Debate in Management of native COA; Balloon Versus Surgery

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History

- Coarctatus (Latin)means contracted tightened and compressed together.

Bonnett 1903

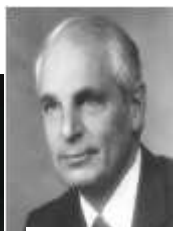
Amato's 1991

1790

Blalock 1944

Crafoord 1944

R E Gross 1948



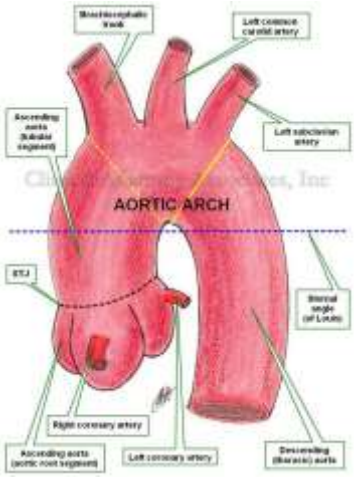
J A Walhausen 1966

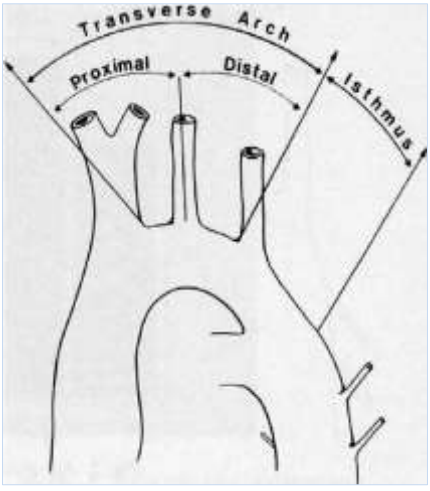
Campbell 1970

Nomenclature and Incidence

- A congenital narrowing of the upper descending Aorta adjacent to the site of attachment of the Ductus arteriosus
- Coarctation of the aorta accounts for 4 - 6 % of all congenital heart defects with a reported prevalence of approximately 4 per 10,000 live births
- Coarctation of the aorta is the sixth most common lesion in congenital heart disease
- It occurs more commonly in males than in females (59 versus 41 percent)

Classification





Classification

Old Classification

Bonnet's classification (1903) :

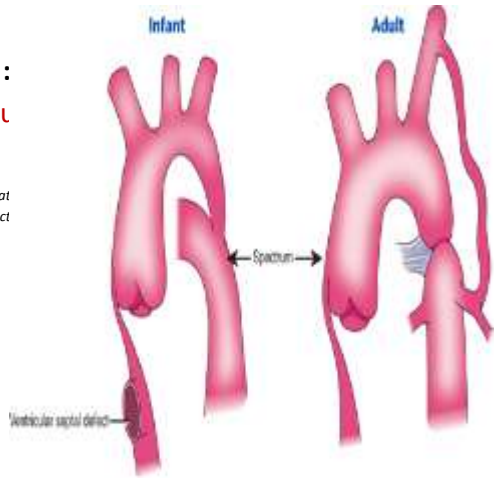
- Infantile pre-ductal, and adu
  post-ductal

(These became obsolete , as we came to know all coarctat or juxta-ductal .(Very difficult to separate into pre or post duct coarctation by simply looking at it , without knowing the hemodynamics)

1.Isolated coarctation

2.Co- arctation with VSD

3.Co arctation with complex heart anomalies

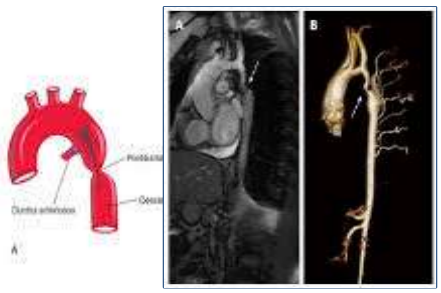


Classification

Amato's surgical classification of coarctation of aorta

- **Type 1 Primary Aortic Coarctation**
- **Type 2 Coarctation with Isthmus hypoplasia**
- **Type 3 Coarctation with Tubular hypoplasia of distal arch**

3A- With VSD 3B-With complex LV outflow lesions

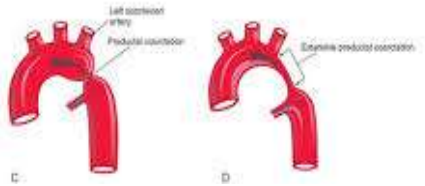


Surgical classification of coarctation of aorta

1- Isolated COA

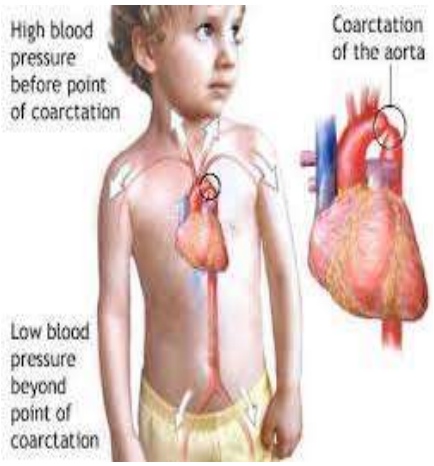
2- COA with VSD

3- COA with complex intracardiac anomalies



Clinical presentation

- Coarctation is a heterogeneous lesion which may present across all age
- Coarctation can present at any age. Neonates with ductal dependent or "critical coarctation" often present with heart failure, acidosis, and shock following closure of the ductus arteriosus
- coarctation must be suspected in infants with other left-sided obstructive heart lesions and may be diagnosed in infants with chromosomal defects, especially those with Turner syndrome



Clinical presentation

- Patients with less severe coarctation may not be diagnosed until later in childhood when a murmur is heard or hypertension noted
- Others may complain of frequent headaches or claudication of the lower extremities with exertion
- Commonly shared features of increased afterload on the left ventricle, exposure of the upper body to hypertension, flow disturbance in the thoracic aorta, and decreased perfusion to the lower body

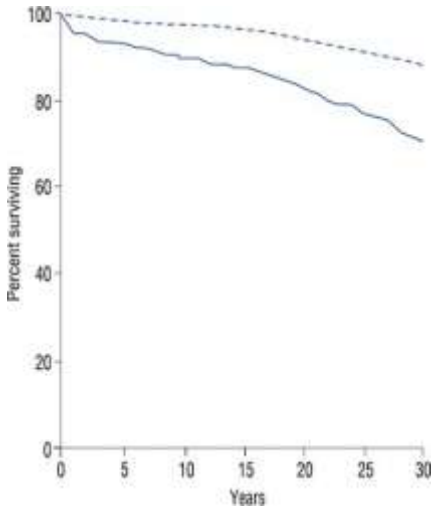
Clinical presentation

Misdiagosis

- Prenatal diagnosis of coarctation is challenging due to the presence of the ductus arteriosus and limited blood flow across the aortic isthmus in utero
- After delivery with Absence of pulse oximetry screening programs , 30% of neonates with coarctation remain undiagnosed upon discharge after delivery
- For patients with extensive collateral blood flow, femoral pulses and lower extremity blood pressures may only be minimally diminished

Prognosis

- Untreated coarctation carries a poor prognosis with average survival age of 35 years of age; with 75% mortality by 46 years of age
- Long term complications are the consequence of long-term hypertension including premature coronary artery disease, stroke, endocarditis, aortic dissection and heart failure



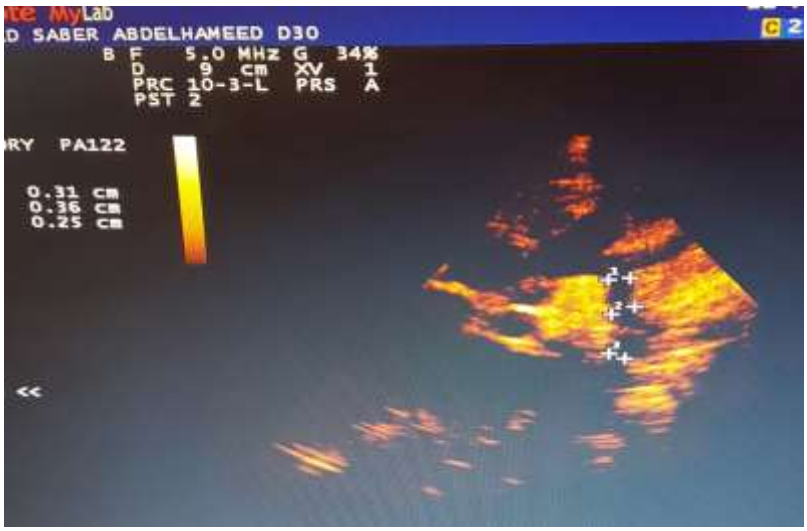
Cohen M, Fuster V, Steele PM, Driscoll D, Moon DC. Coarctation of the aorta. Long-term follow-up and prediction of outcome after surgical correction. Circulation. 1989;80(4):840–845, Epub 1989/10/01.

Evaluation

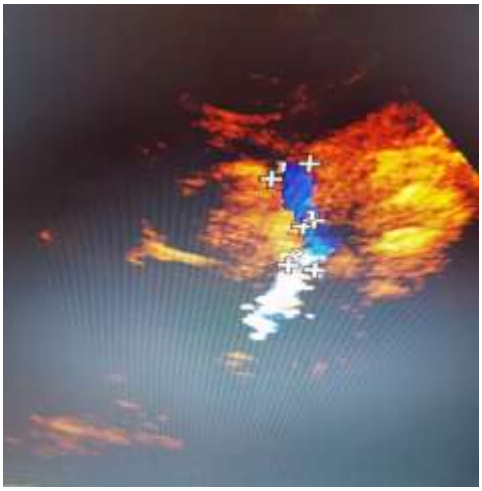
- Chest X-ray is often nonspecific in young patients 3sign and rib notching in older children
- Electrocardiogram is typically normal in infants, but in older children and adults, left ventricular hypertrophy is common due to

ventricular pressure overload

Evaluation



Evaluation



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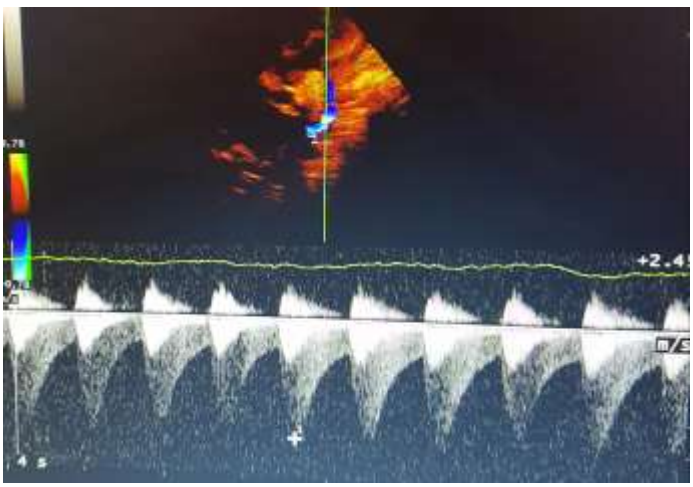

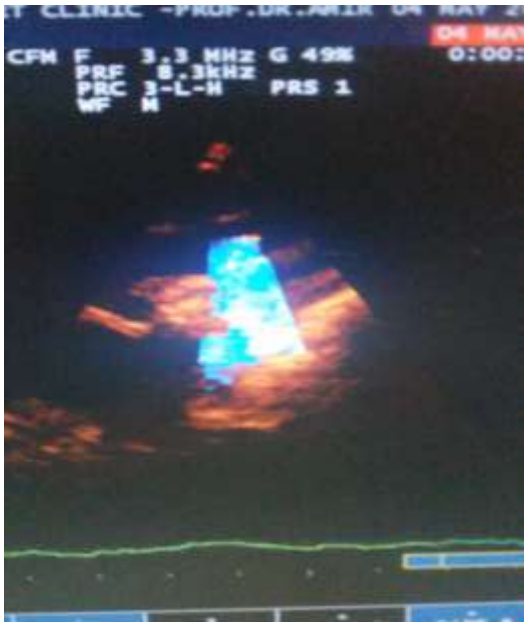
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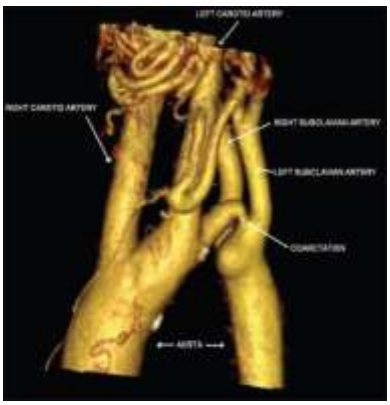
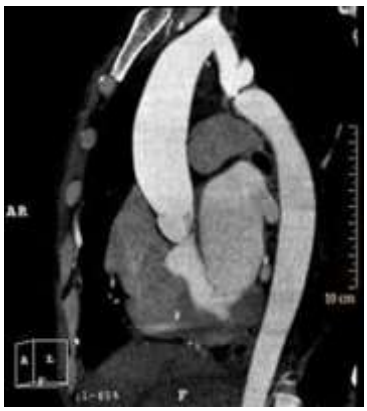
PRF 8.3kHz
PRC 3-L-H PRS 1
WF H

Evaluation


LEFT CAROTID ARTERY
RIGHT CAROTID ARTERY
RIGHT SUBCLAVIAN ARTERY
LEFT SUBCLAVIAN ARTERY
COARCTATION
AORTA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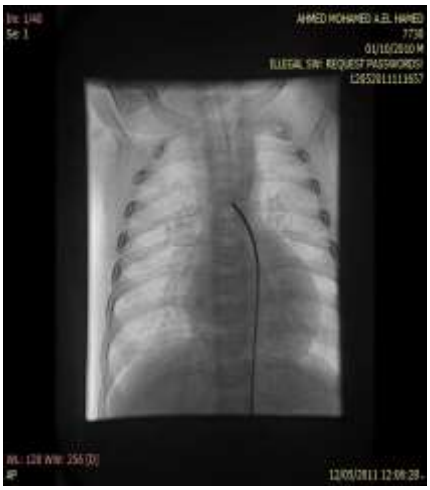
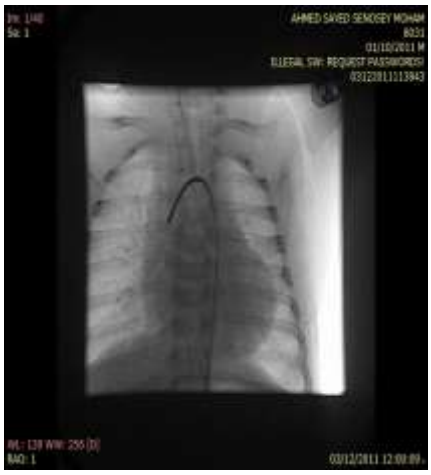
Evaluation





INDICATIONS AND TIMING FOR INTERVENTION

- The presence of systemic arterial hypertension, with resting upper and lower extremity systolic blood pressure difference ≥20 mmHg may be associated with:

1-**Severe COA** demonstrated by spiral CT, MRI, or angiography.

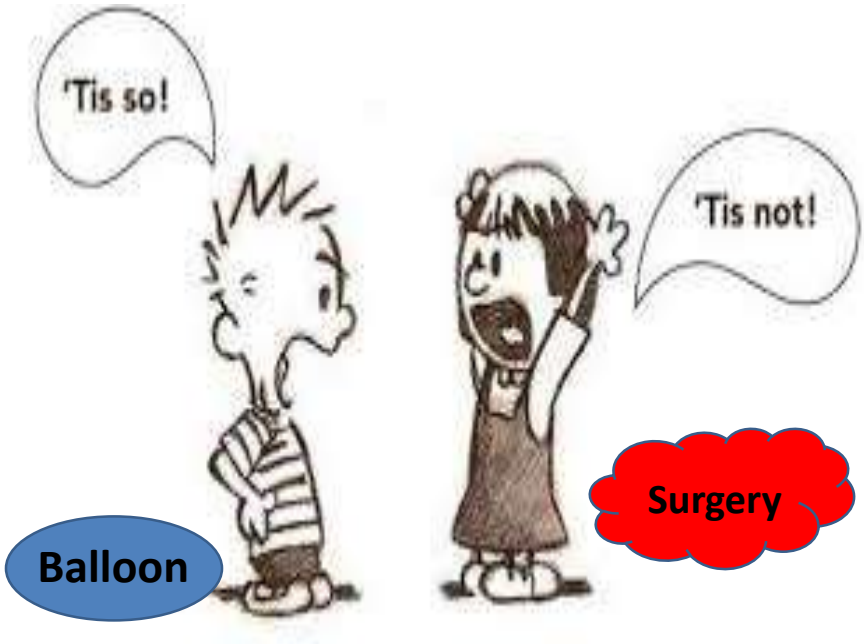
2- **Congestive heart failure** with or without associated cardiac lesions as in neonates and infants

3-**Mild COA** with:

a) Abnormal blood pressure response to exercise with gradient > 20 mmHg

b) LV dysfunction C)Coronary artery

d) LVH and/or LV diastolic dysfunction



Backgrounds of Balloon Dilatation

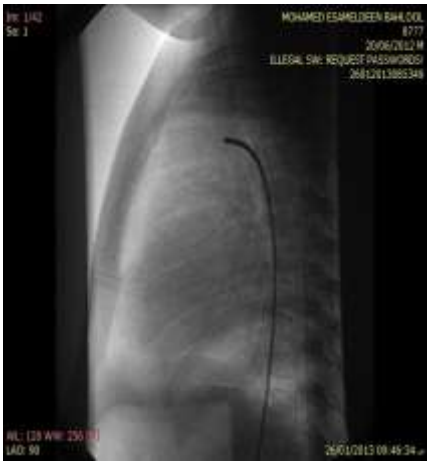
- As early as 1980s James Lock performed Balloon dilation for native COA was first shown to be feasible in a postmortem specimen of coarctation of the aorta (CoA) and in surgically excised CoA segments and experimentally created CoAs in animals could be dilated with a balloon by Lock

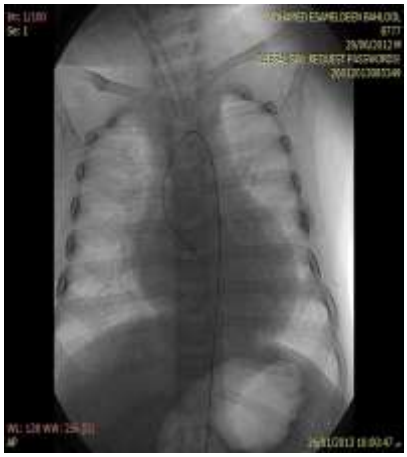
Balloon Dilatation Facts

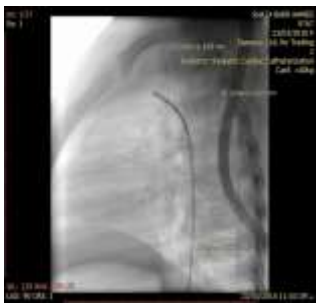
- ✓ Balloon angioplasty has been an acceptable technique for three decades for the relief of coarctation
- ✓ It produces controlled tear of the intima and part of the media which results in an improvement of the vessel diameter
- ✓ Balloon angioplasty is particularly safe and successful in infants between one and six months of age with discrete narrowing and no evidence of arch hypoplasia

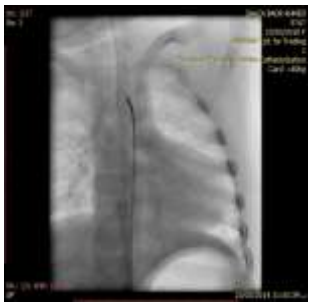
Balloon Dilatation Facts, cont.,

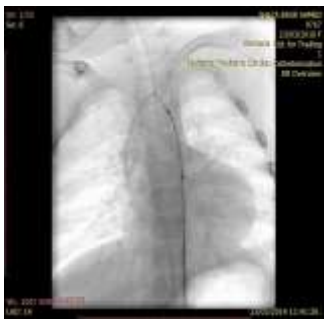
- ✓ It is also considered in critically ill patients regardless of age who have heart failure due to severe ventricular dysfunction, mitral regurgitation or low cardiac output
- ✓ Extending the application of this technique to all age groups fell out of favor due to the high incidence of future aneurysm formation (up to 9%)

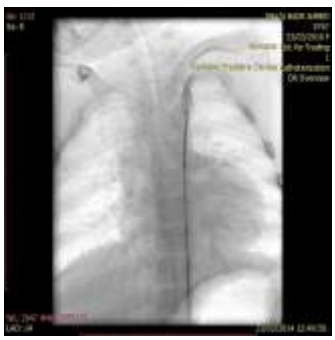












AHA Scientific Statement

Indications for Cardiac Catheterization and Intervention in Pediatric Cardiac Disease

A Scientific Statement From the American Heart Association

Recommendations for Transcatheter Balloon Angioplasty of Coarctation/Recoarctation of the Aorta

Class I

1. Balloon angioplasty of recoarctation is indicated when associated with a transcatheter systolic coarctation gradient of >20 mm Hg and suitable anatomy, irrespective of patient age *(Level of Evidence: C)*.
2. Balloon angioplasty of recoarctation is indicated when associated with a transcatheter systolic coarctation gradient of <20 mm Hg and in the presence of significant collateral vessels and suitable angiographic anatomy, irrespective of patient age, as well as in patients with univentricular heart or with significant ventricular dysfunction *(Level of Evidence: C)*.

Class IIa

1. It is reasonable to consider balloon angioplasty of native coarctation as a palliative measure to stabilize a patient irrespective of age when extenuating circumstances are present such as severely depressed ventricular function, severe mitral regurgitation, low cardiac output, or systemic disease affected by the cardiac condition *(Level of Evidence: C)*.

AHA Scientific Statement

Indications for Cardiac Catheterization and Intervention in Pediatric Cardiac Disease

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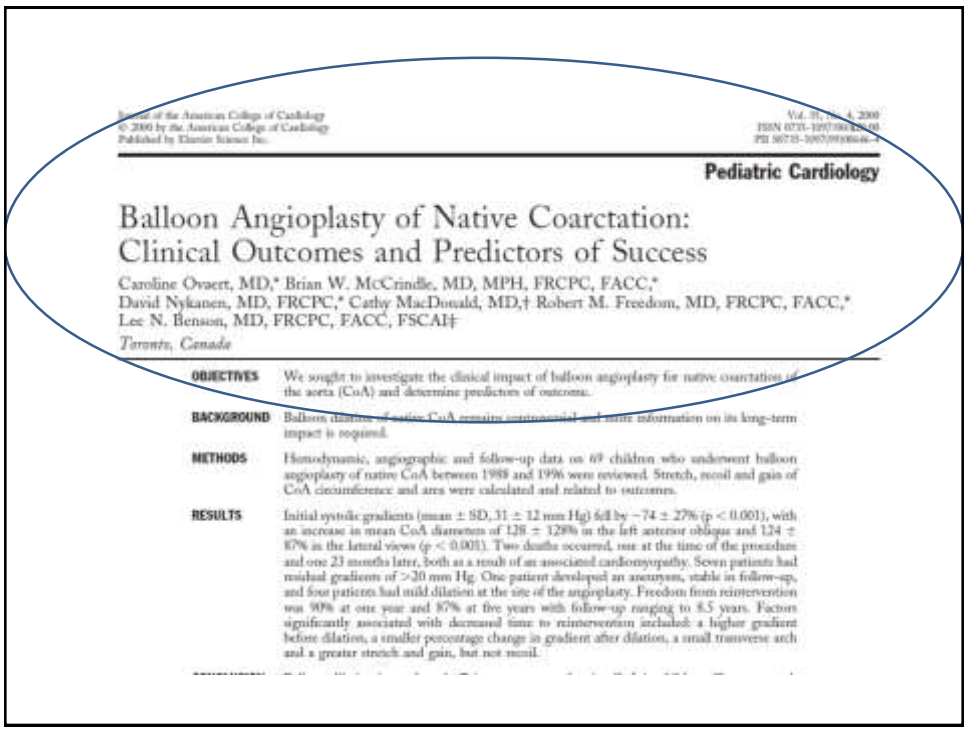
Class IIb

1. Balloon angioplasty of native coarctation may be reasonable in patients beyond 4 to 6 months of age when associated with a transcatheter systolic coarctation gradient >20 mm Hg and suitable anatomy *(Level of Evidence: C)*.
2. Balloon angioplasty of native or recurrent coarctation of the aorta might be considered in patients with complex coarctation anatomy or systemic conditions such as connective tissue disease or Turner syndrome but should be scrutinized on a case-by-case basis *(Level of Evidence: C)*.



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Pediatric Cardiology

Balloon Angioplasty of Native Coarctation: Clinical Outcomes and Predictors of Success

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OBJECTIVES We sought to investigate the clinical impact of balloon angioplasty for native coarctation of the aorta (CoA) and determine predictors of outcome.

BACKGROUND Balloon dilation of native CoA remains controversial and more information on its long-term impact is required.

METHODS Hemodynamic, angiographic and follow-up data on 69 children who underwent balloon angioplasty of native CoA between 1988 and 1996 were reviewed. Stretch, recoil and gain of CoA circumference and area were calculated and related to outcomes.

RESULTS Initial systolic gradients (mean ± SD, 31 ± 12 mm Hg) fell by −74 ± 27% ($p < 0.001$), with an increase in mean CoA diameters of 128 ± 128% in the left anterior oblique and 124 ± 87% in the lateral views ($p < 0.001$). Two deaths occurred, one at the time of the procedure and one 23 months later, both as a result of an associated cardiomyopathy. Seven patients had residual gradients of >20 mm Hg. One patient developed an aneurysm, stable in follow-up, and four patients had mild dilation at the site of the angioplasty. Freedom from reintervention was 90% at one year and 87% at five years with follow-up ranging to 8.5 years. Factors significantly associated with decreased time to reintervention included: a higher gradient before dilation, a smaller percentage change in gradient after dilation, a small transverse arch and a greater stretch and gain, but not recoil.

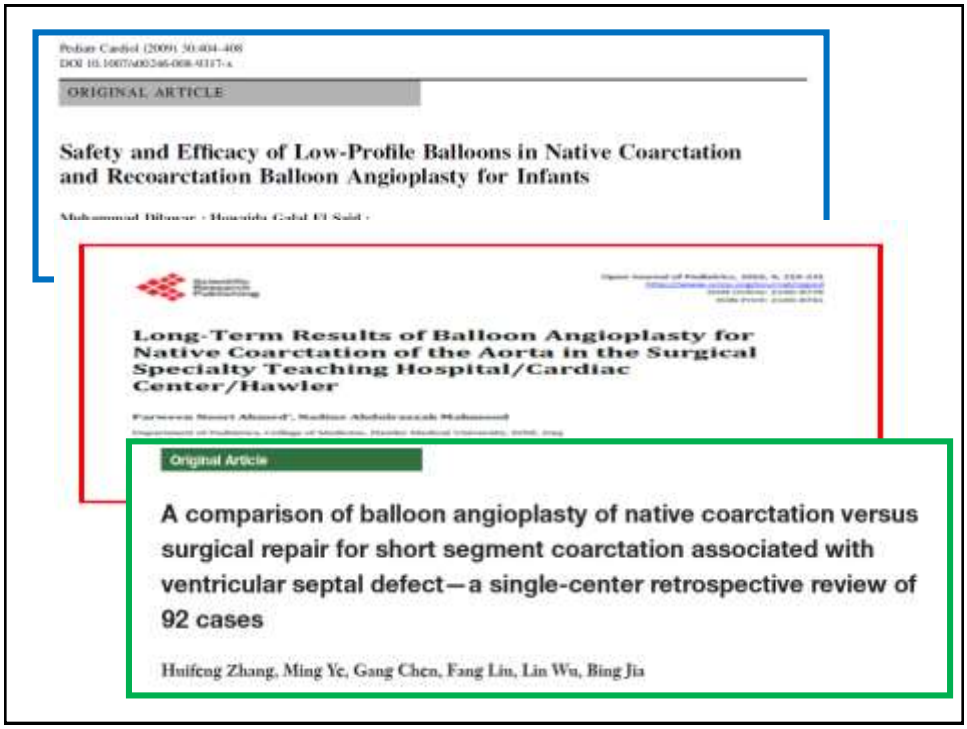

Table 1 Notable studies and guideline statements in the treatment and outcome of coarctation in adults and children

Ref.	*n*	Follow-up	Outcome
Cowley *et al*[56]	36	Mean 14 yr	Randomized trial comparing BA and surgery for native coarctation in children. Aortic aneurysm developed in 35% of BA patients and none of the surgical patients
Carr[51]	846	Mean 36 mo for catheter-based group and 7.8 yr for surgical group	Meta-analysis comparing catheter vs surgical intervention for adults with coarctation. Higher risk of restenosis and need for reintervention found in catheter-based group
Forbes *et al*[58]	578	Median 12 mo	Retrospective multicenter analysis at intermediate follow-up after stent placement for coarctation. Exceeding a balloon:coarct ratio of 3.5 and prestent BA increased risk of aortic wall injury
Warnes *et al*[54]	-	-	ACC/AHA guidelines for management of coarctation in adults
Holzer *et al*[57]	302	3-60 mo	Prospective analysis of acute, intermediate, and long-term follow-up after stent placement for coarctation using CCISC registry. At long-term follow-up, recoarctation in 20% of patients, 4% required unplanned reintervention, and 1% had aortic wall injury
Feltes *et al*[53]	-	-	AHA guidelines for transcatheter intervention in children with coarctation
Forbes *et al*[59]	350	Mean 1.7 yr	Multicenter observational study comparing surgery, BA, and stent placement for native coarctation in children using CCISC registry. Significantly lower acute complication rates in stent group but higher planned reintervention rates. Hemodynamic and arch imaging outcomes superior in stent and surgical patients compared to BA group
Harris *et al*[59]	130	3-60 mo	Prospective, multicenter analysis of short and intermediate outcomes for BA in native and recurrent coarctation in children. Trend toward increased acute aortic wall injury and restenosis in native coarctation patients
Sohrabi *et al*[74]	120	Mean 31.1 mo	Randomized clinical trial comparing covered and bare CP stents for native coarctation in adolescents and adults. Trend of increased rates of restenosis and lower rates of pseudoaneurysm in bare stent group
Meadows *et al*[78]	105	2 yr	Prospective, multicenter, single-arm study assessing safety and efficacy of CP stent in children and adults with coarctation. Two year follow-up of 86% showed 23 fractured stents with no significant clinical effects, 6 aortic aneurysms, 19 repeat catheter interventions, and no surgical interventions

Pediatr Cardiol (2009) 30:404–408
DOI 10.1007/s00246-008-9317-x

ORIGINAL ARTICLE

Safety and Efficacy of Low-Profile Balloons in Native Coarctation and Recoarctation Balloon Angioplasty for Infants

Muhammad Dilawar · Howaida Galal El Said · Amal El-Sisi · Zaheer Ahmad

Received: 7 May 2008 / Accepted: 15 September 2008 / Published online: 14 April 2009

Abstract *Background* Traditionally, high-profile/high-pressure balloons have been used for angioplasties, whereas low-profile/low-pressure balloons have been used for valvuloplasties. High-profile balloons require larger introducing sheaths, which can be a limiting factor for percutaneous catheter interventions in infants. This report aims to report angiographic diameter of the coarctation segment was increased from 2.4 ± 1.0 mm before angioplasty to 5 ± 0.8 mm afterward ($p = 0.001$). There were no immediate major or minor complications. During a follow-up period up to 48 months, only one patient from the native coarctation group experienced recoarctation and underwent

Aspect	Balloon	Surgery
Duration of Hospital Stay	Shorter √	Longer
Procedure mortality	Better √	
Effectiveness	√	√
Recoarctation	3-41%	5-14% √
Aneurysm	4-12% Some 24% others 35%	0-4% depending on method √
Ilifemoral injury	10-20 %	√

Our Country

- ✓ *We have to have our own research.*
- ✓ *Whatever the long term follow up research , no research reached more than 17 years at most (still far before the usual age for HTN)*
- ✓ *How competent will be the long term follow up post balloon dilatation for a child??*
- ✓ *Hand out patient from the pediatrics to the adult cardiology , how difficult!!!!*
- ✓ *Hypertension Prevalence:* The national estimate of the prevalence of hypertension in Egyptians was 26.3%, slightly more prevalent in women 28.9% than in men, 25.7%.Prevalence of hypertension increased progressively with aging reaching a peak in the

age group of 65-74 where more than 50% of individuals have high blood pressure.

Take Home Message

Native Coarctation

- ✓Balloon angioplasty is not recommended for infants less than four months of age especially if the lesion is accompanied by arch hypoplasia, however……..,
- ✓Balloon angioplasty considered in critically ill patients regardless of age who have heart failure due to severe ventricular dysfunction, mitral regurgitation or low cardiac output.

Native Coarctation

Neonates and young infants

✓ Surgical correction is recommended once patient is stable, palliative Balloon might be used if indicated

Debate Older infants and young children (4mo-5y),< 25 KG

✓ The decision between these two modalities is determined by the multidisciplinary team, expertise of the center, and the underlying morphology of the coarctation

Native Coarctation

Older children and adults >25Kg

✓ the decision to perform stent placement versus surgical repair is made on a case by case basis.

Strict Follow up should be ensured


Thank You