



THIRD CORONARY ARTERY

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ABSTRACT

The human heart is in most cases vascularized by two coronary arteries, the right and the left one. Supernumerary or added coronary arteries are also present sometimes. The aim of this paper is to ascertain presence of supernumerary coronary arteries that arise directly from aorta, their frequency, flow, way of branching, and possibly their anastomoses with other coronary arteries. Out of 25 hearts, examined by dissection, 8 of them (32%) had conal artery. According to our opinion, the most suitable term for this artery, in order to differ it clearly from the conal branch of the right coronary artery, is third coronary artery. One heart (4%) had four coronary arteries. Both supernumerary coronary arteries arose from the right aortic sinus. The third coronary artery represents a significant way of collateral coronary circulation, as it frequently anastomoses with anterior interventricular branch.

KEY WORDS: supernumerary coronary artery, third coronary artery, dissection.

INTRODUCTION

The human heart is in most cases vascularised by two coronary arteries, the right and the left one (a. coronaria dextra et a. coronaria sinistra). Supernumerary or added coronary arteries are also present sometimes (1,2). Supernumerary coronary artery which arises independently from the right aortic sinus (sinus Valsavae) and passes through subepicardial adipose tissue of pulmonary conus and anterior side of the right ventricle, is called third coronary artery, preinfundibular artery or gentle Vieussens' artery (1,3,4). Edwards (5) and Miyazaki (6) state that the third coronary artery is more frequently found in adult hearts than in fetal hearts, concluding thereof that it develops only after birth. The third coronary artery often anastomoses with the branch of the anterior interventricular branch and forms Vieussens' arterial ring. This ring represents a significant path of collateral bloodstream under conditions of coronary insufficiency (7,8,9). There have been described cases of anastomosis of conal artery with diagonal branch of the left conal artery (10), also with branches of the right conal artery (11). In patients with occlusive illness of coronary arteries, it is also necessary to perform selective angiography of the third coronary artery. This represents the way of detecting anastomoses of this artery with branches of other arteries that remained unnoticed in usual angiographies of the left or right coronary artery (12,13). Awareness of the presence and distribution of supernumerary coronary arteries is significant for proper interpretation of coronary angiograms, evaluation of seriousness and result of coro-

nary insufficiency, and adequate planning and performing surgical myocardium revascularisation (14). The objective of this paper is to establish presence of supernumerary coronary arteries which arise directly from aorta, their frequency, flow, way of branching and possibly their anastomoses with other coronary arteries.

MATERIAL AND METHODS

25 adult human hearts were used as material. The dissection enabled us to show heart arteries, place of their arising, flow, way of branching and present anastomoses. The hearts were preserved 3-5 days in 10% formalin solution. Adipose tissue was eliminated and coronary arteries and their branches prepared by careful dissection. In cases where presence of the third coronary arteries was established, the aorta was opened by its length at the level of rear sinus in order to get insight into the left and right aortic sinus and presence of corresponding coronary orifices. Radius of these orifices was measured and also their distance from the orifice of the right coronary artery.

RESULTS

Eight out of 25 examined hearts (32%) had conal artery (Figure 1).

It arose from the right aortic sinus, and its orifice, in all cases, was in front of and left from the orifice of the right coronary artery. Radius of the orifice of the third coronary artery was 1-2 mm, and its distance from the orifice of the right coronary artery 1 to 4 mm. One heart (4%) had four coronary arteries. Both supernumerary coronary arteries arose from the right aortic sinus with orifice radius from 0,5 to 2,5 mm (Figure 2).



FIGURE 1. Human hart (dissection preparation);
1 – right coronary artery,
2 – third coronary artery

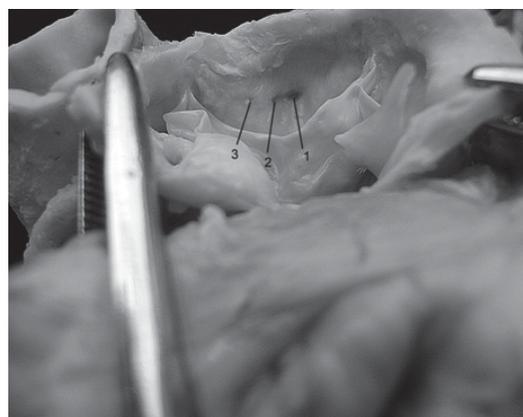
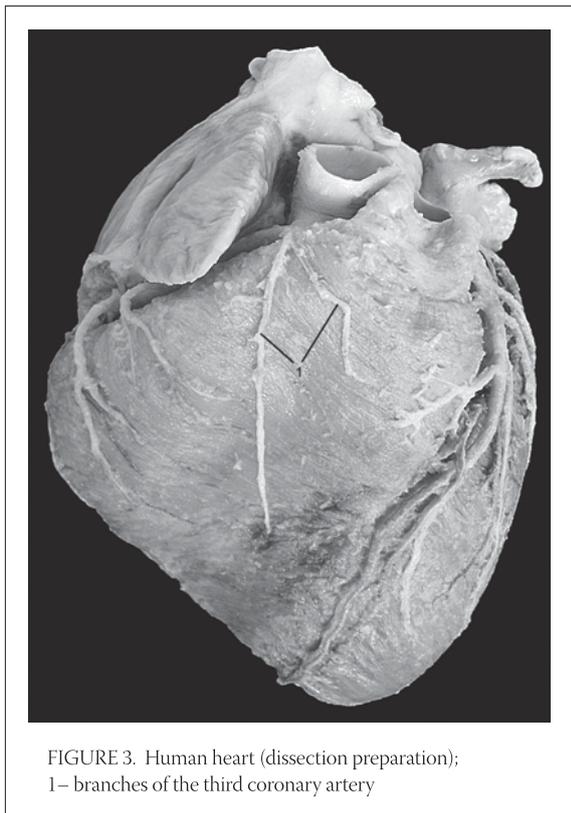
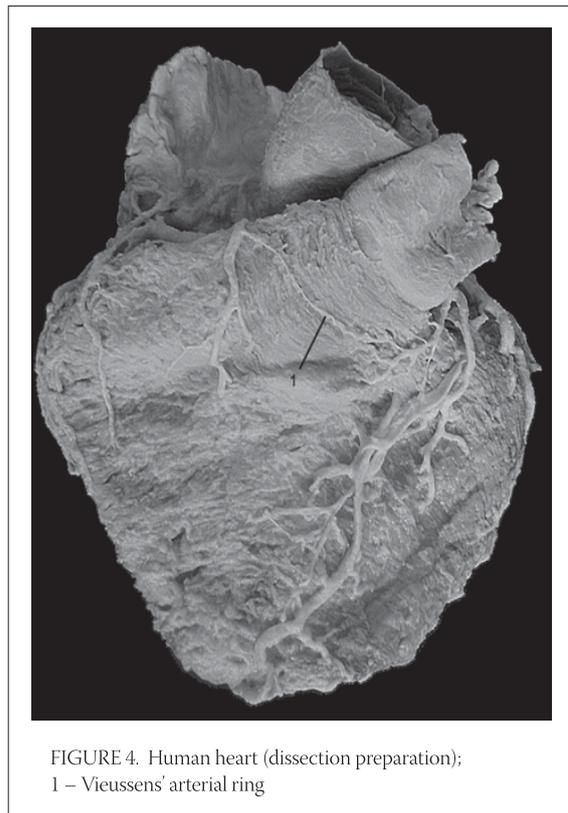


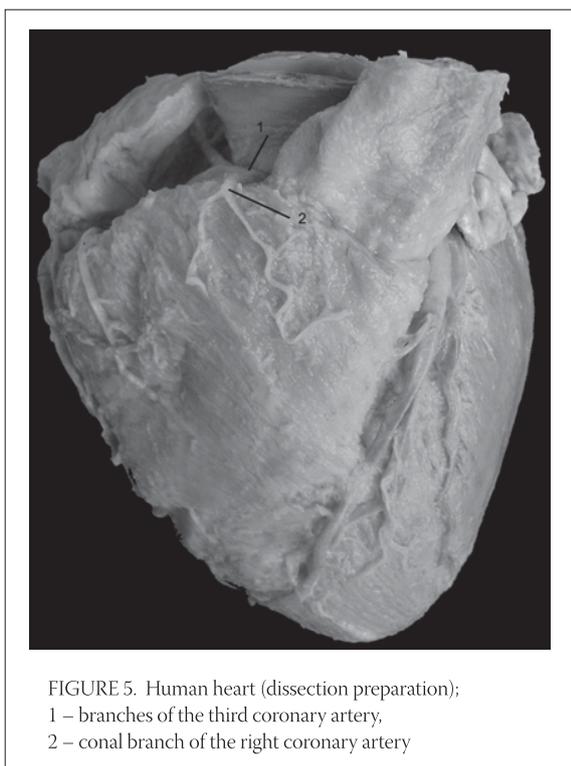
FIGURE 2. Human hart (dissection preparation); 1 -orifice of the right coronary artery,
2 - orifice of the third coronary artery,
3 - orifice of the fourth coronary artery



The third coronary artery passed through the adipose tissue of the coronary groove and reached the pulmonary cone where it most frequently divided in two ending branches. In one case, the third coronary artery was divided in two branches, one of which went to pulmonary cone, while the other was very long and descended along the front side of the right ventricle (Figure 3).



In cases with two hearts, the third coronary artery anastomosed with the anterior intraventricular branch and formed the Viessens arterial ring (Figure 4). Conal branch which started from the proximal part of the right coronary artery had a similar flow, number of branches and way of branching as the third coronary artery (Figure 5). We did not ascertain any anastomoses of the conal branch of the right coronary artery with other arteries.



DISCUSSION

Many authors have studied the blood vessels, their variations and abnormalities. Number of coronary artery variations is relatively frequent and these variations may have related clinical consequences. Here have been described cases of decreased number of coronary arteries, i.e. presence of a single coronary artery arising from the left (15, 16) or the right (1, 17) aortic sinus. Presence of single coronary artery may be related with creation of congestive heart failure or myocardial infarction (18). Supernumerary coronary artery arises mostly from the right aortic sinus. Literature uses different terms for identifying this artery: conal artery, preinfundibular or supernumerary right coronary artery (1, 14, 19). According to our opinion, the most suitable term for this artery in order to separate it clearly from the conal branch of the right coronary artery, is the third coronary artery. Data about frequency of the third coronary artery are

rather diverse, from 1,5% and 8% as stated by Lo (20) and Kurija (21) even to 62% as stated by Hadžiselimović (1). In this study, the third coronary artery was found in 32% of tested cases what is consistent with the results received by Villanoga (2) and Yamagishi (9). Hadžiselimović (1) points out that even three coronary arteries may arise independently from the right aortic sinus what was confirmed by this study too. Four coronary arteries were found in one case, where both supernumerary arteries arose from the right aortic sinus. Literature describes cases with anastomosis of the

coronary artery with the front interventricular branch, diagonal, circumflex one, as well as with the branches of the right coronary artery (10,11,13,22). However, this study ascertained solely anastomosis of the third coronary artery with the anterior interventricular branch with formation of Vieussens' arterial ring. This arterial ring may be formed by the conal branch of the right coronary artery, but it is less significant, as it is more often enfolded with atherosclerotic process (13). In our material we did not find Vieussens' ring with conal branch in its formation.

CONCLUSION

The most suitable term to identify supernumerary heart artery which arises independently from the right aortic sinus is the third coronary artery.

Frequency of the third coronary artery is 32% of examined cases.

The third coronary artery represents a significant path of collateral coronary circulation as it often anastomoses with the anterior interventricular branch.

REFERENCES

- (1) Yu H.G., (1) Hadžiselimović H., Dilberović F., Ovcina F. Blood vessels of the human heart: coronarography and dissection. *Acta Anat. (Basel)*. 1980;106 (4):443-449.
- (2) Vilallonga J.R. Anatomical variations of the coronary arteries: The most frequent variations. *Eur. J. Anat.* 2003; 7(1):29-41.
- (3) Pejšković B., Bogdanović D. Arterije i vene srca. p.8-21. Savremena administracija. Beograd, 1995.
- (4) Crainicianu A. Anatomische Studien uber die Coronararterien und experimentekke Untersuchungen uber ihre Durchgangigkeit. *Virch. Arch.* 1922; 238: 25-36.
- (5) Edwards B.S., Edwards W.D., Edwards J.E. Aortic origin of conus coronary artery. Evidence of postnatal coronary development. *Br. Heart J.* 1981;45(5):555-558.
- (6) Miyazaki M., Kato M. Third coronary artery: its development and function. *Acta Cardiol.* 1988; 43(4):449-557.
- (7) Schlesinger M.J., Zoll P.M., Wessler S. The conus artery; a third coronary artery. *Am. Heart J.* 1949;38(6):823-836.
- (8) Waller B.F. The epicardial coronary arteries: proper necropsy examination. *Indiana Med.* 1986; 79(12):1056-1058.
- (9) Yamagishi M., Haze K., Tamai J., Fukami K., Beppu S., Akiyama T., Miyatake K. Visualization of isolated conus artery as a major collateral pathway in patients with total left anterior descending artery occlusion. *Cathet. Cardiovasc. Diagn.* 1988;15(2):95-98.
- (10) Sharma S., Kaul U., Rajani M. Collateral circulation to the diagonal artery from the infundibular coronary artery in obstructive coronary arterial disease. *Int. J. Cardiol.* 1989;25(1):134-136.
- (11) Kerensky R.A., Franco E.A., Hill J.A. Antegrade filling of an occluded right coronary artery via collaterals from a separate conus artery, a previously undescribed collateral pathway. *J Invasive Cardiol.* 1995;7(7):218-220.
- (12) Feld S., Epstein M., Ayzenberg O., Caspi A. Non-visualized left anterior descending artery revealed on selective conus artery catheterization. *Clin Cardiol.* 1995;18(10):597-598.
- (13) Levin D.C., Beckmann C.F., Garnic J.D., Carey P., Bettmann M.A. Frequency and clinical significance of failure to visualize the conus artery during coronary arteriography. *Circulation.* 1981;63(4):833-837.
- (14) Tanigawa J., Petrou M., Di Mario C. Selective injection of the conus branch should always be attempted if no collateral filling visualises a chronically occluded left anterior descending coronary artery. *Int. J. Cardiol.* 2007;115(1):126-127.
- (15) Takano M., Seimiya K., Yokoyama S., Okamoto K., Ishibashi F., Uemura R., Hata N., Mizuno K. Unique single coronary artery with acute myocardial infarction: observation of the culprit lesion by intravascular ultrasound and coronary angiography. *Jpn. Heart J.* 2003; 44(2):271-276.
- (16) Koizumi M., Kawai K., Honma S., Kodama K. Anatomical study of a left single coronary artery with special reference to the various distribution patterns of bilateral coronary arteries. *Ann. Anat.* 2000;182(6):549-557.
- (17) Benslimane A., Funck F., Bellorini M., Lefevre T., Guillard N., Jacoly J. Single coronary artery arising from the right coronary sinus. Report of two cases. *Arch. Mal. Coeur. Vaiss.* 1998;91(12):1503-1507.
- (18) Becker A.E. Congenital coronary arterial anomalies of clinical relevance. *Coron. Artery Dis.* 1995;6(3):187-193.
- (19) Gupta S.K., Abraham A.K., Reddy N.K., Moorthy S.J. Supernumerary right coronary artery. *Clin Cardiol.* 1987; 10(7):425-427.
- (20) Lo E.A., Dia A., Ndiaye A., Sow M.L. Anatomy of coronary arteries. *Dakar Med.* 1994; 39(1):23-29.
- (21) Kurija H.Z., Chaudhry M.S., Olson T.R. Coronary artery variation in a native Iraqi population. *Cathet. Cardiovasc. Diagn.* 1986;12(6):386-390.
- (22) Mishkel G.J., Biagioni E., Stolberg H. Total occlusion of the circumflex artery with collateral supply from the conus artery. *Cathet. Cardiovasc. Diagn.* 1991; 23(3):194-197.