

# Crossed aorta or retroaortic anomalous coronary sign in the presence of a mechanical aortic valve in a patient after Bentall operation

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We present transthoracic echocardiographic (TTE) findings suggesting a retroaortic course of the coronary artery (CA) related to an anomalous origin of the circumflex or whole left CA from the proximal part of the right CA or right Valsalva sinus, named formerly as a “crossed aorta” or “retroaortic anomalous coronary” (RAC) sign [1, 2].

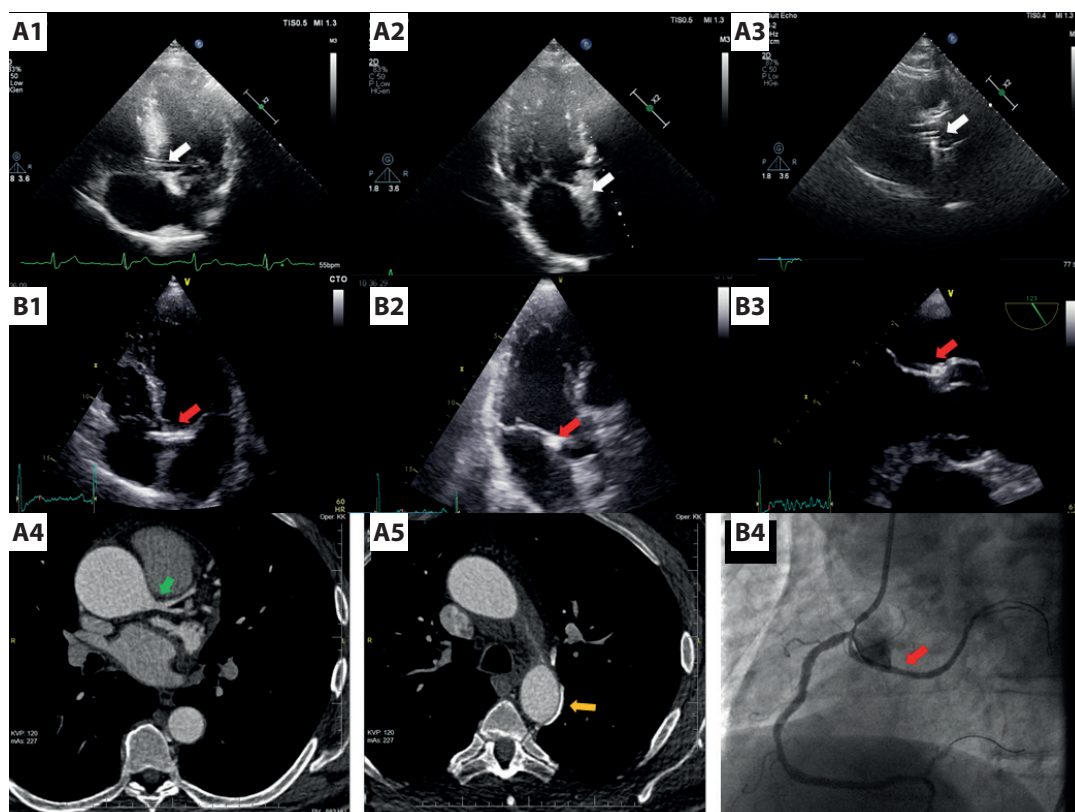
A 57-year-old man treated surgically for aortic aneurysm and regurgitation with an implanted mechanical bileaflet aortic valve SJM 27/28 (St. Jude Medica, Inc., Little Canada, MN, US) with conduit, suffered heart palpitation three months after surgery. On admission, atrial fibrillation was diagnosed, and TTE showed good function of aortic prosthesis, preserved left ventricular ejection fraction (LVEF) of 50%, and mild impairment of right ventricular function. In apical view, two parallel bright echo lines separated with 2–3 mm hypoechoic space were visible near the level of the aortic annulus through the whole heart cycle (Figure 1A and Supplementary material, Video S1). This image corresponded to the “crossed aorta” sign, described later also as the RAC sign, with estimated 63% sensitivity and 94% specificity for the retroaortic course of CA diagnosis [1, 3]. The crossed aorta sign reflects a long cross-section of the CA and, if true positive, should be accompanied by a “bleb sign” rendering the short-axis of the CA in the parasternal long-axis view on TTE seen more clearly on transesophageal echocardiography, see Figure B1–B4. [3] Our patient, however, did not present a “bleb sign,” and computed tomography (CT) done before surgery displayed a normal origin of the left CA from the left Valsalva sinus, revealing, however, an additional vessel behind the proximal part

of the descending aorta (Figure A2–A5 and Supplementary material, Video S2).

This vignette illustrates the situation when the suspected crossed aorta sign or very similar manifestation did not correspond with the diagnosis of anomalous origin of the left or circumflex CA in a patient after Bentall surgery and with an additional extracoronary, retroaortic vessel on CT, and such circumstances should be taken into account since, so far, false positive RAC signs were ascribed only to the presence of valve and annulus calcification [4]. On the other hand, data are accumulating that the retroaortic course of the CA may, in many specific circumstances, pose a significant health risk to patients (related e.g. to ischemia or increased risk during surgical procedures), underscoring the importance of echocardiographic screening based on a broad knowledge of described signs and enabling an effective preliminary diagnosis [5]. The detection of the crossed aorta sign during TTE should prompt the diagnosis of potential ischemia of the inferolateral or posterior wall (e.g. with dobutamine) since both – possible pressure by close structures and more advanced atherosclerosis of the anomalous artery – were reported in the literature. This, as well as the awareness of the possible false positives, such as calcification (devoid, however, of hypoechoic center and moving synchronously with valve leaflets) and the coronary sinus or atypical vessel in the retroaortic region, may enhance the utility of TTE examination.

## Supplementary material

Supplementary material is available at [https://journals.viamedica.pl/kardiologia\\_polska](https://journals.viamedica.pl/kardiologia_polska).



**Figure 1.** Apposition of the images of a mechanical bileaflet aortic valve presenting a “crossed aorta” sign despite normal anatomy of the origin and proximal course of the left CA (images labeled with letter **A**) with the images (from another patient) of anomalous origin of the circumflex CA from the right coronary artery forming a true positive for the retroaortic course of the CA “crossed aorta” or RAC sign as well as a “bleb sign” on a transesophageal study (images labeled with letter **B**). **A1–A3.** False-positive or pseudo-crossed aorta sign. **A1.** Crossed aorta sign (white arrow) in the apical view. **A2.** Echo shadow originating from the posterior aortic valve disc obliterates the retroaortic region at the base of the mitral leaflet when the presence of a “bleb sign” should be assessed (white arrow). **A3.** The opened mechanical aortic discs form parallel lines inside the aortic lumen in the long-axis parasternal view during systole (white arrow). **B1–B3.** Special version of a true positive crossed aorta sign (with coronary stent inside). **B1.** Crossed aorta sign (red arrow) in the apical view, image is formed by the retroaortic course of the circumflex CA which additionally has a stent implanted in its proximal part enhancing the image of the vessel wall (**B2**) Cross-section of the stented retroaortic circumflex artery is visible as hyperechogenic speckle in the aorto-mitral angle (red arrow) (**B3**) the same region examined with better resolution on transesophageal echocardiography shows very clearly cross-section of the anomalous circumflex artery with an implanted stent, forming a special version of stented “bleb sign” with the hypoechogenic vessel lumen inside the hyperechogenic ring (red arrow). **A4.** Normal origin and division of the left main CA on CT examination performed before Bentall surgery (green arrow). **A5.** Additional vessel coursing in the posterior region of the descending aorta visible in the contrast phase of the CT study assessed as a collateral vessel without clinical significance for coronary circulation — for this vessel, however, the probability of it being responsible for forming the crossed aorta sign was assessed by a radiologist as low (yellow arrow). **B4.** Coronary angiography of the patient with a true crossed aorta and bleb sign documenting the retroaortic course of the circumflex CA originating from the right CA. Some images shown in panels **B** were published previously in [1]

Abbreviations: CA, coronary artery; CT, computed tomography; RAC, retroaortic coronary artery

## Article information

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## REFERENCES

1. Wierzbowska-Drabik K, Kasprzak JD, Mrozowska-Peruga E, et al. Circumflex Origin from Right Coronary Artery – The Anomaly That Should Not Be Omitted during Echocardiography – “Crossed Aorta” and “Bleb Sign” Presentation after Stents Implantation. *Echocardiography*. 2016; 33(4): 659–660, doi: [10.1111/echo.13141](https://doi.org/10.1111/echo.13141), indexed in Pubmed: 26667990.
2. Witt CM, Elvert LA, Konik EA, et al. The RAC Sign: Retroaortic Anomalous Coronary Artery Visualization by Transthoracic Echocardiography. *JACC Cardiovasc Imaging*. 2018; 11(4): 648–649, doi: [10.1016/j.jcmg.2017.06.011](https://doi.org/10.1016/j.jcmg.2017.06.011), indexed in Pubmed: 28917682.
3. Wierzbowska-Drabik K, Szymczyk K, Kasprzak JD. Anomalous circumflex origin from the right coronary artery forming ‘bleb sign’ in transoesophageal echocardiography. *Eur Heart J Cardiovasc Imaging*. 2014; 15(8): 932, doi: [10.1093/ehjci/jeu025](https://doi.org/10.1093/ehjci/jeu025), indexed in Pubmed: 24578412.
4. Mancinelli A, Golino M, Miglierina E, et al. Three Echocardiographic Signs to Identify Anomalous Origin of the Circumflex Coronary Artery from the Right Sinus of Valsalva: A Case Report. *CASE (Phila)*. 2020; 4(5): 324–327, doi: [10.1016/j.case.2020.07.008](https://doi.org/10.1016/j.case.2020.07.008), indexed in Pubmed: 33117920.
5. Możeńska O, Buller P, Różańska M, et al. Anomalous origin and retroaortic course of the left circumflex artery: a mystery of a grownup patient with congenital heart disease solved after 15 years. *Kardiologia Pol*. 2021; 79(4): 475–476, doi: [10.33963/KP.15872](https://doi.org/10.33963/KP.15872), indexed in Pubmed: 33723976.