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Dimension of circumflex branch according to type of heart vascularisation in foetal life of human

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Typological differentiation of coronary arteries binds to various areas of vascularisation, which could suggest essential differences between vasculatory dimensions. There are not many papers analysing the influence of heart vascularisation on epicardial vessel dimensions during postnatal human life, furthermore, there are hardly any papers dealing with the prenatal period.

The subject of examination was 188 human foetuses from 4th to 7th month of prenatal life. Foetuses were fixed for minimum 3 months in 9% formalin solution. They were taken from natural abortions and did not characterise any external malformations. There was a different number of foetuses in a variety of morphological age groups. Adachi classification was used to describe all types: type I — classical, with equal coronary arteries, type II — predominance of right coronary artery, type III — predominance of left coronary artery.

Speed of circumflex branch growth in different types of vascularisation is various. Analysis of the differences among dimensions of artery in various types showed there are statistically crucial ones, especially between: types III and I or types III and II.

key words: coronary artery, development, typology of coronary artery

INTRODUCTION

Many factors influence the dimension of coronary arteries, among those are: heart mass and left ventricle mass. Typological diversity of coronary arteries binds to different vascularisation areas, which could cause significant differences between dimensions of vessels. There is not much literature analysing the influence of heart vascularisation type to dimensions of epicardial vessels during human postnatal period of life. Moreover, there are hardly any papers dealing with the prenatal period. The aim of the studies was to determine the influence of heart vascularisation type on the dimension of coronary arteries during the prenatal period of life. Circumflex branch of main branching of left coronary artery was evaluated.

MATERIAL AND METHODS

Research was carried out on 188 foetuses of both sexes at age between 4th and 7th month of foetal life, they were stained for minimum 3 months in 9% formalin solution. They were taken from spontaneous abortions and did not show any external malformations. Different numbers of foetuses were taken into account in following classes of morphological age. Vascularisation types were examined by the means of Adachi classification for three types [1, 8]:

- I type — classic, with equal coronary arteries (Fig. 1);
- II type — right coronary artery predominance (Fig. 2);
- III type — left coronary artery predominance (Fig. 3, 4).

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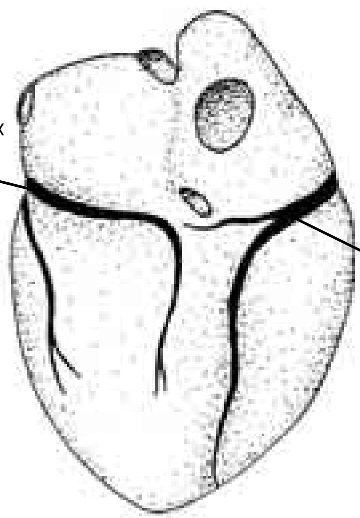


Figure 1. TYPE I — classical type, codominant right and left coronary artery. Diaphragmatic surface (according to Adachi) [1].

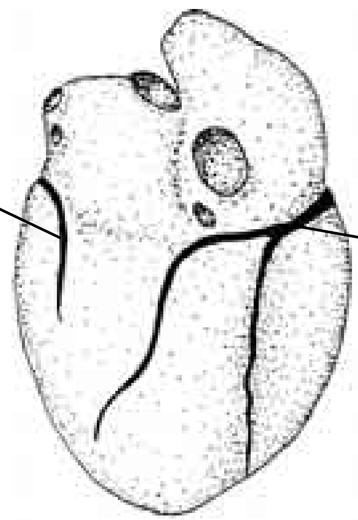


Figure 2. TYPE II — dominant right coronary artery. Diaphragmatic surface (according to Adachi) [1].

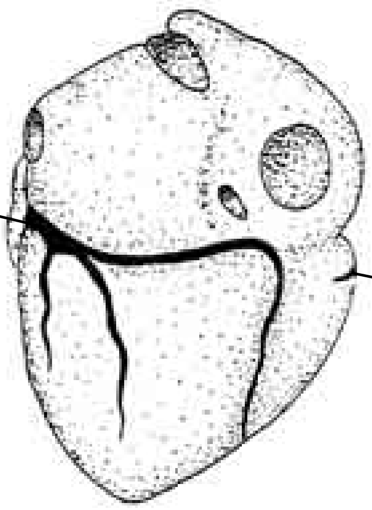


Figure 3. TYPE IIIa — dominant left coronary artery. Diaphragmatic surface (according to Adachi) [1].

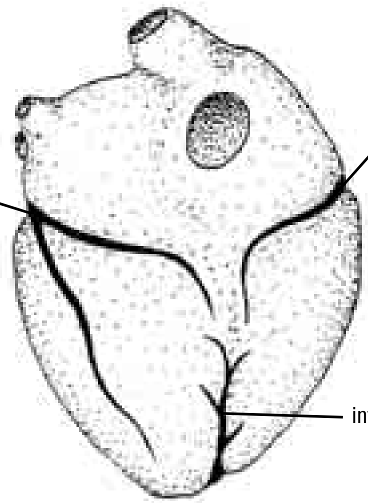
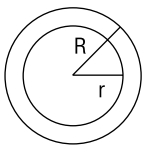


Figure 4. TYPE IIIb — dominant left coronary artery. Diaphragmatic surface (according to Adachi) [1].

The diameter of vessels was measured twice and the dimension was determined on the basis of the arithmetical average of both measurements. The cross-section area was determined as follows:



[According to Grajek [3] R/r = 1.227]
[According to MacAlpina [6] R/r = 1.2]
D — diameter

R — radius of vessel $r = R/1.227$
r — lumen radius $r = D/2 \times 1.227$
PP — cross-section area $PP = \pi r^2$
$D = 2R$ $PP = \pi (D/2.454)^2$

Statistical analysis was performed using the SPSS PC+ program, in the computer workshop of the Histology and Embryology Department of the Medical University of Bydgoszcz.

RESULTS

Permanent growth of average dimension of circumflex branch cross-section area for whole material was noticed. This growth is particularly crucial in 5th month with slower growth during the next month. Rate of circumflex branch growing in following vascularisation types is various. The fastest was in type III in 6th month, the latest one in 7th month. Growth rate in type II is fastest during 5th month and in 6th month it slows down, which is increased during 7th month. In type I circumflex branch growth is the slowest during 6th month with the biggest improvement in 7th month (Table 1).

Based on variation analysis, statistically important differences were found concerning circumflex branch and its different vascularisation types ($p = 0.004$) (Table 1). The differences were between types III and I together with types III and II in particular (Table 2).

DISCUSSION AND CONCLUSIONS

The type of heart vascularisation influences circumflex branch dimensions. Obtained results show dependences of coronary vessels dimensions on typology of heart muscle vascularisation according to circumflex branch as left coronary artery branch. Vascularisation type through various areas of vascularisation influences vessel diameter, which was determined in research concerning heart vascularisation type to diameter of vessels [4, 5, 7, 9]. But, according to Dodge et al. [2], dimensions of left coronary and anterior interventricular artery are not affected by vascularisation type. Only dimensions of right coronary artery and circumflex branch are dependent on type of vascularisation in types I and III. The results of my studies are in accordance with Dodge's ones.

Table 2. Duncan test for each type

Type	PP [mm^2]	Duncan test for groups	Differences between PP
I	0.308	I–II	0.51
II	0.257	I–III	0.182*
III	0.491	II–III	0.233**

*$p \leq 0.05$, **$p \leq 0.01$

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Table 1. Cross-section area of vessel lumen of cicumflex branch in prenatal development in human

Vessel	Age	Type I		Type II		Type III		All		p
		N	PP ± SD [mm^2]	N	PP ± SD [mm^2]	N	PP ± SD [mm^2]	N	PP ± SD [mm^2]	
Circum-	IV			1	0.15 ± 0.000				0.15 ± 0.000	
flex	V	19	0.36 ± 0.100	24	0.28 ± 0.013	29	0.38 ± 0.013	72	0.34 ± 0.013	
branch	VI	30	0.46 ± 0.019	22	0.40 ± 0.013	37	0.61 ± 0.020	89	0.5 ± 0.02	0.004"
	VII	8	0.68 ± 0.019	11	0.48 ± 0.019	7	0.79 ± 0.007	26	0.62 ± 0.02	

Type I — classic, with equal coronary arteries, type II — right coronary artery predominance, type III — left coronary artery predominance; "$p \leq 0.1$