CHARACTER OF RESPONSES OF THE PULMONARY CIRCULATION TO SEROTONIN

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UDC 615.362.018:547.756].015.45:612.215.8

Experiments on cats showed that besides the pressor effect, in 24% of cases serotonin lowered the right ventricular pressure, while in some animals it evoked a combined depressor-pressor reaction. These different types of reaction, previously little known, reflect the complex mechanism of their origin, probably linked chiefly with the reaction of the pulmonary vessels.

The principles governing the effect of serotonin on the circulation in the lungs have been investigated previously [2-6, 8, 9, 12]. Results have been obtained which cast doubt on the role of serotonin in the genesis of pulmonary hypertension [10]. It is not certain that serotonin evokes only pressor responses in the pulmonary circulation, for observations of this nature have been made usually on only a few animals. On the other hand, serotonin frequently evokes dilatation of the peripheral vessels in cats and dogs [7, 11].

The object of this investigation was to study whether pressor responses of the pulmonary circulation to serotonin are regular or frequent.

EXPERIMENTAL METHOD

The character of the change in the pulmonary hemodynamics following intravenous injection of serotonin has been studied by recording the pressure in the right ventricle of cats by the method described by the writer previously [1]. An advantage of this method is that the determination can be made without thoracotomy. Insertion of a polyethylene catheter into the pulmonary artery of cats through the jugular vein, the superior vena cava, and the right chambers of the heart, in the writer's experience, always terminates in perforation of the ventricle wall and death of the animals. The pressure in the right ventricle is known to reflect closely the state of the pulmonary hemodynamics and, at the same time, to give information on the contractile power of the muscle of the right ventricle.

The pressure in the carotid artery and the tone of the bronchial musculature were recorded synchronously.

EXPERIMENTAL RESULTS

The mean pressure in the right ventricle of the cats' hearts was 11.6 ± 0.47 mm Hg. The following types of responses of the right-ventricular pressure to serotonin were discovered in experiments on 91 cats: pressor in 62%, combined (depressor-pressor) in 14%, and depressor in 24% of cases. In every case serotonin caused spasm of the bronchi. The severity of the pressor responses varied in the different animals and, as a rule, it was determined by the original pressure: if the original pressure was low the increase was greater, and vice versa. The mean pressure in the right ventricle in the case of pressor responses to serotonin rarely exceeded 40 mm Hg. Serotonin, injected intravenously in doses of 5-20 μg/kg, increased the pressure in the right ventricle by 64 ± 14.6% ($P < 0.001$), whereas in doses of 25-80

Laboratory of Pharmacology of the Cardiovascular System, Institute of Pharmacology, Academy of Medical Sciences of the USSR, Moscow. (Presented by Academician of the Academy of Medical Sciences of the USSR V. V. Zakusov.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 76, No. 7, pp. 66-68, July, 1973. Original article submitted September 4, 1972.

μg/kg it increased the right-ventricular pressure by 70 ± 9.4% ($P < 0.001$). In combined responses as a rule an initial depressor phase was followed by a pressor phase; the second phase was frequently longer and more marked. The depth of the depressor responses usually depended on the level of the original pressure: if this was high it was reduced to a greater degree by serotonin (sometimes to zero).

With an increase in the dose of serotonin the intensity of the responses of the right-ventricular pressure increased, but no linear relationship could be detected between the intensity of these responses and the dose of serotonin.

These results must be interpreted with great caution. However, despite the widely held view in the literature that serotonin raises the pressure in the pulmonary vessels, the possibility of depressor responses must also be accepted.

There are grounds for ascribing an important role to the pulmonary circulation in the genesis of the depressor responses to serotonin in the pulmonary vessels. For instance, according to these observations in 65% of cases when the right-ventricular pressure was raised the systemic arterial pressure was simultaneously lowered. Depressor responses in the right ventricle were accompanied in 82.4% of cases by lowering of the pressure in the carotid artery. Consequently, the systemic circulation in both forms of response of the right-ventricular pressure responds in most cases uniformly, by the development of hypotension. The role of fluctuations in the systemic arterial pressure in the genesis of the depressor right-ventricular responses for this reason is evidently unimportant. Changes in the heart rate following injection of serotonin are likewise of minimal significance. The writer's observations showed that bradycardia occurs equally often in association with both pressor and depressor responses in the pulmonary circulation.

After further observations it will be possible to analyze the mechanisms lying at the basis of the pressor, depressor, and combined responses of the pulmonary circulation to injection of serotonin.

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