

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

Early re-CoA: when and how to treat?

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Pediatric and Adult Congenital Cardiology

IRCCS Policlinico San Donato

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 balloon 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 intermediate term follow-up. J Am Coll Cardiol 1997; 30: 1847-1852.*

OVER 35 yrs of experience in percutaneous treatment of Aortic Coarctation

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

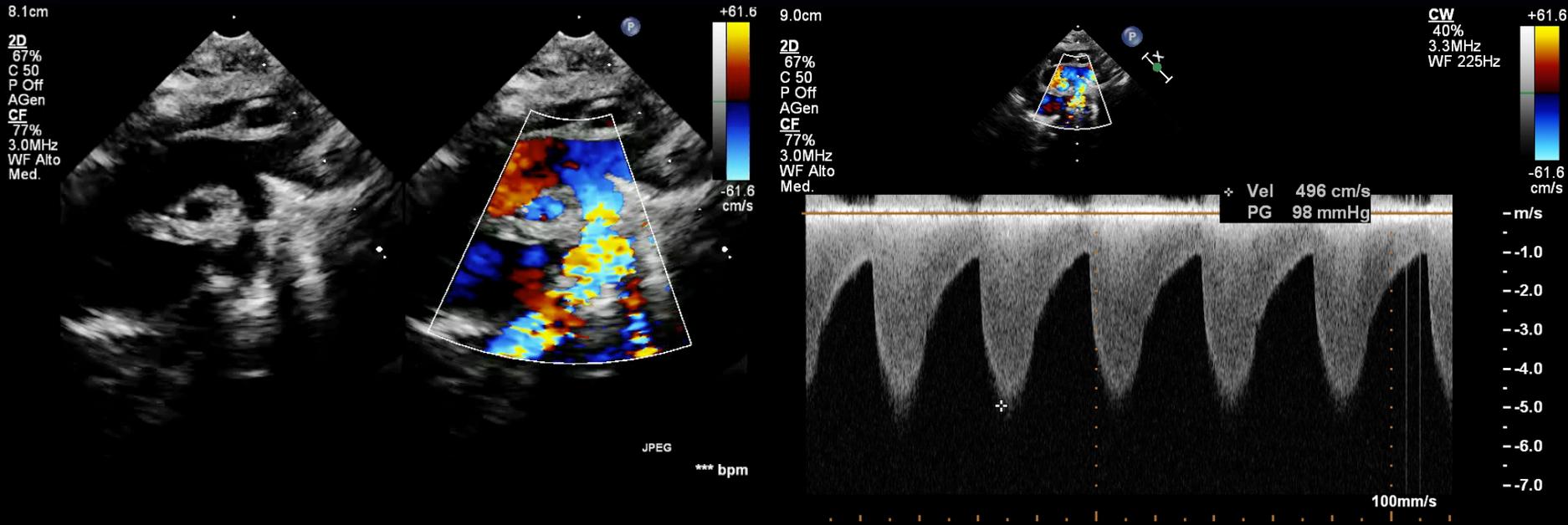
- * “good” clinical conditions**
- * Upper/low extremities < 25 mmHg**
- * Doppler: high velocity but no diastolic run-off**
- * Preserved LV function**



No invasive treatment – follow-up

Early Recoarctation: when to treat

Echo assessment: indication to treat



Aortic arch morphology

Doppler: High velocity + diastolic run-off

Early Recoarctation: when to treat

How to treat

<i>Redo surgery</i>		<i>Uncommon</i>
<i>Angioplasty</i>		<i>Most common</i>
<i>Stenting</i>		<i>In selected pts</i>

Catheter intervention



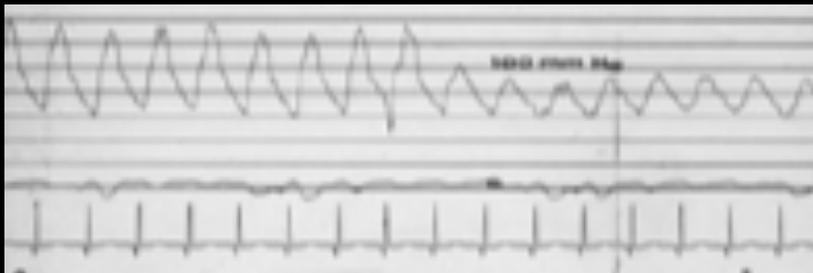
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Vascular access: Femoral artery
Carotid or axillary (< 4 Kg)

Angiography: multiple projection (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.

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 times 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.

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

Age: 3 months

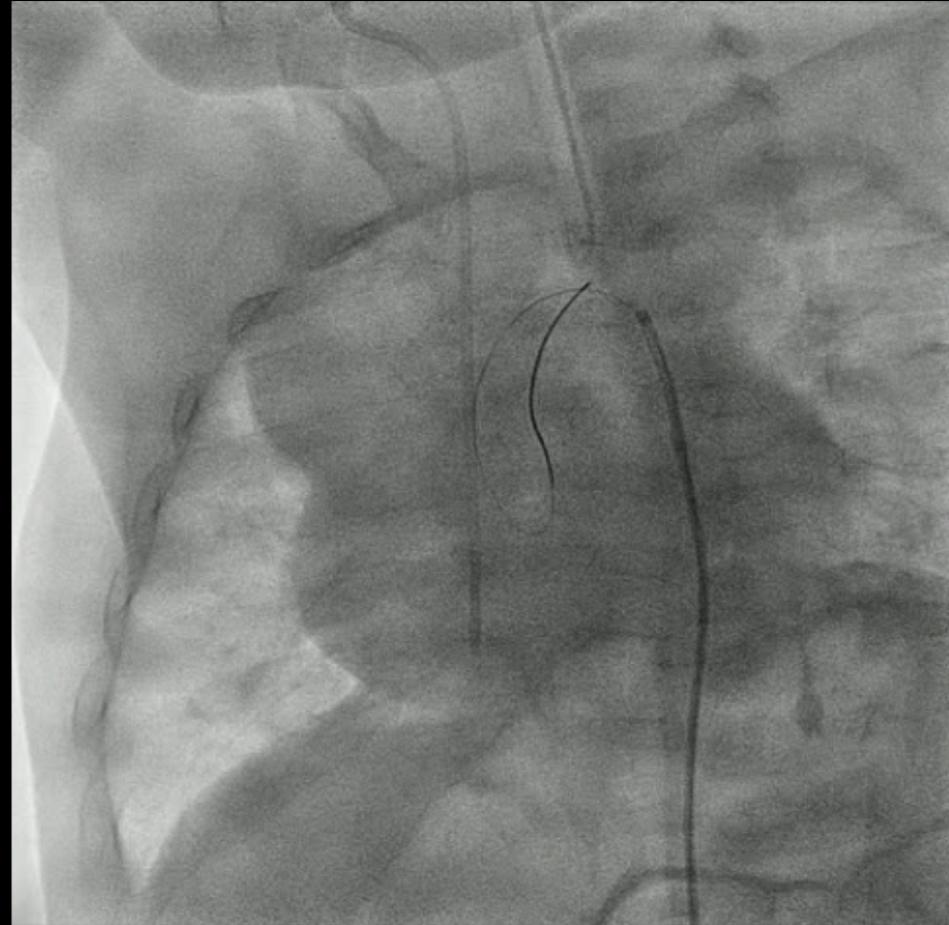
Weight: 5.5 Kg

Diagnosis At birth: large VSD and CoA

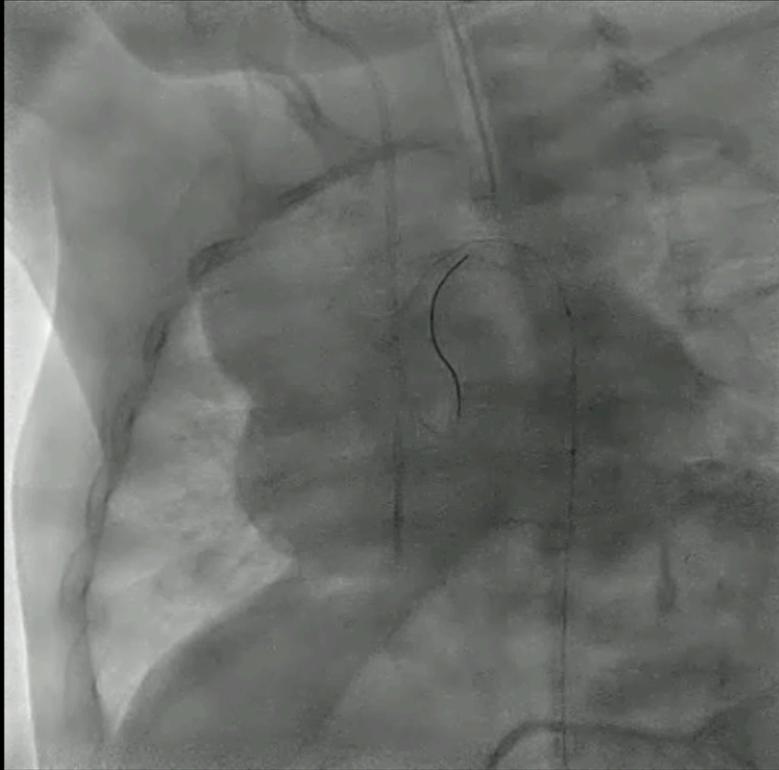
3 days of life: aortic de-coarctation with end to end anastomosis and pulmonary banding.

Admitted in hospital: for Heart failure

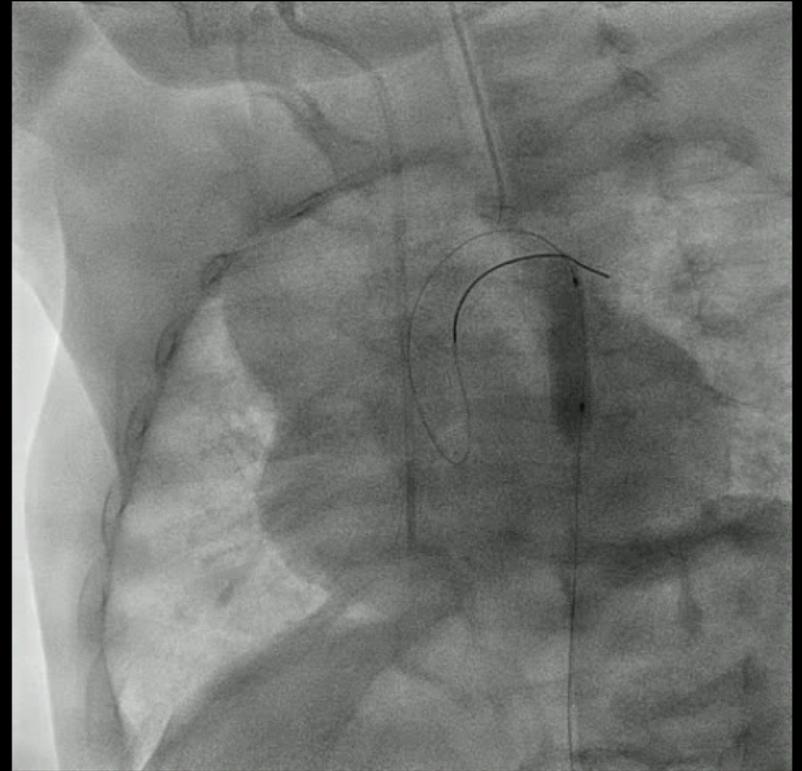
Hemodynamic assessment:
peak to peak gradient: 50 mmHg



Clinical Case 1



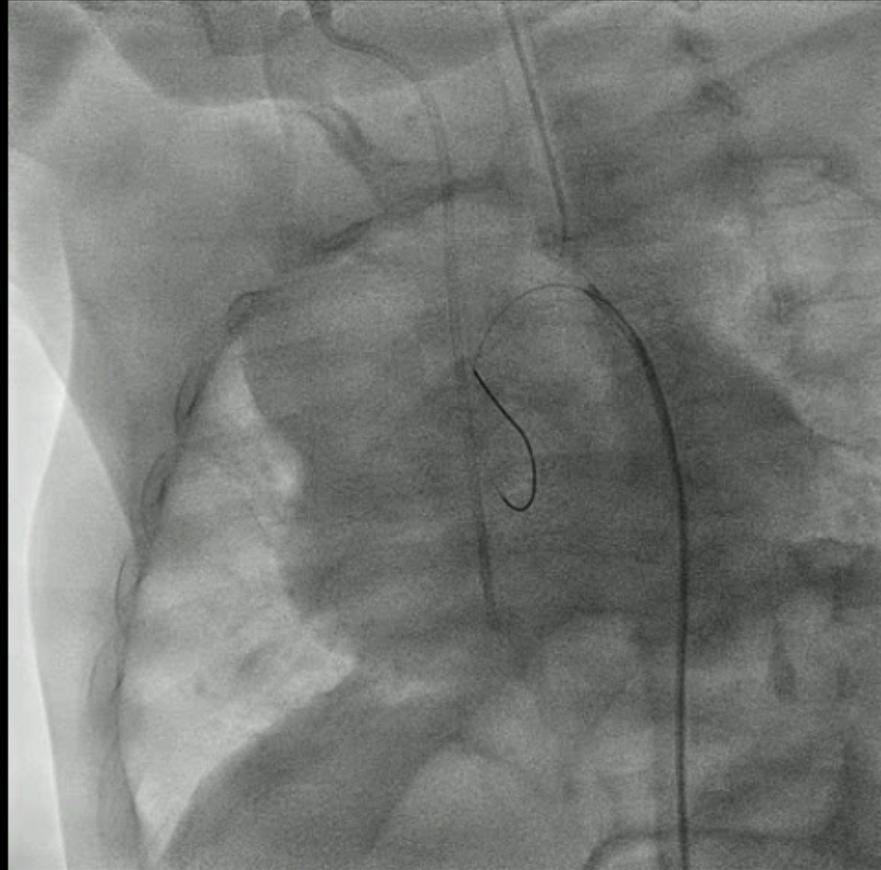
Coronary balloon: NC 4x20 mm 10 ATM



TyShak II balloon: 6x20 mm

Clinical Case 1

Good result: peak to peak gradient 10 mmHg



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

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**

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

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Carotid approach

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)		Percent gradient reduction	Diameter (mm)		Post-BD AI
					Pre-BD	Post-BD		Annulus	Balloon	
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

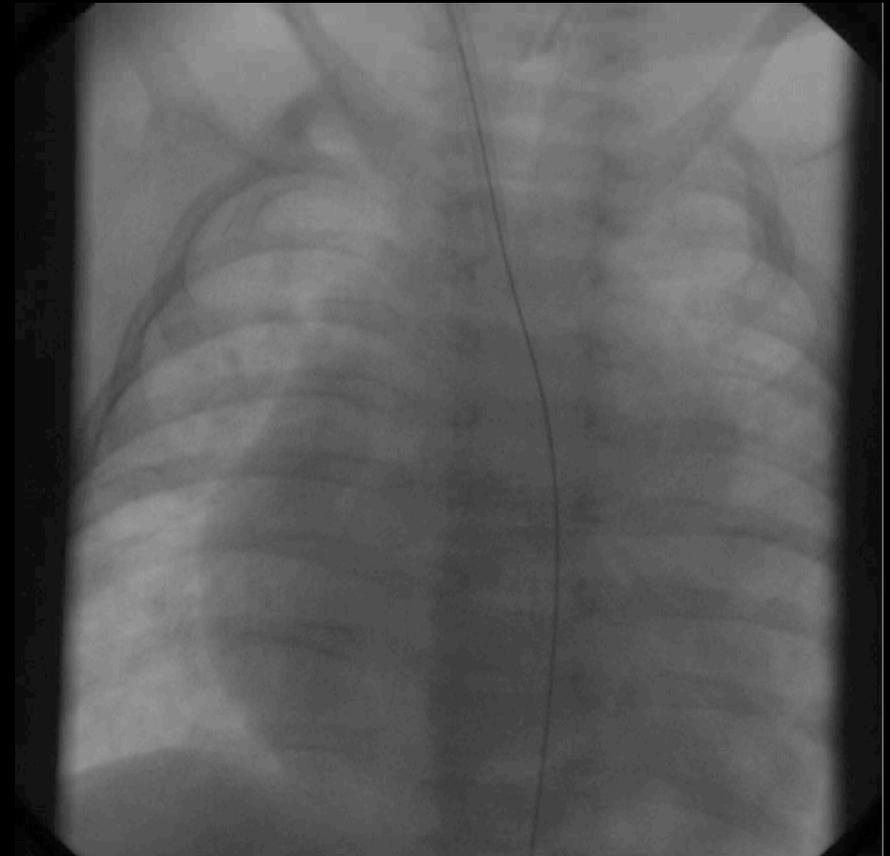
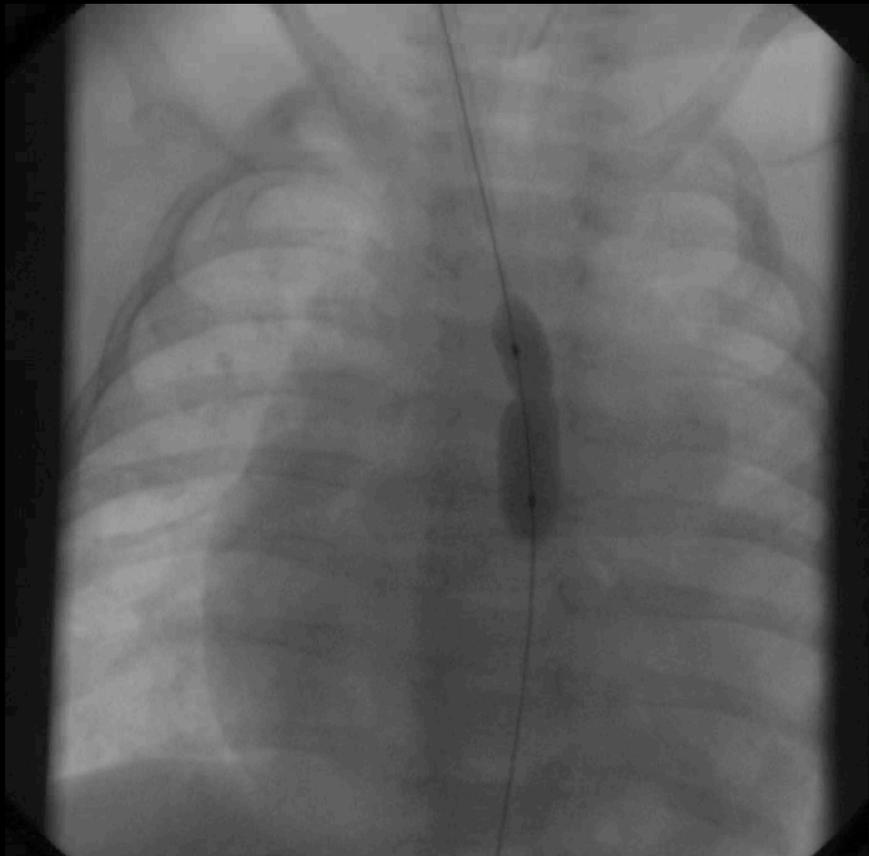
Severe recoarctation in 2 Kg. baby



Carotid approach

Easy crossing of stenotic site

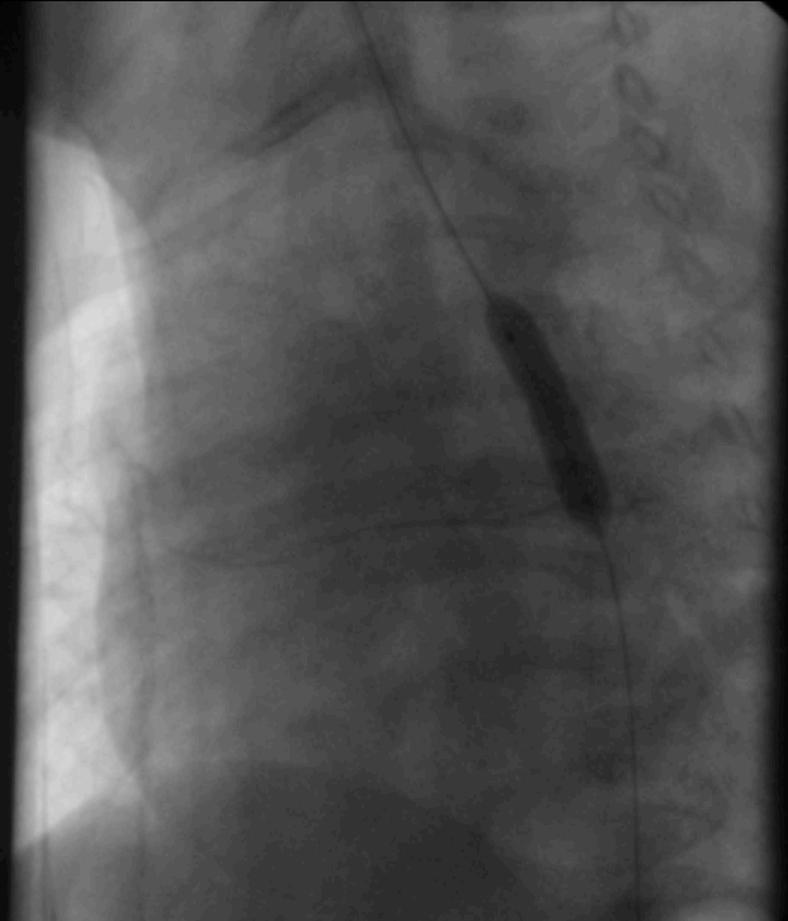
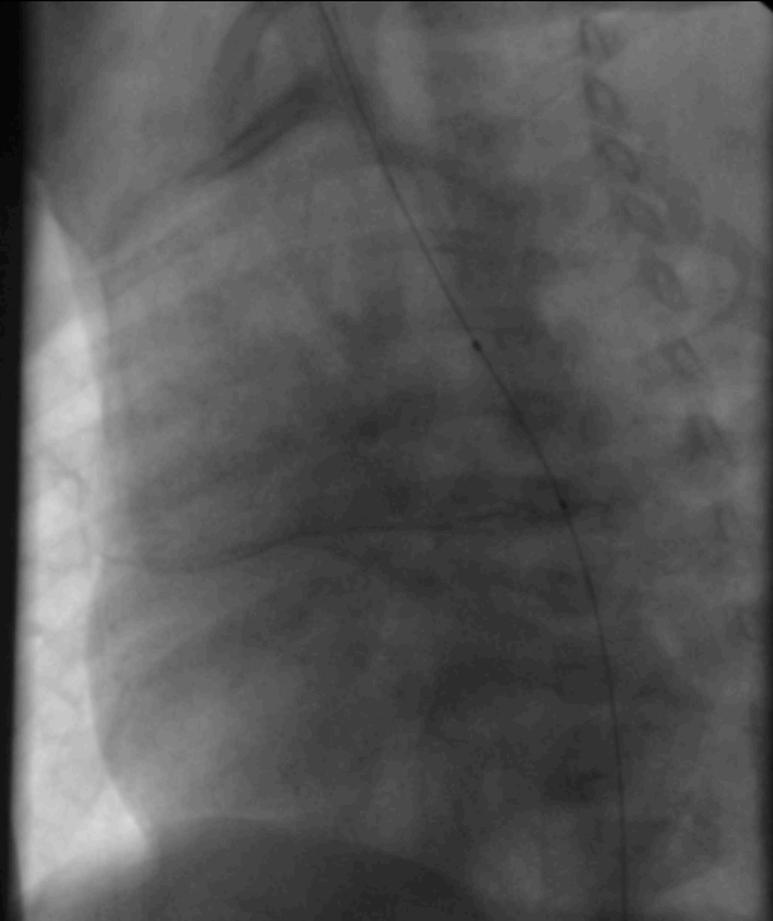
*Immediate check angio
no need of exchange catheter*



Carotid approach

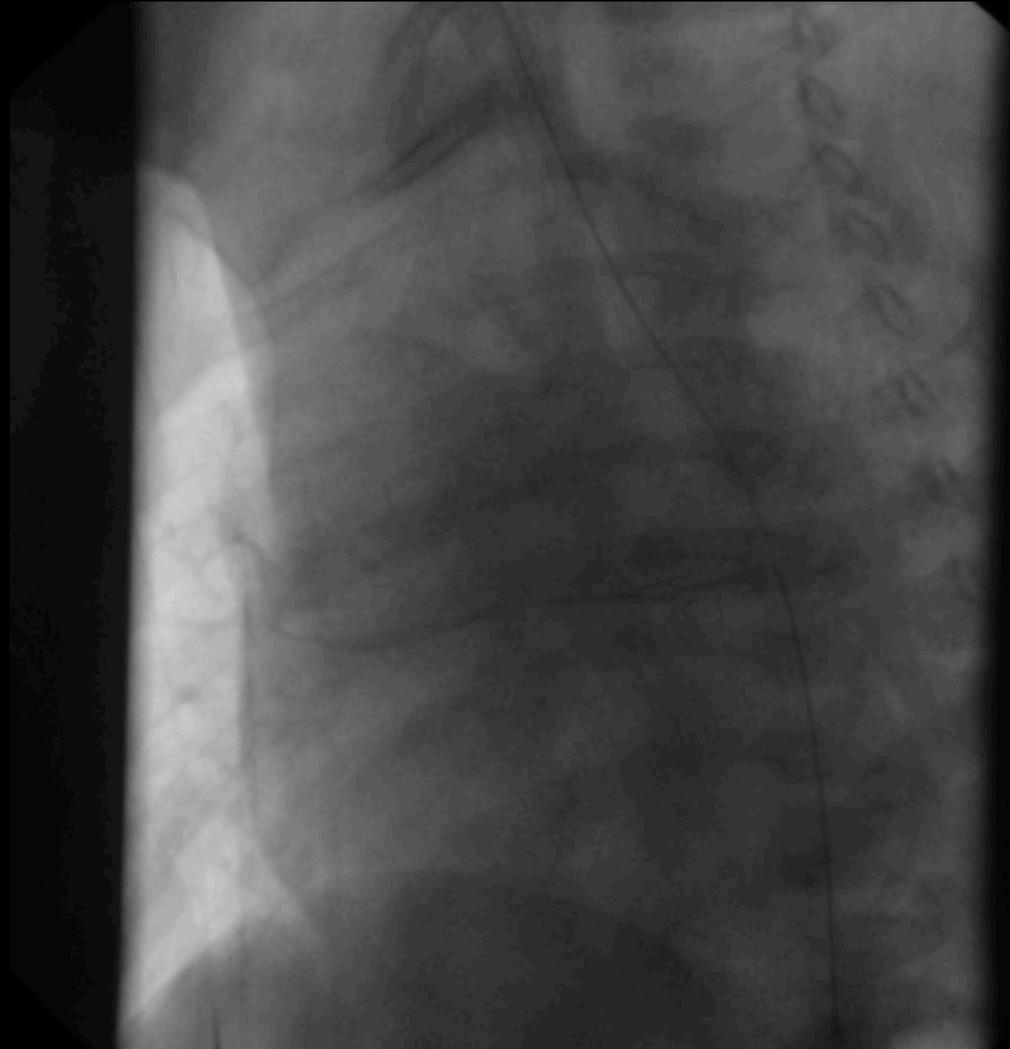
...If the result is suboptimal.....

*...very easy to exchange to a
larger balloon...*



Carotid approach

Excellent result



Clinical Case: 2

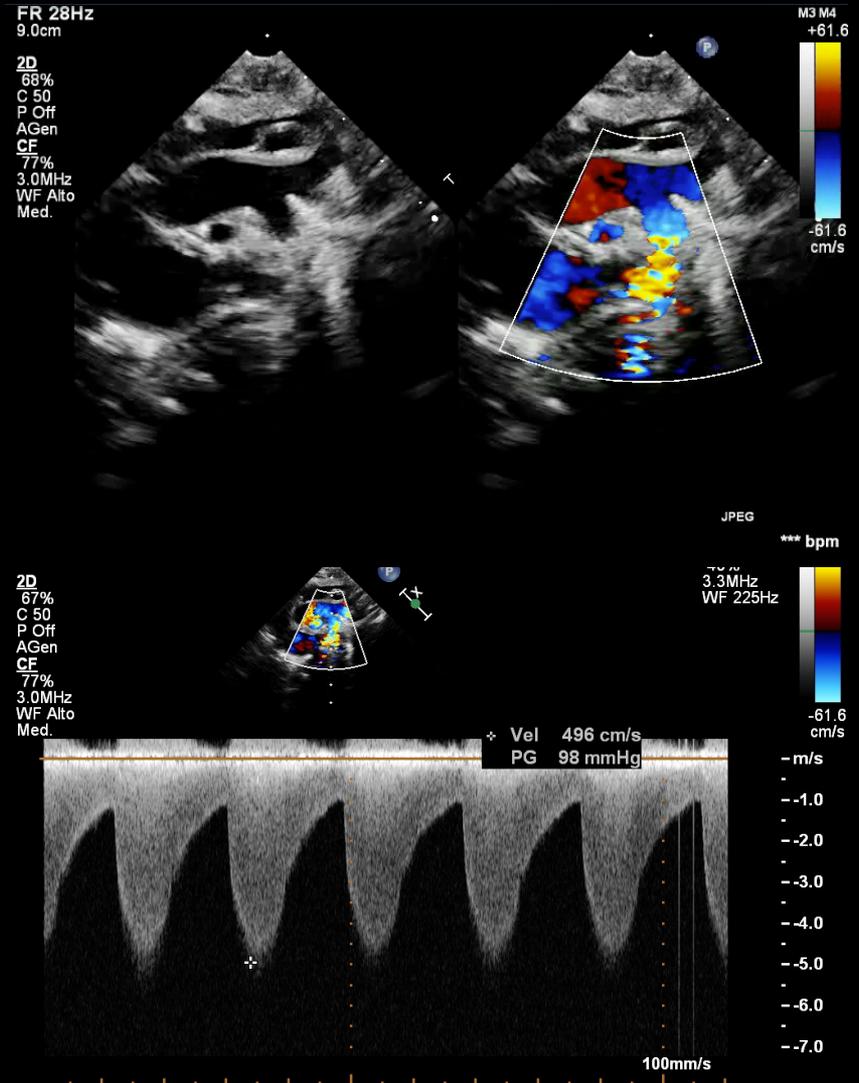
Age: 1 months

Weight: 4 Kg

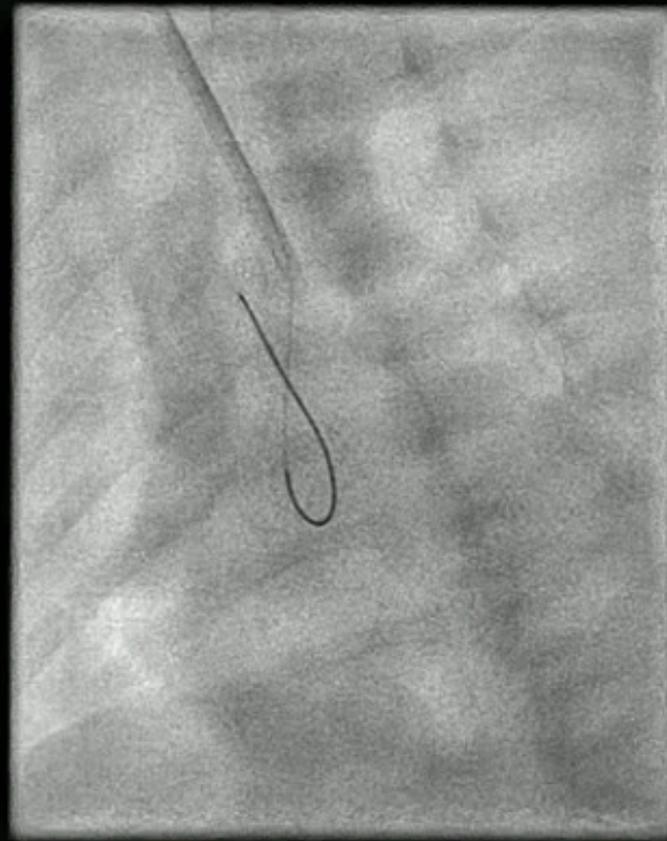
At birth diagnosis: severe aortic coarctation of a persistent fifth aortic arch with atretic fourth homolateral arch.

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.

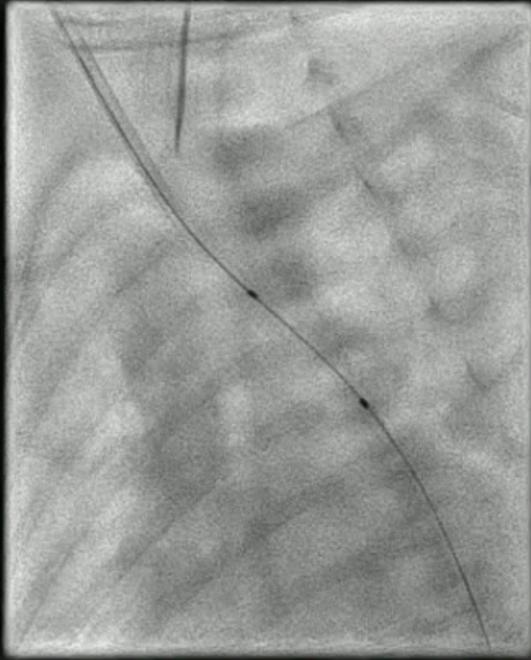


Clinical Case: 2

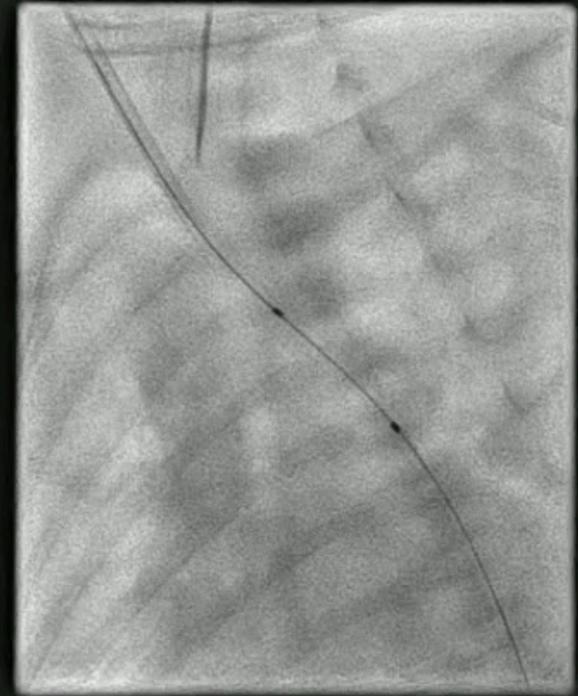


Right common carotid artery approach

Clinical Case:2

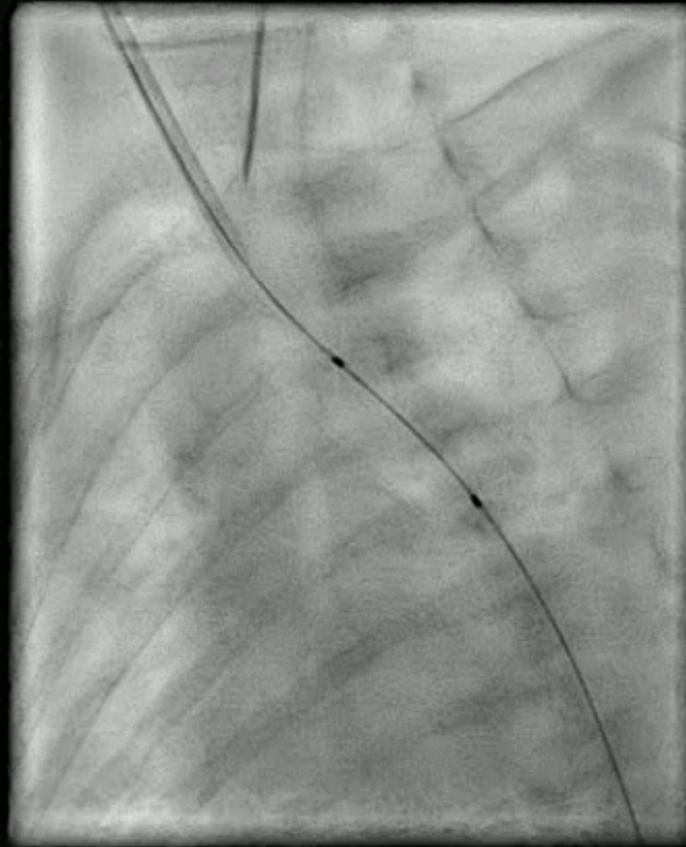


Mini TyShak balloon: 5x20 mm



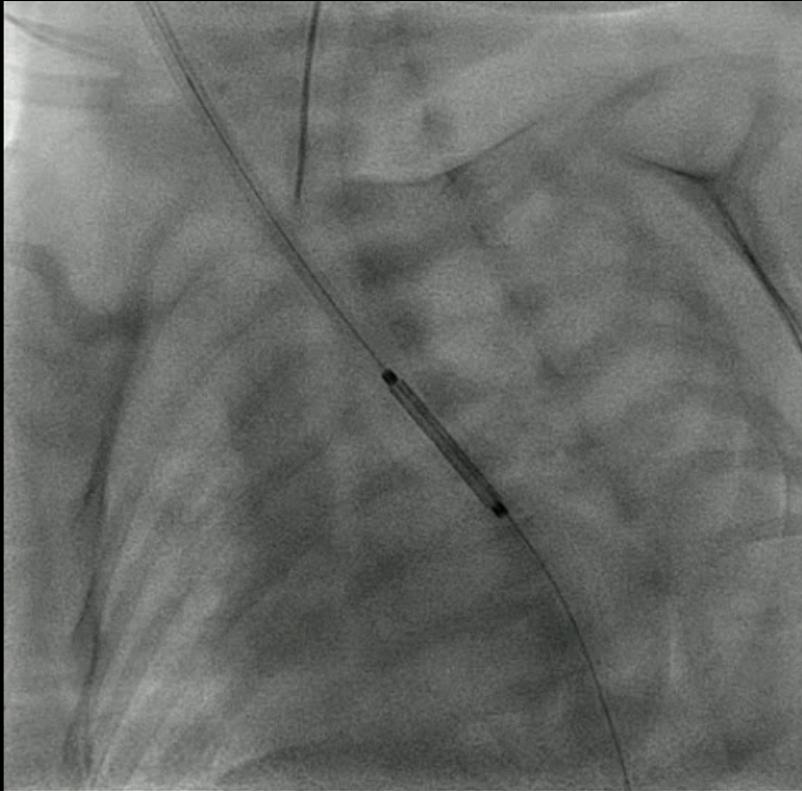
Mini TyShak balloon: 6x20 mm

Clinical Case:2

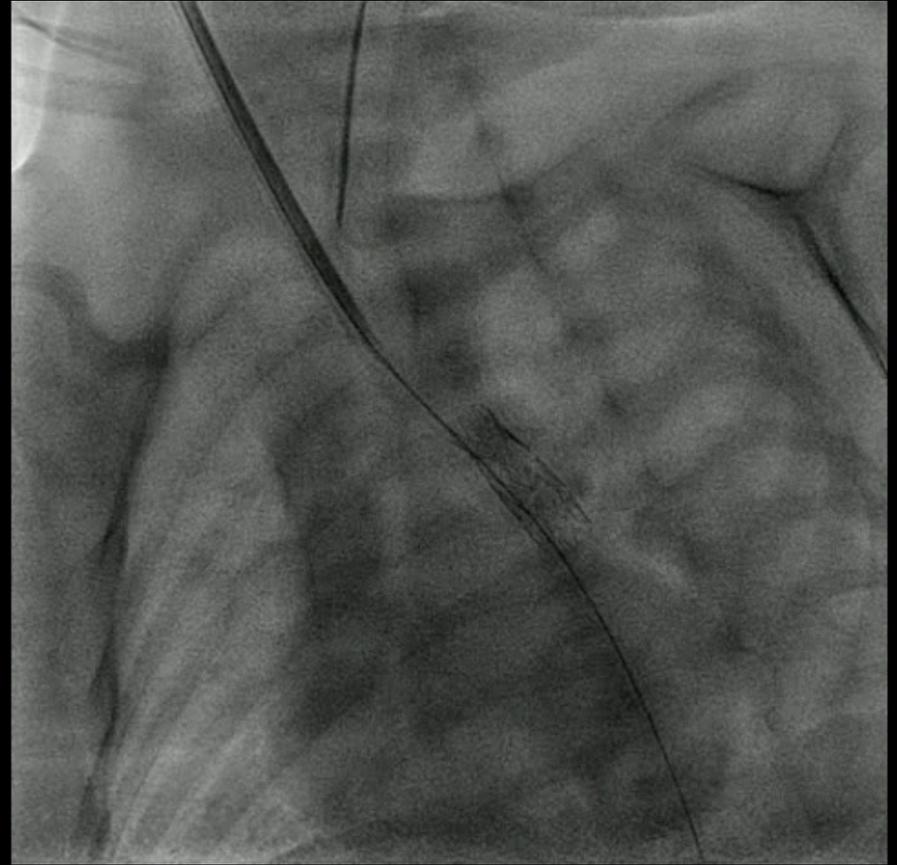


Post balloon angioplasty : no significant increase of vessel diameter
high residual gradient

Clinical Case:2

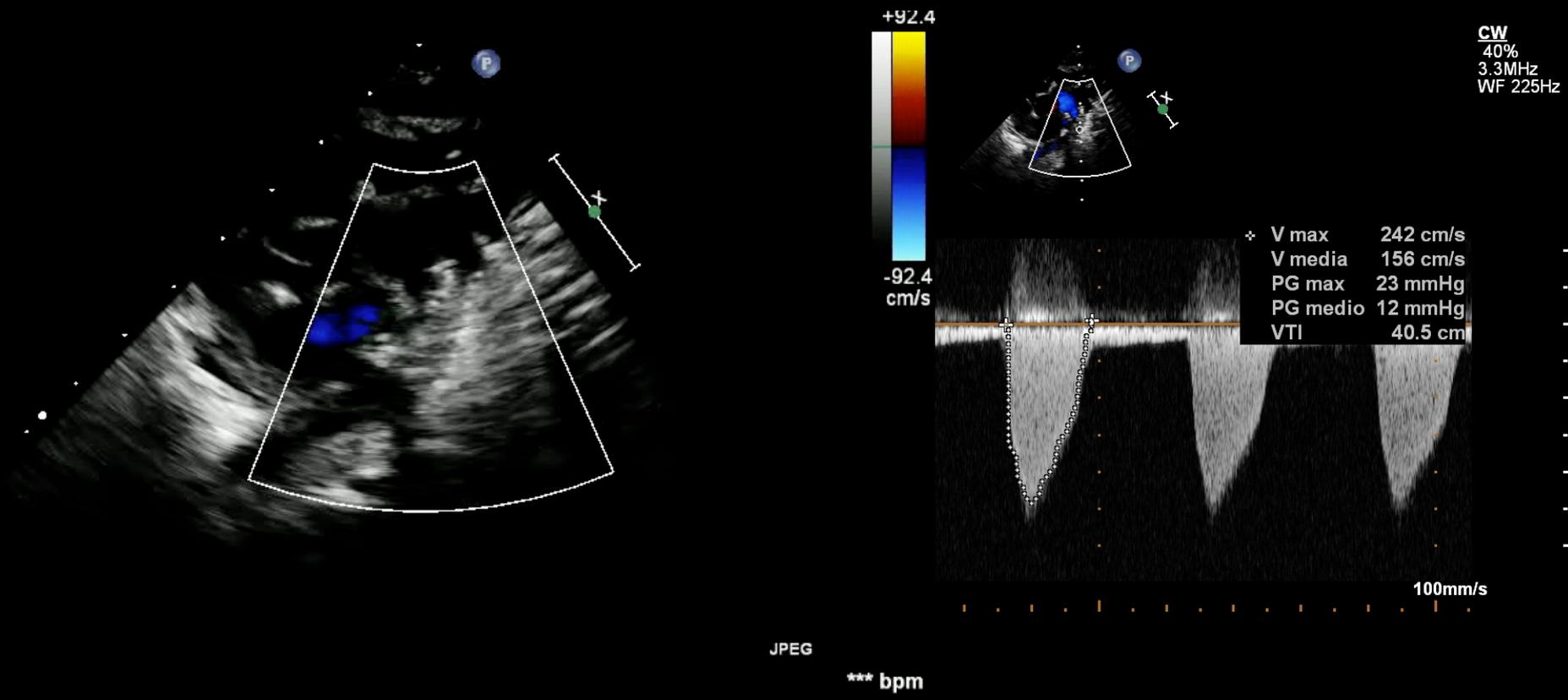


Valeo stent 6x18 mm



Final Result

Echo pre-discharge



Clinical Case: 3

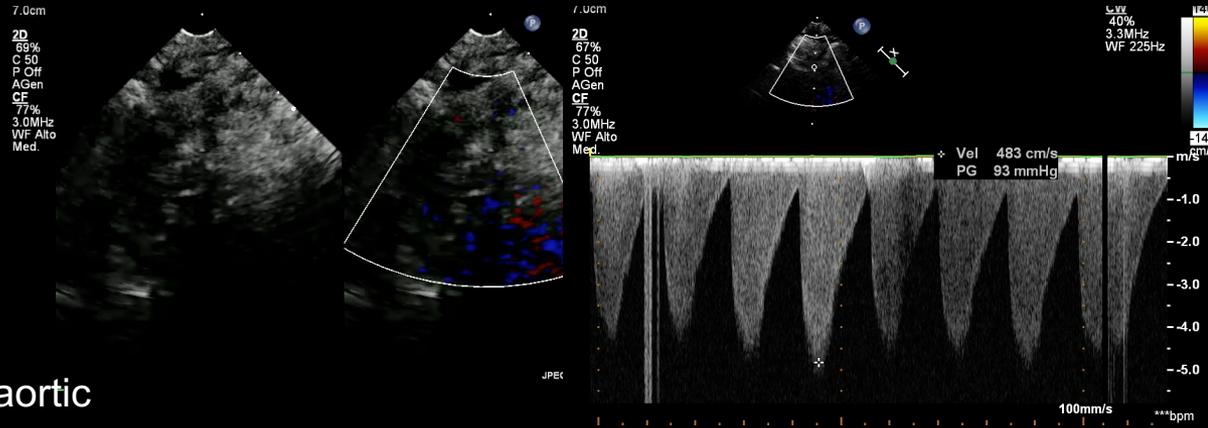
Age: 4 months

Weight: 5,5 Kg

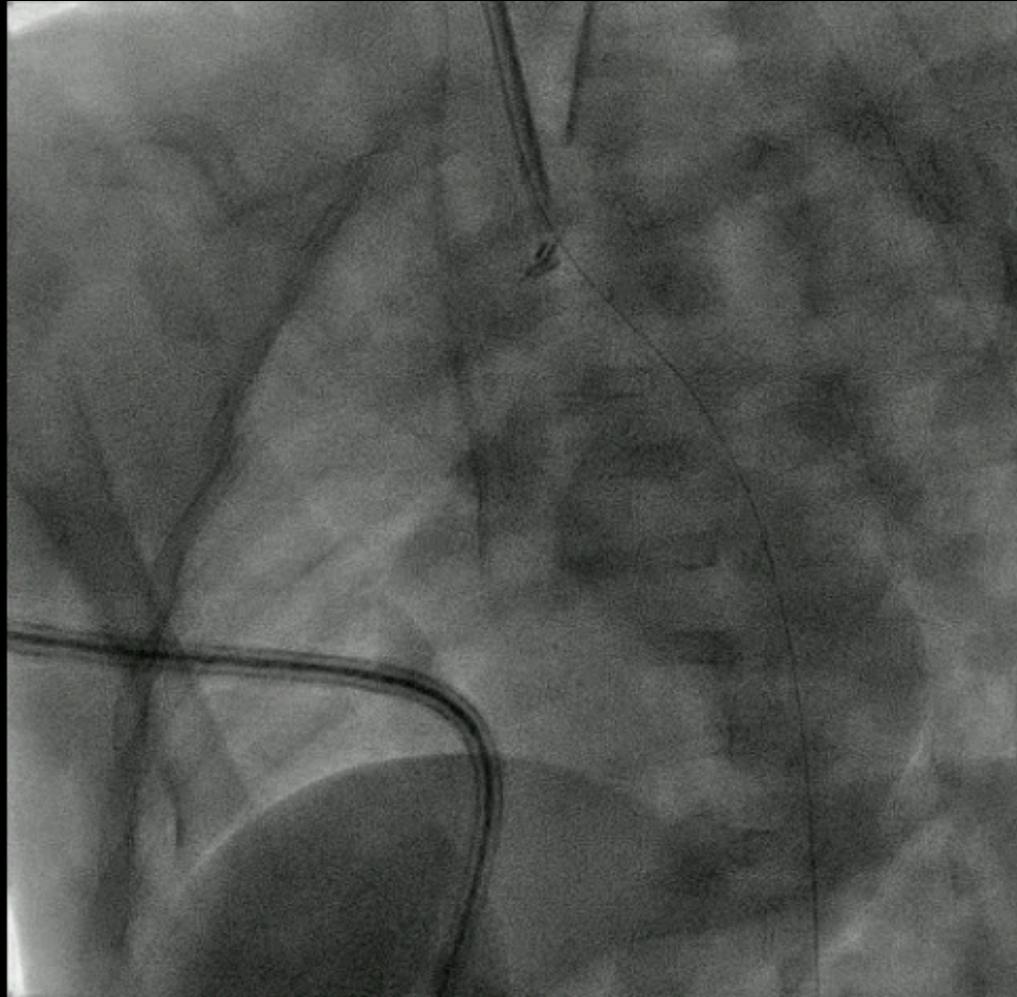
At birth diagnosis: Interrupted aortic arch type B. VSD

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 oloedialstolic tail four months after the surgery.

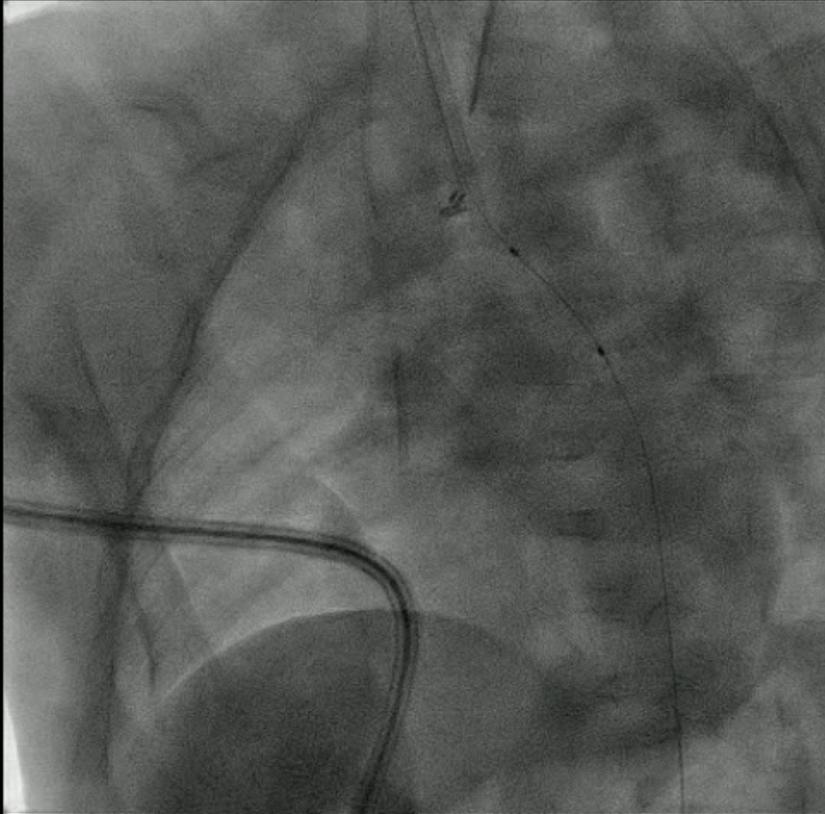


Clinical Case: 3

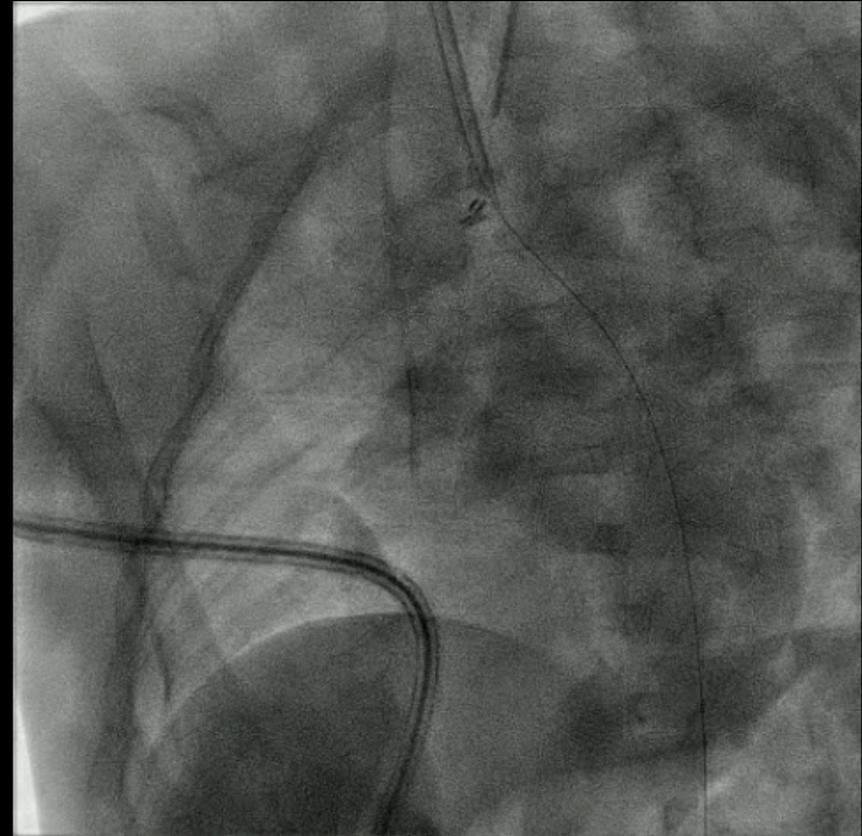


**Right common carotid artery approach
Peak to peak gradient 80 mmHg**

Clinical Case:3

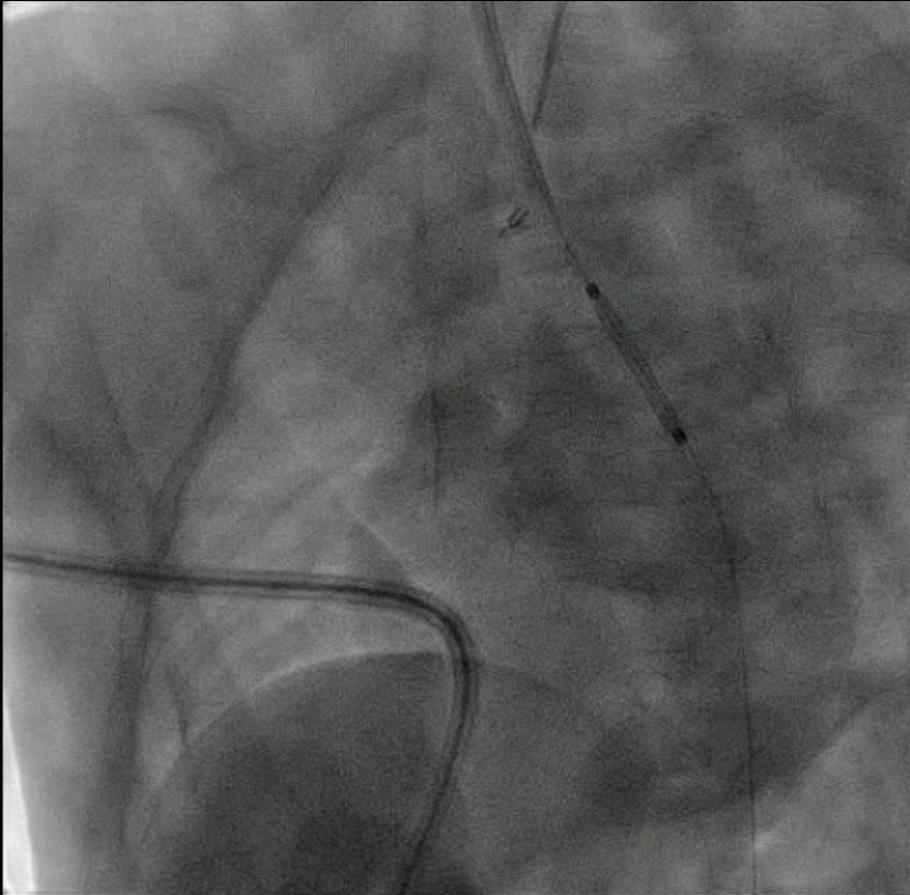


Mini TyShak balloon: 5x20 mm

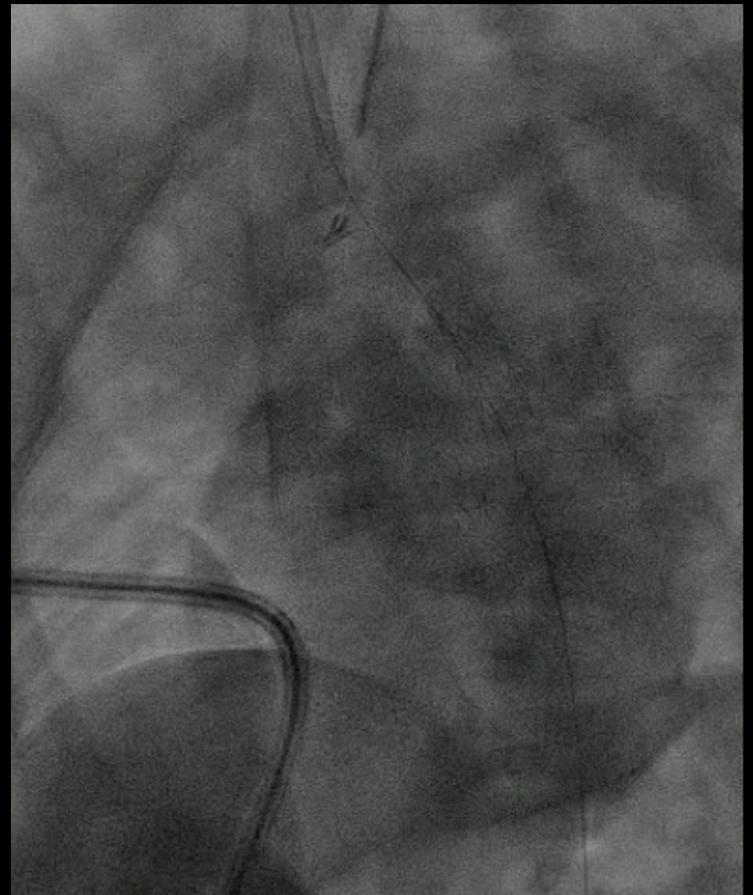


Post angioplasty

Clinical Case:3

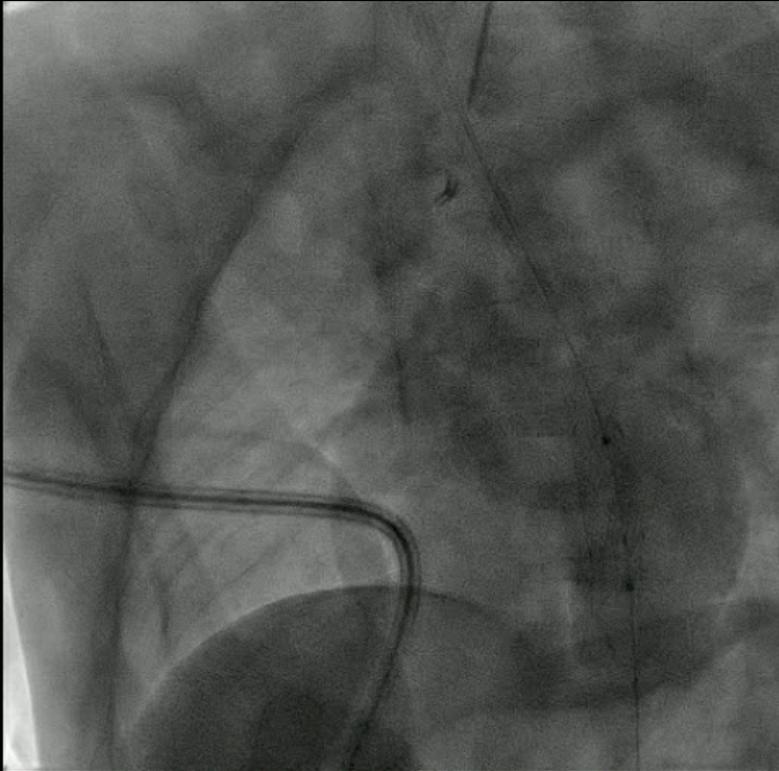


Valeo Stent 6x18 mm

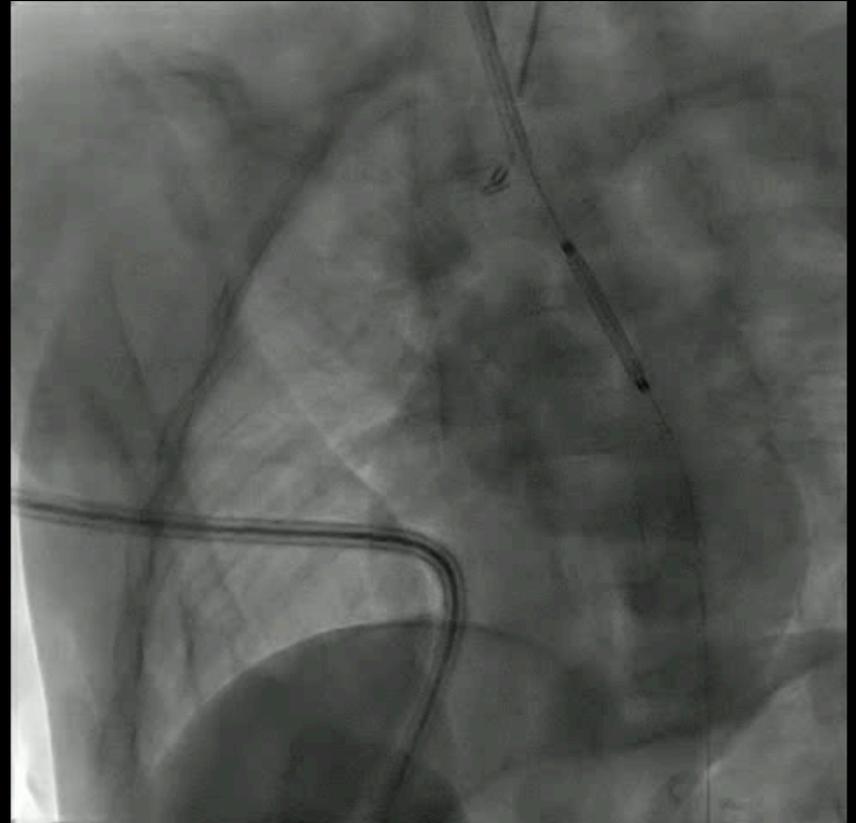


**Post Stenting
“suboptimal result”**

Clinical Case:3

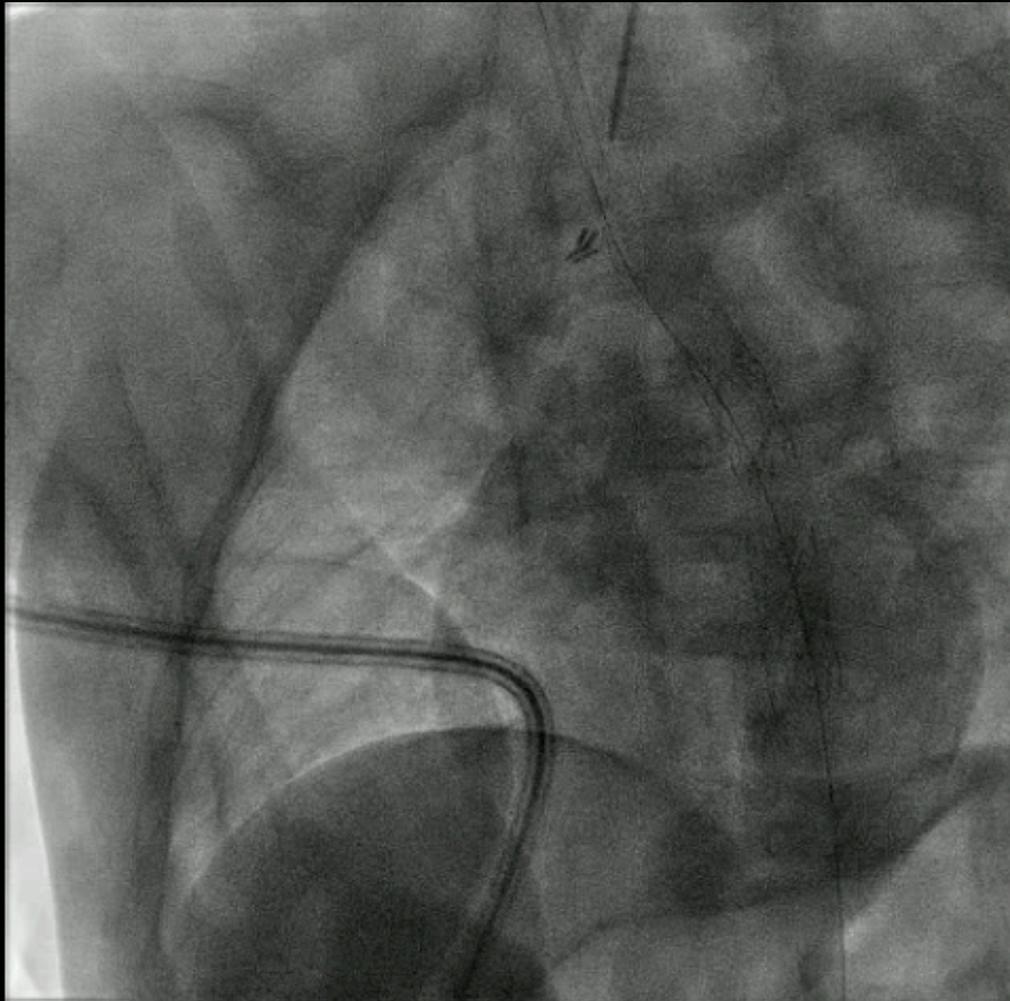


Stent Dislocation



2° Valeo Stent 7x18 mm

Clinical Case:3

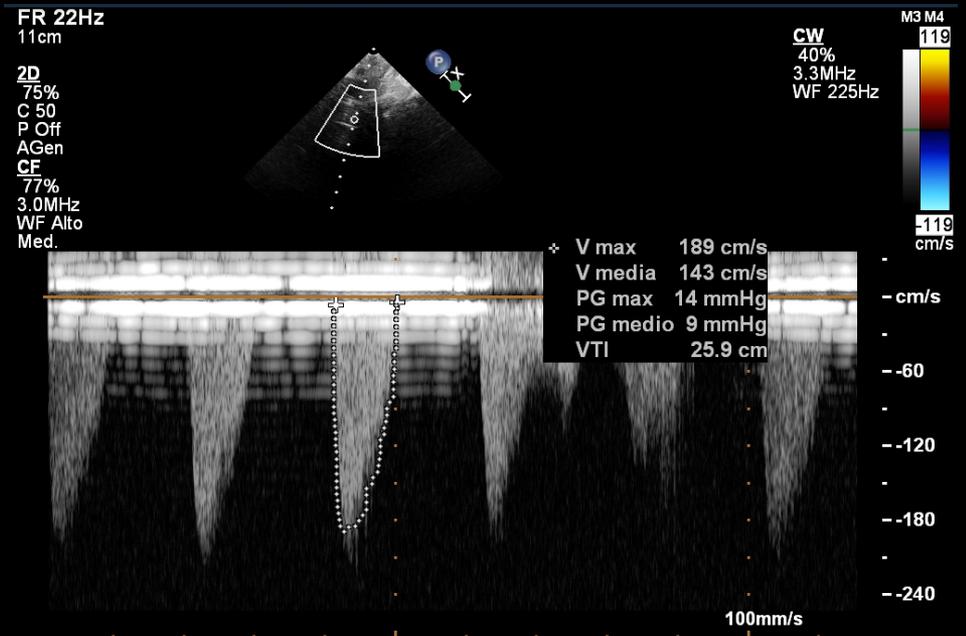
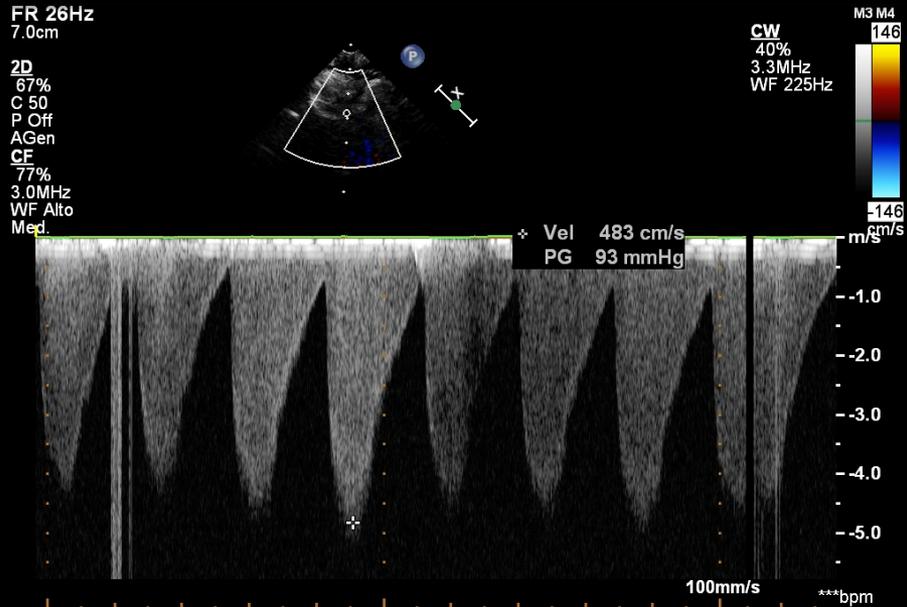


Final result: no residual gradient

Echo doppler evaluation

PRE-

POST-

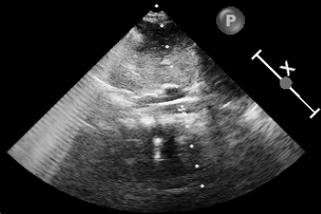


Echo doppler evaluation

PRE-

POST-

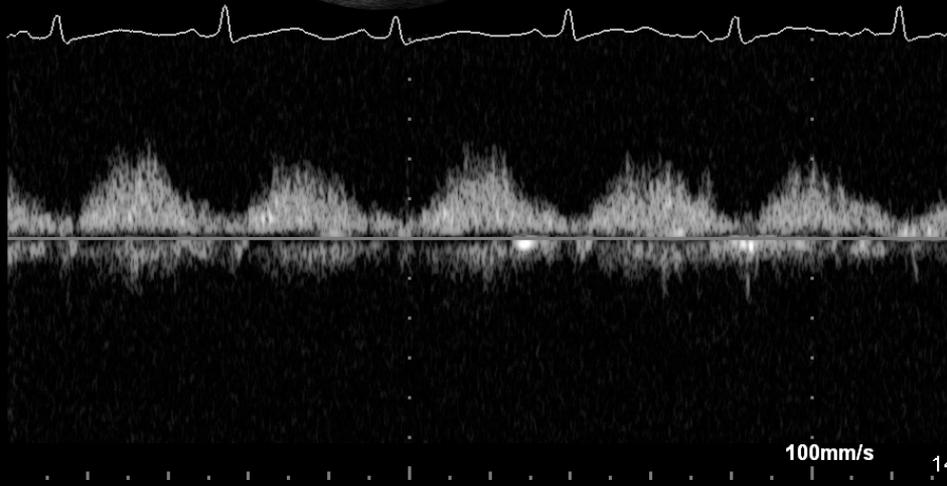
FK 61Hz
10cm
2D
75%
C 50
P Off
Ris



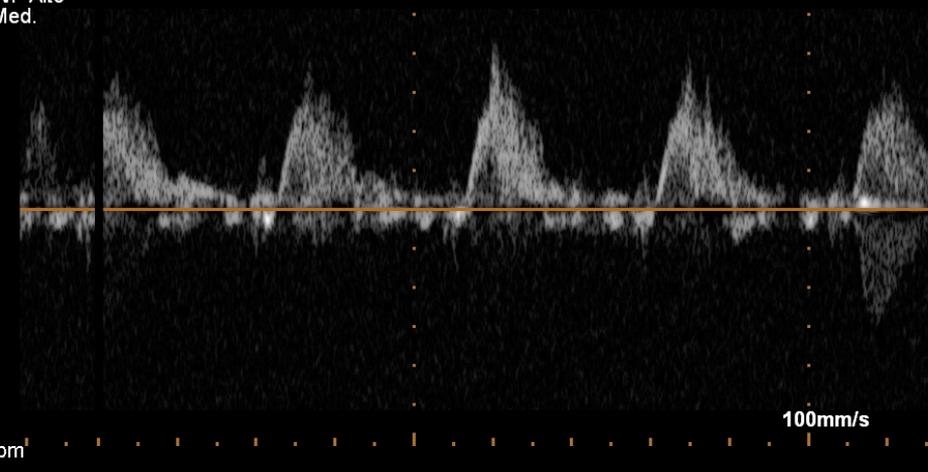
PW
40%
3.0MHz
WF 150Hz
SV2.0mm
5.3cm

FK 101Hz
10cm
2D
69%
C 50
P Off
AGen

CF
77%
3.0MHz
WF Alto
Med.



PW
40%
3.0MHz
WF 150
SV2.0m
5.2cm



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.



Thank you!

Mario Carminati