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RESEARCH ARTICLE

Comparative Assessment of the Heart's Functioning by Using the Akabane Test and Classical Methods of Instrumental Examination

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Abstract
Acupuncture physicians have studied the application of reflexotherapy to cardiology. However, no one has investigated the connection of ancient Chinese diagnostic methods with modern tools. A total of 102 patients (54 men and 48 women) with heart pathology, namely, sick-sinus syndrome, Wolff—Parkinson—White syndrome, and atrioventricular blockade, were studied using the usual instrumental methods (transesophageal electrophysiological study of the heart, echocardiography), after which they underwent Akabane thermopuncture testing as in traditional Chinese medicine. The results of cardio examination from one side of the Akabane test with that from the other side were compared by means of a multiple stepwise regression analysis. We revealed the effects on the characteristic pattern of acupuncture channel lesions inherent in a definite heart pathology, i.e., the most vulnerable acupuncture channel (AC), of such factors as disturbances of the contractile, conductive, or automatic heart functions, and changes in the chambers' size or circulation volume. Changes in the indices of the left and the right branches of these channels usually reflect the opposing natures of the changes in these indicators,

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which should be considered in reflexotherapy. The main value of the Akabane test along with the use of mathematical analysis lies in early, quick, and inexpensive detection of the above-mentioned heart disturbances.

1. Introduction

Many acupuncture physicians have studied the application of reflexotherapy to cardiology [1], and most of those studies have focused on such problems as the influence of acupuncture on heart rate variability [2–8] or the use of acupuncture to treat patients with heart failure, angina pectoris, and arrhythmia [9–18]. Approximately 100 reports are related to the use of acupuncture in treating patients with arrhythmia [6], and many more reports are related to its use in treating patients with other heart disorders. Acupuncture at the HC 6 [2], heart (HT) [7], stomach (ST) 36 [4], and large intestine (LI) 7 [5] acupoints has been proven to regulate heart rate, with acupuncture at the HC 6 acupoint also having been found to be effective in treating patients with heart failure [10]. However, the connection between ancient Chinese diagnostic methods and modern tools still has not been explored. Researchers have mostly experimentally studied the therapeutic impact of acupuncture at certain points on the functioning of the heart. In this paper, we report a noninvasive diagnostic study using the Akabane test to evaluate the effect of acupuncture at various acupoints on the functioning of the heart to demonstrate that the use of the Akabane test can be useful for that purpose.

2. Materials and methods

To compare the data, we first subjected the patients to esophageal electrophysiological examination (EPE) and echocardiographical examination (ECHOCGE) and then to channel testing. We examined 54 men and 48 women (102 patients). In 85% of the patients, we discovered different disorders of the heart rate. The rest of the patients were found to be generally in good health except for temporary functional heart-rate disturbances. To assess the myocardial contractility function, we used the results of the ECHOCGEs of 102 patients. After the ECHOCGEs, all the patients were subjected to channel testing, and the results were analyzed with the help of a multiple stepwise linear regression. As the myocardial contractility function is diverse in its manifestations, we had to analyze a number of different indices. Some of them reflect the contractility parameters proper; others regard the myocardium as a kind of specific pump.

In ancient times in China, the so-called "sacrificial stick" test was used to evaluate quantitatively a channel's activity level according to traditional Chinese medicine (TCM). This test involved bringing a burning sandal stick into the proximity of points at the tips of the fingers and the toes until the first sensation of pain was felt (Fig. 1). At each point, the pulse rate before pain was first felt was measured. When the number of pulse beats was lower than the average one for the channel, the acupuncture channel (AC) and its corresponding organ were hyperactive. However, when the rate was higher, the AC and its corresponding organ were inactive. This test was described by the Japanese doctor Koben Akabane [19] in 1952. Since then, the test has carried his name, and numerous devices for testing the temperature sensitivity thresholds (TSTs) have been developed and used all over the world.

In our study, we used a special certified device, the "Merid" device, invented by V. Muzhikov (Fig. 2) [20–24]. It sends heat impulses to the points through a special infrared diode ($f = 1$ Hz, $\lambda = 920$ nm), and the energy expended is measured in Joules. The increased accuracy of evaluations made by using the TST and the repeated accuracy of the method are used in connection with the fact that humans, as warm-blooded creatures, have a highly-developed system for measuring temperature down to hundredths of a degree.

This study of the relationship between the TST and cardiac activity was conducted in patients at the Department of Cardiac Surgery Hospital N26 in St. Petersburg. The study sample included 19 patients with suspected sick sinus syndrome (SSS), 21 patients with Wolff–Parkinson–White (WPW) syndrome and its analogues, and 62 with atrioventricular (A–V) blockade. They underwent ECHOCGEs and standard EPEs according to the defined recovery time for sinus node function (TSKFR), the corrected recovery time (CTSKFR) for sinus node function, and the effective refractory period (ERP); then, the Wenkenbach point was tested within the first 30 minutes. Thus, we were able to assess whether or not a specific AC had functions of automatism, conduction, and contractility. Healthy patients were not used in this study; however, at the time of the survey, for 16 patients, the investigated parameters were within normal limits, and the results for those patients were used in the calculations.

To assess the bioenergy status at the level of the AC's sensitivity, we performed the Akabane test, and we used a stepwise multiple regression analysis to estimate the dependences of the cardiac parameters on the sensitivity thresholds of the channels. Statistical decisions were made at a significance level of 5% ($\eth \leq 0.05$). We performed the data analyses by using the StatGraf software (StatGraf V-7, USA).

3. Results

3.1. Conductivity function

In this study, a well-known electrophysiological index, the Wenkenbach point (Wp), was used to assess the conductivity function. This index characterizes the rate of the atrioventricular excitation conductivity, especially through the atrioventricular (AV) junction. Excitation conductivity

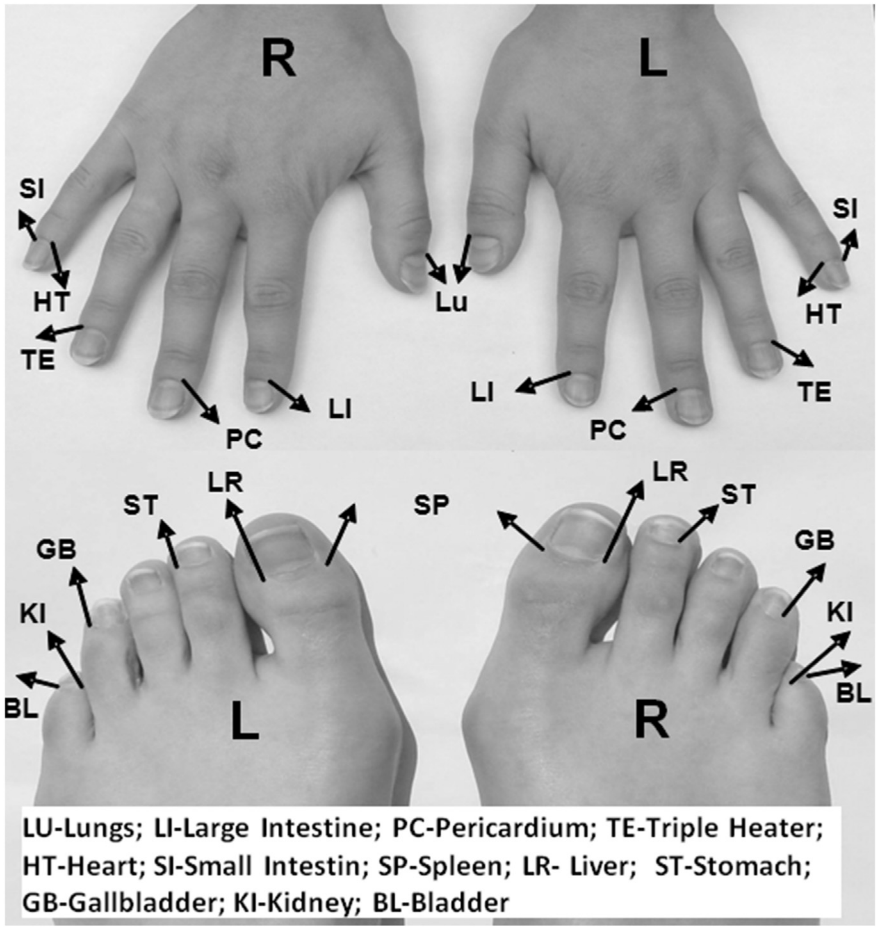

Figure 1 Points commonly used for measuring the heat sensitivity in the Akabane test.

with a rate of 140—180 pulses/min is believed to be normal for an AV junction. Lower values of this index point to some kind of hidden AV conductivity disorder, which can lead to AV heart blocks. If the Wp exceeds 180 pulses a minute, some additional hidden conductive tracts may possibly exist. The activating pulses from the atria move along these tracks, going straight to the ventricles and bypassing the AV junction blocks, thus causing untimely and rapid contractions of the ventricles. This mechanism is mostly responsible for the appearance of the WPW-type tachycardia's syndrome. Thus, this index can be seen to be very important when assessing the myocardium's conductivity mechanism. Conductivity disorders with a slow heart rate can be regarded as manifestations of the yin state whereas tachycardia can be regarded as a manifestation of the yang state.

Figure 2 "Merid" device invented for the Akabane test by V.G. Muzhikov.

Table 1 shows the results of a multiple stepwise regression analysis that included all of the independent variables (sensitivity thresholds of the ACs). In the model, when the Fisher criterion was equal to 4 ($p < 0.05$), only four channels were included, and all influences had negative signs.

The model's predictability coefficient for men was 54%. The right branch of the gallbladder channel played the most important role in Wp regulation with regard to reliability ($t = -3.6$, $p = 0.001$) and the influence coefficient b. When the values of the parameters were increased, Wp values decreased. Additionally, the model included the right branch of the pancreas channel, which was one of the components with a high reliability index ($t = 3.0$, $p = 0.005$). The right branch of the large intestine channel

Table 1 Result from a stepwise regression analysis of the acupuncture channels in men by using the Wenkenbach point (Wp) as the dependent value.

Independent variable	b	SE	t	p
CONSTANT	417.357	42.833	9.743	***0.001
LI_R	−53.040	20.438	−2.595	*0.017
GB_R	−126.612	34.717	−3.646	**0.001
SP_R	−25.837	8.385	−3.081	**0.005
KI_L	−46.194	13.816	−3.343	**0.003

R^2 (Adjusted) = 0.543, and the standard error (SE) of the estimate = 32.788 for $N = n = 35$.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.
+ or − indicates the tendency to significance.
The subscripts R and L indicate the right and the left branches of the AC, respectively.
AC = acupuncture channel; b = regression coefficient; GB = gallbladder; KI = kidney; LI = large intestine; SE = standard error; SP = spleen; t = t-value; Wp = Wenkenbach point.

Table 2 Results from a stepwise regression analysis of the acupuncture channels in men based on the CTSKFR index.

Independent variable	b	SE	t	p
CONSTANT	−190.009	239.321	−0.793	0.437
LR_R	−692.619	173.574	−3.990	***0.001
ST_L	482.691	223.401	2.160	*0.043
BL_L	432.118	67.325	6.418	***0.001
SP_R	193.027	75.719	2.549	**0.019

R^2 (adjusted) = 0.653, and the standard error (SE) of the estimate = 278.891 for $n = 34$.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.
+ or − indicates the tendency to significance.
The subscripts R and L indicate the right and the left branches of the AC, respectively.
AC = acupuncture channel; b = regression coefficient; BL = bladder; CTSKFR = corrected recovery time; L = left; R = right; SE = standard error; SP = spleen; ST = stomach; t = t-value.

and the left branch of the kidney channel had similar reliable influences on the values of the Wp parameter. On the whole, this kind of influence with a negative regulating component is characterized by a decrease in the heart rate and, in fact, is analogous to a parasympathetic vagal influence.

For women, the model's prediction reliability coefficient was 55%. The most reliable ($t > 2.0$) influence for decreasing the Wp parameter value was that of the right branch of the gallbladder channel, as well as those of the right branches of the heart and the large intestine channels, although the influence reliabilities of the last two were not so high ($t = 0.97$). The left branches of the lung, the triple heater, and the urinary bladder channels had the most reliable ($t > 2.0$) influences on increasing the values of the Wp parameter.

3.2. Automatism of the sinus node function

A test based on determining the time necessary for sinus node function recovery (TSKFR) and the corrected time necessary for sinus node function recovery (CTSKFR) is widely used for the purpose of assessing the sinus node function's automatism. Normally, when the TSKFR is being assessed, this time does not exceed 1.5 seconds. Its increase may point to an automatism disorder in the sinus node, which is mostly characteristic of the SSS. Even more accurate data can be obtained while assessing the CTSKFR. Subtracting the value of the cardiac cycle preceding electro-stimulation from the TSKFR gives the CTSKFR. The CTSKFR allows the researcher to obtain a result free from the influence of the heart's own rate on the value of the parameter obtained during the course of the test. Table 2 shows the influences of the ACs on the CTSKFR index in men.

The model's predictability coefficient for men was ~65%. The right branch of the liver channel still had the most reliable influence ($t = 3.9$) on decreasing the value of the parameter although the left branch of the urinary bladder had the most influence ($t = 6.4$) on increasing the value. The state of the liver, and particularly the relative hypo function of its channel's right branch, can be assumed to have an influence on the automatism of the function of a normal sinus node. Furthermore, hormone disorders, with high indices for the left branch of the urinary bladder, may be a major provocative factor leading to a disorder of the function's automatism. Malnutrition also contributes to this disorder through its influence on the left branch of the stomach (ST_L) and the right branch of the spleen (SP_R) earth channels.

For women, the model's predictability coefficient was 60%, and the analysis revealed that only one AC significantly and reliably reduced the function's automatism index under examination, and that AC was the left branch of the urinary bladder channel, which controls the release of sexual hormones. The right and the left branches of both the pancreas and the stomach channels stand out as having reliable positive influences, the influences of the right branches being better articulated and more reliable.

Overall, for both men and women, the recovery of balance in the sexual and the hormonal spheres has the greatest influence on the rehabilitation function's automatism. Other important influence channels are mostly centered in the earth primary element and are connected with inappropriate diets and disruptions of the nutrition Chi flow through the spleen channel.

3.3. AV junction's conductivity

The AV junction's effective refractory period (AVcERP) is widely used to assess the conductivity function at the level of the AV connection. Normally, the AVcERP fluctuates between 0.28 seconds and 0.32 seconds. A lower value of this parameter is a sign of insufficient pulse delay in the AV junction, which may cause the heart's ventricles to undergo untimely contractions at moments when the blood from the atria has not yet filled them. This leads to ineffective hemodynamics at systole, producing small blood discharge into the bloodstream. However, a higher value of this parameter points to the possibility of a conductivity block at the level of the AV junction. Table 3 shows the values of this parameter and the channel's energy activities for men.

As one can see from the aggregate results of the regression model, on the whole, the model has only 31% prediction reliability for men. Additionally, the channels presented in the model have rather low influence reliabilities. The only channel whose influence on bringing down the AVcERP is reliable is the right branch of the pericardium channel (PC_R).

For women, the model's prediction reliability coefficient was 42%. Here again, the PC_R had an influence in bringing down the AVcERP index. Thus, the PC_R had an influence in reducing the AVcERP index, irrespective of the patient's sex. The small intestine channel, which controls the blood electrolytes, especially its right branch, had, in this model, the greatest influence on increasing the AVcERP index in women ($t = 5.3$, $p = 0.001$).

3.4. Assessment of the channel's influence on the ejection fraction

The ejection fraction (EF) index characterizes the blood volume ejected from the heart's left ventricle during every systole, percentage wise, compared with the total volume of blood in the left ventricle. The higher the index is, the more efficiently the heart works in its capacity as a hemodynamic pump. Normally, the average EF index fluctuates from 60% to 85%. Table 4 reflects the influences of the ACs on this index in men. This model's prediction reliability coefficient was 50% and included only three channels with a Fisher's F-criterion = 4.0. The hypo function of the right branch of the large intestine channel was observed to have a highly reliable influence on increasing the EF index although the hypo functions of the left branches of the triple heater and the kidney channels were seen to have influences on decreasing the EF index. For women, the right branch of the urinary bladder channel contributed to EF growth, and the left branch of the small intestine channel contributed to its decrease.

3.5. Assessment of the channel's influence on the size of the left atrium

From the point of view of contemporary science, the left atrium's size exceeding the norm by more than 4 cm is a sign of dilatation of the heart's chambers. Usually, quite logically, this form of dilatation leads to cardiac decompensation and blood circulation insufficiency (BCI). Thus, a marked dependency exists between the left atrium's size and BCI. Table 5 shows the influences of the ACs on the size of the left atrium in men.

The model has a high prediction reliability coefficient of 54% for men. Only the three channels that have influences

Table 3 Results from a stepwise regression analysis of the acupuncture channels in men based on the AVcERP index.

Independent variable	b	SE	t	p
Constant	261.662	55.049	4.753	***0.001
LI_R	85.379	46.198	1.848	*0.079
HT_L	130.628	79.594	1.641	0.116
PC_R	−225.227	86.116	−2.615	*0.016
BL_L	16.218	12.677	1.279	0.215

R^2 (adjusted) = 0.311, and the standard error (SE) of the estimate = 69.028 for $n = 35$.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.
+ or − indicates the tendency to significance.
The subscripts R and L indicate the right and the left branches of the AC, respectively.
AC = acupuncture channel; AVcERP = atrioventricular junction's effective refractory period; b = regression coefficient; BL = bladder; HT = heart; L = left; LI = large intestine; PC = pericardium; R = right; SE = standard error; t = t-value.

Table 4 Results from a stepwise regression analysis of the acupuncture channels in men based on the EF index.

Independent variable	b	SE	t	p
Constant	69.515	8.146	8.533	***0.001
LI_R	28.821	6.199	4.648	***0.001
TE_L	−26.876	9.246	−2.906	**0.007
KI_L	−10.981	3.893	−2.820	**0.008

R^2 (adjusted) = 0.5030, and the standard error (SE) of the estimate = 9.1033 for $n = 31$.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.
+ or − indicates the tendency to significance.
The subscripts R and L indicate the right and the left branches of the AC, respectively.
AC = acupuncture channel; b = regression coefficient; EF = ejection fraction; KI = kidney; L = left; LI = large intestine; R = right; SE = standard error; t = t-value; TE = triple heater.

Table 5 Results of a stepwise regression analysis of the acupuncture channels in men based on the left atrium (LA) index.

Independent variable	b	SE	t	p
Constant	25.517	4.334	5.887	***0.001
LR_R	6.685	1.002	6.671	***0.001
TE_R	11.768	4.994	2.356	*0.022
SP_R	3.329	0.901	3.692	***0.001

R^2 (adjusted) = 0.542, and the standard error (SE) of the estimate = 6.283 for $n = 54$.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.
+ or − indicates the tendency to significance. The subscripts R and L indicate the right and the left branches of the AC, respectively.
b = regression coefficient; L = left; LA = left atrium; LR = liver; R = right; SE = standard error; SP = spleen; t = t-value; TE = triple heater.

on the size of the left atrium and BCI were included in the finite model. Interestingly, they are all represented by their right, yin, branches. The BCI itself is a yin function, too. An increase in BCI is caused by the hypo function of the right branch of the liver channel ($t = 3.4$). That the liver can act as a blood depot which reduces the volume of circulating blood, leading to increased peripheral resistance to blood flow, formation of ascites, and development BCI in general, is common knowledge. Blood circulation insufficiency is increased, mostly with a high degree of reliability ($t = 2.3$) and an influence coefficient of $+11.7$, by asymmetric growths of the indices of the right branch of the triple heater channel. This observation indicates that the right branch of the triple heater channel is the main conduit that has an influence on the general conditions of the central hemodynamics.

In women, the model reflects a significant ($t = 2.0$) influence of the hypo function of the right branch of the small intestine channel on reducing the size of the left atrium. The right branch of the stomach channel has the most pronounced influence ($t = 3.5$) on increasing the size of the left atrium, with the large intestine channel ($t = 2.6$) and the liver channel ($t = 1.9$) also having large influences. A certain similarity exists between the influences of the ACs in men and women on the size of the left atrium. In both cases, the right branches of the channels have more significant influences on dilatation of the left atrium and, consequently, on BCI growth. The influences of the left branches of the ACs on BCI are insignificant in both men and women. On the whole, by making use of the discovered patterns of dependences we have obtained, we can lessen BCI by influencing appropriate channels.

3.6. Assessment of the channel's influence on the myocardial circulatory contractility rate

The myocardial circulatory contractility rate (Ec) is an index that directly reflects the myocardium contractility function. An index exceeding the norm by 35 cm/s points to increased myocardium contractility, as a consequence of thyrotoxicosis, for example. Furthermore, a decreased contractility rate testifies to diffuse sclerotic and dystrophic changes in the myocardium. Such changes are characteristic of hypothyroidism also. Table 6 shows the influences of the ACs on this cardiac function in men. The model is based on the results of 18 observations, so the results have an approximate character. Nevertheless, we believe that these data can be used in medical practice.

For women, the model has a rather high degree of prediction reliability of 36%. The data show for certain that the left branch of the small intestine channel increases ($t = 3.2$) the myocardium contractility rate although the left branch of the heart channel (which was the case with men, as well) and the right branches of the pericardium and the spleen channels reduce the Ec index.

Table 6 Results from a stepwise regression analysis of the acupuncture channels in men based on the Ec index.

Independent variable	b	SE	t	p
Constant	51.272	3.869	13.250	***0.001
LU_L	−16.373	3.342	−4.898	***0.001
TE_L	50.826	4.312	11.787	***0.001
HT_L	−62.834	8.270	−7.597	***0.001
SP_L	−2.395	0.715	−3.350	**0.006
GB_R	8.873	4.256	2.084	+0.061

R^2 (adjusted) = 0.745, and the standard error (SE) of the estimate = 2.220 for $n = 18$.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.
+ or − indicates the tendency to significance. The subscripts R and L indicate the right and the left branches of the AC, respectively.
AC = acupuncture channel; b = regression coefficient; Ec = myocardial circulatory contractility rate; GB = gallbladder; HT = heart; LU = lungs; SE = standard error; SP = spleen; t = t-value; TE = triple heater.

4. Discussion

As one can see from cited literature [25—27], the heart starts to build up long before nerve fibers attach to it. The heart's conduction system is formed during the prenerve period [28—30] as a particular myocardial tissue that performs self-sustainable complex operation of the heart's rhythm. Firstly, the Giss bundle is formed when the embryo is 6—7 mm, after which the auricular-ventricular node forms; last is the sino-atrial node, which forms at an embryo size of 12—14 mm. The heart is the first organ to have life and the last to lose it. By the end of the 23rd day, isolated heart tissue fragments contract even before the beginning of fully developed rhythmic activity. In spite of this, the heart's conduction system, unlike nerve tissue, for example, does not have distinct histological differences from myocytes, which is the reason that during the course of some diseases, conductive bundles are able to form easily as new additional conductive paths. Considering this, one may assume the heart's conduction system to be a possible material and physical representation of the heart's AC, which is the starting point of a living organism's development [20]. The AC system itself forms a body space frame, in which the fate of initial embryo cells will be defined by their topography, which will influence the diversity in the formation of future organs. That the ACs are connected to the main aspects of the heart's activity is substantiated by the high values of the correlation coefficients. These AC connections and their influence vectors for increasing and decreasing different indices are presented in Table 7. The higher the Akabane test result of a given channel branch is, the larger its influence is.

4.1. Influences on the conductivity function

For men, a Wp increase followed by possible tachycardia development is caused mostly by sexual hormonal disruptions, which are due to asymmetrical growth of the right branch of the urinary bladder channel. However, a Wp decrease followed by development of A—B blocks happens because of an imbalance in the peripheral nervous system (right branch of the gallbladder channel), a myocardial inflammation (right branch of the spleen channel), a

Table 7 Summary of the connections of the channels with the basic indices for the functioning of the heart.

	Sex	A—V conductivity Wp	Automatism CTSKFR	A—V conductivity AVcERP	Ejection fraction EF	Left Atrium size LA	Contractility Ec
Increase	Men	BL_R	BL_L, SP_R, ST_L	LI_R, HT_L, BL_L	LI_R	LR_R, SP_R, TE_R	TE_L, GB_R
	Women	LU_L, TE_L	SP_R, ST_R, ST_L	SI_R, SI_L	BL_R, HT_R	ST_R, LI_R, LR_R	SI_L
Reduction	Men	GB_R, SP_R, KI_L, LI_R	LR_R	PC_R	TE_L, KI_L	—	LU_L, HT_L, SP_L
	Women	GB_R, HT_R	BL_L	TE_L, PC_R	SI_L	SI_R	HT_L, PC_R, SP_R

The acronyms used for the ACs are explained in Fig. 1. The subscripts R and L indicate the right and the left branches of the AC, respectively.
AC = acupuncture channel; A—V = atrioventricular; AVcERP atrioventricular junction's effective refractory period; BL = bladder; CTSKFR = corrected recovery time; Ec = myocardial circulatory contractility rate; EF = ejection fraction; GB = gallbladder; HT = heart; L = left; LA = left atrium; LI = large intestine; LR = liver; LU = lungs; PC = pericardium; R = right; SI = small intestine; SP = spleen; ST = stomach; TE = triple heater; Wp = Wenkenbach point.

sympatho-adrenal imbalance (left branch of the kidney channel), and/or problems with the biochemistry of blood (right branch of the large intestine channel) that is reflected in an AC disturbance. For women, a Wp increase is mainly connected to ischemic myocardial (left branch of the lung channel) and thyroid (right branch of the heart channel) injuries. Its decrease is caused by an imbalance in the peripheral nervous system and by focal lesions of the heart's conduction system (right branch of the heart channel). These AC connections to certain functional and biochemical disturbances in the body were recognized based on correlation and regression analyses [20] in hundreds of various studies. In the course of treatment, the influence of the channel's branches must always be targeted because the branches have an asymmetry of $>$ 40% [24]. Stimulation is always performed on the side with the higher index, which corresponds to a hypo function of the AC's branch.

4.2. Influences on the function's automatism

Generally, the main influence on an increase in the function's automatism index is the earth primary element AC due to inflammation (right branch of the spleen channel) or disturbances of overall nutrition balance (stomach channel), which lead to the development of SSS. In such cases, the right branch of the spleen is stimulated to mend the myocardial trophism. Treatment by using infrared-warming results in a substantial increase in the number of heart contractions in as little as a few minutes, and the effect is preserved for several days. A decrease in the index is caused mostly by a hormonal imbalance for women and by liver diseases for men. We should note that the left and the right branches of the hormonal channel (the urinary bladder channel) have different influence vectors for men and women. Thus, the hypo function (left branch of the urinary bladder channel) with high test results causes men to develop SSS and women to develop tachycardia.

4.3. Influences on A—V conductivity

In male organisms, an increase in the AV conductivity index, together with the development of an AV blockage, is primarily connected to changes in the biochemistry of the blood and to hormonal and focal disturbances of the conduction system caused by a variety of reasons. A decrease in this index, resulting in a degradation of the stroke volume from the aortic ventricle at systole, directly affects the myocardial tissue and sequaciously presents in an asymmetry of the right branch of the pericardium channel. In female organisms, an increase in this index is mostly related to electrolyte metabolism through the small intestine (left branch of the small intestine channel) although a decrease is related to thyroid (left branch of the triple heater channel) and pericardium channel lesions, as in male organisms.

4.4. Influences on ejection fraction

Increasing the influence of the right branch of the large intestine channel in men can raise the ejection fraction and, consequently, make circulation more efficient. For women, this can be done by normalizing the hormone balance and by stimulating the heart channel through its left branch to induce a dominant asymmetry in favor of the right index.

When the data presented in this model are studied, one should bear in mind that the majority of the examined patients showed no signs of blood circulation insufficiency. At the same time, a well-known fact is that physically-trained individuals can have an injection fraction of 55% or lower when at rest because the body's rational use of even a small volume of blood is quite sufficient to cover its energy demands in the state of rest. Usually, the ejection fraction index rises sharply under the influence of physical activity, without any noticeable increase in the heart rate. Thus, a decrease in the ejection fraction index in the state of rest can be regarded as a fitness factor and a yang sign in the case of men, who enjoy good health. On the contrary, healthy men showing an increase in the ejection fraction index in the state of rest points to a certain functional lack of adaptability.

4.5. Influences on the size of the left atrium

Left atrium growth is a highly pejorative predictive index caused by a variety of reasons. That all AC branches causing such growth are right, or yin, branches that need to be stimulated in the course of targeted treatment is peculiar. A significant decrease in the dependency of the size of the left atrium on stimulation of the right branch of the small intestine channel is clear only with regard to females, presumably because of the normalization of the electrolyte balance.

4.6. Influences on the myocardial circulatory contractility rate (Ec)

An increase in the myocardial circulatory contractility rate (Ec) index is mainly connected to thyrotoxicosis (left branch of the triple heater channel), a nervous system imbalance (right branch of the gallbladder channel), or an electrolyte imbalance (left branch of the small intestine channel). A decrease in the Ec index is caused by hypoxia (left branch of the lung channel), a myocardial nutrition imbalance (spleen channel), or myocardial inflammation.

5. Summary

These studies have revealed sound connections of the heart's activities to a variety of ACs, which functional connections fit, quite consistently, the aetiopathogenesis of disturbances of the various activities of the heart. The mathematical model used in this study showed that these connections were not random and could be accurately explained in terms of modern physiology. The diverse influences of the vectors for the left and the right branches of the ACs is of particular interest because targeted stimulation of the right or the left branch of an AC will result in a successful body harmonization treatment. However, such estimates with the usual tools for diagnosing the condition of an AC is only possible when a mathematical analysis is involved, as precise target stimulation of the right or the left branch of an AC based only on a doctor's empirical experience is extremely challenging.

Disclosure statement

The authors declare that they have no conflicts of interest and no financial interests related to the material of this manuscript.

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