Session of the Academy of Medical Science USSR on Problems of Nervous Regulation of Circulation and R Respiration

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SCIENTIFIC CONFERENCES AND MEETINGS

THE SESSION OF THE ACADEMY OF MEDICAL SCIENCES OF THE USSR ON THE PROBLEM OF THE NERVOUS REGULATION OF CIRCULATION AND RESPIRATION

(Short Survey of Reports)

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On 13 June in the city of Ryazan, the birthplace of the great Russian physiologist Ivan Petrovich Pavlov, a joint session of the Division of Medico-Biological Sciences and the Division of Clinical Medicine AMN USSR [Academy of Medical Sciences USSR] was begun. The conference, in which the Ryazan Medical Institute imeni I. P. Pavlov participated, was devoted to the problems of the nervous regulation of circulation and respiration. About 200 scientists from various cities of the USSR took part in the work of that session. There were over 400 delegates from medical institutions of the city of Ryazan and the Ryazan Oblast. During the course of four days 29 reports and some supplementary information were presented.

The president of the Academy of Medical Sciences of the USSR, Academician N. N. Anichkov, opened the session with a brief survey of the most important works of I. P. Pavlov on circulation and indicated the general trend for the work of the session. He said its task was not only to utilize these studies of the nervous regulation

of circulation and respiration, but also to determine further methods of treating the problem. The president also noted that one year ago a joint session of two academies on the problems of the physiological teachings of I. P. Pavlov set forth the correct basic principles for subsequent scientific-research work and rejected the erroneous, ideologically faulty formulations of a number of scientists. He reminded those present that upon decision of the session it was recommended that the work of Pavlov in the fields of circulation and respiration be developed in every way. N. N. Anichkov urged that the gap existing between clinical and experimental research be reduced to a minimum, and that work be evaluated, first of all, from the point of view of the effective coordination of clinical investigations with physiological, pathophysiological, pharmacological, biochemical and morphological investigations. He paid special attention to the necessity of creating experimental models of such pathological conditions of the circulatory system as occur with coronary insufficiency, myocardiac infarcts, various forms of hypertensive diseases and other diseases. Concluding his talk, N. N. Anichkov expressed confidence in the fact that our medical science, our Pavlovian physiology and clinical practice would soon achieve new, unusual successes in its progressive development for the good of our Motherland, our great Soviet nation.

Three reports were heard at the first meeting of the session -- by regular members of the AMN A. L. Myasnikov, S. V. Anichkov, and V. N. Chernigovskiy.

In his report, "The Pathogenesis of Hypertension Disease", A. L. Myashikov presented a detailed and systematic survey of the whole question, and acquainted his audience with the latest experimental and clinical data obtained in the Institute of Therapy of the

mechanisms of action in some medicinal substances and the synthesis of new preparations, based on the detailed study of the physiological action of these substances. After giving a number of examples showing that pharmacological influences, in respect to the nervous regulation of circulation and respiration, can be directed at any link of the reflex arc, the speaker focussed his attention on the possibilities of variable pharmacological effect on sensitive nerve endings. The pharmacological analysis of the carotid chemoreceptors made it possible for the author of the report to present a suggestion on the biochemical nature of the processes which take place in the introceptors themselves when they are acted upon by irritants producing circulation and respiration reflexes. On the basis of experiments in the blocking of introceptors with enzymatic poisons and the influence of adenosin-triphosphate on introceptors, S. V. Anichkov reached the conclusion that the direct reason for the development of reflexes by introceptors is the destruction of the energy balance in the tissue, to be specific -- the predominance of the breakdown of macroergate bonds compared to their resynthesis. This conclusion and some particular aspects of the report were subjected to criticism, in which Dr. Kudrin justifiably pointed out that the destruction of the energy balance in the tissue may be considered only one of the reasons for the origination of an impulse in the receptor and that attributing the complex process of receptor excitation to disruption of the energy balance has not yet been sufficiently established.

In an interesting talk, "New Data on the Nervous Mechanisms of Blood Pressure Regulation", V. N. Chernigovskiy discussed the extent to which the overall principle views of I. P. Pavlov on the

function of the nervous system are reflected in the activity of centers governing circulation. In various modifications of experiments with protracted stimulation of receptor fields, V. N. Chernigovskiy, together with V. M. Khayutin, demonstrated that the return of blood pressure to previous levels with protracted stimulation of the receptor field cannot be explained by an adaptation of peripheral receptors, but is evidently caused by an inhibition process originating in the vasomotor center itself. On the basis of the obtained experimental material, the speaker came to the conclusion that afferent impulses exciting the vasomotor center may produce in it an inhibitory process, which in a number of ways is analogous to internal cortical inhibition, and that the process of internal inhibition, which at the present time is considered to be a property only of the cortex, also functions in lower divisions of the central nervous system. This conclusion incurred sharp criticism from some physiologists (Usiyevich, Koshtoyants, Andreyev) and several times the speaker had to give supplementary explanations. Commenting on the report, Academician K, M. Bykov pointed out the great value of the experimental data obtained, but also cautioned the speaker against the use of the term "internal inhibition" with respect to lower divisions of the central nervous system.

The second meeting of the session dealt with the nervous regulation of respiration.

The meeting started with a survey report by Professor N. A. Kurshakov, "Clinical Manifestations of the Failure of Nervous Regulation of Respiration". The speaker started with the correct supposition that the mechanisms of external respiration cannot be

studied isolated from the mechanisms of circulation and the physiological peculiarities of blood. Nevertheless, his report, containing interesting clinical material, was considered unsatisfactory in its treatment of physiological problems concerning the activity of the respiratory center; this was noted by Professors Zubkov, Smirnov and Shik.

The role of the cerebral cortex in the regulation of respiration was considered in the report of Professor M. Ye. Marshak, who used experimental materials obtained by various methods, in particular the bloodless method of determining the percentage of blood saturation with oxygen by use of the oximeter, constructed under the direction of Professor Ye. M. Kreps. The speaker showed that the cerebral cortex plays an essential role in the regulation of human respiration under various conditions. The cortical regulation of respiration in man assures the necessary level of lung ventilation, the tempo and rhythm of respiration, and also the constancy of CO_2 in the alveolar air and arterial blood.

In his report, Professor I. A. Arshavskiy analyzed the interrelationship of the respiratory and cardio-circulatory systems at different ages. He made an attempt to demarcate separate, consecutive age periods. Within the limits of each period, the speaker characterized the functions of the respiratory and cardio-circulatory systems as dependent on the interactions of the organism with those environmental conditions in which the organism functions and develops at a given age. The report of I. A. Arshavskiy evoked a number of critical comments from corresponding member of Academy of Sciences USSR, Kh. S. Koshtoyants, and corresponding member of the Academy of Medical Sciences USSR, A. I. Smirnov.

The meeting devoted to the problem of the nervous regulation of respiration ended with a report by V. F. Lashkov, who demonstrated three types of receptors characteristic for the bronchi and alveoli, and showed that the lungs receive afferent innervation from two sources: from sensory cells of the ganglia nodosum and vagi, and from sensory neurons of definite spinal ganglia. Nerve branches of the spinal ganglia, headed for the lungs, pass through the stellate ganglion. The morphological data obtained by V. F. Lashkov makes it possible to consider the transfer of afferent impulses, proceeing from the lungs, directly to afferent spinal centers governing the activity of the lung vessels, the smooth muscle of the bronchi, bronchial glands and other organs.

The third meeting of the session dealt with the nervous regulation of cardiac activity and the nervous system's role in the pathogenesis of coronary circulation disturbances.

In his report, "The Influence of the Wangering (vagus) Nerve on the Contraction Force of the Ventricles", corresponding member of the Academy of Medical Sciences USSR, A. I. Smirnov generalized the experimental materials of many years of research, stating, that with full inhibition of the auricles or a functional isolation of the auricles and ventricles, there is a well-defined strengthening action of the wandering nerve on the ventricles of the heart. In the speaker's opinion, there is currently no basis for differentiating the action of the wandering nerve on the ventricles of the heart from the action of the stimulating nerve of I. P. Pavlov, since under certain conditions the cardiac fibers of the wandering nerve have the same physiological composition as a trophic nerve, which was indicated by I. P. Pavlov with respect to the stimulating nerve

he discovered. Some obscurities in the presentation of the material and in the conclusions evoked, with the approval of the audience, a number of puzzled questions and comments (Professor A. A. Zubkov).

The report by Professor N. V. Danilov, "Materials on Regulation of the Cardio-Circulatory System", focussed particular attention on a new method of studying cardiac activity, based on the use of a pericardial fistula. The speaker also presented new data on methods of recording the arterial blood pressure in chronic experiments.

The report of lecturer V. A. Shidlovskiy, "Changes in the Bioelectric Activity of Various Sections of the Heart During Stimulation by the Vagus", represented only a fragment of the research devoted to analyzing the modus operandi of mediators in relation to the developmental degree of the peripheral nervous system.

Clinical data on the disturbance of nervous regulation of cardiac activity was presented in the reports of Professor M. S. Vovsi and Professor F. A. Andreyev. M. S. Vovsi presented a survey of the basic data on the pathogenesis of angina pectoris. Using clinical material he showed that the initial "release" mechanism during the start of an angina pectoris attack is a cortical and subcortical impulse.

The report of F. A. Andreyev, "The Significance of the Disruption of Higher Nervous Activity in the Pathogenesis of Disturbances in Coronary Circulation and Myocardial Infarcts", developed the idea that the nervous regulation of peripheral circulation involves not only the tone of vessels and trophic processes in the

vessel walls, but also the blood itself as it passes through the vessels. Therefore, the author, in studying myocardiac infarcts, focussed his attention on those determining conditions which lead to the formation of a thrombus. Somewhat surprising was the speaker's statement, with which many of the clinicians could not agree at all, that he did not accept the possibility of a spastic contraction of the coronary arteries.

The fourth and fifth meetings of the session dealt with various aspects of the nervous regulation of blood pressure and experimental hypertension.

The report given by L. A. Koreysh dealt with the interaction of the cortex, subcortical ganglia and hypothalamic regions in the functional regulation of the human vascular system. The stimulation of the cerebral cortex during operations, and study of the condition of the cardio-circulatory system in brain tumor cases showed that vessel tone regulation by the hemispheric cortex is brought about from the contralateral side. The nearest subcortical ganglion of the striatum-palladium system is also involved in vessel tone regulation on the contralateral side. Stimulation of the hypothalamic region, however, does not cause assymetrical blood pressures, but causes a general rise of the systolic pressure. Electrocardiographic study has shown the predominant influence of the right hemisphere on the left coronary artery, and of the left hemisphere on the right coronary artery. The report stimulated many questions and was highly rated both by clinicians and physiologists.

The report of A. T. Pshonik was devoted to an analysis of experimental data on cortical regulation of human and animal vascular

reactions. Using a large amount of experimental material, the speaker showed convincingly the primary role of the cerebral cortex in the adaptation of the organism to changing external environmental conditions. Chaning the equilibrium conditions for cortical processes during the experiments, the author obtained various forms of failure of vascular reaction, including such "vascular neuroses" which can serve as a model for the study of one of the forms of experimental hypertension. The report was highly praised by a regular member of the Academy of Medical Sciences, A. I. Nesterov, who noted the importance of having a broad group of researchers and doctors use this method of objectively studying vascular reactions in humans.

The report of A. P. Polosukhin, "The Extroceptive and Introceptive Regulation of Circulation, Respiration and Lymph Flow", was the only report at the session which not only analyzed circulation and respiration, but also lymph flow. The speaker showed that changes in venous pressure and changes in lymph flow are reflex in nature, since they can be observed independently of changes in arterial blood pressure. The reflex regulation of lymph flow does not depend on the venous pressure level or the respiratory act (the last contention of the author was proven by the comparison of experiments with artifical and natural breathing, in the presence of complete bilateral pneumothorax).

In his report, "The Diphasic Action of Adrenalin on the Baroreceptors of the Aortic Nerve", regular member of the Academy of Medical Sciences, P. K, Anokhin, analyzed the mechanism of the pressor-depressor relationship. At the beginning of the report, he pointed out that the basic factor which leads to an increase in the

tone of cardio-circulatory system is the cortico-thalamic relationship and the cortex, which relate the organism to the external world. The function of the depressor apparatus should be considered as a response to an increase in blood pressure which occured first. Since an increase in blood pressure leads in most cases to some augmentation of the adrenalin concentration in the blood, it is natural to ask whether there is or is not a change in the condition of the barorecptors of the aortic nerve when they are acted upon by very small concentrations of adrenalin. An oscillographic analysis of the impulses from the baroreceptors showed that the action of adrenalin is apparent first in the increase of the excitability of the barorecptors, and then, in a suppression of their activity. In discussing the report, V. N. Chernigovskiy and S. V. Andreyev expressed the opinion that the speaker had comparatively undervalued the importance of central origination in the process of creating hypertension and in the return of the blood pressure to its original level. In conclusion, P. K. Anokhin pointed out that he began his report with an explanation of the primary role of the cortico-thalamic relationship and that there could hardly be disagreement on this point between physiologists at the present time.

The report of lecturer V. L. Gubar' was devoted to analyzing the relationship of the vasomotor center to depressor impulses under conditions of an electrotonic increase in its excitability. Experiments showed that the reflex activity of the vasomotor center is changed remarkably upon artificial alteration of its excitability. Then the speaker concluded that the effect of the depressor influence depends on the original blood pressure level, which determines the excitability level of the vasomotor center.

The report of candidates in medical science, G. D. Smirnov and A. L. Byzov, pointed out that with an increase in intercranial pressure, regular rhythmical oscillations occur in the arterial blood pressure, with a frequency of 3-5 oscillations per minute. The amplitude of these oscillations reaches 40-100 millimeters of mercury. The author relates these waves to those of the Traube-Gering type and thinks that they are the result of periodically appearing anemia in the vasomotor center. One ought to point out that the report of L. A. Koreysh also mentioned data on the comparatively wave-like changes in man's blood pressure with an increase in intercranial pressure.

The problems of experimental hypertension were considered in the reports of regular members of the Academy of Medical Sciences, N. N. Gorev and A. N. Magnitskiy, and Professor A. M. Blinova.

N. N. Gorev reported on experiments with rabbits and dogs, in which reflexogenic and renal forms of experimental hypertension were produced. The wealth of material (86 rabbits that had hypertension 8-10 months and 4 dogs with hypertension more than a year were used in the experiments) allowed him to study peculiarities of neuro-humoral alterations in both forms of hypertension. In both types, he discovered increased activity in the cholinesterase of the blood and a strengthening of the positive inotropic action of blood serum on the isolated heart. Changes in the central nervous system were also noted, precisely, increased excitability of the subcortical and submedullary centers. The work of N. N. Gorev, quite highly evaluated, was received with interest by the clinicians.

The report of A. N. Magnitskiy was devoted to the study of

the dominant symptoms in regulating circulation. In the speaker's opinion, a stimulus with a specific intensity and frequency may cause the pressor center to become active. In man this dominant state may be caused by impulses originating in the cerebral cortex under the influence of different types of stimuli. These impulses, irradiated to the hypothalamic center, may cause there a stable focus of excitement of a dominant character, which in the speaker's opinion, may be one of the reasons for the origin of hypertensive disease.

A. M. Blinova, together with G. N. Aronova and K. Ye. Serebryanik, presented a report on the functional conditions of the vasomotor center and peripheral vessels in experimental hypertension, obtained by three methods: (1) stimulation of the posterior-lateral area of the hypothalamic region (centrogenous hypertension); (2) compression of the carotid arteries (reflex hypertension); (3) intravenous injection of promethine (humoral hypertension). With centrogenous hypertension it was noted that there were changes in the functional condition of the vasomotor center (intensification of reaction to pressor and decrease in reaction to depressor influences), after-effects, and also a sharp constriction of the renal vessels and decrease in the renal blood flow. This allowed the authors to suggest that a repeated stimulation of the hypothalamic region might be a factor contributing to blood pressure stabilization at an increased level.

The sixth meeting of the session dealt with the histological and anatomical examination of peculiarities in the innervation of the vascular system. The morphological reports presented at the session testified to the fact that morphologists are no longer simply descriptive, but are becoming functional and striving to develop the

ideas of I. P. Pavlov in cooperation with other disciplines.

The report of B. A. Dolgo-Saburov, corresponding member of the Academy of Medical Sciences, was devoted basically to an analysis of the receptors in the venous system. By using intramural apparatus to study various human veins, the speaker showed not only the regularity of receptor distribution in the venous system, but also their similarities and differences, which are conditioned by their functional characteristics. B. A. Dolgo-Saburov demonstrated the connection of the receptor apparatus in the venous channels with the central nervous system and worked out the genesis of the afferent innervation. Using morphological methods, he succeeded in demonstrating the variable reactivity of sensory nerve endings and their unique structural changes under different conditions in the life of the organism.

In her interesting report, devoted to the morphology of the peripheral innervation of blood vessels, Ye. K. Plechkova demonstrated on the basis of contemporary morphological examinations that not only certain reflexogenic zones, but all peripheral vessels, including capillaries, are supplied with a large quantity of sensory nerves, and consequently they should be considered as an extended reflexogenic zone. Denoting the inadequacies of the customary methods of histological examination, Ye. K. Plechkova reported the work of students B. I. Lavrent'yev and V. Portugalov, who used histochemical methods to show that special cells possess enzymatic activity and that receptors show enzymo-chemical alterations during various functional states.

Corresponding member of the Academy of Medical Sciences,

B. V. Ognev, working with V. A. Kryzhkov, studied the dynamics of changes in blood supply to the cortex in children suffering from edema of the brain. Besides morphological data, the report contained indications that with increasing edema of the brain, associated with changes in the cortex and its blood vessels, there is a gradual suppression of reflexes and the function of the child's organism.

Lecturer A. V. Votrin presented new data on the innervation of the division points of the common carotid artery and internal jugular vein. He not only gave a description of all the nervous elements which contribute to innervating the division points of the common cartotid artery and internal jugular vein, but also showed that the usual conception of the sino-carotid reflex zone does not concur with the morphological data, since the reflexogenic endings he discovered are dispersed over a much greater portion of the vessels than had been previously known.

Professor A. A. Smirnov presented comparative-anatomical data on innervating the carotid and aortic reflexogenic zones. In the author's opinion, the carotid glomus is phylogenetically formed earlier than the aortic one. Both glomii receive nerve branchings from two sources: the carotid -- from the glosso-pharyngeal nerve and sympathetic trunks; the aortic -- from the vagus nerve and individual branches from the sympathetic nerve. The report of A. A. Smirnov provoked some objections, since the anatomists did not find his data on the absence of sympathetic innervation of the vessel labyrinth in amphibia and reptiles, and also the data on the blood supply of the arterial glomus itself, fully convincing.

At the seventh (final) meeting of the session, on the evening of June 16, two final physiological reports concerned directly with questions of clinical practice were heard, and the work of the session was summarized.

In the report of P. P. Goncharov, on the role of visceral reflexes in regulating circulation, the important practical problem of tamponing the heart was analyzed. The speaker, in due course suggested and developed the method of chronic pericardial fistulas, and showed that the receptor formations of the pericardium may give rise to powerful reflexes which influence not only the heart, but also the whole cardio-circulatory system and respiration, which, of course, must be taken into consideration in tamponing the heart. He also presented interesting data on changes in the cardio-circulatory system and respiration during swelling of the intestine.

The report of Professor I. P. Petrov dealt with the reflex regulation peculiarities of circulation in shock, blood-loss and asphyxia. Pointing out that the reflex regulation of circulation under pathological conditions has been studied very little, the speaker presented a number of new and interesting experimental results. He was able to show that with an acute excitation of the vasomotor center associated with anemia there is a loss of the sino-carotid reflex. He also noted that in traumatic shock there arise phasic changes in the pressor and depressor sino-cardial reflexes up to the distortion point. Severe blood loss, according to the speaker's data, leads to the cessation and distortion of the sino-cardial depressor reflex. In this case the pressor sino-cardial reflex may either remain or also disappear.

After the discussions at the final session, a talk was given by the Secretary of the Ryazan Oblast' Committee VKP (b), S. N. Larionov, who characterized the prospects for cultural development in the city of Ryazan. He supported the suggestion of the Director of the Ryazan Medical Institute imeni Pavlov for an appeal to the Academy of Medical Sciences to have the scientific session held in Ryazan each year at precisely the same time, since this corresponds with the date of the government's decision to found a Medical Institute in Ryazan imeni Academician I. P. Pavlov.

The closing remarks of the session were made by Academician-Secretary of the Medico-Biological Division AMN USSR, regular member of the AMN, S. Ye. Severin.

Summarizing the results of the session, S. Ye. Severin noted that in spite of the strenuous and exhaustive work of the session, there were still many extremely important questions which were not given nearly enough attention. Comparatively little work was presented on the physiology, pathology, morphology and clinology of the nervous regulation of respiration. Entirely insufficient work was presented at the session on the pharmacology of the nervous regulation of circulation and on experimental therapy. Studies on the interrelationships of cortical and subcortical formations in the regulation of circulation and respiration, both under normal and pathological conditions, were not developed sufficiently and not presented adequately at the session.

S. Ye. Severin also noted that while the work presented at the session indicated marked advances in the study of nervous regulation of circulation and respiration since the joint session of the Academy

of Sciences USSR and the Academy of Medical Sciences USSR, only the first steps have been taken in this direction, requiring marked subsequent development. Success will be guaranteed by both the extraordinary conditions provided in our country for scientific work and the understanding of each scientific worker on the medical front that it is his responsibility and honorable duty to conduct research devoted to the creative development of the enormous scientific inheritance given us by the great physiologist of our Motherland, Ivan Petrovich Pavlov.

V. Shidlovskiy