

**REFRESHER COURSE FOR GENERAL PRACTITIONERS****TACHYCARDIA**

BY

**CRIGHTON BRAMWELL, M.D., F.R.C.P.***Professor of Cardiology, Manchester University*

Palpitation is a very common symptom, and, since it is often due to tachycardia, the various causes of this disorder merit careful consideration. It is convenient to classify cases of tachycardia in two main groups—those in which the tachycardia is due to simple acceleration of the normal sinus rhythm and those in which it results from the incidence of some abnormal rhythm.

**I. ACCELERATION OF THE NORMAL SINUS RHYTHM**

Before enumerating various conditions responsible for this type of tachycardia brief reference must be made to certain physiological principles bearing on the subject.

The cardiac reserve is a measure of the extent to which the heart is capable of raising its output to meet the oxygen requirements of the body during physical exertion, and, since the output per minute is the product of the output per beat and the heart rate, the smaller the increase in stroke volume the greater must be the increase in heart rate to achieve an equivalent increase in output. Comparative physiology provides an interesting illustration of the relation of heart rate to stroke volume. Animals capable of prolonged and severe exertion have slower pulses than sedentary animals. For example, the resting pulse rate of the hare, an exceedingly athletic animal, is under 70, while that of its cousin, the rabbit, a sedentary creature, which seldom strays far from its burrow, is over 200. To compensate for this difference in pulse rate, the hare's heart, relative to its body weight, is three times as big as the rabbit's. It seems to be a general law throughout all warm-blooded animals, both birds and mammals, that those with big hearts have slow pulses and vice versa.

The increase in pulse rate produced by exercise and the time taken to return to the resting rate following exercise have been widely employed in attempting to assess cardiac efficiency. The test employed by National Service medical boards in the examination of recruits was to place one foot on a stool about 18 in. (45 cm.) in height and to raise the body 20 times in 60 seconds. In healthy subjects in good physical training the pulse should return to the resting rate within one minute of the cessation of exercise.

We may now consider certain conditions in which physical exertion causes excessive tachycardia.

In many types of heart disease the stroke volume of the heart is reduced and, consequently, to increase output the heart has to beat faster than in health. But, short of actual disease, tachycardia on exertion may be due simply to physical unfitness resulting from obesity, excessive smoking, lack of exercise, and other causes; in patients with organic heart disease physical unfitness will add to their disability.

The term "effort syndrome" was coined by Lewis in the first world war to describe a condition in which the response of the circulatory and respiratory mechanisms to exertion was excessive in subjects without disease of either heart or lungs. In these patients the ability to perform muscular work is decreased and mild exertion causes breathlessness, palpitation, and other symptoms; the increase in the heart rate after exercise is greater than in health, and it takes longer for the pulse to return to its resting rate. It is now recognized that purely psychogenic factors are responsible

for many of these cases, but a similar clinical picture is seen in patients convalescent from an acute illness such as influenza.

In addition to exertion, emotion may induce tachycardia, in fact clinically it would probably be true to say that nervousness is the most common cause of tachycardia. Many perfectly healthy people are scared at the mere thought of a medical examination, especially when their fate may be determined thereby, while others become unpleasantly heart-conscious when called upon to get up and make a speech. One of my patients, a keen bridge player, told me that this lack of control proved most disconcerting, for whenever she picked up a particularly good hand her heart always started to race and consequently her murmur became audible to her opponents and gave the show away.

During the war National Service medical boards referred many recruits for a second opinion on account of persistent tachycardia. Was the tachycardia physiological or was it pathological? In point of fact it was generally due to fear of being rejected. When, in addition to tachycardia, the recruit had a systolic murmur, as was often the case, for overaction of the heart may produce such a murmur, an especially careful search for other signs of heart disease was indicated. In these recruits the possibility of thyrotoxicosis had to be considered, but even in the absence of thyroid enlargement or exophthalmos the diagnosis rarely presented much difficulty.

Acceleration of the normal sinus rhythm may be due to many other causes, but those mentioned above—namely, heart disease, physical unfitness, the effort syndrome, thyrotoxicosis, and nervousness—are clinically the most important when the patient's principal complaint is palpitation.

**II. TACHYCARDIA CAUSED BY AN ABNORMAL RHYTHM**

This type of tachycardia may occur either in paroxysms or as an established disorder. In paroxysmal tachycardia the heart rhythm is regular and the rate generally between 140 and 240 per minute. The paroxysm is, in fact, nothing more or less than a long series of premature beats with no intervening normal cycles, and, as in the case of premature beats, the ectopic focus from which the paroxysm arises may be either supraventricular or ventricular.

**Supraventricular Paroxysmal Tachycardia**

This type of paroxysm often occurs in people in whom there is no evidence of organic heart disease. Provided the paroxysm is not prolonged, it is not dangerous, but it may be very distressing and even alarming to the patient. Unlike tachycardia due to simple acceleration of the normal sinus rhythm, which arises in response to some obvious physical or nervous stimulus and abates when that stimulus is removed, these sudden bouts of tachycardia start abruptly at any time and for no apparent reason; not infrequently the attacks seem to be associated with a digestive disturbance, but whether this is a causal factor or not it is difficult to say.

Since we rarely have the opportunity of actually observing an attack, the diagnosis has generally to be based on the patient's description of his symptoms. The most characteristic feature is the abrupt transition from the normal to the rapid rate of beating, but not infrequently the paroxysm

is preceded by a short bout of irregular heart action due to extrasystoles (Fig. 1). Patients sometimes say that the attack terminates equally suddenly with a "thump." This is due to the forcible beat following the long compensatory pause which precedes the re-establishment of normal rhythm. In other cases the heart slows down gradually and imperceptibly. Unlike nervous tachycardia, the rate is unaffected by change of posture. The duration of paroxysms varies from a few minutes to a few days, or occasionally longer, but in most cases it lasts from two to twelve hours. When the attack is of long duration acute cardiac dilatation and congestive heart failure may supervene.

The disability experienced during an attack varies greatly in different individuals. In addition to palpitation, some

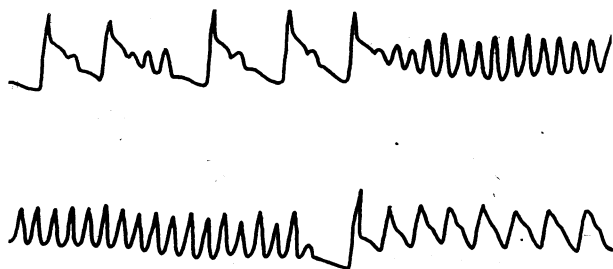


FIG. 1.—Sphygmogram showing short paroxysm of tachycardia, preceded by a period of irregular heart action, due to extrasystoles, and followed by normal rhythm. Note forcible beat following end of paroxysm.

patients complain of anginal pain due to coronary ischaemia, others suffer from manifestations of cerebral anaemia, such as dizziness or even actual syncope. I have, however, occasionally met with patients in whom the disorder of rhythm produced so little subjective disturbance that they were able, admittedly with difficulty, to carry on their normal occupations.

Attacks may terminate in vomiting, and can sometimes be aborted by inducing vomiting by tickling the back of the throat; pressure on the carotid sinus or on the eyeball will sometimes stop an attack; but, although these various tricks are worth trying, none of them is infallible. Fortunately most attacks stop spontaneously. In prolonged attacks, quinidine sulphate by mouth is the most useful remedy: 6 gr. (0.4 g.) should be given two-hourly for five doses, and a similar amount on two successive days if the attack persists. Intravenous quinidine should be used only in cases of exceptional urgency. Full digitalization (1 mg. of digoxin intravenously, followed by 0.5 mg. six-hourly) is sometimes successful in cases which fail to respond to quinidine. Of the cholinergic drugs, which have been used in prolonged attacks, methacholine ("amechol," "mecholyl"), 10–20 mg. subcutaneously, is the most reliable, but is apt to cause unpleasant side-effects. Recently procaine amide has been employed as an alternative to quinidine, but a difference of opinion still exists regarding the relative merits of these two drugs. Oral administration is apt to produce nausea and vomiting, and ventricular fibrillation has been reported when procaine amide was given intravenously. Some workers have reported favourably on intramuscular injection. It is said to be more effective in the ventricular than in the supraventricular type of paroxysm.

#### Ventricular Paroxysmal Tachycardia

Ventricular can be distinguished with certainty from supraventricular paroxysmal tachycardia only by the electrocardiogram, but its presence may be suspected clinically from the fact that, whereas the latter commonly occurs in an otherwise healthy subject, the former is generally asso-

ciated with serious heart disease. It may occur as a complication of acute coronary occlusion or may be initiated by mechanical stimulation in the course of surgical operations on the heart or cardiac catheterization, so that when performing such manipulations it is customary to give the patient quinidine or procaine amide as a prophylactic measure. In view of its seriousness, this complication should be regarded as a medical emergency requiring immediate admission to hospital, and its treatment hardly comes within the scope of the present article.

#### Auricular Fibrillation

This arrhythmia may be either permanent or paroxysmal. Paroxysmal auricular fibrillation is a not infrequent precursor of the established condition in patients with rheumatic or degenerative heart disease. Less commonly the paroxysms recur at more or less regular intervals over periods of years in apparently healthy subjects. The gross irregularity of the heart's action during the attack is generally obvious to the patient and will suffice to distinguish the condition from paroxysmal tachycardia.

In paroxysmal fibrillation the change from normal rhythm to fibrillation may prove most distressing to the patient, and one of my medical colleagues who suffered from such attacks, though otherwise his heart seemed to be perfectly normal, tells me that the sense of increased well-being when, after many years, he became a permanent fibrillator was quite remarkable. When attacks recur frequently continuous digitalization is indicated, in order to control the ventricular rate during the paroxysms. Quinidine, 3 gr. (0.2 g.) twice a day, may reduce the frequency of attacks, but often it has little beneficial effect.

Established auricular fibrillation is generally associated either with advanced rheumatic or degenerative heart disease or with thyrotoxicosis, but it has in rare instances been reported to follow an electric shock or other forms of trauma.

Uncontrolled fibrillation is easily recognized by the fact that it is the only type of tachycardia associated with grossly irregular heart action. From time to time two or more beats follow each other in very rapid succession. When this happens the ventricle contracts before it has had time to fill with blood. Such beats are ineffective on account of the small output of the heart, and only a very feeble pulse wave (Fig. 2), or it may be no pulse wave at all,

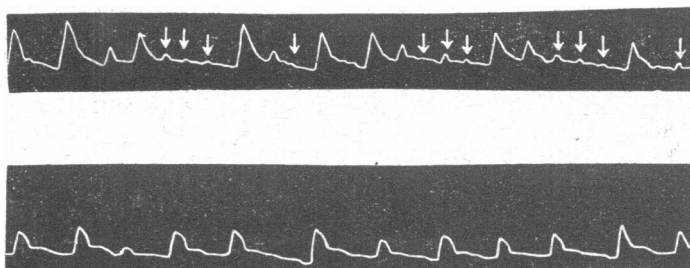


FIG. 2.—Sphygmogram from a case of auricular fibrillation. Upper record, before treatment, showing complete irregularity and a large number of very small pulse waves (marked with arrows). Lower record, after treatment with digitalis, showing greater uniformity in rhythm and form of pulse, all but one of the small ineffective beats having been eliminated. (Reproduced from *The Approach to Cardiology* by permission of Oxford University Press.)

reaches the periphery. Thus the heart rate, as counted with the stethoscope at the apex, is greater than the pulse rate at the wrist, the difference between the two counts being known as the "pulse deficit." The larger the number of ineffective beats the greater is the pulse deficit and the more unproductive work is the heart called upon to perform. It is merely tiring itself out to no purpose. Thus in untreated fibrillation tachycardia is largely responsible for the development of heart failure, the benefit derived from treatment with digitalis being due chiefly to control of the ventricular rate.

Failure to control the tachycardia is usually explained by inadequate dosage. Practitioners are apt to be unduly frightened of digitalis intoxication, which, in my experience, more often results from an excessive maintenance dose given over a prolonged period than from overdosage during the initial stage of digitalization. Patients vary greatly in their tolerance for digitalis, and it is therefore undesirable to use massive doses except in emergency: 3 gr. (0.2 g.) of the powdered leaf given eight-hourly will usually suffice to control the ventricular rate within 24 hours, and thereafter a maintenance dose of 1 to 2 gr. (0.065 to 0.13 g.) generally proves adequate; sometimes even smaller doses suffice. In an emergency 1 mg. of digoxin may be given intravenously.

The most obvious signs of digitalis intoxication are excessive slowing of the heart, nausea, vomiting, and bigeminal heart action, in which every normal beat is followed by an extrasystole. It is important to distinguish between the nausea due to overdosage with digitalis and that due to congestion of the gastric mucous membrane resulting from circulatory stasis in cases of heart failure, since the latter condition is attributable to inadequate control of the tachycardia, which can be relieved only by increasing the dose of digitalis. Likewise, bigeminal heart action is by no means always due to digitalis intoxication, and is not an indication for withdrawing the drug unless it is associated with bradycardia or other toxic manifestations.

When fibrillation is of recent origin, or persists after subtotal thyroidectomy, an attempt should be made to restore normal rhythm with quinidine, 6 gr. (0.4 g.) two-hourly for five doses, repeated if necessary. It is, however, only in those cases in which the disability is attributable to the abnormal rhythm rather than to the associated myocardial or valvular disease that quinidine therapy is indicated. In cases of old-standing heart disease there is a risk of embolism, and the patient is likely to derive more benefit from control of the tachycardia with digitalis.

#### Auricular Flutter

Flutter is closely related to fibrillation and, like fibrillation, may occur either in paroxysms or as an established condition. It is most often associated with either rheumatic or degenerative heart disease. In this disorder the auricle beats regularly at a rate of about 300 per minute and the ventricle usually responds at half that rate.

Clinically, therefore, auricular flutter may be suspected in cases of regular tachycardia when the pulse rate is in the neighbourhood of 150 per minute, and confirmation may be obtained by noting venous pulsation in the neck at double this rate or slowing of the pulse when pressure is applied to the carotid sinus; but the diagnosis can be established with certainty only by the electrocardiogram, which is distinctive.

Under the influence of digitalis the ventricular rate may be reduced to a quarter of the auricular rate or the heart's action may become irregular, the ventricle responding to every second, third, or fourth auricular impulse. Provided 4:1 heart block is maintained auricular flutter will *per se* cause no appreciable disability, but occasionally a 1:1 ventricular response develops, either spontaneously in untreated cases or in the course of treatment with quinidine, and unless promptly controlled may lead to acute cardiac dilatation.

If a patient with auricular flutter is fully digitalized the flutter will often be converted to fibrillation, and subsequently normal rhythm may supervene. Similarly a transient stage of auricular flutter may be observed before normal rhythm is restored when a patient with auricular fibrillation is treated with quinidine.

**Next Refresher Course Article.**—"Medical Aspects of Air Travel," by Sir Harold E. Whittingham.

## COLLEGE OF GENERAL PRACTITIONERS

Eleven additional general practitioners from different parts of the British Isles have been elected to the Foundation Council of the College. Until the first annual general meeting, to be held in the autumn, the Foundation Council will consist of:

G. F. Abercrombie (London), <i>Chairman.</i>	R. M. S. McConaghey (Devon).
G. O. Barber (Essex).	J. G. Ollerenshaw (Yorkshire).
J. Cottrell (Lincolnshire).	R. J. F. H. Pinsent (Birmingham).
D. G. French (Staffordshire).	F. M. Rose (Lancashire), <i>Deputy Chairman.</i>
Annis C. Gillie (London).	Richard Scott (Edinburgh).
H. K. Glyn Hughes (London).	J. D. Simpson (Cambridge).
I. D. Grant (Glasgow).	G. Swift (Hampshire).
J. M. Henderson (Perthshire).	A. Talbot Rogers (Kent).
W. V. Howells (Glamorgan).	G. I. Watson (Surrey).
D. M. Hughes (Carmarthen).	J. C. Young (Belfast).
J. H. Hunt (London), <i>Honorary Secretary.</i>	

**Foundation Membership.**—By February 12 1,600 general practitioners had joined the College.

**Reprints of Steering Committee's Report.**—These will be sent to anyone on request.

**Plans of Surgeries.**—The College is collecting plans and photographs of up-to-date surgeries, consulting-rooms, dispensaries, waiting-rooms, etc. During the past few years many doctors have spent much time and thought in adapting, or building anew, such premises for single or group practices. It is hoped to provide a centre where plans, and perhaps scale-models, of these projects can be collected and studied, so that young doctors may benefit from the experience of others. As this collection grows it will be freely available to any doctors, architects, or builders who may wish to consult it. Will general practitioners who have recently adapted old houses to their practice needs, or who have built new premises, please send to the Secretary (at 14, Black Friars Lane, London, E.C.4) plans and photographs, with a note to indicate the special features of the buildings and of the practices concerned?

## CANCER EDUCATION IN CHELSEA

The Borough of Chelsea's Cancer Education Committee held a public meeting on February 17 at Chelsea Town Hall. The meeting was attended by the Mayor of Chelsea, representatives of various interested bodies, and some 200 members of the public. Alderman G. L. TUNBRIDGE presided. He said that the Chelsea Cancer Education Committee had been formed in 1949 when the Borough Council was asked what it was doing about cancer education. Since then the Committee had produced 12 informative leaflets for lay people.

Mr. R. W. RAVEN, F.R.C.S., then gave a brief address in which he described an investigation carried out by the Chelsea Committee with the aid of a questionnaire. Of the people questioned, 17% believed that cancer is infectious, 27% that it is incurable, and another 20% that it is of doubtful curability; nearly all thought that a careful programme of education would be useful. The object of cancer education, said Mr. Raven, was to substitute knowledge and confidence for ignorance and fear. There were already about 15 cancer education committees at work in Britain, and these should be increased. The population would have to be covered in stages: special attention should be given to teaching district nurses and health visitors—their combined number being nearly 20,000—student nurses, welfare and social workers, who could then disseminate information among lay people. Later a more direct approach by leaflets, lectures, films, and carefully written newspaper articles would be possible. Mr. Raven ended his address by outlining a five-point programme for cancer control.

There then followed a film entitled "Time is Life," and a period for questions. Dr. J. BROWNING ALEXANDER moved the vote of thanks.