closely ape cardiac pain that it often confounds diagnosis. In order to avoid a wrong diagnosis of cardiac-like pain it is necessary to heed certain truths that concern the clinical history, the absence of cardiac signs, the electrocardiogram, and the presence of signs that support a non-cardiac source of the pain.

The History

A man of 50 with closed fist resting on his breast-bone as he describes a sense of tightness on walking that is relieved by halting usually suffers from cardiac pain, but it should be known that in one among five

this symptom arises from a flatulent dyspepsia. It is at this juncture in the clinical inquiry that a false step might be taken. Thus, when the typical story is recited by the patient, the reaction of the doctor should be that the symptom might have its source either in the heart or in the stomach, and he should not prejudge the issue at this early stage, or allow the term "angina" to form too readily on his lips.

Absence of Cardiac Signs

It is a serious fallacy to assume that clinical signs are not expected in one with cardiac pain during the ambulatory period when a major coronary occlusion has not yet taken place, or when its more obvious effects have passed following treatment. It is true that the signs are sparse, but when sought diligently the presence of triple heart rhythm at the lower end of the sternum may be elicited in some 15% of ambulatory cases long after the initial attack of cardiac infarction has subsided; when the occlusive event has been recent, the incidence of triple heart rhythm on auscultation rises to near 85%. For a diagnosis of cardiac-like pain it is conditional, therefore, that a careful clinical examination discovers no such abnormal cardiac signs.

The Electrocardiogram

Naturally, it is imperative that a competent electrocardiogram should be recorded in the investigation of chest pain. Seven, and at the most eight, leads are necessary—namely, leads I, II, III, IIIR (lead III on deep inspiration), CR₁, CR₄, and CR₇; sometimes CR₂ has to be added. The bipolar chest leads are superior to the V leads in that they better portray the S-T segment and the T wave in the normal—expressions in the tracing which are so sensitive to alteration when the myocardial injury from coronary arterial disease is limited in its distribution (Fig. 1). If unipolar limb leads are recorded, and they need not be, it is essential that aVFR (aVF on deep inspiration) is also taken (Fig. 2).

When the electrocardiogram is normal it excludes a diagnosis of cardiac infarction, but for this truism to apply the tracing has to be *strictly* normal. This demands a familiarity with the lesser cardiographic deformities identified with limited or restricted cardiac infarction, which are in contrast with the more obvious

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changes found in salient cardiac infarction (Fig. 3). The lesser irregularities in the tracing include a depression of any portion of the S-T segment in any lead, and especially in lead III, a low T wave in leads I and CR₄ or CR₇, a blunt T wave, a sharp descent of the T wave in leads over the right ventricle, terminal dipping of the T wave, especially in CR₄, depression of the T-U segment, inversion of the U wave in the absence of left ventricular enlargement, the appearance of a Q wave in III, and a notch on the

pectoral lead, CR₁, and in leads reaching across the chest even as far as CR₇. Before this specific cardiogram is named, it is also conditional that significant Q waves and S-T depression should be absent.

Presence of Non-cardiac Signs

When cardiac signs are missing and the electrocardiogram is normal in a patient with chest pain, attention should be turned to its extracardiac causes, and especially to the commonest of them all, dyspepsia. Although occasionally a gastroduodenal ulceration, stomach cancer, oesophageal pouch, intrathoracic stomach, or cholelithiasis may be uncovered, in most cases these organic lesions are absent. In this event, four radiological signs which support the diagnosis of flatulent dyspepsia should be sought.

As a barium meal is watched in its progress along the oesophagus it may proceed *sluggishly* and be halted by spasm at the lower end of the gullet. In another it may recoil violently (*oesophageal arrhythmia*); this sign, present in some 3% of healthy subjects, was met with in 40% of patients with

FIG. 1.—Comparison of the T wave potential in unipolar and bipolar leads. Both in station 1 over the right heart and 7 over the left side, the T wave in V leads are low, flat, or inverted, while in the corresponding CR leads the potential is much more positive. Tracings were from eight healthy subjects.

descending limb of qRS₇ (Fig. 4). These changes are seen in the resting electrocardiogram, and the exercise record to test their significance is not needed except for the low T wave, which can be a physiological finding.

A normal electrocardiogram opposes the diagnosis of cardiac pain as well as cardiac infarction provided the unusual circumstance of *coronary arteriospasm* is excluded, for here a tracing abnormal at one time may appear normal at another. Such a cardiogram, however, is a rare finding, having an incidence of only 1% among all abnormal tracings of coronary arterial disease, and it has a distinctive pattern. Thus, the T wave is depressed or inverted in lead I and in the right

FIG. 2.—A Q wave in III is also present in aV_F, and only during inspiration (aV_FR) does it disappear, showing that it has been a false Q. Tracing was from a healthy subject.

E.C. DESIGN	E.C.	LOCATION of INFARCT
$T_I \setminus T_4$		ANTERIOR
$T_I \setminus T_7$		LATERAL
$T_{III} \setminus T_7$		POSTERO-INFERIOR and LATERAL
QT_{III}		POSTERO-INFERIOR and MEDIAL
Q_1 or B.B.B.		SEPTAL

FIG. 3.—Design of the electrocardiogram in the various kinds of salient cardiac infarction. Roman numerals indicate limb leads, and Arabic numerals indicate chest leads in the first column.

cardiac-like pain. When these abnormal movements are being observed pain is seldom present, for they are not the cause of the pain, and serve only to indicate its dyspeptic nature.

A further radiological sign commonly present in these cases is a *cup-and-spill stomach*, where the barium stagnates for a time in the gastric fundus before spilling over into the main cavity of the stomach (Fig. 5). This behaviour of the meal in the stomach results from a bending of the viscus from pressure by a *distended colon*.

Extent of Invalidism from Cardiac-like Pain

A realization of the hardship imposed on patients in this group through a wrong diagnosis can be gained from an acquaintance with the history in 30 consecutive patients whose average age was 52; 20 being under 55. These form a small sample of a series of 1,000 such cases. The duration of enforced invalidism had exceeded 4 years in 12, 10 years in 6, and 20 years in 2 cases before the diagnosis was corrected. In 12 cases the initial diagnosis had been made by the family doctor, and in the remaining 18 it had been confirmed by a consulting physician, sometimes with the aid of an electrocardiogram. The hardship endured by these patients varied in kind and degree. At the start of the illness 21 were confined to bed for a month, and 6 for two months. Subsequently they had been instructed to forgo customary recreation and hobbies, and often to change their occupation. These restrictions had invariably infused gloom into the home. The pathos which may follow in the wake of such injunctions is poignantly instanced by one case in the series.

The patient was 47 years old when he complained of pain in his chest and consulted his family doctor, who concluded from the history that he had coronary thrombosis and ordered him to bed. The diagnosis was later confirmed by a visiting physician, who recorded an electrocardiogram which was said to indicate the presence of angina. A period of six weeks in bed was followed by a suitable period of convalescence, and subsequently a return to work was permitted. He had been a bus driver, and as a sufferer from coronary thrombosis and angina his employers refused to reinstate him in his previous occupation. He sought less congenial work, but in this, too, he met with no success. He visited the labour exchange daily and interviewed prospective employers, but in vain. Worry weighed him down, his customary self-reliance left him, and insomnia set in, because he had an invalid wife and four children under the age of 15 years. Eventually a bent figure was seen walking towards the river where he was to make his escape through suicide. The coroner pronounced that the man had taken his own life while the state of his mind was disturbed. Necropsy showed wide patent coronary arteries and a healthy myocardium. Subsequent inspection

of the electrocardiogram showed that it had been a physiological tracing.

To save patients from the wretchedness with which this story is pregnant, less reliance must be placed on the patient's description of his illness, and greater reliance on the electrocardiogram, which should be the final arbiter.

Once the diagnosis of cardiac pain has been excluded, the information should be conveyed to the patient immediately and emphatically. Reassurance is not reassuring if it is given late or without conviction, for the mental wound, unless repaired quickly, is sure to fester. A life saved from the bondage of unwarranted invalidism justifies the great care taken to avoid it.

FAULTY MANAGEMENT

It is natural that an illness which has so often killed unexpectedly, and whose outcome is usually unpredictable, should breed a cautious attitude on the part of

FIG. 4.—The lesser electrocardiographic signs of *restricted cardiac infarction*. The examples given were the only abnormality present at the time in a comprehensive electrocardiogram of seven leads, and from patients in whom the presence of cardiac infarction was subsequently confirmed.

any medical practitioner called upon to treat it at its onset and to supervise its progress during convalescence. Now that a quarter of a century has elapsed, however, since the clinical diagnosis of cardiac infarction was confidently made, it should occasion no surprise that the strict instructions once proposed to govern the aftercare of the illness now appear to need revision.

Where do We go Wrong ?

The interrogation of patients who had recovered from cardiac infarction and had left hospital for periods of one to three years uncovered a number of facts which suggest means by which such patients should be

reinstated more effectively than now to their customary mode of life and livelihood. The faulty management included a failure to talk to the patient during and subsequent to the illness, failure to talk to the marital partner, failure to establish a close liaison between the hospital and the family doctor, failure to resettle the patient in his customary work, failure to instruct the patient on the proper use of glyceryl trinitrate, and failure to extend to an intimidated patient the

FIG. 5.—Appearance of the barium meal in a patient with cardiac-like pain. 1, Diaphragm. 2, Gas in stomach and splenic colon. 3 and 4, The cup and the spill of the barium in the stomach. 5, Residue of meal in lower end of oesophagus.

encouragement and reassurance due to him. Too often the illness has been unnecessarily prolonged. The patient has regarded it as continuing, and the doctor has failed to say it has ended. There are faults on both sides, but the doctor is most blameworthy.

Need to Talk to the Patient

The question "Should a doctor tell?" need no longer be posed—anyhow, not in regard to telling the patient about his illness. Through instruction in health magazines, the *Reader's Digest*, and radio and television programmes, patients acquire that superficial knowledge which often emboldens them to question their doctor more closely than hitherto about their own complaints. Of course it is unlikely that a patient can have any real understanding about his illness, but the greater risk that he will obtain misguided information from less reliable sources has to be reckoned with. Great profit, therefore, will be earned if the doctor affords time to talk to each patient with cardiac pain. During the patient's sojourn in hospital, when he resigns to rest and to soliloquy, the words he hears matter more to him than the dedicated administration of medicine and nursing. In this illness, as in many others, words are more telling than deeds. In this context words are deeds. At this juncture the physician, therefore, should grasp the opportunity to disengage himself from the subdued musings and murmurings, so much a feature of medical consultations in the ward, to speak purposefully at the head and not at the foot of the sick-bed.

Need to Talk to the Marital Partner

The wisest plan conceived by the consultant and the family doctor will miscarry if it has not the fullest accord of the marital partner. An over-protective

spouse, who continuously dissuades her husband from putting his hands to any kind of work, has often wrecked the considered advice of a physician, and for this reason it might be more important to treat her than the patient. On the other hand, the wife of one who has passed through an attack of cardiac infarction can be a powerful ally to a doctor in his struggle to restore the patient's self-reliance, and her services should be enlisted at the start. In the recapture of confidence lost through a heart attack the patient can count on greater help from his wife in the home than from a welfare officer in a highly organized rehabilitation centre; public social service can never match the fastness of the family service, and for this reason must never be allowed to supplant it.

Need for Close Liaison between Hospital and Family Doctor

In the management of no other illness is close co-operation between hospital and family doctor so necessary and so worth while. In discussing the illness with the patient it is imperative that both doctors should use the same language, adopt the same views on diagnosis, employ the same terms by which to convey this information, and proffer the same advice on future treatment. Failure to forge this co-operation in management had in one case caused not a little confusion and had hindered the good progress initially predicted for the patient. Thus, the factory doctor had said "thrombosis"; the consultant had said "infarction"; the house-physician had said "angina"; the registrar had said "a block in the heart vessels"; a patient in the ward had said "part of the heart is diseased and finished with"; the family doctor had said "softening of the heart muscle"; the ward sister had said "it is better not to ask." The patient himself added, "I am muddled, doctor, and I cannot sleep."

Foreboding terms which may suggest the doom which might have undertaken a relative or friend should be avoided; the use of less malignant expressions brings rewarding results, and one is suggested here—namely, "a heart attack which is passing," or "a heart attack which has passed," depending on the particular phase of the illness at the time. Whatever terminology is used it should be simple, but should convey the expectancy of a successful outcome of a temporary illness, and imply no sinister meaning.

Need to Reinstate the Patient in Work

Failure to instruct a patient to return to his usual occupation is the commonest form of mismanagement which annuls his resolve to place his illness behind him and which undermines the very happiness of his home. When advocating a return to work it should be emphasized that such work must be customary work. The urge to move a patient from one occupation to another cannot be too strongly condemned; a change of occupation at this time means unsettlement, not resettlement. The wail of so many patients emphasizes the discontent that inevitably follows an enforced change to sedentary work, and it will yield to no remedy. "I am miserable in my new work"; "I am used to handling a saw, not a pen"; "This clerical business gets me down"; "I was never good at figures"; "I have lost my old pals"; "I work among a lot of crocks, and I feel that I am becoming one, too"; "I miss my old

wage packet"; "My wife has now to turn out and earn"; "I have to sponge on my children"; "I have lost my old independence." Such have been the pitiable utterances of these disconsolate patients. Let no one think that a patient has recovered successfully from cardiac infarction because he has lost his heart pain, when he retains its pangs, and which he finds even more difficult to bear.

Experience in the management of these patients who have successfully passed through an attack of cardiac infarction endorses the view that it should become a recognized procedure to direct the patient back to his work after he has rested for a month and convalesced for a second month. That no undue risks are incurred from the adoption of this practice has been proved by inquiry about the physical activities engaged in at the time of the initial attack or subsequent ones. In the great majority of cases the illness set in either at rest or while undergoing habitual easy exercise, and only exceptionally during unaccustomed heavy exertion.

Moreover, to dissuade a patient from resuming his customary work can never be an assurance against the risk of an extension of the cardiac injury; that rests solely with the state of the functioning coronary circulation. Such dissuasion, however, is sure to breed a despondency which will bring misery to the patient and his family. His early return to work, on the other hand, will save him from confirmed invalidism, or will rescue him from a state of despair should he have already drifted into it. What a disappointment it is to prolong life if it is to be a useless one, so dissatisfying to the doctor and such a burden to the patient. In the contest for health, to gain the "consolation prize" is never a consolation.

Need to Instruct Patients on the Proper Use of Glyceryl Trinitrate

In the event of recurrent cardiac pain on physical effort the patient should be informed that this is the aftermath of the initial illness and not a signal of a return of his old trouble. An inquiry among patients concerning the management of these repetitive painful episodes disclosed an unpardonable neglect of instruction on the proper use of glyceryl trinitrate tablets. A talk, lasting only some five minutes, dealing with this therapeutic measure is of inestimable benefit to patients.

Too often the tablets are allowed to become stale and inert from storage; they should be fresh. Some patients swallow the tablets three times daily, and too many allow them to dissolve in the mouth; "chew" or "crunch" should be the operative words, ensuring rapid absorption and benefit. Patients are still instructed not to take too many tablets, thus creating the belief that to do so means that they will get accustomed to them; they need encouragement in their unrestricted use and assurance on the absolute safety of this procedure. Patients are too often frightened by a fullness in the head which may follow ingestion of the first tablet; the harmlessness of this effect should be invariably explained at the outset. Thereafter the discomfort passes unnoticed or at least without complaint. Transcending all other faults is neglect to give instruction in the use of glyceryl trinitrate as a prophylactic measure; a tablet should be allowed to dissolve in the mouth in this instance before any exercise

which customarily brings on the pain. Herein lies the chief virtue of the tablets, and the time and trouble taken to inform the patient on the precise way he is to use this convenient instrument of relief is so very worth while.

Other medicines, in that they cannot be guaranteed to do good, do harm, and whether in the form of a sedative, "peritrate," anticoagulant, or placebo, each serves to remind a patient two or three times a day of the hurdle of his past illness and the imaginary hazards which he may yet meet in the race he has to run. A nitrite, like "peritrate" or "myocardol," taken into the stomach was shown a quarter of a century ago to be no more effective than a placebo in the prevention of cardiac pain, while a critical regard of the state of the coronary arteries and the myocardium at necropsy relegates treatment by anticoagulant drugs to the realm of "therapeusis through wishful thinking."

The need of a patient emerging from cardiac infarction is encouragement, not medicament—encouragement to negotiate harmless hills, not to the swallowing of useless pills.

Need to Dispense Reassurance

For the purpose of estimating prognosis in cardiac infarction the patients may be assigned to two main classes. In the first group, infarction has so injured the heart muscle as to produce the trinity of sinister signs—namely, triple heart rhythm elicited on clinical examination, and cardiac enlargement with pulmonary congestion, which are uncovered by cardioscopy. In such cases the illness has reached serious proportions, demanding treatment of heart failure, and where appropriate encouragement will take the place of firm reassurance.

The majority of patients, however, belong to the second group, for they have emerged successfully from the attack without residual clinical signs. It has already been implied that reassurance is not effective unless conveyed convincingly. To convince, reassurance has to be without strings. This inquiry showed time and again how intended reassurance had failed in its purpose because of the casual introduction of some unfortunate contradiction, and the following are some examples of such unguarded phrases: "You are all right now, *provided* you don't get another attack"; "You will go on well, *if* you look after yourself"; "You can lead a normal life, *but* don't go out by yourself"; "You may do anything, *although* you should do things slowly"; "You have done well, *considering* your age"; "With the *exception* of a scar, the heart has recovered"; "You are over this, *yet* you may go out like a candle."

Of course some patients, fortified by an equable mental equipment, which at all times contributes greatly to the speed and completeness of the recovery, have withstood stoically the forbidding injunctions proffered by doctor, spouse, relative, friend, or *Reader's Digest*. None the less, even these sometimes confessed to a pang of anxiety when informed by word, letter, or obituary notice of the sudden passing of an acquaintance. After all, in the lay mind heart pain continues to be regarded as the twin brother of cancer, and it proves difficult to dislodge the conviction, should this have taken root, that he harbours a mortal illness within his breast. To allay any such fear must always be our purpose in the management of a patient with heart

pain which kills only sometimes, but which maims all the time unless under careful and wise supervision.

Miss E. M. Goldberg, of the medical research unit, and Miss M. E. Druett, almoner to the cardiac department, of the London Hospital, have given me great help in the interrogation of those patients who had passed through an attack of cardiac infarction.

THE THYROID AND THE HEART*

BY

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Both oversecretion and undersecretion of the thyroid hormone have serious effects on the heart. Those of oversecretion are better known because they are much the commoner. Many features of severe hyperthyroidism are historical because the picture has changed in the past decade or two as a result of earlier diagnosis and of more effective antithyroid treatment. Thus the more advanced changes formerly seen and the post-thyroidectomy thyroid crisis are never allowed to develop. In the first stage there is an increase in the heart rate, normal rhythm persisting. Under certain conditions—for example, any event which produces tachycardia in the euthyroid subject, such as an infection or operation—and particularly in the child and young woman, this increase may reach an extreme degree. As a hospital resident I saw a child of 13 with exophthalmic goitre, as we then called it, complicated by acute appendicitis. This had to be treated by operation, and it was followed by a mounting tachycardia which just before death reached the extreme figure for normal rhythm of 250 a minute. The tachycardia of hyperthyroidism is labile and shows an exaggerated response to emotion and, as mentioned, to infections. On the other hand, the heart rate may fall to normal in a few days with complete rest and medical treatment.

Occasionally toxic goitre can be diagnosed with a normal heart rate—that is, in the seventies. I think this may occur in subjects who normally have a bradycardia, and is therefore seen in the male; but it is also met with in the elderly woman who gets paroxysms of auricular fibrillation as evidence of thyroid toxæmia, but between these has sinus rhythm without tachycardia. Such a patient may have a B.M.R. not over the upper limit of the normal. Occasionally in younger women and girls the heart rate is high at times, though they have become fat, feel better, and seem generally to have lost their thyroid toxæmia. Here the tachycardia is probably nervous and not thyrotoxic in origin. Nearly all the abnormal rhythms occur in toxic goitre; and extrasystoles, more often ventricular than auricular, are the first to appear. Superimposed on a sinus tachycardia, they are of some diagnostic value, as this combination is commoner than in any other condition. When the extrasystoles are seen, auricular fibrillation is usually in the offing.

Auricular Fibrillation

Hyperthyroidism is one of the commonest causes of auricular fibrillation, and it is well to consider it, however inconspicuous the other symptoms of toxic goitre. If rheumatic, or coronary, or hypertensive heart

disease is not the explanation, then toxic goitre may be. Unsuspected cases are treated solely with rest and digitalis when antithyroid treatment is essential. A clue to diagnosis is the absence of response to digitalis, as this drug has little effect on the ventricular rate until thyroid toxæmia is reduced; then it does appear to have some action. There is a close connexion between age and the incidence of auricular fibrillation in toxic goitre, with a rise in each successive decade, so that while extremely rare in those under 30—it used to be seen at this age after thyroidectomy—it is common in those over 70. This is true both of established fibrillation and of the paroxysmal form, either before or after thyroidectomy. Restoration of normal rhythm is evidence of good treatment.

It may be that the thyroid hormone plays a part in determining auricular fibrillation even when the secretion of the gland is physiological, as is suggested by the case of a woman aged 34 with mitral stenosis who had the whole of her thyroid gland, which was normal, removed for resistant heart failure. This was a form of treatment resorted to in the 1930's. Although she had been fibrillating for years, normal rhythm returned when she developed myxoedema after the operation. Spontaneous return of normal rhythm in a patient with advanced rheumatic heart disease who has had fibrillation for a long time is a most unlikely event and suggests that the thyroid hormone, even when present in normal amount, affects auricular function.

Other arrhythmias occur only rarely, but now and then there may be auricular tachycardia or flutter, usually alternating with auricular fibrillation. Mild heart block with prolonged A-V conduction time is occasionally seen, even in young subjects.

Blood Pressure

A raised pulse pressure is a cardinal symptom of hyperthyroidism; in fact, it should rank with tachycardia, goitre, eye signs, and tremor. Eye signs may be absent and a goitre not detected, but a diagnosis of toxic goitre in the absence of increased pulse pressure must be regarded as doubtful. This point is particularly important in the differential diagnosis between cases of goitrous tachycardia and those of diastolic hypertension in which tachycardia may be a feature. The first do not show increased pulse pressure despite their tachycardia. This is not to say that the diastolic pressure remains normal in hyperthyroidism. An investigation of 200 cases of toxic goitre showed a slight rise in diastolic pressure but a greater increase in the systolic as compared with 100 controls of the same age and sex distribution. Finally, there is the hypertension seen in middle-aged or elderly women many years after thyroidectomy. The operation has been successful in that thyroid function appears normal, but they show a severe degree of diastolic hypertension. The proportion who develop this seems too high to be accounted for by coincidence, but what connexion it has with toxic goitre in the distant past is obscure.

The electrocardiogram is of limited value in toxic goitre. It will provide an objective record of heart rate and the diagnosis of abnormal rhythms. In configuration the main change is a tall T wave, just the reverse of what happens in hypothyroidism.

Radiology of the Heart in Toxic Goitre

The apex beat is often felt outside the mid-clavicular line, giving an impression of enlargement, and is due to

*Read to the Section of Cardiology at the Annual Meeting of the British Medical Association, Birmingham, 1958.