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Auscultation of the Heart II

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Abstract

So sang Gilbert 50 years ago and so might some sing today with regard to triple rhythm, particularly, perhaps, physicians brought up before the days of modern analysis but not, let us hope, the student of today who has the opportunity to start aright. Triple rhythm signifies that three heart sounds can be heard instead of the usual two and therefore this term should not be used to include splitting of the first or second heart sounds nor for extra-cardiac sounds. The added sound of true triple rhythm falls during diastole.

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AUSCULTATION OF THE HEART

II

BY R. W. D. TURNER

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This particularly rapid unintelligible patter,
Isn't generally heard and if it is it doesn't matter.

—W. S. GILBERT.

TRIPLE RHYTHM

So sang Gilbert 50 years ago and so might some sing today with regard to triple rhythm, particularly, perhaps, physicians brought up before the days of modern analysis but not, let us hope, the student of today who has the opportunity to start aright.

Triple rhythm signifies that three heart sounds can be heard instead of the usual two and therefore this term should not be used to include splitting of the first or second heart sounds nor for extra-cardiac sounds. The added sound of true triple rhythm falls during diastole.

The extra sounds or "clicks" which can sometimes be heard in systole and are probably due to vibrations arising in a dilated pulmonary artery or aorta are not usually included in the term. It is customary also to exclude the opening snap of the mitral valve. Certainly this is an additional heart sound, not normally heard in health, but it occurs only in association with mitral stenosis and is always followed immediately by a mid-diastolic murmur so that it is unlikely to be mistaken for any other sound and will be described separately.

Triple rhythm may be physiological or may accompany serious heart disease and usually its significance can only be determined by consideration of the associated circumstances. In recording triple rhythm it is therefore important always to state whether it is due to the addition of a physiological or of a pathological sound.

In order to avoid confusion it is suggested that the designations first, second, third and fourth heart sounds should be confined to the physiological sounds which can normally be heard or recorded.

Triple rhythm, then, may be due to the addition of a physiological third or fourth heart sound or under pathological conditions triple rhythm may be due to the addition of an extra sound in diastole similar in position in the cardiac cycle to one or other of these physiological sounds (Fig. 4). Some authors, in order to try and avoid confusion use the term "gallop rhythm" for all pathological sounds. My preference is to use the term triple rhythm whenever three sounds can be heard, adding the qualification physiological or pathological after considering the company it keeps and confining the term gallop rhythm to the appropriate cadence, as discussed below.

Not only is there considerable confusion over terminology but great

variability in the recognition of triple rhythm by clinicians. This is partly due to failure to listen with sufficient care. The added sound in triple rhythm is usually of low pitch and occurs in a frequency range which it is relatively difficult for the human ear to appreciate. By the untrained observer these sounds must be specifically sought and it is necessary to listen intently and as specifically as does the trained ear which can pick out individual instruments in a large orchestra. It is also partly due to unawareness of the various conditions which may give rise to triple rhythm.

It is not always appreciated that recognition is often rewarding not only by giving positive help to accurate diagnosis and guidance on prognosis but also as regards avoiding errors of misinterpretation, for example of physiological sounds. The detection of triple rhythm may often provide

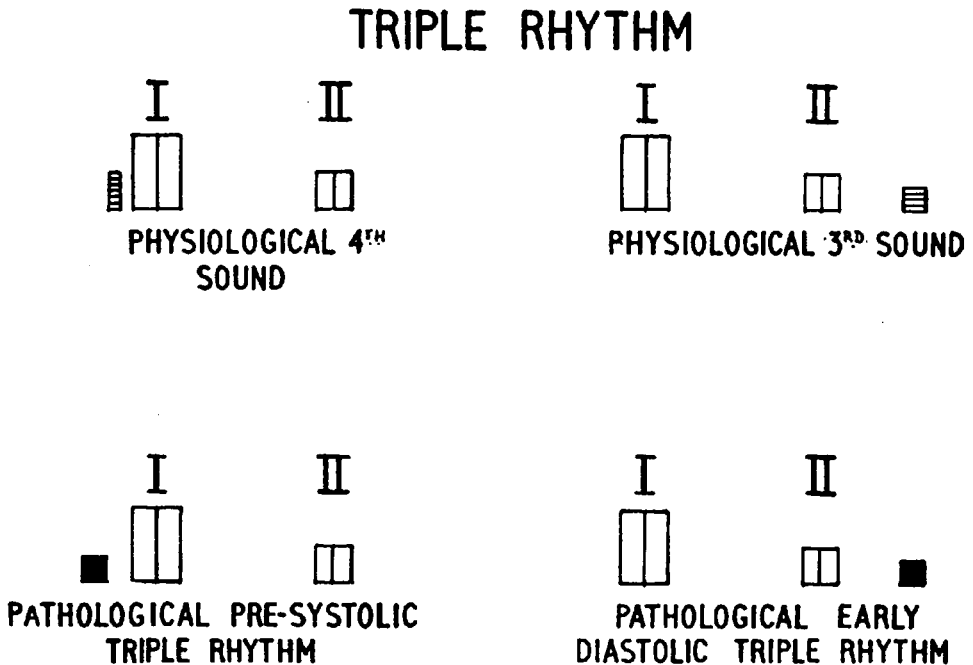


Fig. 4

the first clue to accurate diagnosis when the actual underlying condition has not hitherto been suspected. I have seen this in cases of myocardial infarction, constrictive pericarditis, myocarditis and myopathy.

It will be evident from what has been said that triple rhythm must be discussed as regards timing in the cardiac cycle and as regards its physiological or pathological significance.

By selective electronic amplification and graphic recording these sounds can be intensified and depicted for examination at leisure as already pointed out and in difficult cases phonocardiography is an invaluable aid to precision in diagnosis. However, for most practical purposes interpretation must be made at the bedside.

It is therefore necessary not only to be methodical in examination but to have in mind a clear terminology and classification.

Pre-Systolic (Atrial) Triple Rhythm

Two sounds may result from atrial systole. One (sometimes known as the fourth heart sound) is due to vibrations produced by atrial contraction

itself and the other, although synchronous with and consequent upon atrial systole, is due to vibrations produced in the ventricle.

Physiological Pre-systolic Triple Rhythm

The low pitched vibrations which form the atrial component of the first heart sound are *not usually* audible in health. They occur just after the beginning of the P wave and before the R wave of a simultaneously recorded electrocardiogram (Fig. 5) and are believed to result from actual atrial contraction. That atrial contraction can produce an audible sound is readily demonstrated in patients with complete heart block where there is disassociation between atrial and ventricular contraction. In such cases independent irregular atrial sounds can often be heard. In *some* normal persons, and especially when there is delay in A-V conduction (as reflected in the prolongation of the P-R interval of the electrocardiogram) this sound may be audible immediately before the main first heart sound instead of being "lost" in the louder valvular component. (Physiological fourth heart sound.) It usually differs in quality from splitting of the first sound (from asynchronous closure of the mitral and tricuspid valves) in that the latter is composed of two similar higher pitched sounds.

Pathological Pre-systolic Triple Rhythm

A distinct pre-systolic triple rhythm is frequently heard in patients with left sided heart disease, particularly in those with left ventricular hypertrophy from systemic hypertension or following myocardial infarction. In patients with atypical features which might be due to myocardial infarction, it may give a very useful diagnostic hint. In many patients the clarity of this added sound and its distance from the first heart sound decreases with clinical improvement, and in others, especially with systemic hypertension, there may be no change over many years without clinical deterioration. The sound in fact may often be heard in patients with left ventricular hypertrophy from *symptomless* hypertension. Sometimes too much prognostic significance has been attached to this finding.

Tachycardia shortens diastole and if tachycardia is present this added sound will fall in mid-diastole or be superimposed upon an early diastolic rhythm (see below). In such cases it can only be distinguished by slowing of the heart rate either from pressure over the carotid sinus or as a result of treatment.

In right sided heart disease presystolic triple rhythm may occur from pulmonary hypertension or following major pulmonary embolism.

The pathological sound is believed to be related to ventricular filling but whether from vibrations of the muscular walls or tensing of the valves has not been conclusively determined.

Early Diastolic Triple Rhythm

Triple rhythm from an added sound in early diastole may be due to the physiological third heart sound or to a pathological sound in the same position in the cardiac cycle and probably due to essentially the same mechanism. (Fig. 4).

Two possible mechanisms have been suggested and each has strong proponents. The first is that the sound is produced by vibrations in the ventricular walls and the second that it is produced by closure of the A-V valve leaflets due to the reflux of blood towards the auricles following rapid ventricular filling.

Physiological Early Diastolic Triple Rhythm (Third Heart Sound)

The physiological third heart sound occurs early in diastole, that is shortly after the second heart sound from which it is separated by a readily appreciable gap of .11-.15 second.

Owing to its relative faintness and low frequency this sound can be

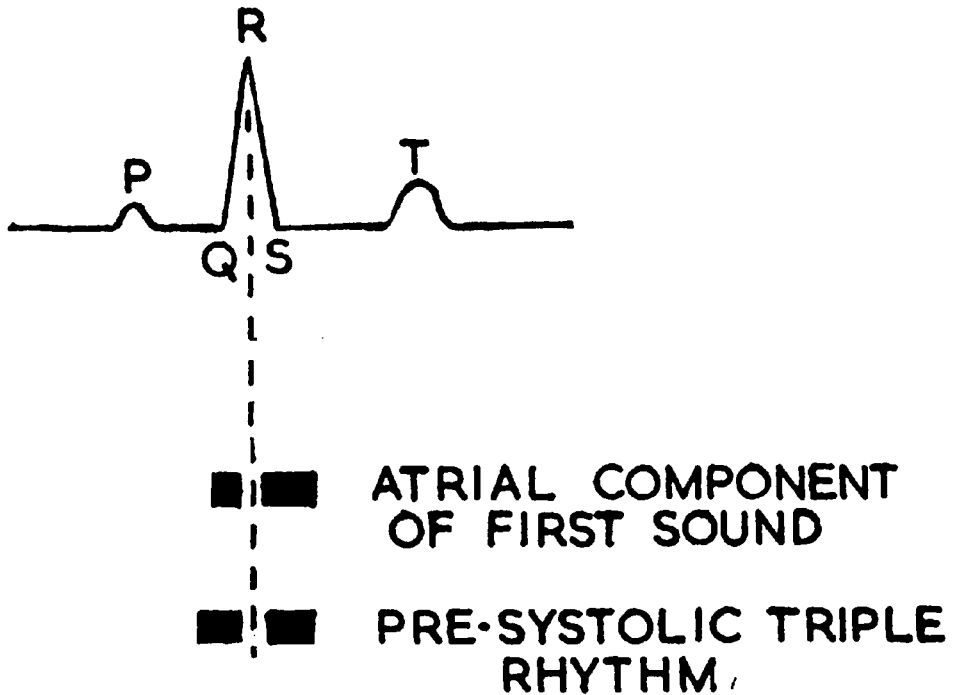


Fig. 5

recorded more commonly than it can be heard but is nevertheless very often audible in young people. In fact it is rarely heard in infancy, occurs more often than not in children, is frequently present in young adults but rarely if ever over the age of 40. It is often present in pregnancy.

It used to be thought that this sound was related to closure of the semi-lunar valves but timing with the carotid and jugular pulses has shown that it is always greater than 0.1" later than this and constantly coincides with the descending limb of the "v" wave, that is during the phase of rapid ventricular filling after the A-V valves open. (Fig. 6).

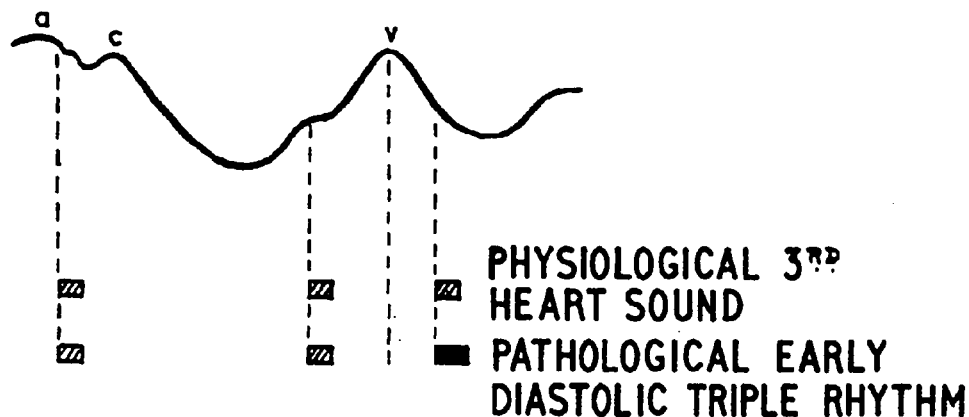
The sound is best heard near the apex beat or between the apex and sternum and in the recumbent posture. It becomes louder or may only be heard if ventricular filling is increased by exercise, emotion or tachycardia from any cause.

Pathological Early Diastolic Triple Rhythm

Pathological third heart sound, ventricular gallop, protodiastolic gallop, rapid filling gallop are synonymous terms for one form of pathological triple rhythm which, as regards timing in the cardiac cycle and probable mechanism, is identical with the physiological third heart sound; that is, at normal heart rates, it is heard early in diastole and shortly after the second heart sound. It may be loudest at the apex or near the sternum depending on which ventricle is involved and also on other factors such as cardiac enlargement, rotation or displacement. It is best heard in the

recumbent posture, especially with the patient lying on the left side and with light pressure of a bell stethoscope or better still by direct auscultation with the ear applied to the chest wall. The sound is of a dull, low frequency quality and is often accompanied by a palpable impulse.

As explained above, it is still not agreed, despite more than 50 years of experiment and discussion, whether this sound is of muscular origin from



PHYSIOLOGICAL THIRD HEART SOUND AND PATHOLOGICAL TRIPLE RHYTHM.

Fig. 6

vibrations of the ventricular wall or results from rebound tensing of the atrio-ventricular valves, but it certainly falls on the descending limb of the "v" wave and corresponds with the period of rapid ventricular filling. For this reason it is apt to be loud when the filling (right atrial) pressure of the ventricle is raised and will not be heard when valvular stenosis precludes rapid ventricular filling.

Triple Rhythm in Constrictive Pericarditis

An added sound in early diastole similar in timing to other varieties of triple rhythm due to rapid ventricular filling is often heard in constrictive pericarditis. It is frequently accompanied by a palpable impulse. Doubtless both sound and impulse are due to a combination of rapid inflow (from the raised venous pressure) and the abrupt limitation of filling produced by the unyielding qualities of the fibrous or calcified pericardium. In fact in quality, though not in timing, this sound resembles an opening snap and the condition is sometimes mistaken for mitral stenosis. However, there is no murmur and examination will reveal the clinical and radiographic features of constrictive pericarditis.

GALLOP RHYTHM

When tachycardia is present the cadence of triple rhythm is often that described as a "gallop" and because of the frequent association with

myocardial failure this sound is of serious prognostic significance. The louder the added sound the more serious the outlook.

Summation Gallop

Summation gallop signifies the super-imposition of atrial and ventricular added sounds. This may occur with prolongation of the A-V conduction time (P-R interval of the electrocardiogram) or, more frequently, with tachycardia. Because of the loudness of this triple rhythm and its ready detection summation gallop is probably the variety of pathological triple rhythm most frequently recognised and its association with tachycardia from ventricular failure is responsible for the gloomy prognosis so often associated with "gallop" rhythm.

Summation of the two added sounds can, of course, only be proved by the demonstration of quadruple rhythm with slowing of the heart rate.

OPENING SNAP OF THE MITRAL VALVE

The opening snap of the mitral valve is a very characteristic physical sign with which all should be familiar. Not only is it frequently and clearly to be heard and present more often than not in patients with mitral stenosis

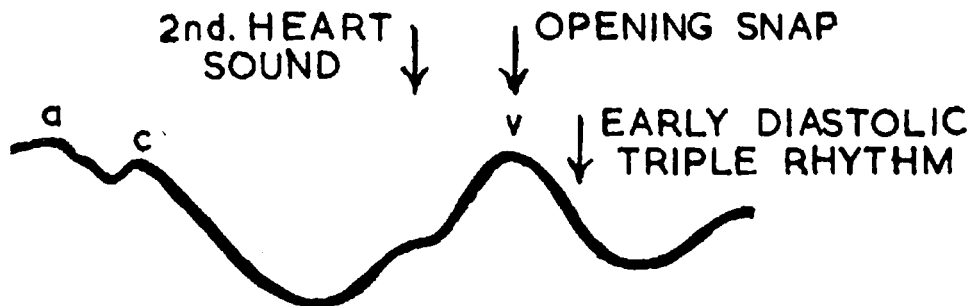


Fig. 7

but its detection may give the stimulus to listen with care for an apical mid-diastolic murmur not previously heard. Also, paradoxically, its *absence* in a patient with signs of mitral stenosis may be more important than its presence and signify that the valve is calcified, rigid or dominantly incompetent. Finally, if not recognised it may be mistaken for some other condition.

In timing this sound occurs earlier in diastole (.08"-.12" after the beginning of the second sound) than a third heart sound or pathological triple rhythm (.12"-.15" and coincides with the peak of the "v" wave, that is to say with the opening of the A-V valves. (Fig. 7).

In quality the sound usually differs from other forms of triple rhythm in being "metallic" rather than "dull." In position it is often heard over a wide area but is loudest at the left sternal border in the third or fourth intercostal space. When heard it is always followed by a mid-diastolic apical murmur but such a murmur may occur without a snap.

In significance it has been claimed that a clear opening snap like a loud first heart sound implies the presence of a "pliant" or "diaphragmatic" valve with the inference that such a valve will be readily amenable to surgical treatment. Although it does signify a mobile anterior cusp our experience has been that it does not by any means follow that the valve margins will not be rigid or that valvotomy will be successful.

Differential diagnosis is chiefly from splitting of the second heart sound and from triple rhythm. However, two other conditions with which it may be confused should be mentioned. Rarely a similar opening snap of the tricuspid valve may accompany tricuspid stenosis and an added sound similar in quality to a snap but similar in timing to a third heart sound may be associated with constrictive pericarditis.

DIFFERENTIAL DIAGNOSIS OF TRIPLE RHYTHM

The differential diagnosis of the added sounds which are discussed in this section can be appreciated from Fig. 8.

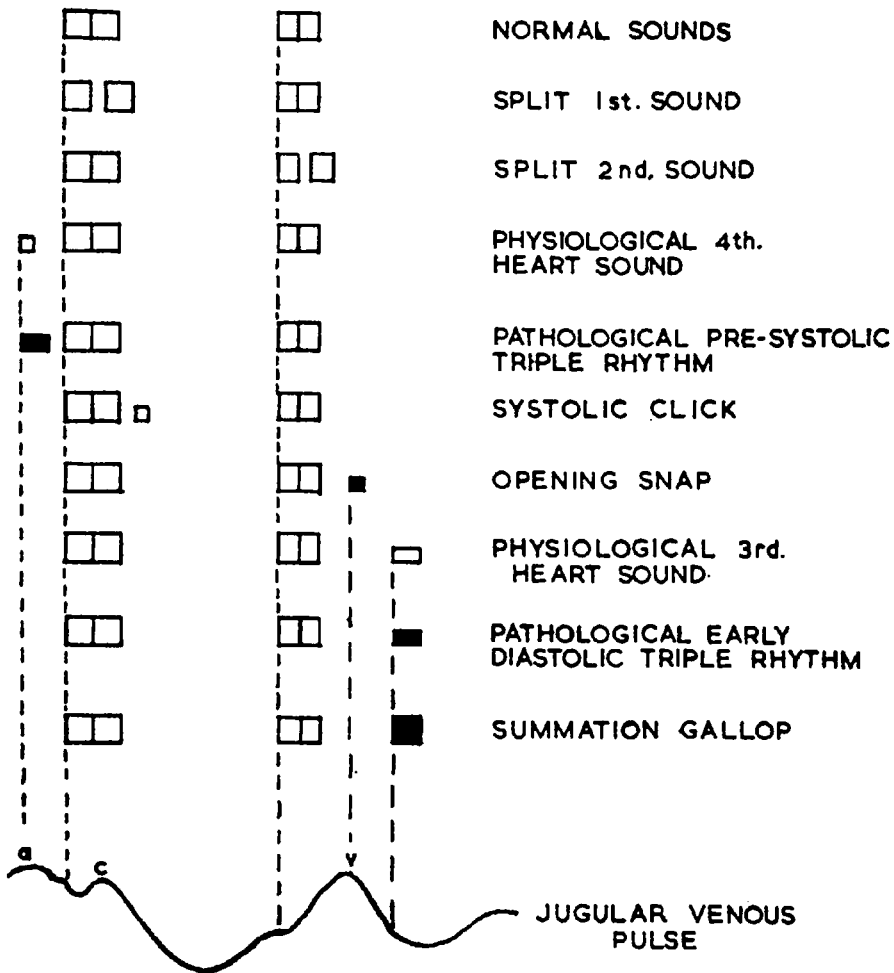


Fig. 8

[TO BE CONTINUED