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Реферати

УЛЬТРАСТРУКТУРНЫЕ ИЗМЕНЕНИЯ СОКРАТИТЕЛЬНОЙ АППАРАТА МИОКАРДА ЖЕЛУДОЧКОВ КРЫС НА ЭТАПАХ ПРЕНАТАЛЬНОЙ ОНТОГЕНЕЗЕ В НОРМЕ И ПОСЛЕ ДЕЙСТВИЯ АЛКОГОЛЯ

Твердохлеб И.В., Марченко Д.Г.

Сведения о формировании сократительного аппарата сердца и распределении миофибрилл в кардиомиоцитах в условиях внутриутробной интоксикации этанолом остаются предметом значительных споров. Целью исследования было определение изменений ультраструктуры сократительного аппарата кардиомиоцитов желудочков сердца крыс при пренатальном развитии в условиях внутриутробной алкогольной интоксикации. Определено, что хроническая алкогольная интоксикация в пренатальном кардиогенезе повреждает сократительный аппарат кардиомиоцитов желудочков за счет дезорганизации структуры саркомеров, фрагментации и дезориентации миофибрилл, значительного угнетения саркомерогенеза, снижения содержания миофибрилл, что ассоциировано с деструкцией митохондрий. Выраженность изменений в данных структурах зависит от зоны и срока развития эмбриона. Наиболее существенные изменения обусловлены прямым токсическим действием этанола и происходят на ранних сроках кардиогенеза.

Ключевые слова: пренатальный онтогенез, алкогольная интоксикация, миокард желудочков, миофибриллы, ультраструктура.

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ULTRASTRUCTURAL CHANGES OF THE RAT CONTRACTILE MYOCARDIAL APPARATUS DURING PRENATAL ONTOGENESIS IN NORM AND AFTER ALCOHOL INFLUENCE

Tverdokhlib I.V., Marchenko D.G.

Information on the formation of the contractile apparatus of the heart and the distribution of myofibrils in cardiomyocytes under conditions of intrauterine intoxication with ethanol remain a subject of considerable debate. The aim of the study was to determine changes in the ultrastructure of the contractile apparatus of rat ventricular cardiomyocytes during prenatal development in conditions of intrauterine alcohol intoxication. It was determined that chronic alcohol intoxication in prenatal cardiogenesis damages the contractile apparatus of ventricular cardiomyocytes due to disorganization of the structure of sarcomeres, fragmentation and disorientation of myofibrils, significant inhibition of sarcomere genesis, and a decrease in the content of myofibrils, which is associated with destruction of mitochondria. The severity of changes in these structures depends on the zone and period of development of the embryo. The most significant changes are due to the direct toxic effect of ethanol and occur in the early stages of cardiogenesis.

Key words: prenatal ontogenesis, alcohol intoxication, ventricular myocardium, myofibrils, ultrastructure.

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STRUCTURAL ORGANIZATION OF TRACHEA AND PRIMARY BRONCHUS OF THE 7-10 MONTHS' FETUS

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The histological examination was conducted on 24 series of the thoracic part histological sections of trachea and the primary bronchus in the human fetus of 231.0-375.0 mm of parietal-coccyxal length. Microscopic study of the trachea and bronchus in the fetus of 231.0-375.0 mm TKD showed that their wall consists of mucosa, submucosa, fibrous-cartilage layer and adventitia, which in different age periods have their structural features. Histological examination of the trachea and primary bronchus in the early period of the ontogenesis of the human fetus revealed a fragmentary nature of the cartilage skeleton structure of the trachea and primary bronchus at the completion of the formation of other layers. It was established that at the end of the fetal period of ontogenesis (311.0-375.0 mm PCL), an intensive development of the components of the trachea wall and primary bronchus, which anatomically causes increased growth and formation in this period of prenatal ontogenesis, is observed.

Key words: trachea, primary bronchus, microscopic structure, fetus, human.

The work is a fragment of the research project «Peculiarities of the morphogenesis and topography of systems and organs in the pre and postnatal periods of human ontogenesis», state registration No. 0115U002769.

Structural organization of trachea and bronchi in the elderly is written in a number of fundamental works and monographs [1]. The peculiarities of age-related anatomy of these structures in newborns and children are also covered in scientific publications [4]. At the same time, the development of modern methods of vital visualization of the internal organs [3] of the fetus requires more detailed information about the structure at the stages of prenatal ontogenesis [6], and especially in the fetal period, when the processes of organogenesis are completed, since the development in neonatology of modern care

technologies for premature babies, the development of fetal surgery, in which intervention on the trachea and primary bronchi make up a significant proportion today, require the consideration of the fetus as an object of surgical intervention [2, 5].

Imagination about the histological structure in the dynamics provides the key for understanding not only the features of physiology of organs of the child's body in different age periods (especially during the newborns), but also many processes of pathology.

Therefore, examination on the structural rearrangement of the wall of the trachea and the primary bronchi in the human fetus of different age groups, the study of the histogenesis of their walls in the prenatal period of human ontogenesis needs further study.

The purpose of the work was to establish the peculiarities of the formation of the structural organization of the trachea and primary bronchus in human fetuses 7-10 months.

Materials and methods. The histological examination was conducted on 24 series of the thoracic part histological sections of trachea and the primary bronchus in the human fetus of 231.0-375.0 mm of parietal-coccyxal length.

The study was carried out in accordance with the requirements of the "Instruction on conducting forensic medical examination" (Order of the Ministry of Health of Ukraine No. 6, dated January 17, 1995), in compliance with the basic bioethical provisions of the Council of Europe Convention on Human Rights and Biomedicine (dated 04.04.1997), the Helsinki Declaration World Medical Association on Ethical Principles of Scientific Medical Research with Human Participation (1964-2013) and the Order of the Ministry of Health of Ukraine No. 690 dated September 23, 2009. By the Commission on Biomedical Ethics of the "Bukovinian State Medical University" moral and legal violations in the medical research were not revealed.

Results of the study and their discussion. It is known, that the primary laryngeal-tracheal growth appears during the fourth week of development. Since the onset of growth at the distal end, thickening (bronchial buds), which, as the trachea extends, are caudally formed until they reach their definitive position in the chest. These extensions are the bronchial patches and the entire branching of the bronchial lung tree.

Microscopic study of the structure of the trachea in the fetus of 231.0-245.0 mm PCL showed that the trachea wall is represented by the mucosa, submucosa, fibrous-cartilage layer and adventitia (fig. 1).

The mucosa of the trachea is lined with single-layered pseudostratified and ciliated epithelium (respiratory epithelium). The tracheal epithelium is supported by a thick basement membrane. Beneath the basement membrane, the lamina propria consists of loose connective tissue, which becomes more condensed at its deeper aspect to form a band of fibro-elastic tissue. The lamina propria of the mucosa contains a large number of elastic fibers, single lymphatic follicles, and some circular localized bundles of smooth muscle cells.

Underlying the lamina propria is the loose submucosa containing numerous mixed sero-mucous glands which decrease in number in the lower parts. Excretory ducts of these glands form the flask expansions through their pathway. The last ones are opened on the mucosa surface. It should be emphasized that these glands are primarily identified in the posterior and lateral part of the trachea wall. The adventitia of the trachea is formed by a loose connective tissue, which contains blood vessels and nerves.

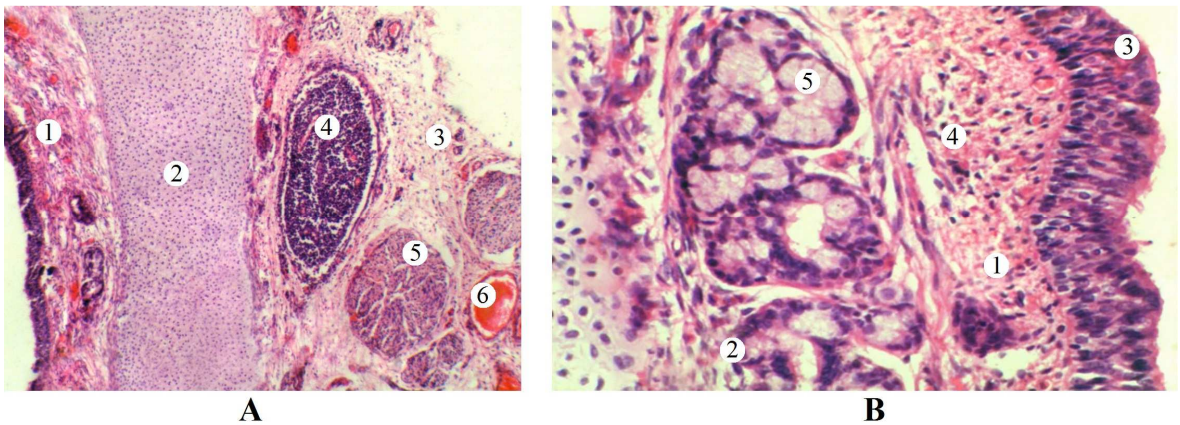

Fig. 1. Structural organization of the trachea wall (A) and its mucosa with submucosa (B) of the fetus 245,0 mm PCL. Specimen. Stained with Haematoxylin and eosin x 80 (A), x 400 (B): A: 1 – mucosa with submucosa; 2 – fibrous-cartilage layer; 3 – adventitia; 4 – follcle; – nerve; 6 – blood vessel. B: 1 – mucosa; 2 – submucosa; 3 – respiratory epithelium; 4 – lamina propria; 5 – secretory portions of the sero-mucous gland.

In the human fetus, 271.0-310.0 mm PCL, the structural components of the trachea's wall have an identical structure with that in the previous age period. Under the basement membrane of the mucosa epithelial plate is present a well-visible lamina propria, which is represented by a loose connective tissue.

The last one contains longitudinally oriented elastic fibers, lymphatic follicles and some circularly located bundles of smooth myocytes. In the submucosa there are mixed sero-mucous glands, the excretory ducts of which open on the surface of the mucosa. The submucosa passes into a dense fibrous connective tissue of the perichondrium of unclosed cartilage rings.

The blood vessels of the trachea form in its mucosa several parallel placed networks, and under the epithelium - a dense capillary meshwork. Lymphatic vessels also form plexuses (fig. 2).

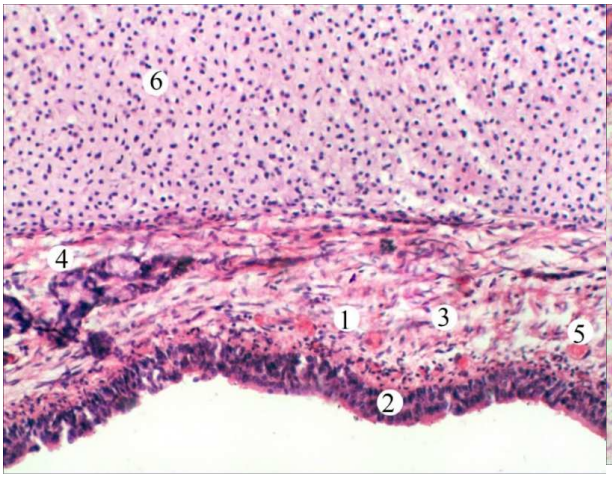

Fig. 2. Fragment of the trachea wall of the fetus 300,0 mm PCL in the region of its bifurcation. Specimen. Stained with Haematoxylin and eosin x 200: 1 – mucosa with submucosa; 2 – mucosa epithelial plate; 3 – lamina propria of the mucosa; 4 – secretory portions of the sero-mucous gland; 5 – blood capillary; 6 – fibrous-cartilage layer.

Fig. 3. Fragment of the wall of the right primary bronchus of the fetus 300,0 mm PCL. Specimen. Stained with Haematoxylin and eosin x 200: 1 – fibrous-cartilage layer; 2 – adventitia; 3 – nerve; 4 – artery.

The mucosa of the primary bronchus, like the trachea, is lined with a ciliated epithelium, thickness of which is gradually reduced by changing the shape of cells from high prismatic to low cubic. Among the epithelial cells, besides the ciliated, are the goblet, endocrine and basal cells. The mucosa lamina propria of the bronchus contains longitudinally oriented elastic fibers. In the submucosa connective tissue the final parts of the mixed sero-mucous glands are localized. The fibrous-cartilage layer is represented by non-closed cartilaginous rings. The outer adventitia is formed by a loose connective tissue (fig. 3).

At the end of the fetal period of ontogenesis (311.0-375.0 mm PCL), an intensive development of the components of the trachea wall and the primary bronchus is observed. The mucosa of the trachea is formed by a single-layered, respiratory epithelium in which the ciliary, endocrine and basal cells are located, as well as a large number of goblet cells (Fig. 4). With the help of submucosa of less thickness, the mucosa is associated with underlined tissues with dense parts of the trachea. The excretory ducts of the mixed sero-mucous glands in their pathway form the flask expansions that open on the surface of the mucosa. The acini consist of secretory cells, some of which contain a small amount of granules, and other cells are expanded with a large amount of homogeneous secret.

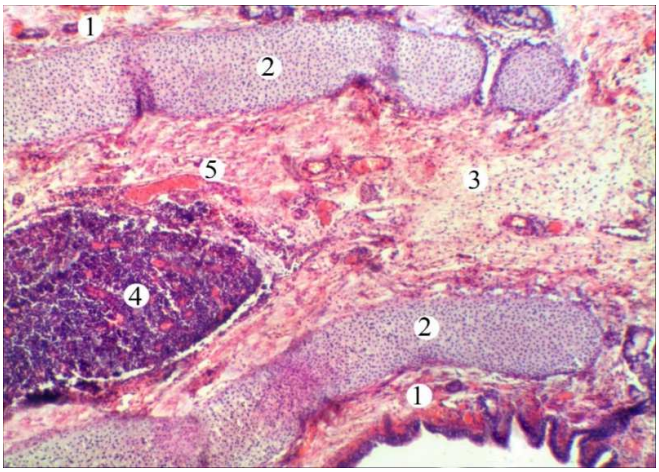

Fig. 4. Microscopic structure of the bifurcation region of the trachea of the fetus 360,0 mm PCL. Specimen. Stained with Haematoxylin and eosin x 80: 1 – mucosa with submucosa; 2 – fibrous-cartilage layer; 3 – adventitia; 4 – lymphatic nodule; 5 – blood vessel.

The adventitia of the trachea is well visible; it joins the organ with adjacent parts of the mediastinum. The blood vessels of the trachea form in the mucosa plexus, and under the epithelium - a capillary meshwork. Lymph vessels also form plexus.

The mucosa of the right and left primary bronchi is represented by a single-layered respiratory epithelium. The mucosa lamina propria of the primary bronchus is well expressed, contains longitudinally oriented elastic fibers, but the lamina muscularis of the mucosa is rather thin. The bundles of smooth muscle cells, which have a circular direction, separate the mucosa of the bronchus from the submucosa connective tissue layer. In the last one are located blood vessels and secretory

portions of the mixed sero-mucosal and protein glands. The fibrous-cartilaginous mucosa is well developed.

The bundless of smooth myocytes, which have a circular direction, separate the mucosa of the bronchus from the submucosa connective tissue layer. In the last one, blood vessels and secretory portions of mixed sero-mucous glands are located. The fibrous-cartilage layer is well developed.

Conclusion

Histological examination of the trachea and primary bronchus in the early period of the ontogenesis of the human fetus revealed a pronounced fragmentary nature of the structure of the cartilage skeleton of the trachea and primary bronchus at the completion of the formation of other layers.

Prospects for further research include studies on the formation of the trachea microscopic structure and primary bronchus in human fetuses of 7-10 months to testify the possibility for further studying their structural organization in newborns.

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Реферати

СТРУКТУРНА ОРГАНІЗАЦІЯ ТРАХЕЇ І ГОЛОВНИХ БРОНХІВ У ПЛОДІВ ЛЮДИНИ 7-10 МІСЯЦІВ

Хмара Т.В., Федонюк Л.Я., Сарафинюк Л.А., Галагдина А.А., Гончаренко В.А.

Гістологічне дослідження проведено на 24 серіях послідовних гістологічних зрізів грудної частини трахеї і головних бронхів у плодів людини 231,0-375,0 мм тім’яно-куприкової довжини. Мікроскопічне вивчення будови трахеї та бронхів у плодів 231,0-375,0 мм ТКД показало, що їх стінка представлена слизовою оболонкою, підслизовою основою, волокнисто-хрящовою та адвентиційною оболонками, які в різні вікові періоди мають свої структурні особливості. Гістологічне дослідження трахеї і головних бронхів у ранньому плодовому періоді онтогенезу людини виявило виражений фрагментарний характер будови хрящового скелету трахеї та головних бронхів при завершеному формуванні інших оболонок. Встановлено, що наприкінці плодового періоду онтогенезу (311,0-375,0 мм ТКД) спостерігається інтенсивний розвиток компонентів стінки трахеї та головних бронхів, що анатомічно обумовлює посилений ріст та формоутворення в даний період пренатального онтогенезу.

Ключові слова: трахея, головні бронхи, мікроскопічна будова, плід, людина.

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СТРУКТУРНАЯ ОРГАНИЗАЦИЯ ТРАХЕИ И ГЛАВНЫХ БРОНХОВ У ПЛОДОВ ЧЕЛОВЕКА 7-10 МЕСЯЦЕВ

Хмара Т.В., Федонюк Л.Я., Сарафинюк Л.А., Галагдина А.А, Гончаренко В.А.

Гистологическое исследование проведено на 24 сериях последовательных гистологических срезов грудной части трахеи и главных бронхов у плодов человека 231,0-375,0 мм теменно-копчиковой длины. Микроскопическое изучение строения трахеи и бронхов у плодов 231,0-375,0 мм ТКД показало, что их стенка представлена слизистой оболочкой, подслизистой основой, волокнисто-хрящевой и адвентициальной оболочками, которые в разные возрастные периоды имеют свои структурные особенности. Гистологическое исследование трахеи и главных бронхов в раннем плодовом периоде онтогенеза человека выявило выраженный фрагментарный характер строения хрящевого скелета трахеи и главных бронхов при завершенном формировании других оболочек. Установлено, что в конце плодного периода онтогенеза (311,0-375,0 мм ТКД) наблюдается интенсивное развитие компонентов стенки трахеи и главных бронхов, что анатомически обусловливает усиленный рост и формообразование в данный период пренатального онтогенеза.

Ключевые слова: трахея, главные бронхи, микроскопическое строение, плод, человек.

Рецензент Старченко І.І.