

PERCUTANEOUS CORONARY INTERVENTION WITH STENT DEPLOYMENT IN ANOMALOUSLY ARISING CORONARY ARTERIES

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ΕΛΛΗΝΙΚΟ ΙΝΣΤΙΤΟΥΤΟ ΚΑΡΔΙΑΓΓΕΙΑΚΩΝ ΝΟΣΗΜΑΤΩΝ

Background

- **Coronary artery anomalies are usually benign and discovered as incidental findings during coronary angiography for suspected coronary artery disease.**
- **Estimated incidence in adult angiographic series 0.2–1.3% (in patients without other congenital cardiac malformations).**
- **PCI in anomalous coronary arteries poses certain technical difficulties, particularly in selectively cannulating the diseased vessel and coaxial positioning of the guiding catheter for optimum stability, in order to aid wire and device passage into these tortuous arteries.**



TABLE II. Incidence of Coronary Artery Anomalies, Angiographic Series

Author (ref.)	Total no. patients	Anomalies	Incidence (%)
Liberthson (8)	Not stated	21	0.6
Engel (9)	4,250	51	1.2
Chaitman (10)	3,750	31	0.83
Baltaxe (11)	1,000	9	0.9
Kimbiris (12)	7,000	45	0.64
Donaldson (13)	9,153	82	0.9
Hobbs (14) ^a	38,703	601	1.55
Wilkins (15)	10,661	83	0.78
Yamanaka	126,595	1,686	1.3

^aThis is an earlier subgroup of this series of patients.



Materials & Methods

- **We retrospectively analyzed the records of seven patients, who underwent PCI with Drug-Eluting Stent implantation in anomalous coronary arteries at the Euromedica – Kyanous Stavros Hospital in Thessaloniki from 1/1/2003 till 31/6/2009.**
- **In this single-center study particular reference is given to technical aspects of the PCI procedure itself and to the anatomy of the anomalous arteries.**
- **MACE rate examined (Death, Myocardial Infarction, Target Vessel Revascularisation).**



Isolated Coronary Artery Anomalies* (n= 4.535)

	<u>No.</u>	<u>Incidence</u> <u>(%)</u>	<u>(%)</u>
<u>Benign</u>			
Cx from Right SoV	19	0.42	31.1
Separate origin of Cx and LAD in Left SoV	16	0.35	26.2
RCA from ascending aorta	14	0.31	22.9
Absent CX ("super-dominant RCA")	3	0.06	4.9
Small coronary artery fistulae	4	0.09	6.5
Total	56	1.25	91.6

Potentially serious

RCA from Left SoV	3	0.06	4.9
Single coronary artery from Right SoV (R/II/S type)	2	0.04	3.3
Total	5	0.10	8.2

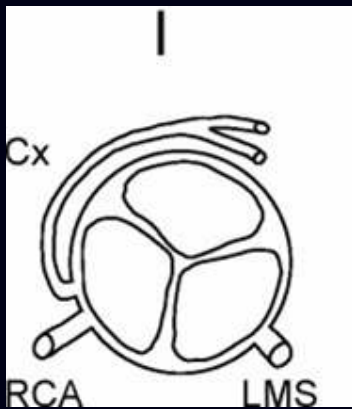
*LAD, left anterior descending; CX, circumflex; RCA, right coronary artery; SoV, sinus of Valsalva.



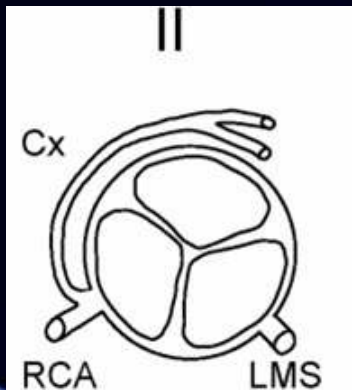
Results

- 4 patients (males, aged 34, 66, 68 and 76 y.o.) had PCI in an anomalously arising Cx from the right SoV.
- In 3 cases the target lesion was in the proximal, retroaortic portion of the anomalous vessel, whilst in the remaining case the target was the principal obtuse marginal branch.
- Judkins and Amplatz right guiding catheters were suitable for these interventions, whilst in one case we employed a two-wire strategy (as described by Das and Wysham) using a wire passed into the RCA to enhance guiding catheter stability, in order to facilitate the passage of a second wire into the anomalous Cx.

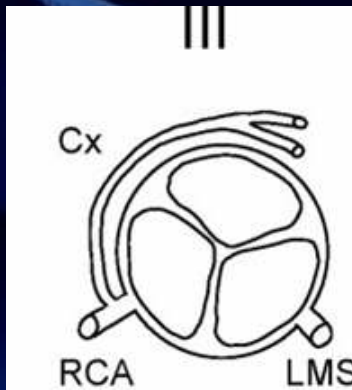




Two patients had separate ostia for RCA and Cx within the Right SoV (type I)



In one patient RCA and Cx had common ostia in the Right SoV (type II)



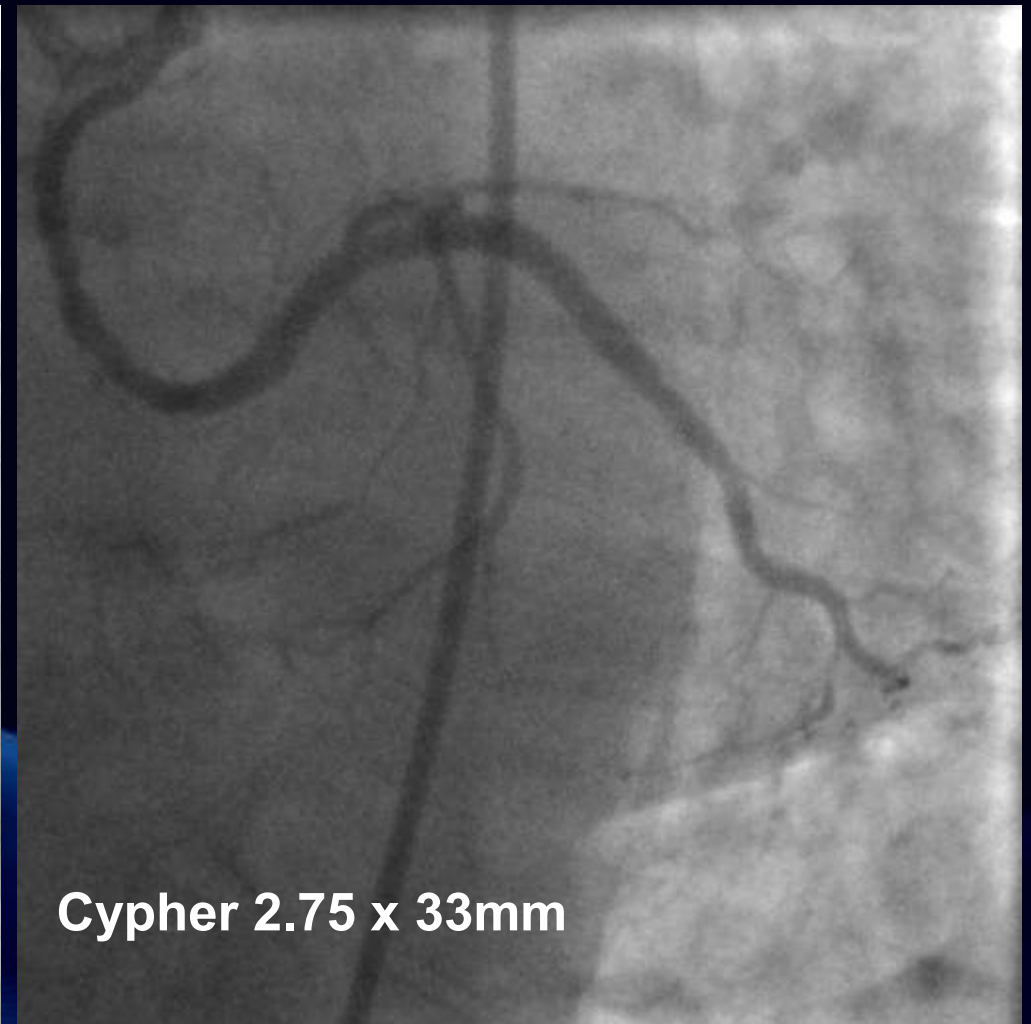
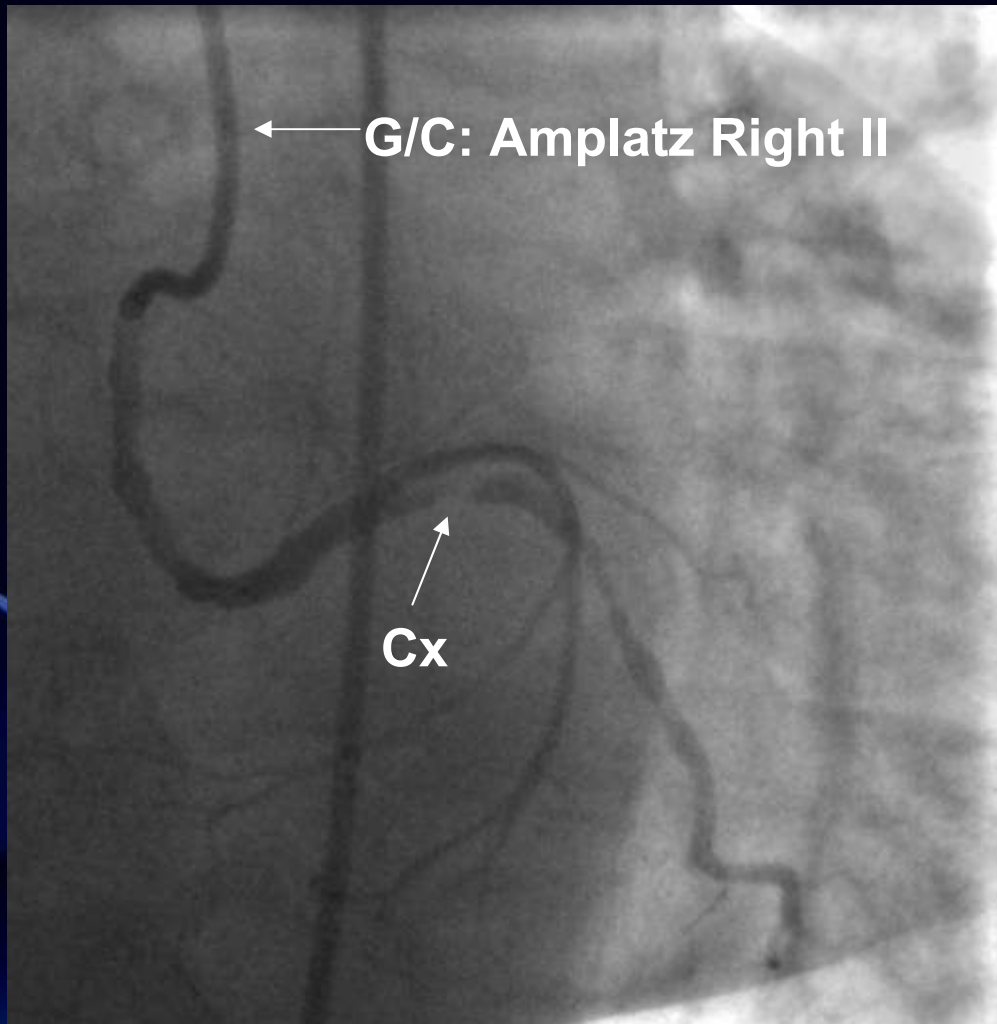
One patient had the anomalous Cx arising as a branch from the proximal RCA (type III)



Case 1, Anomalous Cx from Right SoV

C/C: Critical stenosis in anomalous Cx

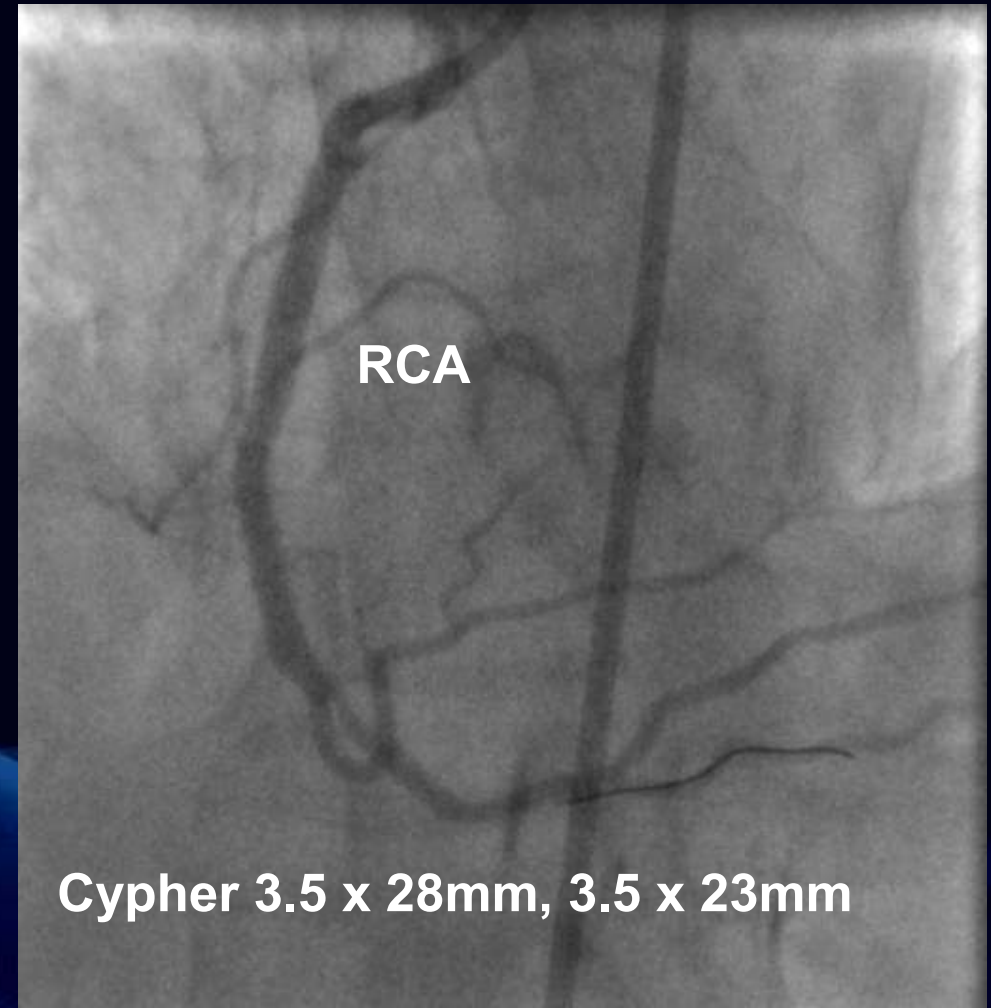
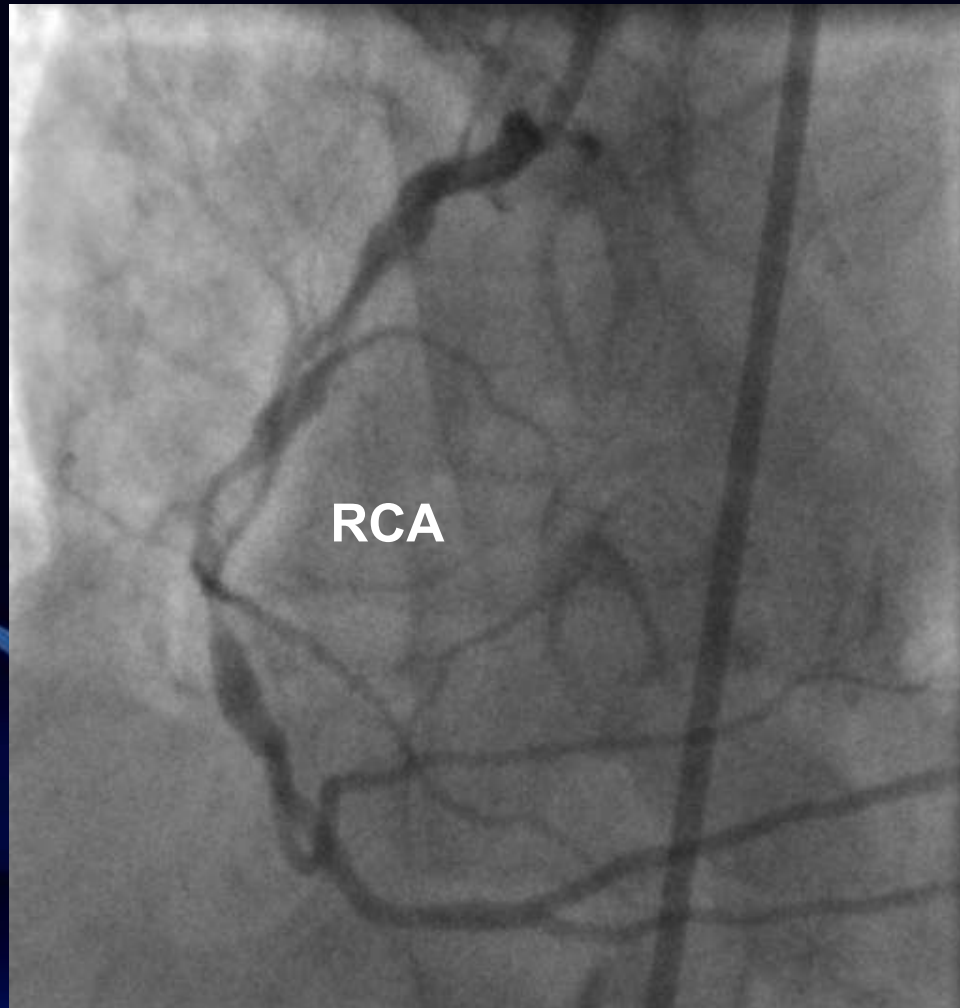
Final result post PCI



Case 1, Anomalous Cx from Right SoV

C/C: Severe, long lesion in RCA

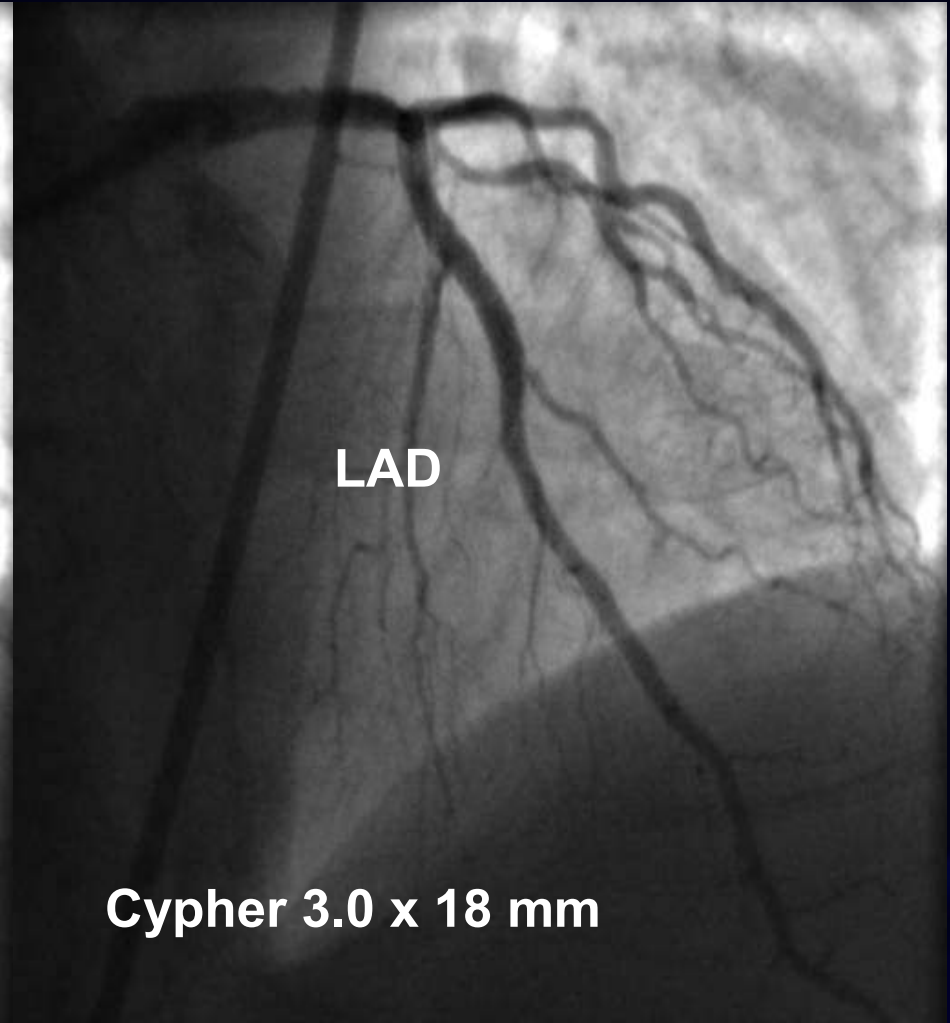
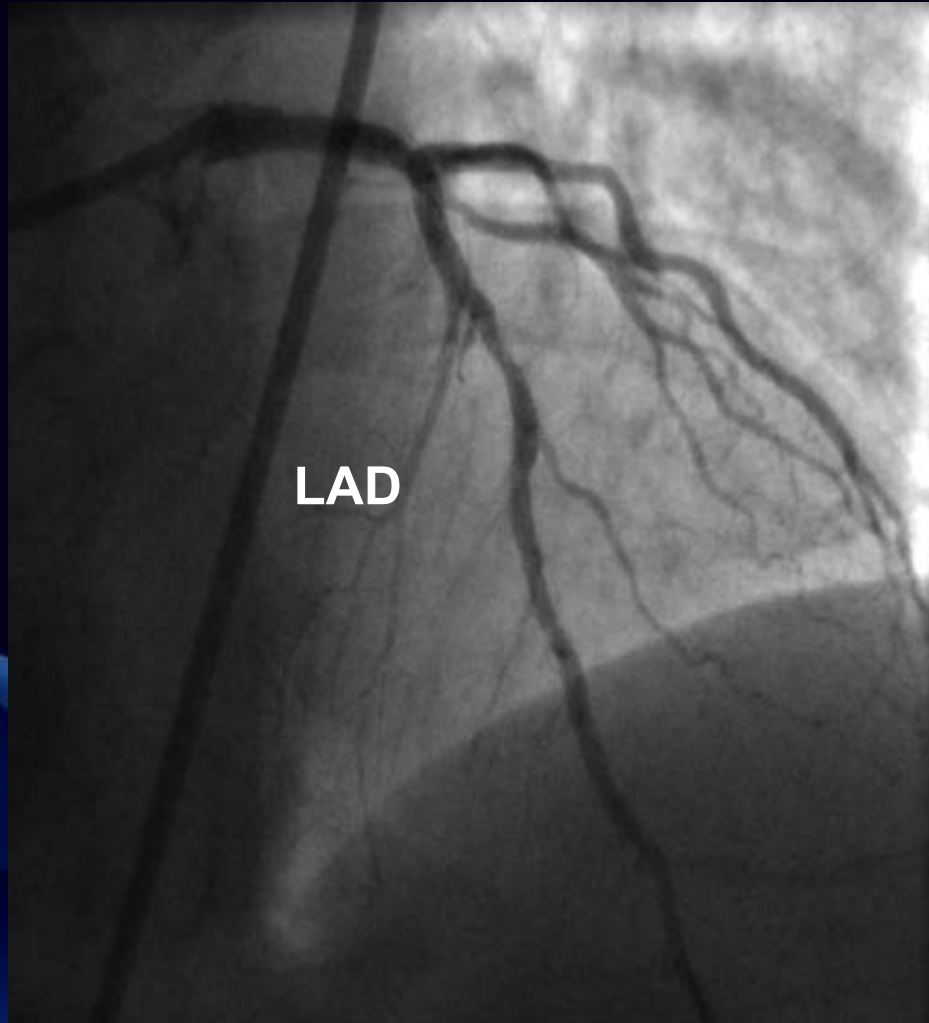
Final result post PCI



Case 1, Anomalous Cx from Right SoV

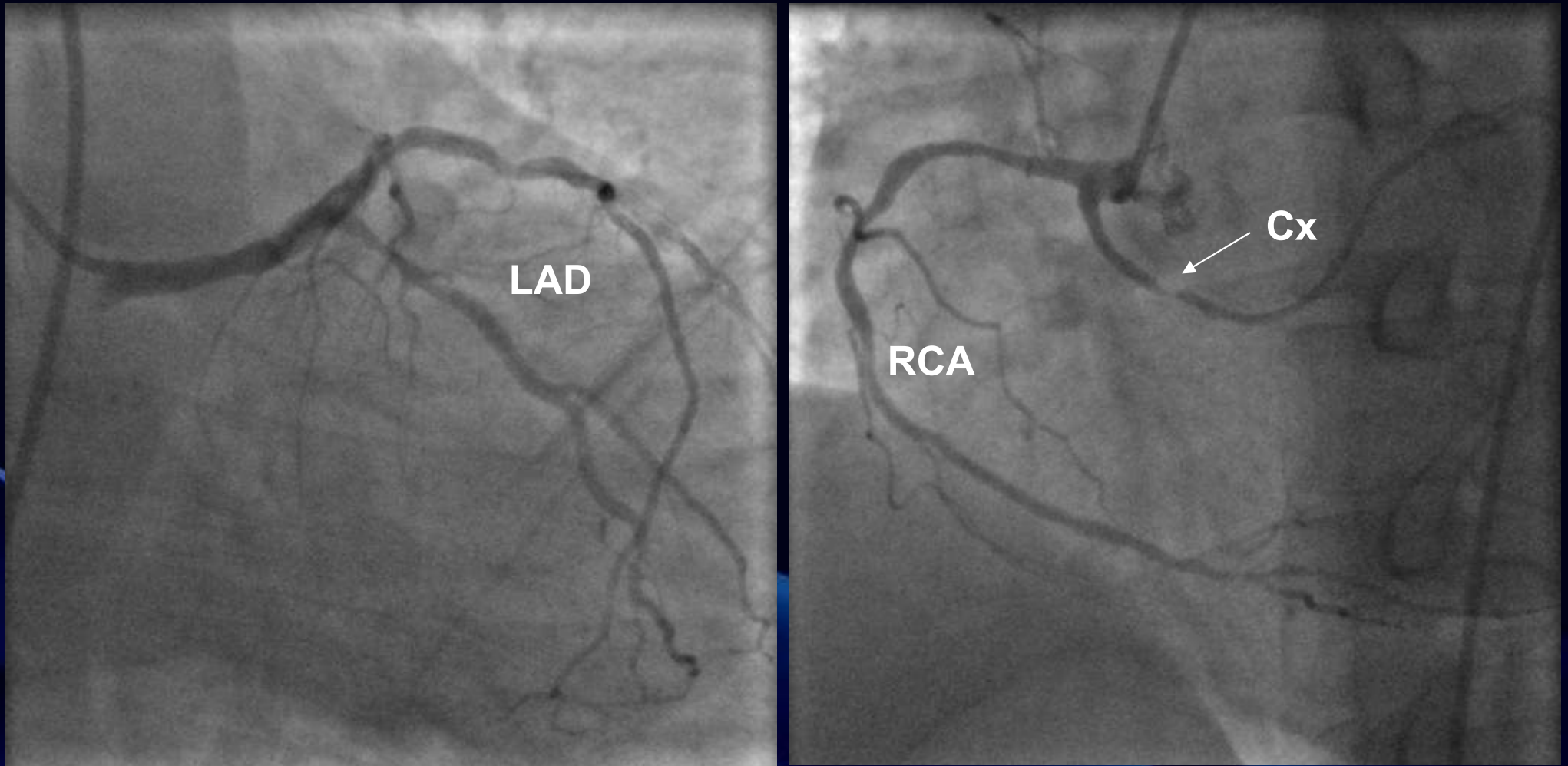
C/C: Severe stenosis in mid LAD

Final result post PCI



Case 2, Anomalous Cx from Right SoV

Diagnostic Coronary Angiogram



Case 2, Anomalous Cx from Right SoV

Immediate result post PCI

← G/C: Judkins Right 4

Cx

Taxus 2.5 x 12mm

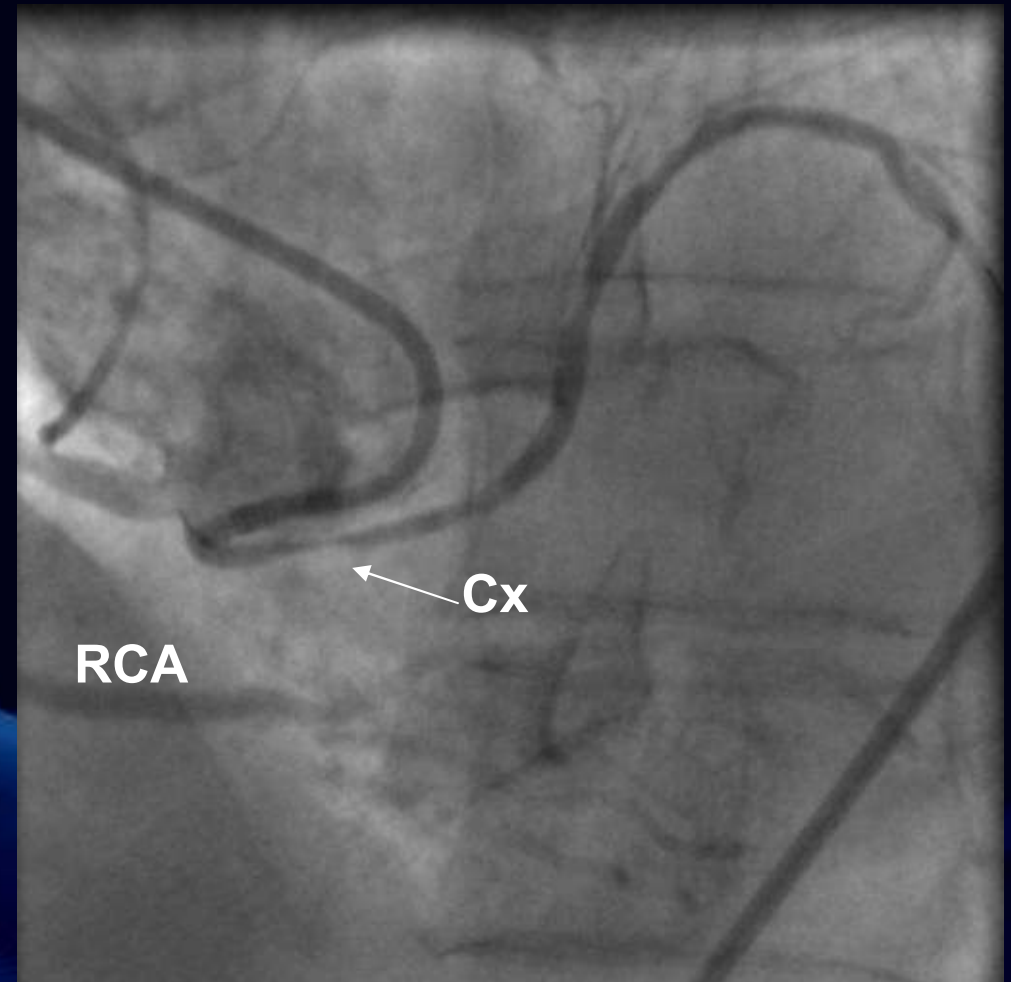
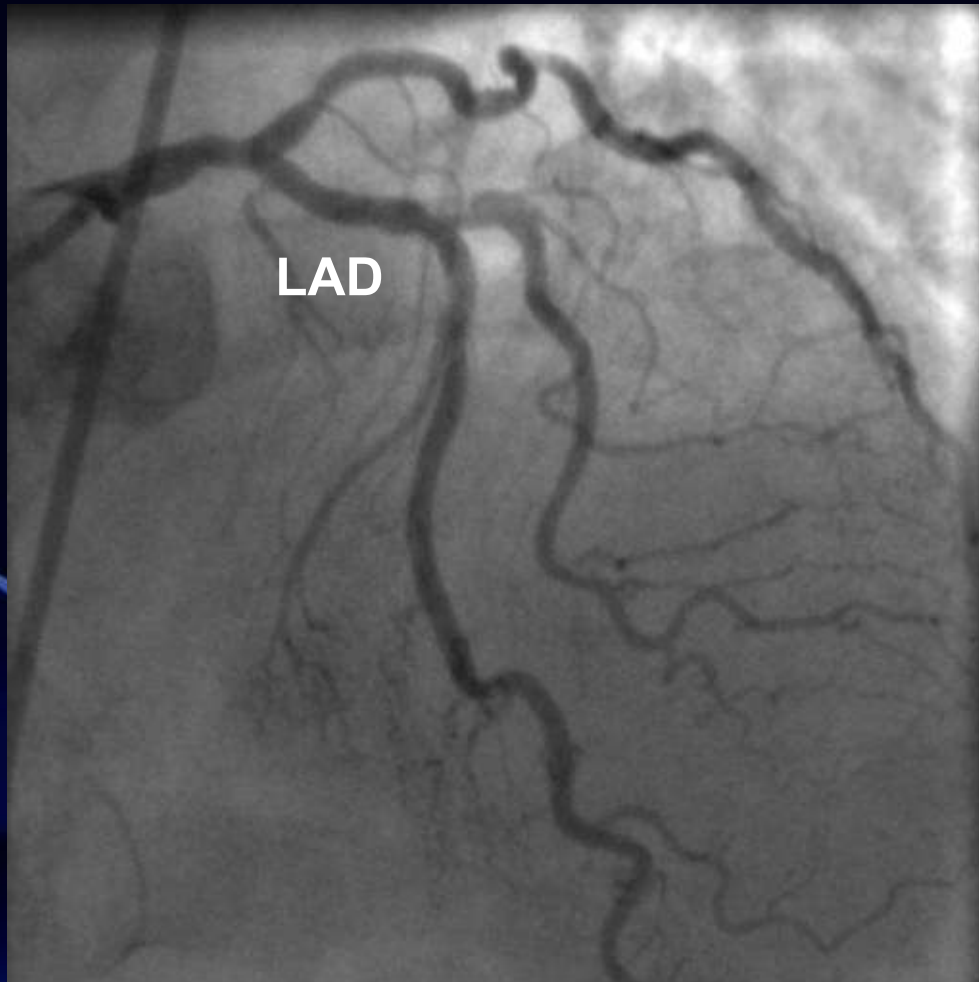
23 months post PCI

Cx



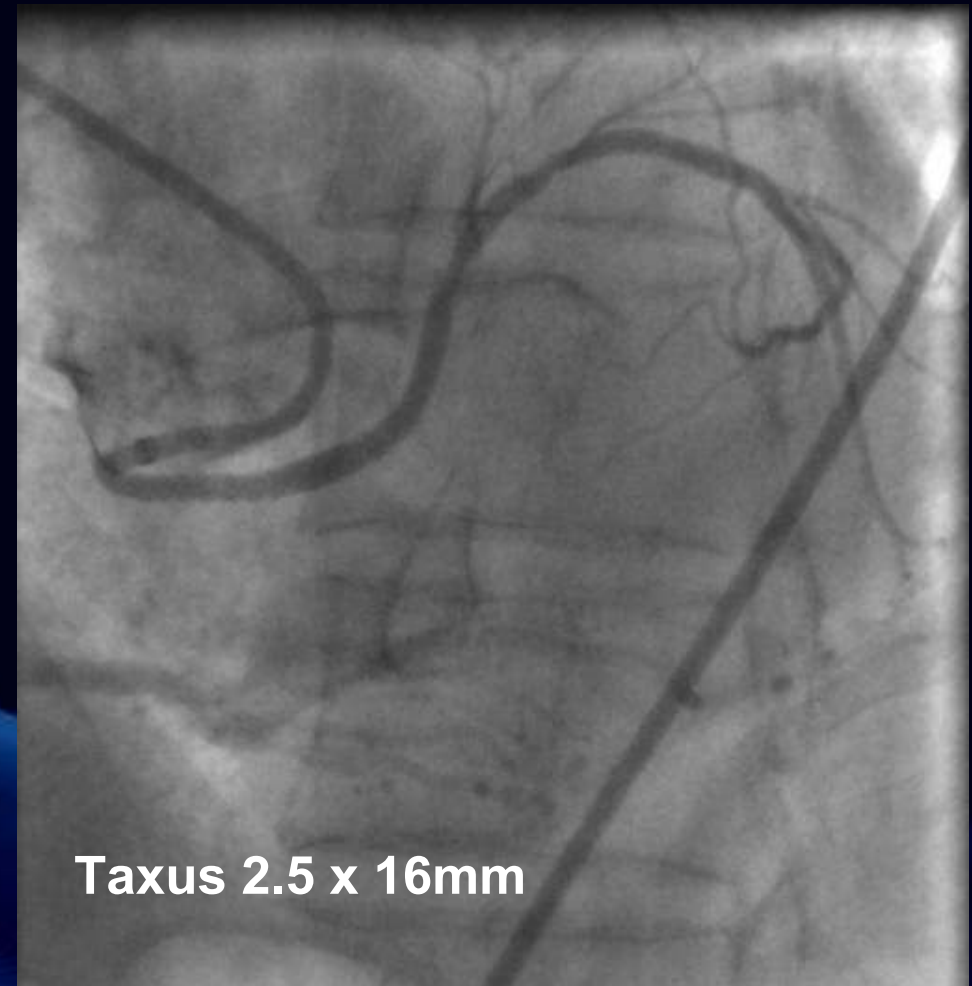
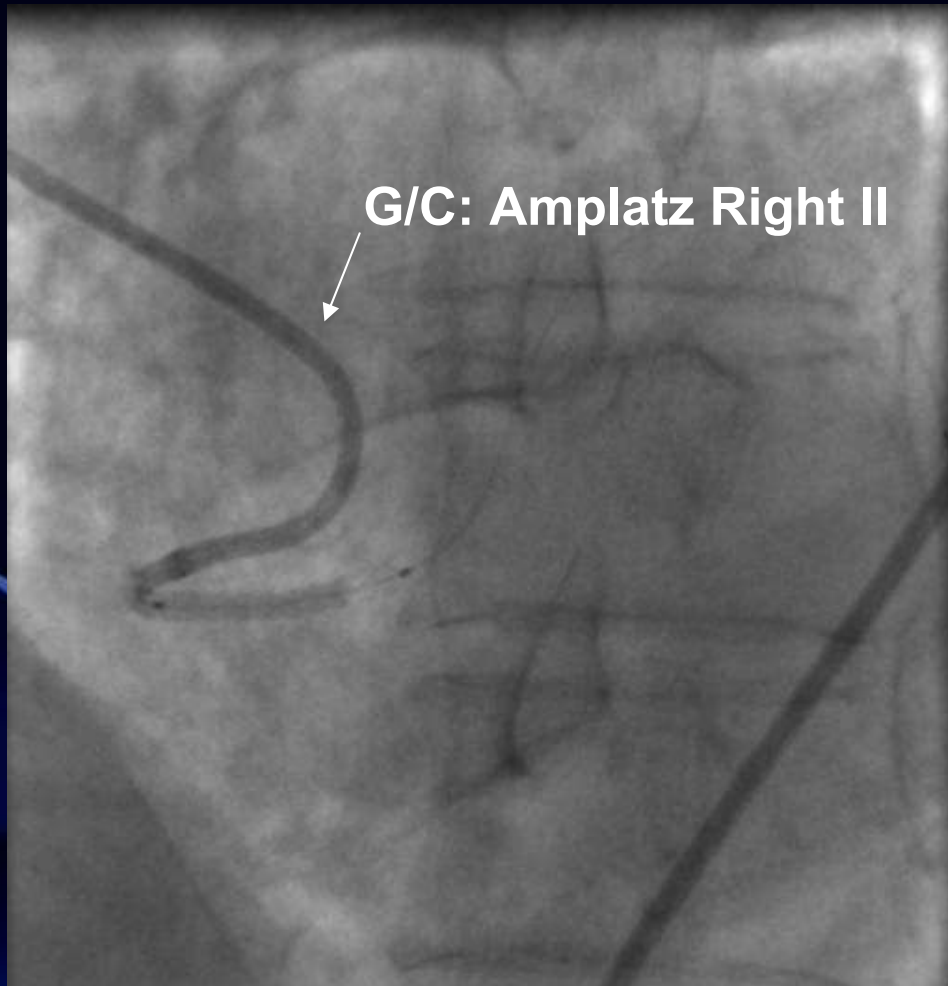
Case 3, Anomalous Cx from Right SoV

Diagnostic Coronary Angiogram



Case 3, Anomalous Cx from Right SoV

Final result post PCI



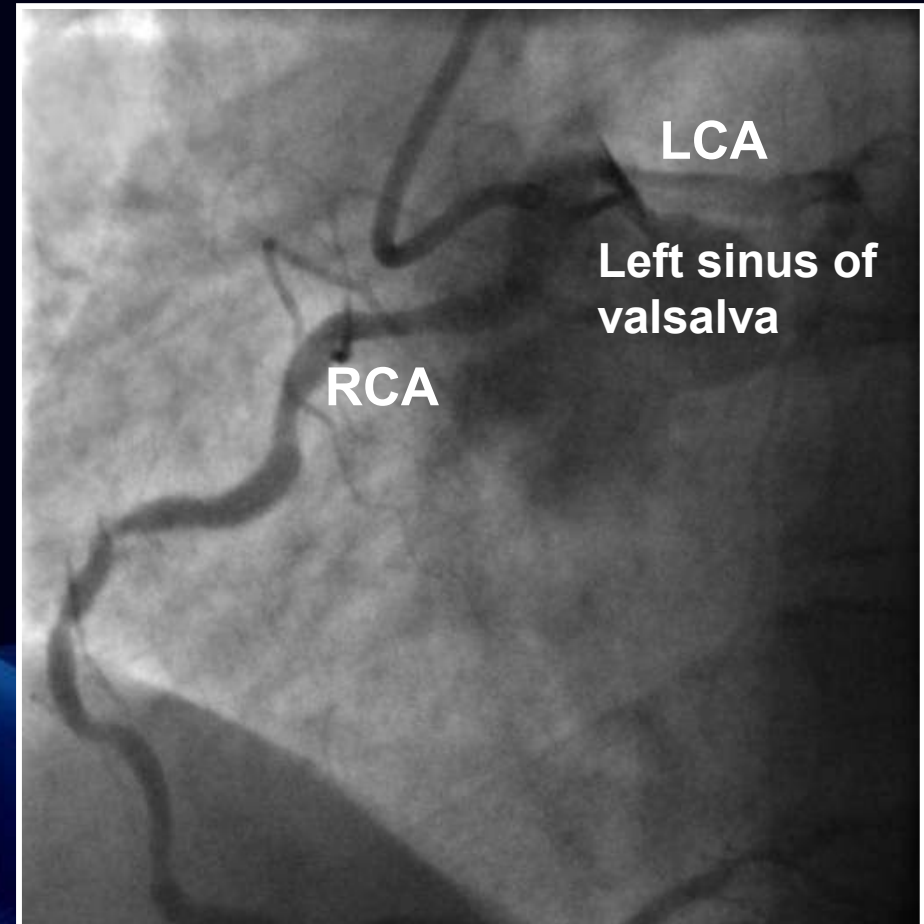
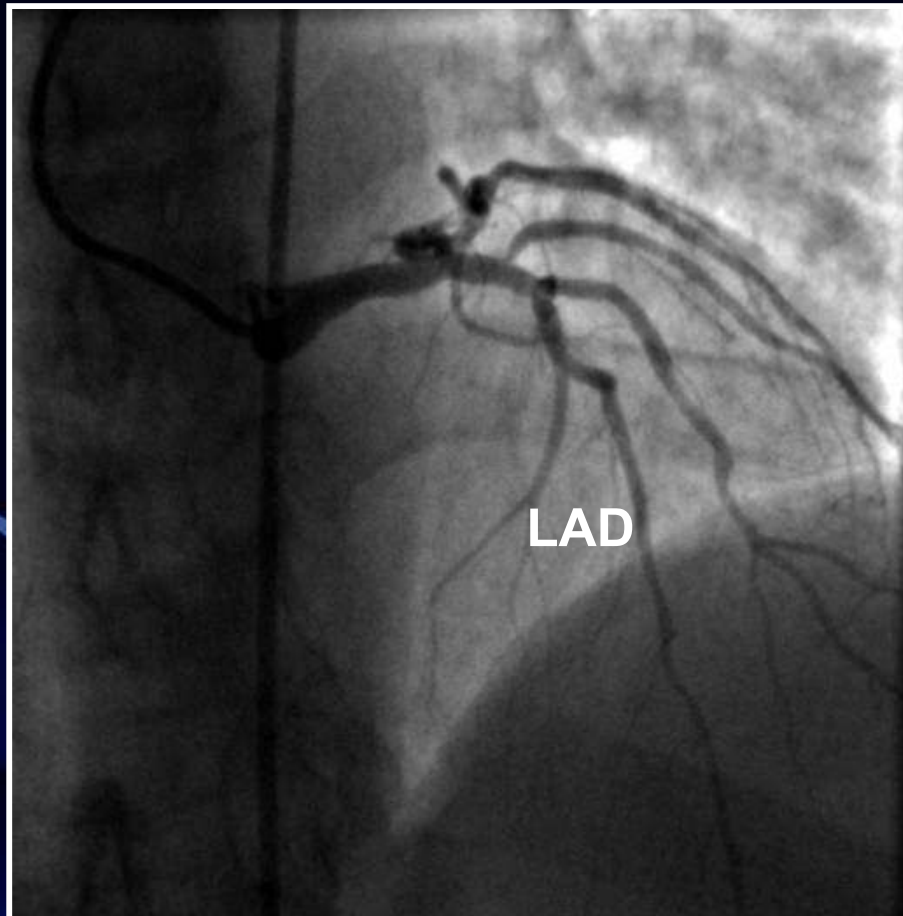
Results

- **2 patients (males, 46 and 59 y.o.) with an anomalous RCA arising from the left SoV were also treated percutaneously.**
- **AL II guiding catheter was used in both cases.**
- **In one case the RCA was totally occluded at its midsegment and we used a hydrophilic wire and the anchoring technique to facilitate its crossing to the distal vessel.**



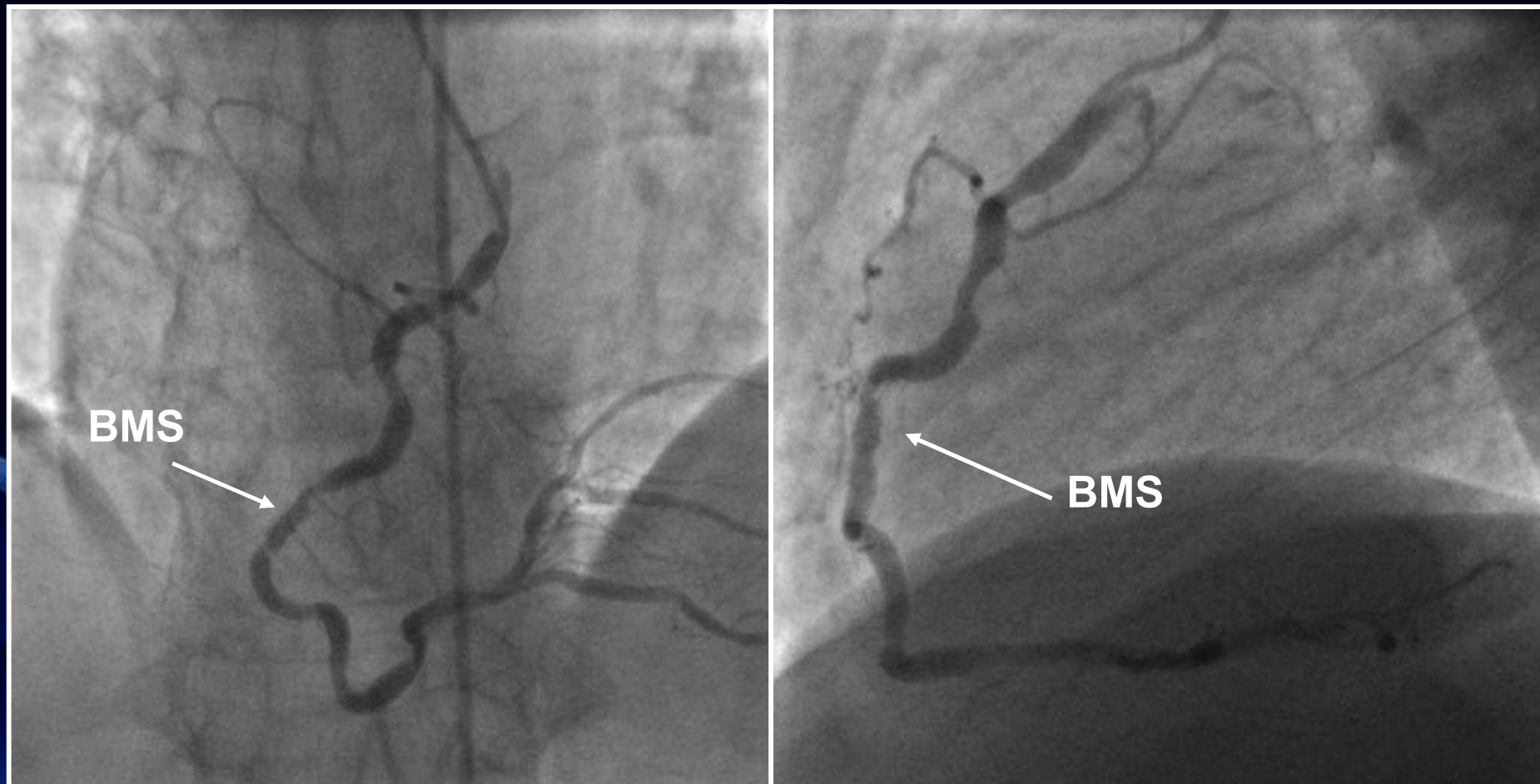
Case 1, Anomalous RCA from Left SoV

Diagnostic Coronary Angiogram

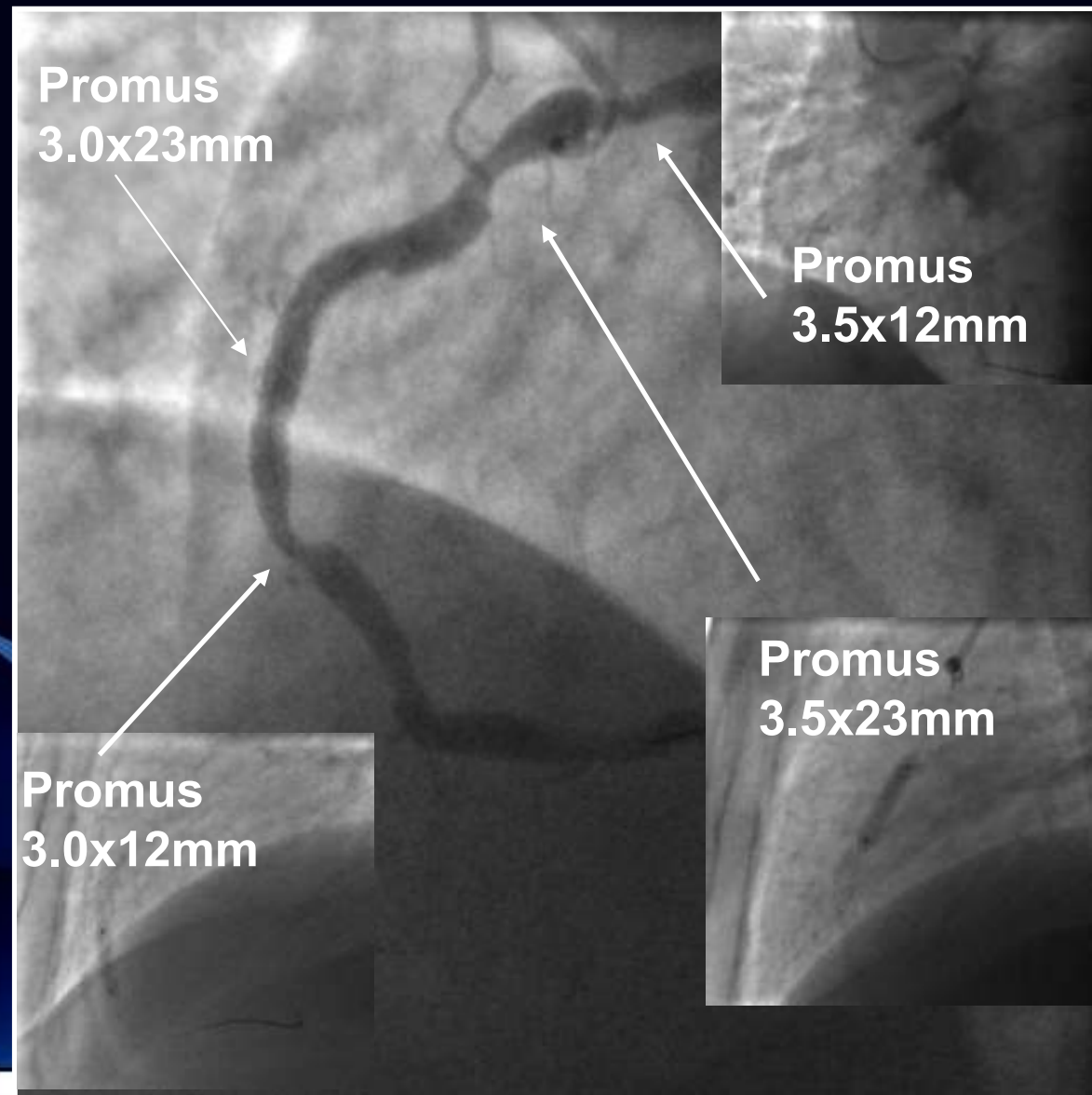


Case 1, Anomalous RCA from Left SoV

Severe proximal lesions in RCA and restenosis of a previously implanted Bare Metal Stent.



Case 1, Anomalous RCA from Left SoV



G/C: Amplatz Left II

G/W: BHW



Case 1, Anomalous RCA from Left SoV

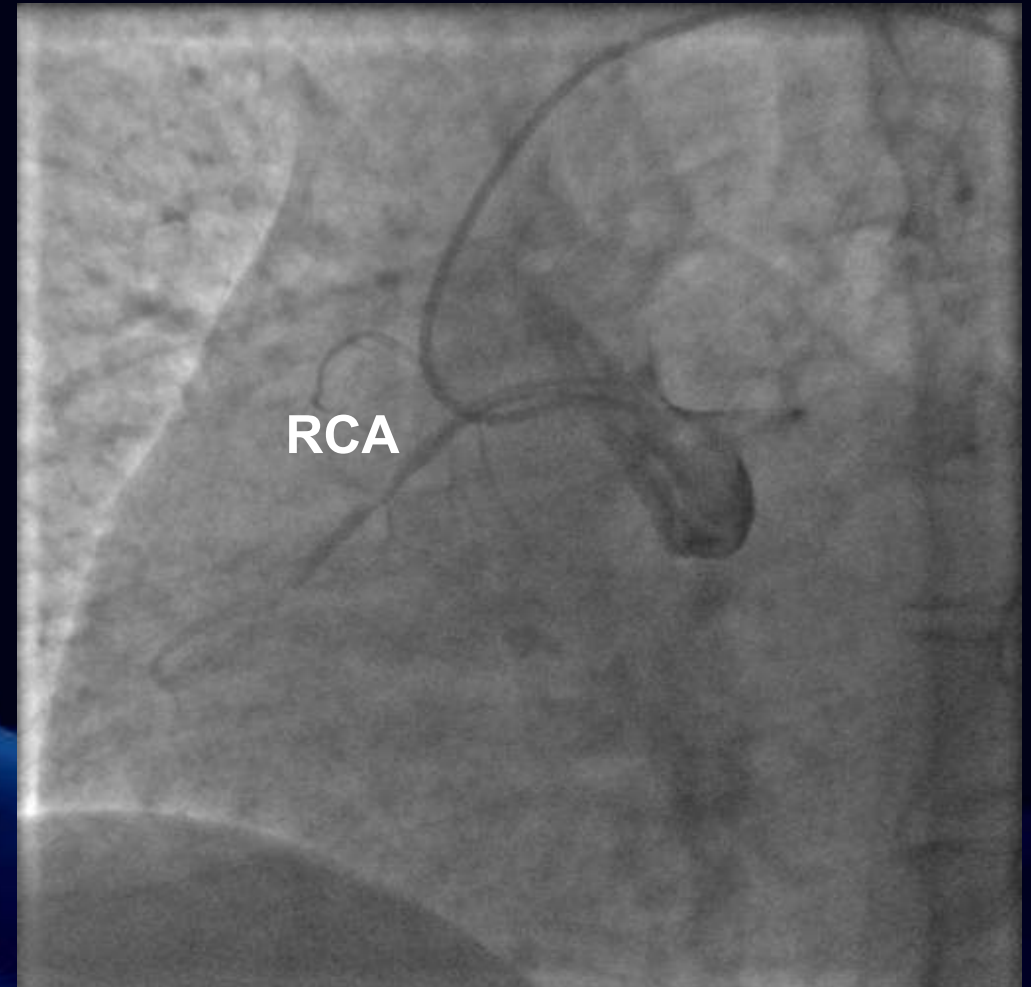
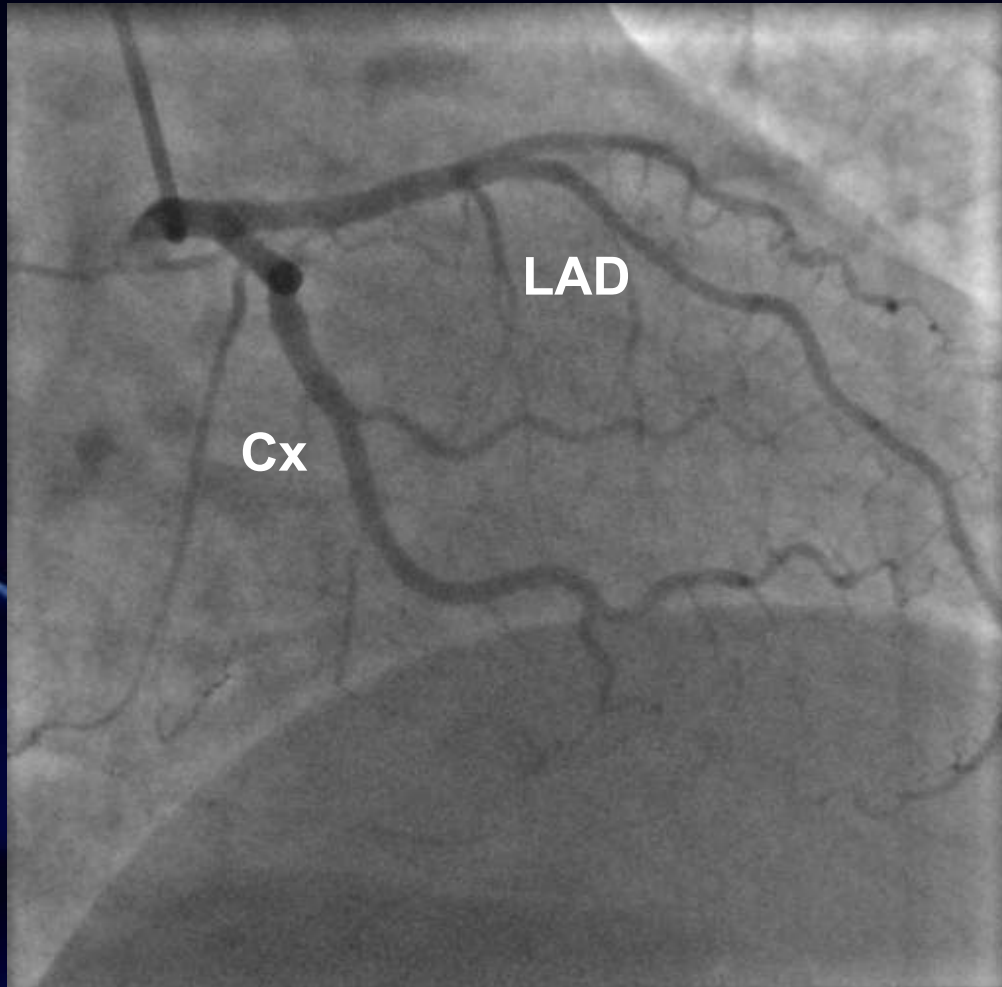
Final result post PCI



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Case 2, Anomalous RCA from Left SoV

Diagnostic Coronary Angiogram



Case 2, Anomalous RCA from Left SoV

Final result post PCI

G/C: Amplatz Left II

G/W: BHW

Taxus 2.75x32mm, 2.75x16mm, 2.5x24mm,
2.25x24mm, 2.25x16mm (Full Metal Jacket).



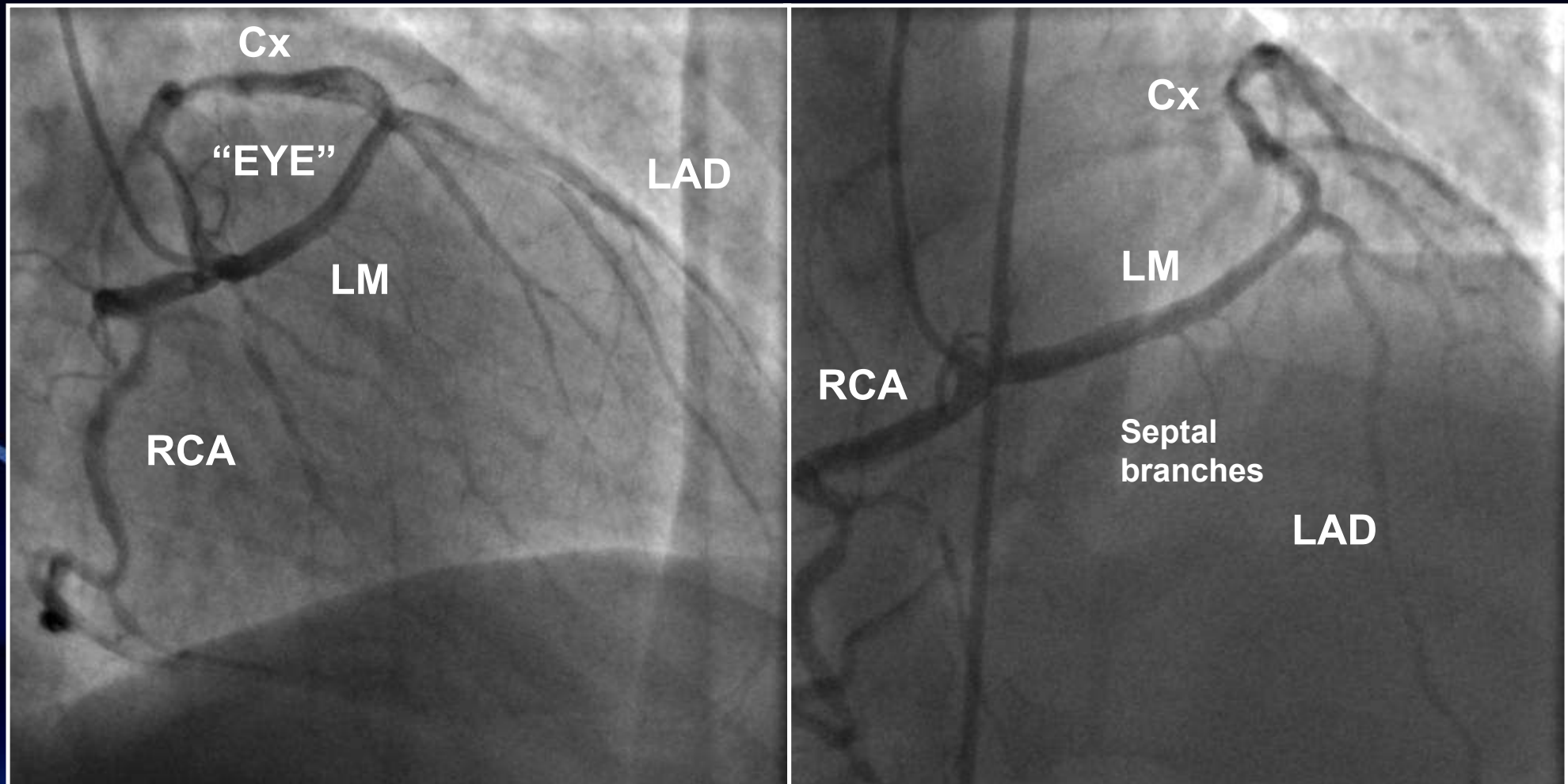
Results

- **1 patient (male, 52 y.o.) with Single Coronary Artery arising from the right SoV underwent PCI for a severe lesion of the Cx.**
- **ART 4 SH guiding catheter provided good back-up support.**



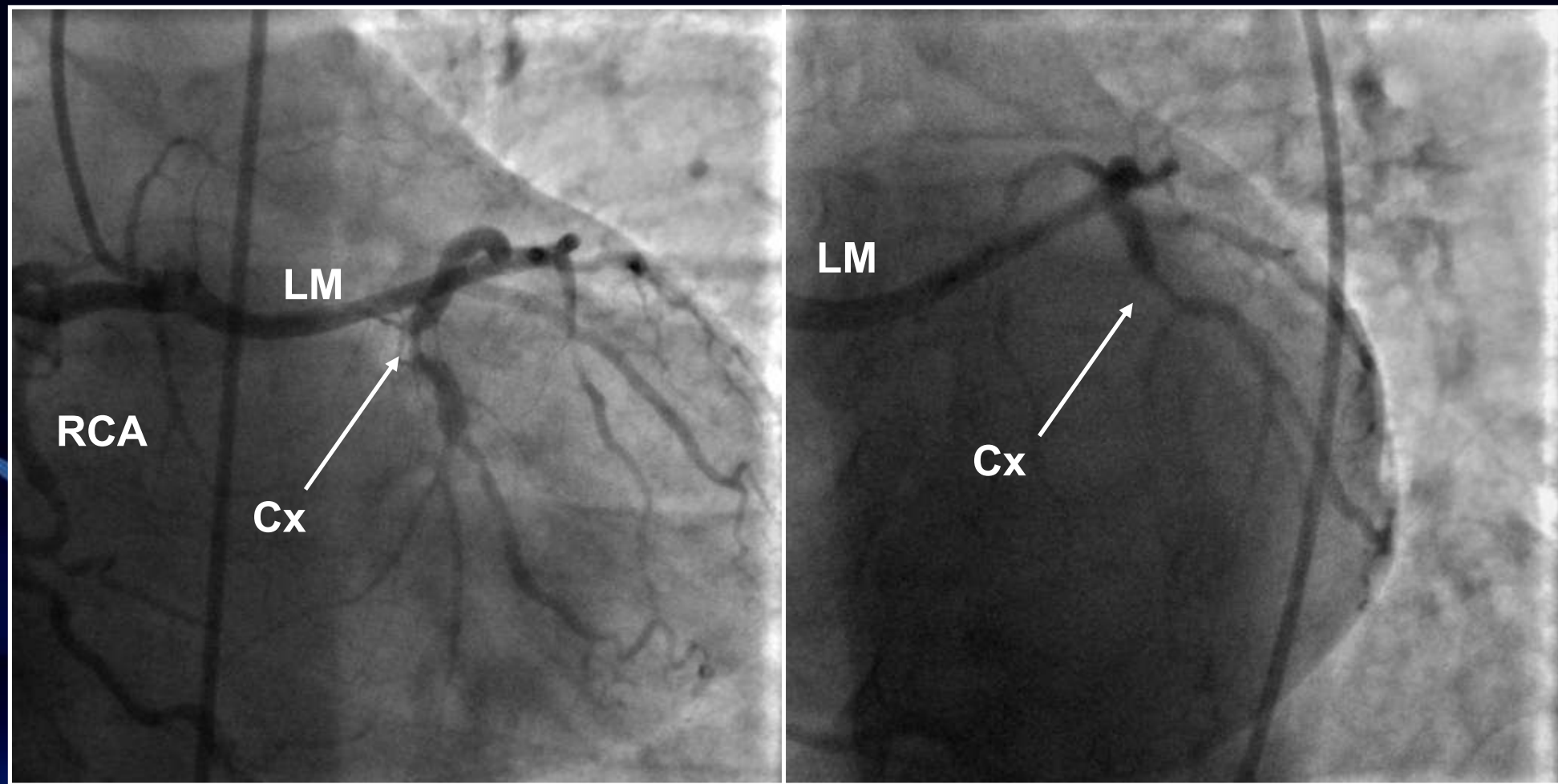
Case 1, Anomalous LM from Right SoV

Single Coronary Artery, Left Main has an intraseptal course prior to its bifurcation



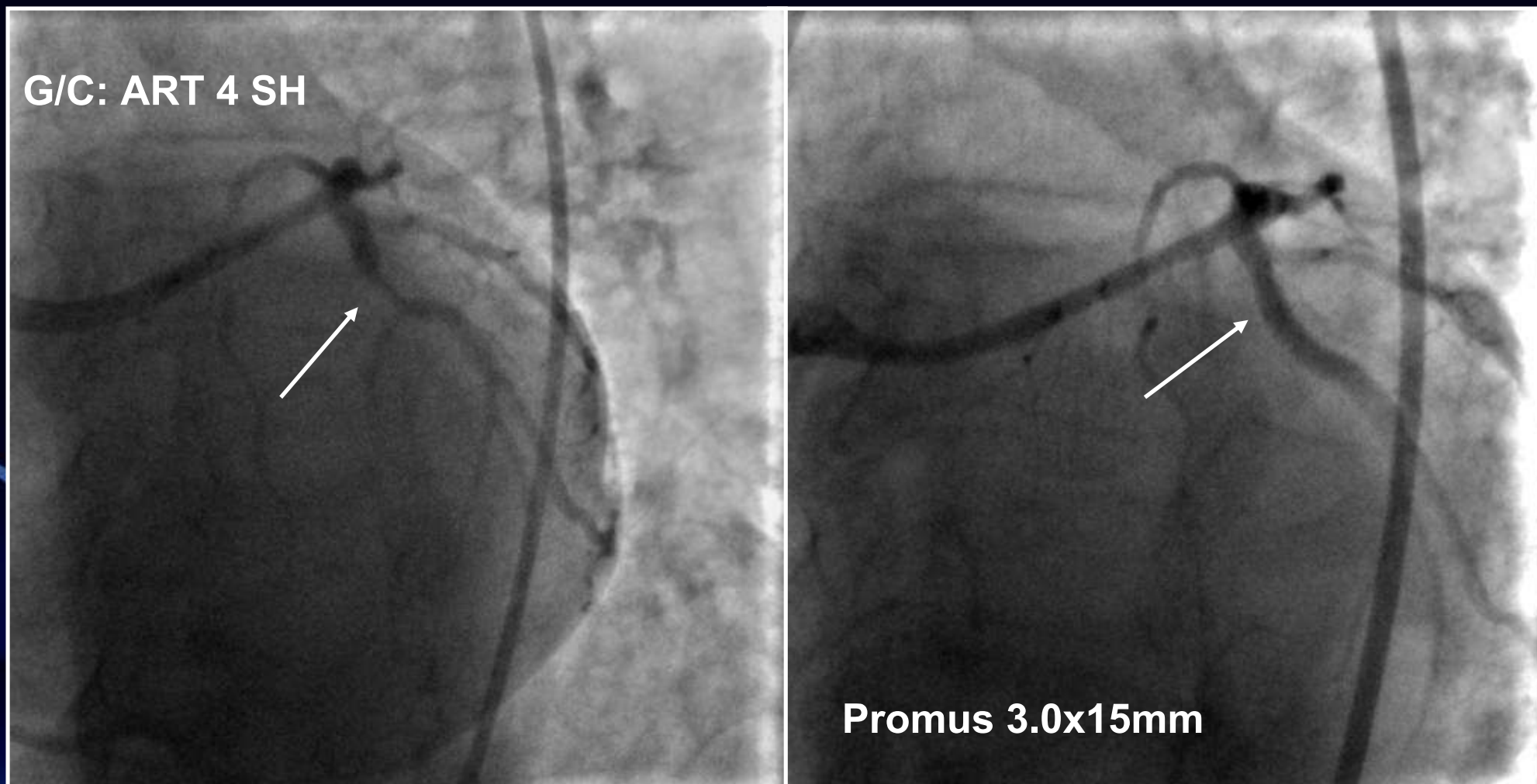
Case 1, Anomalous LM from Right SoV

Severe stenosis of the Circumflex artery



Case 1, Anomalous LM from Right SoV

Final result post PCI



Case 1, Anomalous LM from Right SoV

Final result post PCI



In 1979 Lipton et al proposed a very useful angiographic classification further modified in 1990 by Yamanaka and Hobbs

'R' (right)-type / 'L' (left)-type according to the site of origin of the single coronary artery, i.e. in the right or left SoV.

In group I the artery follows the anatomical course of either a right or left coronary artery.

In group II one coronary artery arises from the proximal part of the normally located other coronary artery i.e. the right one in the R-II type and the left one in the L-II type.

In group III the left anterior descending artery and the Cx arise separately from the proximal part of the normal coronary artery



The final designation refers to the course of the anomalous arteries in groups II and III from one to the other side of the heart:

‘A’ denotes course anterior to the great vessels

‘P’ a course posterior to the great vessels.

‘B’ indicates course between the aorta and the pulmonary artery

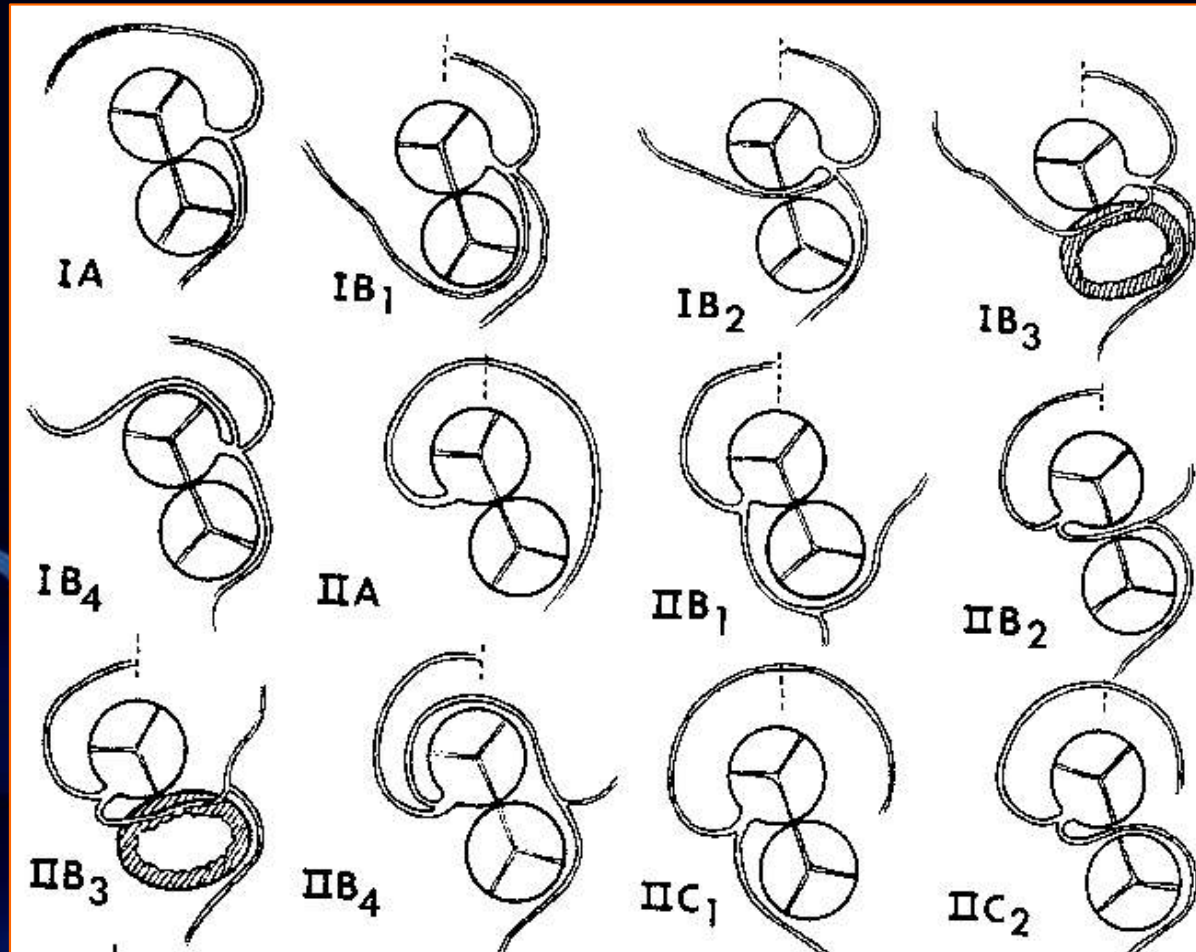
‘S’ is used when part of the route is through the interventricular septum

‘C’ finally stands for a combination of diverse routes



Classification by Shirani and Roberts

An ostium originating from left aortic sinus is type I, and if arises from the right aortic sinus, it is type II

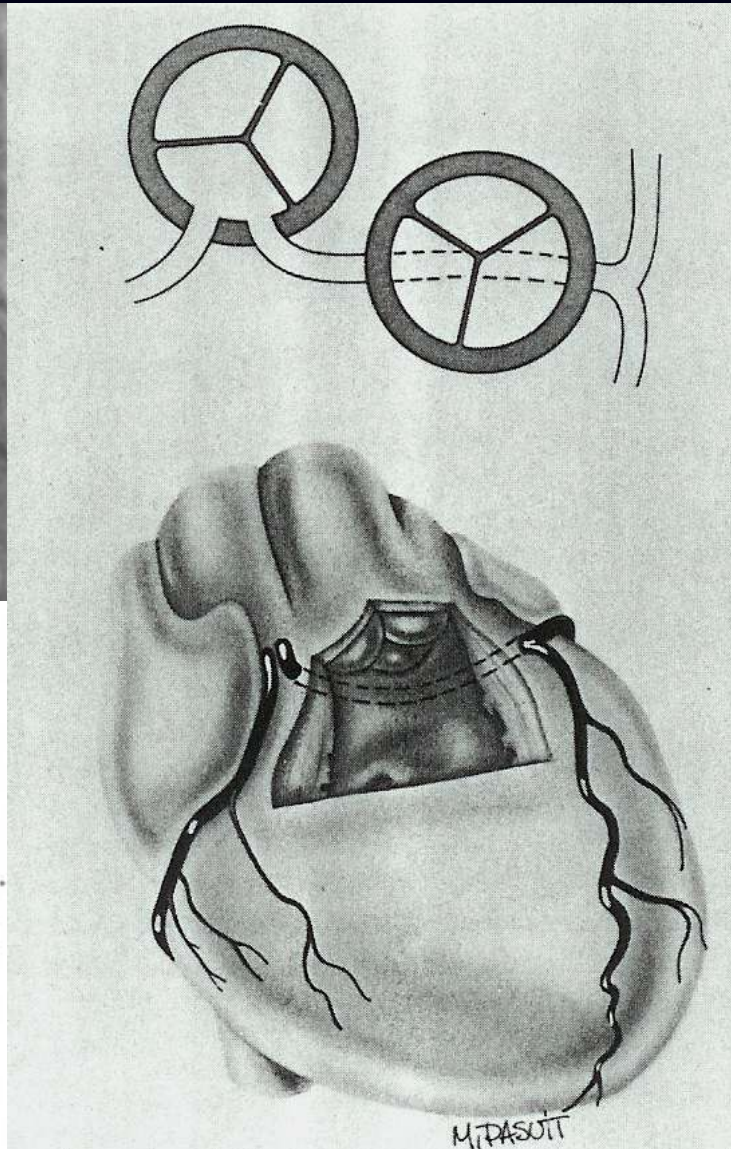


The most common type is IIB: a solitary ostium in the right aortic cusp associated with an aberrant-coursing left main coronary artery (LMCA).

The type I is rarer.



ΤΑΞΙΝΟΜΗΣΗ

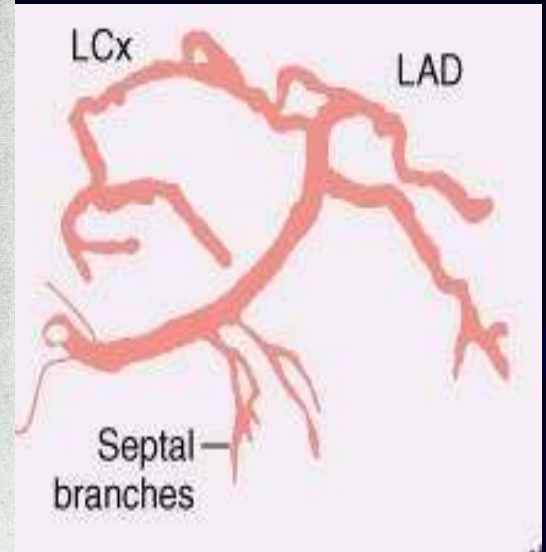
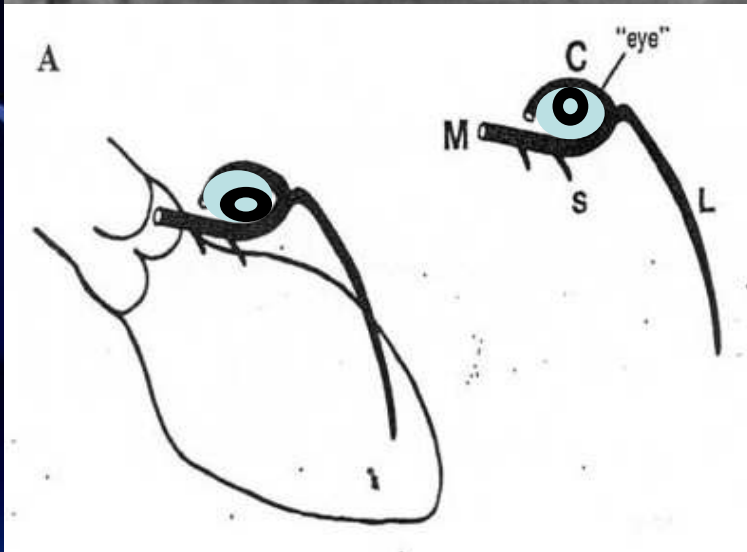


R/II/S

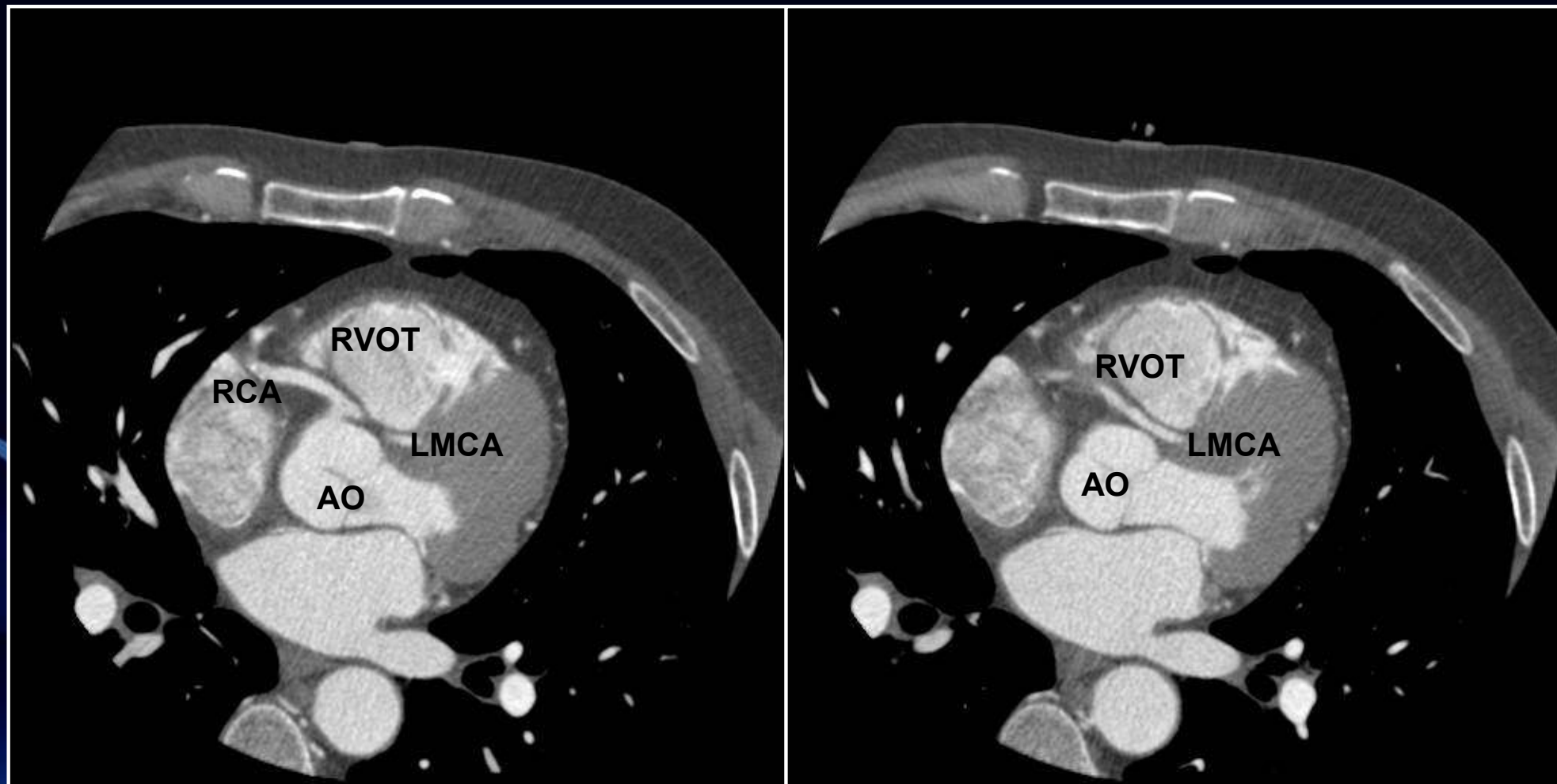
by Yamanaka and
Hobbs

II/B3

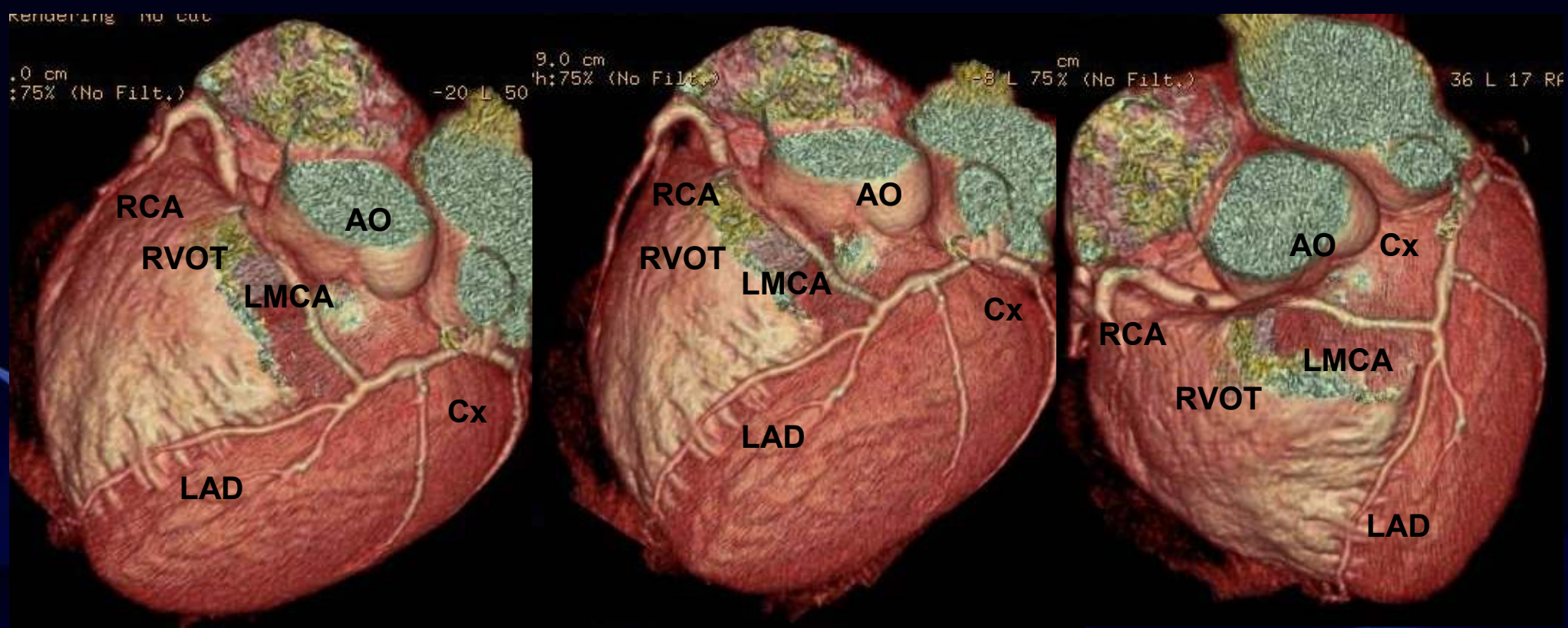
by Shirani and
Roberts



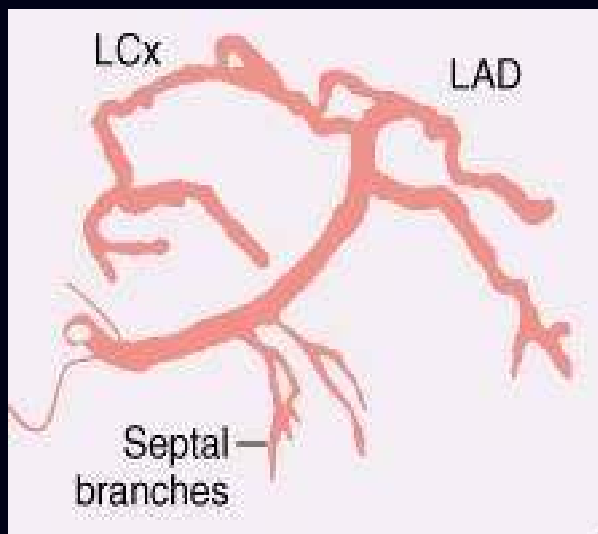
A cross sectional image, demonstrating the left coronary artery (LMCA) travelling between the aorta (AO) and the Right Ventricular Outflow Tract (RT V).



A 3-D, Volume rendering image, where the left coronary artery (LMCA) is shown to pass in front of the aortic valve (AO), between the right sinus of Valsalva and the Right Ventricular Outflow Tract



“Dot and Eye” Method-Septal course



In the RAO the left main and circumflex form an ellipse-like configuration (similar to the appearance of an eye), with the left main forming the inferior aspect of the ellipse and the circumflex forming the superior portion.

Septal perforators coming off the left main help to differentiate it from other subtypes.

LAD length short

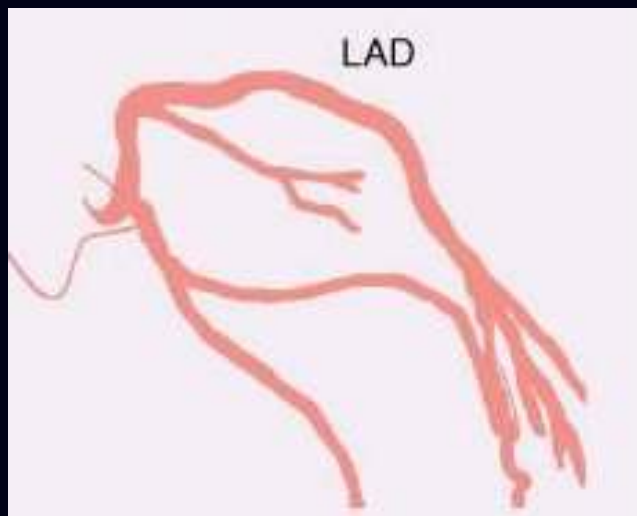


Serota, et al. Am J Cardiol 1990; 65:891-898



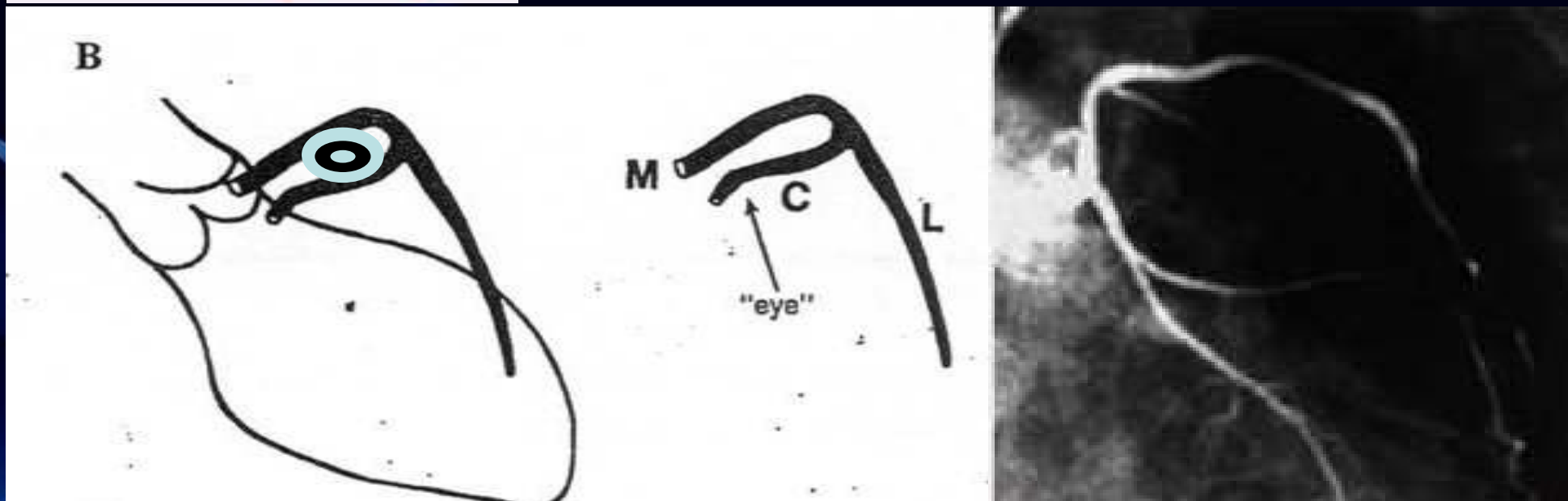
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“Dot and Eye” Method-Anterior course



In the RAO, the left main and the initial portion of the circumflex will form an ellipse (eye). The left main forms the upper portion of the ellipse, and the circumflex forms the lower portion.

LAD length short
No Septals from LM

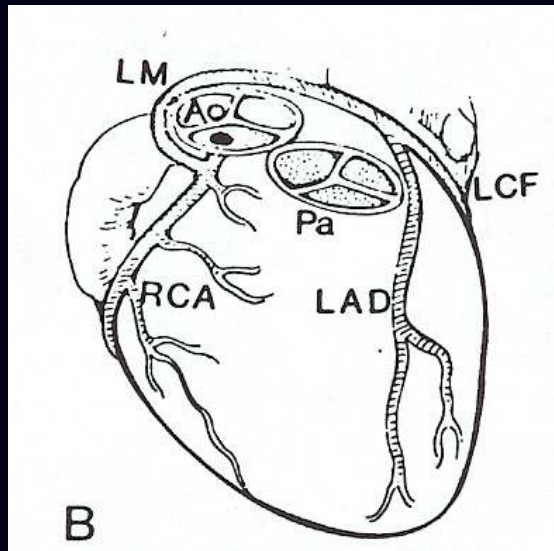


Serota, et al. Am J Cardiol 1990; 65:891-898



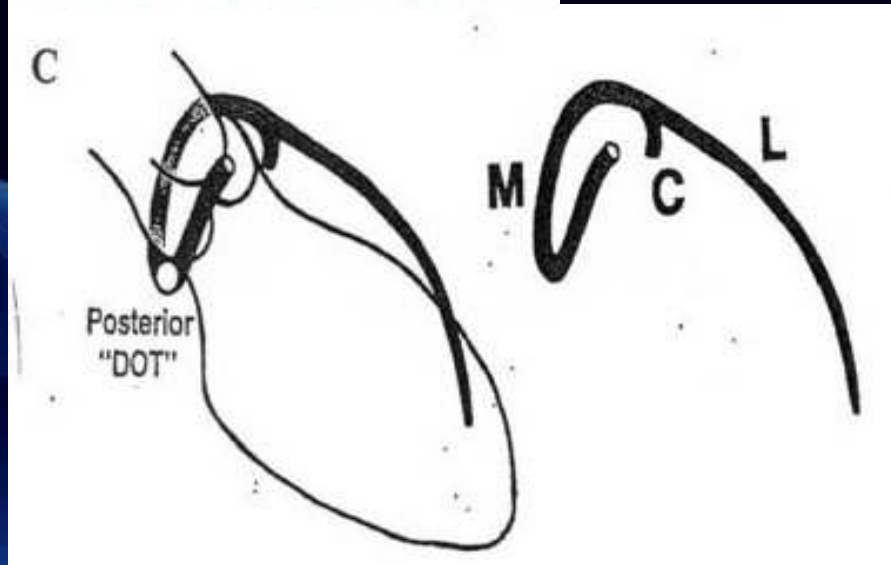
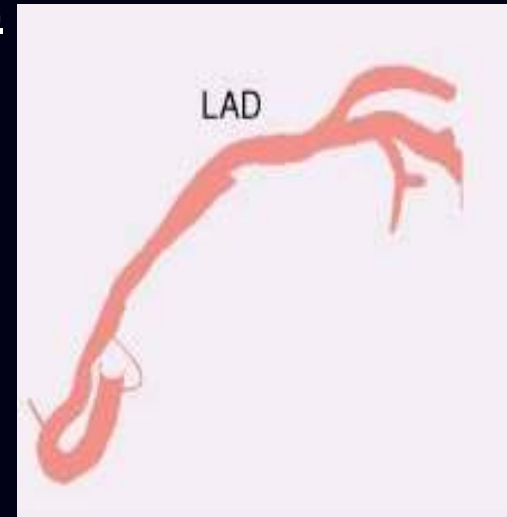
ΕΛΛΗΝΙΚΟ ΙΝΣΤΙΤΟΥΤΟ ΚΑΡΔΙΑΓΓΕΙΑΚΩΝ ΝΟΣΗΜΑΤΩΝ

“Dot and Eye” Method-Posterior course



POSTERIOR COURSE

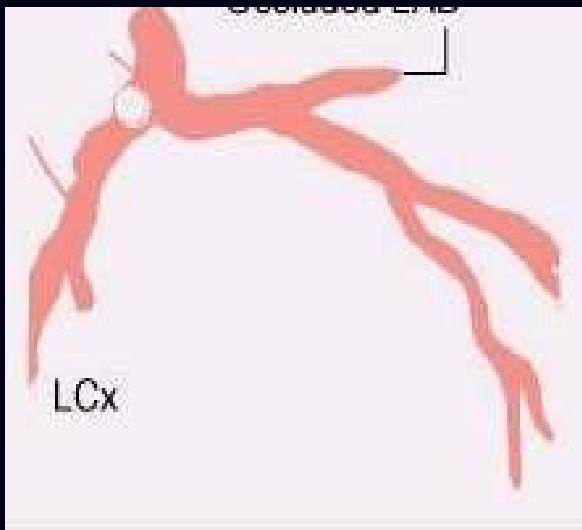
An RAO ventriculogram or aortogram will place the left main on end, giving the appearance of a dot on the posterior aspect of the aorta



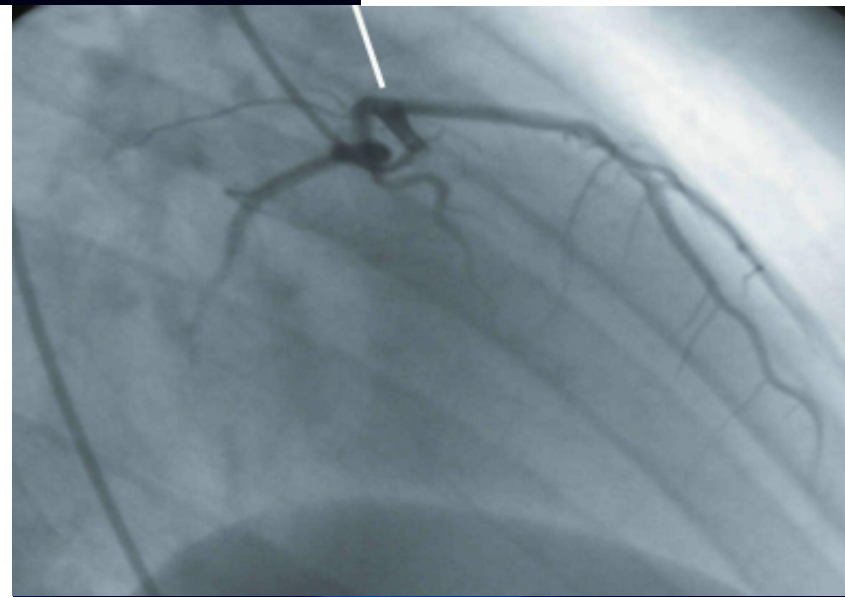
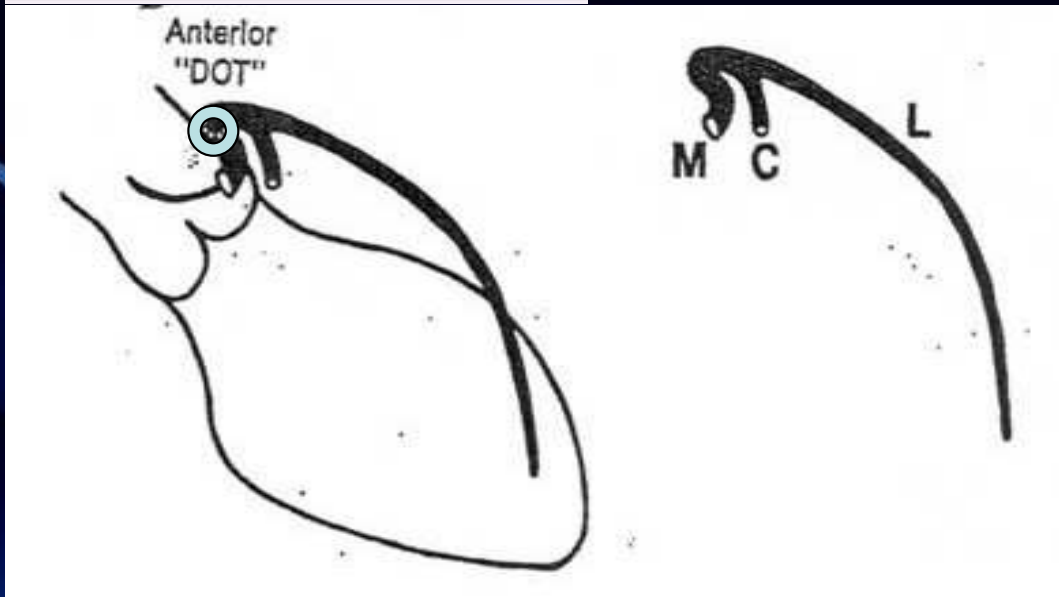
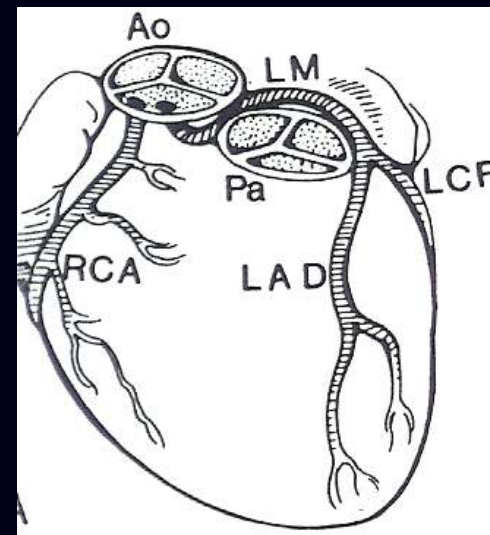
Serota, et al. Am J Cardiol 1990; 65:891-898



“Dot and Eye” Method-Interarterial course

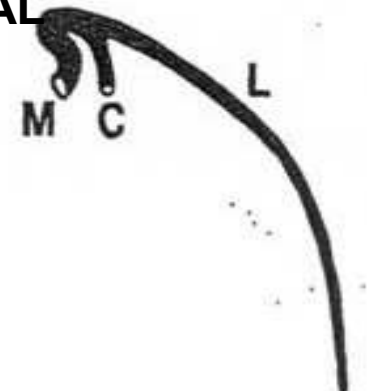
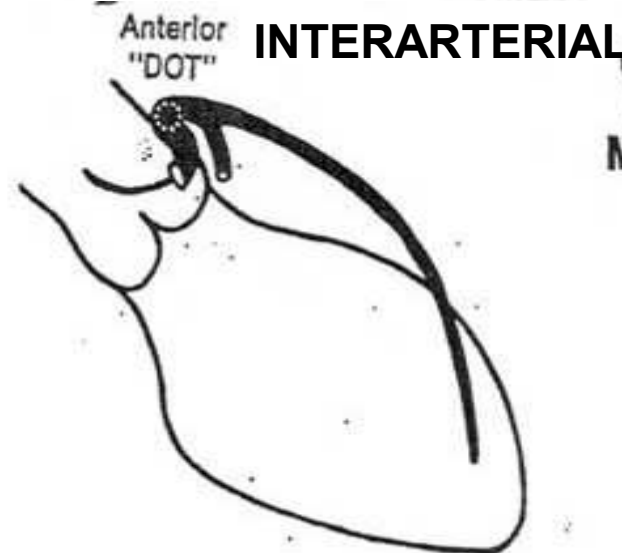
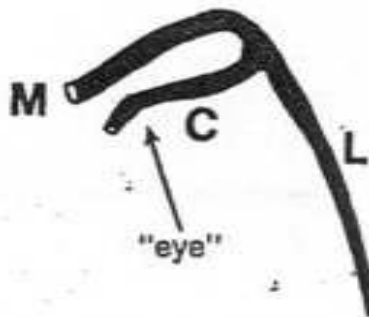
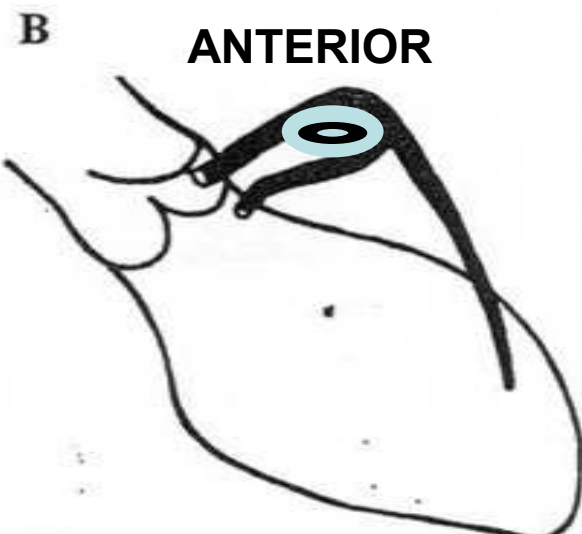
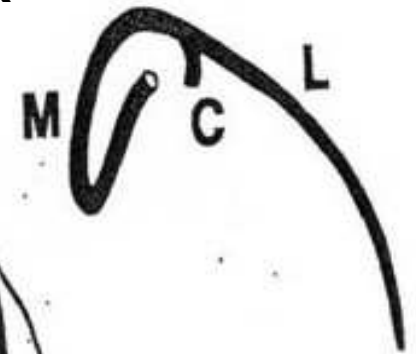
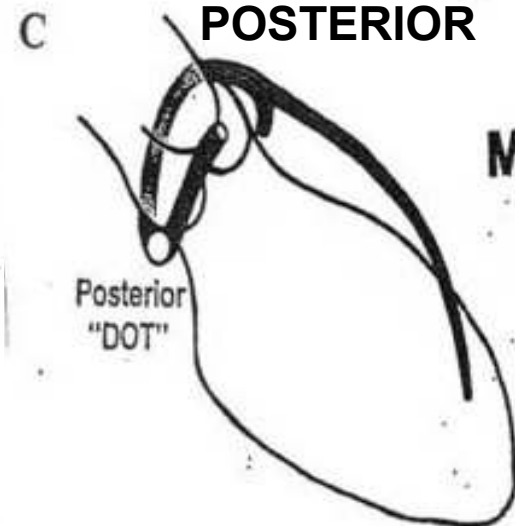
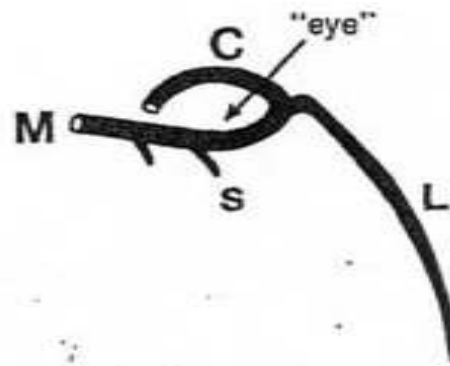


A ventriculogram or aortogram performed in the RAO projection will place the left main on end, giving the appearance of a radiopaque dot on the anterior aspect of the aorta



Serota, et al. Am J Cardiol 1990; 65:891-898





TECHNICAL CONSIDERATIONS

Considering the possible technical difficulties of angioplasty of an anomalous vessel, several aspects merit attention.

- ✓ **the orifice configuration**
- ✓ **the exit angulation from the aorta**
- ✓ **the route the artery takes**
- ✓ **and the location of atherosclerotic lesions.**

The major factor determining successful angioplasty in these vessels is guiding catheter selection, since stable guiding catheter position is the key to abnormally arising coronaries.

The choice of guidewire can also affect the final outcome



TECHNICAL CONSIDERATIONS

With occasional exceptions, the guides used successfully are those matched to the sinus of Valsalva from which the anomalous artery arises rather than to the eventual distribution of the artery.

Coronary arteries arising from the **left sinus of Valsalva**, be they normal or anomalous, are likely to be successfully cannulated with a ***left Judkins, a left Amplatz, or a left Voda***

Like normal arteries arising from the **right sinus of Valsalva**, anomalous arteries arising there are likely to be catheterized without difficulty using a ***right Judkins, a right or left Amplatz, or a multipurpose catheter.***



TECHNICAL CONSIDERATIONS

Theoretically, performing PCI of a single coronary artery increases the procedural risk since a complication leading to dissection (e.g., guiding-catheter induced) of the single ostium may be catastrophic. Practically, since the single ostium usually has a very large caliber, the risk of guiding catheter damage is low.

The double guidewire technique provides excellent back-up support for the guiding catheter



Conclusions

- **PCI in anomalous coronary arteries is a feasible therapeutic strategy with excellent clinical results.**
- **Selection of appropriate guiding catheter and other equipment is essential to the technical success of the procedure.**
- **Since these cases are rare, the reported experience of other practitioners may provide helpful tips.**

