

Stents in aortic coarctation and atresia

Shakeel A Qureshi

Evelina London Children's Hospital

London, UK

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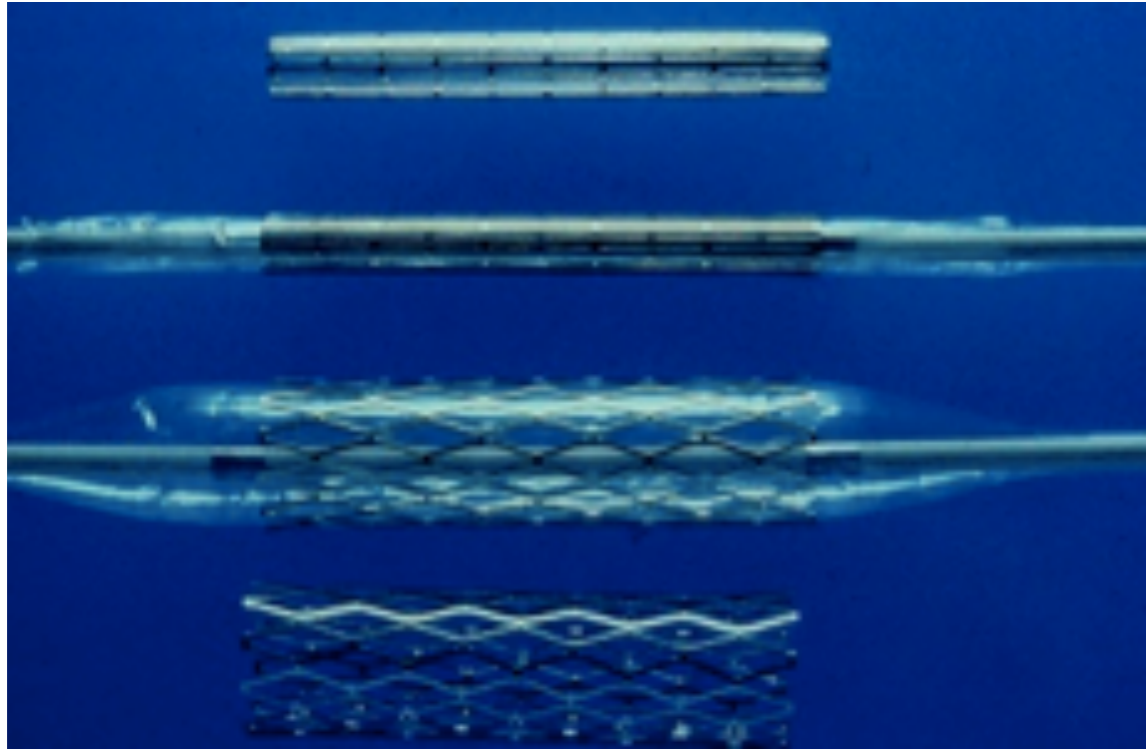
Disclosures

Consultancy: NuMED Inc
Lifetech Inc
Venus Medtech

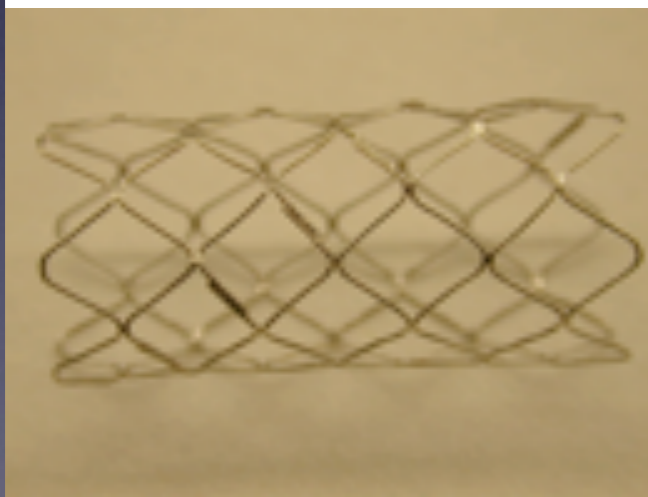
Proctor: Medtronic Inc
St Jude Medical

Bare stents

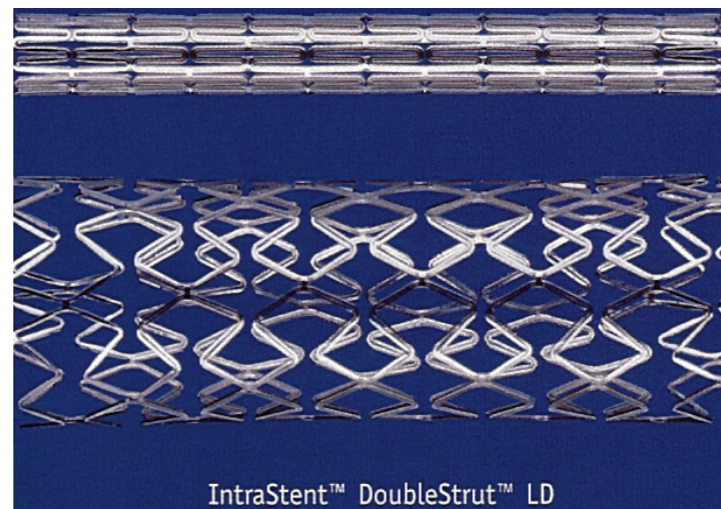
Palmaz stent



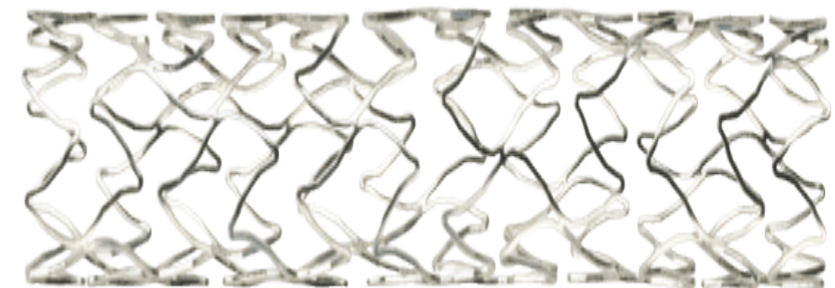
Palmaz Genesis stent



C-P stent



Intrastent



Jostent Wavemax

Complications of stenting

Acute complications categories:

Benign: Technical complications	41/565 (7.3%)
Stent migration	28
Balloon rupture	13
Less serious: Peripheral vascular complications	18 (3%)
Peripheral emboli	1
Significant access arterial injury	13
CVA	4

Complications of stenting

• Acute aortic wall complications in 22/565 (3.9%) procedures

- Intimal tears 8
- Aortic wall dissection/rupture 9
- Aortic aneurysm 6

• Pre-stent balloon angioplasty, coarctation in abdominal aorta vs isthmus/ transverse aortic arch, and age over 40 were significantly related to aortic wall complication

Bare stents in aortic coarctation

Over a 1000 patients in the literature

Deaths rare 0-1.4%

Neurological (embolic stroke) 0-3.7%

Aneurysms (after bare stents) 0-17%

Vascular access – arterial avulsion, stenosis, false aneurysm formation and thrombosis

Stent migration approximately 5%

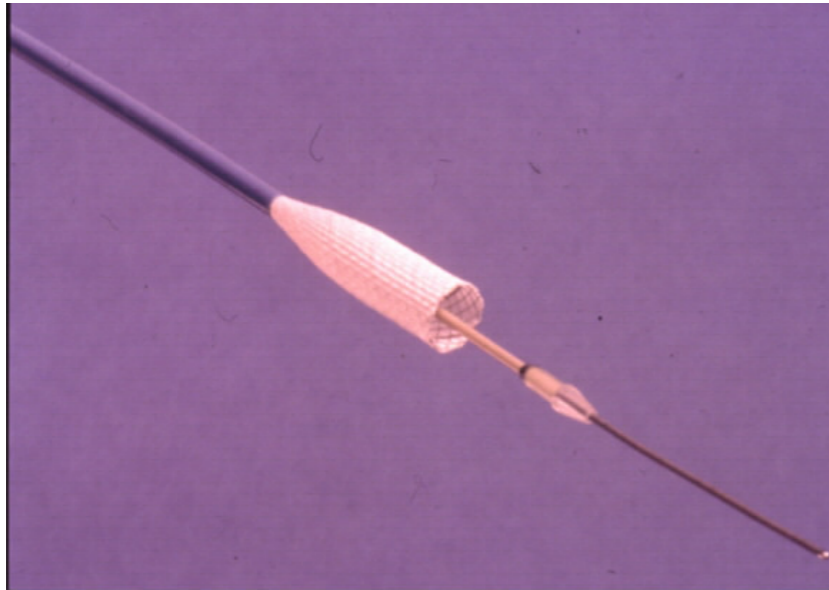
Balloon rupture

Paradoxical hypertension

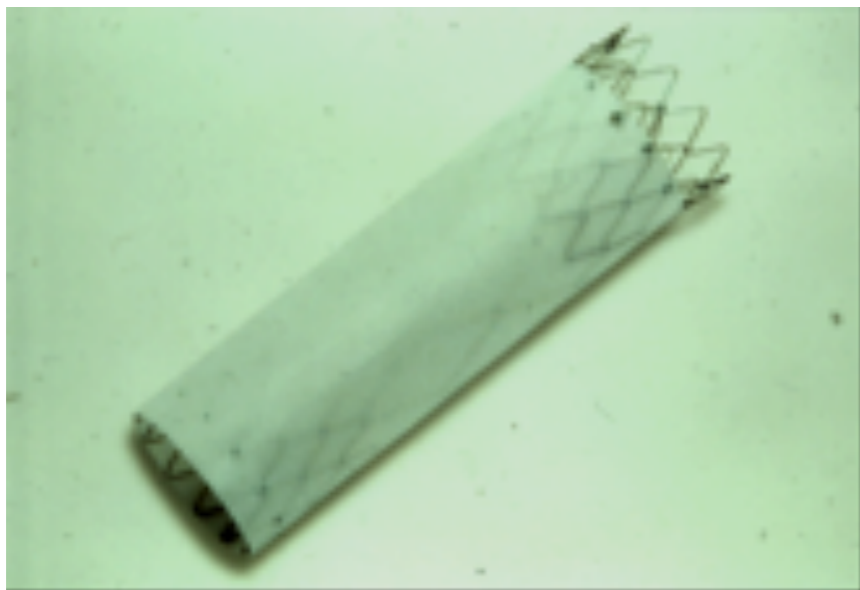
Endocarditis

Covered stents

Covered Stents



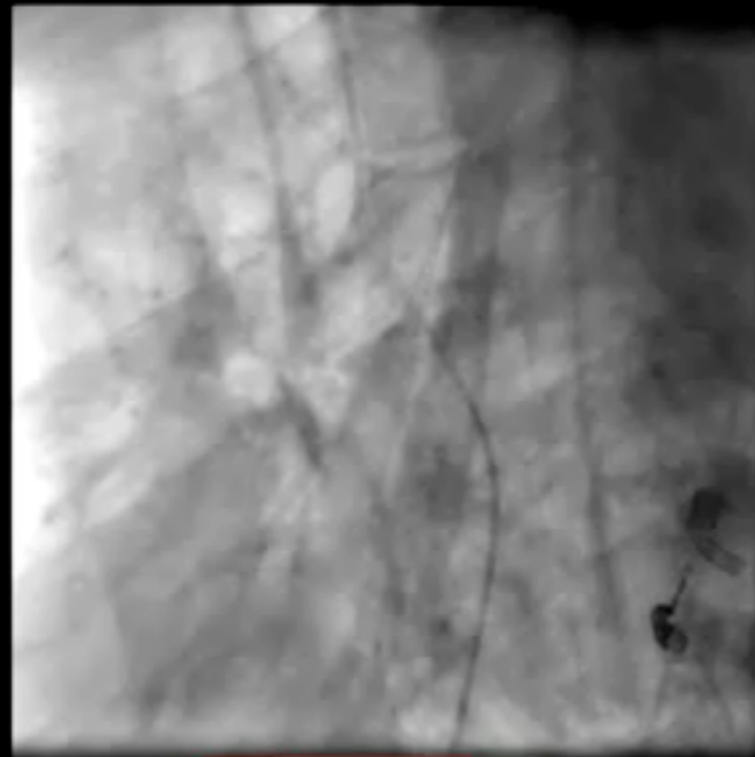
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Cook
Jomed
NuMed
Atrium



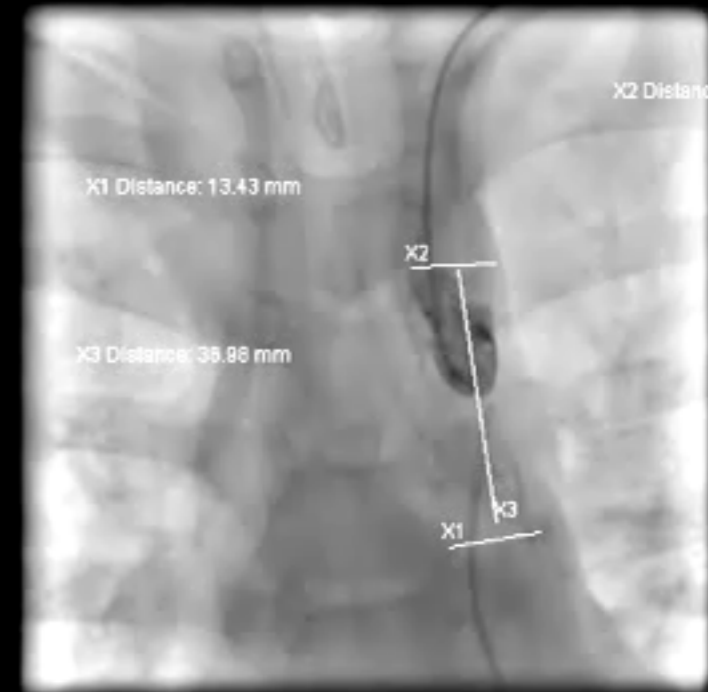
Stenting in tight native aortic coarctation



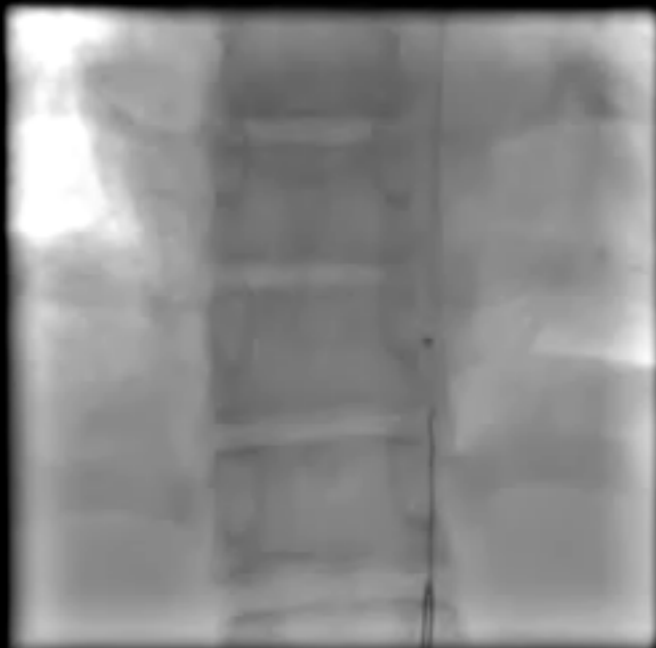
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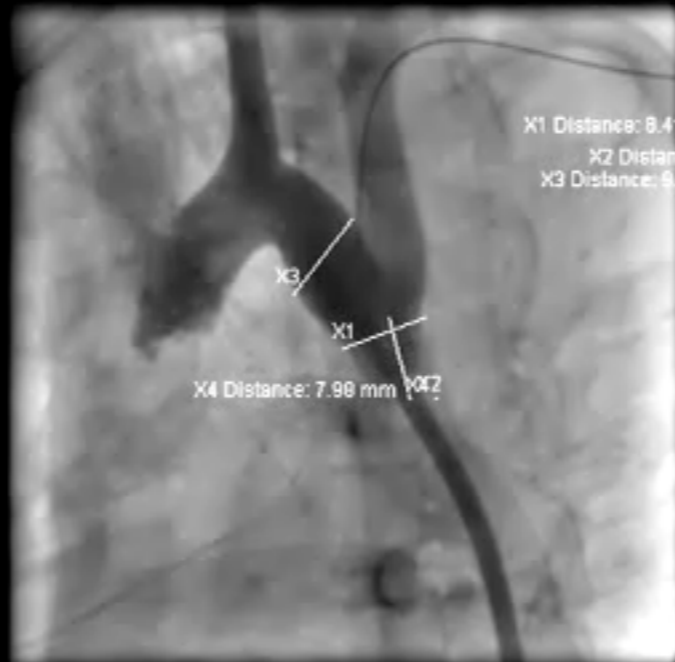
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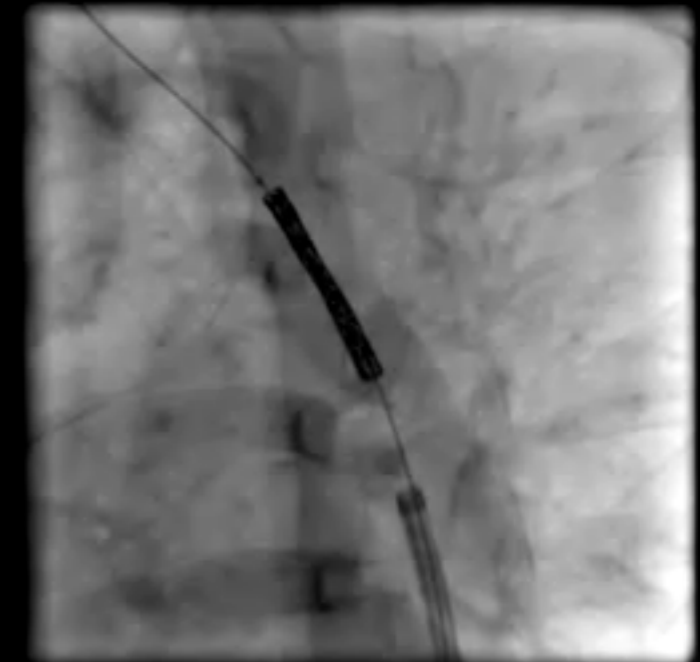
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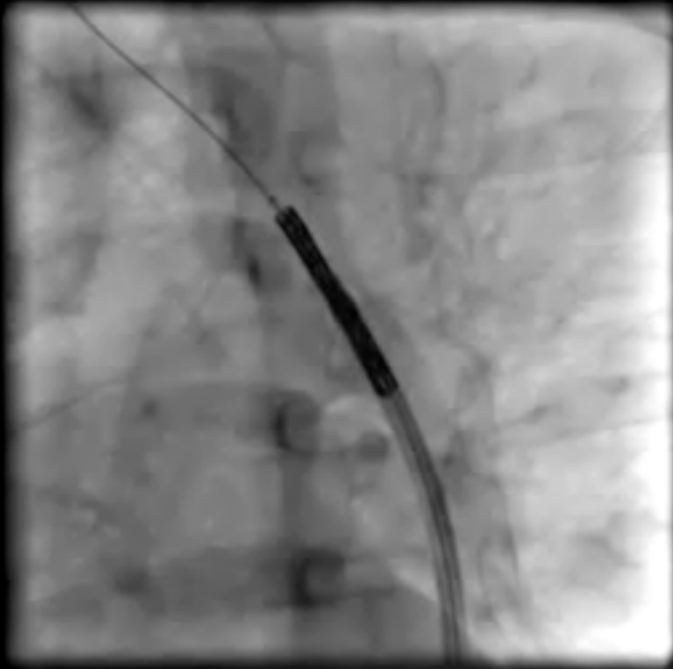


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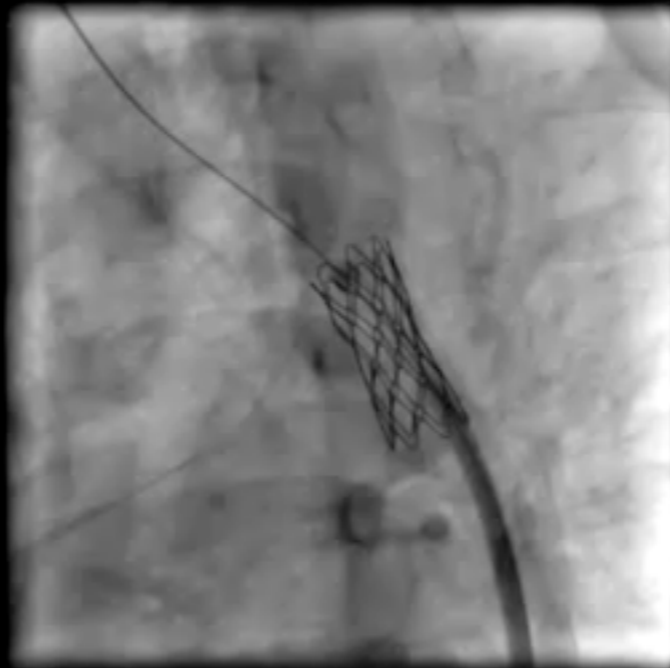
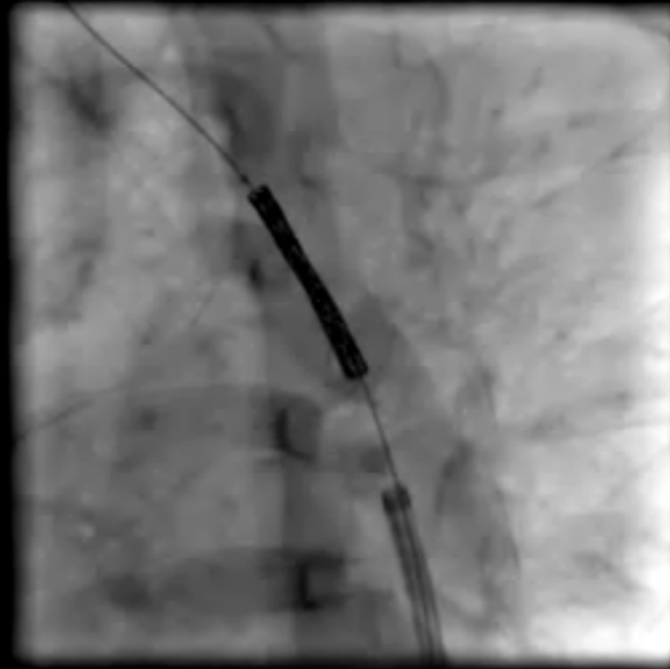


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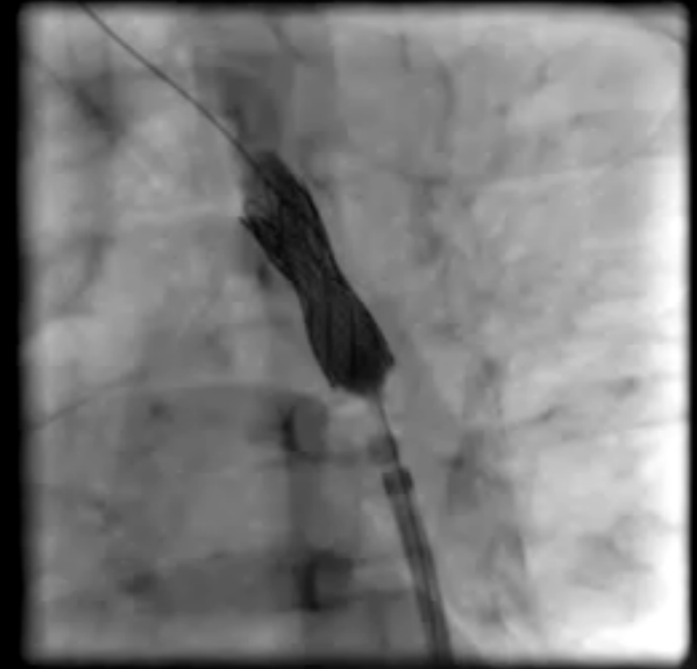
Stenting in tight native aortic coarctation



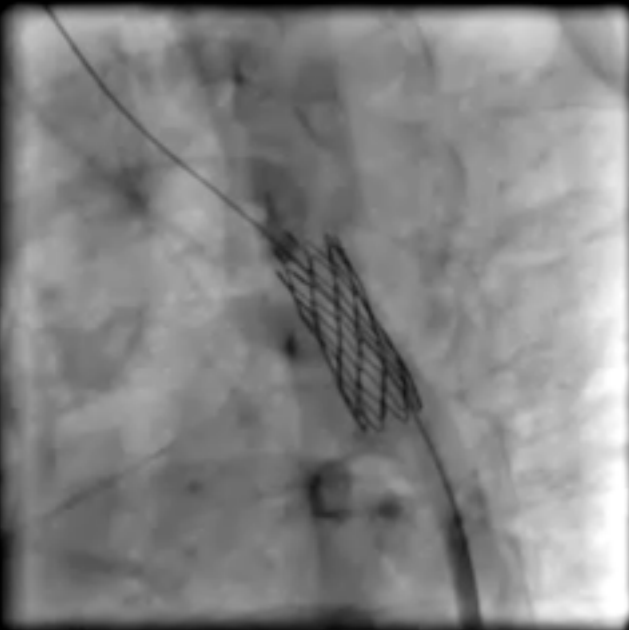
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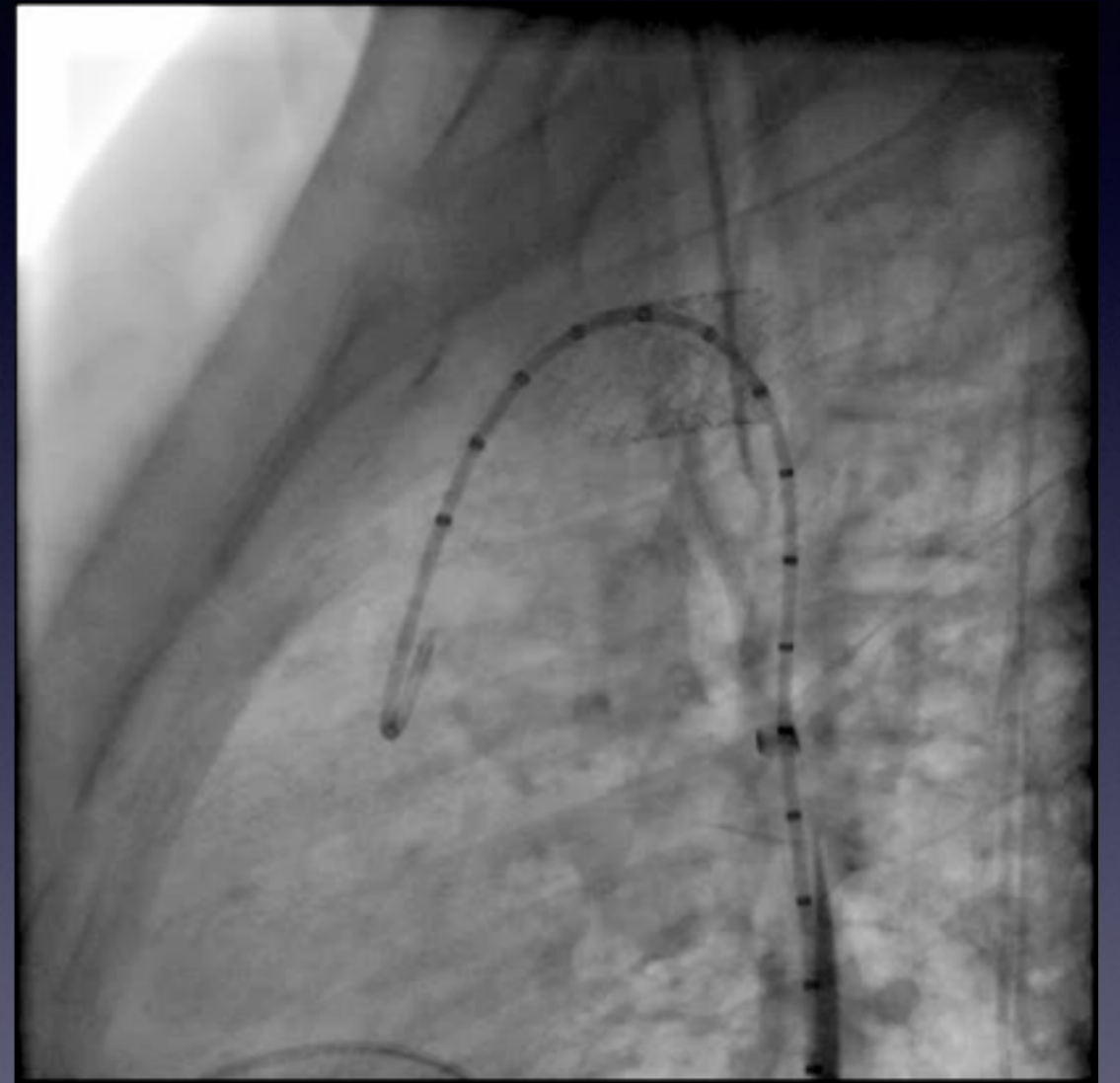
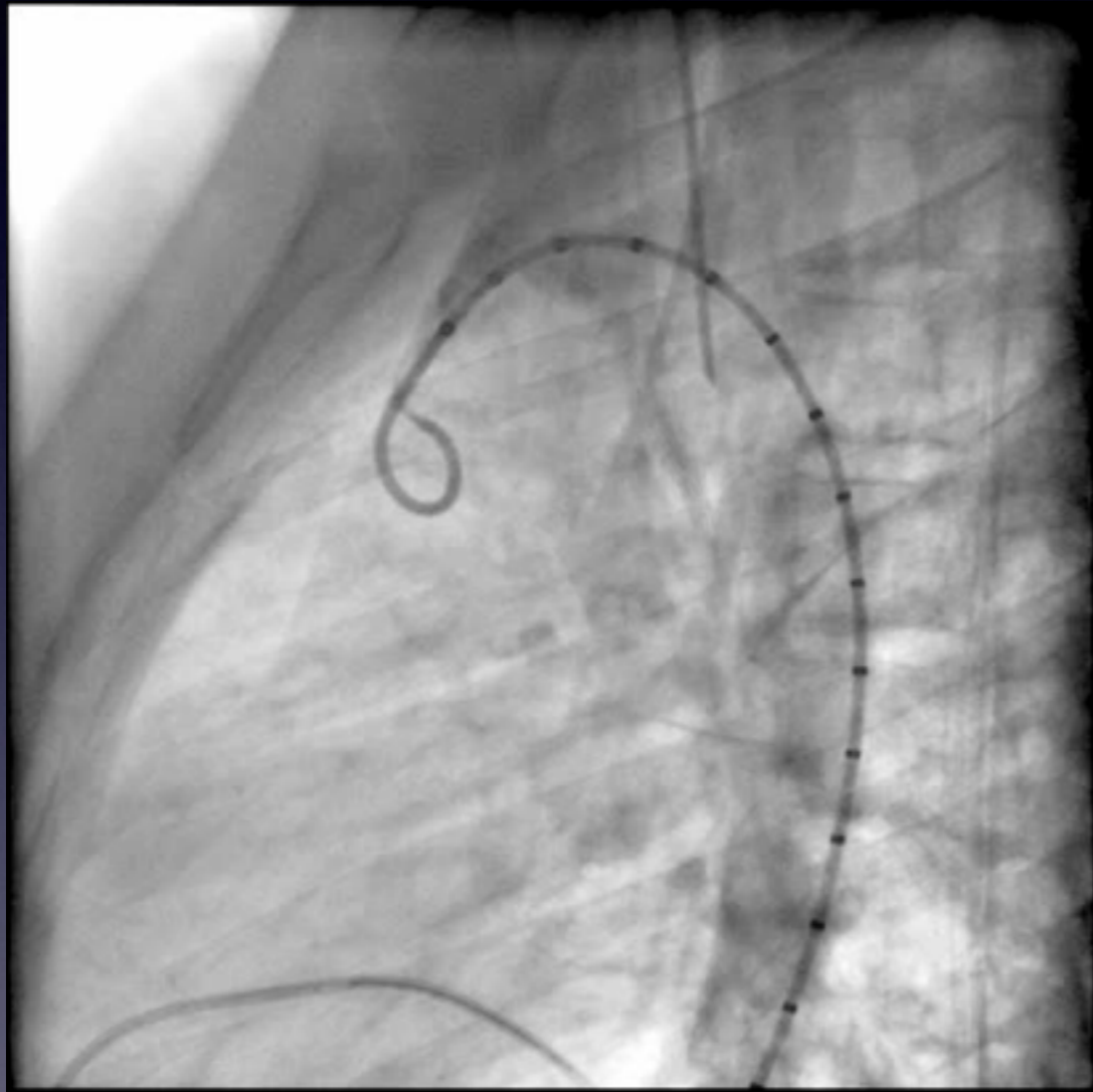


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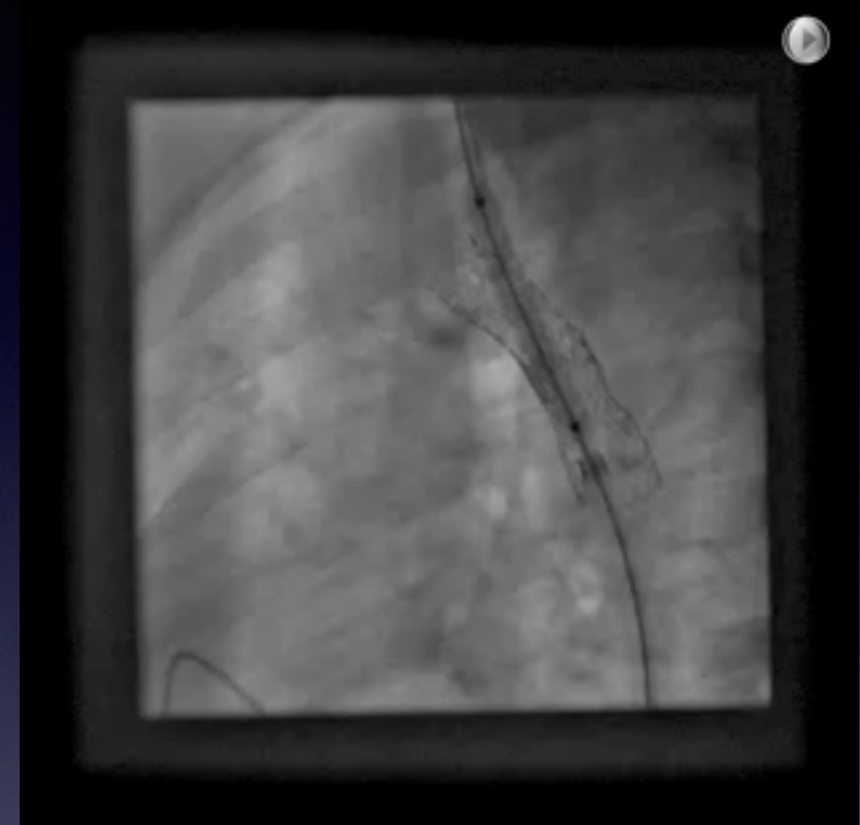
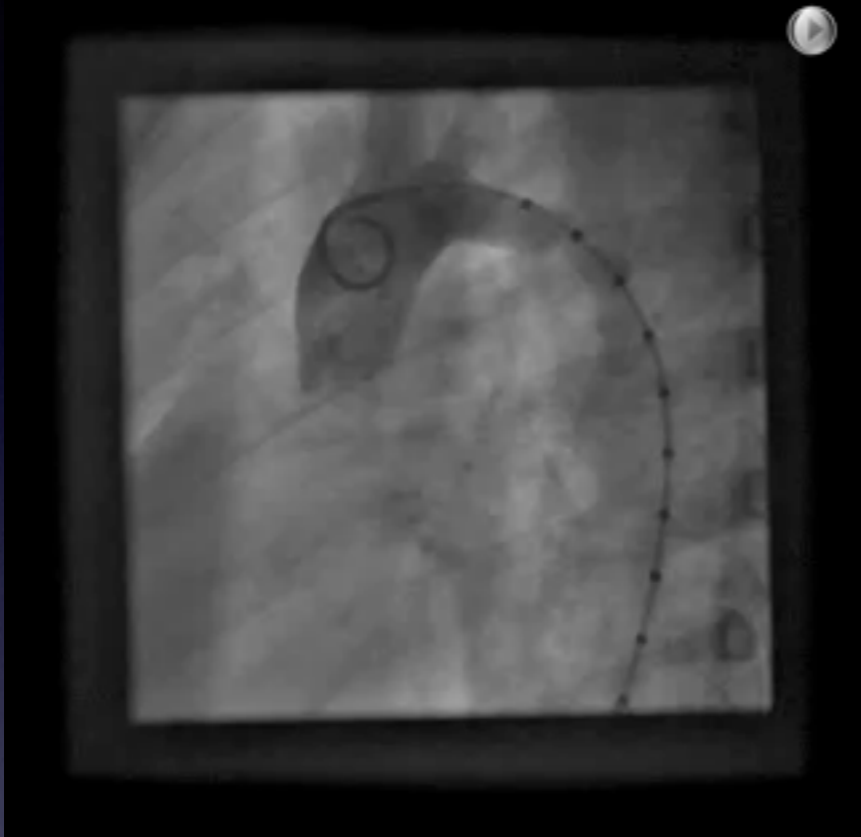


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Transverse arch stenting



Stents for complex arch anatomy



Covered stents for complications



Stents in aortic coarctation

- Covered stents (Cheatham-Platinum) used widely in adolescents and adults now
- 7 studies reporting on 96 patients who had covered stents
- Aneurysms in 2 pts
- Stent fractures in 3 pts
- No other major complications



Tzifa A et al. J Am Coll Cardiol 2006;47:1457-63
Butera G et al. Am Heart J 2007;154:795-800

Covered stents

Concerns

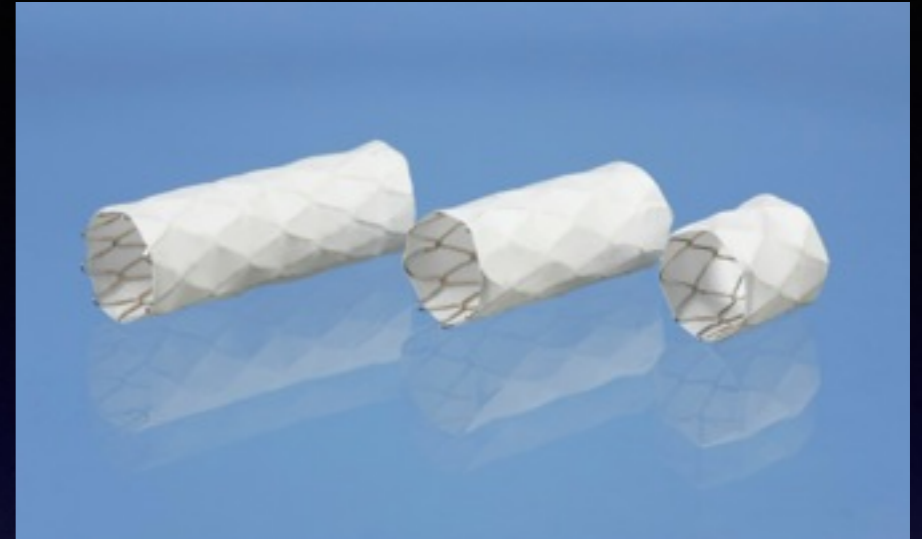
- Spinal artery occlusion
 - originates below the level of T9 vertebra in over 90% of the patients
- Covering origin of left subclavian artery
 - Stent -graft -induced occlusion of the ostial left subclavian artery is well tolerated, especially if there are no stenotic vertebral and or carotid arteries and if the vertebrobasilar system is intact

Covered stents

Concerns

- Aortic rupture

- Covered stents do not prevent rupture
- Multiple covered stents may be needed for rescue



- Redilation

- 7 pts had re-dilation of covered CP stents 12 - 25 months after implantation. No complications

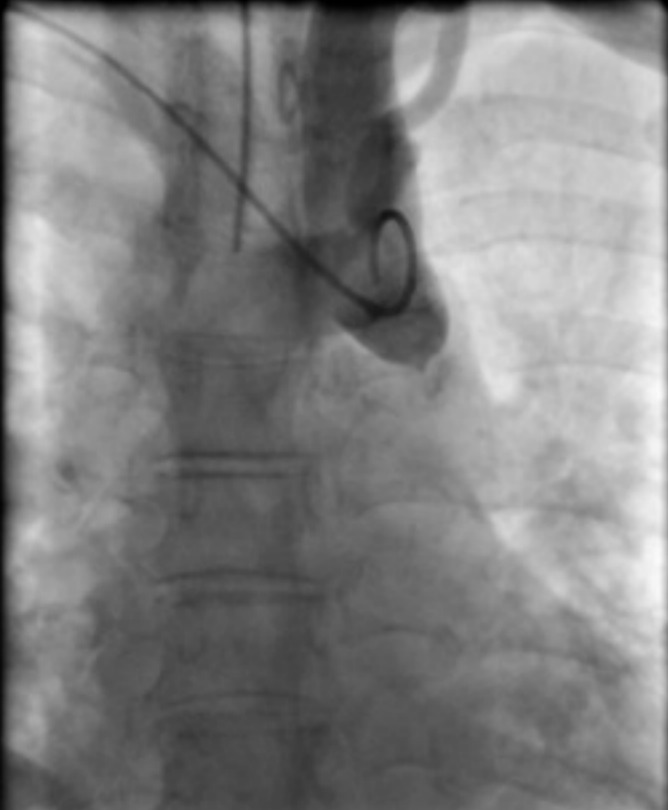
(Butera et al, 2008)

Stents in aortic coarctation and atresia

- Aortic atresia in adult patients is usually acquired
- So there is a potential continuity between isthmus and descending aorta
- May vary from localised membranous atresia to long segment
- Surgical treatment in adults is a challenge and is associated with complications such as paraplegia, post-coarctectomy syndrome, paradoxical hypertension, pleural effusion and laryngeal nerve palsy
- Severe aortic coarctation in adults is treated with stents nowadays

Stenting in aortic atresia

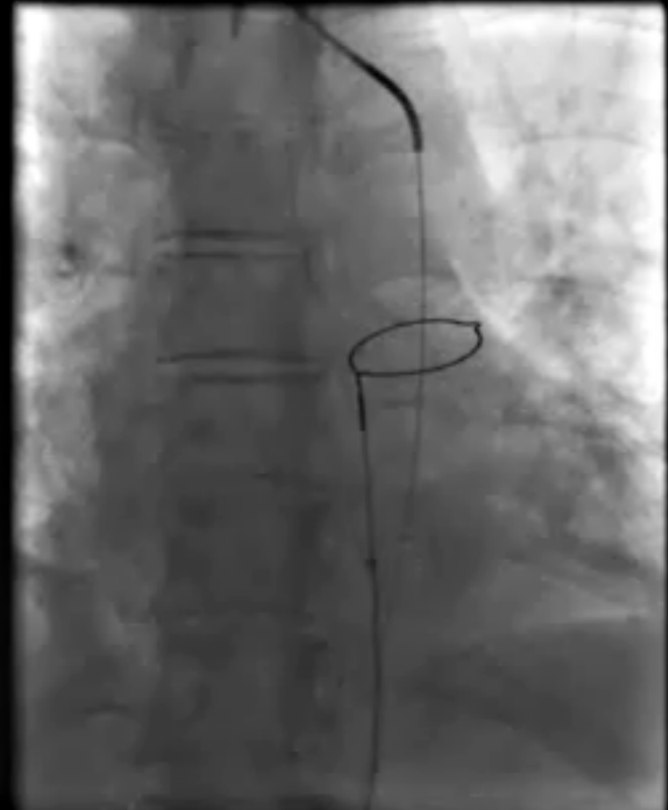
Look for dimple



LEFT
LAO 10



LEFT
LAO 70



LEFT
LAO 10



LEFT
LAO 10



LEFT
LAO 70

Stenting in aortic atresia

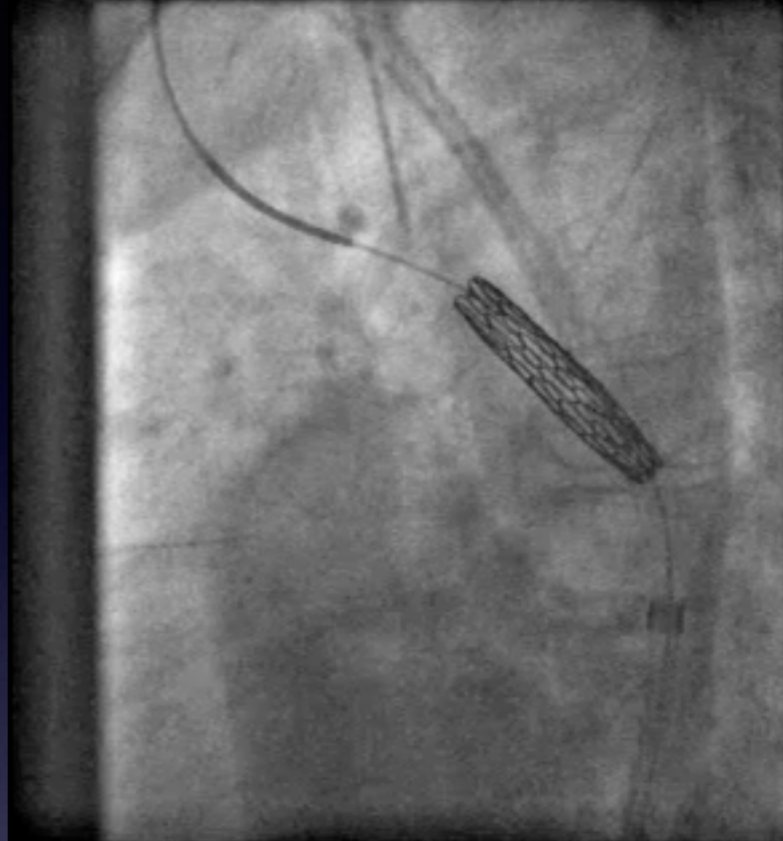
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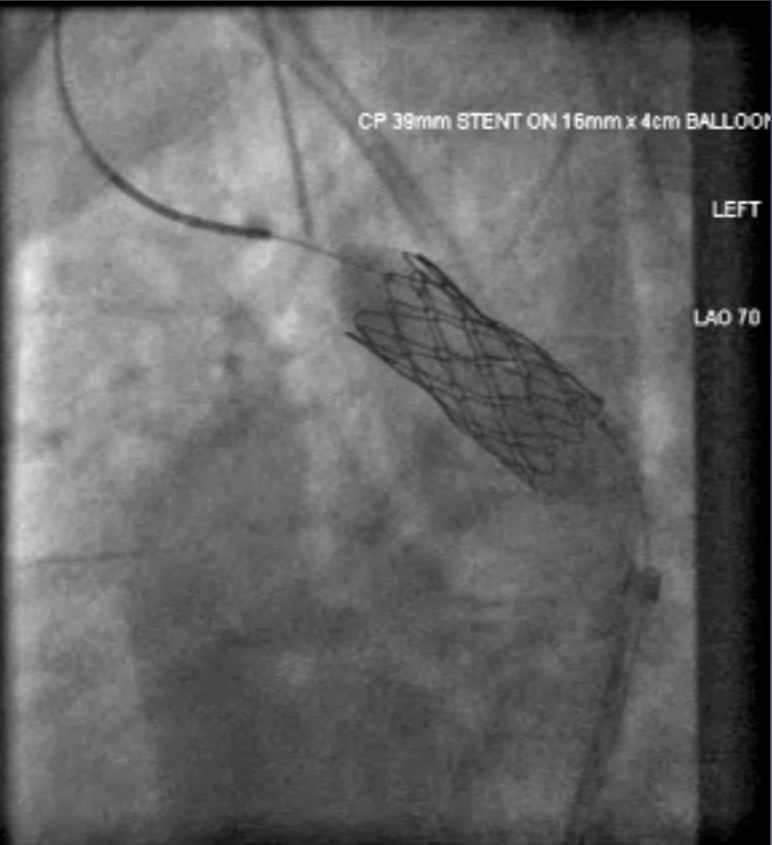
LEFT
LAO 10



LEFT
LAO 70



LEFT
LAO 70



CP 39mm STENT ON 16mm x 4cm BALLOON
LEFT
LAO 70

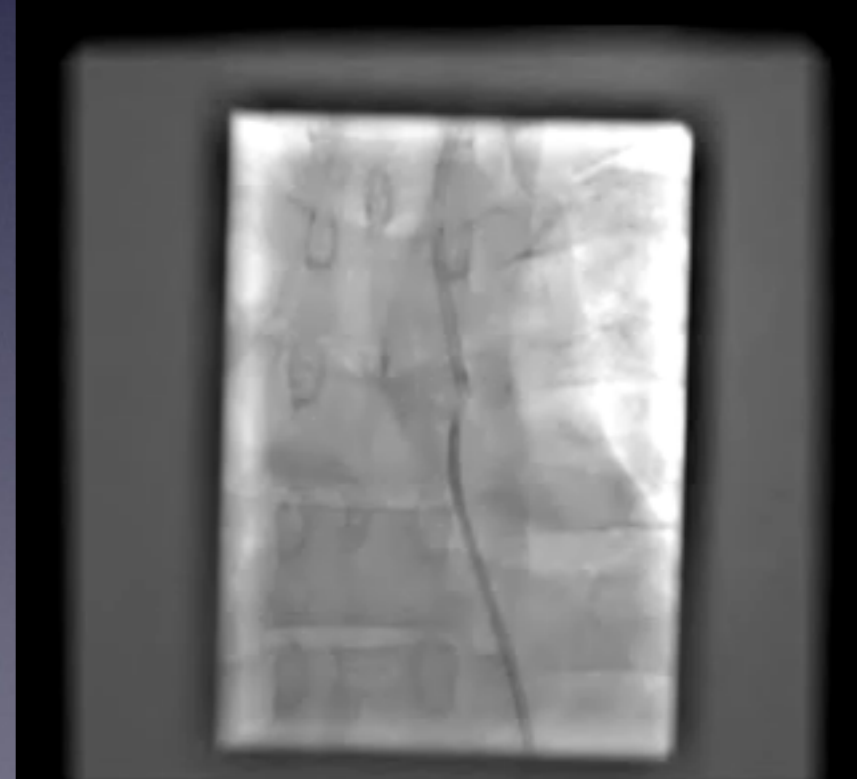
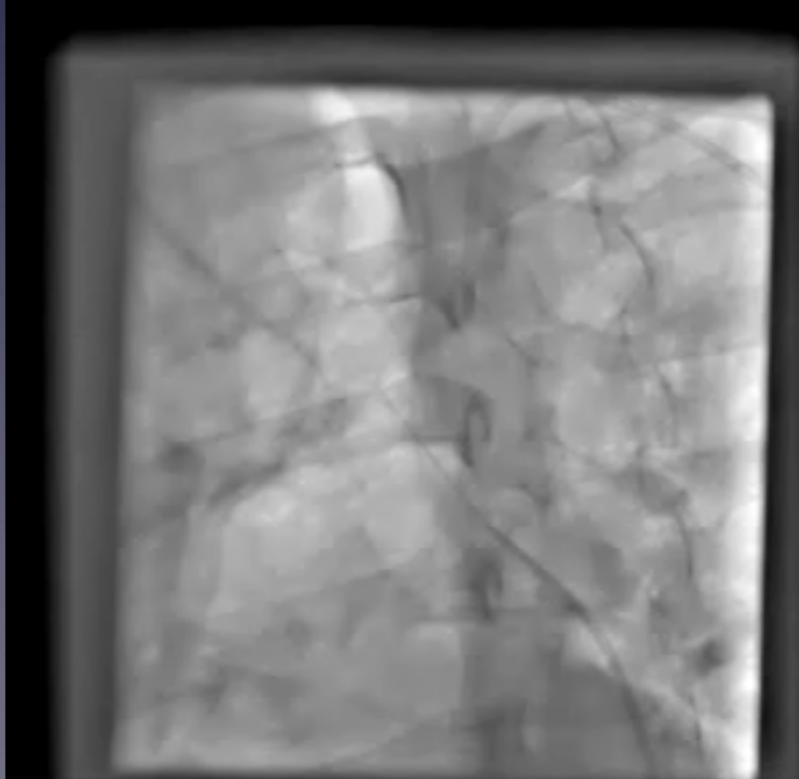
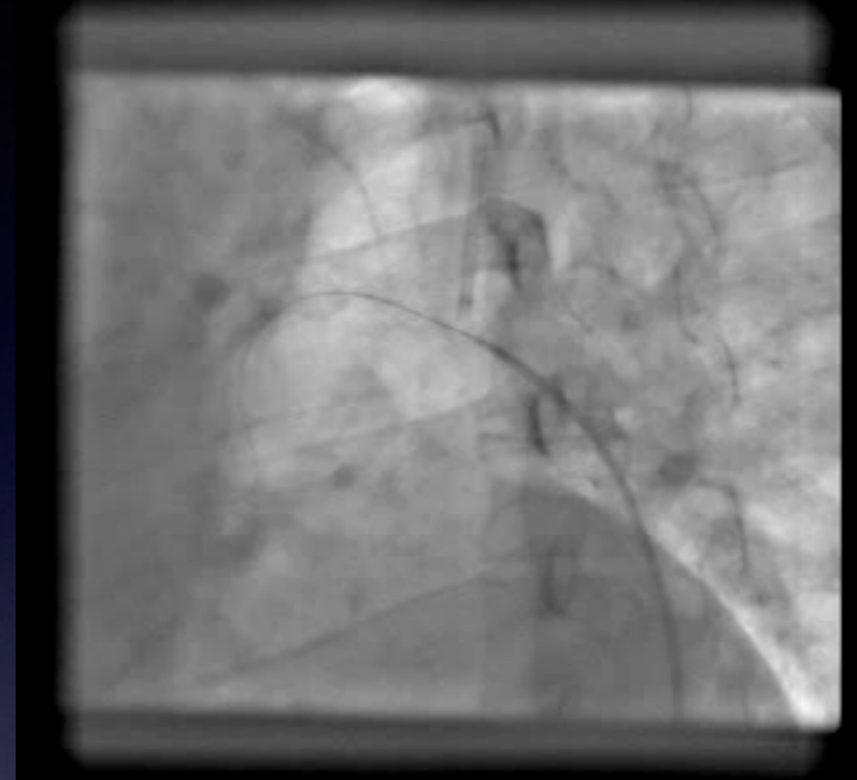
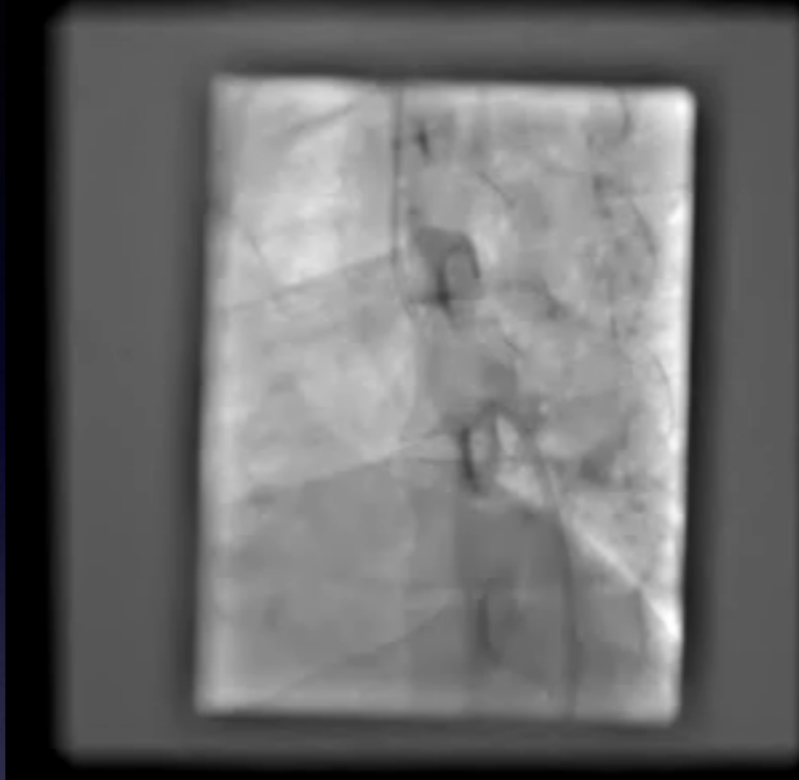


LEFT
LAO 10

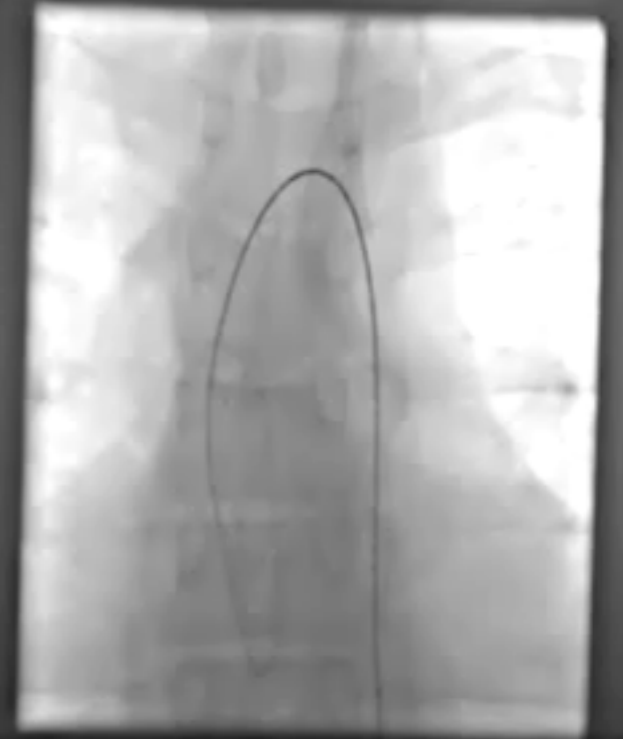
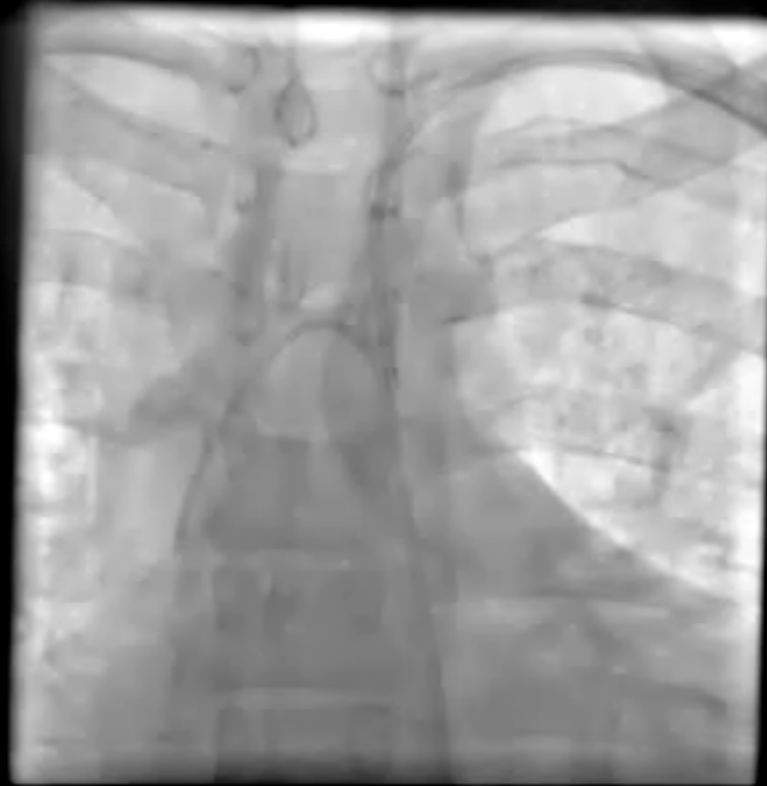


CP 39mm STENT ON 16mm x 4cm BALLOON
LEFT
LAO 70

Stenting in aortic atresia

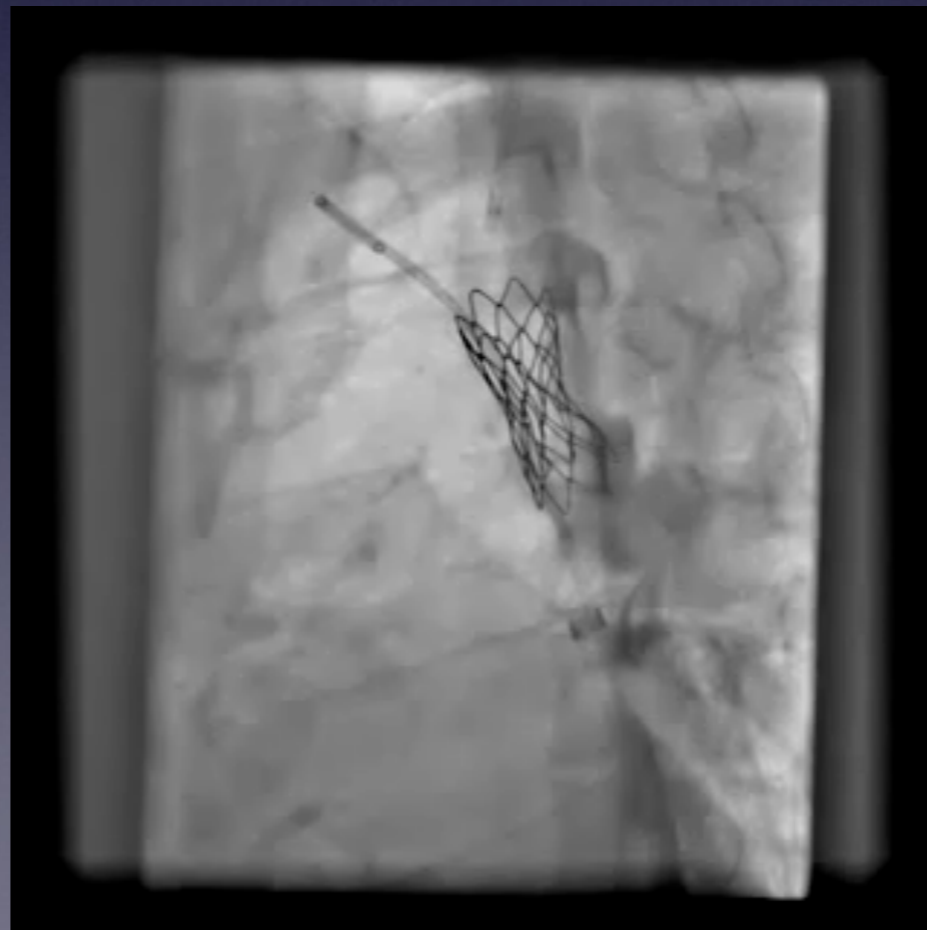
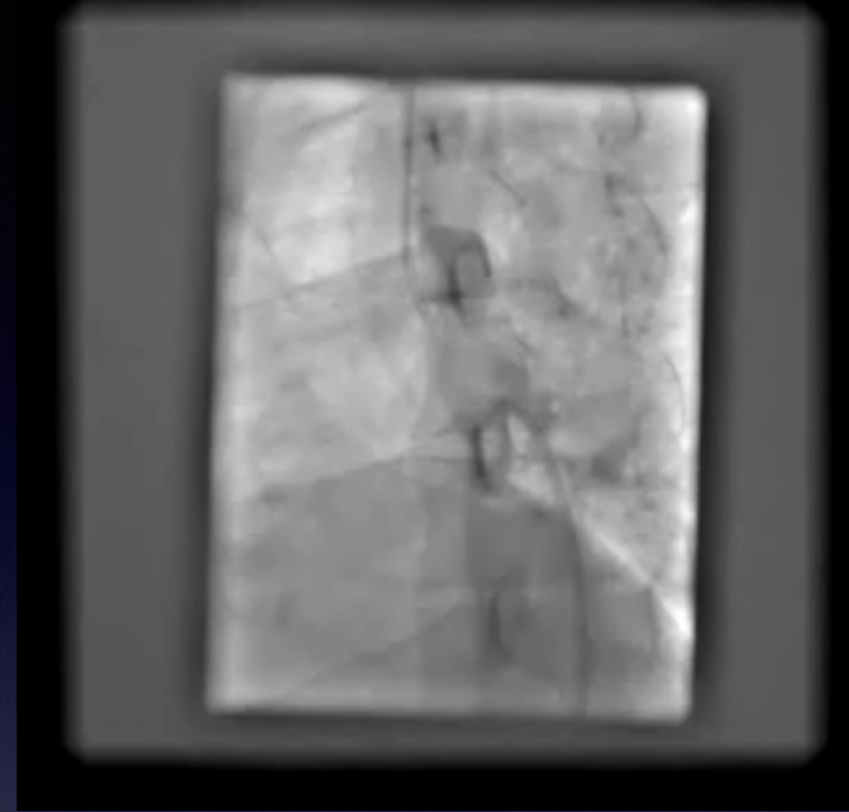
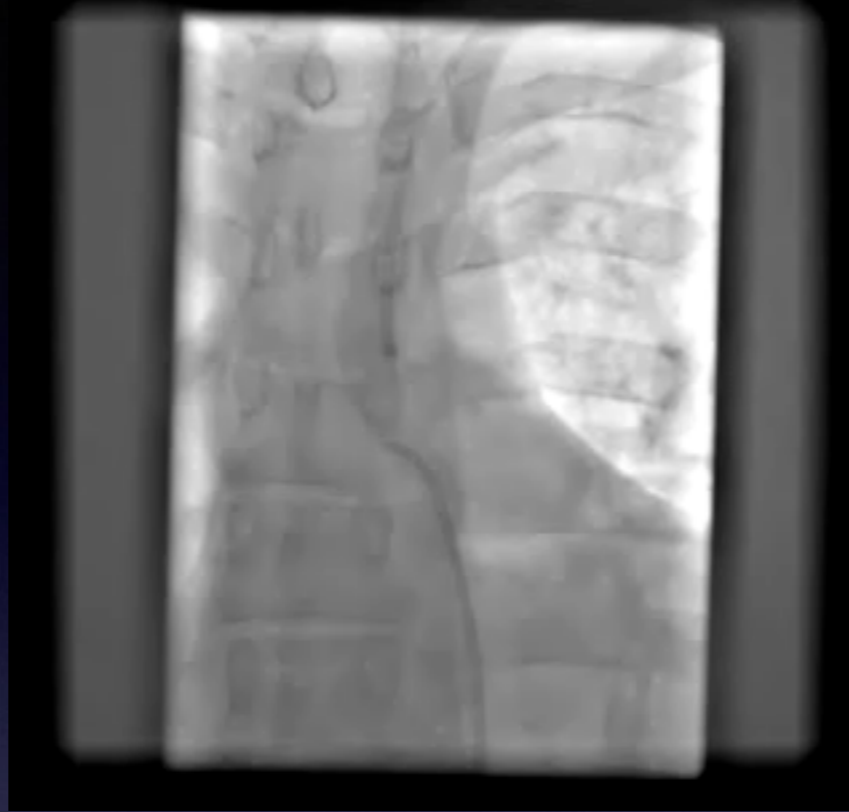
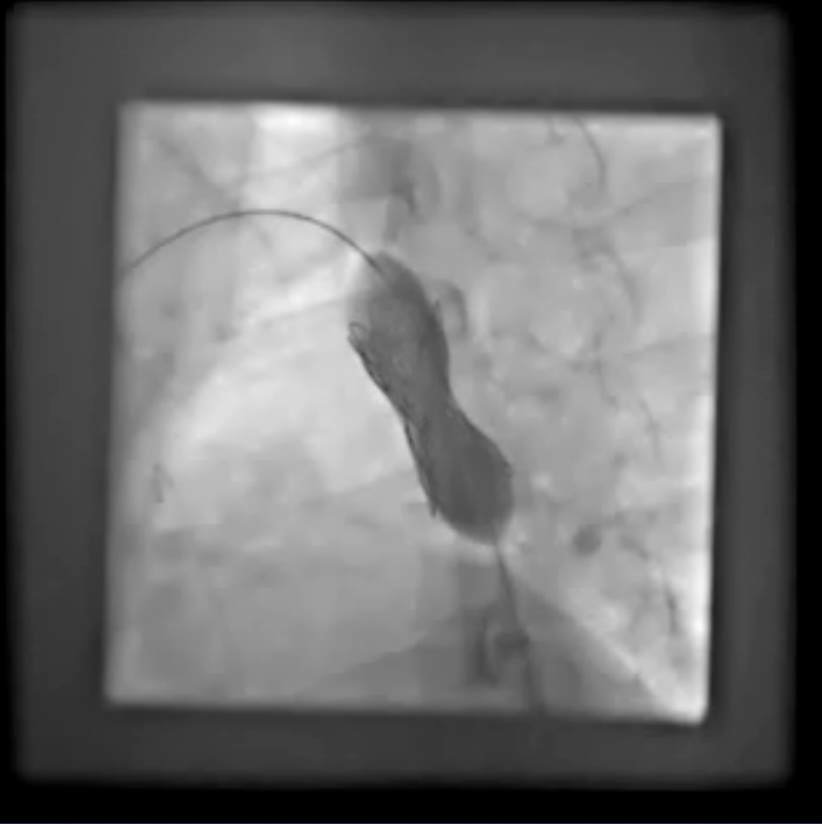


Stenting in aortic atresia

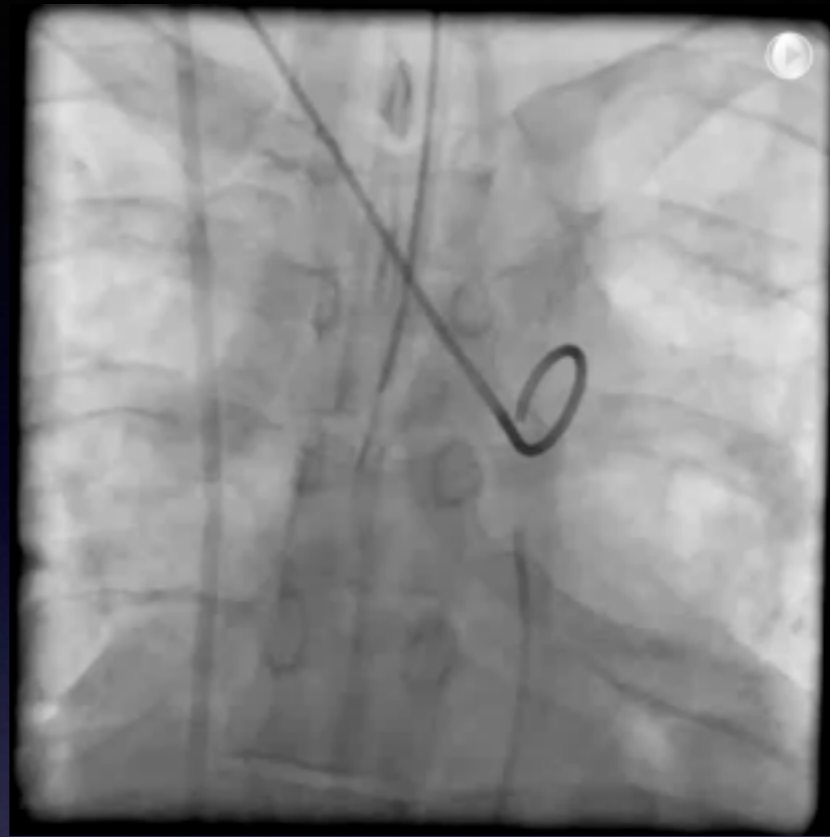


- Mullins sheath advanced into position
- Inner and outer balloons inflated
- Balloon withdrawn into sheath or sheath advanced over balloon

Stenting in aortic atresia



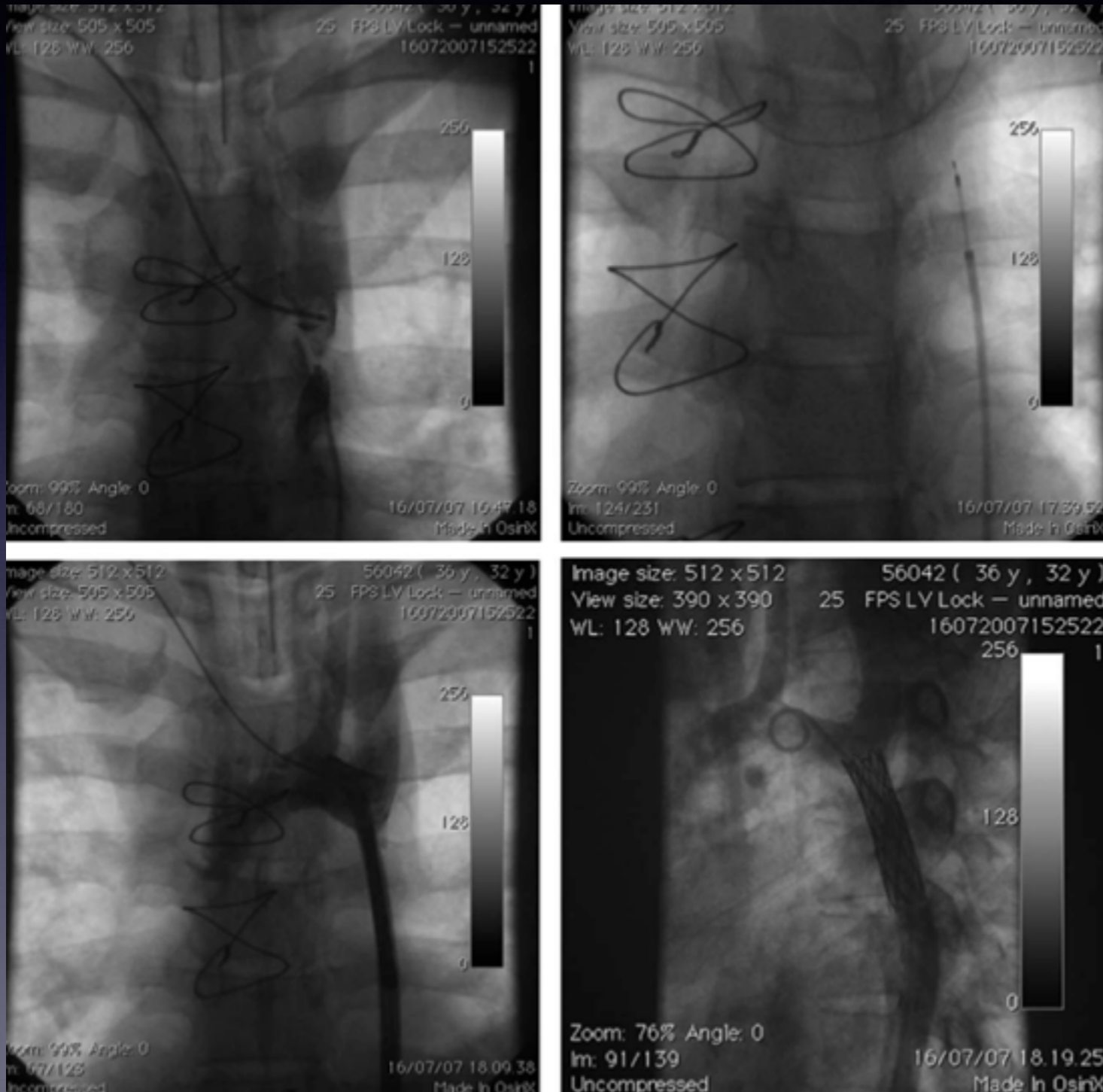
Stenting in aortic atresia



Aortic interruption - treated with radiofrequency perforation and covered stents

- 4 pts with interruption of aortic isthmus, age range 32 - 63 years
- Radial and femoral arterial access
- Baylis RF generator and Nykanen wire used in all
- Guidewire circuit established and predilation with coronary balloon
- Covered CP stents implanted through 12 Fr Mullins sheath

Aortic interruption - treated with radiofrequency perforation and covered stents



- No complications from procedure
- 1 pt needed redilation 8 months later as stent initially was electively under-dilated
- Excellent result maintained during follow up
- No aneurysms seen on CT 1 year later

Stents in aortic coarctation and atresia

- 9 patients treated in 3 centres
- Age range at diagnosis 30.8 ± 16.2 years (range 13- 58 years)
- Associated defects: bicuspid aortic valve, ASD, VSD in 1 pt each

Stents in aortic coarctation and atresia

- General anaesthesia
- Heparin to keep ACT >200 secs
- Radial artery access in 7/9 pts
- Femoral arterial access in all the pts
- Aortogram above the interruption and below in different projections to define the anatomy and the length of interruption

Stents in aortic coarctation and atresia

- To perforate the interruption:
 - Transseptal needle used in 5/9 pts
 - RF perforation in 1/9 pt
 - Stiff end of a coronary guide wire in 3/9 pts
- Perforation with stiff end of guidewire or RF can be from above or below, depending on the relative size of the isthmus and descending aorta
- Once perforation performed, check angiograms performed to confirm needle or wire position within the aorta

Stents in aortic coarctation and atresia

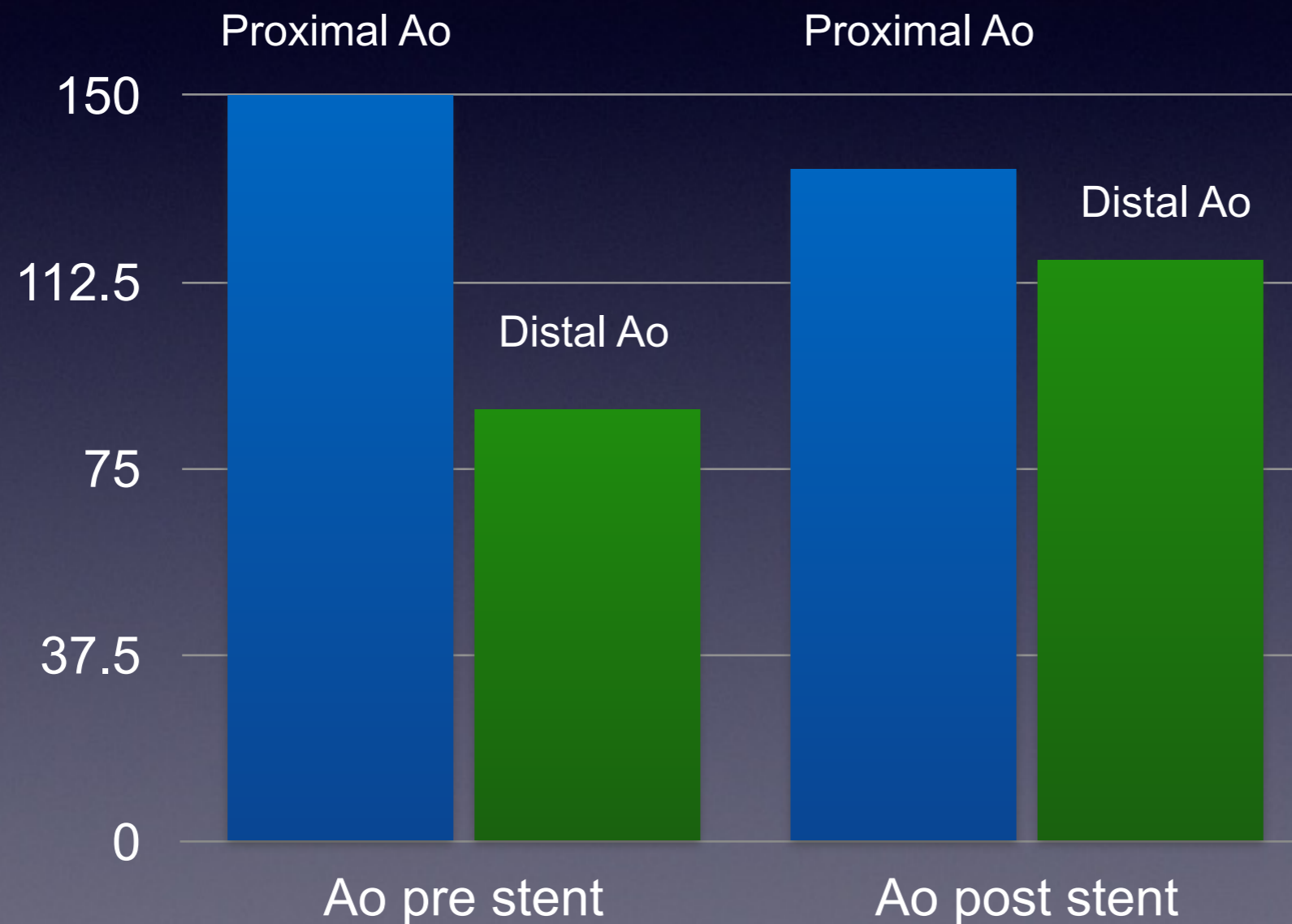
- If perforation from below, the transseptal needle replaced with a coronary guide wire in isthmus or transverse arch before advancing a catheter or sheath across
- If perforation from above, then wire is snared from below and a circuit established, before advancing the appropriate Mullins sheath from femoral artery
- The guide wire can be positioned in ascending aorta or innominate artery, with a catheter in left subclavian artery acting as a guide
- Covered CP stents mounted on BIB balloons used in all cases
- Repeat pressure measurements and angiograms performed at the end

Stents in aortic coarctation and atresia

- Mean length of atretic segment 8.1 ± 3.2 mm (range 5 - 11mm)
- Mean procedure time was 140 ± 19.87 minutes (range 120-180)
- Mean fluoroscopy time was 34.8 ± 4.01 minutes, (range 30.4 - 41 minutes)
- Mortality 0%
- No immediate or late complications

Stents in aortic coarctation and atresia

Aortic systolic pressures (mm Hg)



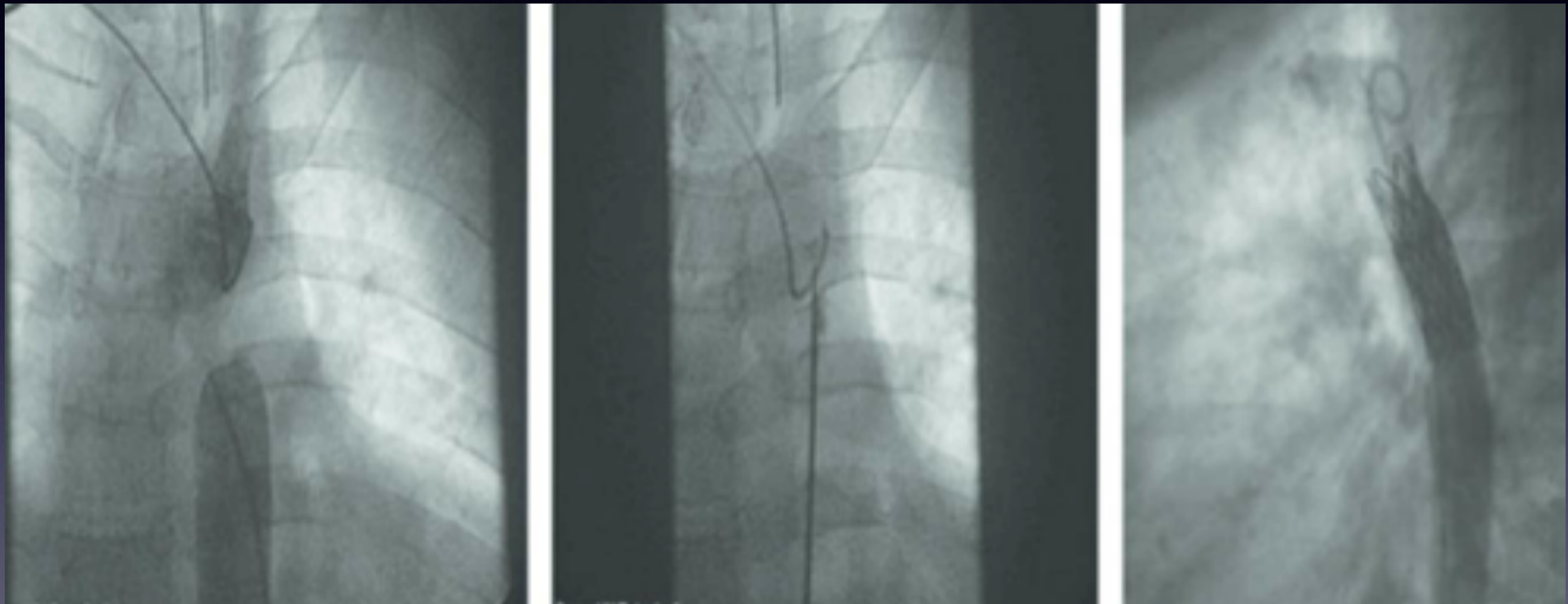
Stents in aortic coarctation and atresia

- Mean follow up of 4.3 years, range 1 - 5 years)
- 7 pts had CT scans and 2 had repeat catheterisation
- No stenosis or dissection or aneurysms in any pts

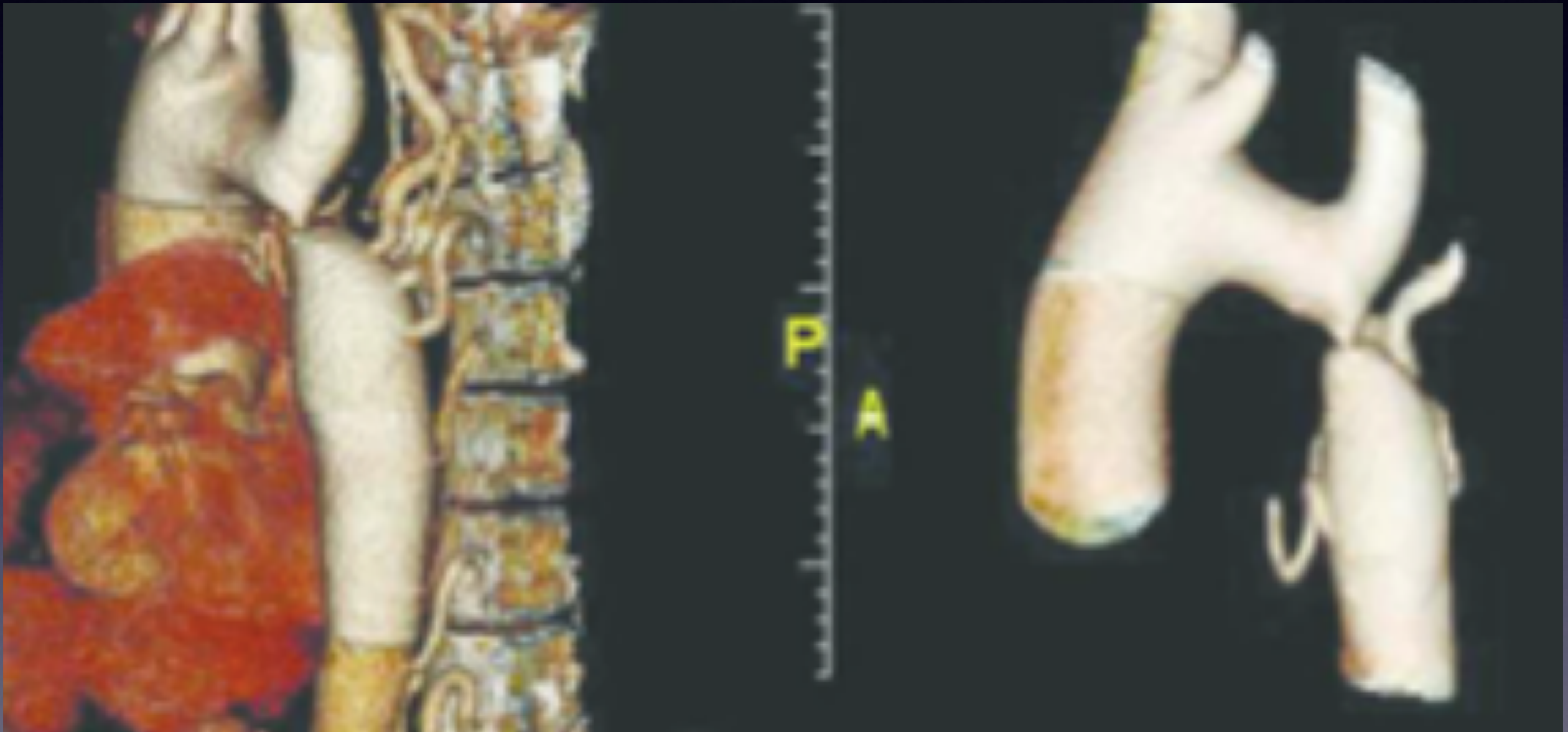
Stenting in aortic coarctation and atresia

- Bare stents can be used in aortic coarctation but may be associated with higher incidence of complications
- Covered stents have wider use and have a lower incidence of complications
- Can be used in coarctation and atresia

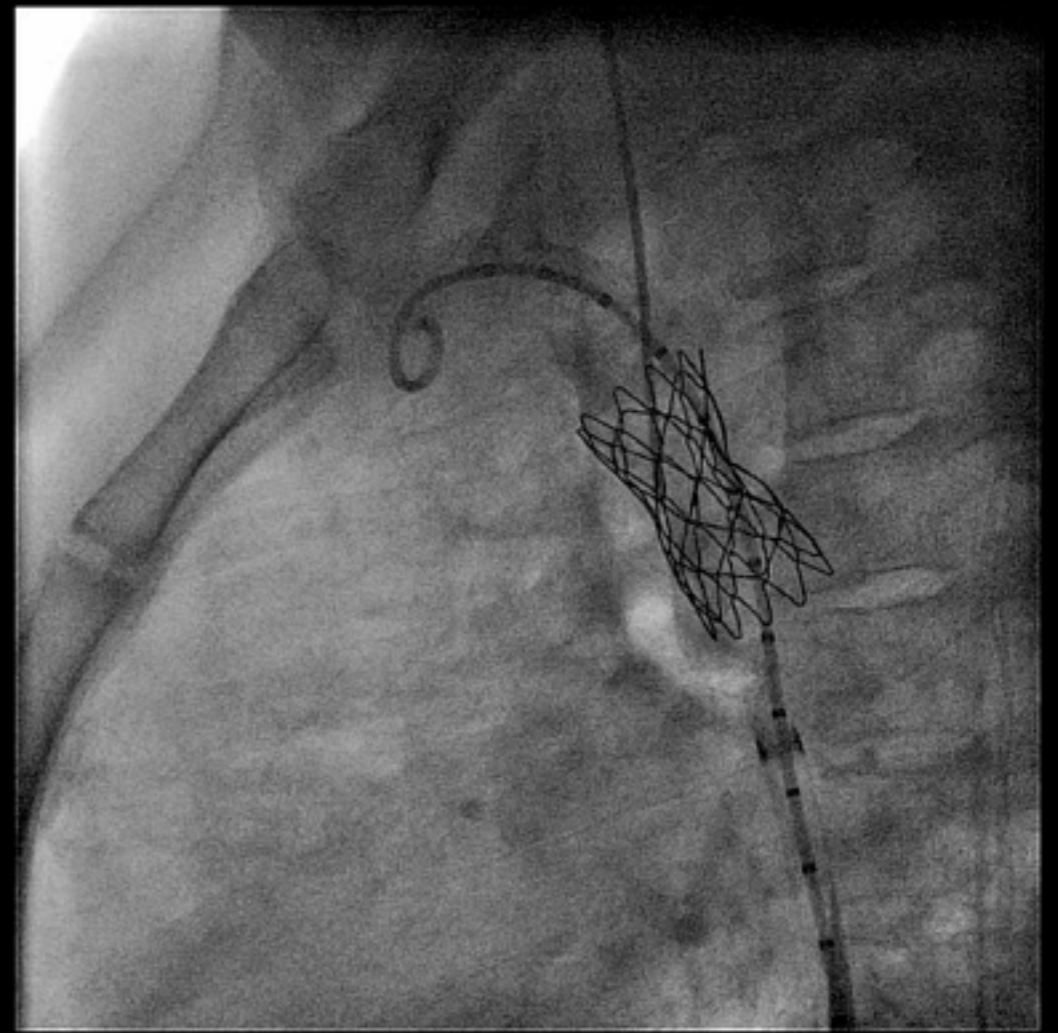
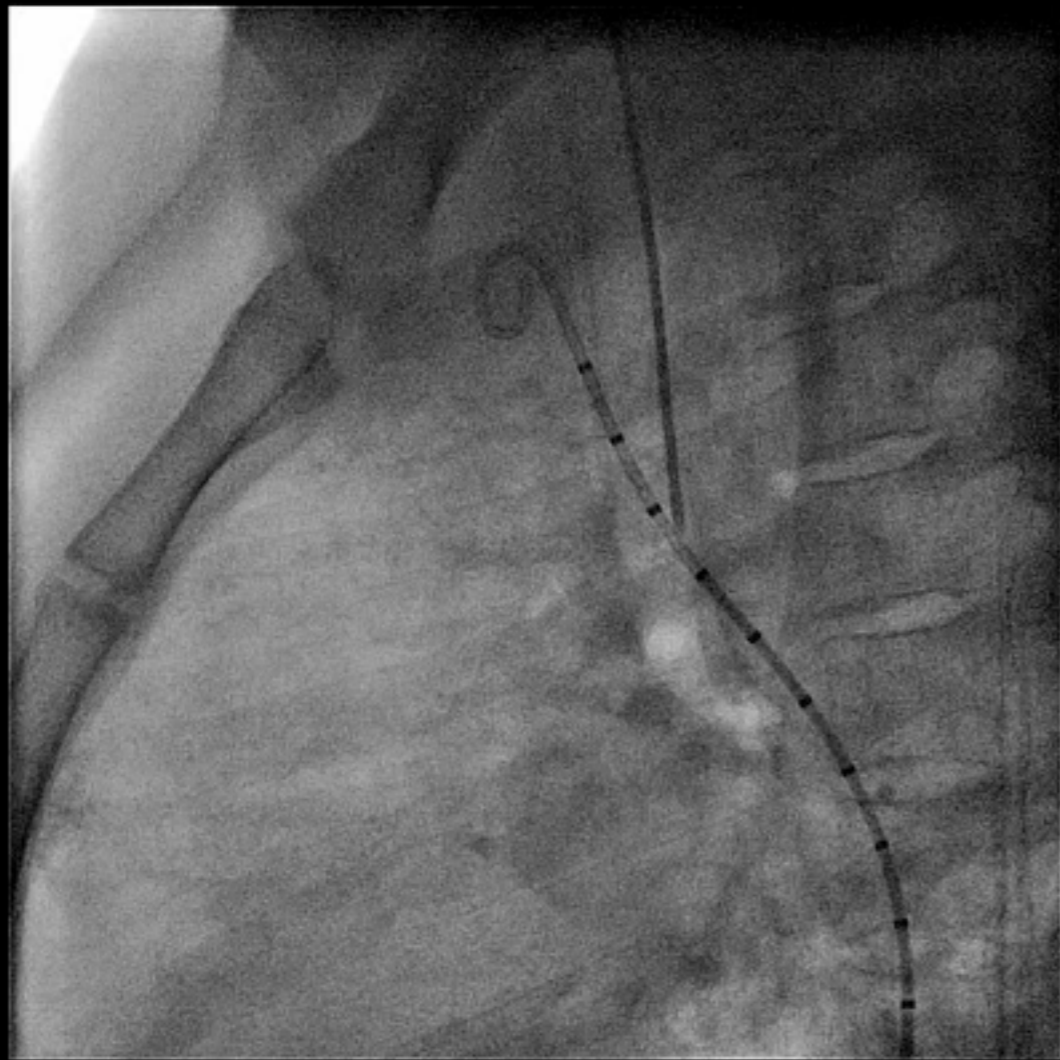
Stents in aortic coarctation and atresia



Stents in aortic coarctation and atresia



Aortic coarctation stenting



Stents in aortic coarctation and atresia

- Aortic arch atresia results in loss of continuity of lumen of the aorta
- In newborns, atresia or arch interruption is different morphology than adults
- In newborns, usually associated with VSD and other defects
- In adults, interruption may be isolated

Complications of stenting

Aortic dissection 9/565 (1.6%) procedures

Dissection preceded by stent migration 1 pt

No technical problems in 8 pts

3 patients (2 aortic stents, 1 interposition graft stent patient) had emergency surgery

2 of these 3 pts suffered severe neurological injuries, with 1 death next day & 1 death 6 months later

3 patients underwent successful placement of 1, 2, and 3 covered stents

3 pts managed medically with antihypertensive drugs