

7. Cardiometry practices

7.1 Electrodes setting method and mandatory orthostatic test procedure

7.1.1 Electrodes setting method

For doing the ECG and RhEO procedures, the electrodes are set in the zones of aorta and apex of the heart as shown in figure 91. In these positions the data on the CVS hemodynamics characteristics and functioning is more informative and precise (ref. para 4.1.6).

The upper electrode is set on the bone in the zone of aorta, which is convenient for the electrode fixing on the body. The lower electrode is set 5 cm below the metasternum on the soft tissues. Both electrodes are to be set on the anteromedian body line.

Figure 92 shows the setting of the additional electrodes of the rheograph generator. The zone of these electrodes setting can be chosen arbitrary. But they are to be set somewhat aside from the pick-up electrodes as indicated in the picture. They receive the signals of generator. In Fig. 92, the 5-th electrode is connected to the common bus (grounding) of the instrument. It is set in the lower body.

The simple arrangement of the electrodes allows their prompt setting on the body of the patient and setting the instrument to work without entailing the inconvenience for patient and personnel.

Figure 93 shows the instrument-to-electrodes connection.

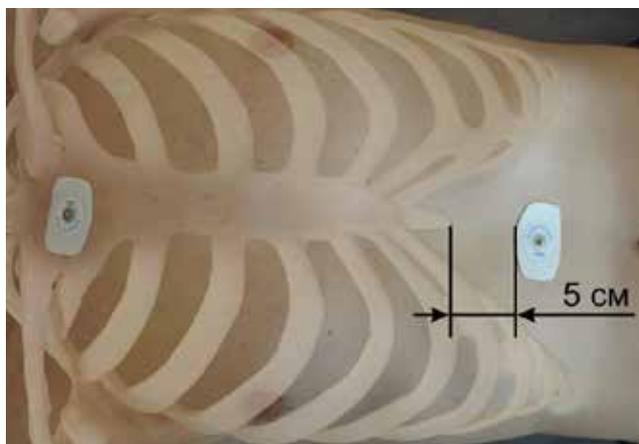


Fig. 91. ECG electrodes setting in the zone of aorta and apex of the heart

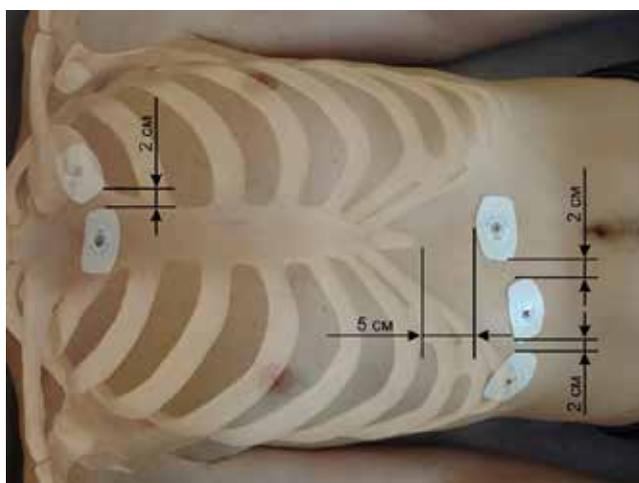


Fig. 92. Extension of the informative capability of ECG thanks to synchronous recording of the rheogram using the same electrodes

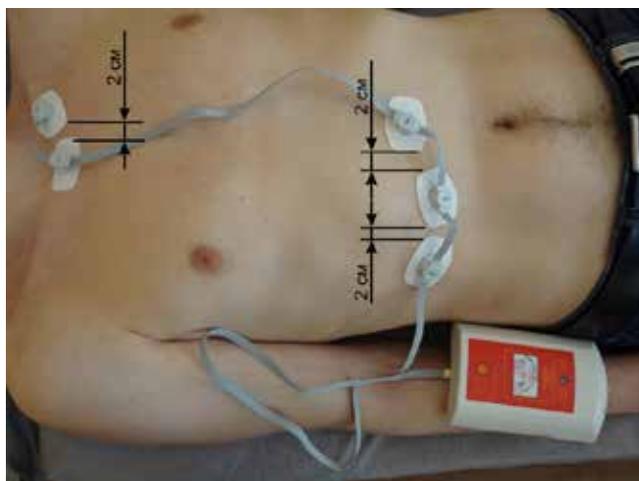


Fig. 93. Connecting the instrument to electrodes

7.1.2 Making the orthostatic test

The orthostatic test is of fundamental importance. After the first recording in laying position is made, the second recording shall be made in sitting position. The metachondrial cardiomyopathy can be detected only through the orthostatic test. The sitting position for the probe is shown in Fig. 94.

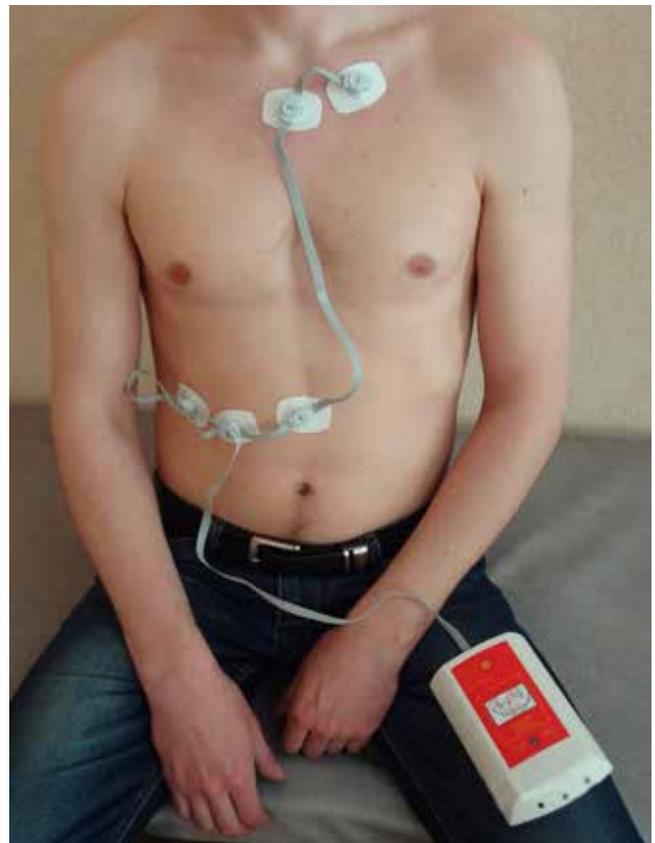


Fig. 94. Orthostatic test in sitting position

7.2 Cardiometric instrument application

7.2.1 ECG and RhEO signals recording

a. To begin with, a patient data shall be entered in the database. This entry shall be saved after procedure. It can be used for the next examination of the patient. Push the button Add the patient (Fig. 95).

b. Enter the basic parameters: family name, first name, date of birth, sex, weight. This is mandatory data (Fig. 96).

c. Go to Patient record to enter the ECG and RhEO of the patient (Fig. 97).

d. In Patient record mode, push the button Preview (Fig. 98), the picked-up signals of the patient shall be displayed. If there is no interference and the quality of signals is normal, push the button Record. Pay attention on the indication of remaining time of the record (in seconds, green line in the right lower angle). The recommended duration is 30 seconds. The duration can be set and is indicated in the lower portion of display, saved and represented in the follow-up records.

e. After making the records in lying position, the patient assumes the sitting position for recording. Push the button to start the record. So, two records shall be made: in laying and in sitting positions.

7.2.2 Calculation of blood volume in phase

a. Change over to mode Analysis. Select Total recalculation (Fig. 99).

b. In few seconds, the data on all blood volumes will be represented on display (Fig. 100).

c. Review the results. It is required to estimate the availability and quantitative readings of abnormal parameters.

7.2.3 Phases check after their automatic determination

It is necessary to make sure, that automatic detection/determination of phases on ECG is correct (Fig. 101).

In case of any error, correct it manually. Use the button Manual setting of QRST points (Fig. 102). To change the point position on the graph, it is required to set the cursor to location of a new point

and push the left button of the mouse while keeping the CTRL key pushed. The window used for point moving, adding, deleting, position changing, entering additional data on ECG will appear.

To save the corrections to points positions, push the button Save manual correction of points (Fig. 103).

7.2.4 Check of CVS state and patient age adequacy

The ECG potential depends on the age. It is an additional indicator of CVS general condition. Use the zoom-in/zoom-out mode to check the R wave amplitude (in random units (Ru)) vs the vertical scale.

– 800 Ru to 1000 Ru and more for age up to 30 years.

– 500 Ru to 800 Ru for age of 30 to 50 years.

– 300 Ru to 500 Ru for age of 50 to 80 years.

The amplitude below 300 Ru indicates the condition that can cause the manifestation of various compensatory mechanisms.

7.2.5 Recalculation using the manual points

Pushing the Recalculation using manually corrected points button activates the function of the hemodynamics parameters calculation based only on the manually corrected points. Pushing the Total recalculation button will result in reset of all manually set points. In necessity, the procedure of manual setting of points on the ECG graph can be repeated manually (Fig. 104).

7.2.6 Analysis of phase blood volumes measuring results

Revert to Analysis mode and check the calculation results. It is important to determine the presence of deviation from the norm in percent and the scope of deviation.

The deviation to larger value indicates that the atrium (ventricle) is functioning under load.

The deviation to smaller value indicates the lack of blood volumes (Fig. 100).

7.2.7 Medical assessment of metabolic processes in cardiac muscles

Select Analysis mode and the function Energetic state of myocard (Fig. 105).

Estimate:

- on the upper graph: oxygen level in myocards, in RU
- on the middle graph: lactate level (lactic acid), in RU
- on the lower graph: creatinephosphate, in RU.

The oxygen shows the cardio muscles capability to perform the work.

Lactate shows if the muscles are working and how intensively. The high rating indicates that the muscles are overloaded, but their energy store is sufficient to fulfill the work.

Creatinephosphate shows the energy store required for muscles work.

7.2.8 Index of stress estimation based on R – R intervals and on stroke volume

On pages Distribution (Fig. 106) and Stress index (Fig. 107), the stability of state is estimated (Fig. 8.4). Fig. 106 represents the stroke volumes (SV), Fig. 107 represents the RR intervals distribution.

7.2.9 One more useful option for ECG and RhEO review

The Zoom-in (Fig. 109) page has an option that allows to deselect the image of the ECG signal graphic derivative by pushing OFF touch key in field ECG.

For the better visualization, on the ECG graph the separate phases can be highlighted using the mouse (Fig. 108).

7.2.10 Compensation of R wave absence on the ECG

The presence of all points, except for R point, is checked in zoom-in mode to ensure they are set correctly (Fig. 109):

- a. Change-over to Analysis mode. It can be seen, that the blood volumes have significant deviations. It happens due to incorrect determination of R point. It is just absent. That is why the program provides the mode for setting the overall average interval $RS = 46$ ms (Fig. 110);
- b. Push the button Drag R (Fig. 111);
- c. In result, the real hemodynamic values are obtained, and R point is in-situ. (Fig. 112, 113).

7.2.11 Preliminary evidence of ill health conditions

CAUTION! When making the diagnosis, take care not to overlook the complicated or ill condition of the cardio-vascular system. In folder zoom-in, the typical records of CVS most undesirable states are listed.

- a. Select the function of viewing the coincidences of recorded and reference images. The table with list of health states will appear. Now it is required to ensure that the patient has none of them (Fig. 114).
- b. Point them with the mouse, the relevant information will come on for the comparison (Fig. 115)
- c. If the coincidence is found out, and the decision on presence of symptoms is taken, push OK button. The information will go to patient history records for printing-out.
- d. From now on, the particular attention should be paid to the patient. He comes in the risk group.
- e. If this is not the case, and everything is OK, the further investigation would not take up a lot of time.

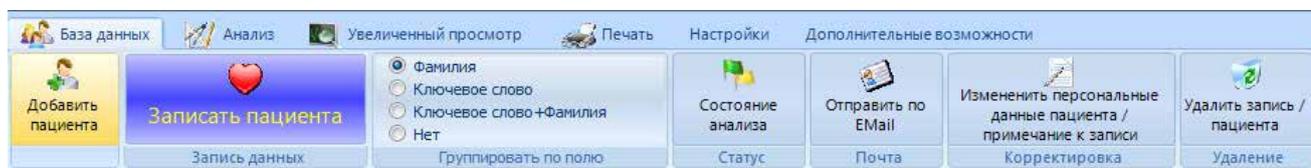


Fig. 95. Data base page in HDA program



Fig. 96. Data base page, "Patient" window in HDA program

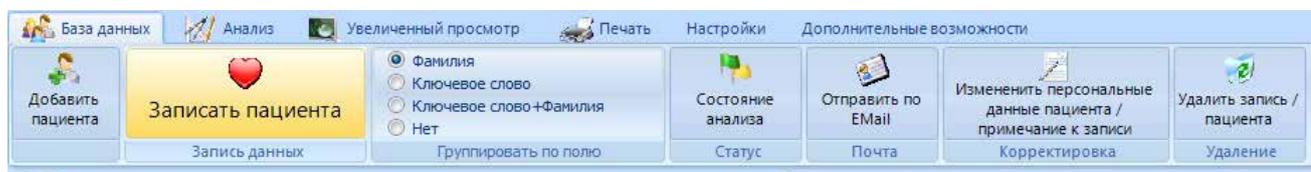


Fig. 97. Data base page in HDA program

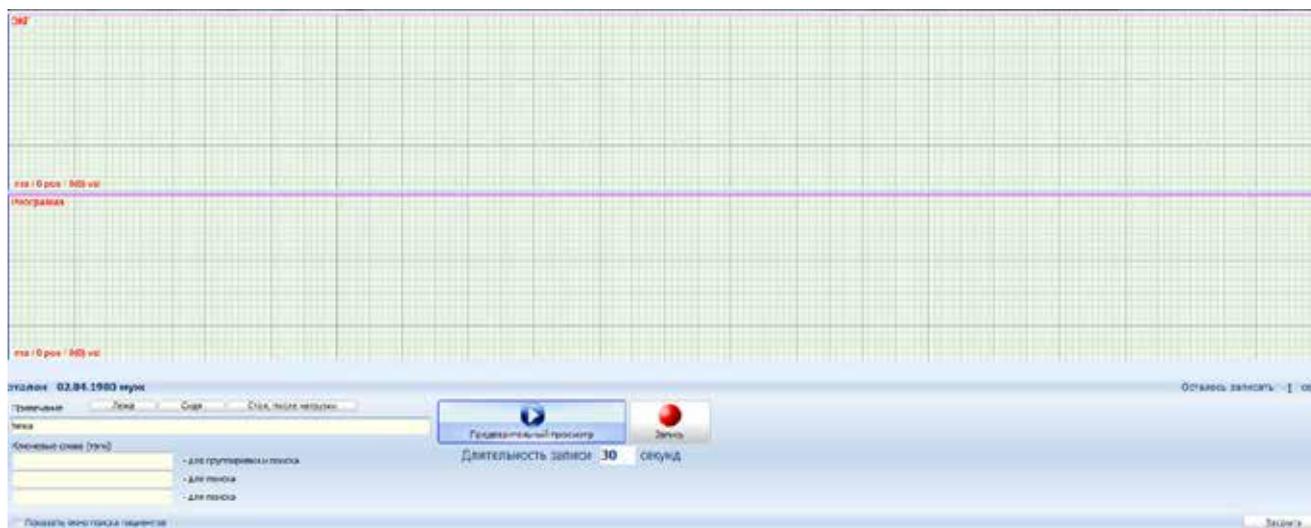


Fig. 98. Data base page, "Patient records" window in HDA software program



Fig. 99. Analysis page in HDA software program



Fig. 100. Analysis page after “Total recalculation” command



Fig. 101. Zoom-in page



Fig. 102. Zoom-in page, “Manual setting of QRST points” window



Fig. 103. Zoom-in page. The corrections in the points setting are saved after pushing the button “Save manual corrections in points”



Fig. 104. Page “Analysis”. After making corrections in points setout, the hemodynamic parameters determination is effected by pushing the button “Recalculation based on manually set points”



Fig. 105. Page “Myocard energy state”

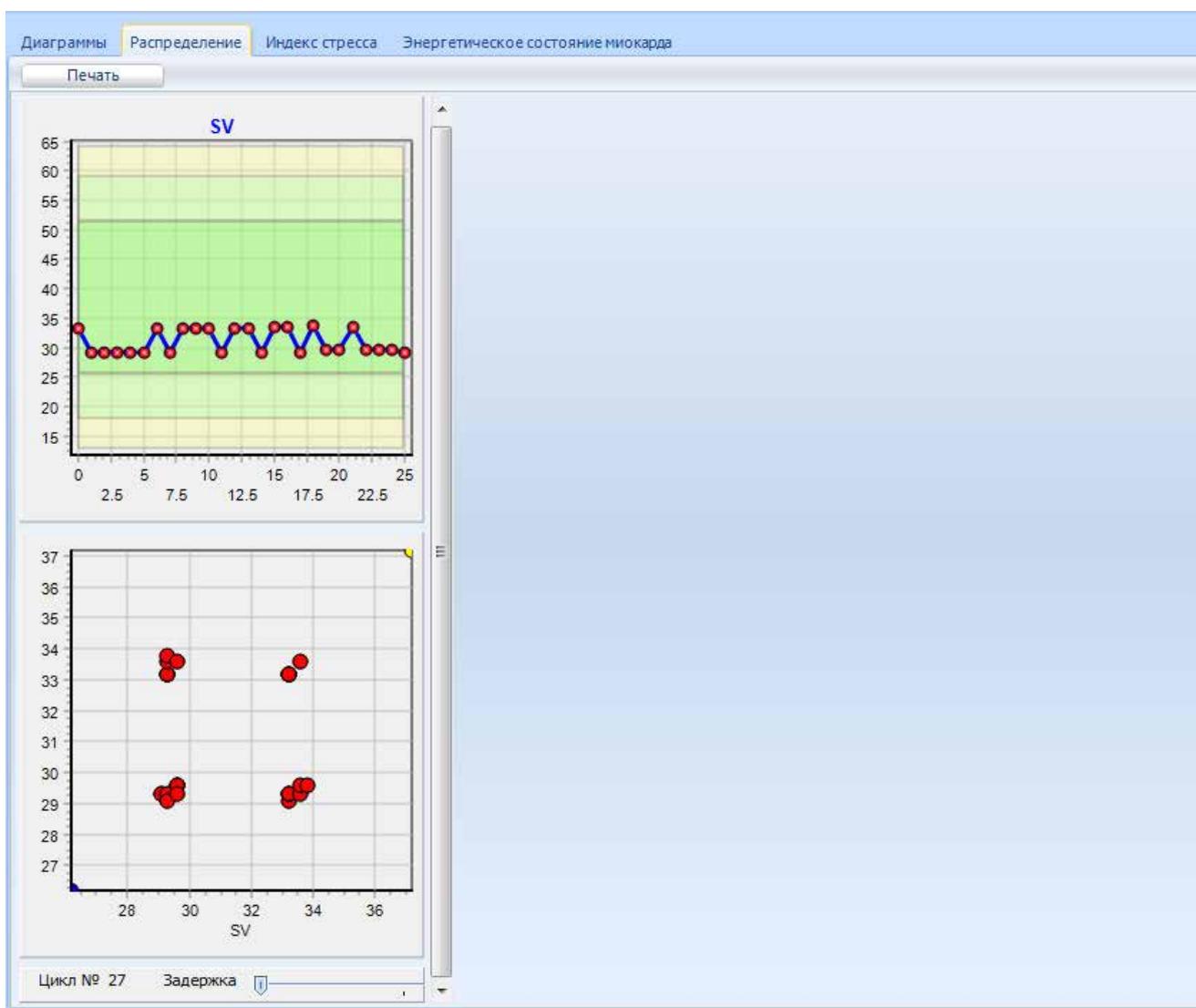


Fig. 106. Page “Distribution”

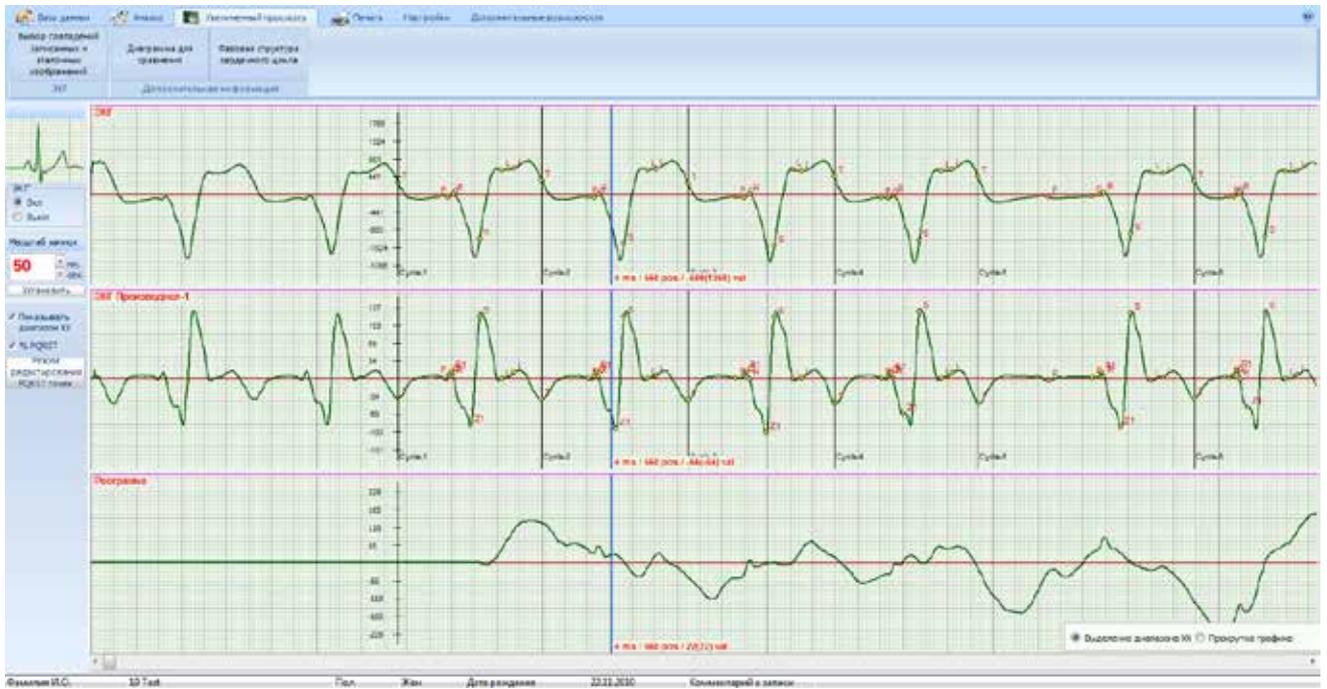


Fig. 109. Zoom-in page



Fig. 110. Page "Analysis". Active button "Drag R"

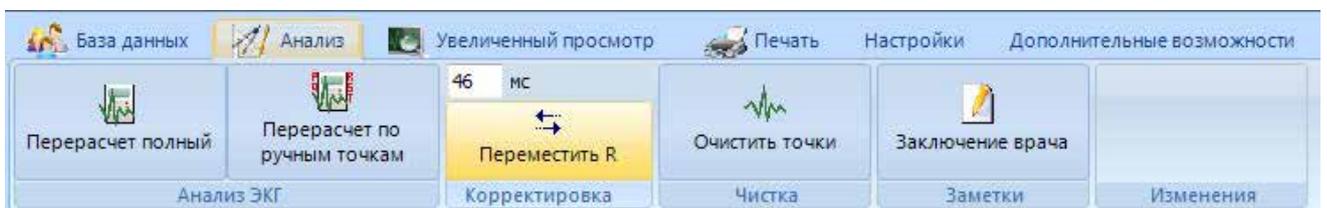


Fig. 111. Page "Analysis". In field "Updating", the "Drag R" button is active



Fig. 112. Page "Analysis"



Fig. 113. Zoom-in page



Fig. 114. Zoom-in page. Active window: “Diagnosis based on selected coincident recorded and reference images on ECG”



Fig. 115. Zoom-in page.: Active window: “Diagnosis based on selected coincident recorded and reference images on ECG”. The state “Cardiac insufficiency 1. Very low amplitude of IVS and myocard contractions”

7.3 ECG and RhEO records quality evaluation

After the ECG and RhEO recording, it is necessary to make sure that the records are of good quality. For this, it is required to change over to Database mode and examine the records made in “laying and in sitting positions”. Both shall have the data of repeated cycles. At that, the RhEO shall not have the apparently manifested isoline. The isoline shall be clearly manifested only after the hemodynamics parameters are calculated in the “Analysis” mode. It is of critical importance that the ECG and RhEO shall be synchronized in S point. Specifically, through this point on the RhEO the isoline will pass. Without this procedure, the RhEO loses its diagnostic value.

It is reasonable to repeat the ECG procedure if the extrasystole or any other infrequent change in ECG traces are shown up. It would be a good thing for the diagnostics of a patient to do additionally some knee bendings before the repeated ECG recording. Also a reliable information can be ensured by tests that include “inhale-exhale” exercises.

All extra recording shall be by all means supplemented with comments. They may be rather short, but still very valuable and helpful for further analysis.

In case of revisit, there is no need to enter again the patients personal data in the database. The patient’s data shall be found in base and the ECG recording mode can be selected immediately.