CLASSIFICATION OF CARDIAC ARRHYTHMIAS AND CONDUCTION DISTURBANCES

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Special report

Classification of cardiac arrhythmias and conduction disturbances

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In our previous report on the definition of terms related to cardiac rhythm,[1] we stressed the importance of adequate definition and classification of electrocardiographic (ECG) findings. Having for the time being completed the list of definitions, we accepted the assignment to proceed with the classification of arrhythmias and conduction disturbances. In doing so, the following points were agreed:

1. Basic classification should be wide and should cover all relevant aspects of cardiac rhythm. In addition, it should be flexible and easily allow for modifications and extensions.

2. Classification should primarily be concerned with those aspects of cardiac rhythm which can be deduced from a surface tracing. As a consequence, it should be mainly descriptive and, with few exceptions (e.g., re-entry, entrance block, concealed conduction), avoid the enumeration of mechanisms of arrhythmias and conduction disturbances.

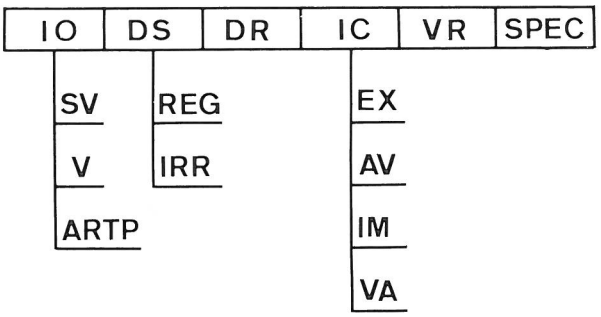

Fig. 1. Basic classification scheme for arrhythmias and conduction disturbances. See text for explanation. *IO* = impulse origin; *DS* = discharge sequence; *DR* = discharge rate; *IC* = impulse conduction; *VR* = ventricular rate; *SPEC* = special phenomena; *SV* = supraventricular; *V* = ventricular; *ARTP* = artificial pacemaker; *REG* = regular; *IRR* = irregular; *EX* = exit; *AV* = atrioventricular; *IM* = intramyocardial; *VA* = ventriculo-atrial.

3. Definition and classification are the hallmarks of a coding system, which in turn may serve as an annotation system for ECG reading and reporting and as a key to storage and retrieval.[2-4] The possibilities of coding, however, should not interfere with subclassification. In other words, the manner in which the classified data can be stored and retrieved in a handy and useful way should be considered separately, and could be adapted as needed to local facilities for ECG processing.[3]

4. Because of diversity of opinion and differences in technique of recording and measurement, criteria for the diagnosis of various arrhythmias and conduction disturbances have not been laid down, although the urgent need for this is fully recognized.

At present, the most detailed system of classification for arrhythmias is that of Katz and Pick,[5] in which various disturbances of impulse forma-

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Table I. Classification according to impulse origin

1. Supraventricular
   - I. Sino-atrial (SA) node
   - II. Atrium (excluding SA node and atrioventricular (AV) junction)
     - A. Right
     - B. Left
     - C. Multifocal*
     - D. Unspecified
   - III. AV junction
   - IV. Unspecified supraventricular
2. Ventricular
   - I. Right
   - II. Left
   - III. Septal
   - IV. Multifocal*
   - V. Unspecified
3. Impulse origin undetermined (supraventricular or ventricular)
4. Artificial pacemaker**
   - I. Atrial pacing
     - A. No sensing function (asynchronous, fixed rate)
     - B. Atrial sensing, inhibited mode
     - C. Atrial sensing, triggered mode
   - II. Ventricular pacing
     - A. No sensing function (asynchronous, fixed rate)
     - B. Atrial sensing, triggered mode
     - C. Ventricular sensing, inhibited mode
     - D. Ventricular sensing, triggered mode
   - III. Atrioventricular pacing
     - A. No sensing function (asynchronous, fixed rate)
     - B. Ventricular sensing, inhibited mode

*See also Table VI. 8 and Ref. 1, regarding multifocal rhythm.
**Classification according to the recommendations of the Tenth Bethesda Conference on Optimal Electrocardiography.[7]

Table II. Classification according to discharge (impulse) sequence

1. Single or up to two consecutive discharges
   - I. Premature impulses (excluding manifest parasystolic impulses)
     - A. Extrasystoles
       - a. Doublet (couplet)
       - b. Bigeminy
       - c. Trigeminy, quadrigeminy, etc.
       - d. R on T phenomenon
       - e. Other patterns
     - B. Captures
     - C. Unspecified
   - II. Escapes
2. Regular rhythms
   - I. At inherent rate (including escape rhythm)
   - II. Bradycardia
   - III. Accelerated rhythm
   - IV. Tachycardia
   - V. Flutter
     - A. Typical
     - B. Atypical
3. Irregular rhythms
   - I. At inherent rate (including escape rhythm)
     - A. Respiratory
     - B. Non-respiratory
       - a. Ventriculophasic
       - b. Arrest
       - c. Other
   - II. Bradycardia
     - A. Respiratory
     - B. Non-respiratory
       - a. Ventriculophasic
       - b. Arrest
       - c. Other
   - III. Accelerated rhythm
     - A. Respiratory
     - B. Non-respiratory
       - a. Ventriculophasic
       - b. Arrest
       - c. Other
   - IV. Tachycardia
     - A. Respiratory
     - B. Non-respiratory
       - a. Ventriculophasic
       - b. Arrest
       - c. Other
   - V. Fibrillation

tion and conduction are grouped according to well-defined entities. To update this system would involve the major task of summarizing all possible combinations of arrhythmias and conduction disturbances, including those recently identified. Therefore, this Task Force has selected the analytical approach proposed by Schamroth and Friedberg.[6] This is based on the systematic analysis and classification of cardiac rhythm according to *impulse origin, discharge sequence,* and *impulse conduction.* To these have been added *discharge rate, ventricular rate,* and a group of *special aspects* related to impulse formation and/or conduction (Fig. 1). Each of these components can be subdivided in varying degrees of depth, depending on the interest of the user. Accordingly, the cardiac rhythm—be it normal or abnormal—can be characterized and classified with respect to the characteristics of the components mentioned above. Only those aspects considered relevant to a given rhythm are indicated. When the activity of two or more pacemakers is evident in a single tracing, each should be specified and analyzed separately, even though their joint activity may constitute a well-defined entity, as in atrioventricular dissociation and some manifestations of the sick sinus syndrome. For instance, sinoventricular dissociation due to

Table III. Classification according to rate of discharge

1. 20 or less/min.
2. 21–30/min.
3. 31–40/min.
4. 41–50/min.
5. 51–100/min.
6. 101–150/min.
7. 151–200/min.
8. 201–250/min.
9. More than 250/min.

Table IV. Classification according to impulse conduction

1. Conduction from a pacemaker (exit of an impulse)
   - I. Normal or presumably normal
   - II. First degree block
   - III. Second degree block
     - A. Type I (Wenckebach)
     - B. Type II (Mobitz II)
     - C. Advanced
   - IV. Unspecified block (concealed discharge)*
   - V. Impaired conduction presumably due to physiological refractoriness
     - A. Delayed conduction
     - B. Intermittent failure
2. Atrioventricular conduction
   - I. General classification
     - A. Normal
     - B. First degree block
     - C. Second degree block
       - a. Type I (Wenckebach)
       - b. Type II (Mobitz II)
       - c. Advanced
     - D. Third degree block
     - E. Unspecified block*
     - F. Impaired conduction presumably due to physiological refractoriness
       - a. Delayed conduction
       - b. Intermittent failure
       - c. Persistent failure (duration unspecified)
     - G. Short PR-interval**
     - H. Alternation of conduction
   - II. Bundle branch and fascicular conduction
     - A. Normal
     - B. Right bundle branch block (RBBB)
       - a. Incomplete
         - (1) Intermittent (transient, non-permanent)
         - (2) Persistent (duration unspecified)
       - b. Complete
         - (1) Intermittent (transient, non-permanent)
         - (2) Persistent
     - C. Left bundle branch block (LBBB)
       - a. Incomplete
         - (1) Intermittent
         - (2) Persistent
       - b. Complete
         - (1) Intermittent
         - (2) Persistent
     - D. (Left) Anterior fascicular block (LAFB)
       - a. Intermittent
       - b. Persistent
     - E. (Left) Posterior fascicular block (LPFB)
       - a. Intermittent
       - b. Persistent
     - F. Combinations of bundle branch and fascicular block (specify)
     - G. Impaired conduction presumably due to physiological refractoriness (aberrant conduction)
       - a. Right
       - b. Left
       - c. Right and left
       - d. Unspecified
3. Intra-myocardial conduction
   - I. Intra-atrial conduction delay (including aberrant atrial conduction)
   - II. Intra-atrial block
   - III. Unspecified (non-specific) intraventricular conduction delay or block
4. Ventriculo-atrial conduction
   (See general classification of AV conduction Table IV.2.I.)

*Applicable to single premature impulses and escapes (Table II.1). See Ref. 1, regarding second degree block.

**Only applicable to sinus rhythm and not necessarily implying conduction which is faster than normal. See also Ref. 1, regarding short PR syndrome.

ventricular tachycardia with retrograde block is classified under the heading of *Sinus rhythm with failure of AV conduction due to physiological refractoriness in the AV junction* (possibly with the addition of ventricular capture or fusion), as well as separately under the heading of *ventricular tachycardia with retrograde block* (usually third degree). The same reasoning applies to the classification of alternating rhythms.

Deviation from this rule is appropriate whenever separate analysis would imply repetition of identical statements. For example, with multiform ventricular activity, the site of origin is classified as multifocal ventricular, when it can be reasonably assumed that the alteration in QRS configuration is due to a difference in site of impulse formation in the ventricle (e.g., multifocal ventricular parasystole). When this is not the case, it is preferable to indicate the site of origin as "unspecified ventricular" with an additional

Table V. Classification according to ventricular rate

See classification according to rate of discharge (Table III)

Table VI. Special aspects related to impulse formation and/or conduction

1. Artificial pacemaker function
   - I. Normal
   - II. Defective
     - A. Pacing
     - B. Sensing
     - C. Pacing and sensing
2. Concealed conduction
   - I. In a pacemaker
   - II. In the AV junction
   - III. In the subjunctional region

   Effect of concealment (applicable to all sites mentioned above)
     - A. Impairment of conduction
     - B. Facilitation of conduction
     - C. Resetting of subsequent discharge
     - D. Combinations
3. Coupling interval
   - I. Constant (80 msec. or less)
   - II. Variable
4. Entrance block (protection)
   - I. Parasystole
     - A. Intermittent
     - B. Persistent
   - II. Other
5. Enhancing mechanisms
   - I. Supernormality
     - A. Of conduction
     - B. Of excitability
   - II. Other
6. Gap phenomena
   - I. In the AV conduction system
     - A. During anterograde conduction
     - B. During retrograde conduction
   - II. In other parts of the heart
7. Isorhythmic dissociation
8. Multiform configuration of wave forms
   - I. Bidirectional (alternating)
   - II. Fusions
     - A. Atrial
     - B. Ventricular
   - III. Torsade de pointes*
   - IV. Unspecified
9. Pre-excitation
   - I. Atrial
     - A. Intermittent
     - B. Persistent
   - II. Ventricular
     - A. WPW pattern
       - a. Intermittent
       - b. Persistent
     - B. Short PR syndrome
       - a. Intermittent
       - b. Persistent
10. Re-entry
    - I. Atrial
    - II. AV junctional
    - III. Ventricular
    - IV. Combined atrial and ventricular

    Further specifications, applicable to above:
      - A. Concealed
        - a. Single
        - b. Repetitive
      - B. Manifest
        - a. Single
        - b. Repetitive

*A specific type of irregular and usually repetitive ventricular tachycardia in which specific etiological factors are involved and in which, during each paroxysm, the QRS axis progressively changes, so that in some leads the ventricular complex appears to twist around the isoelectric line.

statement indicating multiform configuration of the wave forms (see Table VI.8).

Descriptive statements such as "uniform" and "multiform" do not fit into a classification according to impulse origin (Table I), discharge sequence (Table II), and impulse conduction (Table IV). This is especially true in those cases where one is uncertain as to the mechanism underlying the alteration in configuration—e.g., bidirectional tachycardia and some cases of multiform ventricular or atrial extrasystoles.

While such an approach may at first look strange, it does in fact follow a logical order and allows for easy extension of the subdivision of individual components. For example, the electrophysiologist may wish to analyze AV conduction with regard to conduction in the AV junction and the subjunctional region, or he may even wish to distinguish between conduction in the approach fibers, the AV node, and the common AV bundle. Also, some electrocardiographers may wish to distinguish between typical and atypical type I AV block, or between type I, type II, and advanced intermittent bundle branch block. Likewise, some may wish to classify defective artificial pacemaker function in terms of transient or persistent failure.

The following Classification Tables constitute a basic framework and are considered self-evident. For nomenclature the reader is referred to the report on definitions.[1] Disagreement may arise over the use of the adjectives *intermittent*

and *persistent.* In the present context, dealing with the classification of single electrocardiograms, "intermittent" refers to an electrocardiographic phenomenon during a particular rhythm, which lasts less than the duration of the available record. If it continues throughout the recording it is classified as "persistent." From a clinical point of view, however, such manifestations may well be of temporary nature. For that reason *persistent,* referring to an established but not necessarily an ever-present phenomenon, is preferred to *permanent.* Intermittency which manifests as persistent in a given ECG will be apparent from different statements in consecutive records, e.g., persistent bundle branch block in one record and normal conduction in another.

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