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# Morphological and Morphometric Features of Arterial Duct Structure

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***Abstract:*** *Normally, the arterial duct undergoes obliteration immediately after birth and turns into a connective tissue cord. Filling the lungs with oxygen leads to the closure of the duct with a thickened intima and a change in the direction of blood flow. The arterial (Batalov) duct is a structural formation of the fetal heart, through which the blood ejected by the left ventricle into the aorta passes into the pulmonary trunk and returns again to the left ventricle.*

*Vascular wall components: 1. the endothelium is a special type of epithelium that develops de novo. It consists of one layer of thin leaf-shaped cells that connect to each other at the edges. The endothelium forms the inner lining of the vessels. 2. Connection-woven, elastic and smooth muscle fibers in various combinations and ratios depending on the type and caliber of the vessel. 3. Nerve fibers and special small blood vessels that feed the walls of the arteries and veins. The wall of the blood vessel consists of 3 layers: 1. Internal - tunica intima 2. Middle - tunica media 3. External - tunica externa s. adventitia.*

***Keywords:*** *arterial duct, morphology, Botalov duct, artery, aortic arch, embryonic development, anastomosis.*

**Relevance of the topic.** Arteries, depending on the structure, distinguish arteries of 3 types: 1) Elastic type - aorta; pulmonary trunk; 2) Muscle type - most of the middle and small arteries; 3) Musculo-elastic type - subclavian artery; femoral artery. The wall of all types of arteries, like veins, consists of 3 layers. Depending on the type of artery, the relative thickness of these layers and the nature of the tissues forming them vary. The elastic arteries in their walls contain a large number of elastic fibers, due to which they are very stretchable and elastic. Tunica intima is thick (20% of the entire wall), consists of endothelium and subendothelial layer. The inner elastic membrane tunica media (muscularis) is a large number of fenestrated (terminated) elastic membranes located concentrically. Between the membranes lie smooth tunica adventitia myocytes - thin, formed by loose fibrous connective tissue with a large number of collagen and elastic fibers. Blood vessels (vasa vasorum) and nerves pass. Muscle-type arteries endothelium elastic membrane. Muscle tissue. Connective tissue. Muscle-type arteries deliver blood to different areas of the body. Since different organs need different periods of blood, such arteries should have the ability to change their lumen if necessary. In the walls of such arteries, a layer of smooth muscle cells is well developed. The diameter of the arteries is controlled by the sympathetic nervous system and ranges from 0, 3 to 5 mm. Muscle-type arteries: tunica intima wall structure - endothelium; subendothelial layer; the inner elastic membrane of tunica media (muscularis) is the thickest, formed by helically arranged smooth muscle cells. The outer elastic membrane of tunica adventitia is thin, consists of loose fibrous connective tissue; blood vessels and nerves. Mixed (musculo-elastic) type arteries Occupy an intermediate position between the other two types. In their walls, they have both muscular and elastic components. In the middle layer, these components are distributed evenly. Such arteries are able to withstand high blood pressure due to elastic components and at the same time can change their lumen due to the presence of smooth muscle cells. The highest blood pressure is noted in the arteries extending from the heart, then as blood movement slows due to friction against the walls of the vessels, the pressure gradually decreases. In a healthy person in a normal state, systolic pressure is 120 mm Hg, and diastolic pressure is about 80.

The objectives of this study are to study the differences in the structure and topography of aortic sinuses in fetuses, newborns and children in the early postnatal period.

**Research materials and methods.** The present study was conducted on 252 hearts with ascending aorta taken from fetuses starting from 3-4 lunar months, newborns and children of both sexes under 3 years of age. At the same time, the selection of tissue specimens was carried out on fruits and newborns without external deformities and in children who died from causes unrelated to cardiac pathology. Sex, body length, head circumference, chest circumference, nipple level, and epigastric angle were recorded in each fetus before taking the study material. The age of the fetus defined in the Gaza formula. The age of the children was found out by medical histories. The preparations were selected evenly for each month of pre-natal development, starting from 3-4 lunar months. Children distributed into two age groups: a) to year I (chest age), where newborns and children up to 6 months and children from 6 months to year I are separately isolated; b) children 1-3 years of age (early childhood). 180 drugs were studied microscopically and 150 were examined histo-topographic ally. Due to the small size of the studied formations in the fetuses and newborns, measurements were made under a binocular stereomicroscope MBS-2, visual observation clarified the position of the aorta sinuses in relation to the frontal plane of the heart. Since the aortic sinuses are located intra cordially, the anatomical preparation technique was used to access them. When studying the topographies of the mouths of arteries, the landmarks were the median line of the corresponding sinuses, their upper edge, the free edge of the semi-lunar dampers and the commissure between us.

**Results of the study.** Age-related features of heart shape and size, ascending aorta, aortic sinuses, and aortic valves. In the late embryonic and early postnatal periods, the shape and size of the heart and ascending aorta have individual and age differences. The increase in the size of these formations occurs unevenly at all ages. In fruits of 4 lunar months, the aortic size of the heart is 9-18 mm, the length of the ascending aorta is 5-7.1 mm. By the time of birth, the longitudinal size of the heart and the length of the ascending aorta increases more than 3 times and reaches 33-46 mm 16.2-24.1 mm, respectively. In children before the first year, the size of the heart and the length of the ascending aorta increases more slowly than at the end of the intrauterine period. In children aged 1-3 years, compared with the fruits of 10 moons, the longitudinal size of the heart increases by 16-19 mm, and the length of the ascending aorta - by 5.9-8.3 mm. By the end of the intrauterine period of development, the transverse size of the heart is 25-39 mm and in comparison with the fruits of 4 lunar months increases more than 3 times. The perimeter of the ascending aorta in fruits reaches 16-21 mm in 10 months, those and others are 3-3.5 times more than in four-month-old fruits. In infants (up to year I), the transverse size of the heart was determined at 26-47 mm, the perimeter of the ascending aorta at 24-29 mm; therefore, the increase in these values in this period was slower than in utero. In children aged 1 year, the transverse size of the heart increases by 16-20 mm, and the perimeter of the ascending aorta by 9.5-10 mm. In both the late embryonic and the early postnatal periods, there is a certain correlative relationship between the shape and size of the heart and the ascending aorta. In a large part of observations, a long ascending aorta is noted at a given narrow heart shape; a short ascending aorta is observed with a short and wide heart shape. The length of the ascending aorta depends on the longitudinal size of the heart. In fruits and young children, the aortic valve consists of 3 half lunar dampers, respectively, in the wall of the ascending aorta, there are depressions - aortic sinuses. In each shutter, it distinguishes between a base that attaches to the wall and participates in the formation of a fibrous ring, and a free edge. The side edges of the flaps are attached to the wall of the aorta. Here, splices - adhesions (commissures) are formed between the free edges of the dampers. In the middle of the free edge of the flaps there is a nodule, and on the sides of it there are holes. In fruits of 4-5 lunar months, the flaps are thin, the nodules and wells on their free edge are weakly expressed; the height of the flaps (1-2.3 mm) is less than their width (1.5-3 mm), the depressions of the aortic sinuses are not expressed. At the age of 6-7 lunar months, in the center of the free edge of the dampers, there is a quadrangular nodule, on the sides of which the holes are already well expressed; in the area of the commissure are noticeable in the form of conical knots; height of dampers (1.5-3.4 mm), also less than their width (2.8-5.6 mm). Depressions of aortic sinuses in the age group in question are pronounced. At the upper edge of the sinuses there is a thickening of the aortic wall in the form of a limiting roller. The dimensions of the aortic sinuses correspond to the parameters of the same dampers. In fruits of 10 lunar months, the height of the floor of the lunar dampers (2.7-4.5 mm) approaches the height of the aortic sinuses (2.8-4.6 mm), and the width of the dampers (5.5-7.9 mm) is slightly greater than the width of the corresponding (5.6-7.6 mm). At this age, the right and left crown sinuses are whiter than without the crown aortic sinus. The obtained data show that by the time of birth, the size of the aortic sinuses and the floor of the lunar dampers compared with the sizes of these formations in fruits of 4-5 lunar months more than doubled. After birth, further growth and development of parameters of the floor of the lunar shutters of the aortic valve and the corresponding sinuses occurs. At the age of 1 year, the height of the dampers (4.2-7.5 mm) is 1-2 mm less than the height of the sinuses (6-8.5 mm), and their width (7-10 mm) is 1-1.5 mm more than the width of the sinuses (6, -8.5 mm). In children 1-3, the height of the floor of the lunar dampers and aortic sinuses in comparison with similar formations of newborns is twice as high. The width of the dampers (8.5-11 mm) and sinuses (7 gr 3-9.5 mm) is larger than their size in fruits of 10 lunar months. The aortic sinuses are deep, a restrictive roller is clearly expressed at their upper edge. In the late embryonic and early postnatal periods, the back floor of the lunar shutter is larger than the right and left. Our data coincide with the results of studies conducted by A.M. Ochkurenko (2015) in adults. O.G. Goncharov (2018) notes that the dimensions of the right floor of the lunar shutter are larger than other aortic valve dampers; our data do not support the pattern outlined. We did not find sex differences in the sizes of the lunar dampers and aortic sinuses in the age groups studied. In fetuses and children, in the studied age periods, there is a correlative relationship between the size and shape of the floor of the lunar shutters (aortic sinuses) with the size and shape of the heart and ascending aorta. With a long and narrow heart shape, a long ascending aorta is observed, the floor of the lunar dampers and aortic sinuses are high and narrow. The flaps have a semi-lunar shape. With a short and wide heart shape, the ascending aorta is short, the semi-lunar dampers and aortic sinuses are low and wide in most observations. The shape of the dampers is semi-oval, trapezoidal.

**Conclusions.** Of 752 patients with non-overgrown arterial duct examined at the clinic of the Research Institute of Blood Transfusion and Circulatory Pathology of the Republic of Uzbekistan from 2016 to 2017, pulmonary hypertension is noted at 25.4%. The development of pulmonary hypertension is noted by wide, non-overgrown arterial ducts. The severity of pulmonary hypertension is directly related to the size of the shunt. With age, the size of the functioning arterial duct increases. The classic clinical symptomatic complex of the non-overgrown arterial duct changes a variety of symptoms, determined by the ratio of pressure in the pulmonary artery and aorta. The lag of the main indicators of physical development in the group of patients with pulmonary hypertension was noted in 40.4% of children, by height and 67.4% - by weight, which is three times higher than the corresponding indicators in patients with an uncomplicated non-overgrown arterial duct. The most significant physical underdevelopment is expressed in patients with pulmonary hypertension. The auscultatory pattern of a non-overgrown arterial duct without characteristic systole-diastolic noise should be recognized as natural and typical in the event of pulmonary hypertension malformation complication. Diagnostic value in the non-overgrown arterial duct complicated by pulmonary hypertension is more stable than systole-diastolic noise, peripheral symptoms of malformation, more pronounced on the lower extremities, allowing to differentiate the non-overgrown arterial duct from septal defects and establish the level of bypass grafting even against the background of high pulmonary hypertension. We attach particular importance to the increased pulse pressure, which exceeded 1/2 of systolic only in patients with non-overgrown arterial duct; for septal defects and in healthy children, the pulse pressure did not exceed 1/2 of systolic in any case.

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