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

Short title: Crossed aorta sign: Differential diagnosis

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

57-year-old man treated surgically because of aortic aneurysm and regurgitation with the implantation of metallic bileaflet aortic valve SJM 27/28 with conduit, suffered the heart palpitation three months after surgery. At admission atrial fibrillation was diagnosed and TTE showed good function of aortic prosthesis, preserved left ventricular ejection fraction (LVEF), EF of 50% and mild impairment of right ventricular function. At apical views two parallel bright echo lines separated with 2–3 mm hypoechoic space were visible near the level of aortic annulus through the whole heart cycle (**Figure A1** and Supplementary material, *Video S1*). This image corresponded to “crossed aorta” sign, described later also as RAC sign with

estimated 63% sensitivity and 94% specificity for retroaortic course of CA diagnosis [1, 3]. Crossed aorta sign reflects long cross-section of CA and, if true positive, should be accompanied by “bleb sign” rendering short-axis of CA in parasternal long axis view in TTE or more clearly in transesophageal echocardiography, see [Figure B1–B4](#). [3] Our patient, however, did not present “bleb sign” and computed tomography (CT) done before surgery displayed normal origin of left CA from left Valsalva sinus, revealing, however, an additional vessel behind the proximal part of descending aorta, [Figure A2–A5](#) and Supplementary material, *Video S2*.

This vignette illustrates the situation when alleged crossed aorta sign or very similar manifestation did not correspond to anomalous origin of left or circumflex CA in patient after Bentall surgery and with an additional extracoronary, retroaortic vessel in CT and such circumstances should be taken into account since so far false positive RAC were ascribed only to the presence of valve and annulus calcifications [4]. On the other hand, the data is accumulating that retroaortic course of CA may, in many specific circumstances, pose significant health risk to the patients (related e.g. to ischemia or an increased risk during surgical procedures), underscoring the importance of echocardiographic screening based on wide knowledge of described signs and enabling in such a way 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 hypoechogenic center and moving synchronously with valve leaflets) and 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

Article information

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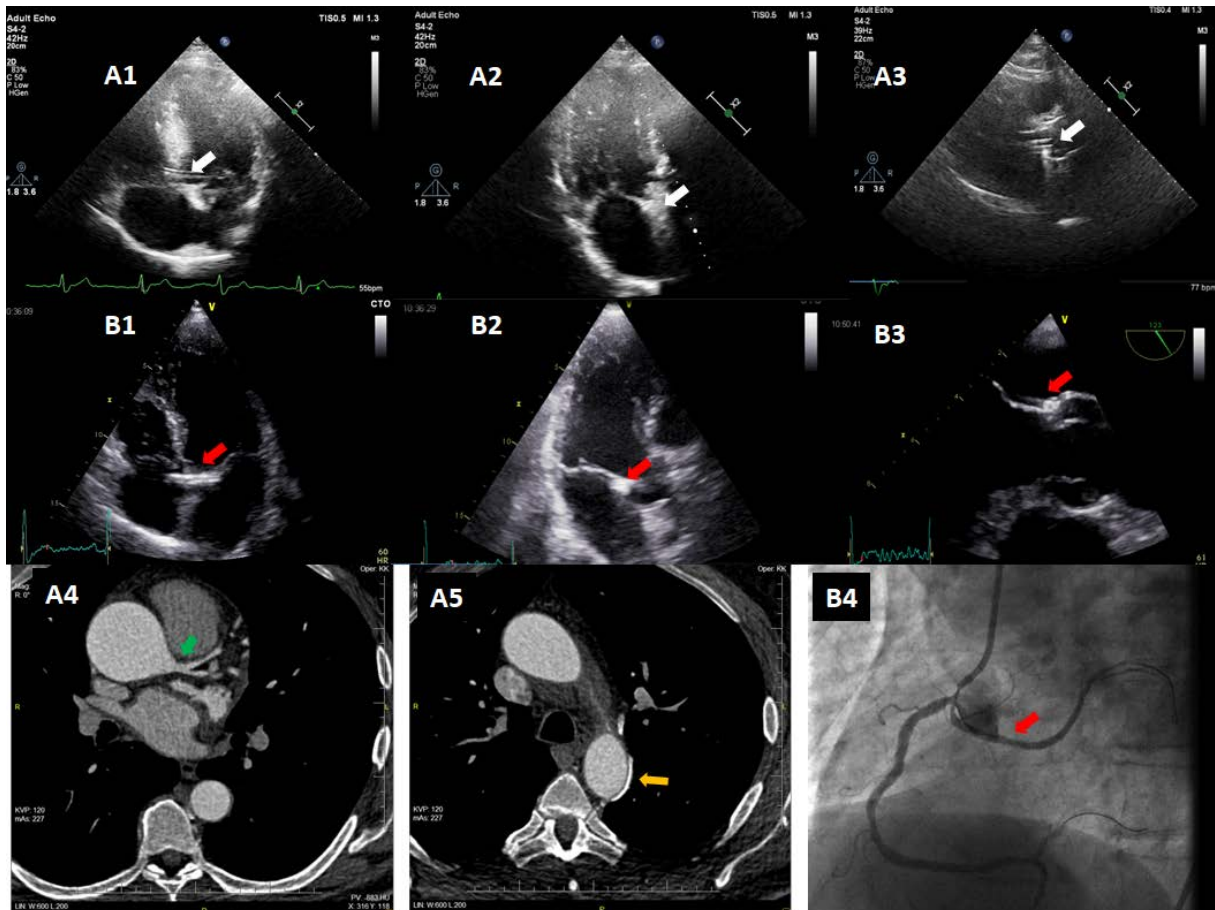


Figure 1. The apposition of the images in patient with the mechanical bileaflet aortic valve presenting “crossed aorta” sign despite normal anatomy of origin and proximal course of left CA (images denotes with A letter) with the images of other patient with anomalous origin of the circumflex CA from right coronary artery forming true positive for retroaortic course of CA “crossed aorta” or RAC sign as well as “bleb sign” in transesophageal study (images denoted by B letter). **A1–A3.** False-positive or pseudo crossed aorta sign. **A1.** Crossed aorta sign (white arrow) in apical view. **A2.** Echo shadow originated from the posterior aortic valve disc obliterates the retroaortic region at the base of mitral leaflet when the presence of “bleb sign” should be assessed (white arrow). **A3.** The opened mechanical aortic discs form parallel lines inside aortic lumen in long axis parasternal view during systole (white arrow). **B1–B3.** Special version of true positive crossed aorta sign (with coronary stent inside). **B1.** Crossed aorta sign (red arrow) in apical view, image is formed by retroaortic course of circumflex CA which additionally has a stent implanted in its proximal part enhancing the image of the vessel wall (**B2**) the cross-section of the stented retroaortic circumflex artery is visible as hyperechogenic speckle in the mitroaortic angle (red arrow) (**B3**) the same region examined

with better resolution in transesophageal echocardiography shows very clearly cross-section of anomalous circumflex artery with 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 in CT examination performed before Bentall surgery (green arrow). **A5.** Additional vessel coursing in posterior region of descending aorta visible in contrast phase of CT study assessed as some collateral vessel without clinical significance for coronary circulation — for this vessel the probability of being responsible of forming crossed aorta sign was however assessed by radiologist as low (yellow arrow). **B4.** The coronary angiography of patient with true crossed aorta and bleb sign documenting retroaortic course of circumflex CA originating from right CA.

Some images of the patient shown in B panels were published previously in [1]