

Nazaryan¹ R., Garmash¹ O., Gargin¹ V., Garmash² Ye.

INFLUENCE OF LOW BODY WEIGHT IN NEWBORNS ON MICROCIRCULATORY BED OF PERIODONTIUM

¹Kharkiv National Medical University, Ukraine,

²V.N. Karazin Kharkiv National University, Ukraine.

Abstract. *We investigated periodontium of newborn rats with experimental model of IUGR. Light microscopy showed that microcirculatory response was characterized by a pronounced decrease in vascular density ($20,9 \pm 18,2$ %); presence both contractility and dilatation of the capillary bed. Endotheliocytes of microcirculatory bed are flattened; there are signs of their desquamation. The increasing intravascular blood clotting in the postcapillary and venular portions of the microcirculatory system, along with a partial reduction of the capillary link have been observed. Perivascular space is characterized by initial sclerotic process.*

Key words: *microcirculatory bed, intrauterine growth retardation (IUGR), periodontium.*

The recent growth of somatic diseases in children can often be attributed to a violation of prenatal development or early neonatal life. The adverse consequences of intrauterine growth retardation (IUGR) is characterized by problems in postnatal adaptation, pathological development of the nervous, cardiovascular and other functional systems [1, 2, 3, 4, 5]. The frequency of IUGR varies in different countries from 12 to 39% among mature newborns [6]. Regarding this, an (IUGR) pathogenesis studies will help to develop prevention and correction of abnormal conditions of periodontal tissues on preclinical phase of pathological process.

And early correction of abnormalities and optimal rehabilitation is important not only from a medical point of view, but also for social applications. Distant consequences of IUGR are also frequently characterized by delays in oral

development, in oral pathology as overcrowding, retardation of teeth eruption, dental caries, etc [7, 8, 9, 10].

Currently there is no doubt about the fact that practically all diseases of neonatal period are accompanied by violations of the vascular system. This is due to the fact that the vascular system is an indicator of any pathological process, determining babies regulatory and adaptive mechanisms, characteristics of the connective-tissue matrix [11].

At the same time, it is known that the dystrophic and inflammatory periodontal diseases are caused by the vascular system violations, particularly at the microvasculature bed level [12, 13]. The aim of our investigation is to evaluate experimental data of morphology and function of the tissues and periodontal microvasculature bed at low birth weight.

Materials and methods. The study was conducted on rat line whose mothers had a spontaneous hypertension, which is known to be one of the most frequent causes of placental insufficiency, and, as a consequence, IUGR.

We investigated 62 full-term animals. The control group included middleweight rats, the study group included rats which body weight at birth was below the median weight (6.84×10^{-3} kg) of body of all posterity by more than 20%. The control group included 29 animals. The study group included 33 animals. Group of middleweighted animals (control group) included 16 male rats (48,48 %), 17 female rats (51,52 %). There were 17 male rats (58,62 %), 12 female rats (41,38 %) in the study group.

Immediately after birth, rats were subjected to a primary zoometric measurements: animal weighing, general and tail length measuring have been conducted. Second zoometric study of experimental animals was performed directly before the sacrifice of the experiment. It was performed in accordance with international standards of bioethics at 1, 14 and 40 days of the animal age. Zoometric results are presented in Table. 1. This table also presents data on the number of observations in each of the subgroups.

After sacrificing, periodontal tissues of the rats were fixed in 10% formalin and

after routine proceeding produced sections that were stained with hematoxylin and eosin, by Rego, by Van Gizon. Images of stained sections of parodontal tissues were acquired by "Olympus BX-41" microscope. Morphometric study was performed by "Olympus DP-soft version 3.2" program.

Results and discussion. After examination of hematoxylin and eosin stained sections subgroup rats sacrificed at day 1 after birth, we found noticeable changes in the morphofunctional state of the microvasculature bed of parodontium in the study group compared with the control. Vascular bed of uneven blood flow, together with the empty collapsed vessels there are extremely expanded vessels filled with blood.

In addition to localized microthrombi postcapillaries and venules, small clots are present in the lumen of the vessels.

Endotheliocytes of microcirculatory bed are flattened, there are signs of their desquamation. Processes of formation of new vessels are not expressed (present).

Also, initial sclerotic processes are present in the perivascular space. Morphometric studies showed the pronounced decrease in vascular density ($20,9 \pm 18,2$ %) compared to the control group.

After examination of micropreparations stained by Rego in proper mucous plate of periodontium, areas of ischemia in each of the studied cases of low-weight rats were identified in deeper layers. In the control group, these areas of tissue were solitary. When comparing slides stained by Rego and with hematoxylin and eosin, ischemia zones are characterized by necrobiotic processes, from initial dystrophic to formation of degenerative foci of necrosis.

Our study of animal subgroups that were sacrificed at day 14 after birth, revealed quite similar pattern in the structure of microcirculatory bed in periodontal tissues. However, the study group was more homogeneous. Also, in this group, the empty dilated vessels were found along with spasmed and filled with blood vessels. In the perivascular space of these vessels, petechial (focal) hemorrhages were observed. In many cases the processes of new vessels formation in the study group were intensive focally.

Table 1.

The results of zoometric studies test animals and the number of observations in the subgroups

The study group and the subgroups	body weight (in kg $\times 10^{-3}$)	body length (m $\times 10^{-3}$)	tail length (m $\times 10^{-3}$)	number of observations
Primary zoometric study				
	5,29 \pm 0,18*	52,06 \pm 1,48*	15,82 \pm 0,56	33
	6,93 \pm 0,17	54,17 \pm 0,88	18,10 \pm 0,68	29
Secondary zoometric study				
1	5,78 \pm 0,67*	56,33 \pm 2,02*	17,05 \pm 1,52	12
1	7,60 \pm 0,24	57,58 \pm 1,23	20,33 \pm 1,06	12
14	18,13 \pm 1,90	71,77 \pm 4,69*	38,85 \pm 5,03*	13
14	22,72 \pm 1,43	88,22 \pm 8,70	52,11 \pm 4,57	9
40	42,63 \pm 3,87	108,63 \pm 7,19	74,65 \pm 5,74*	8
40	57,18 \pm 8,28	103,25 \pm 20,58	80,00 \pm 25,81	8

Where: – low-weight rats;

– middle-weight rats

A₁ – low-weight rats sacrificed at the first day after birth;

B₁ – middle-weight rats sacrificed at the first days after birth;

A₁₄ – low-weight rats sacrificed at 14 day after birth;

B₁₄ – middle-weight rats sacrificed at 14 day after birth;

A₄₀ – low-weight rats sacrificed at 35 days after birth;

B₄₀ – middle-weight rats sacrificed at the 35th day after birth;

* - The difference between a group of low-weight rats and middle-weight rats is significant (at 5% confidence level).

There were no significant difference in structure of microvasculature bed between control and study group of rats sacrificed on the 40th day after the birth. At the same time, in the perivascular space more pronounced sclerotic processes are

observed. Morphometric study showed that larger relative amount of connective tissue component in the study group compared to the control.

Our results are in a good agreement with the known facts that development of placental insufficiency is one of the most important factors leading to the formation of the syndrome of intrauterine fetal development. Immune, nutritional, endocrine and metabolic disorders along with the activation of free radical oxidation, accompanying placental insufficiency have damaging effects on the fetus. This effect depends on the duration and length of gestation. At the same time, the effects of IUGR as microvascular periodontal disorders, which underliy the development of pathological processes in the mouth further ontogeny has not been previously described.

Conclusions. Thus, low birth weight is characterized by damage to the microvasculature bed with the ischemia foci formation and initiation of the sclerosis process, which subsequently ontogeny can lead to pathological changes in the oral cavity.

References.

1. Barker D. J. The developmental origins of chronic adult disease / D. J. Barker // *Acta Paediatr. Suppl.* – 2004. – Vol. 93, N 446. – P. 26–33.
2. Barker D. J. The malnourished baby and infant / D. J: Barker // *Br. Med.* – 2001. – Vol. 60. – P. 69–88.
3. Chatelain P. Children born with intra-uterine growth retardation (iugr) or small for gestational age (sga): long term growth and metabolic consequences / P. Chatelain // *Endocrine regulations.* – 2000. – Vol. 33. – P. 33–36.
4. Effects of size at birth and childhood growth on the insulin resistance syndrome in elderly individuals / J. G. Eriksson, T. Forsen, J. Tuomilehto [et al.] // *Diabetologia.* – 2002. – Vol. 45, N 3. – P. 342–348.
5. Endocrine profile of children with intrauterine growth retardation / A. Fattal-Valevski, H. Toledano-Alhadeef, A. Golander [et al. // *J. Pediatr. Endocrinol. Metab.* – 2005. – Vol. 18, N 7. – P. 671–676.

6. Neerhof M. G. Causes of intrauterine growth restriction / M. G. Neerhof // Clin. Perinatol. – 1995. – Vol. 22, N 2. – P. 375–385.
7. Are intrauterine growth restriction and preterm birth associated with dental caries? / M.C. Saraiva, H. Bettiol, M. A. Barbieri, A. A. Silva // Community Dent. Oral. Epidemiol. – 2007. – Vol. 35, N 5. – P. 364–376.
8. Peedikayil F. C. Delayed tooth eruption / F. C. Peedikayil // E-Journal of Dentistry. – 2011. – Vol. 1, N 4. – P. 81–86. – Mode of access : <http://www.ejournalofdentistry.com/ebook/Issue4/index.html> (07.09.2012). – Title from the screen.
9. Seow W. K. A study of the development of the permanent dentition in very low birthweight children / W. K. Seow // Pediatr. Dent. – 1996. – Vol. 18, N 5. – P. 379–384.
10. Seow W. K. Effects of preterm birth on oral growth and development / W. K. Seow // Australian Dental Journal. – 1997. – Vol. 42, N 2. – P. 85–91.
11. Tideman E. Cognitive function in young adults following intrauterine growth restriction with abnormal fetal aortic blood flow / E. Tideman, K. Marsal, D. Ley // Ultrasound Obstet. Gynecol. – 2007. – Vol. 29, N 6. – P. 614–618.
12. Tsimbalistov A.V., Statovskaja E.E., Sosnina Yu.S. Peculiarities of the microcirculation in periodontal tissues in patients with vegetovascular dystonia. Institut stomatologii: nauchno-prakticheskij zhurnal, pechatnij organ institute stomatologii posle diplomnogo obrazovanija (SPbINSTOM) 2010; 4 : 68—69.

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13. Periodontitis and the risk of cardiovascular diseases – review of epidemiological studies / A. Klosinska, M. Nowacka, G. Kopec et al. // Kardiol. Pol. – 2010. – 8. – . 973 – 976.

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