

**Should Ductal Stent Implantation be  
Considered for All Newborn Infants with  
Reduced Pulmonary Blood Flow?  
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**Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?**

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**FINAL MBBS EXAMINATION QUESTION:**

**Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?**

**True or False statement**

**Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?**

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**FINAL MBBS EXAMINATION QUESTION:**

**Should ductal stent implantation be considered for SELECTED newborn infants with reduced pulmonary per flow?**

**True or False statement**

# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?

## Possible advantage of ductal stent implantation:

- **Less invasive than surgery**
- **Success / Failure rate**
- **Mortality and morbidity**
- **Stay in ICU**
- **Uniform flow to the left and right pulmonary artery**

# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?

## Possible alternative to ductal stent:

- **Intravenous/oral prostaglandin**
- **Systemic-pulmonary arterial shunt:**
  - **Classic Blalock-Taussig shunt (1944)**
  - **Pott shunt (1946)**
  - **Waterston shunt (1962)**
  - **Modified Blalock-Taussig shunt (1962)**
  - **Central shunt**
  - **Sano shunt (2003)**

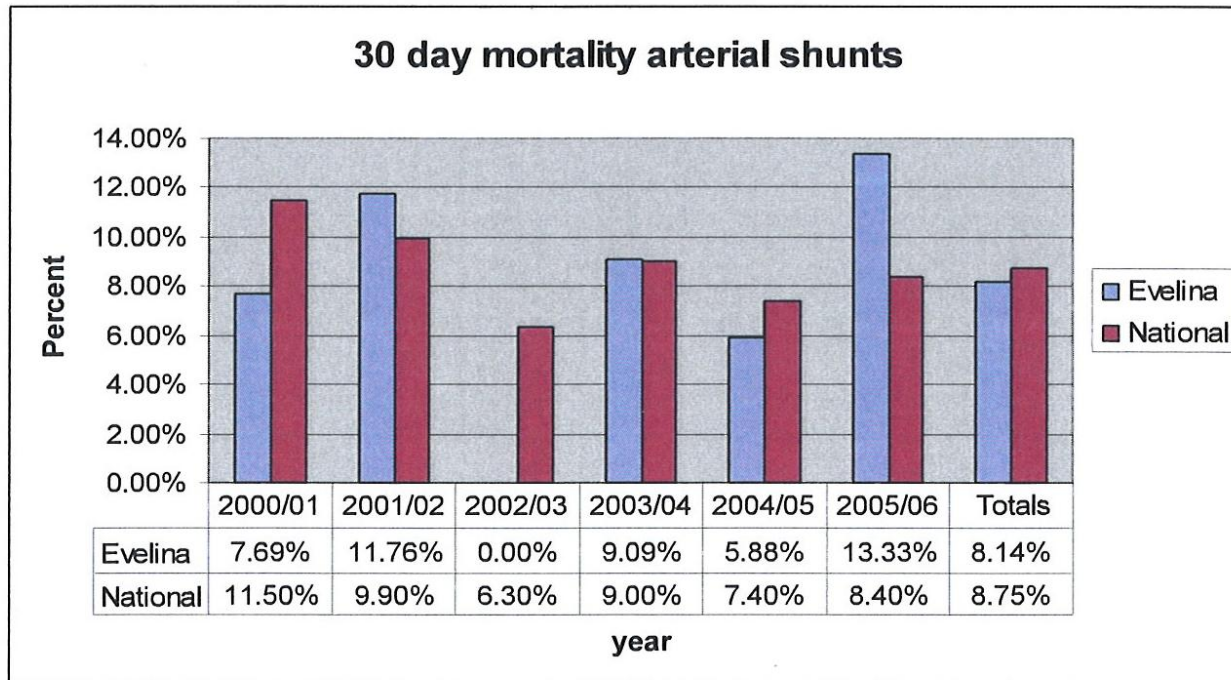
# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?

	<u>Stented PDA</u>	<u>Modified BT shunt</u>
<b>Mortality</b>	<b>0 (6-10%)</b>	<b>6-11%</b>
<b>Failure rate</b>	<b>0-9%</b>	<b>0%</b>
<b>Stay in ICU</b>	<b>M=5dys</b>	<b>M=2dys</b>
<b>Ventilation</b>	<b>M=1.7dys</b>	<b>M=4.5hr</b>
<b>Thrombosis</b>	<b>2%</b>	<b>1.5%</b>

# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?

## UKCCCAD data for BT shunts

National  $n = 613$



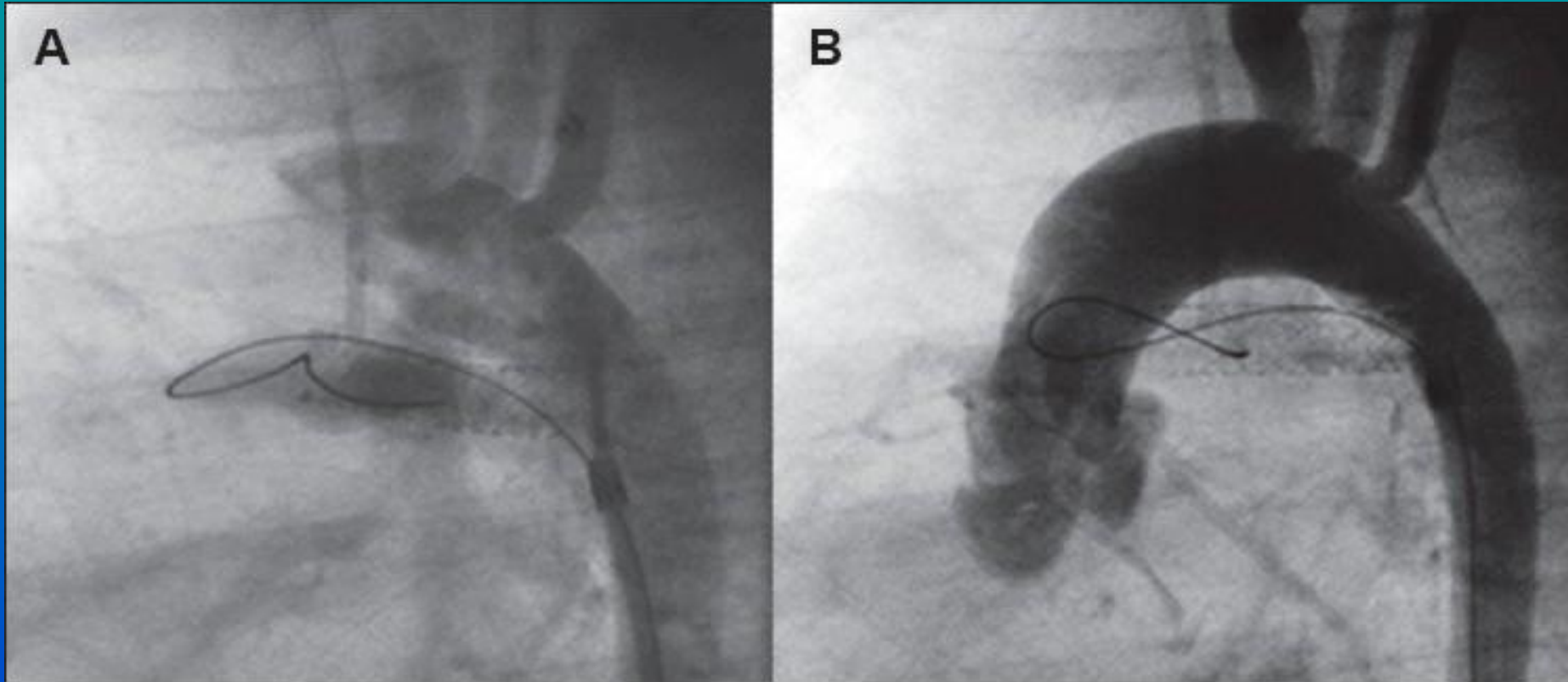
# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?

## Potential problems/ complications associated with stenting PDA:

- **Supporting team and equipment**
- **Identification of appropriate cases**
  - **Basic cardiac anatomy**
  - **Various PDA morphology**
- **Stent migration/ embolisation**
- **Acute thrombosis of the stent**



# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?



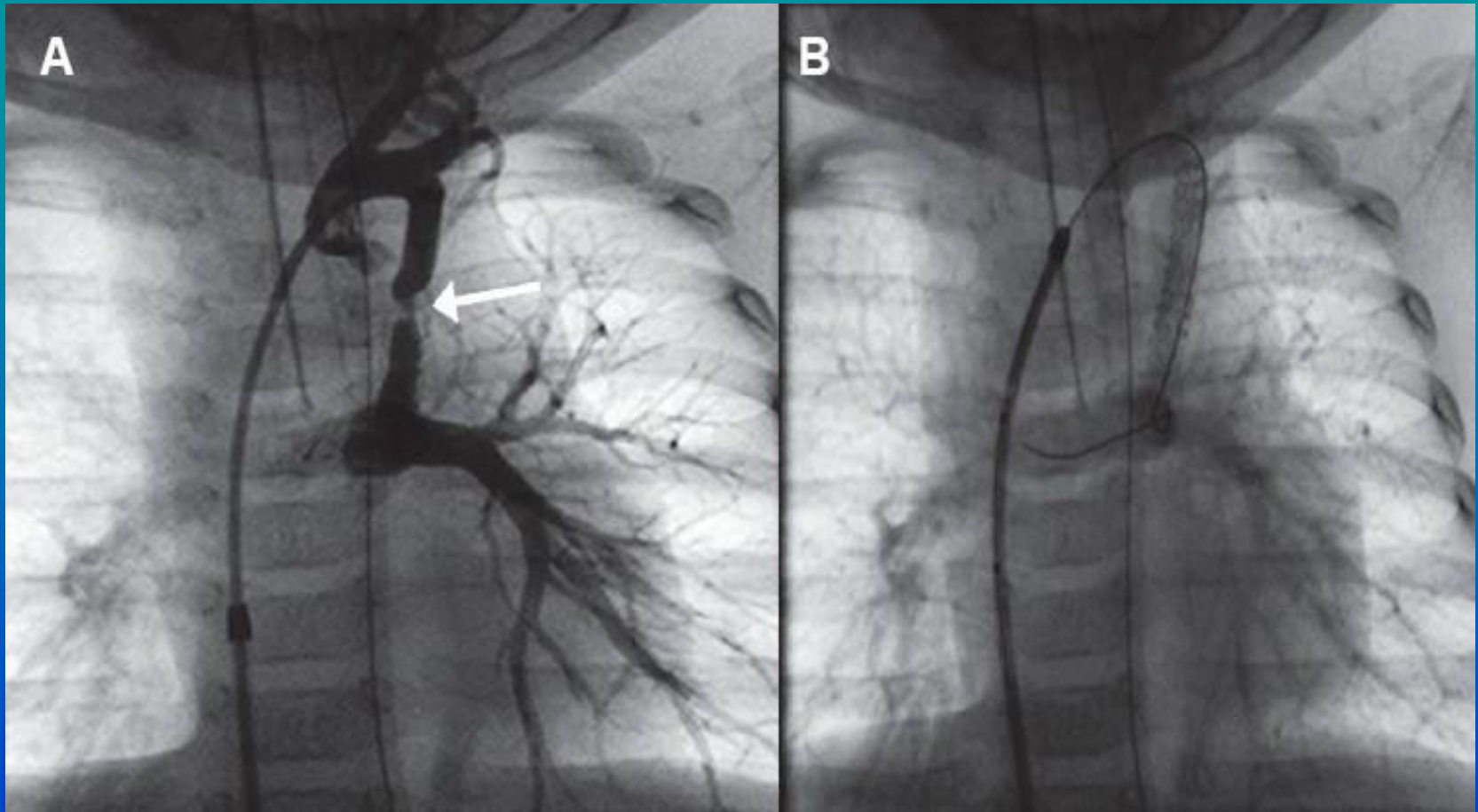
Acute stent thrombosis. (A) Immediate post-stent expansion is showing - good flow through the stented ductus. (B) Ten minutes post-expansion. The guidewire is still across the stent. There is rapidly falling oxygen saturation with very severe desaturation. The entire stent is filled with thrombus

# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?

## Potential problems/ complications associated with stenting PDA (continued):

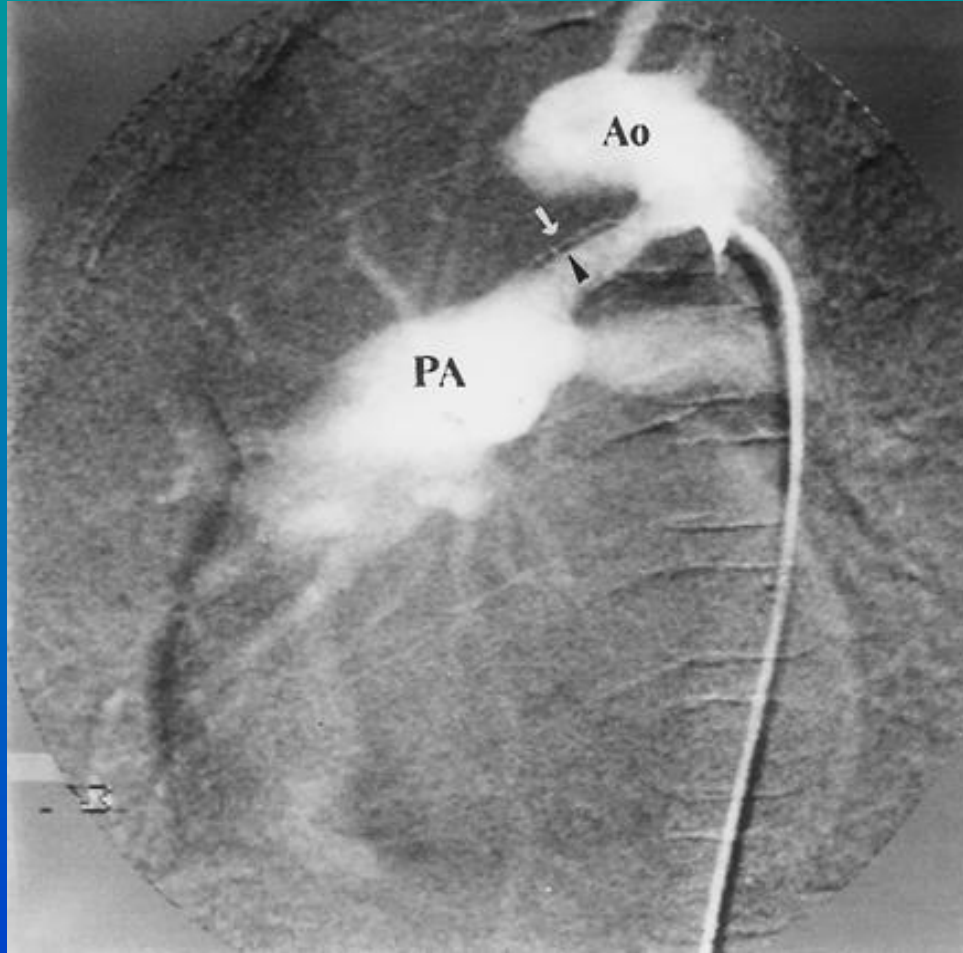
- **Acute spasm of the PDA**
- **Stenosis of unstented segment of duct**
- **Neo-intimal proliferation**
- **Accelerated branch PA stenosis**

# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?



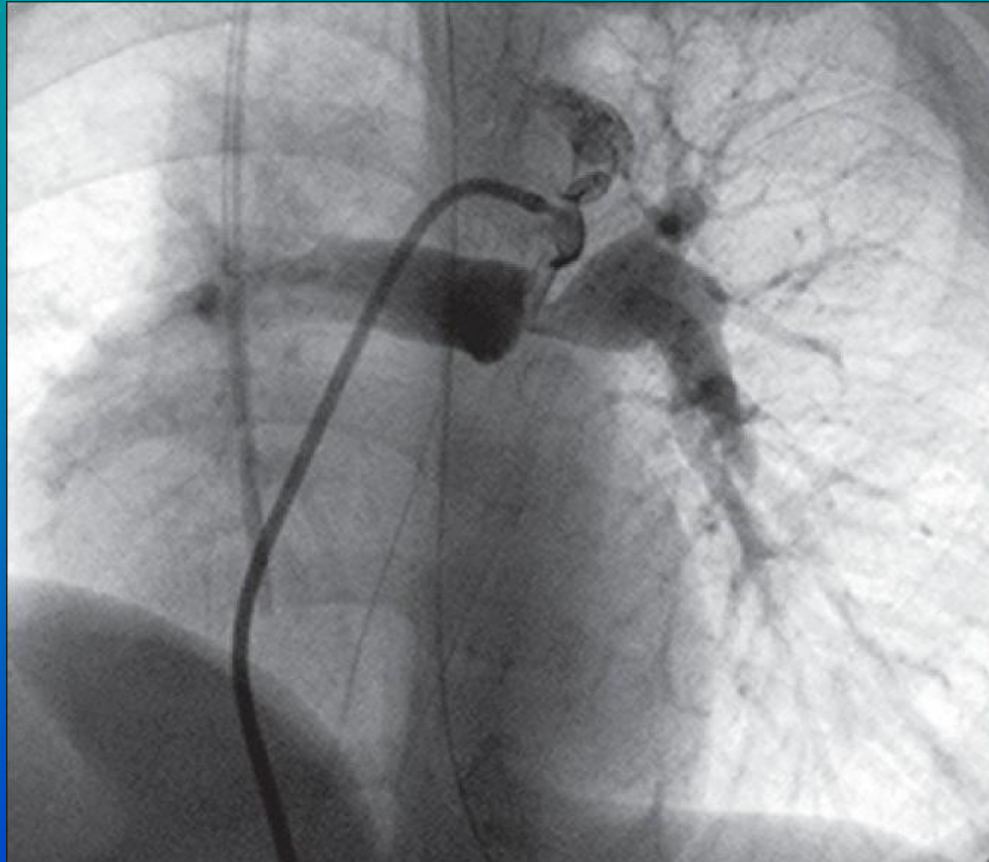
(A) Long tubular ductus from the left subclavian artery. Only the distal half of the ductus was stented. Two months postductal stenting. Severe stenosis of unstenated ductus adjacent to the stent (arrow). (B) Second stent implanted to cover the entire length of the ductus

# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?



Angiography in left anterior oblique projection showing duct after redilation at age of 18 months (patient had tricuspid atresia with restrictive ventricular septal defect). Duct is patent, with well-developed pulmonary arteries, but some neointimal proliferation is seen as a filling defect between stent mesh and lumen of duct (arrowed). Ao indicates aorta; PA, pulmonary artery.

# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?



Ductus arteriosus in TOF-PA arising proximally from the underside of the aortic arch inserting onto the proximal part of the LPA. Significant stenosis of the LPA is present. The tip of a JR catheter passed transvenously into the aorta via the VSD is engaged in the ampulla for adequate visualization

# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?

## Potential problems/ complications of modified BT shunt:

- Those associated with surgery
- Forequarter gangrene—reported in 1997

### Forequarter gangrene

- Fore quarter gangrene: complication of Blalock Taussig Shunt  
*Raheel Hussain, Yahya Al-Faraidi.  
European Journal of Cardio-thoracic Surgery 11 (1997) 582–584*
- Pre-term (34 week) baby, birth weight 1.7 kg with critical pulmonary stenosis, VSD and PDA



- Diaphragmatic paralysis

# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?

## Potential problems/ complications of modified BT hunt (late):

- **Shunt occlusion**
  - acute thrombosis
  - chronic stenosis
- **Xeroma**
- **Pseudo-aneurysm**
- **Distortion of pulmonary artery**
- **Differential PA growth**
- **Innominate arterial steal**
- **Differential forelimb growth**



# Should ductal stent implantation be considered for ALL newborn infants with reduced pulmonary blood flow?

## Cardiac Operations After Patent Ductus Arteriosus Stenting in Duct-Dependent Pulmonary Circulation

Vladimiro L. Vida, MD, PhD, Simone Speggorin, MD, Nicola Maschietto, MD, Massimo A. Padalino, MD, PhD, Chiara Tessari, MD, Roberta Biffanti, MD, Alessia Cerutti, MD, PhD, Ornella Milanesi, MD, and Giovanni Stellin, MD  
Pediatric and Congenital Cardiac Surgery Unit, and Pediatric Cardiology Unit, University of Padua, Padua, Italy

(Ann Thorac Surg 2010;90:605–9)  
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# Cardiac Operations After Patent Ductus Arteriosus Stenting in Duct-Dependent Pulmonary Circulation

## **Conclusions:**

**Operations after PDA stenting are safe and low-risk. The presence of PDA stents requires additional surgical maneuvers on pulmonary arteries in near half of the patients, and postoperative interventions can be required.**

# Cardiac Operations After Patent Ductus Arteriosus Stenting in Duct-Dependent Pulmonary Circulation

**Study period: August 2004 – April 2009**

**n = 15 Consecutive babies**

**age = 12 (7 – 45dys) - stenting**

**age = 11 (5 – 13 months) - surgery**

# Cardiac Operations After Patent Ductus Arteriosus Stenting in Duct-Dependent Pulmonary Circulation

<b>Retrieval of stent (emergency)</b>	<b>n</b>	<b>=2</b>
<b>Additional intervention</b>	<b>n</b>	<b>= 6/13 (46%)</b>
	<b>dilate stenotic stent</b>	<b>= 5</b>
	<b>LPA stenosis (multiple)</b>	<b>= 1</b>

# Cardiac Operations After Patent Ductus Arteriosus Stenting in Duct-Dependent Pulmonary Circulation

<b>Elective group</b>	<b>n</b>	<b>= 13</b>
<b>Pre-op PA stenosis</b>	<b>n</b>	<b>= 8</b>
LPA	n	= 4
RPA	n	= 3
PA discontinuly	n	= 1
<b>Iatrogenic</b>	<b>n</b>	<b>= 4</b>

# Cardiac Operations After Patent Ductus Arteriosus Stenting in Duct-Dependent Pulmonary Circulation

## Details of surgery:

**Complete stent retrieval = 3 (27%) – PA segment excised**

**Partial stent retrieval = 10 (73%)**

**PA plasty (flap / patch) = 7**

**Modified BT shunt = 1**

# Cardiac Operations After Patent Ductus Arteriosus Stenting in Duct-Dependent Pulmonary Circulation

## Post op. Follow up:

**Survivors = 12**

**Lungscan = 7**

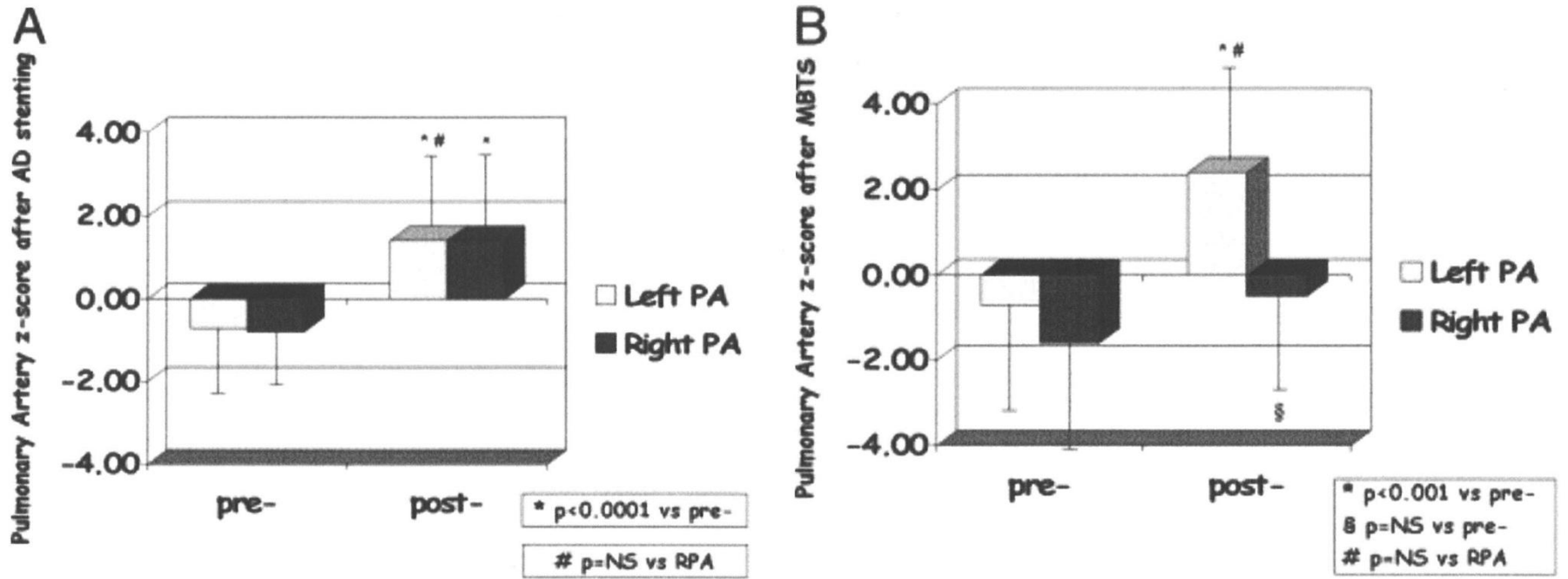
**Hypoperfusion left lung = 4 (28%, 28-30%)**

**Balloon dilatation = 4**

# Pulmonary Artery Growth After Palliation of Congenital Heart Disease With Duct-Dependent Pulmonary Circulation: Arterial Duct Stenting Versus Surgical Shunt

Giuseppe Santoro, MD; Giovanbattista Capozzi, MD; Giuseppe Caianiello, MD; Maria Teresa Palladino, MD; Chiara Marrone, MD; Gabriella Farina, MD; Maria Giovanna Russo, MD; Raffaele Calabrò, MD

*J Am Coll Cardiol.* 2009;54(23):2180-2186. doi:10.1016/j.jacc.2009.07.043



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*J Am Coll Cardiol.* 2009;54(23):2180-2186. doi:10.1016/j.jacc.2009.07.043

**Study period: April 2003 – January 2009**

**Study population:**

- A) Stented: 45**
- 27 - no further intervention**
  - 18 - progressive cyanosis**
  - 5 - exclusion (isolated, disconnected, bilat PAS)**
  - 13 - study group**
  - 8 - mild to moderate antegrade pulmonary flow**



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*J Am Coll Cardiol.* 2009;54(23):2180-2186. doi:10.1016/j.jacc.2009.07.043

**Study period: April 2003 – January 2009**

**Study population:**

**B) BT shunted: 89**

**14 - pre-op angiogram (complex heart + failed stenting)**

**8 - sole pulmonary blood flow**

**6 - additional pulmonary flows source**

# Fate of the stented arterial duct

Gibbs JL, Uzun O, Blackburn ME, Wren C, Hamilton JR, Watterson KG. The fate of the stented arterial duct *Circulation* 1999;99:2621–5

# Fate of the stented arterial duct

## CONCLUSIONS:

**Ductal stenting cannot be recommended. In patients with HLH, it provides only short-term palliation even when combined with pulmonary artery banding. With duct-dependent pulmonary blood flow, the procedure carries high risk, and duration of palliation is poor. In patients with bilateral ducts and absent central pulmonary arteries, good palliation may be achieved, but repeated angioplasty is necessary to counteract intimal hyperplasia.**

**Thank you 謝謝！**

# Stenting the ductus arteriosus: Case selection, technique and possible complications

Mazeni Alwi

*Ann Pediatr Cardiol. 2008 Jan-Jun; 1(1): 38-45*

# Stenting of PDA as an alternative to Blalock-Taussig shunt

Shakeel A Qureshi Evelina Children's Hospital  
London, UK

*CardioEgypt, Cairo, 2010*

# Initial results and medium-term follow-up of stent implantation of patent ductus arteriosus in duct-dependent pulmonary circulation

Mazeni Alwi, MRCP; K.K. Choo, MRCP; Haifa Abdul Latiff, MD; Geetha Kandavello, MRCP; Hasri Samion, MD; M.D. Mulyadi, MD

*J Am Coll Cardiol.* 2004;44(2):438-445.  
*doi:10.1016/j.jacc.2004.03.066*

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*J Am Coll Cardiol.* 2009;54(23):2180-2186. doi:10.1016/j.jacc.2009.07.043



# Modified Blalock-Taussig Shunt in Palliative Cardiac Surgery

E.V. Ussiri<sup>1</sup>, E.T.M. Nyawawa<sup>1</sup>, U. Mpoki<sup>2</sup>, E.R. Lugazia<sup>2</sup>, G.C. Mannam<sup>3</sup>, L.R. Sajja<sup>4</sup>, S. Sompali<sup>4</sup>

*East and Central African Journal of Surgery, Vol. 12, No. 2, November/December 2006, pp. 23-27*

# Clinical Outcomes of Palliative Surgery Including a Systemic-to-Pulmonary Artery Shunt in Infants With Cyanotic Congenital Heart Disease

Jennifer S. Li, MD, MHS; Eric Yow, MS; Katherine Y. Berezny, MPH; John F. Rhodes, MD; Paula M. Bokesch, MD; John R. Charpie, MD; Geoffrey A. Forbus, MD; Lynn Mahony, MD; Lynn Boshkov, MD; Virginie Lambert, MD; Damien Bonnet, MD; Ina Michel-Behnke, MD; Thomas P. Graham, MD; Masato Takahashi, MD; James Jagers, MD; Robert M. Califf, MD; Amit Rakhit, MD; Sylvie Fontecave, MD; Stephen P. Sanders, MD

*Circulation. 2007; 116: 293-297 Published online before print June 25, 2007, doi: 10.1161/CIRCULATIONAHA.106.652172*

# Outcomes of systemic to pulmonary artery shunts in patients weighing less than 3 kg: Analysis of shunt type, size, and surgical approach

John W. Myers, BS, Nancy S. Ghanayem, MD, Yumei Cao, PhD, Pippa Simpson, PhD, Katie Trapp, BS, Michael E. Mitchell, MD, James S. Tweddell, MD, Ronald K. Woods, MD, PhD

*Read at the 39th Annual Meeting of The Western Thoracic Surgical Association, Coeur d'Alene, Idaho, June 26-29, 2013.*