7th 'Utrecht Sessions' on congenital heart disease:

Aortic Anomalies

February 7th - 8th, 2020

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UMC Utrecht
Wilhelmina Children's Hospital

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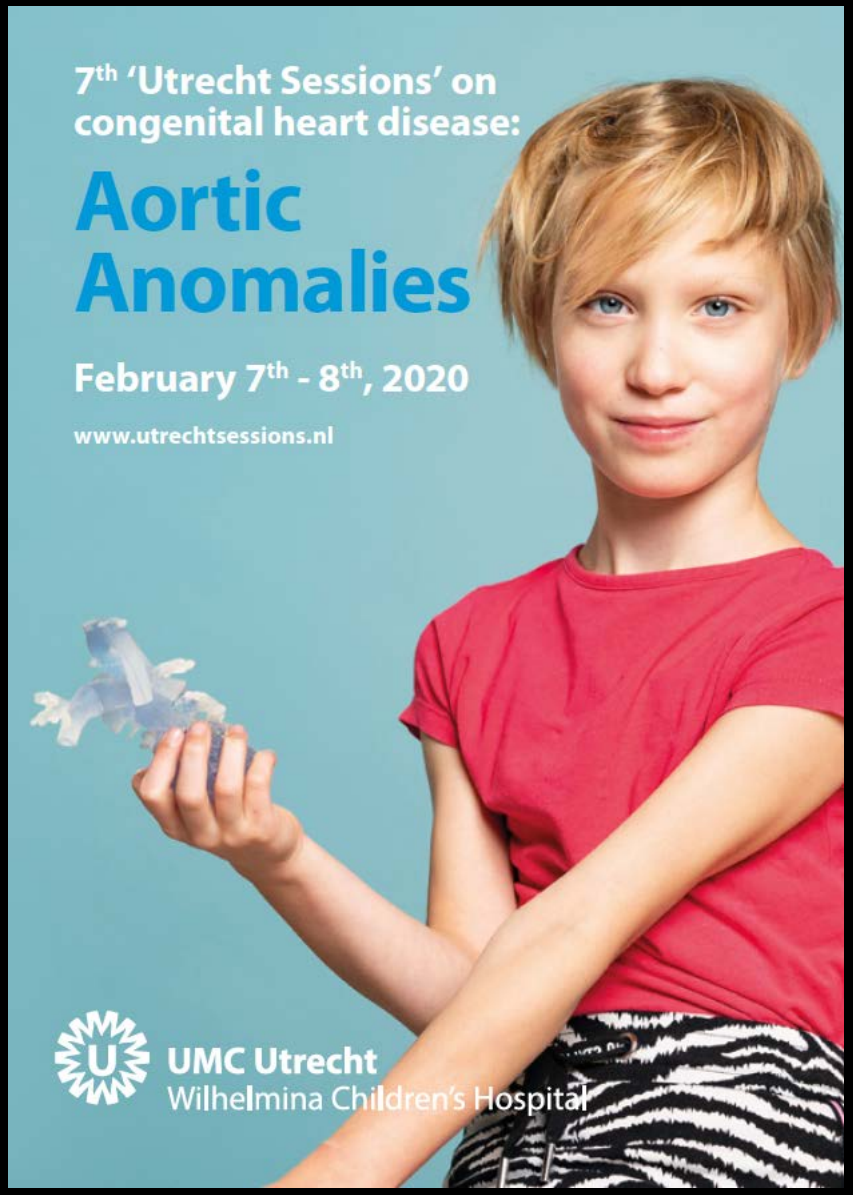

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Wilhelmina Children's Hospital

Early re-CoA: when and how to treat?

Mario Carminati
Pediatric and Adult Congenital Cardiology
IRCCS Policlinico San Donato

Coarctation treatment : history

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First surgical repair: 1944

✓ *Crafoord C, Nylin G: Congenital coarctation of the aorta and its surgical treatment. J Thorac Surg 1945; 14: 347-361.*

First percutaneous angioplasty:1982

✓ Singer MI, Rowen M, Dorsey TJ: Transluminal aortic bal- loon angioplasty for coarctation of the aorta in the newborn. Am Heart J 1982; 103: 131-132.

First stent implantation: 1991

✓ *O'Laughlin MP, Perry SB, Lock JE, et al: Use of endovascular stents in congenital heart disease. Circulation 1991; 83: 1923-1939.*

✓ *Ebeid MR, Prieto LR, Latson LA: Use of balloon expandable stents for coarctation of the aorta: Initial results and interme- diate term follow-up. J Am Coll Cardiol 1997; 30: 1847-1852.*

OVER 35 yrs of experience in percutaneous treatment of Aortic Coarctation

Early Recoarctation: when to treat

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Early recoarctation problem

✓Re-coarctation is rather common (up to 30%) after surgical repair performed in infancy

✓When to treat?

* Clinical criteria (signs of cardiac failure)
* Hemodynamic criteria (hypertension, pressure gradient, LV function

Early Recoarctation: when to treat

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Early recoarctation

** "good" clinical conditions*

** Upper/low extremities < 25 mmHg*

** Doppler: high velocity but no diastoic run-off*

** Preserved LV function*

→ **No invasive treatment – follow-up**

Early Recoarctation: when to treat

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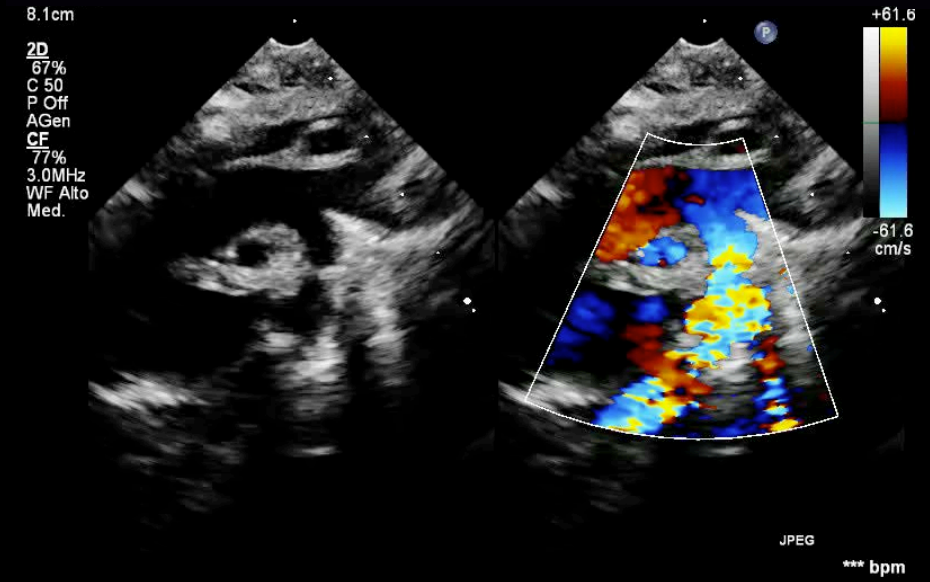
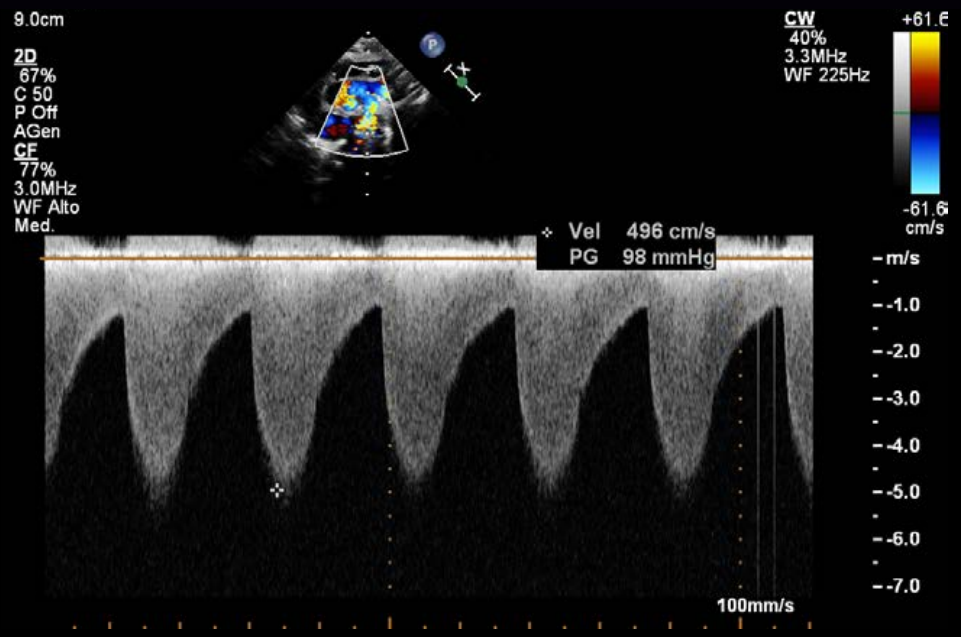
Echo assessment: indication to treat



Aortic arch morphology



Doppler: High velocity + diastolic run-off

Early Recoarctation: when to treat

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How to treat

Redo surgery → *Uncommon*

Angioplasty → *Most common*

Stenting → *In selected pts*

Catheter intervention

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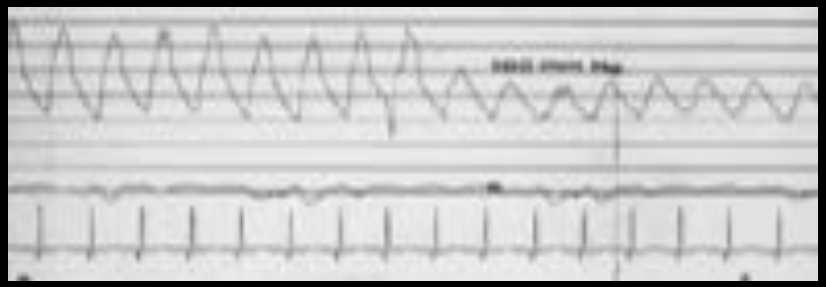
Vascular access: Femoral artery
Carotid or axillary (< 4 Kg)

Angiography: multiple proiection (PA/LL/LAO)
3DRDA if is possible
Evaluation of aortic arch, coarctation segment

Hemodynamic assessment: pressure recording Asc/Desc Ao
pull back across aortic coarctation



MPA2 4 Fr-0.014 guide wire for pull back pressure

Indication to treat: **peak to peak systolic pressure gradient more than 20 mmHg across aortic coarctation.**

Balloon angioplasty

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Guide wire: 0.014 inch (BMW, Choice,etc)
0.021 inch j tipped

Balloon: Coronary no comp. balloon (0.014)
Mini Ty-Shak (0.014)
Ty-Shak II
Wanda

Balloon size:

✓ two or more time size of the coarcted segment
✓ no larger than the size of the descending aorta at level of the diaphragm
✓ no larger than the size of aortic arch

Warning: guide wire should always be left in place across the coarctation segment and all angiographic and balloon dilatation catheters should be exchanged over the guide wire.

Balloon angioplasty

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Immediate results: good result in over 80% of patients with Re-coa

significant reduction of the gradient across the coarctation

Increased diameter of aortic segment

Complications:

aortic dissection

aortic rupture

development of aneurysm

Vascular access damage

Clinical case1

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Age: 3 months

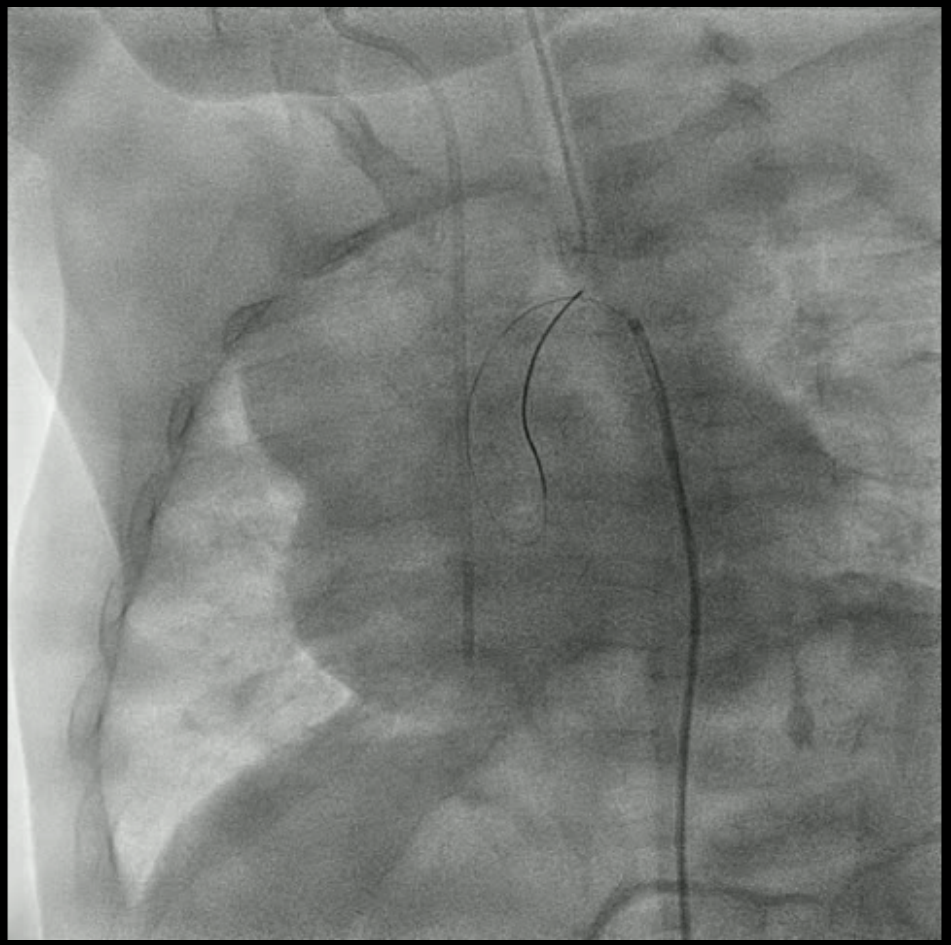
Weight: 5.5 Kg

DiagnosisAt birth: large VSD and CoA

3 days of life: aortic de-coarctation with end to end anastomosis and pulmonary banding.

Admitted in hospital: for Heart failure

Hemodynamic assessment:
peak to peak gradient: 50 mmHg



Clinical Case 1

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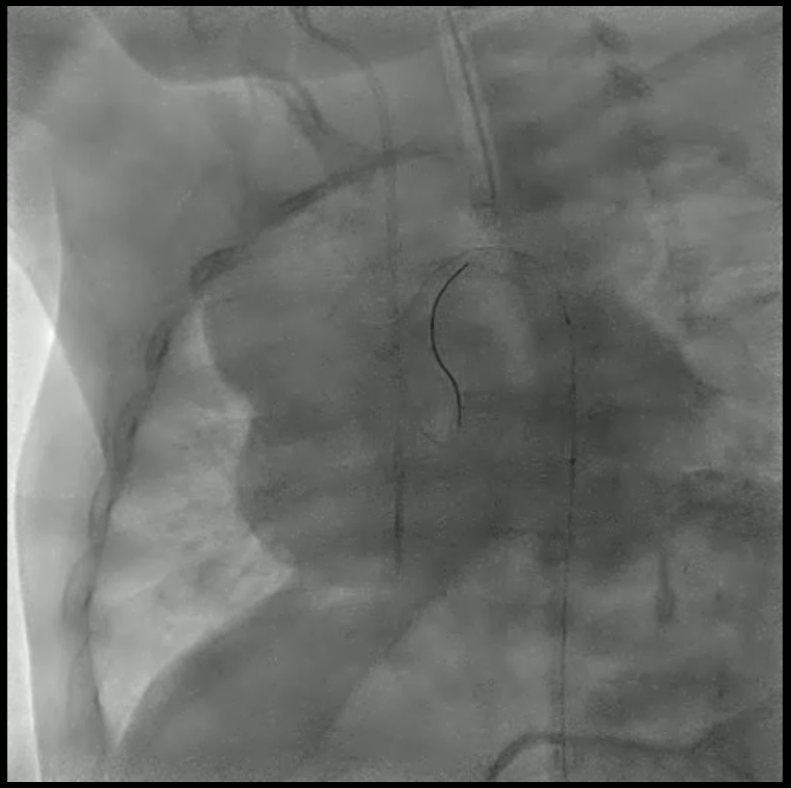
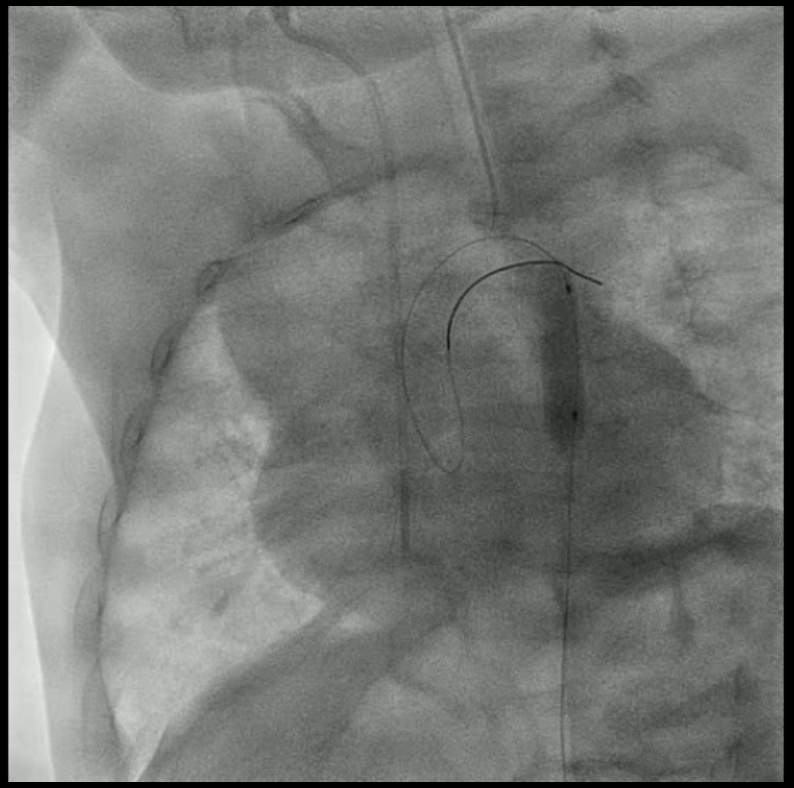


Coronary balloon: NC 4x20 mm 10 ATM



TyShak II balloon: 6x20 mm

Clinical Case 1

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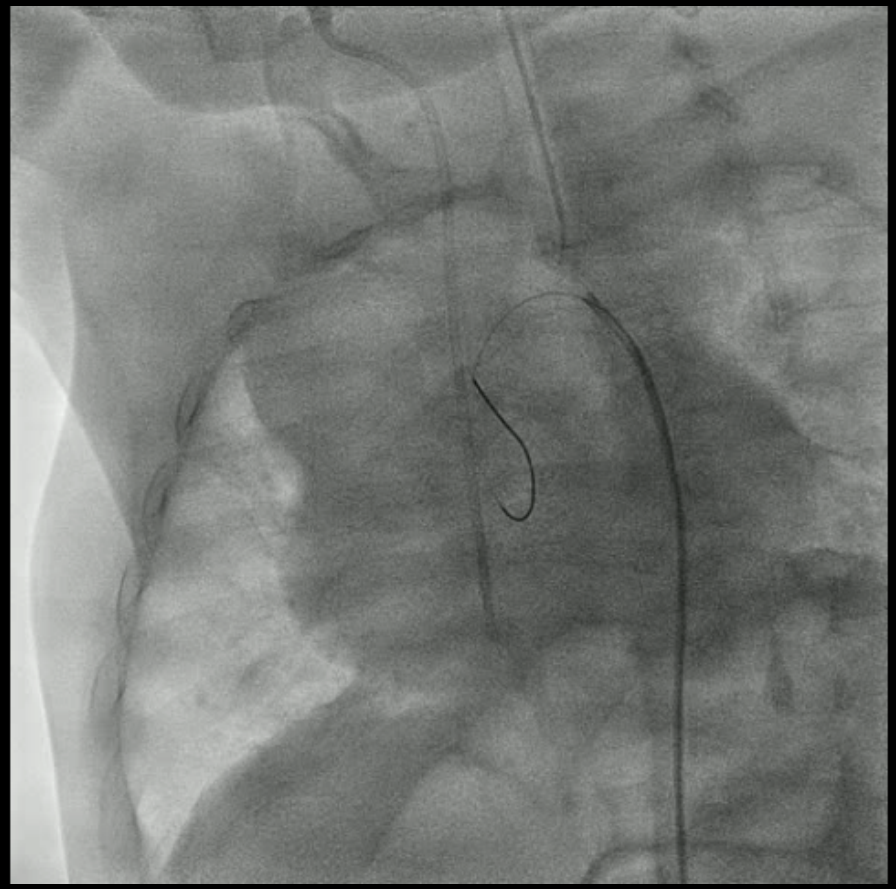
Good result: peak to peak gradient 10 mmHg



Balloon angioplasty is the treatment of the choice for recoarctation in infancy

Stent implantation

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Advantages of stent

less recoil
less vessel injury
less risk of aneurysm

Disadvantages of stent

need of large sheath
risk of stent migration
in-stent restenosis
failure to adapt to growth

Carotid approach

Cardiol Young 1995; 5: 155-160

ISSN 1047-9511

The carotid arterial approach for balloon dilation of critical aortic stenosis in neonates—immediate results and follow-up

Sandra Giusti, Adele Borghi, Sofia Redaelli, Philipp Bonhoeffer, Isabella Spadoni, Rocco Macrì and Mario Carminati

From the Department of Cardiology, Ospedale Pediatrico Apuano, Massa and the Department of Cardiology, Ospedali Riuniti, Bergamo

Carotid approach

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Table 1. Details of 20 patients undergoing balloon dilation of aortic valve.

Patient No	Age (days)	Weight (kg)	Heart failure	Associated lesions	LV-Ao gradient (mm Hg) Pre-BD	LV-Ao gradient (mm Hg) Post-BD	Percent gradient reduction	Diameter (mm) Annulus	Diameter (mm) Balloon	Post-BD AI
1	3	3.0	+	-	80	30	62	7	6	++
2	14	3.0	+	AI, PAD, PHT	63	15	76	7	8	++
3	6	2.1	+	-	125	65	48	5	4	-
4	20	4.0	+	MS, PAD, PHT	55	30	45	6	6	-
5	8	3.0	+	-	50	0	100	6	6	-
6	2	3.4	+	-	95	15	84	8	8	+
7	3	2.7	+	MI, PAD	25	10	60	6	6	+
8	9	3.0	+	-	70	15	79	6	6	+
9	5	3.0	+	-	70	40	43	7.5	6	++
10	2	3.3	+	-	48	27	44	6	6	++
11	9	3.3	+	VSD, AoCoarc, PAD	30	0	100	6	5	+
12	10	4.0	+	-	70	20	71	6.5	6	-
13	1	2.8	+	MI	100	65	35	6	6	++
14	1	3.1	+	Ao hypoplasia	30	0	100	4	5	-
15	7	3.4	-	-	65	30	54	6	8	-
16	2	2.5	+	AoCoarc, HLV	130	50	62	6	5	-
17	14	3.5	-	-	75	20	73	7	7	-
18	9	3.5	-	-	100	30	70	8	7	-
19	25	3.5	-	-	165	65	61	7	7	++
20	5	3.1	-	-	160	20	87	6	6	+

AoCoarc: aortic coarctation; Ao hypoplasia: aortic hypoplasia; AI: aortic insufficiency; Ao: aorta; BD: balloon dilation; HLV: hypoplastic left ventricle; LV: left ventricle; MI: mitral insufficiency; MS: mitral stenosis; PAD: patent arterial duct; PHT: pulmonary hypertension; VSD: ventricular septal defect.

20 newborns → No procedure related death

Carotid approach

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Severe recoarctation in 2 Kg. baby

Carotid approach

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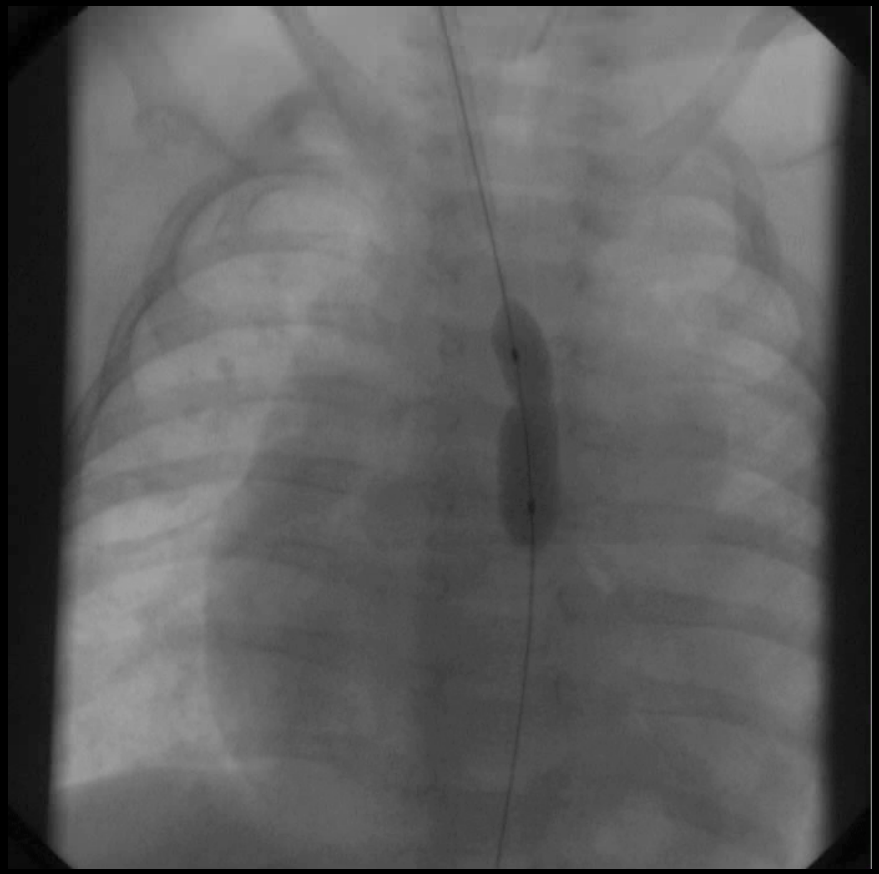
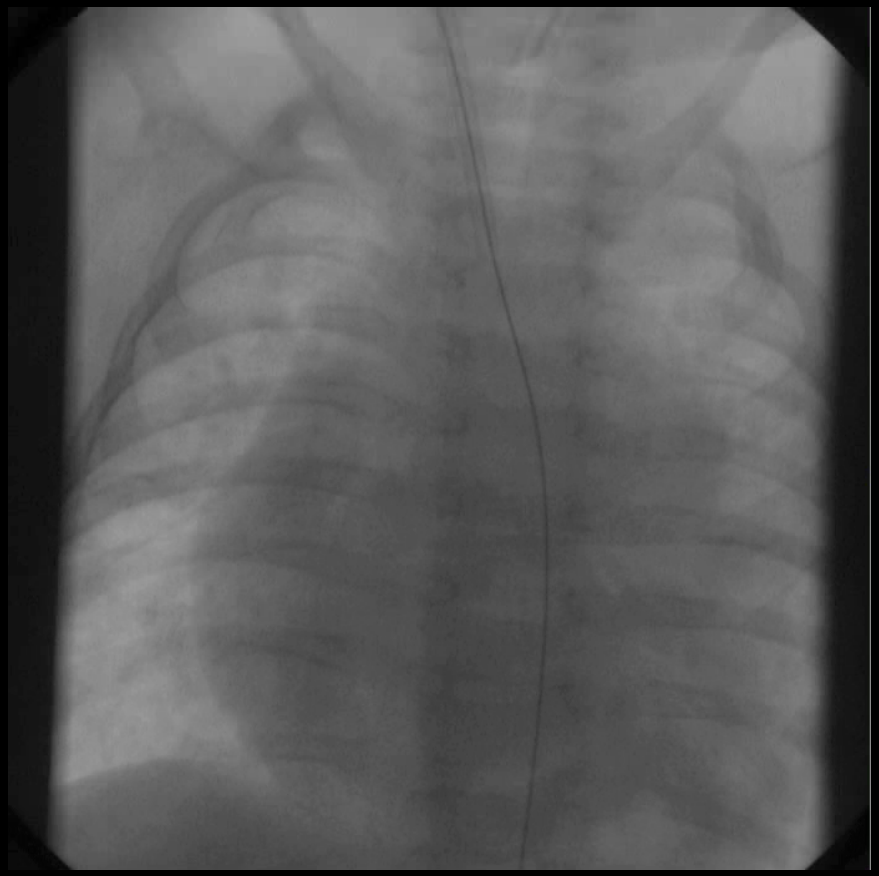
Easy crossing of stenotic site

Immediate check angio
no need of exchange catheter





Carotid approach

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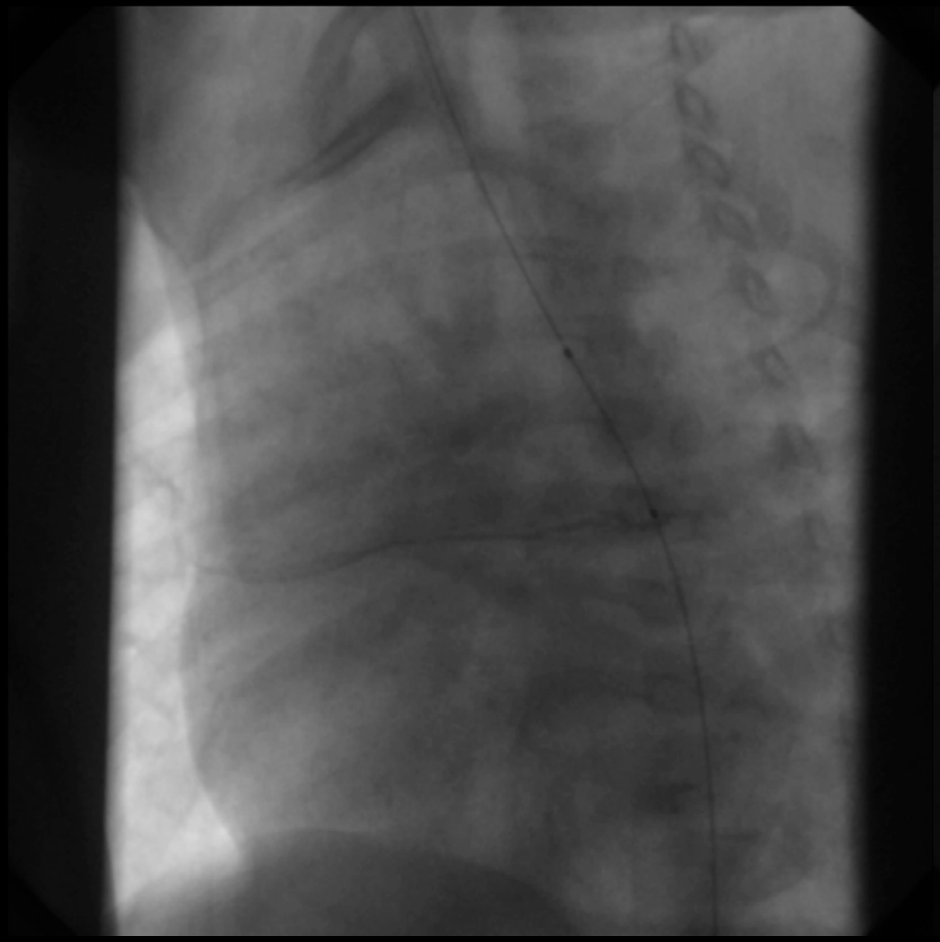
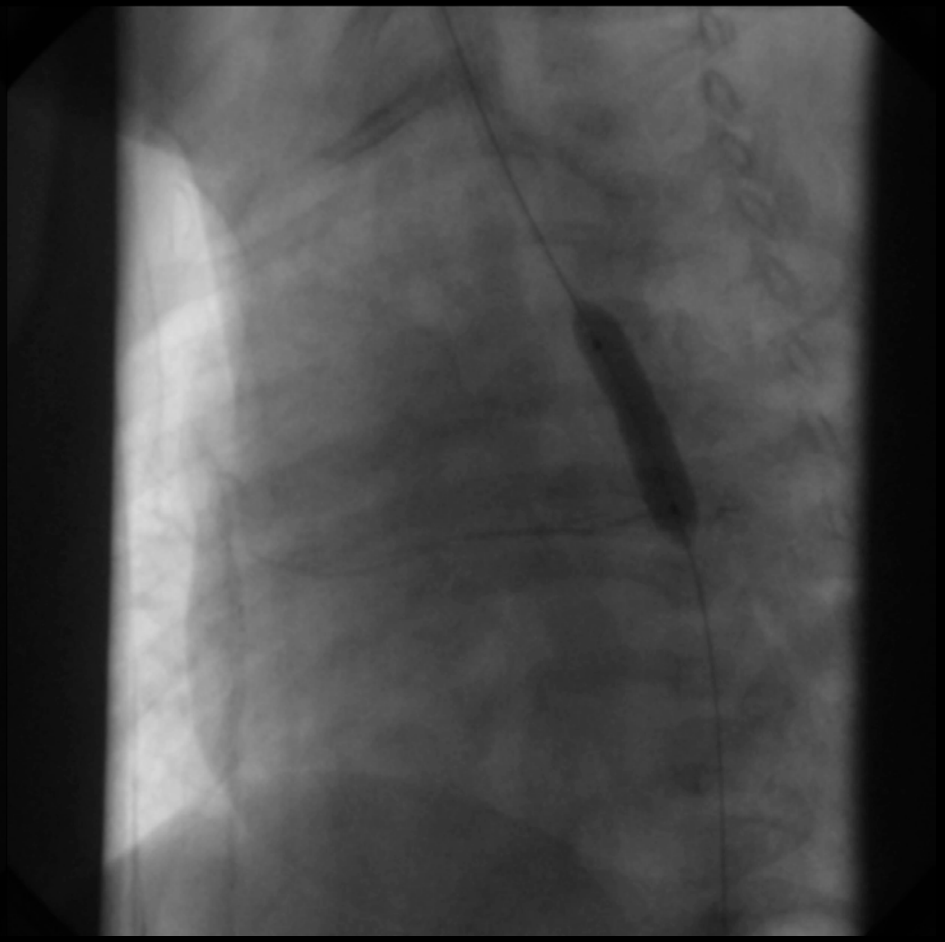
…If the result is suboptimal…..



…very easy to exchange to a larger balloon…



Carotid approach

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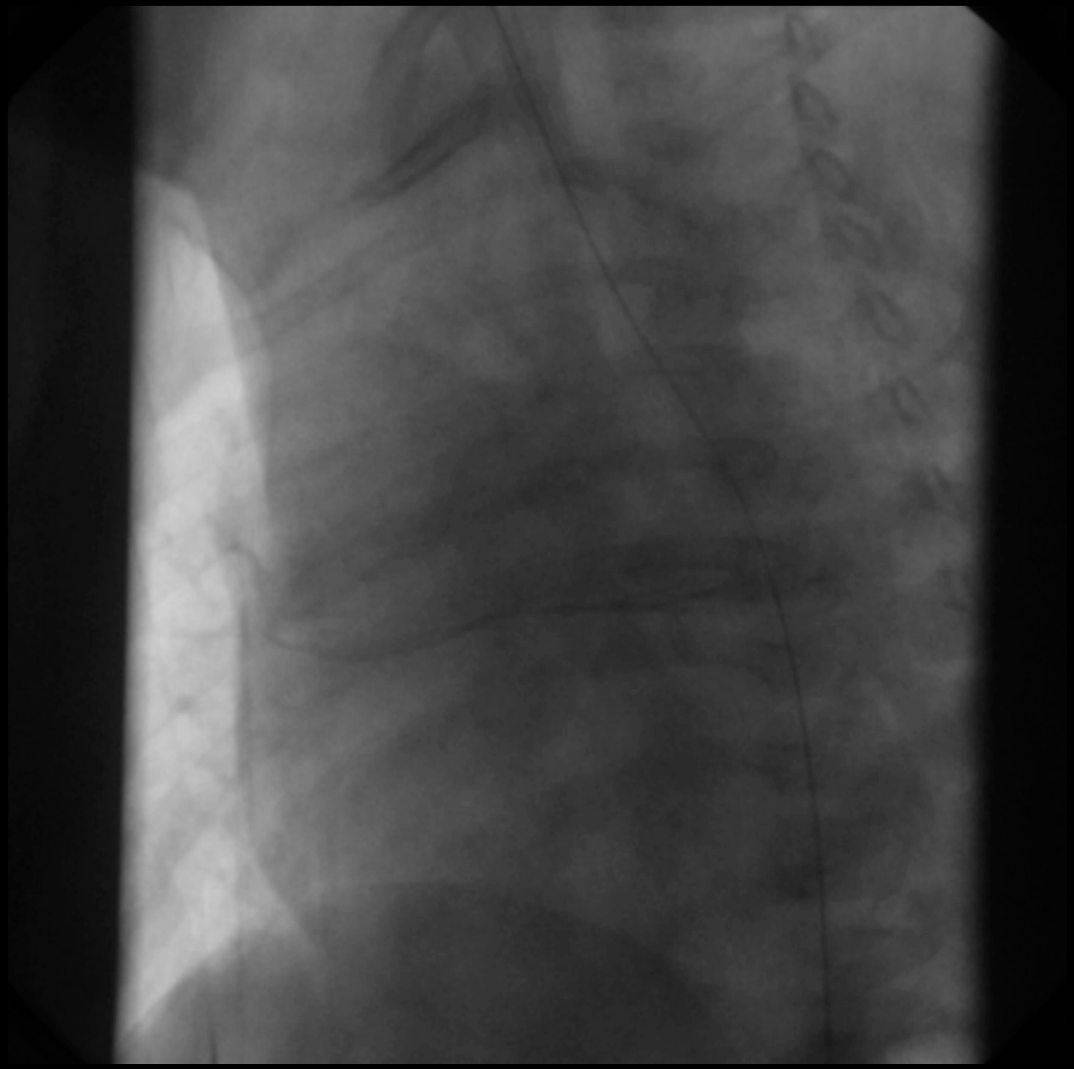
Excellent result



Clinical Case: 2

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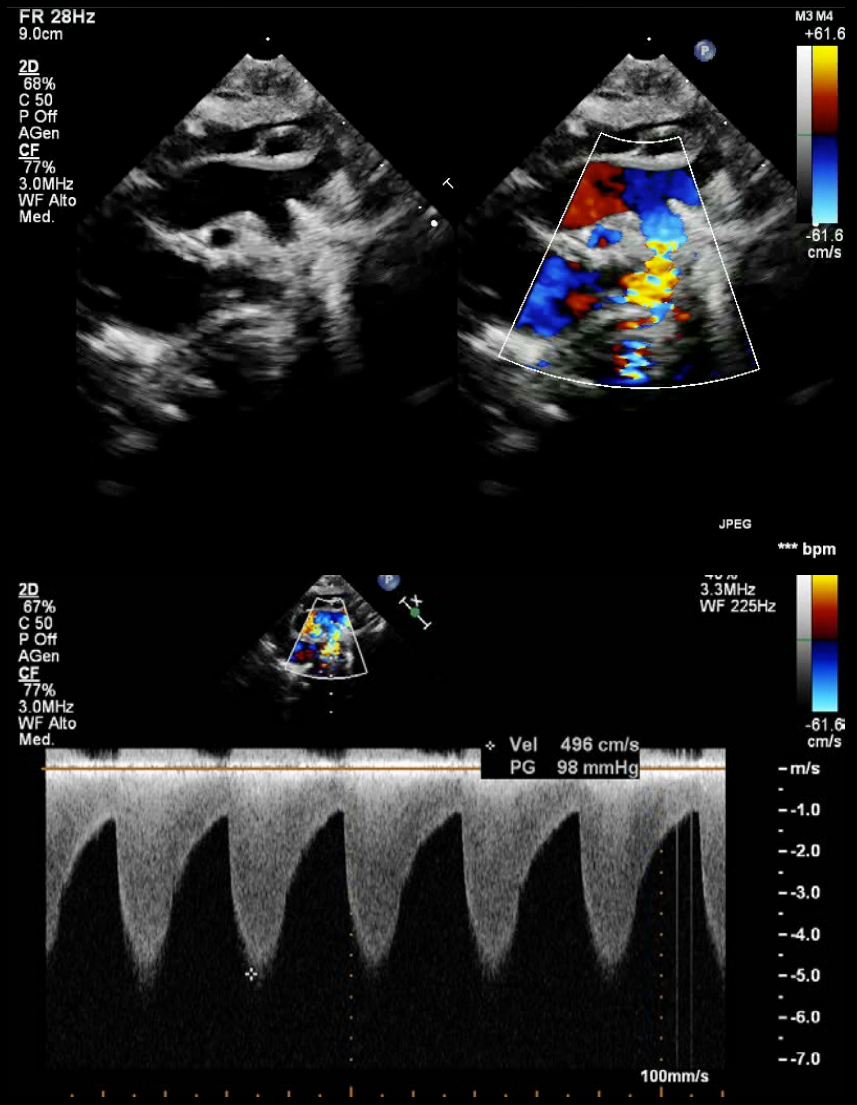
Age: 1 months

Weight: 4 Kg

At birth diagnosis: severe aortic coarctation of a persistent fifth aortic arch with atretic fourth homolateral arch.

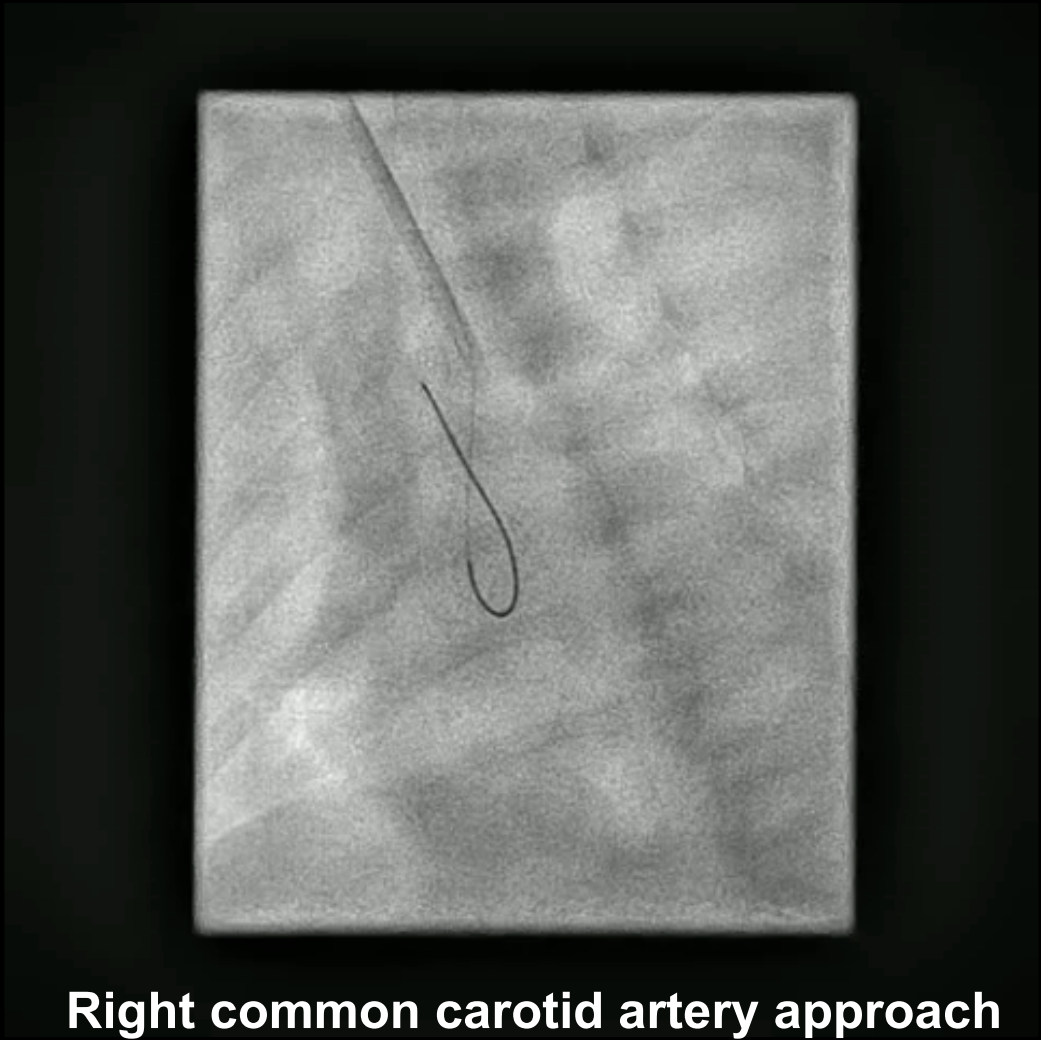
3 days of life: resection of the atretic left fourth arch and reconstruction of the left fifth aortic arch through an end-to-end anastomosis

Hospital admission: severe aortic recoarctation (maximum gradient 100 mmHg with prominent olodiastolic tail) one months after the surgery.



Clinical Case: 2

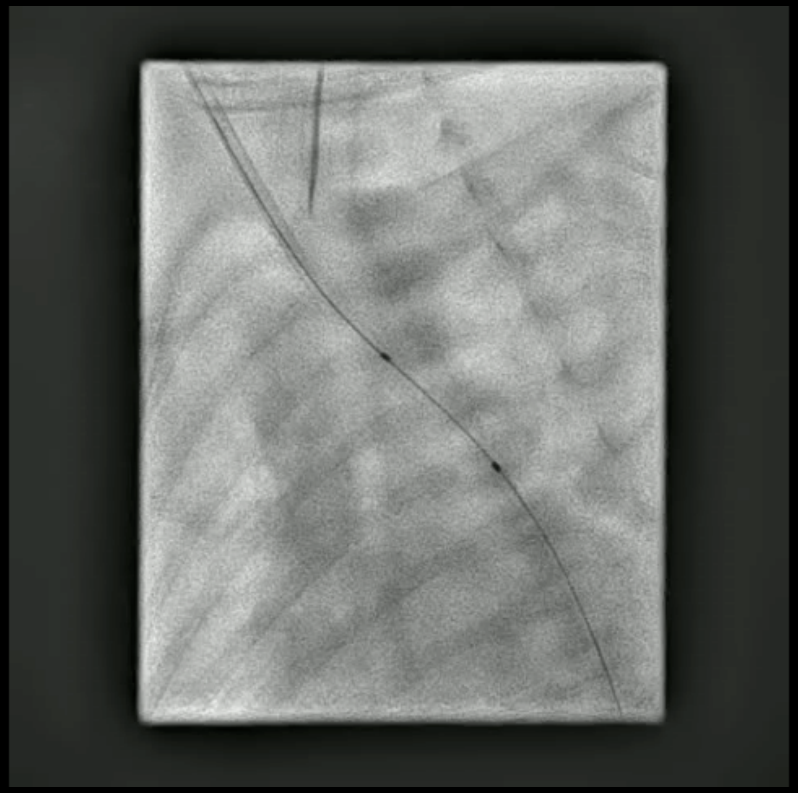
I.R.C.C.S. POLICLINICO SAN DONATO



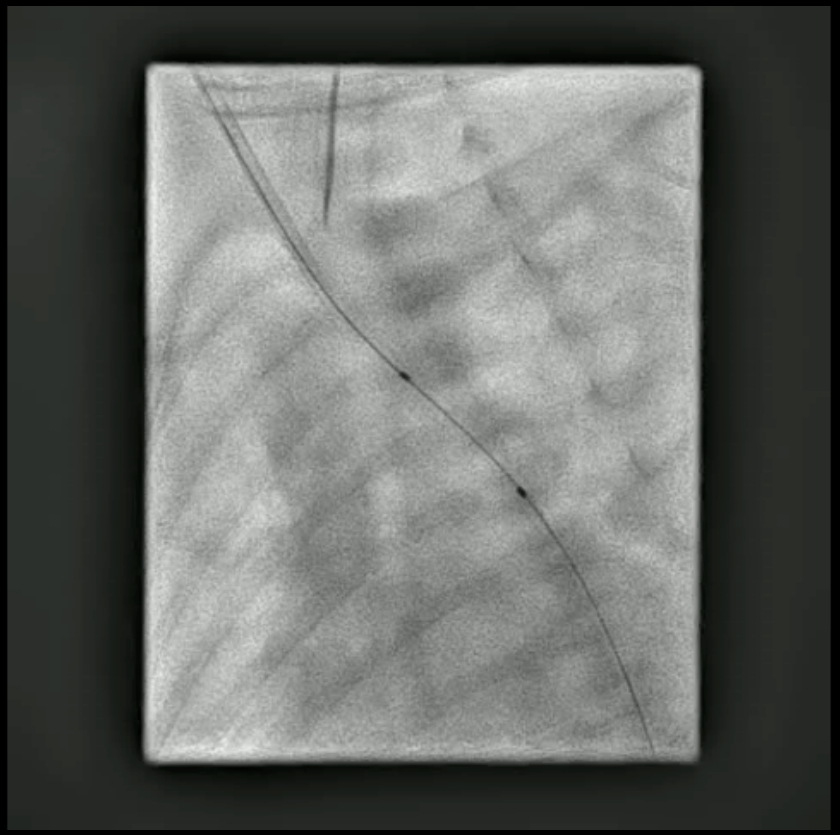
Right common carotid artery approach

Clinical Case:2

I.R.C.C.S. POLICLINICO SAN DONATO



Mini TyShak balloon: 5x20 mm



Mini TyShak balloon: 6x20 mm

Clinical Case:2

I.R.C.C.S.
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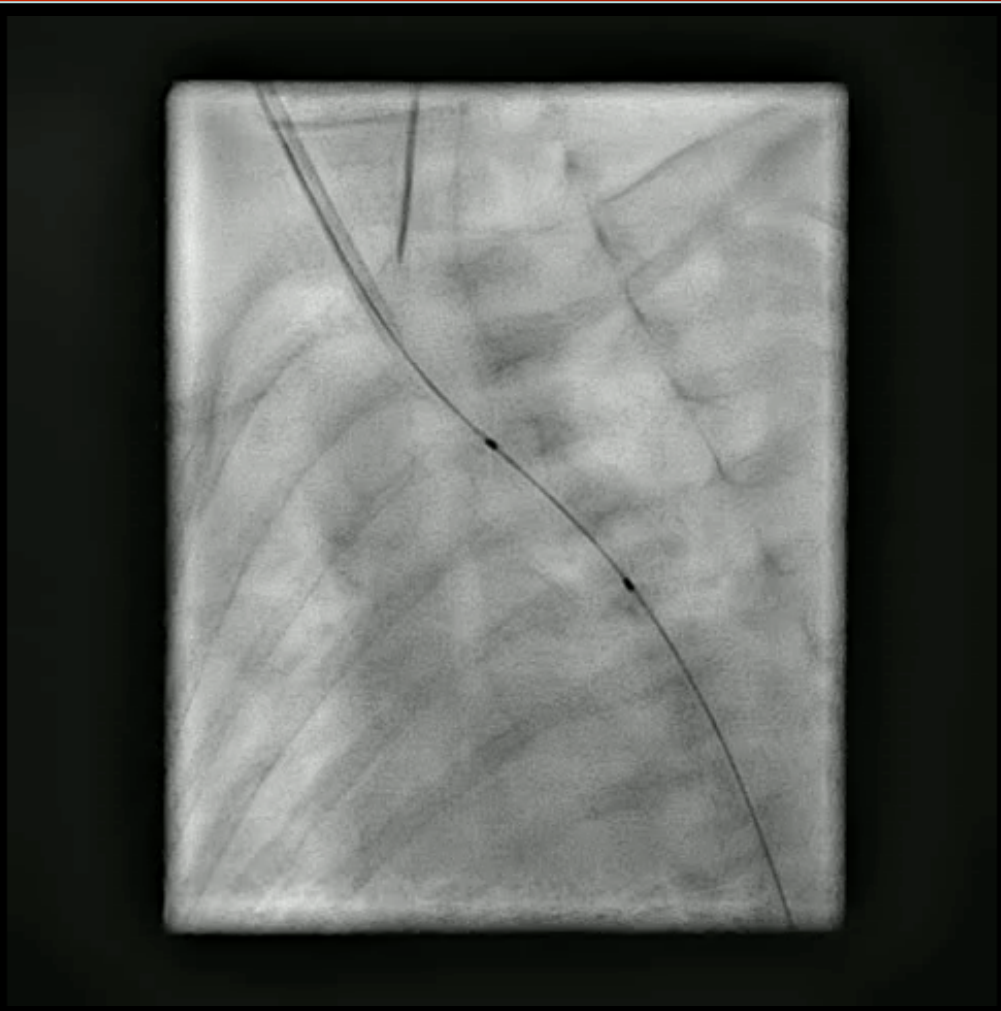
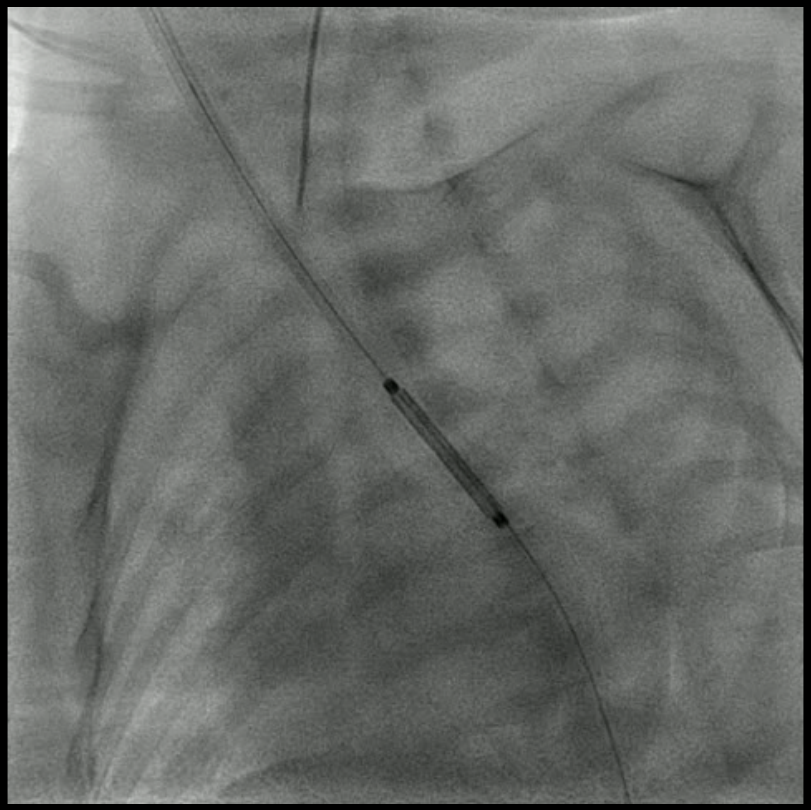
SAN DONATO

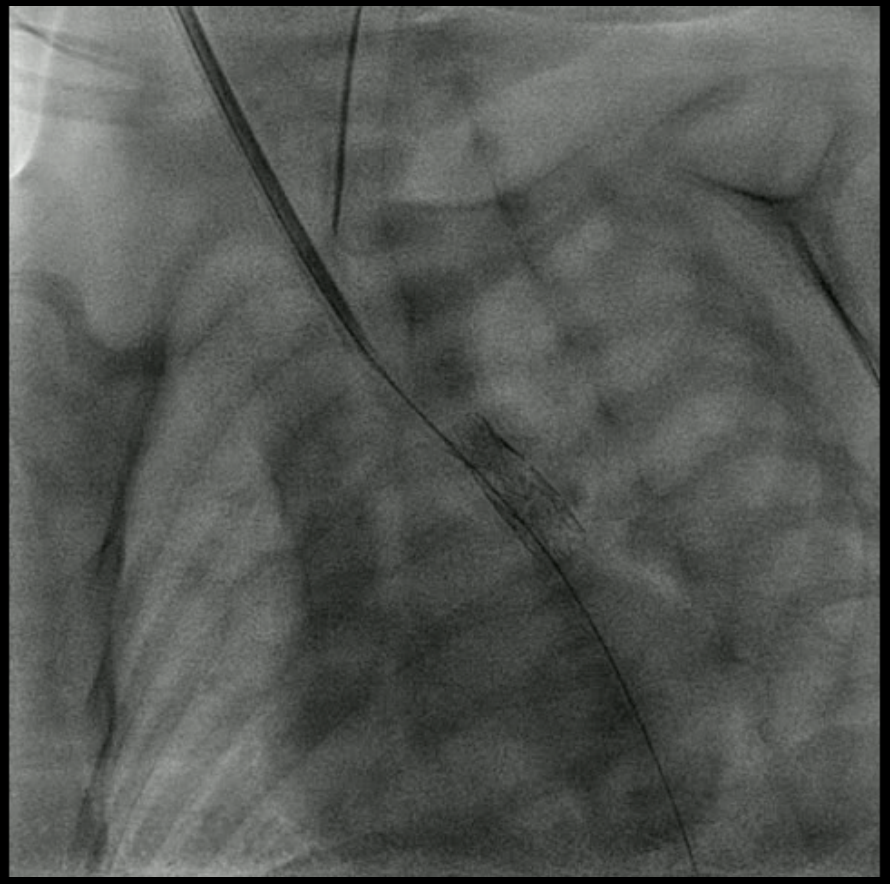


Post balloon angioplasty : no significant increase of vessel diameter
high residual gradient

Clinical Case:2



Valeo stent 6x18 mm



Final Result

Clinical Case:2

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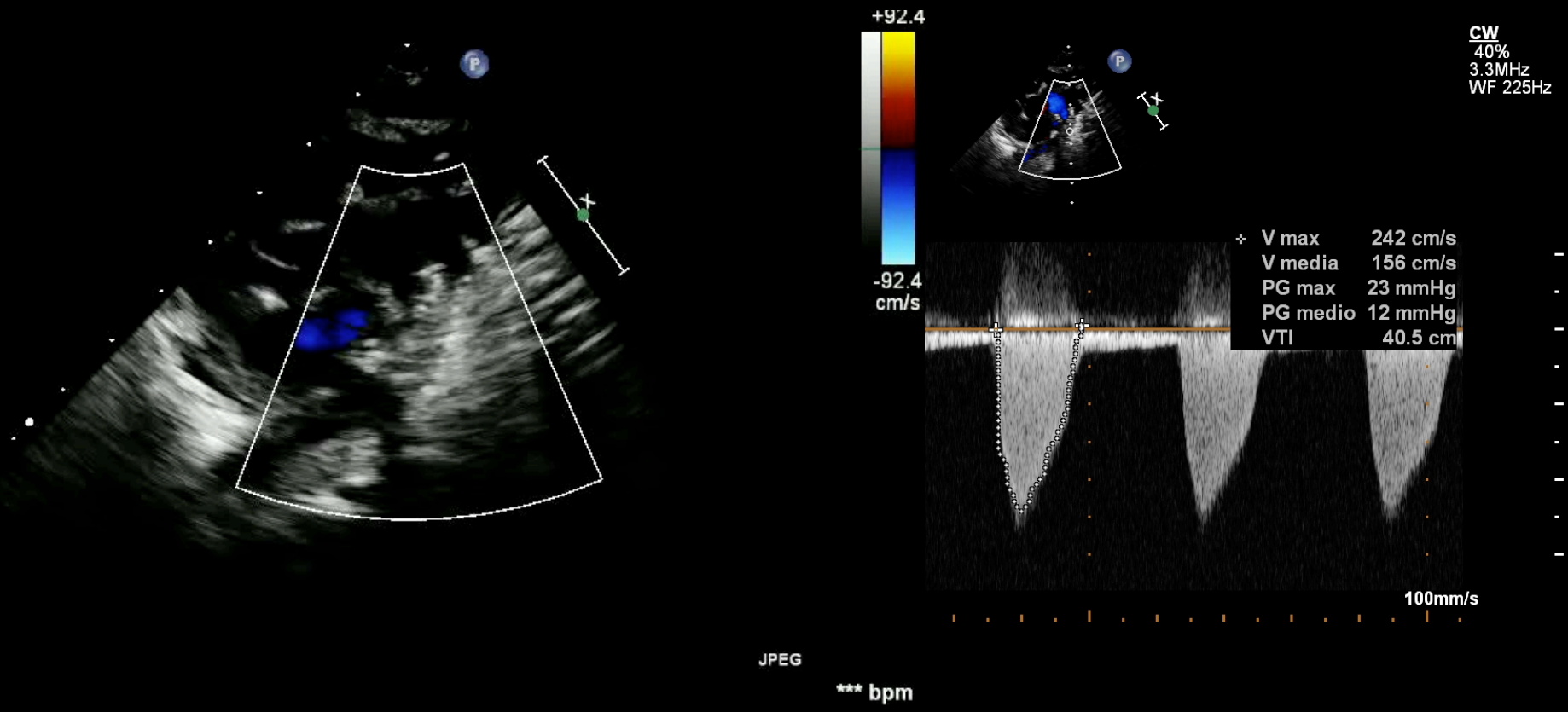
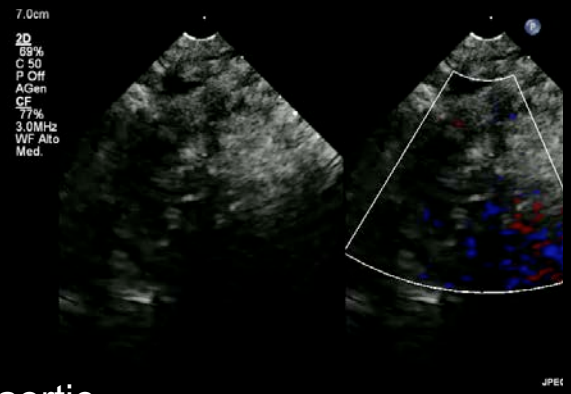
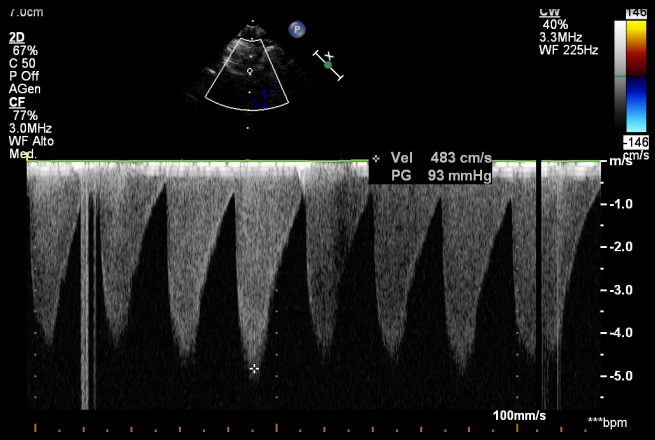
Echo pre-discharge



Clinical Case: 3

I.R.C.C.S. POLICLINICO SAN DONATO





Age: 4 months

Weight: 5,5 Kg

At birth diagnosis: Interrupted aortic arch type B. VSD

8 days of life: aortic arch reconstruction with anterior patch and VSD closure

Admitted in hospital: severe aortic recoarctation (maximum gradient 98 mmHg with prominent olodiastolic tail four months after the surgery.

Clinical Case: 3

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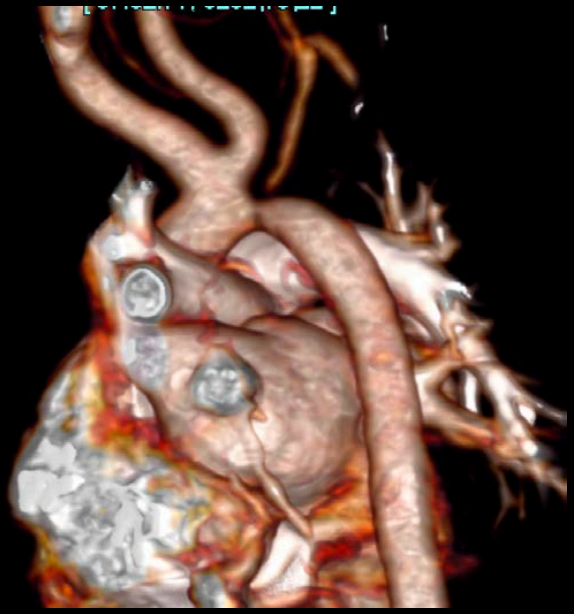

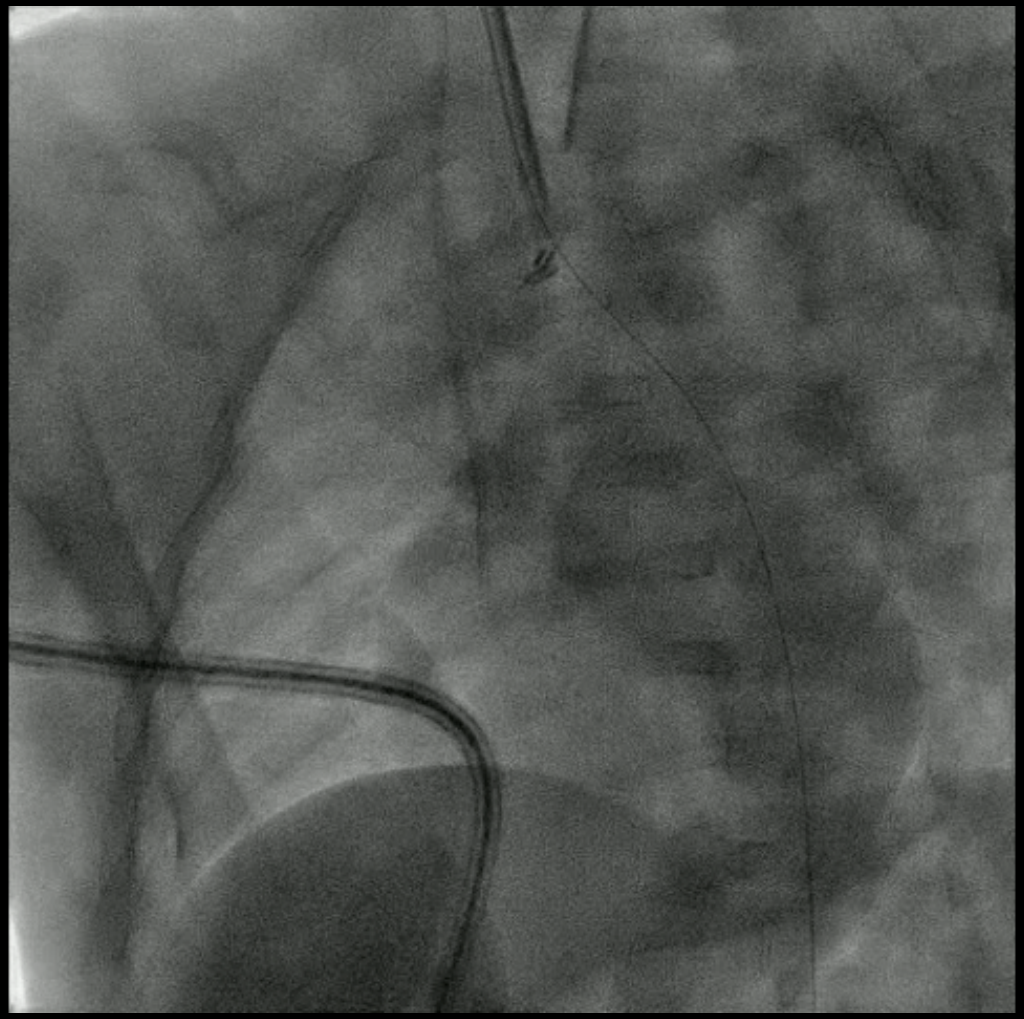

Right common carotid artery approach
Peak to peak gradient 80 mmHg

Clinical Case:3

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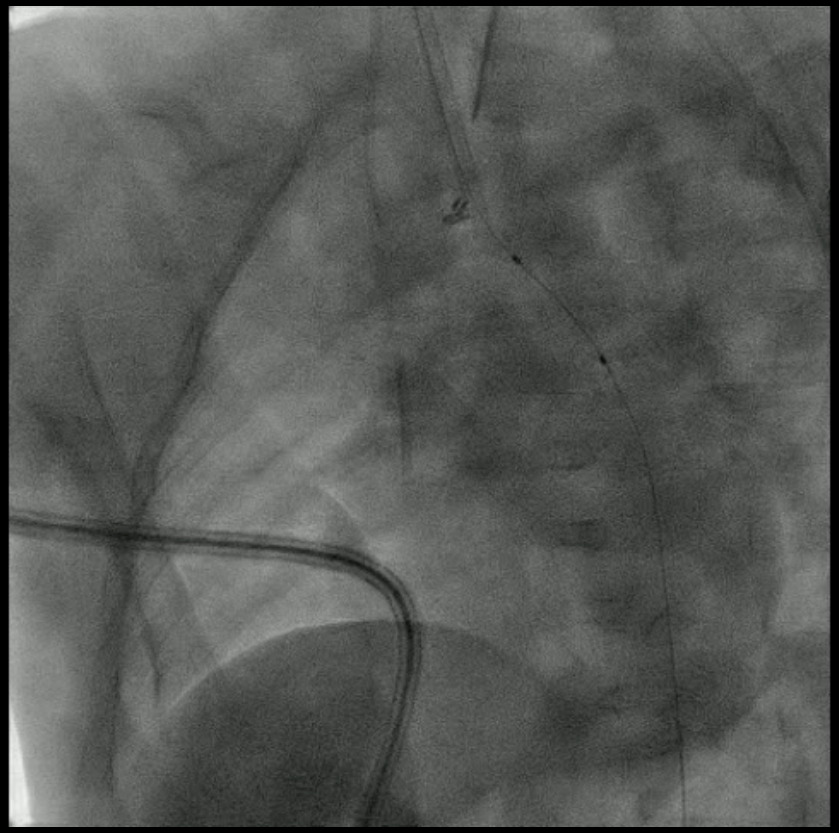
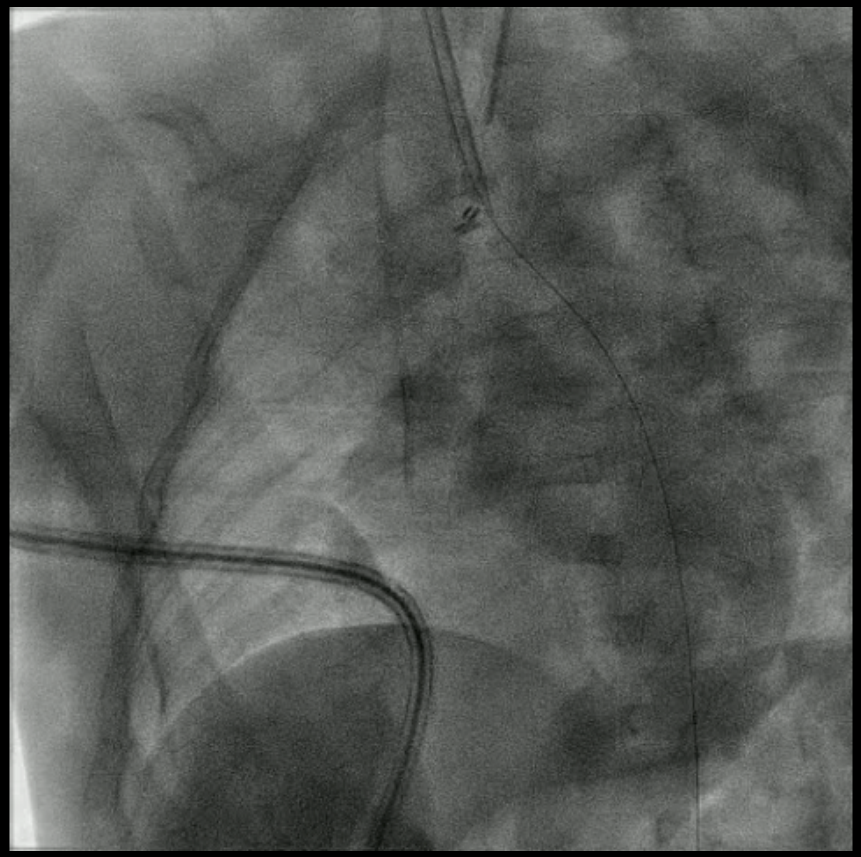


Mini TyShak balloon: 5x20 mm



Post angioplasty

Clinical Case:3

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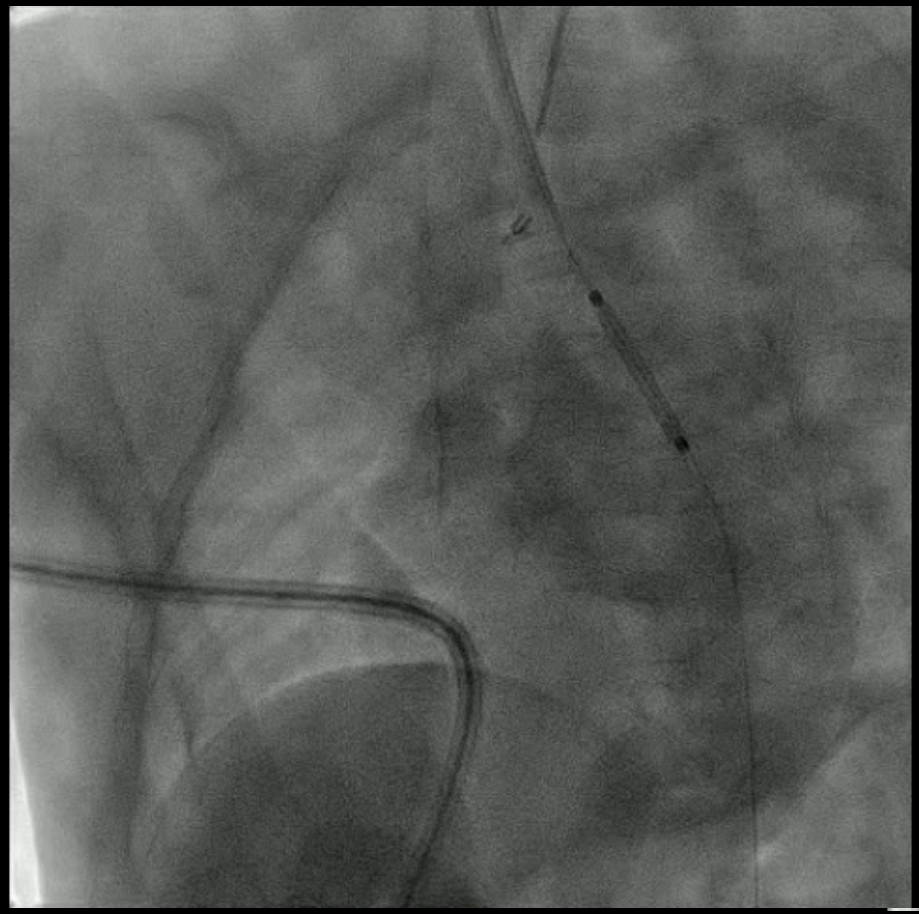
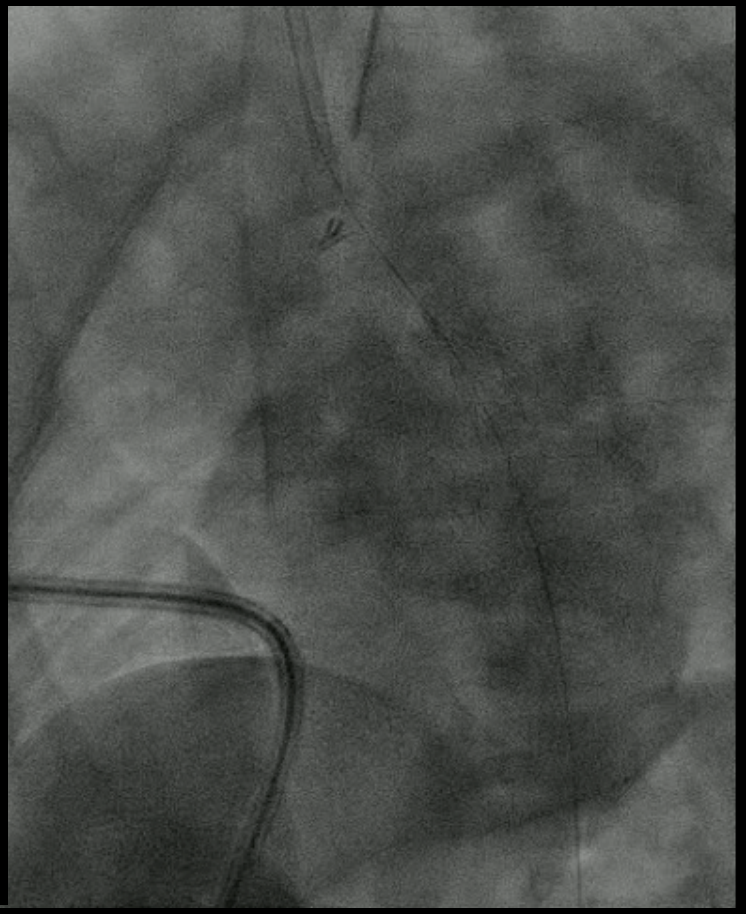


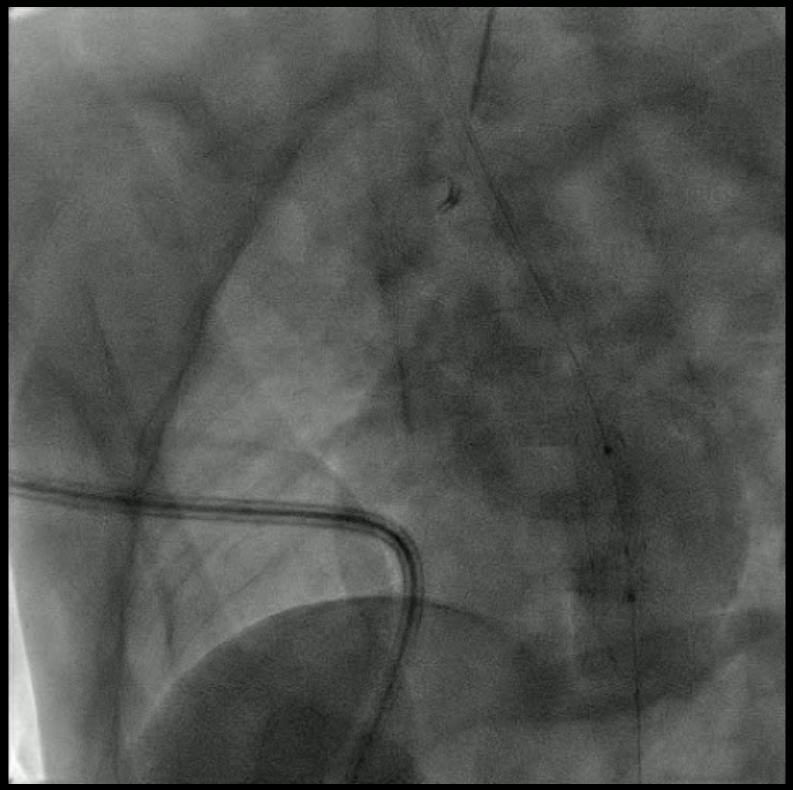
Valeo Stent 6x18 mm



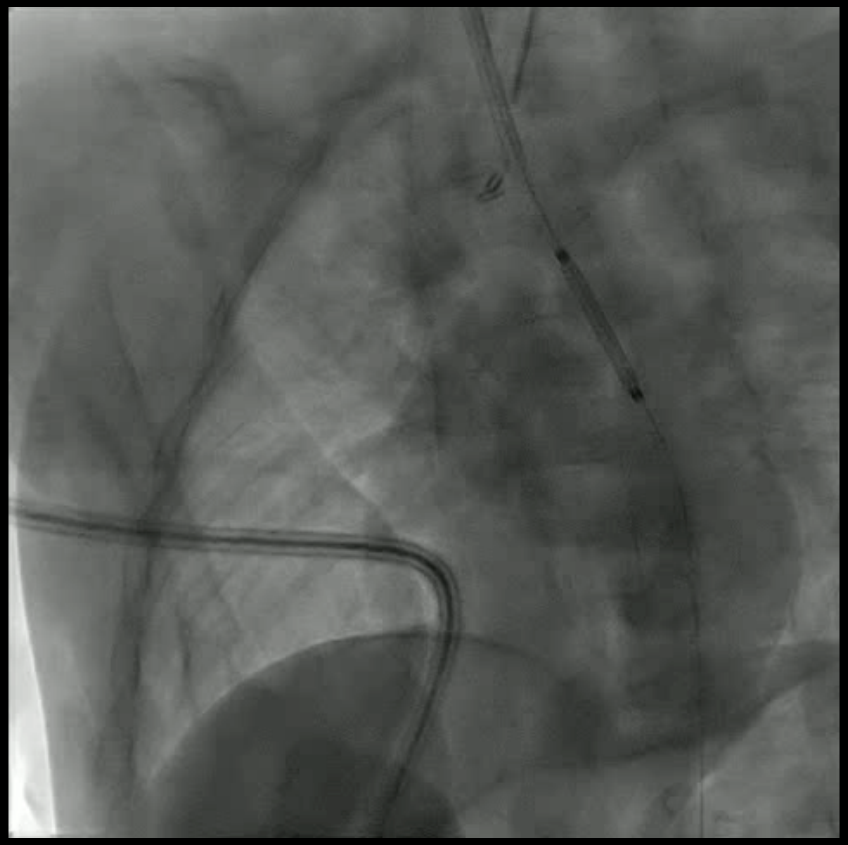
Post Stenting
“suboptimal result”

Clinical Case:3

I.R.C.C.S. POLICLINICO SAN DONATO



Stent Dislocation



2° Valeo Stent 7x18 mm

Clinical Case:3

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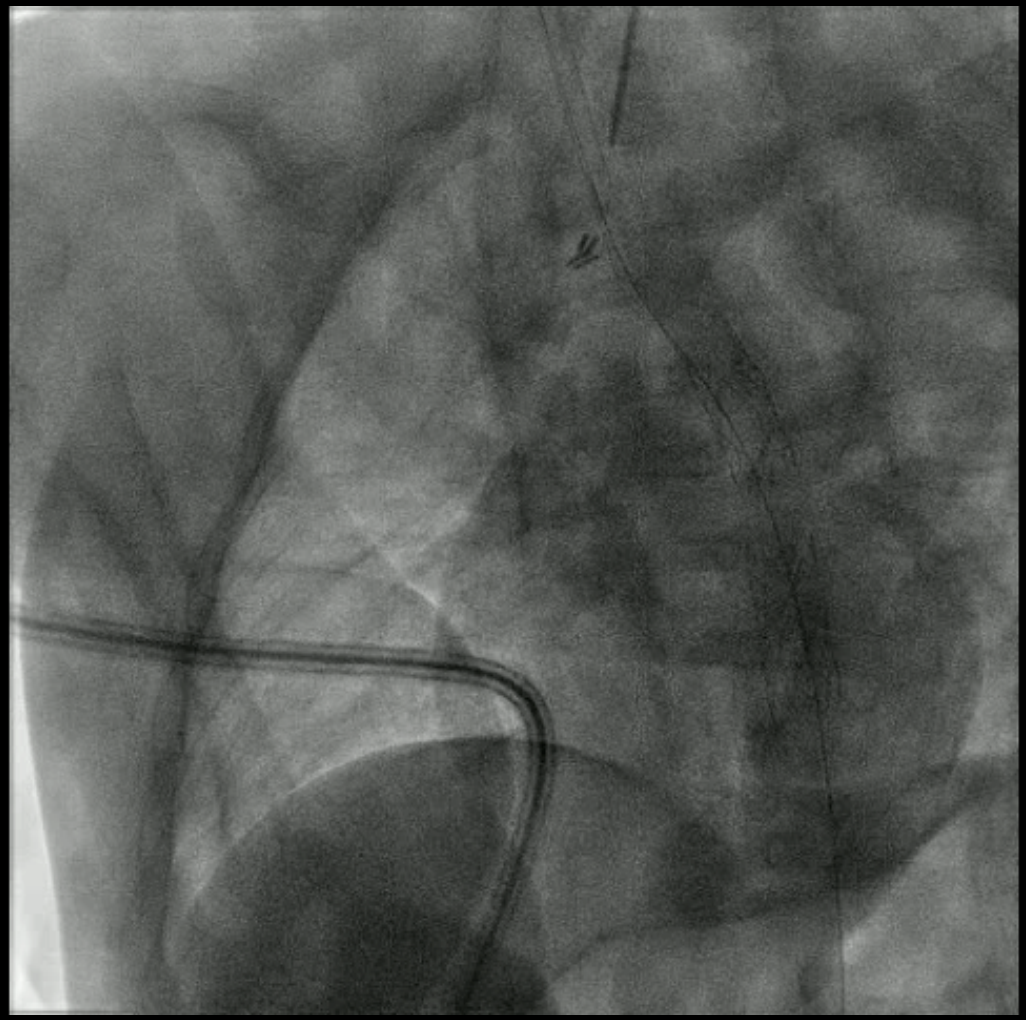

Final result: no residual gradient

Clinical Case:3

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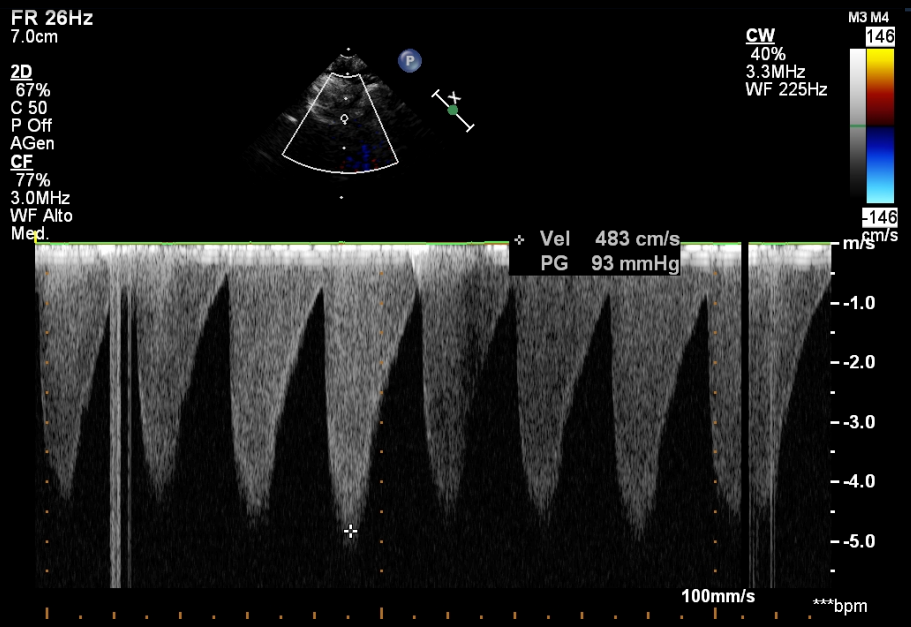
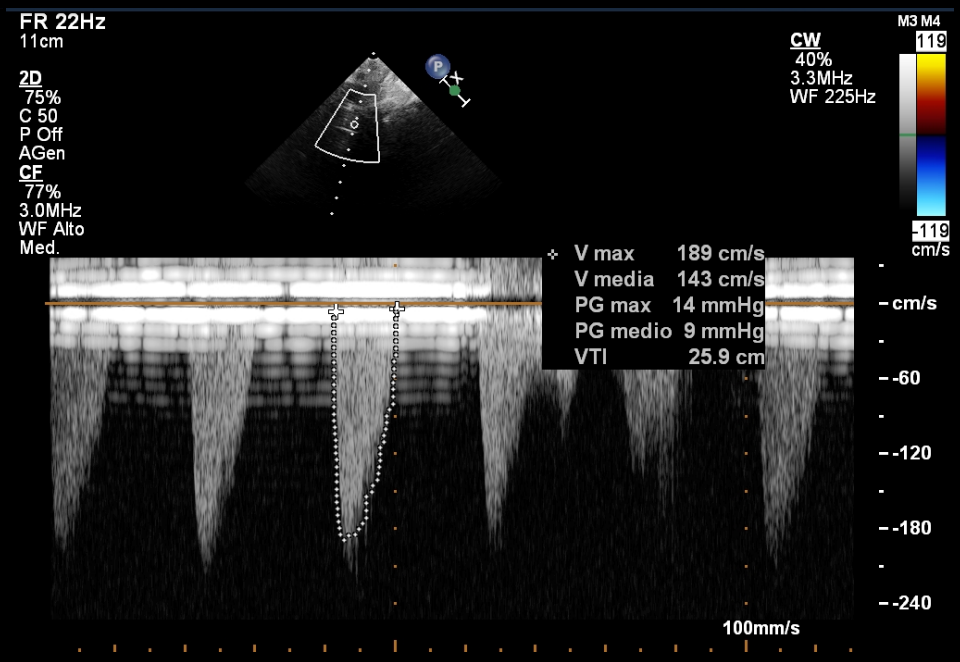
Echo doppler evaluation

PRE-



POST-

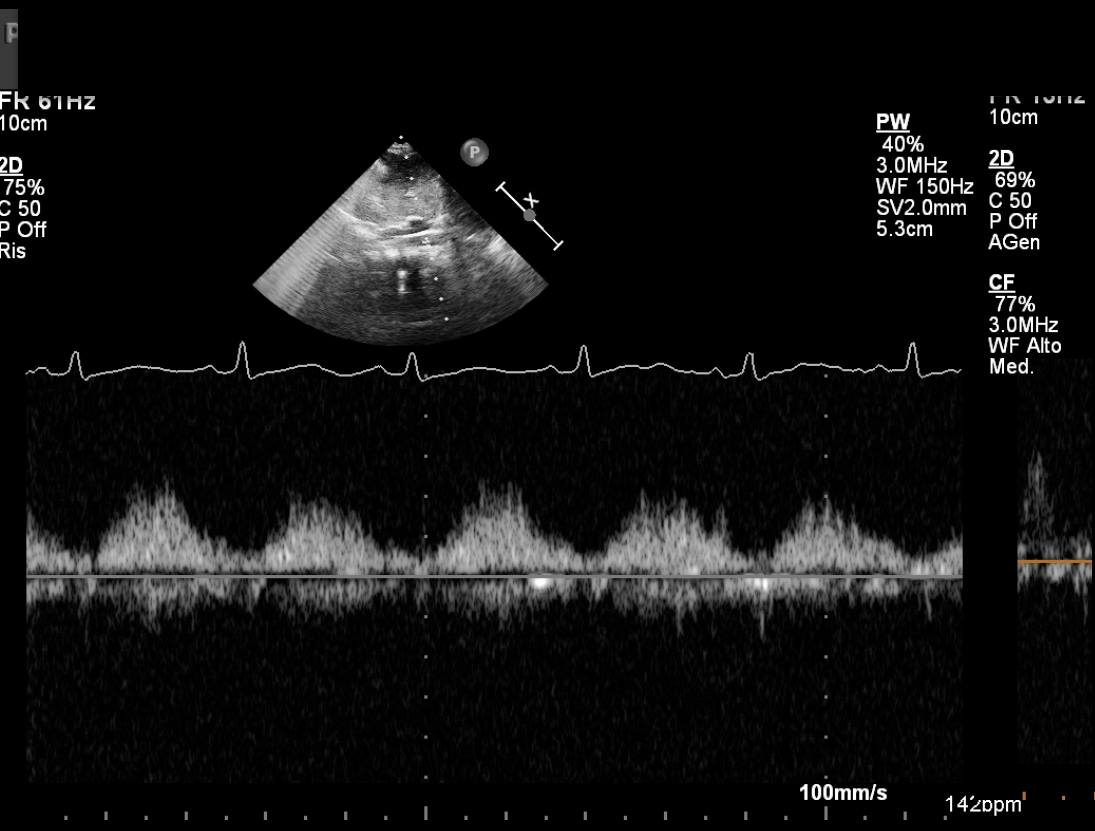


Clinical Case:3

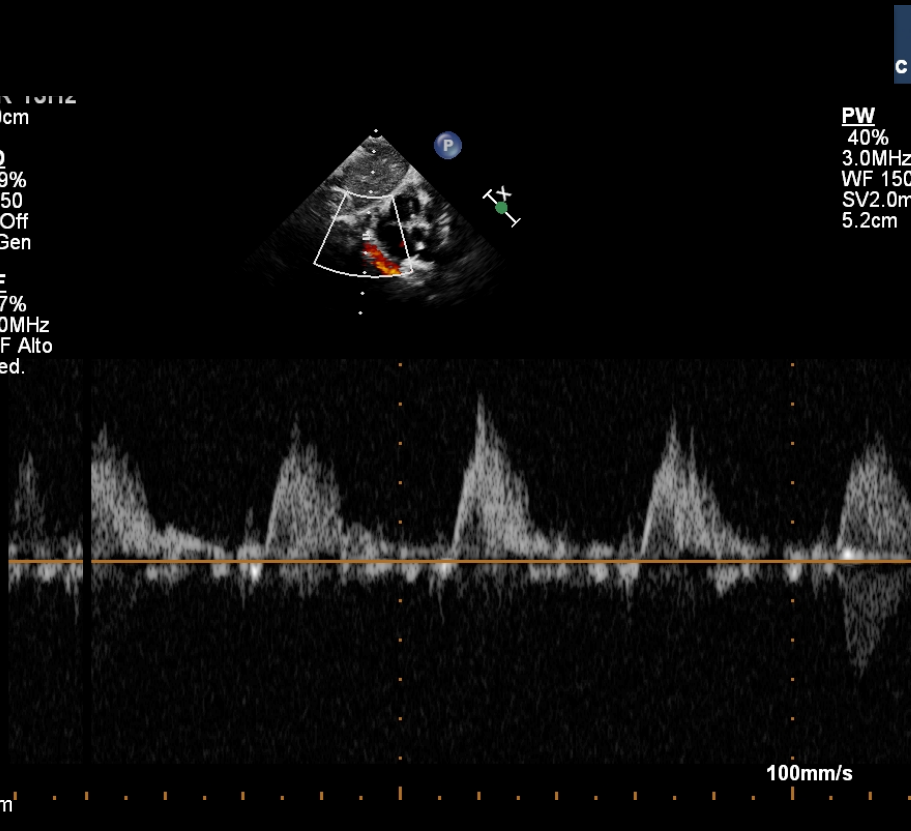
I.R.C.C.S. POLICLINICO SAN DONATO

Echo doppler evaluation

PRE-



POST-



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Conclusions

* Early treatment is feasible for early Recoarctation

* Angioplasty is the first option

* Stent implantation can be adopted if needed

* Carotid approach is the key issue for achieving good results and avoiding complications in pts with body weight less than 4 Kg.

Early Recoarctation: when to treat

I.R.C.C.S.
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Thank you!

Mario Carminati