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Research Article

Possibilities of the Akabane Test and TCM Principles for Monitoring Patients with Sick Sinus Syndrome

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ABSTRACT

Background: Sick sinus syndrome (SSS), in terms of diagnosis and treatment, is one of the most difficult problems associated with irregular heart rhythm. Until now, there is no unified generally accepted theory explaining its pathogenesis, there are no unambiguous criteria for making a diagnosis. In this regard, it is interesting to consider this disease from the point of view of Traditional Chinese Medicine (TCM) based on the results of assessing the bioenergetics of such patients using the Akabane test.

Methods/Design: On the basis of the cardiac surgery department of a multidisciplinary hospital, 107 patients with a verified diagnosis of SSS and receiving only medication were examined. Of these, there were 64 men and 43 women. In total, 245 tests of Akabane were carried out, including in the dynamics of observation.

Results: according to this test, with tachy and brady syndrome, as well as with normosystole, these patients showed general patterns at the level of acupuncture canals (AC), which consisted in an increase in asymmetry at the level of their left and right branches, while in the norm of this asymmetry was not. In addition, the opposite dominance of the left and right branches of the AC was revealed in tachy and brady syndrome. The analysis of these dependencies from the point of view of TCM is carried out. The possibility of predicting the time and nature of arrhythmias based on the assessment of biorhythms of certain AC is shown.

Conclusion: Alternative concepts of the pathogenesis of this disease are shown. The use of the Akabane test for patients with SSS allows them to be effectively monitored based on new physical principles, which is much easier and more convenient compared to traditional methods.

Introduction

The term “sick sinus syndrome”, introduced by M.J. Ferrer (1968), means the occurrence of a sharp bradycardia or cessation of the sinus node activity with paroxysms of supraventricular tachycardia. The clinical picture of this syndrome is characterized by extreme polymorphism of heart rhythm disturbances even in the same patient, which complicates the diagnosis and prognosis of the condition [1-4]. The existing methods of Holter monitoring of these patients are rather complicated and expensive. In this regard, we conducted this study, showing the capabilities of the Akabane test and its interpretations in the light of TCM for monitoring these patients.

According to the main theoretical concepts of TCM, the work of all human organs and systems is controlled by the system of Acupuncture Channels (AC), which are represented on the human body by Acupuncture points, which, based on the connection with a certain organ or physiological system, are connected into an energy line that forms a specific AC. At the same time, various types of influence on such points lead to a change in the activity of the organs associated with them, which is used in reflexology. The quantitative assessment of AC activity is especially effective using the Akabane test, which has high correlations with various physiological and biochemical parameters of the body, which allows effective monitoring using this simple test. In TCM, it is customary to assess the activity of an AC by the amount of Chi (QI)

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energy in it, which from the point of view of modern physiology corresponds to the concept of "Functional activity" of a certain organ or system with which a particular AC is connected.

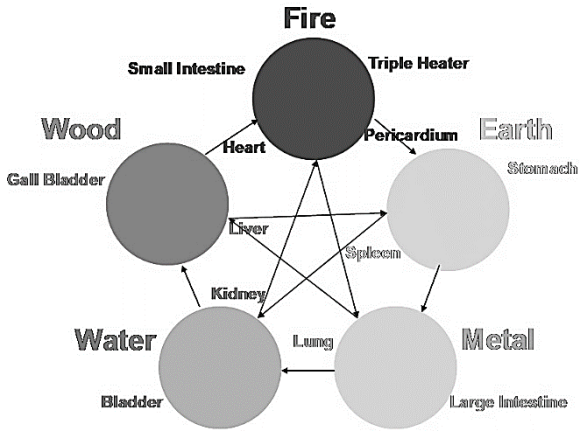

Figure 1: The system of Five primary elements.

In turn, the 12 main AC form the system of the 5 Elements (Figure 1), which are responsible for the general balance of energy distribution in the body through stimulating and inhibiting interactions between the organs [5-7]. According to a number of researchers, in terms of its principles this five-point system of regulation is one of the most accomplished and well-known in modern technology. Traditionally, the level of energy (activity) is characterized by two notions. These are 'fullness', which corresponds to the hyperactivity of an organ corresponds to the YANG factor, and 'emptiness', which corresponds to an organ's inactivation and corresponds to the Yin factor. According to TCM, the main flow of energy moves clockwise in a circle of circulation. However, as a result of various reasons, the uniform movement of energy at the level of certain AC and primary elements can be disturbed and lead to its local excess or deficiency. In this case, other regulatory mechanisms are manifested, associated with the depressing effect of one primary element on another. For example, an excess of energy of the primary element Fire - inhibits (melts) Metal. Metal destroys Wood, and it destroys the Earth. Water slows down (extinguishes) Fire, and the Earth blocks the path of Water. The interaction of these connections is important for understanding the causes of arrhythmias.

There are a number of modern studies showing that AC are real systems for transferring information between the environment and living organisms, including plants. Wherever there is water, information transmission channels are spontaneously formed where there is a dynamic self-focused propagation of coherent radiation with its phase synchronization [8-11]. Such energy waves in the connective tissue can 'capture' neighbouring molecules, cells and biological units in their coherent vibrations. Thus, this optical waveguide in the form of an AC can provide a nondissipative flow of energy and information throughout the body [12]. It was found that the main electrophysiological and echocardiographic indicators of the heart function have significant correlations with the AC activity according to the Akabane test [13]. Thus, this test can be used to effectively monitor cardiac patients.

Materials and Methods

In total, 107 patients with a verified diagnosis of SSS, who received only drug treatment, were examined on the basis of the cardiac surgery department of the 26 St. Petersburg multidisciplinary hospital. Of these, there were 64 men and 43 women. In total, they performed 245 Akabane tests, including those in the dynamics of observation at different heart rate values. To quantitatively evaluate a channel's activity level in TCM, the so-called "sacrificial stick" test was used in ancient times in China. This test involved a burning sandal stick that was brought in proximity to points at the tips of every finger and toe until the first sensation of pain. At each point, the pulse rate before pain was first felt, was measured. If the number of pulse beats was lower than the average one for all the channels, it proved the hyperactivity of an acupuncture channel and its corresponding organ. Conversely, when the rate was higher, it represented the inactivity of a channel and its corresponding organ.

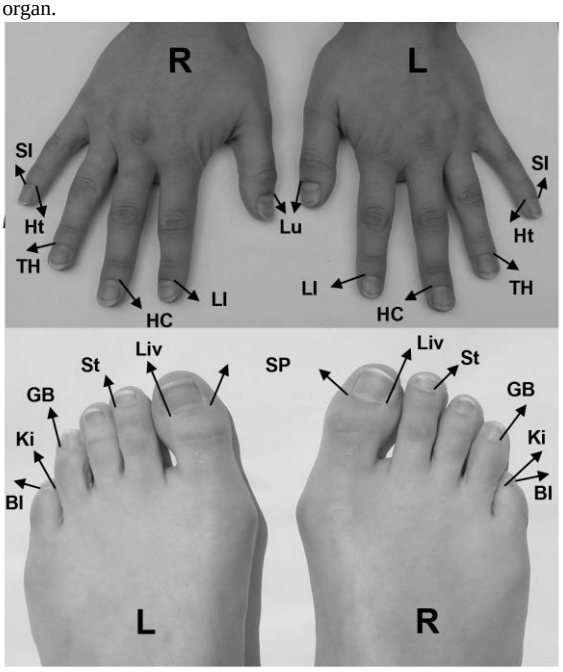

Figure 2: Topography of acupuncture points, used for evaluation of the AC in Akabane test.

This test was described by the Japanese doctor Koben Akabane in 1956. Since then, the test has carried his name [14]. This test measures the pain thresholds in temperature sensitivity (TS) when heat is applied to the "entrance-exit" points of each channel (LU11, LII1, PC9, TE1, HT9, SI1, SP1, LR1, ST45, GB44, KI1, and BL67) by applying an impulse light-emitting diode (LED) non-coherent infrared radiation (IR)-light onto the skin ($f = 1$ Hz, $\lambda = 920$ nM), recording the total energy expenditure in joules [15-17]. Each impulse radiates 0.07 joules of thermal energy. These measurements were carried out using a certified device- 'Merid', invented by the author of the paper. TS is our bodies' basic reactive system; it is as significant as important indicators such as body temperature, as it gives a very clear representation of functional and psycho-physiological profiles. Their topography is shown in (Figure 2).

According to classical Oriental literature as well as according to our study results, the following channels have different regulatory functions:
LU - lungs channel, connected with the function of lungs and tissue breathing.
Li - large intestine channel, connected with the large intestine function and its microbe flora, it participates in the regulation of arterial pressure, biochemical blood indices.

PC - pericardium channel, connected with the cardiac muscle trophicity and its structure. In addition, it is connected to muscular activity, arterial blood pressure levels and emotions.
TE - triple heater channel, connected to the central and peripheral hemodynamic, and with body energy consumption. In addition, it regulates the hormones in the body, thyroid and hypophysis.
HT - heart channel, regulates the cardiac rhythm, body's physical strength.
Si - small intestine channel, connected to the electrolytic balance and food digestion.
SP - spleen-pancreas channel is connected to the pancreas and immunity.
LR - liver channel is connected to liver function and central nervous system, stress levels
St - stomach channel is connected to the digestion function.
GB - channel of the gallbladder is connected to the digestion function and peripheral nervous system.
Ki - kidney channel is connected to the kidney function and the adrenal glands.
BL - urinary bladder channel is connected to the urogenital system, its functions and its related hormones, it reflects the state of vertebrae column as well [15-20].
Each channel consists of the left (l) and the right (r) branch between which normal symmetrical activity balance is maintained.

To evaluate the parameters of the biorhythmic activity of organs and body systems, the Cosinor analysis method is currently widely used, when using the smallest standard deviations from points with real measurements of AC parameters in the dynamics of observation, we can construct a resulting curve reflecting the biorhythm [21, 22]. To calculate the biorhythm parameters, we used the licensed TSA programme (Time Series Analysis-Cosinor V-6.0 Lab View. License N 125403071), as well as analogues of this programme. Statistical decisions were made at a significance level of 5% ($p \leq 0.05$). Data analysis was provided using software package SPSS Inc. V 15.

Results

Since the general thresholds of perception of temperature pain sensitivity have individual differences, in order to compare the HR parameters between different patients, the ratio of each indicator to the arithmetic mean of 24 values of this test was found. So, after scaling, the weighted average TS was close to 1.0. In the case of functional insufficiency (Yin syndrome) of the associated physiological system or organ, this indicator was more than one, and with its increased activity (Yang syndrome) it became less than 1.0 in proportion to the degree of its severity. At the time of the test, in 63 cases, there was a brady syndrome when the heart rate was less than 60 beats/min. Normosystole (heart rate = 60-80 beats/min.) Was noted in 146 cases, and tachycardia syndrome in 46 cases, when the heart rate exceeded 80 beats/min. We studied the main relationships between heart rate and the state of AC from the position of these three groups.

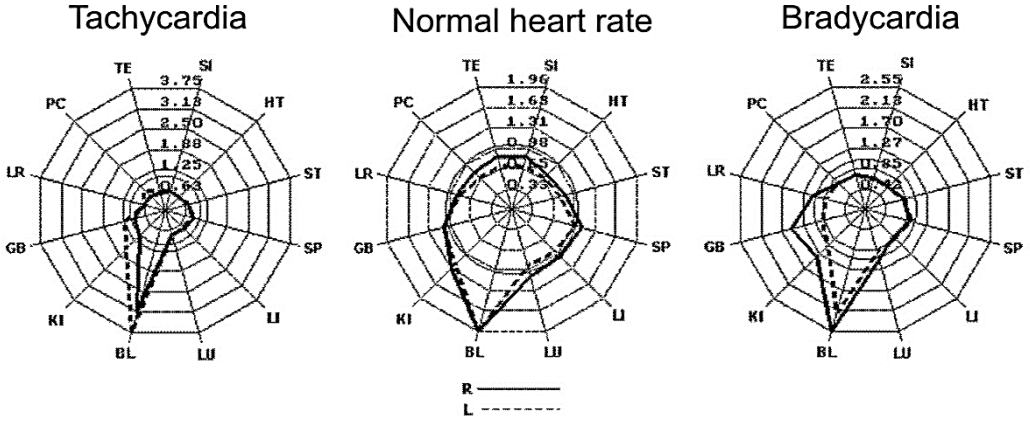

Figure 3: Diagram of the distribution of AC activity in tachycardia, bradycardia and norm systole.

Figure 3 shows the averaged graph of the Kiwiata diagram of the distribution of HR parameters for 12 main AC at the time of tachycardia, normo-systole and at the time of bradycardia with a heart rate of less than 50 beats/min. With the norm of systole, the indicators of all AC are more balanced and there is no significant asymmetry between the right and left branches of the AC, and the maximum mean values of the BL channel indicator are 1.96. In tachycardia, the minimum AC values of the primary element 'Fire' (PC, TE, HT, SI) and the maximum values (3.75) of the BL channel are noted. At the same time, a significant asymmetry is observed between the right and left branches of the BL, KI, BL channels. With bradycardia, there is less hyperactivity of AC 'Fire' and less AC 'Water' (BL = 2.55), but with a greater level of asymmetry, especially along the BL channel, which controls the peripheral nervous system. With all this, the most important difference between tachy and brady syndrome is the change in laterality, especially along the BL channel. So, with tachycardia, its Yang-left branch (BLl) dominates, and with bradycardia, the right (Yin) branch (BLr) already dominates. A similar situation was noted in the difference in AC laterality- GB and KI.

These data show the importance of evaluating symmetry - desymmetry in the body at the AC level as the main criterion for the manifestation of pathology in the body. The higher the level of asymmetry in the AC, the higher the level of functional or organic changes in organs or physiological systems associated with a specific AC [15-17, 19, 20]. Since changes in symmetry in the AC precede the clinical manifestations of crisis states, thus, already by visual assessment of the AC profile, especially in the dynamics of observation, thus it is possible to predict tachy or brady arrhythmias based on the ratio of the right and left branches of the indicated AC.

According to our observations, in tachy and brady syndrome, with an increase in heart rate deviations from the norm, the asymmetry most reliably increases not only mainly along the BL channel, but also

between the right and left branches of LU, LI, which in this pathology are a kind of trigger points in reflecting the tendency of heart rate change. An indicative template for assessing arrhythmia in SSS is shown in (Figure 4). It has a comfort zone with a number of contractions of 66 beats per minute ("Golden section of the rhythm"), corresponding to the absence of asymmetry along the channels - LU, LI, GB. Thus, there is a kind of intersection of changes in their meanings. In general, with the growth of tachycardia, the indicators of their left branches increase, and the values of the right branches decrease. With brady syndrome, the opposite relationship is observed. At the same time, with tachy syndrome, the value of the left branch of the AC-KIr and the average total values TS of the channels of the primary elements of 'Fire' decrease.

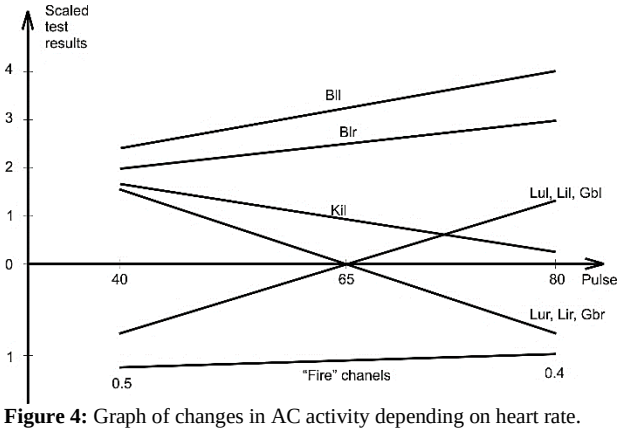

Figure 4: Graph of changes in AC activity depending on heart rate. Vertical axis is the scaled channels TS. Horizontal axis- heart rate values.

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To monitor the patient's current state and predict crises, it is important to analyse each test, especially in the dynamics of observation, taking into account the obtained patterns. Along with the assessment of the quantitative relationships of the AC indicators with the heart rate, the assessment of the structure of the correlation dependences between the AC is of great diagnostic value. Since the estimation of the table correlation matrix of 24 x 24 AC is difficult for perception, we used a visual system for estimating correlation relationships based on a circular diagram. For this, two (based on the presence of + and - correlations) circular diagrams were used, taking into account the location of each AC in the structure of the five primary elements and their relationships with other AC.

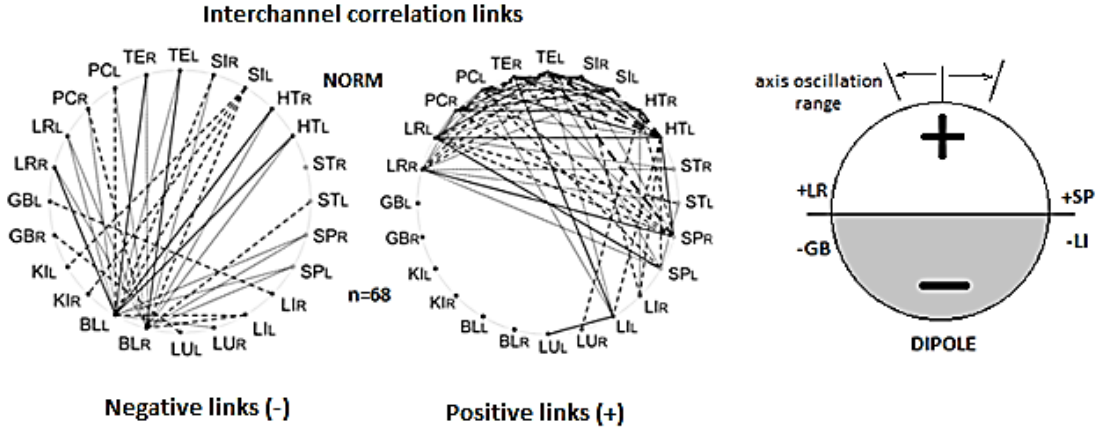

Figure 5: The matrix of interchannel connections in norm.

Referring to (Figure 5) shows the matrix 24 of correlation interchannel connections characteristic in the norm of 68 carefully selected in the group of 'healthy' individuals (men and women) from the first sample. The relationship diagram has a pronounced polar structure in which negative connections go mainly from BL, and positive connections are present between the AK of the cardiovascular system. The thickness of the lines of the relationship diagram increases with the increase in the correlation coefficient. If we overlap the left and right diagrams, we will get one circle with two poles of interchannel positive and negative links, which completely repeats the ancient Chinese monad Yin-Yang, but at the 'water' and 'fire' primary elements' level.

In this way the diagrams reflect the global dipole regulation structure, which forms the basis of the 5 primary elements system functioning. We discovered this energy dipole in 1995 [7, 15, 16, 23]. Normally the negative regulating pole (-) is in the 'water' primary element system, mostly at the urinary bladder channels level. In these channels, according to TCM, there is an accumulation of energy. The positive regulating pole (+) is mostly concentrated at the 'fire' primary element channel's level, and partly at the 'wood' and 'earth' primary element channel's level, where mainly energy consumption occurs.

Since the activity of AC is determined by the number of open points on it, then using the acupuncture atlases of TCM with the localization of points on the channels, it is easy to calculate the maximum possible

theoretical activity of the (+) Yang pole, which is equal to the sum of points on the fire channels (HT+SI+PC+TE= 56 points) and the negative Yin pole (KI+BL= 94 points) [18]. Their ratio is in the proportion (1.6), close to 1.62 which is the proportion of the "Golden section". We regard the presence of such a balance in the Dipole as a state of harmony in the body to which we must strive. With age or with illnesses, or from external influences, some of the points on the channel can 'close' with a change in its activity in the test. In this case, the proportion of the cross section also changes, which leads to an increase in the Yang or Yin components with loss of harmony in the dipole.

An important role in the balancing of the dipole belongs to the channels of the "boundary layer" at the level of the primary elements, tree-earth or wood-metal (AC-LR, GB, SP and LI). This line is the most dynamic by changes "boundary layer", at the level of which, due to the transition of its separate channels into the zone of (+) or (-) regulation, the operative control of various functions of the organism takes place. As the dipole embodies the law of the "opposites unity and struggle", the main conflicts of different kinds of pathology geneses are also located at this level of dipole regulation. Examination of different patients shows that depending on the kind of pathology or the character of the regulating influence, in which the dipole takes part, the dipole central axis can move at the primary elements level, but mostly within the borders of the 'water' and 'fire' primary elements. The number, direction and strength of connections in SSS can vary depending on heart rate with an increase in the (+) or (–) dipole component, but in general, these 24 connections reflect the individual characteristics, 'portrait' of each patient. Thus, the primary diagnosis of diseases is possible on the basis of the 'fingerprint' principle.

For the SSS syndrome itself as a whole, in addition to a violation of the structure of correlations, an increase in the influence of regulatory zones with channels - BL, PC, LI and GB, which are a kind of core of the main manifestations of this pathology (Figure 6). The role of the LI channel is explained by the influence of microbial bio flora on endogenous biorhythms of the whole organism. The state of the PC channel mainly reflects the violation of trophic disorders of the heart muscle, especially in myocarditis and ischaemia. The more active and pronounced myocardial damage, the greater the asymmetry of its branches [15, 16]. The number 24-AC itself belongs to the Fibonacci series in which all the values of the indicators are interconnected in the form of a single ensemble. 1 indicator changes- in response to this, the values of all others change, as in a kaleidoscope. Therefore, for example, using discriminant analysis according to the data of several tests and training groups, it is possible to diagnose various rhythm disturbances with an accuracy of more than 80% [15].

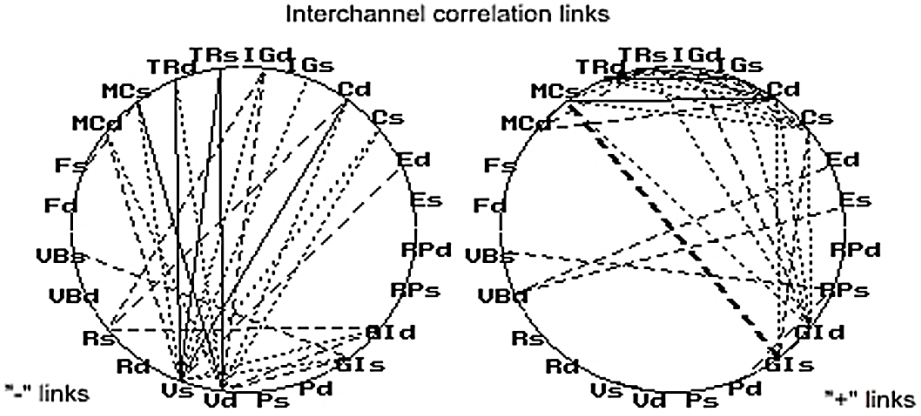

Figure 6: The matrix of correlations between the AC with SSS.

To understand the influence of specific AC on various indicators in various diseases, the use of the stepwise regression method is especially effective [15-17, 19, 20, 24, 25]. However, in this case, especially according to the data of group statistics, the results are rather blurred, since at different frequency ranges of the pulse in the obtained models, the sides of the AC and the signs of influence change. The influence is also exerted by the different genesis of this disease. Table 1 shows the final step-by-step linear regression model of the relationships between AC and heart rate in 43 men with SSS at the time of tachycardia.

Table 1: Final step-by-step linear regression model of the relationships between AC and heart rate in men with SSS.

Channels	b	SE	t	p
Constant	68.31	5.39	8.61	0.001
LIr	-3.50	1.84	-1.89	0.06
LIl	+3.17	2.00	1.58	0.12
GBl	+2.44	1.65	2.08	0.04
KIr	-3.45	2.31	-1.49	0.14
KIl	+2.82	1.72	1.64	0.10

R-SQ. (ADJ.)= 0.31; 43 observations.

In this model, a fairly high coefficient of explainable variance (R-SQ = 0.3180) of the polygon of values is obtained. From the obtained dependences, only AC-GBl has a significant relationship with heart rate with a (+) sign. This means that an increase in its values will characterize an increase in tachycardia. For the LIr channel, only a tendency (p=0.06) to a significant regulatory effect on heart rate with a (-) sign was noted.