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A simple numerical coding system for clinical electrocardiography*

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A simple numerical coding system for clinical electrocardiography has been developed. This system enables the storage in coded form of the ECG analysis. The code stored on a digital magnetic tape can be used for a computer print-out of the analysis, while the information can be retrieved at any time if needed. Experience gained in the coding of 35,000 ECGs has shown that the system meets the requirements in a large hospital, and can easily be combined with computer analysis of ECGs [5].

clinical electrocardiography; coding system; storage; retrieval; ECG analysis; computer print-out

Introduction

In view of the divergence in the interpretation and evaluation of electrocardiograms (ECGs) it is hardly surprising that at present none of the existing coding systems for electrocardiography satisfies the demands of all concerned in the reading of ECGs.

In fact, a generally accepted coding system hardly seems a feasible goal if one is not willing to sacrifice personal habits for the sake of uniformity of interpretation and all that goes with it. However, if some general demands are met, it should be possible to design a code which, with supplementary suggestions and constructive criticism, could eventually lead to a system which is acceptable to the majority. Such general requirements are:

1. The feasibility of correlating ECG findings with age, sex and other patient data.
2. The simple arrangement of a system to allow for easy processing of the daily output of ECGs in a large hospital, e.g. 1000 beds.
3. Acceptability in clinical practice. For this reason the system should be arranged to conform to the clinician's way of reading an ECG, and not the other way round.
4. The possibility of including all relevant information in the code, thus allowing its use for computer processing of the evaluation.
5. Flexibility of the system to allow for necessary modifications.

With these aims in mind we have elaborated on the simple and logical system presented by Schamroth and Friedberg [1] for the coding of cardiac arrhythmias, to include abnormalities in wave form and voltage, and various diagnostic considerations. In addition, the original tables of Schamroth and Friedberg [1] were modified.

The basic code

The basic code (see Table A) comprises 43 digits, each of which corresponds to one position on a Hollerith punch card. Each position represents a

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TABLE A (see text for discussion)

*Basic code for electrocardiography**

Position	Group	Item	Code	Table
35	Rhythm	Impulse origin	Imp. Or.	1
36		Discharge sequence	Disch. Seq.	2
37		Conduction sequence during exit of the impulse from the pacemaker or retrograde conduction of an A–V junctional impulse	Exit/Retro.	3
38		Conduction sequence in the A–V junction	A–V	4
39		Special phenomena related to impulse conduction	Spec. phen.	5
40		Ventricular rate	V. Rate	6
41			Imp. Or.	1
42			Disch. Seq.	2
43		Vide pos. 35	Exit/Retro.	3
44		through 39	A–V	4
45			Spec. phen.	5
46		Incompletely analysed mechanisms	Incompl. mech.	7
47	Non-rhythm	Mean frontal plane electrical axis of QRS	Â-QRS	8
48		P wave voltage and morphology	Pvolt./morph.	9
49		Leads pos. 48	Leads	16
50		PT_A segment	PT_A	10
51		Leads pos. 50	Leads	16
52		QRS morphology	QRS morph.	11
53		Leads pos. 52	Leads	16
54		QRS morphology	QRS morph.	11
55		Leads pos. 54	Leads	16
56		QRS voltage	QRS volt.	12
57		Leads pos. 56	Leads	16
58		ST segment	ST	13
59		Leads pos. 58	Leads	16
60		T wave	T	14
61		Leads pos. 60	Leads	16
62		QT interval and U wave	QT/U	15
63	Diagnoses	Intra-atrial and intra-ventricular conduction	I.A./I.V.	17
64		Hypertrophies	Hypertr.	18
65		Probability pos. 64	Prob. Hypertr.	24
66		Coronary heart disease	CHD	19
67		Stage of coronary heart disease pos. 66	Stage	20
68		Coronary heart disease	CHD	19
69		Stage of coronary heart disease pos.68	Stage	20
70		Probability of CHD pos. 68	Prob. CHD	24
71		Effect of drugs	Drugs	21
72		Effect of biochemical change	Biochem.	22
73		Miscellaneous diagnoses	Misc.	23
74	Final	Comparison with previous ECG	Comp.	25
75		Final evaluation	Final	26
76		Notes for the clinician	Notes	27
77		Non codable findings	Non-codable	28

* The 'positions' in this table represent the corresponding columns on a Hollerith card.

certain aspect of the ECG or a diagnostic group and can be subdivided into ten digits (from 0 through 9) to indicate possible deviations of that component. In each position only one digit can be marked. The combination of digits yields the final code.

Four major groups can be identified:

Group 1 represents cardiac rhythm and covers 12 positions. This permits the analysis and coding of two different rhythms according to site of impulse formation, discharge sequence, conduction during exit of the impulse from the pacemaker site, conduction within the A–V junction and special phenomena related to impulse conduction. In addition, the activity of a third pacemaker and the ventricular rate of the rhythm which is represented first in the code can be indicated as well.

Group 2 covers 16 positions for the mean frontal plane electrical axis of QRS (1 position), P wave voltage and configuration (1 position), PT_A segment (1 position), QRS configuration (2 positions), QRS voltage (1 position), ST segment (1 position), T wave (1 position), QT interval and U wave (1 position). In addition, 7 positions are available to indicate the leads in which possible

deviations of the items in this group can occur. Each of the 7 items to which this pertains is thus followed by one 'lead position'.

Group 3 covers 11 positions, representing various diagnostic considerations such as: intra-atrial and intraventricular conduction (1 position), hypertrophies (1 position), coronary heart disease (CHD) (2 positions), effect of drugs (1 position), effect of biochemical change (1 position) and miscellaneous electrocardiographic diagnoses (1 position). Two positions are available to indicate the probability of diagnosis for hypertrophies and CHD, respectively.

For each of the positions representing CHD, 1 position has been added for the stage of myocardial infarction.

Group 4 covers 4 positions for comparison with previous ECGs, final evaluation (from normal to pathological), notes for the clinician and noncodifiable findings. Each is represented by 1 position.

In Table A the column on the extreme left indicates the position on the code card which represents the item in the central column. The column headed 'code' gives the abbreviation of the item as it is represented on a coding sheet (see Fig. 1). The column on the extreme right lists the Tables that indicate the subdivision of components and the diagnostic groups (see Tables 1 through 28).

Table 1 (positions 35 and 41)

Impulse origin

0. sinus impulse
1. atrial impulse
2. A–V junctional impulse
3. ventricular impulse
4. atrial impulse, multifocal
5. ventricular impulse, multifocal
6. artificial atrial pacemaker impulse
7. artificial ventricular pacemaker impulse
8. supraventricular impulse
9. site of impulse origin not determined: supraventricular impulse with aberration or ventricular impulse

Table 2 (positions 36 and 42)

Discharge sequence

0. normal inherent rhythm (including escape rhythm)
1. escape beat(s)
2. bradycardia
3. premature beat(s)
4. tachycardia (including accelerated rhythm)
5. flutter
6. fibrillation
7. 'chaotic' discharge
8. arrhythmia
9. arrest

Table 3 (positions 37 and 43)

Conduction sequence during exit of the impulse from the pacemaker to the surrounding myocardium, or retrograde conduction of an A–V junctional impulse

0. normal conduction
1. first degree block (delayed conduction)
2. second degree block of the Wenckebach type
3. third degree (complete) block
4. second degree block with constant preceding conduction times
5. high degree block
6. interference
7. protection block with or without exit block (parasystolic rhythm)
8. reciprocation and other reentry mechanisms

Table 4 (positions 38 and 44)

Conduction sequence in the A–V junction: anterograde conduction of supraventricular impulses or retrograde conduction of ventricular impulses

0. normal conduction in the A–V junction
1. first degree block (delayed conduction) in the A–V junction
2. second degree Wenckebach block in the A–V junction
3. third degree (complete) block in the A–V junction
4. second degree block in the A–V junction with constant preceding conduction times (Mobitz, type II)
5. high degree (advanced) block in the A–V junction
6. interference in the A–V junction
7. block and/or interference in the A–V junction
8. preexcitation (Wolff–Parkinson–White syndrome)
9. short P–R interval

Table 5 (positions 39 and 45)

Special phenomena related to impulse conduction

1. alternation of conduction in the A–V junction
2. concealed conduction in the A–V junction
3. intra-atrial block
4. aberration
5. fusion beats
6. capture beats
7. varying coupling intervals
8. variant form (of W.P.W. syndrome)
9. 'supernormal' mechanism

Table 6 (position 40)

Ventricular rate

1. less than 20 beats/min
2. 20–40 beats/min
3. 40–60 beats/min
4. 60–100 beats/min
5. 100–125 beats/min
6. 125–150 beats/min
7. 150–200 beats/min
8. more than 200 beats/min

Table 7 (position 46)

Incompletely analysed mechanisms

0. sinus activity
1. atrial premature beats
2. A–V junctional premature beats
3. ventricular premature beats
4. supraventricular premature beats
5. supraventricular pacemaker activity of undetermined mechanism
6. ventricular pacemaker activity of undetermined mechanism
7. spare
8. spare
9. no conclusive rhythm analysis

Table 8 (position 47)

Mean frontal plane electrical axis of the QRS complex ($\hat{A}$–QRS)

1.	horizontal	− 30° to + 30°
2.	intermediate	+ 30° to + 75°
3.	vertical	+ 75° to +110°
4.	right axis deviation	+110° to +180°
5.	left axis deviation	− 30° to − 90°
6.	undefined	±180° to − 90°
7.	indeterminate	
8.	shifting $\hat{A}$–QRS	

Table 9 (position 48)

P wave voltage and morphology

0. normal P wave
1. broad and/or notched P wave of normal voltage
2. notched P wave with terminal increase in voltage
3. positive–negative P wave with broad terminal negativity
4. prominent peaked P wave
5. high peaked P wave
6. high broad P wave
7. positive–negative P wave with high peaked positivity and broad terminal negativity
8. negative P wave
9. respiratory variation of P wave voltage and/or morphology

Table 10 (position 50)

PT_A segment

0. normal PT_A segment
1. downward sloping PT_A segment depression
2. horizontal PT_A segment depression
3. PT_A segment elevation

Table 11 (positions 52 and 54)

QRS morphology

0. normal QRS width
1. absence of the normal small Q-wave
2. small Q wave
3. prominent Q wave
4. wide Q or QS
5. QR pattern
6. R pattern
7. RSR′ pattern
8. notched and/or slurred QRS complex
9. widened QRS complex

Table 12 (position 56)

QRS voltage

0. normal QRS voltage
1. normal QRS voltage with delayed intrinsicoid deflection
2. low QRS voltage
3. high QRS voltage
4. high QRS voltage with delayed intrinsicoid deflection
5. small R wave
6. high R wave
7. high R wave with delayed intrinsicoid deflection
8. deep S wave
9. electrical alternans of the QRS complex

Table 13 (position 58)

ST junction and ST segment

0. normal ST–J and ST-segment
1. normal ST–J or ST–J depression of less than 1 mm and upward concavity of the ST segment
2. ST–J depression of 1 mm or more and upward sloping ST or upward concavity of the ST segment
3. normal ST–J or ST–J depression of less than 0.5 mm and horizontal or downward sloping ST segment
4. ST–J depression of 0.5–0.9 mm and horizontal or downward sloping ST segment
5. ST–J depression of 1 mm or more and horizontal or downward sloping ST segment
6. normal ST–J or ST–J elevation of less than 1 mm with upward convexity of the ST segment
7. ST–J elevation of 1 mm or more with upward convexity of the ST segment
8. ST–J elevation of more than 0.5 mm with upward concavity of the ST segment

Table 14 (position 60)

T wave

0. normal T wave
1. high and/or peaked positive T wave
2. notched T wave
3. flat and/or symmetrically positive T wave
4. isoelectric T wave
5. positive–negative T wave
6. negative–positive T wave
7. asymmetrically inverted T wave
8. symmetrically inverted T wave
9. T wave alternans

Table 15 (position 62)

Q–T interval and U wave

0. normal Q–T interval and normal U wave
1. normal Q–T interval and prominent U wave
2. normal Q–T interval and diphasic or negative U wave
3. shortened Q–T interval and normal or absent U wave
4. shortened Q–T interval and prominent U wave
5. shortened Q–T interval and diphasic or negative U wave
6. prolonged Q–T interval and normal or absent U wave
7. prolonged Q–T interval and prominent U wave
8. prolonged Q–T interval and diphasic or negative U wave
9. fusion of a prominent U wave with the preceding T wave: Q–T interval indeterminable

Table 16 (positions 49, 51, 53, 55, 57, 59 and 61)

Leads

0. all limb leads
1. I and/or aVL, with or without one or more of leads II and V_3–V_6
2. one or more of leads II, III and a VF
3. V_3R, V_1, with or without one or more of leads V_2–V_5
4. one or more of leads V_2–V_5
5. V_6, with or without one or more of leads V_5–V_2
6. V_1 and/or V_2 and one or more of leads V_4–V_6
7. V_3R, V_1–V_4, I and/or a VL
8. one or more of leads II, III, aVF and one or more of leads I, V_2–V_6, aVL
9. one or more of leads II, III, aVF and one or more of leads V_3R, V_1–V_3, I and aVL

Table 17 (position 63)

Intra-atrial and intraventricular conduction

0. normal intra-atrial and intraventricular conduction
1. intra-atrial conduction disturbance
2. incomplete RBBB
3. complete RBBB
4. intermittent RBBB
5. incomplete LBBB
6. complete LBBB
7. intermittent LBBB
8. intermittent RBBB and intermittent LBBB
9. intramural conduction disturbance

Table 18 (position 64)

Hypertrophy and enlargement

0. no signs of hypertrophy or enlargement
1. left atrial hypertrophy or enlargement
2. left ventricular hypertrophy or enlargement
3. combined left atrial and left ventricular hypertrophy or enlargement
4. right atrial hypertrophy or enlargement
5. right ventricular hypertrophy or enlargement
6. combined right atrial and right ventricular hypertrophy or enlargement
7. biatrial hypertrophy or enlargement
8. biventricular hypertrophy or enlargement

Table 19 (positions 66 and 68)

Coronary heart disease

0. no signs of coronary heart disease
1. coronary heart disease
2. coronary insufficiency
3. subendocardial injury
4. nontransmural infarction
5. anterior wall infarction
6. lateral wall infarction
7. posterior wall infarction
8. posterolateral infarction
9. apical infarction

Table 20 (positions 67 and 69)

Stage of coronary heart disease

1. acute
2. recent
3. old
4. recent or old

Table 21 (position 71)

Effect of drugs

0. no signs of drug effect
1. possible effect of drugs
2. digitalis effect – consistent with
3. digitalis intoxication – consistent with
4. antiarrhythmic drug effect – consistent with
5. antiarrhythmic drug intoxication – consistent with

Table 22 (position 72)

Effect of biochemical change

0. no signs of biochemical change
1. possible effect of biochemical change
2. hypopotassaemia – consistent with
3. hyperpotassaemia – consistent with
4. hypocalcaemia – consistent with
5. hypercalcaemia – consistent with

Table 23 (position 73)

Miscellaneous diagnoses

1. early repolarization; subepicardial injury should be excluded
2. pericarditis – consistent with
3. cardiac aneurysm – consistent with
4. cardiomyopathy – should be considered
5. ECG change – consistent with CNS lesion, posttachycardia or postpacing syndrome, or a preceding episode of circulatory arrest
6. dextrocardia
7. postextrasystolic T wave change

Table 24 (positions 65 and 70)

The probability of diagnoses

1. cannot be excluded with certainty
2. possible
3. consistent with
4. probable
5. conclusive

Table 25 (position 74)

Comparison with previous ECG

0. no previous ECG available
1. not distinctly changed in comparison with previous ECG
2. distinctly changed in comparison with previous ECG
3. comparison with previous ECG indicates change towards normalization
4. comparison with previous ECG indicates increase in ECG abnormalities
5. comparison with previous ECG indicates a typical evolution
6. ECG stress test indicates no abnormality
7. ECG stress test indicates change towards normalization
8. ECG stress test is suggestive of CHD

Table 26 (position 75)

Final evaluation

0. normal ECG
1. ECG within normal limits
2. borderline ECG
3. slightly abnormal ECG
4. abnormal ECG
5. pathological ECG
6. normally functioning pacemaker
7. abnormally functioning pacemaker
8. poor technical record

Table 27 (position 76)

Notes for the clinician

1. interpretation under reservation; repeat the record if possible
2. repeat the record
3. repeat the record with leads one intercostal space higher and one intercostal space lower than usual
4. repeat the precordial leads with extension to V_9
5. repeat the record with leads to the right of V_3R, V_1
6. repeat the record with a strip for rhythm analysis
7. detailed analysis demands an intracardiac electrogram or esophageal ECG
8. exercise ECG desirable
9. consult a cardiologist

Table 28 (position 77)

Noncodable findings

1. noncodable aspect of ectopic pacemaker activity
2. noncodable P wave abnormality
3. noncodable aspect of QRS morphology
4. noncodable aspect of QRS voltage
5. noncodable ST–T segment deviation
6. noncodable aspect of intra-atrial and/or intraventricular conduction
7. noncodable hypertrophy
8. noncodable aspect of coronary heart disease
9. noncodable diagnoses (miscellaneous)

Coding of the ECG

The interpretation of the ECG is noted on a coding sheet (see Fig. 1) or check marked on a preprinted optical reading form (Fig. 2), according to the numerical subdivision of Tables 1 through 28. The coded interpretation is subsequently punched on a Hollerith punch card. The optical reading form has the advantage that it can be punched automatically, thus eliminating one possible source of error. Figure 1 is an example of the coding of 10 different ECGs on one coding sheet. The punch card with the coded ECG interpretation is used to give a computer print-out of the evaluation. Figure 3 is a print-out of example Nr. 5 in Figure 1. In addition, the code is stored on digital magnetic tape for further data processing. The coding is done by a secretary but can equally well be done by the cardiologist himself, or by one of the trainees.

The design of the optical reading form or coding sheet corresponds to Table A. Positions 1 through 9

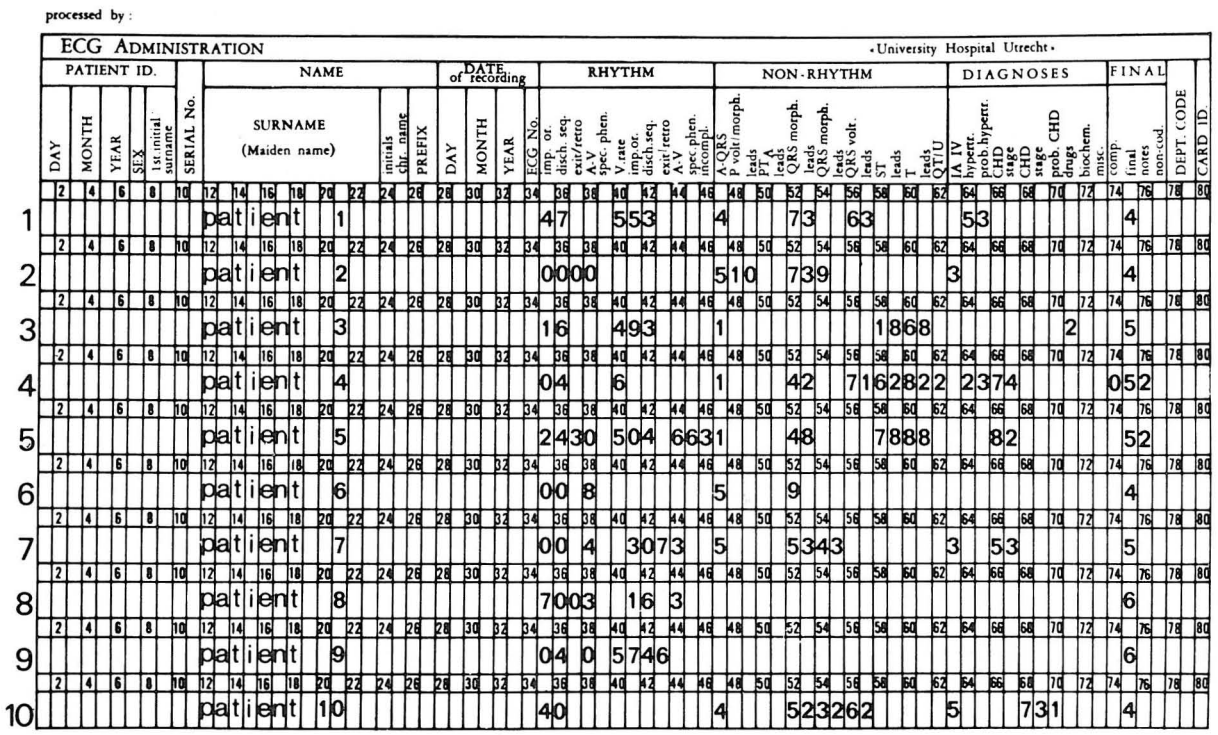

Fig. 1 Coding sheet designed for the coding of ten different ECGs.

are used for patient identification, consisting of six digits for date of birth (D D M M Y Y), one digit for sex (1 for male or 2 for female) and two digits (according to serial number in the alphabet) indicating the first initial of the patient's surname (or maiden name of a married woman). For differentiation of patients in the very rare case of identical surnames as well as dates of birth, a two-digit 'serial number' can be indicated in positions 10 and 11. Next, the patient's surname (or maiden name) is indicated in positions 12 through 27, with the initials of the Christian name in positions 24 and 25, and prefixes, if any, in positions 26 and 27.

The date of recording is noted in positions 28 through 33, while the serial number of the ECG can be marked in position 34, if several ECGs of the same patient are recorded on the same day. Positions 35 through 77 are used for the coding of the ECG, while the code numbers for department and ward are noted in positions 78 and 79, respectively. Position 80 represents the code for electrocardiography and is used for card selection in the computer department.

Coding rules

In order to ensure uniformity in the use of the numericals presented in Tables 1 through 26, we had to define each component and the criteria on which a given electrocardiographic diagnosis is based. These definitions have been described in detail [2].

In addition, in order to overcome some of the limitations imposed by the use of a limited number of positions of which each can only be subdivided into ten digits, some general coding rules had to be formulated.

These general rules are:

1. Findings are classified and coded according to the principal deviation.

2. In the presence of multifocal pacemaker activity the rhythm which dominates the ventricular rate is represented first in the code (positions 35–40).

3. The analysis of a complicated sinus rhythm into its components has been given priority over the analysis of ectopic activity and the analysis of an ectopic rhythm takes priority over extrasystolic

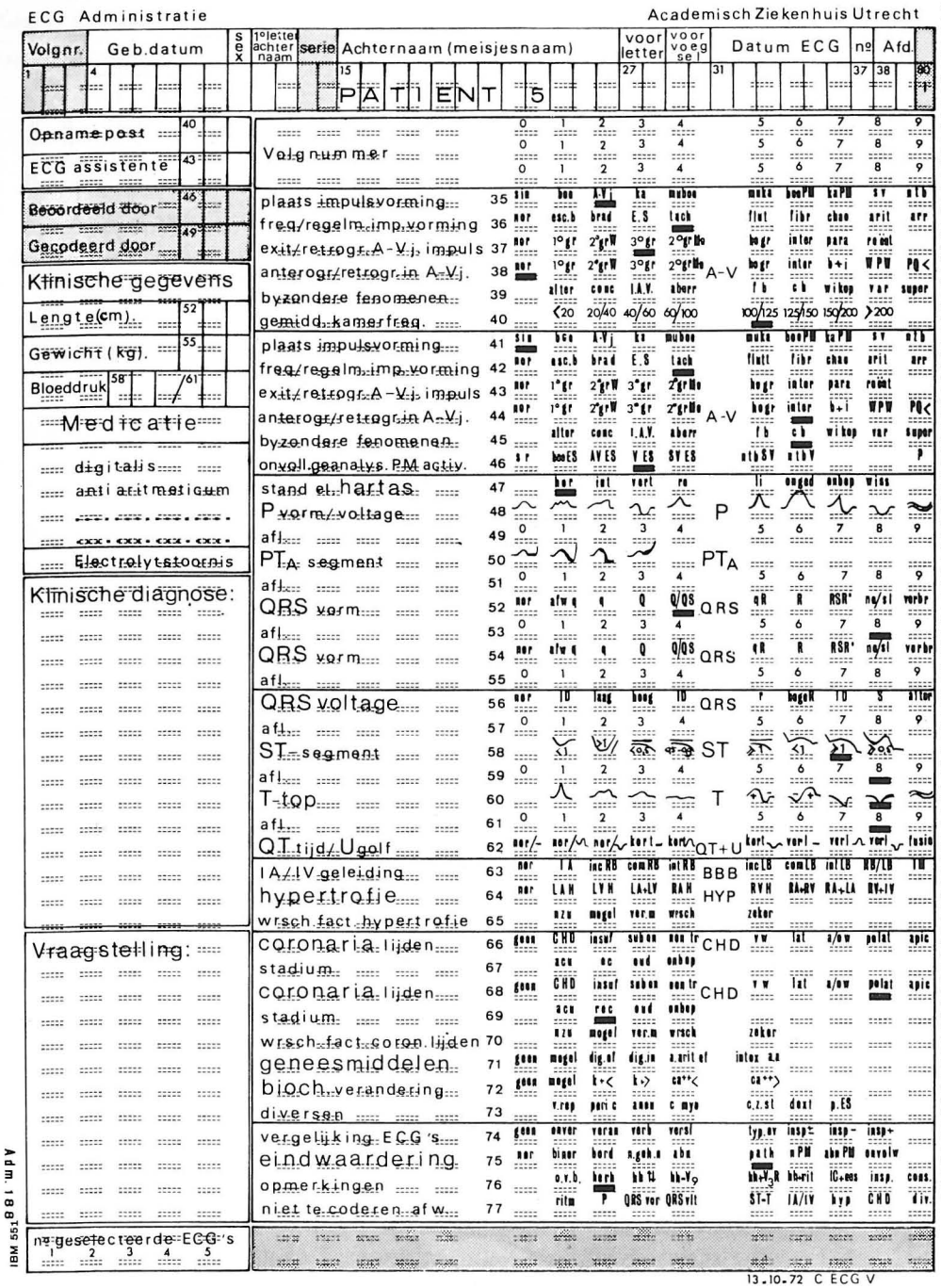

Fig. 2 Optical reading form on which the code of example 5 in Fig. 1 is check-marked. The print is in Dutch for local use, but can, of course, be translated into any language.

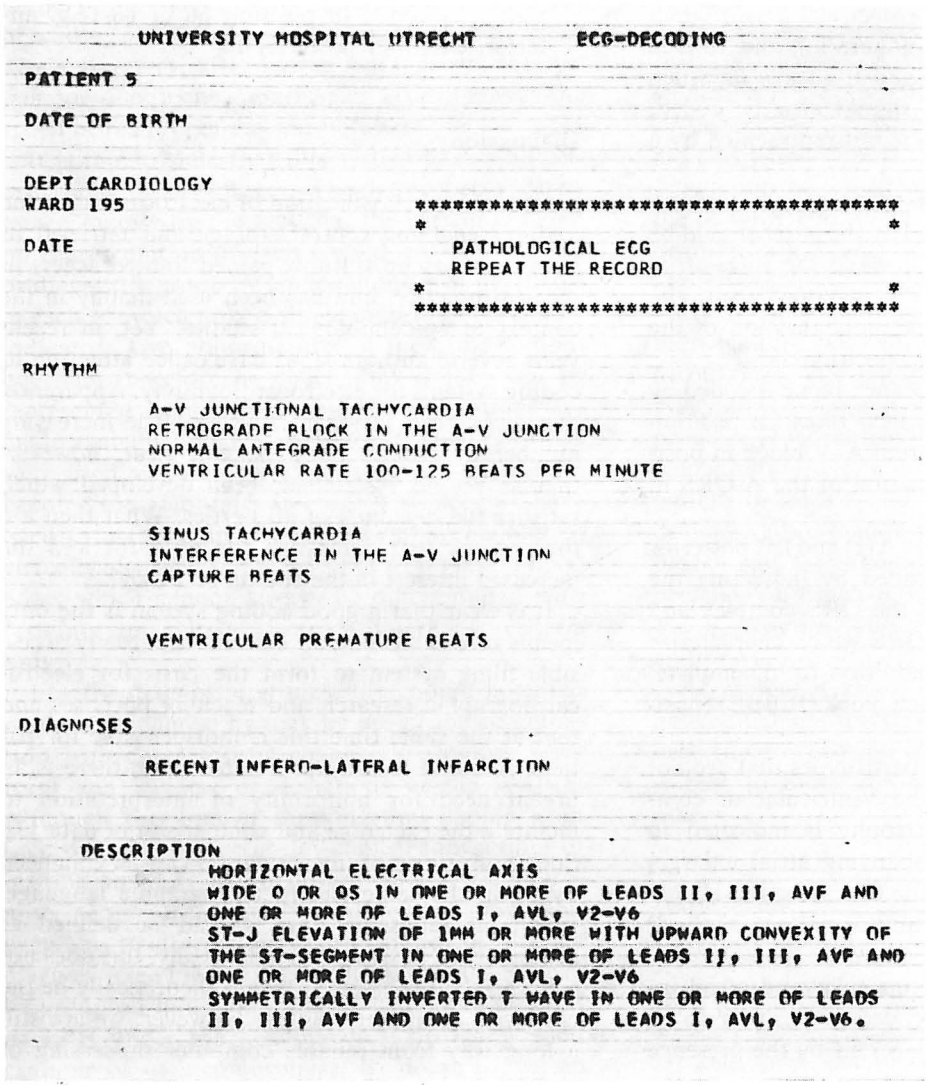

Fig. 3 Computer print-out of the ECG reading of example 5 in Fig. 1.

activity. Thus it will be found that position 46 is only rarely used for uncomplicated sinus rhythm, supraventricular and ventricular extrasystoles in the presence of more complex arrhythmias.

4. The relation between retrograde P′ wave and QRS complex in cases of A–V junctional activity is indicated by characterizing their respective conduction times as 'normal' or 'delayed' (first degree block) [1].

For instance:

a. When the P′ wave and QRS complex coincide, both anterograde and retrograde conduction are coded as 'normal' even though they may both be equally prolonged.

b. When the P′ wave follows the QRS complex, retrograde conduction is coded as 'delayed' and anterograde conduction as 'normal'. The reverse is done when the P′ wave precedes the QRS.

5. To supplement the diagnostic groups 'intra-atrial and intraventricular conduction' (position 63), 'hypertrophies' (position 64) and 'coronary heart disease' (positions 66 and 68), the abnormalities in

rhythm, mean frontal plane electrical axis of QRS (Â-QRS), PT_A segment, configuration and voltage of the P–QRS–T complex and the leads in which these abnormalities occur should also be coded, whenever a given diagnosis is not represented by a single digit.

a. In cases of combined intra-atrial and intraventricular conduction disorders the latter should be indicated in position 63, while the intra-atrial conduction disturbance is apparent from the typical abnormality in the configuration of the P wave to be indicated in position 48.
b. Partial bilateral bundle branch block is coded by indicating the bundle branch block in position 63, an accompanying partial A–V block in position 38 or 44 and a deviation of the Â-QRS in position 47.
c. Left anterior hemiblock (LAH) and left posterior hemiblock (LPH) are coded by indicating the typical abnormalities in the QRS complex and the deviation of the Â-QRS which characterize these sites of block, in addition to 'incomplete' (partial) left bundle branch block (ILBBB) (position 63).
d. In cases of combined hypertrophies that are not included in Table 18, the ventricular or combined ventricular hypertrophy is indicated in position 64. The accompanying atrial enlargement is apparent from the characteristic abnormality in configuration and/or voltage of the P wave (position 48).
e. In cases of combined ventricular and atrial infarction, the former is coded in position 66 or 68, while the latter is suggested by the presence of a horizontal depression or elevation of the PT_A segment (position 50), and from supraventricular arrhythmias, if any (positions 35–40 or 41–45).
f. In cases of two differently localized infarcts or two different manifestations of coronary heart disease (e.g. an old infarct and signs of acute coronary insufficiency), the less likely of the two is coded in position 68. A probability factor with regard to this can then be marked in position 70.
g. For a more exact localization of the myocardial infarcts listed in Table 19, use is made of the leads in which the characteristic changes in the QRS-T complex occur. These are indicated in their respective positions, while the 'basic' localization is coded in position 66 or 68 (e.g. anterior, lateral or posterior).

Discussion

Coding and classification of electrocardiographic findings enabling central storage and retrieval of such data has up till now gained limited access in medical practice, and has been used mainly in the context of epidemiological studies. Yet, in recent years several authors [1–4] have called attention to coding systems for electrocardiography. Apparently there is a need for such a system. The increasing number of articles does make it clear, however, that as yet no system has been developed which satisfies the demands of all parties. What then are the reasons that determine the need for and the increased interest in the coding of ECGs?

It is clear that a good coding system is the only means of establishing an efficient and easily accessible filing system to form the basis for electrocardiographic research and teaching purposes and that at the same time this is indispensable for patient care and follow-up. Furthermore, there is an urgent need for uniformity of interpretation to facilitate the exchange and comparison of data [3]. Such uniformity of interpretation can be enhanced by using the same electrocardiographic language, which, at the same time, should be defined as accurately as possible [2]. Admittedly, this does not solve all the problems as would theoretically be the case with computer reading. However, we are still a long way from reliable computer processing of clinical ECGs and thus, for the time being and probably also in the near future, one will have to compromise between automated reading of at least some ECGs and reading by the cardiologist. It is of additional advantage if the coding system which is being used can be integrated in the processing of the ECGs and at the same time enables the comparison of data of both ways of reading the ECG [5]. Importance has been ascribed to convenience in the use of the system presented above, so that manual coding would not be too elaborate and time-consuming. After all, it is precisely for this reason that most of the present coding systems are considered unsuitable for routine clinical use. We have, therefore, made efforts to adapt the general

design of the code to the conventional clinical method of reading an ECG. Our experience to date has been that a secretary, after having worked with the system for about one month, can keep up with the speed of reading of any cardiologist.

It is fair to state that this system has its advantages and disadvantages. The latter being determined mainly by the fact that the system is based on representation of each component of the ECG or diagnostic group by a fixed number of positions, in each of which only a single digit (aspect) can be indicated. Two abnormalities of the same component can therefore be coded only if they can be represented by one digit, or if two positions are made available for that component. Dual positions were used as sparingly as possible lest the system become too elaborate. In many instances we have tried to use one digit to indicate abnormalities of virtually identical significance, or to represent diagnoses which cannot always be differentiated with certainty on purely electrocardiographic criteria only.

For the diagnostic groups, the coding potential could be expanded by making use of the combination with characteristic changes in rhythm, wave form and voltage, or deviations of the Â-QRS. Although this line of thinking and coding is in accordance with present-day clinical conventions of reading an ECG [6], it nevertheless is a compromise, necessitating specially developed computer programs to afford a direct print-out of the desired diagnosis (see Fig. 3). This print-out, of course, can be produced in any language. The coding of LAH or LPH under the heading of ILBBB is a good example of such compromise. By doing so, we do not imply that LAH or LPH is identical with ILBBB. The coding rule mentioned under 5c will, however, avoid that all cases of left axis deviation would be printed as LAH. At the same time the coding of a qR complex in lead aVL, and commonly also in lead I, will enable the selection of LAH from true ILBBB.

It seems important to stress that use of this system is not dependent on the way in which the ECGs are recorded. Also it is not necessary to store the data on a punch card, thus bypassing the limitation of mentioning only one aspect in a given position. This, however, would decrease its manageability and hamper its routine use in hospital practice.

For the same reasons we have purposely avoided a too quantitative subdivision of components. If such subdivision is needed, e.g. for epidemiological studies, it is suggested that the positions 75, 76 and 77 be used for this purpose, provided its characters are adequately defined. For routine clinical use, we only report and code heart rhythm, the position of the Â-QRS and eventual abnormal findings. The position of the items which are considered normal are left blank.

Up till now, approximately 35.000 ECGs have been handled with this coding system and stored in our files, yielding an average of less then 1% noncodifiable findings. Most of these concerned the presence of more than two different aspects of QRS configuration, e.g. a widened QRS complex, a qR pattern in leads I and aVL with marked left axis deviation (as a manifestation of left anterior hemiblock) and a QS complex in leads V_1–V_4; or the presence of a high R wave in leads I, aVL and/or V_5, V_6 together with a high R wave in leads V_1, and/or V_2.

At present it seems questionable whether these noncodifiable aspects of the QRS complex will necessitate expansion of the positions. We think it is best to await the experience and criticism of others.

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