Vegetative reactivity of the newborn and the prognostic ability of reflexology

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Autonomic reactivity of a newborn and the prognostic ability of the reflex therapy

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SUMMARY

The purpose given research there was a definition discriminant capabilities reflexology of the state of autonomic reactivity and the identification of its predictors in newborns. We examined 115 term infants with grade III perinatal hypoxic-ischemic encephalopathy in the late neonatal period. The features of autonomic homeostasis under the influence of reflexotherapy have been investigated. Evaluation and prognosis of the effectiveness of reflexology in newborns with cerebral ischemia is based on discriminated prognostic parameters of heart rate, such as indices of autonomic balance and tension, as well as fashion, with the dominance of the humoral regulation circuit. Reflexology allows both to discriminate and predict the autonomous adaptive characteristics of a particular newborn and can be used to prevent the breakdown of his adaptation.

Key words: discriminant analysis, autonomic reactivity, newborn,acupuncture.

RESUME

The aim of this study was to determine the discriminant ability of reflexotherapy in vegetative reactivity and to identify its predictors in infants. The study involved 115 full-term newborns with perinatal hypoxicischemic encephalopathy of III degree in the late neonatal period. The features of vegetative homeostasis under the influence of acupuncture were examined. Assessment and forecast of the effectiveness of acupuncture in neonates with cerebral ischemia is based on discriminated prognostic parameters of cardiac heart rate, such as indexes of autonomic balance and tension, as well as mode, with the dominance of humoral regulation circuit. The reflex therapy allows both discriminating and predicting the adaptive autonomous characteristics of a specific newborn, and used to prevent the disruption of its adaptation.

Keywords: discriminant analysis, autonomic reactivity, newborn, acupuncture.

INTRODUCTION

The vegetative status of children who have undergone severe cerebral ischemia is characterized by the development of vegetative reactivity according to the hypersympathicotonic variant, which persists throughout the entire period of neonatality. The hypothalamus, autonomic structures of the brain stem, limbic and reticular systems, which are in close relationship with the cerebral cortex, take part in the functioning of the autonomic nervous system. Reflexotherapy causes changes in the indices of autonomic homeostasis with the restructuring of autonomic reactivity according to the vagotonic type [2]. Advances in functional neuroimaging techniques have made it possible to study the neuroanatomical and neurophysiological responses associated with acupuncture. Several studies have proven that stimulation of acupuncture points induces cross-reactions in specific subcortical and cortical regions of the brain. Thus, activation of the sensorimotor cortical network (thalamus, anterior cingulate gyrus, primary and secondary somatosensory cortex) was noted. Simultaneously with deactivation in the network of limbic, paralimbic structures and the neocortex (medial prefrontal cortex, caudate, tonsils, posterior cingulate gyrus cortex and parahippocampal region). Acupuncture mediates pain-relieving, calming effects through these internal neural axes [10, 11], which play a central role in affective and cognitive perception of pain [5], in the regulation and integration of physical, neuropsychic development [6], endocrine, immunological [9] , sensorimotor and autonomic functions [4]. marked activation of the sensorimotor cortical network (thalamus, anterior cingulate gyrus, primary and secondary somatosensory cortex). Simultaneously with deactivation in the network of limbic, paralimbic structures and the neocortex (medial prefrontal cortex, caudate, tonsils, posterior cingulate gyrus cortex and parahippocampal region). Acupuncture mediates pain-relieving, calming effects through these internal neural axes [10, 11], which play a central role in affective and cognitive perception of pain [5], in the regulation and integration of physical, neuropsychic development [6], endocrine, immunological [9] , sensorimotor and autonomic functions [4]. marked activation of the sensorimotor cortical network (thalamus, anterior cingulate gyrus, primary and secondary somatosensory cortex). Simultaneously with deactivation in the network of limbic, paralimbic structures and the neocortex (medial prefrontal cortex, caudate, tonsils, posterior cingulate gyrus cortex and parahippocampal region). Acupuncture mediates pain-relieving, calming effects through these internal neural axes [10, 11], which play a central role in affective and cognitive perception of pain [5], in the regulation and integration of physical, neuropsychic development [6], endocrine, immunological [9] , sensorimotor and autonomic functions [4]. paralimbic structures and neocortex (medial prefrontal cortex, caudate, tonsils, posterior cingulate cortex and parahippocampal region). Acupuncture mediates pain-relieving, calming effects through these internal neural axes [10, 11], which play a central role in affective and cognitive perception of pain [5], in the regulation and integration of physical, neuropsychic development [6], endocrine, immunological [9] , sensorimotor and autonomic functions [4]. paralimbic structures and neocortex (medial prefrontal cortex, caudate, tonsils, posterior cingulate cortex and parahippocampal region). Acupuncture mediates pain-relieving, calming effects through these internal neural axes [10, 11], which play a central role in affective and cognitive perception of pain [5], in the regulation and integration of physical, neuropsychic development [6], endocrine, immunological [9] , sensorimotor and autonomic functions [4].

The actual question is, according to what parameters of autonomic reactivity reflexotherapy

delimits newborns into groups with less stressful adaptation and a higher reserve capacity of autonomic regulation. Which regulation loop is dominant? What indicators have predictive value, predicting the effectiveness of therapy and the choice of the method of action? Inappropriate choice of methods and techniques of rehabilitation is fraught with overloading the hypothalamic-pituitary-adrenal axis with disorganization of the adaptive reactions of newborns and the formation of vegetative-dependent somatic pathology, delay in the development of motor skills in infancy [1]. The use of a differentiated and individualized version of rehabilitation treatment, taking into account the state of adaptation of the autonomic nervous system to ischemic damage, the level of the functional state of the body, will increase the effectiveness of the therapy.

The aim was to study the discriminating ability of reflexotherapy of the adaptive capabilities of the autonomic functions of a newborn with cerebral ischemia in the "mother-child" system.

MATERIAL AND METHODS

Investigated 115 newborns with perinatal hypoxic-ischemic encephalopathy of the III degree in the late neonatal period. A clinical, neurological examination, rheoencephalography, cardiointervalography, and a study of electrocutaneous conduction at the beginning and at the end of the course of therapy were carried out. All children were divided into 2 groups: 31 newborns of the first control group received only protocol treatment, the second included 84 children, with additional use of reflexology. Taking into account the option of restorative impact, the main group is divided into 3 subgroups. Against the background of protocol treatment in the first subgroup, acupuncture was performed for both the mother and the child - 21 mother-child pairs; in the second subgroup, acupuncture was performed only in 32 puerperas; and in subgroup 3, the course of reflexology was carried out only to children - 31 newborns.

By the beginning of rehabilitation and restorative treatment in the late neonatal period, the initial age of children of the first subgroup was 10.2 ± 0.7 days, the second - 9.9 ± 0.6 days, the third - 10.8 ± 0.3 days. The age of children in the comparison group was 9.8 ± 0.5 days. By the end of the course therapy, the age of children of the first subgroup was 29.3 ± 0.4 days, the second - 27.2 ± 0.6 days, the third - 28.4 ± 5.5 days, the control group - 28.2 ± 0.4 days. The groups are identical in terms of the main characteristics of newborns: age, sex, gestational age, weight, body length, head and chest circumference at birth, clinical manifestations, severity of the lesion, concomitant diseases and protocol therapy, as well as mothers - the course of pregnancy, age, the number of births, complications, psychoemotional state. All babies were breastfed or mixed-fed.

The electrical conductivity of representative points of the mother and the child was investigated by the Ryodoraku method according to Y. Nakatani. An inhibitory effect was used according to F. Mann's prescription and stimulation of the group Lo-point. The procedure was carried out after the morning feeding, exclusively during the sleep of the newborn. The duration of the procedure is up to 60 minutes. Used disposable needles "SuJok Acupuncturae Needles Sterilized by Gama-ray" from Subal. Acupuncture course consisted of 5 sessions.

Autonomic dysfunctions were assessed by the indicators of heart rate variability using the cardiointervalography method, taking into account the parameters of the mode (MO), the variation range (ΔX), the amplitude of the mode (AMo), stress indices (TI), vegetative balance, the vegetative indicator of the rhythm and the indicator of the adequacy of regulation processes.

Statistical processing was carried out by parametric, nonparametric methods with the calculation of the mean, standard error of the mean, Student's t-test and Pearson χ^2 with Yates correction and step-by-step, with the inclusion, discriminant analysis of the application of StatSoft Statistika 5.0 programs.

RESULTS

In the materials presented earlier, it was noted that the initial autonomic functions, ascertained in all newborns of both groups, are characterized by maladjustment with high activity of the central circuit of nervous regulation (IN = 861.9 ± 91.31 c.u.). The sympathetic division of the autonomic nervous system predominates (AMo = 36.91 ± 2.15%). Decreased ability of humoral regulation (MO = 0.38 ± 0.011 s), without vagotonic compensation (ΔX = 0.07 ± 0.012 s). Upon completion of the rehabilitation course, children of the standard treatment group, in whom the activity of the central circuit of nervous regulation (IN = 1032.6 ± 123.91 c.u.) and the sympathetic section (AMo =

36.1 ± 1.59%), decreased humoral regulation (MO = 0.37 ± 0.012 s) without parasympathetic involvement (ΔX = 0.07 ± 0.012 s), do not reflect reliable dynamics of indicators and retain the state of maladjustment. Complex rehabilitation treatment with the inclusion of reflexology in children of the main group created the preconditions for the transfer of autonomic reactivity to the vagotonic variant and satisfactory adaptation. Thus, the severity of nervous regulation decreased (IN = 664.9 ± 69.43 c.u.), sympathetic tone fell (AMo = 29.3 ± 1.70%), humoral regulation increased (MO = 0.410 ± 0.011 s) with the presence of alignment of the cholinergic component (ΔX = 0.13 ± 0.043 s). In subgroups, the severity of changes is different. The activity of the parasympathetic department in patients of the first subgroup significantly increased by 20.0%, in the second - by 6.1%, and in the third, it even decreased (by 3.8%) in relation to the initial indicator, but at the same time exceeded the indicators of the standard treatment group by 88.2% in the first and by 13.2% in the second subgroup. The activity of the adrenergic system decreased by 12.2% in the first, by 11.2% in the second, and by 18.7% in the third subgroup relative to the control group. The increase in humoral regulation was most clearly manifested in the first subgroup (by 9.3%) in relation to the control group. Decrease in the activity of the central mechanisms of regulation of the heart rate by the end of the late neonatal period in the first, second and third subgroups, respectively, by 21.7%, 23.2% and 14.4%, compared with the initial indicators. The autonomic balance index decreased in children of the main subgroups by 18.8%, 22.4% and 14.5%, indicating the increasing influence of parasympathetic innervation. The indicators of the adequacy of the regulation process, which make it possible to characterize the sympathetic effect on the sinus node, in children in the main subgroups had a more significant dynamics of decrease (by 9.4%, 13.9%, 10.6%, respectively) than in children of the control group (by 2.8%), indicating the realizing pathway of humoral stimulation. The vegetative rhythm index decreased, differing by 22.2% in the first, by 25.8% in the second and by 17.7% in the third subgroup (p <0.05) from the values of the standard treatment group, reflecting the predominant direction of the central hemodynamic regulation vector parasympathetic division of the autonomic nervous system [3]. respectively) than in the children of the control group (by 2.8%), indicating the implementation of the path of humoral stimulation. The vegetative rhythm index decreased, differing by 22.2% in the first, by 25.8% in the second and by 17.7% in the third subgroup (p <0.05) from the values of the standard treatment group, reflecting the predominant direction of the central hemodynamic regulation vector parasympathetic division of the autonomic nervous system [3]. respectively) than in the children of the control group (by 2.8%), indicating the implementation of the path of humoral stimulation. The vegetative rhythm index decreased, differing by 22.2% in the first, by 25.8% in the second and by 17.7% in the third subgroup (p <0.05) from the values of the standard treatment group, reflecting the predominant direction of the central hemodynamic regulation vector parasympathetic division of the autonomic nervous system [3].

When creating a group classifier of the adaptive characteristics of the autonomic functions of a newborn, all seven studied parameters were included in the development. Reflexology discriminates a child's group according to two variables - these are the autonomic balance and stress indices with high total power and reliability (Wilks' lambda 0.76986; approximation F (2.112) = 16.740; p <0.00001). Variables whose dynamics in parametric statistics was characterized by a high degree of reliability are not included in the model. The values of the Wilks' partial lambda show that the vegetative equilibrium index makes the greatest contribution. The discriminant values of specific statistics in the group model are presented in table. 1.

Table 1

Predictors of the autonomic reactivity of the newborn in the model of the control and main groups

Переменные	Лямбда Уилкса	Частная Лямбда	F-вкл. 1,112)	p-уровень	Толер.	1-Толер. (R-квад.)
Индекс вегетативного равновесия	0,98	0,78	31,3	0,00001	0,35	0,65
Индекс напряжения	0,85	0,90	12,1	0,0007	0,35	0,65

The centroids of the groups are distant in the coordinate system space far from each other. This statement is based on the high values of the square of the Mahalanobis distance (1.518), Fisher's F-test (16.579) and the p-level of significance (0.00004).

For both group predictors, classification functions were generated. The statistical model is represented by two equations:

$F_1 = 0.0061469\ f_1 - 0.001546\ f_2 - 3.904253$; $F_2 = 0.0022883\ f_1 + 0.000029\ f_2 - 1.049491$,

where F_1 - the formula of the comparison group; F_2 - the formula of the main group; f - factor value. The predictive factors are introduced into the formulas: f_1 - vegetative balance index; f_2 - stress index.

Based on the known values of the cardiointervalogram indicators, both formulas are calculated. Comparison of the values of the values of functions makes it possible to resolve the issue of assigning a child to the first or second group. When $F_1 > F_2$, the newborn belongs to group 1, characterized by adaptation stress. When $F_1 < F_2$ - to group 2 with satisfactory adaptive ability. The assignment to the first group is an indication for the appointment of reflexotherapy in a pair "mother-child".

Discriminatory functions also allow you to differentiate the choice of inhibitory or exciting techniques. If the values of $F_1<0$ and $F_2<0$, then a stimulating technique is recommended. When $F_1>0$ and $F_2>0$ - depressing. The prediction accuracy of the classification matrix in the standard treatment group reaches 41.9%, and 96.4% when reflexology is included in rehabilitation treatment. The overall classification accuracy is 81.7%.

The dissimilarity of the severity of changes in subgroups, noted above, predetermines the possibility of a personalized approach to the use of reflexology for a newborn and the choice of an option for individual (either maternal or child), or joint therapy (both maternal and child) in the "mother-child" system. The program introduced only one factor into the model of subgroups (Wilks' lambda 0.83635; approximation F (2.81) = 7.9246; p = 0.0007), which determines the discrimination between subgroups. This is the mod - the most common value for the RR interval (sec.). On its basis, classification functions are determined for each of the subgroups. The mathematical model consists of three formulas:

$F_1 = 290.8279\ f - 62.529$; $F_2 = 262.1835\ f - 50.657$; $F_3 = 268.1868\ f - 52.990$,

where F_1 - subgroup formula 1; F_2 - formula 2 subgroups; F_3 - formula 3 subgroups; f - value fashion.

The choice of the treatment option is based on a comparison of the values of the results of the equations. The newborn belongs to the subgroup with the highest value of the classification function. The fashion maximally discriminates the first subgroup from the second (p = 0.0002) and third (p = 0.0032) with some overlap between the edge zones of the centroids of the second and third subgroups (p = 0.367). In this regard, in the subgroups (for the first, second and third, respectively) the sensitivity of classification is lower than in the group model and is 76.2–78.1–80.6%.

DISCUSSION AND CONCLUSIONS

Modern reflexology peculiar exclusively individual (personalized) approach based on the identification of characteristic abnormalities in reflexogenic skin zones, in particular, in acupuncture points. The presence and nature of these deviations are predictors of the effectiveness of reflexology in a particular patient [7]. Discriminant analysis makes it possible to classify a newborn as a patient with either pronounced or modest effectiveness of the forthcoming treatment options, based on the set of initial parameters of the child's autonomic reactivity. The characteristic features of the autonomic homeostasis of the newborn, associated with the nosology of the lesion, the psychoemotional state of his mother [8], predetermine the choice of a personal approach to restorative reflexotherapy treatment with predicting the expected effect based on the initial data, that is, the provision of predictive (predictive) help. The vegetative imbalance according to the hypersympathicotonic variant in newborns who have undergone severe hypoxic-ischemic brain damage, despite drug treatment, is restored exclusively by reflexology, mainly together with the mother. Cerebral ischemia by order of the Ministry of Health and Social Development of Russia No. 266 dated April 13, 2007, which approved the list of medical indications for the use of reflexology in neonatal practice, was classified as such (No. 333). Pharmacologically, a newborn is defenseless due to the lack of drugs that affect sympathetic activity, without narrowing the field of consciousness, fraught with depression and respiratory arrest, or allowed for use in this age period according to pharmacokinetic parameters. those who have suffered severe hypoxic-ischemic brain damage, despite drug treatment, are restored exclusively by reflexology, mainly together with the mother. Cerebral ischemia by order of the Ministry of Health and Social Development of Russia No. 266 dated April 13, 2007, which approved the list of medical indications for the use of reflexology in neonatal practice, was classified as such (No. 333). Pharmacologically, a newborn is defenseless due to the lack of drugs that affect sympathetic activity, without narrowing the field of consciousness, fraught with depression and respiratory arrest, or allowed for use in this age period according to pharmacokinetic parameters. those who have suffered severe hypoxic-ischemic brain damage, despite drug treatment, are restored exclusively by reflexology, mainly together with the mother. Cerebral ischemia by order of the Ministry of Health and Social Development of Russia No. 266 dated April 13, 2007, which approved the list of medical indications for the use of reflexology in neonatal practice, was classified as such (No. 333). Pharmacologically, a newborn is defenseless due to the lack of drugs that affect sympathetic activity, without narrowing the field of consciousness, fraught with depression and respiratory arrest, or allowed for use in this age period according to pharmacokinetic parameters. Cerebral ischemia by order of the Ministry of Health and Social Development of Russia No. 266 dated April 13, 2007, which approved the list of medical indications for the use of reflexology in neonatal practice, was classified as such (No. 333). Pharmacologically, a newborn is defenseless due to the lack of drugs that affect sympathetic activity, without narrowing the field of consciousness, fraught with depression and respiratory arrest, or allowed for use in this age period according to pharmacokinetic parameters. Cerebral ischemia by order of the Ministry of Health and Social Development of Russia No. 266 dated April 13, 2007, which approved the list of medical indications for the use of reflexology in neonatal practice, was classified as such (No. 333). Pharmacologically, a newborn is defenseless due to the lack of drugs that affect sympathetic activity, without narrowing the field of consciousness, fraught with depression and respiratory arrest, or allowed for use in this age period according to pharmacokinetic parameters.

The overlap of the edge segments of the centroids of the subgroups indicates the effectiveness of all variants of the technique, which is applicable for influencing only the maternal component of the living "mother-child" system in the presence of contraindications for reflexotherapy to the newborn. In newborns who received a course of reflexology with all exposure options, there is a pronounced shift of autonomic homeostasis towards the dominance of parasympathetic influences, manifested in a decrease in the stress index, fashion amplitude, variation range, and is regarded as a state of satisfactory adaptation. The optimal choice when drawing up a program for the rehabilitation of a newborn, due to the ability of reflexology to discriminate against the autonomic homeostasis of the child, ensures good tolerance of rehabilitation procedures.

heart rate parameters, such as indices of autonomic balance and tension, as well as fashion, with the dominance of the humoral regulation circuit.

Thus, the developed method of reflexology allows both to discriminate and predict the autonomous adaptive characteristics of a particular newborn and can be used to prevent the breakdown of his adaptation.

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