A CODING SYSTEM FOR THE ARRHYTHMIAS*

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Descriptions of cardiac arrhythmias, when written out in full, are laborious long-hand procedures. There is, for instance, no more succinct way of stating complete A-V dissociation between normal sinus rhythm and non-paroxysmal A-V nodal tachycardia. This is a lengthy and cumbersome statement, its registration is time-consuming, and it presupposes an excellent knowledge of the arrhythmias on the part of the reader. If the information in this statement could, by means of symbols, be expressed with logic, clarity and simplicity in an easily remembered format, the understanding, registration and classification of the arrhythmia would be facilitated.

The purpose of this paper is to present the basic principles of a coding system for the arrhythmias, using symbols that can be clearly understood and internationally accepted. It is a system that uses signs available on a conventional typewriter and which is flexible enough to represent with ease any newly discovered arrhythmia.

Basic Principles

Every normal and abnormal cardiac rhythm has 3 fundamental components which, in order of importance, are:

1. The anatomical site of impulse formation.
2. The type and sequence of impulse discharge.
3. The mode of impulse conduction.

Symbols are allocated to each one of these three components, and a combination of symbols representing all three constitutes the final code.

SECTION I. SYMBOLS REPRESENTING IMPULSE ORIGIN

There are 4 possible anatomical sites of impulse origin, viz. the *sinus node,* the *atria,* the *A-V node,* and the *ventricles.*

The site of origin is the most important single aspect of any cardiac rhythm and is therefore represented in the code by large capital letters (Table I). These symbols have the same implication in French, Spanish, German, Dutch, Interlingua and Esperanto.

TABLE I. SYMBOLS REPRESENTING IMPULSE ORIGIN

S	= sinus node
A	= atria
N	= A-V node
V	= ventricles

TABLE II. SYMBOLS REPRESENTING DISCHARGE TYPE AND SEQUENCE

t	= tachycardia
b	= bradycardia
f	= fibrillation
fl	= flutter
p	= parasystole
x	= extrasystole
xm	= multifocal extrasystoles
x2	= extrasystoles every second beat, i.e. in bigeminal rhythm
x3	= extrasystoles every third beat
xx	= a pair of extrasystoles, i.e. two extrasystoles in succession
)x(	= an interpolated extrasystole

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SECTION II. SYMBOLS REPRESENTING DISCHARGE TYPE AND SEQUENCE

An arrhythmic discharge may be in the form of *tachycardia, bradycardia, extrasystole, fibrillation, flutter, parasystole,* or *escape rhythm.* These are represented in the code by 'small' (lower case) letters (Table II).

A combination of symbols from Sections I and II forms the basic code.

Examples:

1. Vx = ventricular extrasystole.
2. Sb = sinus bradycardia.
3. Af = atrial fibrillation.
4. Vp = ventricular parasystole.
5. Vxm = multifocal ventricular extrasystoles.
6. Ax2 = atrial extrasystoles in bigeminal rhythm.
7. Vxx = ventricular extrasystoles in pairs.
8. V)x(= an interpolated ventricular extrasystole.

Sinus Rhythm

Normal sinus rhythm needs no further identification and is simply represented by the single large capital letter S.

Escape Rhythm

An escape rhythm is an inherent discharge of an ectopic pacemaker (situated in the atria, A-V node, or ventricles) which becomes manifest when the faster dominant pacemaker is suppressed. It is the natural rhythm of an ectopic pacemaker and, as in the case of normal sinus rhythm, needs no further qualification; it is represented simply by an unqualified symbol from Section I.

Examples:

9. A = atrial escape rhythm.
10. N = A-V nodal escape rhythm.
11. V = ventricular escape rhythm.

(See also examples 28, 29 and 30)

A single escape beat (in contrast to continuous escape rhythm) is represented by the appropriate large capital letter qualified by the number 1.

Example:

12. V1 = a single ventricular escape beat. (See also example 20)

TABLE III. SYMBOLS REPRESENTING IMPULSE CONDUCTION

–	= normal conduction between sinus node and atrium, or atrium and A-V node
=	= normal conduction through both bundle branches
— or –=	= simple delay in conduction; first-degree block
—, — —	= progressively increasing delay in conduction
/	= complete block
≠	= incomplete block; second-degree block
≠ +	= the supernormal phase of conduction
a	= interference at atrial level
n	= interference at A-V nodal level
v	= interference at ventricular level
,	= the comma, or disjunctive punctuation mark, *separates* statements either, but not both, of which is operative at the same time
:	= the colon, or conjunctive punctuation mark, *joins* statements *both* of which are operative at the same time

SECTION III. SYMBOLS REPRESENTING IMPULSE CONDUCTION

The conduction sequence is indicated by horizontal lines or dashes between the anatomical symbols (written now in small letters). The whole conduction sequence is enclosed in parentheses. Thus, (s−a−n=v) indicates normal conduction from the sinus node through the atria, A-V node and both bundle branches to the ventricles. A complete list of conduction symbols is shown in Table III.

Anterograde Conduction

Normal anterograde conduction

Example:

13. St (s – a – n = v) represents sinus tachycardia with normal anterograde conduction.

First-degree block. An additional dash between the anatomical symbols in the conduction code represents a simple delay in conduction.

Example:

14. Sb (s – a – n– = v) represents sinus bradycardia with first-degree A-V block.

Second- and third-degree block. The symbol for blocked conduction is the oblique line (/). The position of this symbol in relation to other symbols indicates the type of block. When used by itself, it means complete block ; when written through a dash, viz. (–/–) it means incomplete block. If conduction is intermittent with a constant ratio, the ratio is stated, e.g. 3 / 2. When no constant ratio exists, no figure is given.

Examples:

15. S (s – a – n ≠ v) represents normal sinus rhythm with irregular A-V block, i.e. there is no constant ratio of conducted to non-conducted sinus impulses.
16. S (s – a – n 4 ≠ 3 v) represents sinus rhythm with 4:3 A-V block.
17. St (s – a – n – , – – , 4 ≠ 3 v) represents sinus tachycardia with 4:3 A-V block showing the Wenckebach phenomenon. *Note*: The comma separates statements either of which is operative at a given moment.
18. Afl (a – n ≠ v) represents atrial flutter with irregular A-V block.
19. S (s 3 / 2 a – n = v) represents sinus rhythm with 3:2 S-A block.

Retrograde Conduction

A reversed sequence of anatomical symbols represents retrograde conduction. Thus, (v – n – a – s) indicates normal retrograde conduction from the ventricles to the sinus node. The above sequence is used with ventricular escape beats and escape rhythms.

Example:

20. V (v – n – a – s) represents ventricular escape rhythm with normal retrograde conduction.

However, a conduction disturbance may also exist between an atrial or ventricular ectopic focus (extrasystolic or parasystolic) and the surrounding myocardium. This is termed 'exit block' (see also section below titled 'Exit block'). To allow for the coding of this disturbance, the symbol for extrasystoles or parasystole (x or p) is always included in the conduction sequence when coding these arrhythmias.

Examples:

21. Vx (x – v – n – a – s) represents ventricular extrasystole with normal retrograde conduction.
22. Vx (x – v – n – – a – s) represents ventricular extrasystole with delayed retrograde conduction to the atria, i.e. first-degree V-A block.
23. Vtx (x – v – n – a – s) represents paroxysmal ventricular tachycardia with normal retrograde conduction. See also section below titled 'Paroxysmal and non-paroxysmal tachycardia'.
24. Vtx (x – v – n – , – – , 4 / 3 a – s) represents paroxysmal ventricular tachycardia with 4:3 V-A block showing the Wenckebach phenomenon.

SPECIFIC APPLICATION

Phasic Aberrant Ventricular Conduction

In phasic aberrant ventricular conduction there is temporary, intermittent or isolated, abnormal intraventricular block (bundle-branch block) during rhythm that otherwise shows normal intraventricular conduction. It is represented by a single, instead of a double, line between the letters n and v in the conduction sequence, thereby indicating that the supraventricular impulse has travelled down one bundle branch only.

Example:

25. Ax (x – a – n – v) represents atrial extrasystole with phasic aberrant ventricular conduction.

Exit Block

Occasionally, a parasystolic or extrasystolic impulse is blocked between the ectopic focus and the surrounding myocardium. This is referred to as exit block. Only an intermittent exit block can be diagnosed with certainty.

Examples:

26. Vp (p 2 / 1 v – n – a – s) represents ventricular parasystole with 2:1 exit block.
27. Vp (p / v – n – a – s) represents ventricular parasystole with irregular exit block.

Dual Rhythms

A dual rhythm exists when two pacemakers concurrently and independently contribute to the rhythm of the heart. This occurs, for example, in (*i*) complete A-V block, (*ii*) paroxysmal ventricular tachycardia with retrograde V-A block, (*iii*) A-V nodal tachycardia with retrograde block, and (*iv*) parasystole. In such circumstances, both rhythms must be shown in the notation. This is effected by conjoining the codes for both rhythms by means of a colon (the conjunctive symbol), thereby indicating that both rhythms are operative at the same time.

Example:

28. S (s – a – n /) : V (v – n /) represents sinus rhythm with complete A-V block coexisting with ventricular escape rhythm.

A-V Nodal Rhythms

The notation of A-V nodal rhythms must show both anterograde and retrograde conduction of the nodal impulse. Both sequences are conjoined by a colon, the conjunction symbol, to indicate that the processes are operative at the same time. The anterograde sequence is shown first.

Examples:

29. N (n = v : n – a – s) represents A-V nodal escape rhythm with normal anterograde and retrograde conduction. Conduction times to the ventricles are the same, i.e. the P wave will be superimposed on the QRS complex.
30. N (n – = v : n – a – s) represents A-V nodal escape rhythm with delayed anterograde conduction and normal retrograde conduction. The P wave will be recorded just before the QRS complex.
31. N (n = v : n – – a – s) represents A-V nodal escape rhythm with normal anterograde conduction and delayed retrograde conduction. The P wave will be recorded just after the QRS complex.

Interference

This word is used in the electrophysiological sense, viz. the collision of impulses from more than one pacemaker; the impulses spread through the heart simultaneously and obstruct each other's progress. A dual rhythm must be present for this to occur. The symbol for interference is an oblique line through an anatomical symbol (Table III). Thus, n̸ represents interference within the A-V node. *Note*: interference in the atria (a̸) or in the ventricles (v̸) results in atrial or ventricular fusion complexes.

Example:

32. S (s – a – n̸) : Vtx (x – v – n̸) represents sinus rhythm coexisting with paroxysmal ventricular tachycardia. The rhythms are dissociated and interference occurs within the A-V node.

Paroxysmal and Non-Paroxysmal Tachycardias

Paroxysmal tachycardia is a succession of 3 or more extrasystoles and thus has an abrupt onset and termination. The tachycardia is therefore 'extrasystolic' in type and is consequently represented by the symbols for tachycardia and extrasystole, viz. tx. See examples 23, 24 and 32.

Non-paroxysmal A-V nodal tachycardia[1] is due to the discharge of an enhanced A-V nodal pacemaker—a situation analogous to the enhanced sinus pacemaker in sinus tachycardia. It is not 'extrasystolic' in type and the onset and termination are therefore not abrupt; there is also a gradual variation in rate. This rhythm is therefore represented by the symbol t which requires no further qualification.

Example:

33. Nt (n = v : n – a – s) represents non-paroxysmal A-V nodal tachycardia with normal anterograde and normal retrograde conduction.

Miscellaneous

The following further examples will help to illustrate various points.

Examples:

34. Vf represents ventricular fibrillation. Since conduction is chaotic, no conduction sequence is shown.
35. Af (a – n ≠ v) represents atrial fibrillation. Some degree of intermittent A-V block is always present in uncomplicated atrial fibrillation, thus resulting in an irregular ventricular response.
36. Vtp (p – v – n – a – s) represents parasystolic ventricular tachycardia with normal retrograde conduction to the sinus node.

The conduction sequence may, for convenience, be further abbreviated so that only the abnormal part of the sequence is written. For example, sinus rhythm with complete A-V block, which is normally coded as S (s – a – n /), may be further abbreviated to S (n /).

DISCUSSION

The coding, classification and card-indexing of scientific parameters in any discipline are essential for study, teaching and research purposes.

At present, the only method for coding the arrhythmias is a numerical system.[2] In this system, each arrhythmia is represented by an arbitrary number. For example: *Supraventricular tachycardia of undetermined origin with aberrant ventricular conduction* is classified and coded as 121.72. It is clear that the coding and decoding of arrhythmias with this system requires an excellent knowledge of the arrhythmias and this would seem to place it beyond the reach of the average reader. Furthermore, decipherment requires reference to a Master Table which cannot be memorized. Thus, any classification based on such a numerical code is largely arbitrary; the authors also indicate that some overlapping in classification is unavoidable.

An ideal system should be simple and virtually self-explanatory. By ascribing symbols to each of the three fundamental components which are basic to any arrhythmia, all the arrhythmias can be coded by a simple permutation of symbols which, in addition, have a mnemonic significance, and whose meaning thus becomes immediately apparent.

A system of correlative symbols similar to this has been used successfully in radiology[3] and, having proved its worth, has been extended to cover an even wider range.[4]

A code which uses correlative symbols which have physiological and pathological meaning is of distinct advantage; it is easily memorized, readily understood, and so enables the student to grasp any arrhythmia presented to him, once the basic code is understood. We have used this system (which is described here in basic outline only) not only for the registration of the arrhythmias, but also, by simple adaptation, for their indexing and classification. The classification system[5] consists of 4 major divisions, based on the primary component of the notation, i.e. the sites of impulse origin: *S*inus, *A*trial, *N*odal and *V*entricular rhythms. Further subdivisions are based on the secondary and tertiary components of the notation. This system can be used with ease in all cases where indexing and classification of the arrhythmias are required, e.g. in libraries, museums, hospital records and insurance records.

SUMMARY

The basic principles of a coding system for the arrhythmias are presented. Symbols are allocated to the three fundamental components of every arrhythmia: the impulse origin; the discharge sequence; and the conduction sequence. A combination of symbols from all three sections constitutes the final code. The symbols have a mnemonic connotation, are available on the conventional typewriter, and are applicable internationally.

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