

I. Experimental problems

AGE MORPHOMETRIC CHARACTERISTIQUE OF MICROPINOCYTOTIC VESICULATION IN VASCULAR ENDOTHELIAL CELLS (VEC)

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Micropinocytotic vesicles (MPV) are an obligatory component of vascular endothelial cells (VEC). It is accepted that they play a basic role in the trans-cellular transport of water-soluble and other macromolecular substances (5, 8, 13). That is why the degree of their manifestation gives an information about VEC permeability. This directed our efforts to study morphometrically the age-related variations of MPV in VEC of large blood vessels.

Material and methods

MPV in three basic localizations (luminal, basal, and intracellular) were counted on ultrathin sections of aorta, pulmonary trunk and both caval veins (62 VEC from every vessel each) of rats (newborn, 10-, 20-, 30-, 60-day old and mature). Sections passing through all VEC zones and possessing a maximal number of $2\mu\text{m}$ and on $1\mu\text{m}^2$ section area from the interior of cells. Data obtained were processed by means of variation analysis and mean values were characterized by their parameters. Reliability was controlled by Student's T-criterion.

Results and discussion

Biostatistical studies demonstrated that distribution of MPV number in the three basic localizations possessed a normal Gaussian curve with minimal dispersion. In comparison with that in fetal VEC, MPV quantity immediately after birth (newborn rats up to 12 hours) is evidently increased. On table 1 concrete data about mean values according to vessels, localizations, and age groups are presented.

The analysis of quantitative data enables the following-up to the general dependence between the factor «age» and MPV count of the vessels studied. On the basis of that when comparing mean values according to localization we establish that MPV number increase is, in general, a regular process; there is a tendency of MPV number increase with age. However, this tendency shows a certain unstability during the first month after birth. It is manifested by a definite, statistically significant irregularity of vesicle count increase with the aorta. Concerning the other vessels, during this period increase and decrease succeed

Table 1
Average number of MPV with luminal (L), basal (B) and intracellular (I) localization in endothelial cells of the large blood vessels in rat

Blood vessel	Newborn	10-day old	20-day old	30-day old	60-day old	mature
Aorta						
L	9.89±0.23	15.40±0.25	17.66±0.34	20.96±0.21	32.77±0.34	40.51±0.43
B	10.04±0.26	12.19±0.27	14.80±0.34	20.08±0.44	24.19±0.38	33.03±0.29
I	15.70±0.35	18.97±0.36	22.45±0.41	25.49±0.32	36.03±0.39	43.97±0.48
Pulmonary trunk						
L	10.34±0.24	18.65±0.29	19.73±0.28	17.86±0.26	26.69±0.34	34.52±0.45
B	11.79±0.20	15.71±0.39	17.82±0.28	17.93±0.26	25.78±0.31	27.09±0.28
I	13.05±0.31	15.50±0.28	19.67±0.33	18.22±0.48	24.45±0.31	29.95±0.53
Anterior caval vein						
L	11.99±0.27	14.75±0.29	14.41±0.34	15.92±0.42	28.95±0.39	31.40±0.34
B	7.82±0.30	11.96±0.15	14.50±0.35	14.71±0.24	24.20±0.31	28.99±0.40
I	11.18±0.30	10.41±0.22	11.50±0.25	11.67±0.34	19.05±0.29	27.49±0.25
Posterior caval vein						
L	12.02±0.23	14.80±0.26	16.64±0.32	17.91±0.22	28.57±0.38	29.39±0.33
B	10.66±0.22	19.80±0.25	15.07±0.35	15.55±0.30	23.17±0.38	16.15±0.39
I	11.64±0.29	11.01±0.23	13.25±0.31	11.83±0.28	18.43±0.27	27.85±0.37

each other indicating a different not particularly great pointedness. Differences with caval veins (between newborn and 30-day old rats) and with pulmonary trunk (between 20-day and 30-day old rats) are statistically insignificant. After these phenomena, concerning all the localizations of the vessels studied a calm, regular and almost vector increase sets in. However, MPV number in aortic VEC where this tendency is the steadiest one at the end of the first month after birth and later on is greater than that in other vessels when all the cases and localizations are concerned (differences are significant). It is found out that besides MPV number increasing continues practically till maturation having in mind the concrete temporal disturbances up to the 30th postnatal day. About 60 days after birth, MPV reach a definite quantitative optimum for all vessels after which the increase is slow and quantitative differences between veins are statistically insignificant. Therefore, it seems that during this period vesiculation reaches the degree of morphological maturity as a completely differentiated transport system corresponding to functional requirements of the vascular wall and to local hemodynamic conditions.

The morphometric data concerning MPV in VEC presented here during postnatal ontogenesis aren't known in the literature; there are single reports by now about certain arteries (5,9) and capillaries (1, 7, 10, 12) in mature animals. Our data enable the detection of regularities of MPV morphokinesis as well as of tendencies of MPV development and reactivity. The curve of this trend reflecting quantitative aberrations, i. e. age and functional MPV lability, gives an idea of their development and outlines a number of peculiarities of the qualitative and quantitative characteristic of endothelial permeability thus enabling the establishing of a relation with the general functional particularities of developing organism, too. The tendency has the character of a general activation of micropinocytotic vesiculation with age and with increasing functional loading of blood vessels, respectively. This dependence has been reflected also in MPV number increase reported by us elsewhere (11) with spontaneously hypertensive rats as well as after biogenic amine (serotonin, histamine) treatment.

It has to be noted that MPV number increase with age is in opposite correlation with the development of VEC organelle apparatus. Thus individual VEC development is a results from discrepancy of two successive differentiations: a productive-secretory and a permeability one. That is why VEC permeability differentiation requires a synthetic-metabolic dedifferentiation.

Morphometric data about MPV in VEC during ontogenesis characterize the micropinocytotic vesicular system as a dynamic population determined both quantitatively and qualitatively by concrete endothelium requirements. The aforementioned (11) data about MPV reactivity argue also in favour of that. This dynamic and functional MPV lability makes us consider very distantly the recently disseminating concept (2, 3, 4, 6, 7) that MPV are static formations combined constantly with cytolemma and with each other.

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ВОЗРАСТНАЯ МОРФОМЕТРИЧЕСКАЯ ХАРАКТЕРИСТИКА МИКРОЦИТОЗОЙНОЙ ВЕЗИКУЛЯЦИИ В ВАСКУЛЯРНЫХ ЭНДОТЕЛИАЛЬНЫХ КЛЕТКАХ

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РЕЗЮМЕ

Проведено морфометрическое исследование микроцитозойных везикул васкулярных эндотелиальных клеток аорты, легочного ствола и полых вен крыс разного постнатального возраста. Исследование проводилось на ультратонких срезах. Полученные данные обработаны вариационно-статистическим методом. Установлено, что до шестидесятого дня после рождения число микроцитозойных везикул увеличивается. Тенденция к их увеличению показывает некоторую нестабильность в течение первого постнатального месяца, что наблюдается прежде всего при исследованиях легочного ствола и полых вен. Нарастание количества микроцитозойных везикул рассматривается как выражение перматюрического дифференцирования васкулярных эндотелиальных клеток. Полученные данные характеризуют везикулярную систему эндотелиальных клеток как динамическую популяцию, количественные и качественные характеристики которой функционально детерминированы

loading of blood vessels. The dependence of the number of microcytoid vesicles on the postnatal age of the animals was studied by means of ultra-thin sections. The obtained data were processed by the variational-statistical method. It was established that up to the 60th day after birth the number of microcytoid vesicles increases. A tendency towards their increase shows a certain instability during the first postnatal month, which is observed above all in the studies of the pulmonary trunk and the venae cavae. The increase in the number of microcytoid vesicles is considered as an expression of maturation differentiation of vascular endothelial cells. The obtained data characterize the vesicular system of endothelial cells as a dynamic population, the quantitative and qualitative characteristics of which are functionally determined

РЕЦЕНЗИИ

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