

Available online at www.sciencedirect.com**ScienceDirect**journal homepage: <http://www.elsevier.com/locate/crvasa>**Case report****Ventricular fibrillation associated with aortic stenosis and coronary cascade****Ľubomír Rusňák^{*}, Martin Fiala, Igor Nykl, Jaroslav Januška, Marian Branny**

Department of Cardiology, Hospital Podlesí a.s., Třinec, Czech Republic

ARTICLE INFO

Article history:

Received 3 February 2014

Accepted 13 February 2014

Available online 12 March 2014

Keywords:

Coronary circulation

Coronary cascade

Aortic stenosis

Ventricular fibrillation

ABSTRACT

We report a case of a patient with severe aortic stenosis in the setting of bicuspid valve and coronary cascade, who was successfully resuscitated from ventricular fibrillation occurring during physical exertion. Both conditions may cause steal effect leading to myocardial ischemia and ensuing ventricular tachyarrhythmia. Following replacement of the aortic valve by mechanical valve prosthesis, the patients declined implantation of cardioverter-defibrillator rendering doubts about possible independent association between ventricular fibrillation and coronary cascade.

© 2014 The Czech Society of Cardiology. Published by Elsevier Urban & Partner Sp.z.o.o. All rights reserved.

1. Introduction

Coronary cascade is an anomaly of coronary artery circulation rarely detected by coronary angiography with reported prevalence of 0.002% [1]. It is represented by a large communication between the left and the right coronary arteries. Unlike coronary artery collaterals present in case of obstructive coronary atherosclerosis, inter-coronary communications occur in the absence of coronary atherosclerosis as possible residuum of left and right coronary artery anastomosis existing in the embryological coronary circulation [1–6]. We report a case of such coronary cascade associated with aortic valve stenosis and ventricular fibrillation.

2. Case report

A 45-year-old male with was admitted for further examination following short stay in a local hospital after cardiopulmonary resuscitation due to ventricular fibrillation while playing soccer. No specific changes were present on standard 12-lead surface ECG. Transthoracic echocardiography showed degenerative changes of the aortic valve in the setting of bicuspid valve with severe aortic stenosis and mild regurgitation associated with left ventricular hypertrophy and otherwise good left and right ventricular performance. Trans-radial coronary angiography revealed a large communication between the left circumflex artery and ramus posterolateralis dexter of the right coronary artery in the absence of luminal

^{*} Corresponding author at: Department of Cardiology, Hospital Podlesí a.s., Konečná 453, Třinec 739 61, Czech Republic. Tel.: +420 558304451; fax: +420 558304457.

E-mail address: lrusnak@gmail.com (Ľ. Rusňák).

<http://dx.doi.org/10.1016/j.crvasa.2014.02.007>

0010-8650/© 2014 The Czech Society of Cardiology. Published by Elsevier Urban & Partner Sp.z.o.o. All rights reserved.

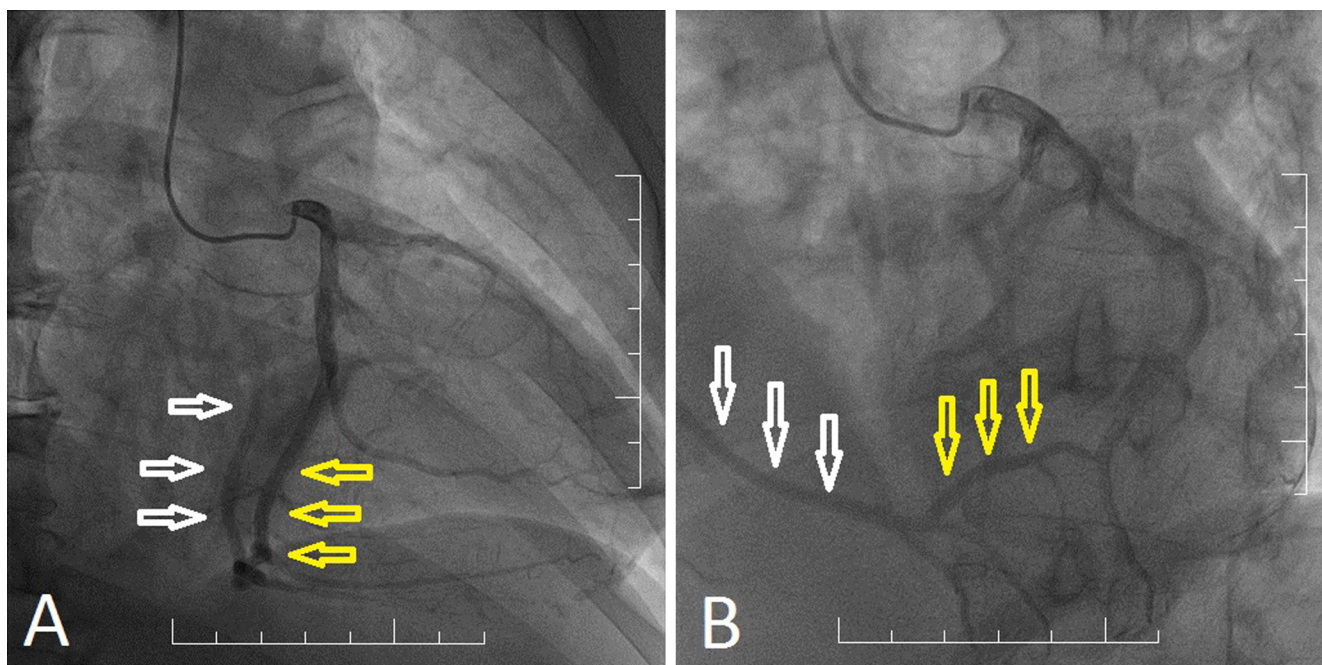


Fig. 1 – Selective left coronary artery angiography visualized right coronary artery (white arrows) through the coronary cascade (yellow arrows) in the right oblique view (panel A) and left oblique view with cranial tilt (panel B). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

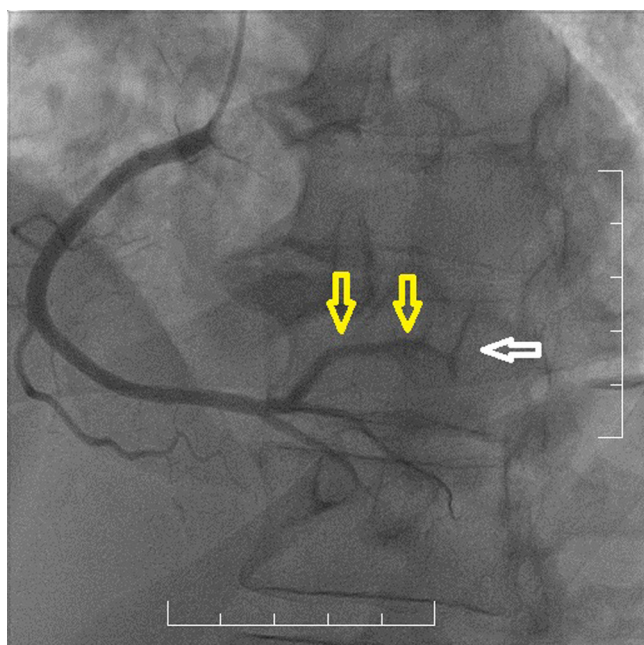


Fig. 2 – Selective right coronary artery angiography visualized only distal portion of the left circumflex artery (white arrow) through inter-arterial communication (yellow arrows) as a consequence of the competitive flow with the dominant inflow from the left coronary artery. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

narrowing or occlusion. The communication was visualized by selective injection of both left and right coronary arteries showing dominant flow from the left coronary artery (Fig. 1) suppressing residual flow from the right coronary artery (Fig. 2).

The patient underwent uneventful surgical replacement of the aortic valve with mechanical valve prosthesis. He declined implantation of cardioverter-defibrillator and was released home on the seventh postoperative day.

3. Discussion

We report a case of ventricular fibrillation in a young man that might have been associated with both present conditions. Severe aortic stenosis is traditionally connected with possible coronary hypoperfusion during physical activity and possible proarrhythmic effect of the entailing myocardial ischemia [12]. Similar effect of myocardial hypoperfusion during physical exertion can occur in the presence of coronary cascade [13].

Inter-coronary continuity, also referred to as coronary cascade, is one of the anomalies of coronary circulation that is only rarely detected on coronary angiography [1–5]. Compared to the tortuous and intramurally located collaterals [6], coronary communicants form direct connections between two main coronary arteries, are extramurally located, straight in their course, and large in diameter generally exceeding 1 mm. Two types of coronary cascade were previously described including communicants between the left circumflex artery and the right coronary artery located in the

posterior atrio-ventricular groove (as in our case), and communicants between the left descending artery and ramus inter-ventricularis posterior of the right coronary artery in the distal inter-ventricular groove [1–5].

True prevalence of the coronary cascade is unknown. The first ever published case was reported by Weiner et al. in 1979 [7]. One postmortem study of 100 human hearts from individuals with an average age of 61 years described 7 cases of inter-coronary continuity [3]. Our case is the first documented coronary cascade out of 40,837 coronary angiographies performed in the department, which corresponds to the incidence of 0.002%, and is consistent with the 0.002% incidence of inter-coronary continuity found in 126,595 consecutive coronary angiographies evaluated by Yamanaka et al. [1]. Other authors observed one case of coronary cascade in 12,674 and 7986 consecutive coronary angiographies, respectively [8,9].

The origin of such a large inter-coronary communication in the absence of atherosclerotic coronary disease also remains unknown. Persistence of the original direct anastomosis between the left and the right coronary arteries, which is present in the embryological coronary circulation has been suggested thus ranking the condition among congenital malformations [2–4]. Histological examination demonstrated no structural difference between the communicants and normal coronary arteries, while their wall structure differed from that of collaterals [4].

The clinical significance of coronary cascade has to be determined. Specifically its potential role in giving rise to ischemia due to possible steal phenomenon and its proarrhythmic effect is unknown. Coronary cascade can serve as a natural bypass in a case of significant obstructive coronary atherosclerosis [10]. However, unidirectional flow through the communication has been also suggested to cause inadequate myocardial perfusion and myocardial ischemia by the steal phenomenon [11,12]. In prior reports, history of chest pain on physical exertion based the referral to coronary angiography. Independent relation between ischemia induced by the steal-phenomenon and resultant ventricular tachyarrhythmia has not been reported so far. Concurrence of the severe aortic stenosis with left ventricular hypertrophy and the coronary cascade forestalled identification of such a causal connection in our patient. However, coronary malformation (as generally all conditions associated with myocardial ischemia arising from the steal effect) should be always considered a potential risk of sudden cardiac death.

Conflict of interest

During working on this article did not occur any conflict of interest by authors.

Funding body

Our work was not financially supported by any subject, grant or fund.

Ethical statement

Our work was done according to ethical standards and rules for responsible conduct of research.

Informed consent

The patient agreed to participate in our case report.

REFERENCES

- [1] O. Yamanaka, R.E. Hobbs, Coronary artery anomalies in 126,595 patients undergoing coronary arteriography, *Catheterization and Cardiovascular Diagnosis* 21 (1990) 28–40.
- [2] M. Petit, J. Reig, *Arterias coronarias: aspectos anatómicos*, Masson-Salvat, Barcelona, 1993:155–158.
- [3] J. Reig, A. Jornet, M. Petit, Direct connection between the coronary arteries in the human heart: intercoronary arterial continuity, *Angiology* 46 (1995) 235–242.
- [4] V.P. Carangal, G.J. Dehmer, Intercoronary communication between the circumflex and right coronary arteries, *Clinical Cardiology* 23 (2000) 125–126.
- [5] B.A. Hines, P.W.T. Brandt, T.M. Agnew, Unusual intercoronary artery communication: a case report, *Cardiovascular and Interventional Radiology* 4 (1981) 259–263.
- [6] E. Glassman, F.C. Spencer, K.R. Krauss, et al., Changes in underlying coronary circulation secondary to bypass grafting, *Circulation* 50 (Suppl. II) (1974), II-80–3.
- [7] B.H. Weiner, R.M. Mills, O.E. Starobin, et al., Intracoronary anastomosis in the absence of obstructive lesions of the coronary arteries, *Chest* 76 (1979) 488–489.
- [8] R. Atak, U. Güray, Y. Akin, Images in cardiology: intercoronary communication between the circumflex and right coronary arteries: distinct from coronary collaterals, *Heart* 88 (2002) 29.
- [9] A. Arat-Ozkan, T. Gürmen, M. Ersanli, et al., A patient with bicuspid aorta and intercoronary continuity: a rare and variant of coronary circulation, *Japanese Heart Journal* 45 (January) (2004) 153–155.
- [10] S.H. Lee, S.H. Park, A.Y. Ji, et al., Protective role of intercoronary communication between right coronary artery with chronic total occlusion and normal left circumflex artery against recurrent myocardial ischemia, *Journal of Lipid and Atherosclerosis* 1 (2) (2012) 105–109.
- [11] M. Gur, R. Yilmaz, R. Demirbag, Unidirectional communication between the circumflex and right coronary arteries: a very rare coronary anomaly and cause of ischemia, *International Journal of Cardiovascular Imaging* 22 (2006) 339–342.
- [12] E. Braunwald, *Heart disease a textbook of cardiovascular medicine*, 6th ed., W.B. Saunders Co., Philadelphia, PA, USA, 2001. p. 1675.
- [13] T. Ulus, B. Görenek, H.U. Yazıcı, H. Özdoğan, Intercoronary continuity between the right and circumflex coronary arteries causing myocardial ischemia, *Türk Kardiyol Dern Arş (Archives of the Turkish Society of Cardiology)*, 39 (2011) 576–578.