12. Comparative analysis of diagnostics criteria used in classical cardiology and in cardiometry

12.1 ECG analysis generally used in cardiology and its diagnostic capabilities

1. Cardiac rhythm and heart rate
2. Inter-beat intervals and heart blocks
3. WPW syndrome
4. S-T segment (portion)
5. Q wave
6. P wave
7. Hypertrophia
8. T wave
9. Electrical axis
10. Dysrhythmia (rhythm disturbance)
11. Miscellaneous.

12.1.1 Cardiac rhyme and its frequency

The normal heart rate within the period from resting state to physical load can be from 55 to 140 per minute (bpm). The value of this parameter depends on the heart capability to produce the stroke (SV) and minute (MV) volumes of blood depending on the body oxygen need.

The heart rate at rest is the information-bearing metric of the cardiac rate parameter. It is a system-level index. The cardiac rate shall be within 60 … 80 BPM. The deviation from this range testifies to the CVS tension, that can be provoked by local or systematic oxygen supply characteristics in the organism. The cardiac rate deviation (difference in instantaneous values of cardiac rate) is more meaningful parameter. The less is the variation, the more problematic is for the organism to sustain the cardiac work. However, this parameter is not included into list of the mandatory testing parameters of the classical cardiology. It is only used in the detailed health checks. The rigidity index (also known as Baevsky index) is an indicative of the working organism state of balance when performing the work aimed at maintaining the vegetovascular process.

The cardiac rate is regulated by the respiratory rhythm.

Outputs to be used for cardiological and cardiometrical diagnoses comparison:

The heart rate at rest normally shall be within the range of 55 to 85 BPM. In cardiometry, the sinus rhythm type is not taken into account since it does not provide information on the cause of its variation, and therefore does not provide the significant diagnostic information.

12.1.2 Intervals and block-outs

In classical cardiology, only the intervals and segments of ECG are taken into account. The cardiac phases are not considered to be the diagnostic criteria. The ICG and hemodynamics interrelation is not taken into account at all. The interval duration analysis without considering the hemodynamic parameters (the phasic volume of blood first of all) can not be taken for the diagnostic criterion in more than 90 % of medical cases because it does not take into account the compensation mechanisms as a part of the cardio vascular system activity. The overall cardio-vascular system activity is based on the phase compensation mechanism. If any phase fails to fulfill its function, another phase will strive to compensate for this. There is no point to consider barely the intervals duration without taking into account their interaction with the hemodynamic processes.

The cardiac conduction system block-out does not exist. In classical cardiology, this parameter neglects the 'cardiac muscles metabolic process-and-coronary vessels condition' relationship.

The attempt to make a comparison with the problems related to total or partial conductivity of nerve fibers of peripheral part of the organism had no effect. In practical work, there is no precedent of full recovery after the cardiac conductivity asequence has been detected, neither after pharmacotherapy nor after surgical treatment.

The implantation of cardiostimulator involves the central nervous system (CNS) problems and depends on the hemodynamics-to-sympathetic nervous system relationship. The classical cardiology does not offer an explanation for the cardiac muscles contraction in the zone that is more distal than the complete block-out zone. At that we shall

keep in mind that there are not duplicating conducting system of heart.

It is important that the hemodynamics depends on quality of cardiac muscles metabolism (that determines the muscle contraction) and on quality of coronary arteries (that ensure the oxygen supply as required by metabolism function).

The comparison of the cardiology- and cardiometry-based diagnostics outcomes proved the following:

It makes no sense to use the term "heart block" in diagnostics, since there is no variation in cardial conduction. It is necessary to analyze the metabolism quality in Q – R – S, S – L, L – j phases.

12.1.3 WPW syndrome

The WPW syndrome is based on the theory of the supposedly existed ventricles preexcitation syndrome. It can not happen in principle, since the biochemical elements input/output phase sequence can not be disturbed. Also, the premature excitation can not occur, since the AV node generates the spike only in response to pressure applied on the node by the appropriate volume of blood. AV node is baroceptor. It (the same as the aorta baroceptors) can not be excited by any other source. Na^+ entry into the cell and the consequent cardiac muscles contraction corresponds to QRS complex. This mechanism is based on the aerobic process. It is followed by the electromechanical interfacing (Ca^{++} entry into the cell and the subsequent output of K^+). It is required for building-up the ventricle-and-aorta pressures differential that enables the aorta valve opening. These are the anaerobic processes in the course of which the lactate is generated in heart muscles and the creatinephosphate is activated. Even from the theoretical point of view, the sequence can not be changed, otherwise the valve shall not open. The terms "premature/tardive" polarization and repolarization" are in contrary to the real conditions. The spike potential, in particular when it is equal to «0», ascertains only the existence of the electromechanical interface. In classic cardiology, the priority is given to the determination of the aortic valve opening moment. In this connection, the phonendoscope is a symbol of medicine. But on the ECG, the end moment of completion of Ca^{++} entering the cell and of K^+ yield is not marked at all. In CARDIOMETRY the authors introduced a new designation which is point L corresponding to origin of the rapid ejection phase.

The classic cardiology does not offer a method of WPW syndrome treatment. Also, the following fact is not mentioned: in case of presence of the given syndrome, the ECG form can be changed in what is related to the S wave regeneration through the breathing exercises, without any drugs treatment. The delta waves availability depends on the characteristics of the lungs and atriums anatomical features interaction. There is one more factor: sedimentation of various necrobiotic, microbic, bacterial extraneous elements of blood under the left or right atrioventricular valve.

The following conclusions can be used for the cardiological and cardiometrical diagnoses comparison:

When the ECG form suggests the WPW syndrome, it is not a cause to suspect the unsafe health condition. It is required to control the oxygen consumption in Q – R – S phase, it should not be less than the lower normal value. This factor depends on the delta wave form.

12.1.4 ST segment

In classical cardiology, the ST segment is not regarded as a segment consisting of three cardiac cycle phases. At that, depending on particular case, T wave may be mentioned or not in the segment description. This fact does not allow to accurately identify, whether ST segment shape suggests the pathology features. It is only possible to assess the probability of the ischemia or of the myocardial infarction.

In CARDIOMETRY, the T wave is not considered in the cardiac cycle phases analysis. The T wave amplitude characterizes only the aorta diameter. It depends on the stroke volume of blood coming to aorta and expanding it to the value at which the pressure in aorta reaches the value sufficient for the baroceptors response and for generation of the response pulse that controls the sanguimotion in vessels.

Important is the analysis of two phases: S – L and L – j. They function in the anaerobic mode against the background of the constant tension of the car-

diac muscles that follows after the QRS complex. The ECG form in these phases depends on the metabolism quality, namely, on Ca++ and K+. Without determination of the biochemical elements movement activity borders, in the cardiology these two phases are defined as electromechanical coupling. Based on their shape, in classical cardiology the hyper- (hypo) calciemia (caliemia) is diagnosticated. These phases are very informative. The quantity of lactate accumulated during these phases demonstrates the potential resource of the cardiac muscles activity.

To measure the gravity of the myocardial infarction, it is required to assess the S – L phase, but not the ST complex as a whole. The notion "reciprocal depression" can by applied only to S – L phase.

When the coronary arteries are in critical condition, the S - L wave is manifested on the ECG in the form of a straight line located below the isoline, and it represents the myocardial infarction. When the large quantity of lactate is accumulated in myocard muscles, the S - L phase amplitude is elevated, thereby indicating the muscles fatigue.

Implications for the cardiological and cardiometrical diagnoses comparison:

T wave shape is not a criterion to be used for the ischemic heart disease evaluation. The amplitude of T wave represents the aorta diameter variations. The wave inversion is related to the symptom of cold limbs, because the pumping ability of the aorta decreases and the available blood fails to ensure the peripheral structures of organism.

12.1.5 Q wave and evolution of R wave

In classical cardiology, the Q wave shape is associated with the myocardial infarction condition assessment. If the infraction is excluded, the hypertrophic cardiomyopathy or WPW syndrome are considered.

This philosophy is not used in cardiometry science. The point is that P – Q phase is a part of the auricular systole and characterizes the atrioventricular valves closing. At the end of their full closing, the pressure in ventricles shall reach the level at which AV node initiates the response pulse generation. The shape of P – Q phase depends on two parameters: 1) the anatomic shape of lungs and atriums that have an effect on the atrioventricular valves closing, 2) on accumulation of various pathogenic agents that cause the bacillary, viral, mycotic and parasitic infections of multiorgan polysystemic tropic-fixed character. In connection with above-mentioned information, the P – Q phase analysis is the main factor in the ECG assessment.

The analysis can be carried out only based on the orthostatic test. P – Q phase amplitude variations relative to the isoline are assessed. There should be no variations in healthy condition. When the variations are significant, first of all the steps should be taken for the blood clearance. Usually, the use of the naturopathy treatment is rather effective.

Variations in P – Q duration denotes the myocardium muscles dilatability quality. This quality determines the flow resistance in the period of the myocardiums blood ejection to ventricles.

The inputs for the cardiological and cardiometricle analyses comparison:

It is important to pay attention at the P – Q phase variations relative the isoline and realize that these variations are not manifested in normal conditions. This condition can be identified only through the orthostatic test. In classic cardiology it is infeasible because of the technical capabilities of the medical equipment. But this criterion is very important because it represents the compositional change of the blood associated with bacillary, viral, mycotic and parasitic infections of multiorgan polysystemic tropic-fixed character. This criterion denotes the potential disease of organs and systems followed by chronic illness (of central nervous system, brain tunics, cardiovascular system, joints, spinal column, endocrine system and others). The body organs and systems condition can be normalized through elimination of disease-producing factors by means of the blood purification using the natural means.

The P – Q phase and Q wave do not provide the information useful for the myocardial infarction detection.

Let us consider the R wave evolution process.

In classic cardiology, the R wave bifurcation is considered to be asequence, without taking into account the quality of biochemical processes and coronary blood flow.

The R wave bifurcation represents the reverse motion of the interventricular septum. As a rule

this condition is not caused by the asequence (it can't take place even theoretically), but most likely it is caused by the congenital fistulas in coronary artery. With the heartbeating, the portion of coronary artery blood is released via fistulas to the ventricle.

So, the comparison of the cardiological and cardiometrical diagnosis proved the following:

the R wave bifurcation is not caused by asequence. It is caused by the IVS reverse stroke in the period of the ventricular cavity dilatation caused by the blood shunt via the congenital fistulas of coronary arteries.

12.1.6 P wave

In classical cardiology, P wave helps to detect the atriums hypertrophy.

P wave represents the atrium systole. Its shape depends on the hemodynamic balance in pulmonary circulation and systemic circulation systems functioning, and on the right and left atrioventricular valves anatomy. The atrial systole function is meant for the atrioventricular valve closing.

Summary of the cardiological and cardiometrical diagnoses comparison:

In cardiometry, the P wave bifurcation shows the pulmonary circulation and systemic circulation systems hemodynamics disbalance. Availability of a number of waves indicates the myocards flexibility degradation that is typical for the multifocal cardiosclerosis.

12.1.7 Ventricular hypertrophy

The cardiology does not provide the distinct and explicit criteria of the ventricular hypertrophy. The cardiology does not provide the clear criteria for detection of this disease.

In cardiometry, the hypertrophy is not the criterion of pathology. It occurs only as an aftereffect of the regular athletic loads. It is important to correctly evaluate the ECG shape of the people who stopped the regular training. In this case, the hypertrophy may provoke the changes in the cardiac muscles metabolism due to quantitative changes in the process of lactate accumulation and utilization. In case of the myocard hypertrophy, the R wave amplitude decreases while the stroke volume increases.

Findings for the cardiological and cardiometrical diagnoses comparison:

In case of hypertrophia it is important to monitor the metabolic parameters.

12.1.8 T wave

In classic cardiology, the myocardial ischemia and posterior myocardial infarction symptoms are revealed based on T wave analysis.

The cardiometry clearly ascertains that the T wave characterizes only the aorta diameter variations (dilatation or contraction) caused by the ventricle and aorta pressures and volumes correlation.

Findings for the cardiological and cardiometrical diagnoses comparison:

T wave does not provide the information required for ventricles diagnostics. The shape of the wave depends on the ventricle and aorta pressures ratio. The T wave amplitude characterizes only the aorta diameter. It varies depending on the stroke volume of blood entering the aorta and expanding it to the size at which the pressure in aorta is sufficient for the aorta baroceptors response and for generating the pulse that controls the sanguimotion. In cardiometry, the j – Tн slow ejection phase (preceding the T wave) is analyzed. Exactly in it, the closing stage of the blood volume distribution in ascending aorta takes place until the pressure applied to the aorta baroceptors becomes sufficient to trigger the aortic dilatation process. This dilatation is represented by wave T. The wave inversion is associated with symptoms (cold hands and feet), since the aorta pumping function degrades and aorta fails to ensure the full-scale blood supply to peripheral organs of organism.

12.1.9 Electrical axis of heart

The electrical axis of heart parameter has no the diagnostic value.

Findings for the cardiological and cardiometrical diagnoses comparison:

Has no diagnostic value for the pathology recognition.

12.1.10 Rhythm disturbance

The classical cardiology considers the tachycardia conditions with narrow and wide Q – R – S complex. Based on the complex duration, the regular and irregular tachycardia are distiguished.

In cardiometry it is assumed that the dysrhythmia may happen in three cases:

• in case of localized peripheral increase in hemodynamic resistance that causes the response of the arteriovenous anastomoses

• in case of fibroblasts quantity increase in SA or AV nodes

• in case of respiratory arrhythmia.

The occurence of multiple P waves is caused by the multifocal cardiosclerosis. P waves appear until the atrioventricular valve gets closed (which is hampered by low elasticity of ventricles).

Findings for the cardiological and cardiometrical diagnoses comparison:

It is important to know the form of the extrasystolic QRS complex. This is a criterion for the extrasystole aetiology determination.

12.1.11 Other information

In cardiology it is a matter of convention to evaluate the following parameters:

– Pericarditis
– K+ level
– Digitalis intoxication
– Hypothermia
– Pulmonary embolism
– Dextrocardia
– Atrial septal defect
– Electrical alternation
– Availability of electric cardiac pacemaker and QT protraction.

The cardiometry enables to estimate the quality of the following phenomena:

A) U wave appears on the ECG in the period of early diastole phase. It has relation with the filling of coronary blood flow. The quality of filling can be diagnosed only with the help of the simultaneously recorded rheogram of the segment from point T (wave T end) to the point of U wave initiation

B) Hyper- (hypo) calcemia is evaluated in S – L phase based on the phase amplitude

C) Hyper- (hypo) kaliemia is evaluated in L – j phase based on the phase amplitude

D) j point does not change its position on the ECG. This is the end of the electromechanical interface

E) Neither early nor late polarization (repolarization) exist

F) “Re-entry” phenomenon does not exist.

Findings for the cardiological and cardiometrical diagnoses comparison:

The considered classical cardiology capabilities have a number of limitations of theoretical character. The most of the generic symptoms of the ECG form compliance with the pathologies can not exist even theoretically. First of all, they are: asequence, blocking and polarization reversal. They make the basis for the diagnostics and the theory arrhythmia theory. The remaining diagnostic criteria can not be used for the diagnostics of the hemodynamics and metabolism. The described symptomatic paradigm proves the fact that functional diagnostics specialists or cardiologist shall recommend to undergo the additional examination. The “here and now” diagnostics procedure does not exist.

12.2 Cardiometrical analysis of ECG. Level of its diagnostic capabilities

The following parameters can be diagnosed based on the cardiometry science: hemodynamics parameters, myocards metabolic process and CVS functions. Mathemantics is a tool for analysis. ECG is the information-bearing signal. RhEOgram is an ancillary signal. The above-mentioned parameters are sufficient to make accurately the diagnosis, do prognostication and to follow up the therapy.

The diagnosable parameters:

1. Metabolic characteristics of cardiac muscles: oxygen, lactate, creatinephosphate.

2. Cardiovascular system functional characteristics:

- contractile function of IVS
- contractile function of miocardium
- venous blood circulation condition
- aorta diastolic pressure build-up function
- function of myocardium relaxation in early diastole phase;
- presence of high systolic pressure
- depletion of blood flow in the left and right coronary arteries stomas
- gating of systemic and pulmonary blood circulation systems.

The extrasystole sources caused by arteriovenous fistulas functioning (all types of arrhythmia).

The extrasystole sources caused by the fibroblasts potential influence leading to sudden cardiac death.

3. Hemodynamic parameters:

MV – minute volume of blood, l/min.

SV – stroke volume of blood, ml

PV1 –volume of blood that flows to ventricle during the early diastole that characterizes the sucking-on function of ventricle, ml

PV2 – volume of blood that flows to left (aortic) ventricle of the heart in the atrial systole phase, characterizes the atrial transport function, ml

PV3 – volume of blood ejected by heart ventricle in the rapid ejection phase, ml

PV4 – volume of blood ejected by heart ventricle in the slow ejection phase, ml

PV5 – volume of blood (SV portion) transferred by ascending aorta in function of the peristaltic pump, characterizing the aorta tonus, ml.

4. System characteristics:

- CVS state stability
- phase volumes of blood – to – early diastole volume relation
- momentary and mean value of cardiac rate.

5.Psycho-physiological characteristics:

- type of physiological adaptive response
- attention concentration level.

12.3 Decision making in case of discrepancy between data obtained in practice using the cardiological and cardiometrical methods

Let us consider the comparison of diagnosis obtained using the classical cardiology method and cardiometry method from the interchangeability point of view. The classical standard approach is sufficiently limited (Fig. 131). It was developed and did not advance because it is based on multiple contradictions.

It is reasonable to apply the superposition principle, i.e. to apply one function to a result of another function. This approach is used in physical science that is based on natural science laws. For this purpose, the result obtained through the cardiology methods can be described using the cardiometry functions. In spite of the possible contradictions, this approach allows to introduce the logical induction into standard reasoning, thus resulting in making the precise diagnosis, appropriate and effective medical treatment and predictive modeling of the further progress of the disease. At that, the essence of the standard diagnose is preserved.

So, it is required to match the most important contradictions in the block-outs assessment.

1. Block-outs (12.1.2) and rhythm disturbance (12.1.10).

Any block-out shall be assessed from the position of the compensating mechanism inherent to the individual features of the coronary arteries, or caused by the fibroblasts existing in SA and AV nodes area, or by arteriovenous fistulas work. In medical report, it is recommended to make the

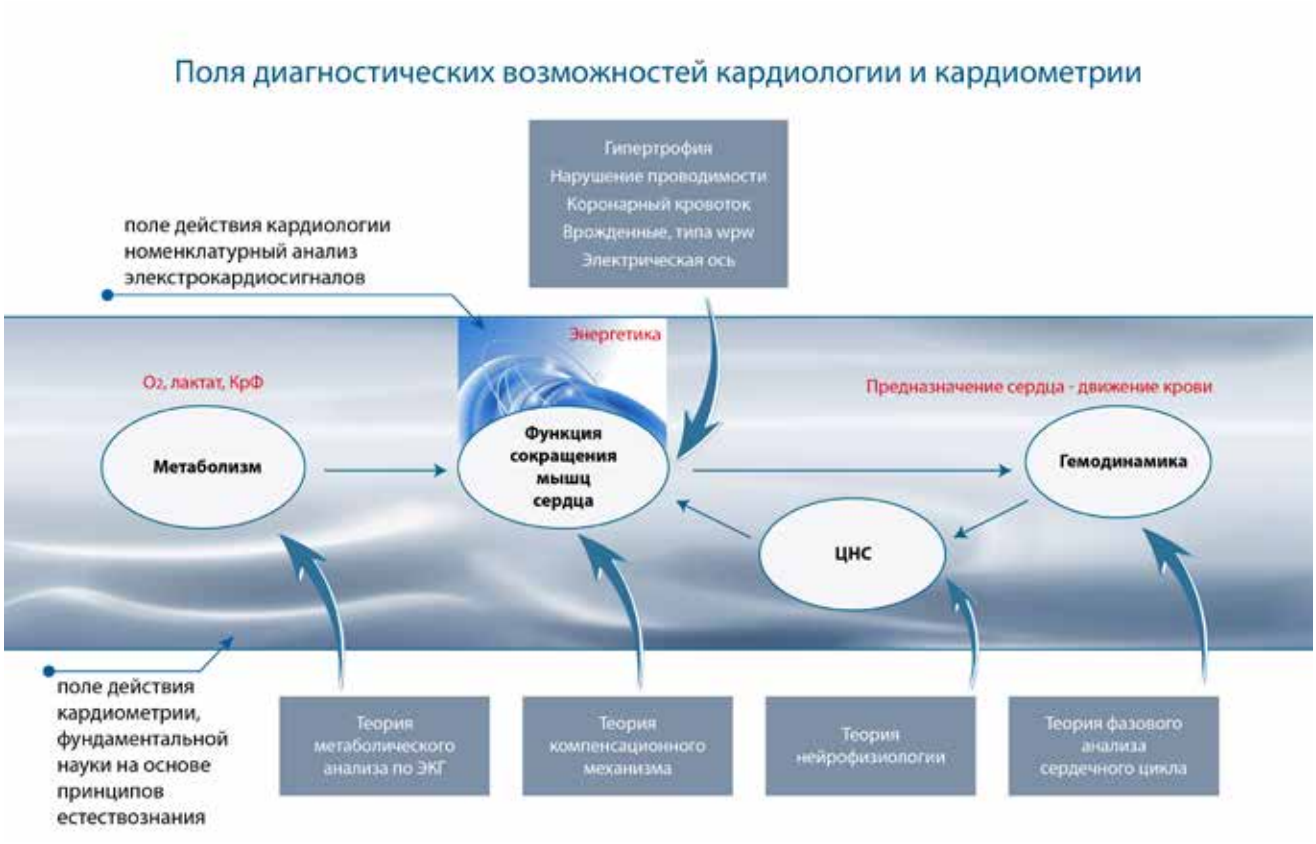

Fig. 131. Diagnostic capabilities of cardiology and cardiometry

following record: the block-out related to … (specify one of the diagnosable causes).

The contradictions are still present, but now the effective medical treatment is feasible.

2. WPW syndrome (12.1.3).

WPW syndrome is assessed from the cardiac muscles metabolism point of view. The normal range and measured quantities of the oxygen, lactate and creatinephosphate are specified. The method of metabolism correction is recommended. This philosophy is very effective.

3. S – T segment (12.1.4) and the ventricular hypertrophy (12.1.7).

The S – T segment (12.1.4) and the ventricular hypertrophy are assessed from the point of view of metabolism and processes corresponding to electromechanical linking. The lactate and creatine-phosphate contents are specified. These phases are very important and require sufficient metabolic energy consumption. They have an effect on the initial conditions of the blood energy at entering the aorta. This is represented on the RhEO in the form of the pressure rise in the rapid ejection phase (L – j).

In this segment, the stroke volume (SV) value (characterizing the ventricular hypertrophy) is estimated.

The segment levitation beyond the isoline denotes the compensation of the myocardium muscles weakness.

If the ECG form indicates the electromechanical interface segment depression (smoothing and onset in the lower portion of the S wave) that corresponds to the acute form of the infarction, the immediate measures must be taken.

4. Q wave and R wave development R (12.1.5).

P – Q is the most important phase, it shows the blood purity or the blood impurity of bacillary, virus, mycotic or parasitic nature. The actual state can be assessed only through the orthostatic test. The phase amplitude variation relative to isoline is the only criterion for assessment. The blood purity normalization removes most of the symptoms and first of all normalizes the arterial pressure.

The R wave bifurcation occurs only due to presence of congenital fistulas of coronary arteries. This abnormality is not dangerous, but the attention should be paid to physical load rate setting.

5. P wave (12.1.6).

When a number of P waves are represented on the ECG, the evaluation of the P wave can be correlated with the classical variant of the wave with

using the term "multifocal cardiosclerosis". The other variations of P wave shape can be compared with other manifested variations.

6. T wave (12.1.8)

It is not required to mention the relation with the myocardial infarction. The T wave shape is evaluated only when it is compared with other variations and symptoms. The T wave indicates the aorta dilatation when the patient takes the antihypertensive medication.

7. Others (12.1.11).

In all other cases, the ECG variation (or a number of interdependent variations) is (are) compared in a similar manner with the standard diagnose.