

## Coronary Artery Bypass Surgery in Patients with Anomalous Circumflex Artery

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The anomalous origin of the circumflex artery (Cx) is uncommon and presents course variations that might make the coronary artery bypass surgery (CABG) difficult. Two patients presenting unstable angina were submitted to coronary angiography that disclosed tri-vessel disease and presence of Cx with an anomalous origin and retroaortic course with severe stenosis. Both patients underwent CABG with use of bilateral internal thoracic artery (ITA) grafts. Therefore, CABG with bilateral ITA use is feasible in cases of an anomalous origin of the Cx artery. However, this finding may constitute an additional technical setback.

### Introduction

Congenital abnormalities of the coronary arteries comprehend origin and course alterations, with the incidence of such anomalies being relatively low, ranging from 0.2% and 1.2% of the population<sup>1,2</sup>.

The anomalous circumflex artery (Cx) originating from the initial portion of the coronary artery or the right aortic sinus is found in 0.45% to 0.67% of the cases of coronary angiography and has been associated to a higher incidence of atherosclerosis and myocardial ischemia, which can result in sudden death<sup>2-4</sup>.

Variations in the course and anatomical characteristics of this anomalous circumflex artery can hinder the surgical revascularization of these vessels as these arteries always present a retroaortic course, which brings some additional technical difficulty. We report the surgical treatment of two anatomical variants of anomalous origin of the circumflex artery (Cx), where it was possible, in both cases, to perform the revascularization using bilateral internal thoracic artery (ITA) grafts.

### Case Report

Two male patients aged 51 and 56 years old, respectively, presenting a picture of unstable angina, were submitted to a

### Key words

Internal mammary-coronary artery anastomosis; coronary artery bypass; coronary arteriosclerosis; myocardial revascularization; mammary arteries.

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coronary angiography study that disclosed in both the existence of tri-vessel disease and the presence of anomalous origin of the Cx. In the first patient the Cx originated from the proximal portion of the right coronary artery, with a severe proximal obstructive injury (Figure 1A). In the second patient, the Cx originated from the separated ostium in the right aortic sinus and the stenosis was located in the mid-aortic segment (Figure 2A). As expected, both Cx presented a retroaortic course.

The patients were submitted to coronary artery bypass grafting (CABG). In the first patient, the Cx marginal branches in the lateral wall of the LV were fine-caliber vessels (<1 mm), preventing an adequate anastomosis. Therefore, the anomalous Cx was dissected since its origin in the right atrioventricular groove and along its retroaortic course in the transverse sinus. The ITA graft *in situ* was anastomosed to the Cx artery segment in the transverse sinus, from behind and beyond the aorta, without cardiopulmonary bypass (CPB) (Figure 1B). In the second patient, the location of the Cx injury was in the middle segment and the marginal branches of the LV lateral wall had adequate caliber. The right ITA graft *in situ*, going through a retroaortic course, was anastomosed to the marginal branch, with the conventional technique (Figure 2B). In both cases, the left anterior descending (LDA) artery was revascularized with the use of a left ITA graft and an additional vein graft to the posterior descending artery.

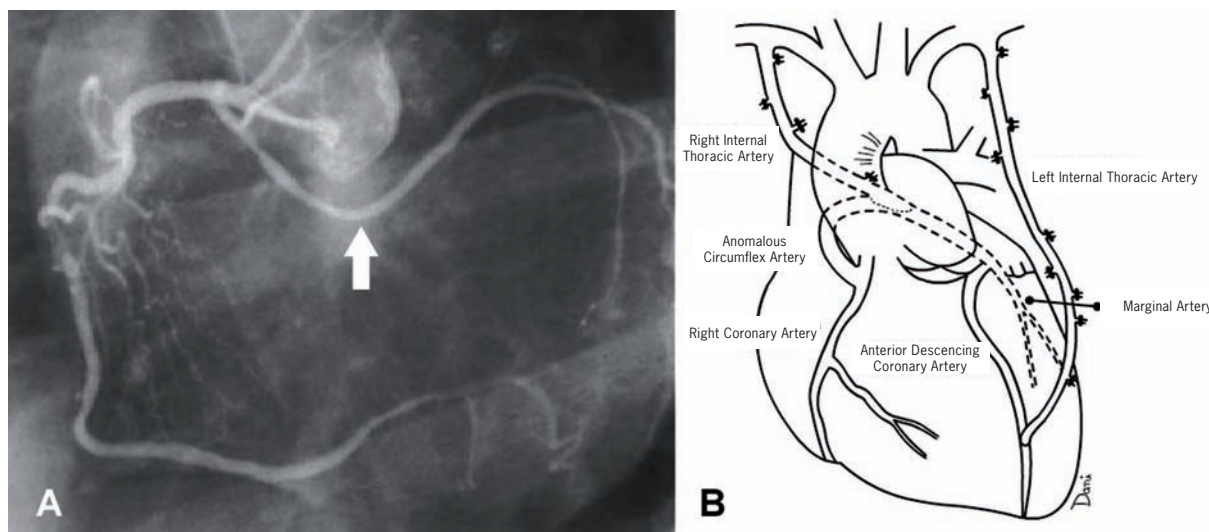
The patients presented a satisfactory post-surgical evolution with no complications and still currently being followed on an out-patient basis, with stable evolution.

### Discussion

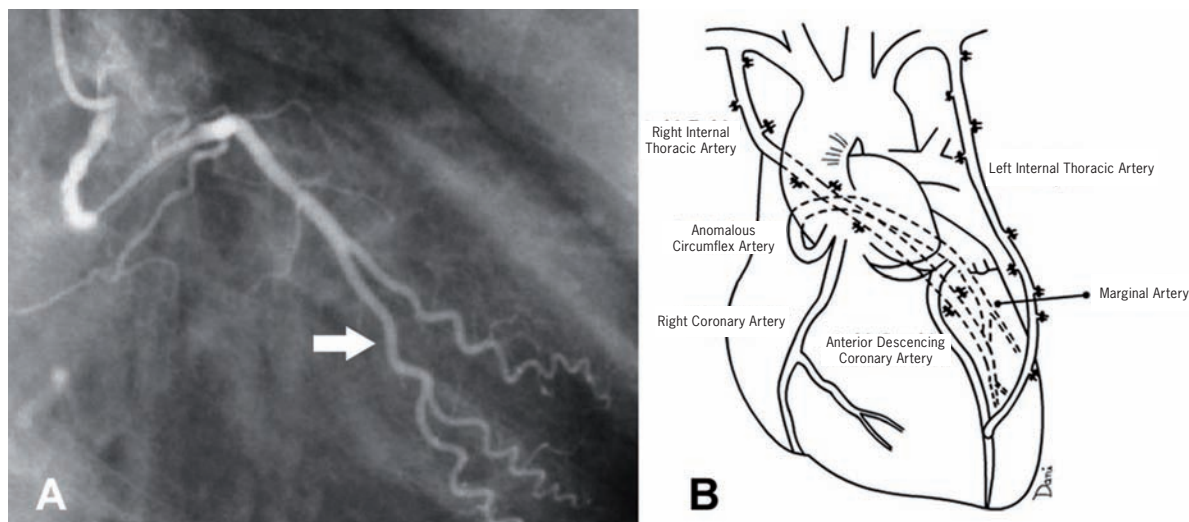
The anomalous Cx origin with retroaortic course is associated to sudden death due to myocardial ischemia. The retroaortic course of the initial segment of the anomalous Cx allows, under conditions of physical exertion or exercise, the compression by the aorta and ischemia<sup>2</sup>. The documented occurrence of spasm involving anomalous Cx has also been reported<sup>6</sup>.

Ueyama et al<sup>7</sup> studying the cases of anomalous origin of the Cx in a consecutive series of coronary angiographies, showed that in 35% of the cases the Cx originates from a separate ostium in the right aortic sinus, with the remainder of it coming-off as a branch of the right coronary artery. In all cases, the anomalous Cx had a retroaortic course before going through the left atrioventricular groove. This study also showed that 80% of the anomalous Cx had more than 2 mm in diameter between the origin and the beginning of the course in the left atrioventricular groove. However, after emerging from the left atrioventricular groove, 70% of the marginal branches measured less than 1.5 mm, the minimum possible

## Case Report



**Fig. 1** - Coronary angiography showing the circumflex artery originating from the right coronary artery. B. Schematic drawing showing the surgical technique employed in this case. The white arrow indicates the site of the anastomosis.



**Fig. 2** - Coronary angiography showing the circumflex artery originating from the separated ostium in the right aortic sinus. B. Schematic drawing showing the surgical technique employed in this case. The white arrow indicates the site of the anastomosis.

diameter to perform a coronary anastomosis with a venous or arterial graft<sup>7</sup>.

In both cases reported here, it was possible to use the right ITA *in situ* to perform the revascularization of the Cx through the transverse sinus, in one case, without CPB. This technique allows the joining of two great recent advances in CABG, i.e., the technique without ECC and the use of a bilateral ITA graft for the left coronary system<sup>8</sup>.

In the first case, the right ITA had to be anastomosed to the Cx along its retroaortic course, just after the atherosclerotic obstruction, due to the small caliber of the marginal branches. In the second case, it was possible to use to conventional

technique, with the revascularization of the marginal artery on the lateral wall with the right ITA graft.

Compared to the conventional technique, off-pump CABG is associated with a better immediate outcome, with lower perioperative morbidity and a significant decrease in costs<sup>9</sup>. The bilateral use of the ITA grafts brings additional benefits, decreasing the incidence of cardiovascular events and increasing long-term survival, when compared to the single use of the ITA<sup>10</sup>. This significant benefit occurs when both ITAs are used for the revascularization of the left coronary system and are observed even in sub-groups of higher-risk patients, such as diabetic patients, the elderly and those with

ventricular dysfunction<sup>10</sup>.

In conclusion, the complete CABG is feasible in cases of anomalous origin of the Cx, with the use of bilateral ITA grafts. However, this variation may constitute an additional technical difficulty for the surgeon, as it presents unexpected anatomical details. The techniques employed here showed to be effective

in the treatment of the different presentations of the Cx with an anomalous origin.

#### Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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