THE VECTORCARDIOGRAM IN SOME STATIC TESTS

Y. N. Vassilev

Functional changes under modified static conditions (orthostatic, clinostatic, transitions to them and the like) using vectorcardiographic registration have not been studied hitherto. They are of interest both from physiological and clinical viewpoint, and have a practical bearing on sports medicine also. The reason of vectorcardiography being insufficiently developed is attributed to the fact that as yet, it is in the process of research, particularly the three-plane system of Akulinchev (1960), employed in our work (Tz. Pavlov — 1972). Hence, we made it our aim to carry out observations along this line. A number of physiological positions which afford data contributing to the solution of some important circulation problems were made use of.

The orthostatic test has been long since applied in sports medicine neurovegetative diagnostics, in certain physiological examinations and the like (N. S. Misjuk et al. — 1974). R. F. Goldstein et al. (1975) established a difference in the reaction to the test between healthy individuals and subjects with cardiovascular diseases.

The sitting position constitutes a transition state of the test referred to. The latter is of practical interest since this particular position is employed in veloergometry, and therefore data are indispensable for the interpretation of changes taking place during the test (L. Tomov, I. Tomov — 1975). Moreover, the comparative study of VCG in horizontal and sitting position may provide additional information about the state of circulation.

On elevated lower part of the body (test of lifted lower limbs) the blood flow distribution is altered. The possibilities of the latter differ in healthy subjects and decompensation.

Material and Method

A series of twenty clinically healthy subjects, aged 15—50 years, were studied. We worked with apparatus VEKS 4M according to the three-plane system suggested by I. T. Akulinichev (1960). Examinations were conducted under conditions of secured physical and mental rest, in the morning, after horizontal lying-down position for 10—15 minutes. The initial vectorcardiogram (VCG) was registered prior to each test. The investigations were made at 30-minute intervals in the following order: 1) test with lifted lower part of the body at 60°; 2) sitting position test; 3) orthogonal position test.

The optimal time of recording was determined on the basis of preliminary elaborations, proceeding from the complex changes in the organism, registered in addition with ECG, blood pressure and heart rate. The aim was to record changes directly provoked by the test, prior to the marked interference of com-

pensatory mechanisms. Table I illustrates the times of test changes' registration considered as the most favourable.

Table 1

Test	Optimal registration time
Lifted lower part of body	8—10 sec.
Sitting position	5—10 sec.
Orthostatic position	5—10 sec.

Blood pressure measurements were made just prior to testing and after the VCG record.

The results of the study were verified statistically according to G. Piryov and Tz. Tzanev (1973).

Results

1. Lifted lower part of body test. A reduction of the three QRS loops is registered in the VCG: with mean 20.0 per cent for the frontal loop, 33.33 per cent—for the sagittal, and 30.77 per cent — for the horizontal one.

The changes are essential for the frontal loop ($T_{\Delta}=47.58$, at $T_{table}\ 5\%=53$). The changes for the sagittal and horizontal loop are very significant since $T_{\Delta}=37.8$ and 38.84, at $T_{table}\ 1\%=39$.

Here the blood pressure shows a systolic increase with 9.45 mm Hg average which is essential ($T_{\Delta}=49.12$, at $T_{table}=5\%$ mm$=53$), at insignificant fall of diastolic pressure, averaging 5.12 mm for the group. 2. Sitting position test. The rightside and anteriorward shift of the electric axis amounts to a few degrees. The area increase of the loops is characteristic although it is statistically significant for the horizontal loop only ($T_{\Delta}=50.13$, at $T_{table}\ 5\%=53$) at 18.70 per cent average modification.

The listed below changes occur in the course of testing: 1) a prompt increase of loops in the three planes, lasting for 20 seconds average period; 2) it is followed by a reduction in size; 3) within 3 minutes, the loops are augmented once again as compared to the starting horizontal position. Hence, it is recommended to perform recording at that very instant.

The blood pressure shows an increase in systolic pressure, averaging 9.42 mm Hg for the group, i. e. it is insignificant as $T_{\Delta}=51.19$, at $T_{table}\ 5\%=53$. 3. Orthostatic test. VCG reveals about 10 per cent leftside, downward and posteriorward shifting. Simultaneously, area reduction takes place as follows: frontal loop — mean 19.25 per cent, sagittal — 28.84 per cent and horizontal — 4.75 per cent.

The above described changes are essential for the frontal loop ($T_{\Delta}=48.42$, at $T_{table}\ 5\%=53$), very significant for the sagittal loop ($T_{\Delta}=37.58$, at $T_{table}\ 1\%=39$), and insignificant for the horizontal loop ($T_{\Delta}=55.14$, at $T_{table}\ 5\%=53$).

Changes in the loops from all three planes are rather marked in the extreme horizontal electric position.

Systolic pressure for the whole group displays a mean 13.53 mm fall, and diastolic one — a rise with 16.83 mm, with changes being estimated as signif-

icant (accordingly $T_d = 51.35$ and 49.60, at T_{table} 5% = 53). Reverse reactions are also possible in isolated cases, most likely due to a neurovegetative type of dystonia.

Discussion

The vectorcardiogram proves helpful in the dynamic follow-up of changes in the cardiovascular system. Their statistical significance is demonstrated by the present study. Thus we are enabled to prognosticate the changes in some morbid conditions which will be subject to further studies.

Along with that, during the sitting and lifted lower part of body tests, the blood pressure displays a systolic increase of about 10 mm Hg, accompanied by various VCG changes: by a reduction of loops in the former, and by an increase of lcops in the latter. At this point the change in the loop magnitude is in opposite sense, whereas the changes in blood pressure are one-way. This may be explained by the different hemodynamic conditions. In lifted lower part of body, conditions are created for an enhanced return flow, whilst in sitting position a reflux of part of the blood in the distal segments occurs. In all likelihood, a variety of reflectory factors interfere. Yet in the early period of cardiac insufficiency, derangements in the listed above regularities might be anticipated.

In orthostatic position a reduction of loops from all three planes is observed, most probably owing to a degree difference from the sitting position, and to the interference of additional reflex mechanisms as well.

Furthermore this is an indication that the size of VCG loops in the latter case is less affected by blood pressure than by the other factors exerting influence on the heart electric force. It is a well known fact that some authors (M. B. Tartakovskii — 1964) attribute the changes in the size of VCG loops to the magnitude of cardiac electric forces.

Assessment of the above described vectrocardiographic tests proves the vectorcardiogram sensibility in functional changes taking place in the cardiovascular system.

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ВЕКТОКАРДИОГРАММА ПРИ НЕКОТОРЫХ СТАТИЧЕСКИХ ТЕСТАХ

Й. Н. Василев

РЕЗЮМЕ

Производят анализ ВКГ при измененных статических условиях: при ортостатическом тесте, тесте с приподнятой нижней частью тела и тест сидячего положения. Даны и одновременные изменения кровяного давления и оптимальные времена для регистрации тестов. Устанавливают отсутствие параллелизма между величиной петли и высотой кровяного давления. Векторкардиограмма показывает чувствительность к изменяющимся функциональным условиям сердечно-сосудистой системы.