



CENTRE
HOSPITALIER
UNIVERSITAIRE
BORDEAUX

Université
de BORDEAUX

Création de shunt

Le point de vue du cardiologue

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Service des cardiopathies congénitales de l'enfant et de l'adulte- Hôpital cardiologique Haut Lévêque - Bordeaux

Quand ?



Ductodépendance pour la perfusion pulmonaire

Fallot
APSO (1-2)
Ebstein
APSI
SVP critique

Ductodépendance pour la perfusion systémique

HLHS
IAA
Coarctation aortique

Quand ?

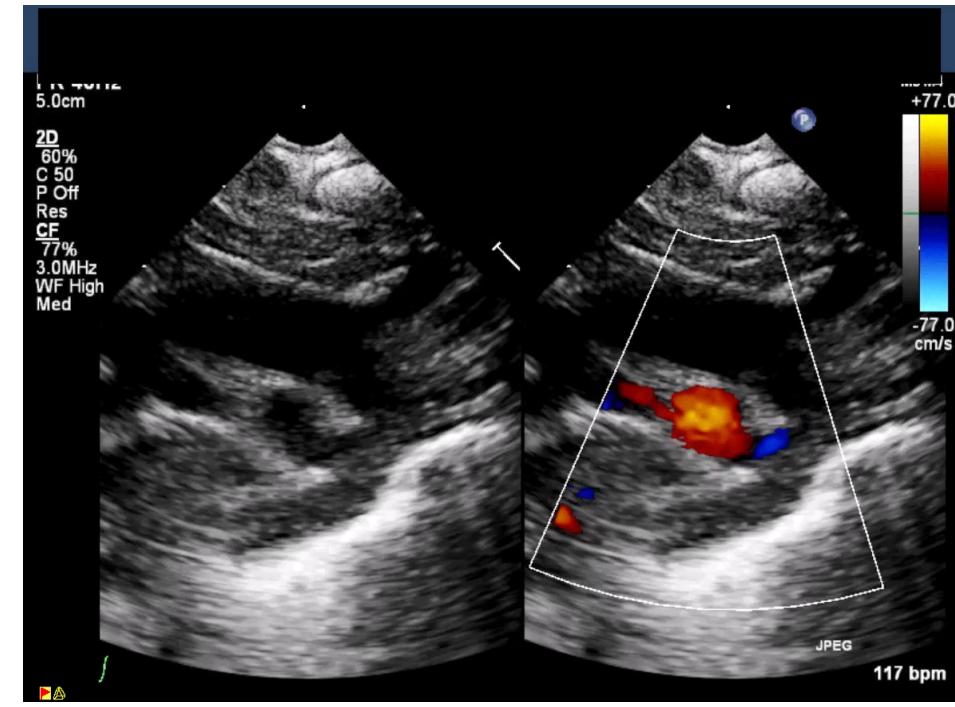
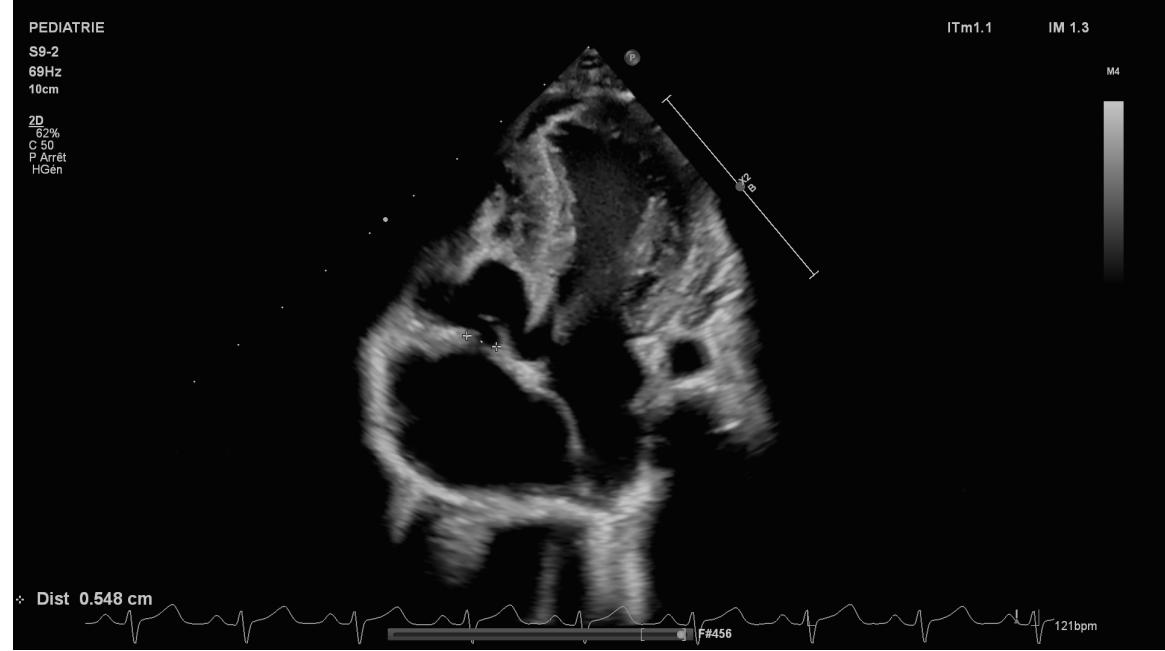


Ductodépendance
pour la perfusion
pulmonaire

Ductodépendance
pour la perfusion
systémique

Ductodépendance pulmonaire

- **Définition** : Atrésie ou hypoplasie de la voie d'éjection pulmonaire sans autre suppléance (MAPCA) → dépendance du CA pour la circulation pulmonaire
- **Conséquence** : désaturation à la fermeture du CA
- **Prise en charge immédiate** :
 - Prostine
 - 250 ug/50 ml G5 : 0,025 ug/kg/min
- **Prise en charge plus durable** : **shunt systémico-pulmonaire**

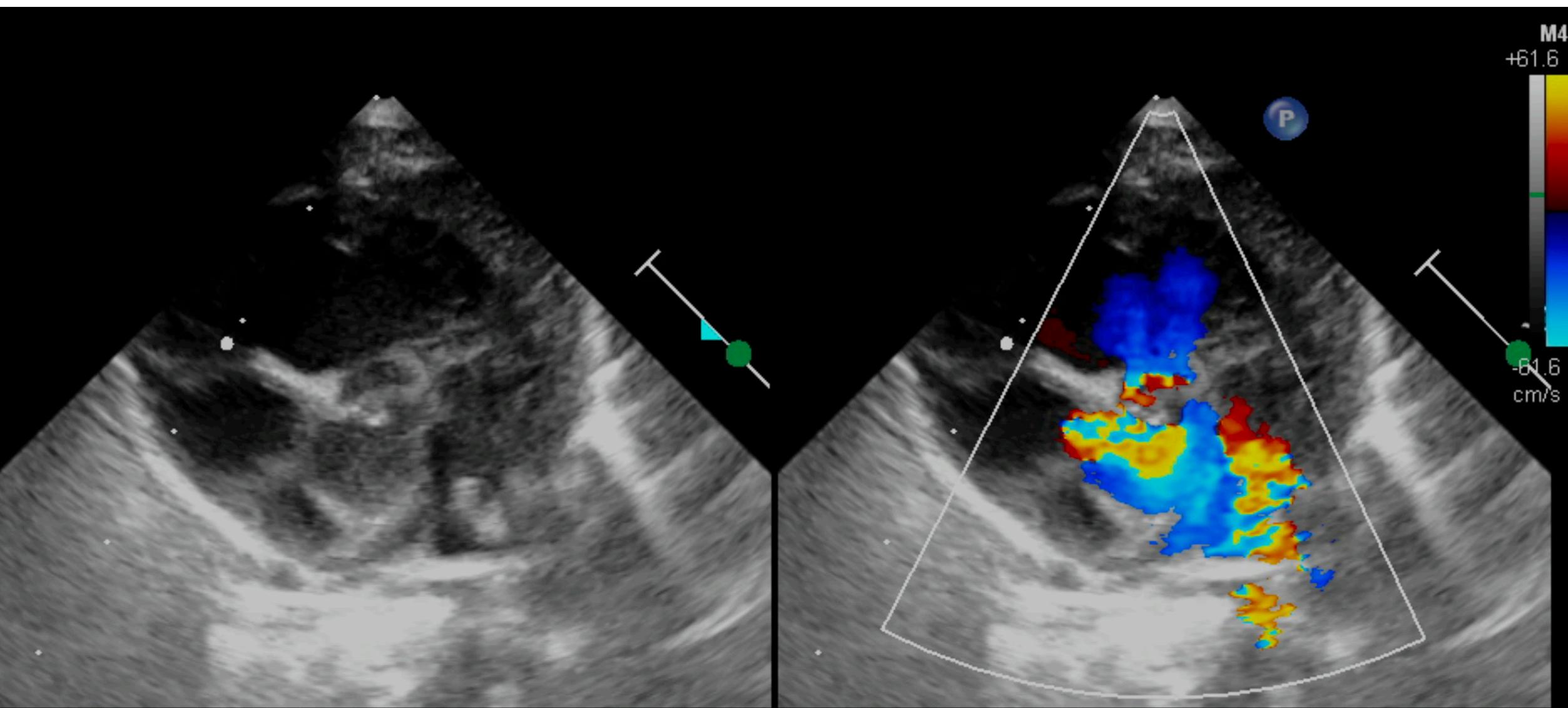


M4

+61.6

-61.6

cm/s



Ductodépendance pulmonaire

Objectifs du shunt systémico-pulmonaire :

- Survie en attente de la cure complète
- Assurer la croissance des AP en prévenant la distorsion
- En gardant un équilibre du Qp/Qs

Ductodépendance pulmonaire

Quel shunt ?



BTT shunt



Stenting CA

Ou Prostine au long cours

Ductodépendance pulmonaire

Quel shunt ?

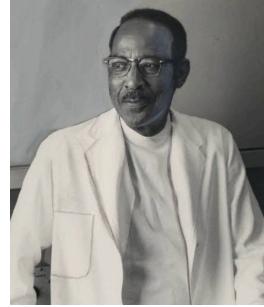


BTT shunt

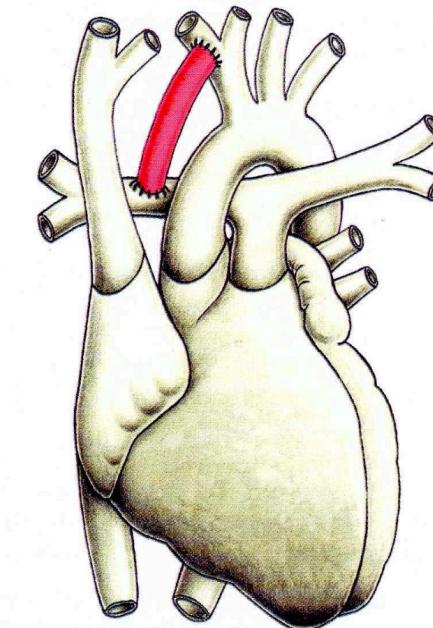
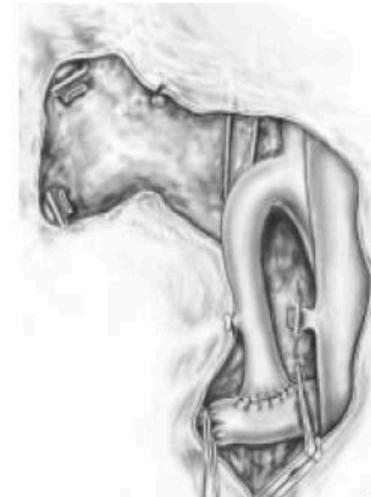
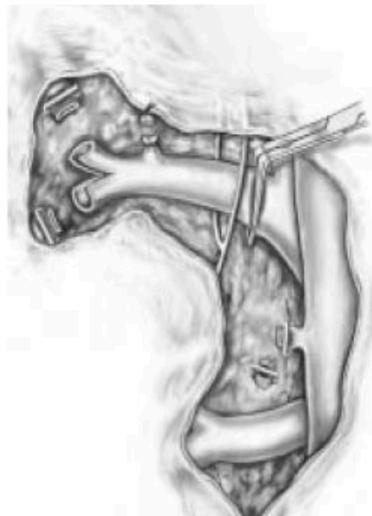
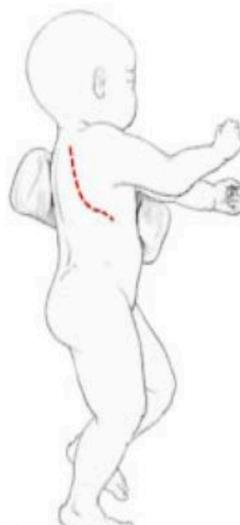
Stenting CA

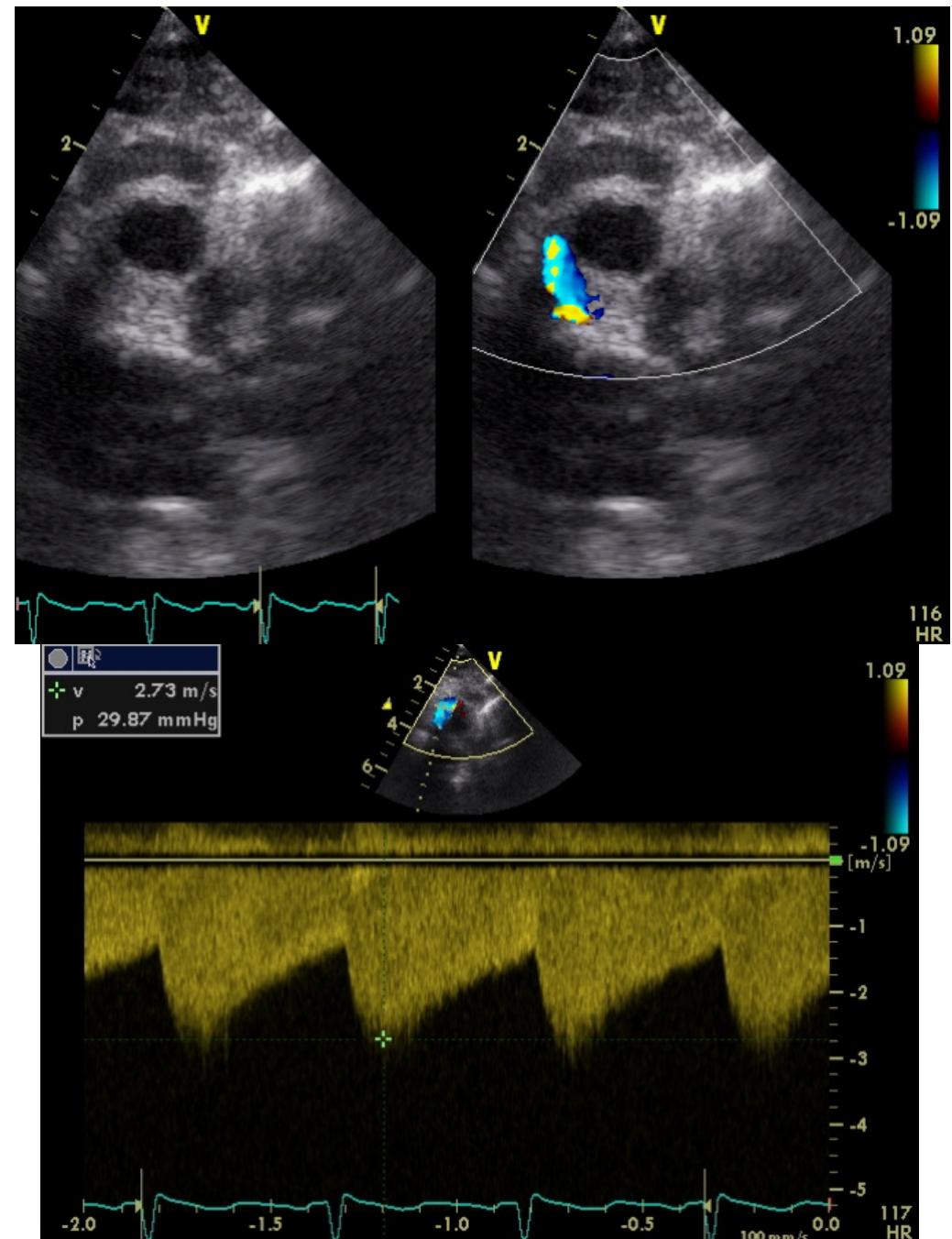
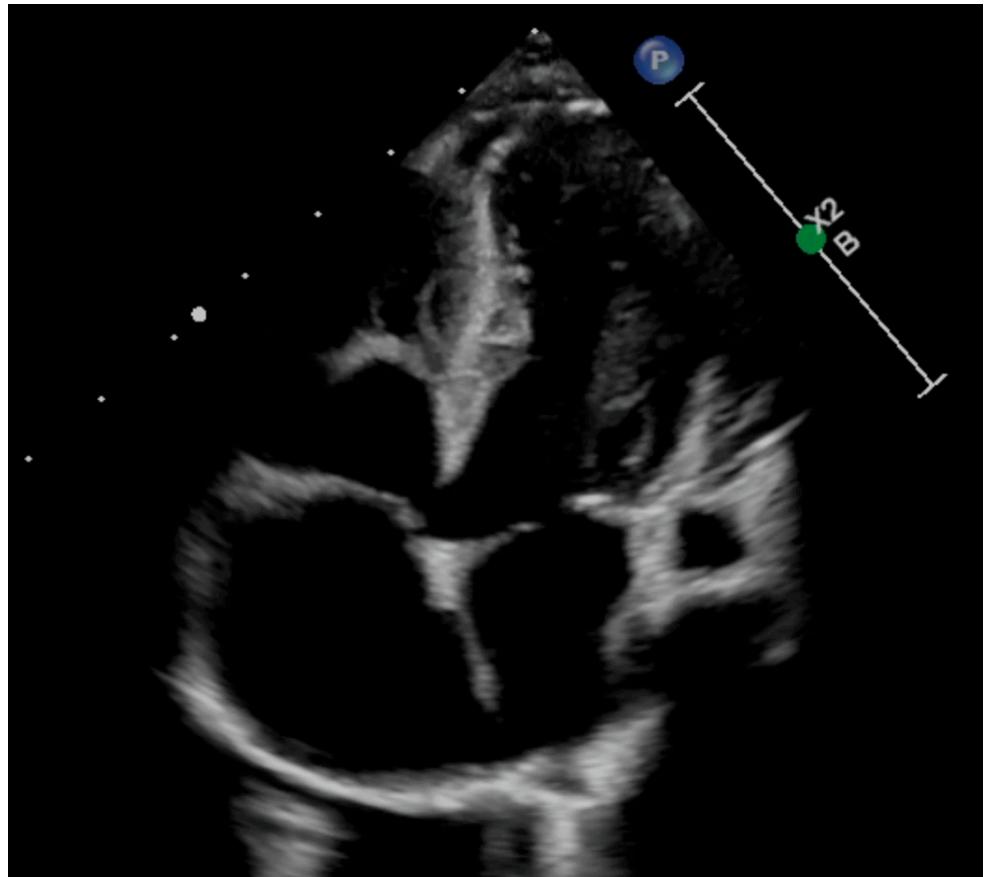
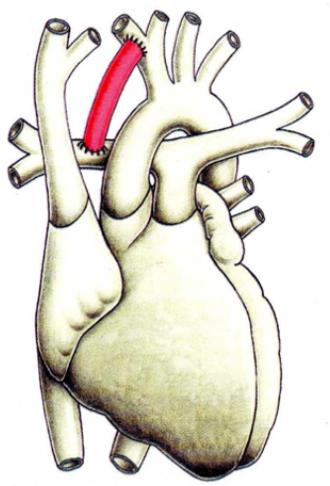
Ou Prostine au long cours

Blalock – Taussig – Thomas Shunt



- 1ère intervention en 1944 (John Hopkins Hospital, Baltimore)
- Initialement connexion directe ASC sur AP
- Distorsion AP, difficulté d'équilibre et de reproductibilité du Qp/Qs
- Désormais modified BTTS : Tube prothétique en PTFE (3 à 4 mm) entre ASC et AP
- Sternotomie le + souvent. Souvent sans CEC.





Evaluation ETT du Blalock

- **Visualisation sur toute la longueur** pour confirmer la bonne perméabilité et le bon calibre
- **Vmax du Blalock** : peu utile, dépend de
 - De l'hémodynamique : FE, PA, PAP, RVP, volémie
 - De l'anatomie : taille des AP
 - De la chirurgie : taille, longueur, position du blalock
 - De la rhéologie : Ht, volémie
 - De la ventilation
 - L'équation simplifiée de Bernouilli n'est pas applicable pour la mesure des gradients
- **VP** :
 - Perméabilité en faveur d'une bonne perméabilité de l'AP
 - Vmax : oriente vers hyperdébit si $> 0,8 \text{ m/s}$
- **VTD isthme aortique** : reflux attendu, oriente vers hyperdébit $> 20 \text{ cm/s}$
- **Reflux aorte abdominale**

Qp/Qs

$$\frac{\text{Sat O}_2 \text{ Ao} - \text{Sat O}_2 \text{ VC}}{\text{Sat O}_2 \text{ VP} - \text{Sat O}_2 \text{ AP}} \rightarrow 30$$

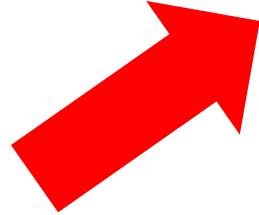
100 ← Sat O₂ Aorte →



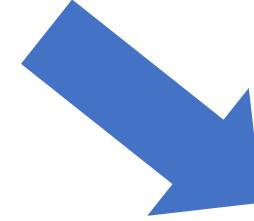
$$\frac{30}{100 - \text{SpO}_2}$$



SpO₂ 90% : Qp/Qs à 3
SpO₂ 85% : Qp/Qs à 2
SpO₂ 70% : Qp/Qs à 1
SpO₂ 50% : Qp/Qs à 0,6



Tableau



Hyperdébit pulmonaire :

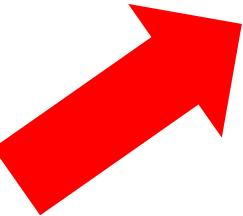
- Insuffisance cardiaque
- $\text{SpO}_2 > 90\%$
- RT surchargée

Hypodébit systémique :

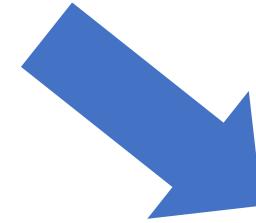
- Hypoperfusion cérébrale / NIRS cérébrales basses
- PAM et PAD : basses
- Vol diastolique coronarien
- Entérocolite
- Insuffisance rénale
- **ETT** : vol diastolique (VTD istme, reflux AA), augmentation retour gauche (Vmax VP)
- **Biologie** : lactates / cytolysé hépatique / hyperkaliémie / $\text{SvO}_2 < 25\%$ de la SaO_2

Qp/Qs

- $\text{SpO}_2 < 70\%$
- PAD normale ou haute
- RT : hypoperfusion



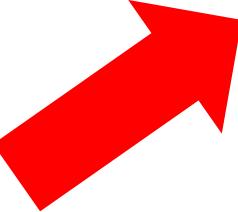
Causes



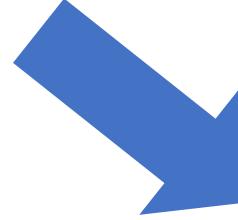
- **Baisse RVP :**
 - *FiO₂ trop élevée*
 - *Alcalose ou hypocapnie*
 - *Hématocrite normale ou basse*
- **Elévation RVS :**
 - *Douleur/agitation*
 - *HTA*
 - *Hypothermie*
- **Structurelle** : Blalock trop grand

Qp/Qs

- **Augmentation RVP :**
 - *Pré-capillaire* :
 - Acidose/hypoxie/hypercapnie
 - Cause pneumologique : atélectasie, épanchement pleural, pneumothorax, pneumopathie, ...
 - *Post-capillaire* : dysfonction VU, fuite VAV, ...
- **Baisse RVS :**
 - *Hyperthermie*
 - *Vasodilatation*
 - *Antalgie/sédation*
- **Structurelle** :
 - Blalock trop petit
 - Thrombose Blalock



Prise en charge



Qp/Qs

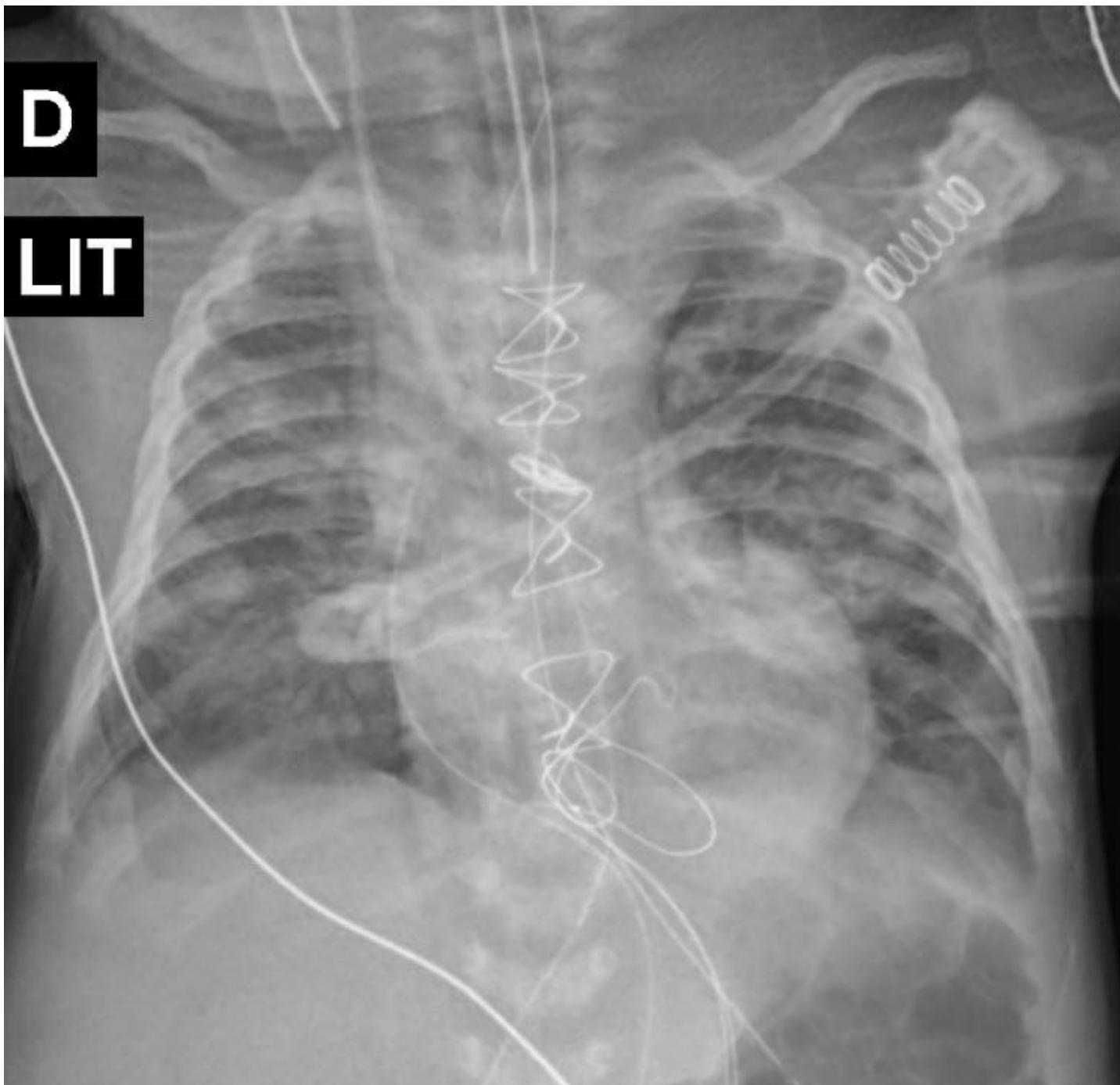
- **Augmenter RVP :**
 - Accepter acidose/hypercapnie
 - FiO_2 21%
 - PEP
 - $\text{Hg} > 15\text{ g/dl} \rightarrow \text{Fer, CGR}$
- **Baisser RVS :**
 - Antalgie/sédation
 - Vasodilatateurs (MILRINONE), IEC
 - Élévation T° de $0,5^\circ\text{C}$
- **Si inefficace : reprise chirurgicale**
++ (clip du Blalock, stenting Blalock pour baisse calibre, changement du Blalock, ...)

- **Baisser RVP :**
 - Normalisation pH/ CO_2
 - FiO_2 100%
 - NO
 - Traitement d'une atteinte pulmonaire
 - Abaisser Ht
- **Augmentation RVS :**
 - Baisse T° de $0,5^\circ\text{C}$
 - Baisse vasoplégiants
 - Vasopresseur (NAD, VP)
- **Traitement étiologie curable :**
 - Thrombose Blalock
 - Obstacle post-capillaire : VP, CIA, ..

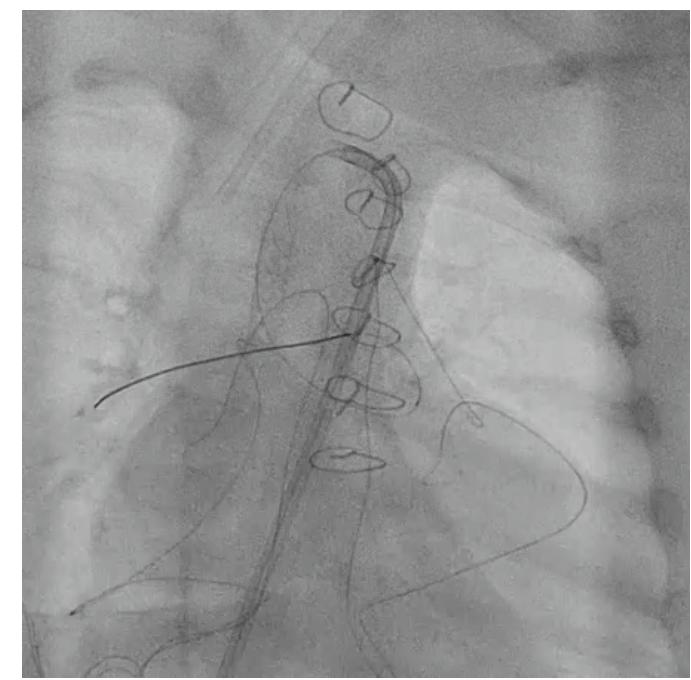
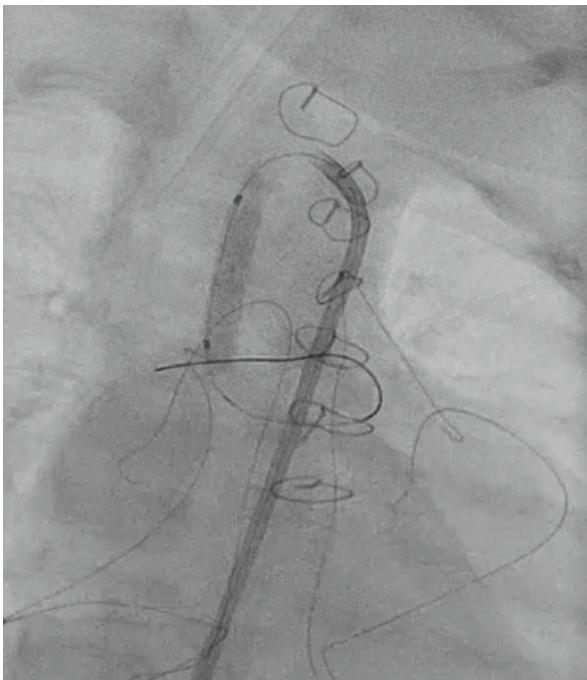
D

LIT

anulo



PO5 Blalock sur APSI
Désaturation progressive





A Single-Centre Retrospective Review of Modified Blalock-Taussig Shunts: A 22-Year Experience

Adrian Tarca, MBBS, BSc^{a*}, Giulia Peacock, MBBS^a,
Elizabeth McKinnon, PhD^b, David Andrews, FRACS^c,
Jelena Saundankar, FRACP^a

1 centre : Australie, Perth

185 Blalock

3,5 kg

Mortalité globale 13,5% (6% T4F, 19% APSI)

Two Thousand Blalock-Taussig Shunts: A Six-Decade Experience

Jason A. Williams, MD, Anshuman K. Bansal, BS, Bradford J. Kim, BA,
Lois U. Nwakanma, MD, Nishant D. Patel, BA, Akhil K. Seth, BS, Diane E. Alejo, BA,
Vincent L. Gott, MD, Luca A. Vricella, MD, William A. Baumgartner, MD, and
Duke E. Cameron, MD

Division of Cardiac Surgery, The Johns Hopkins Medical Institutions, Baltimore, Maryland

Article de 2007

John Hopkins Hospital, Baltimore, Maryland

62 ans

2016 Blalock

Baisse du nombre de procédure

Baisse de la mortalité

Diversification des pathologies

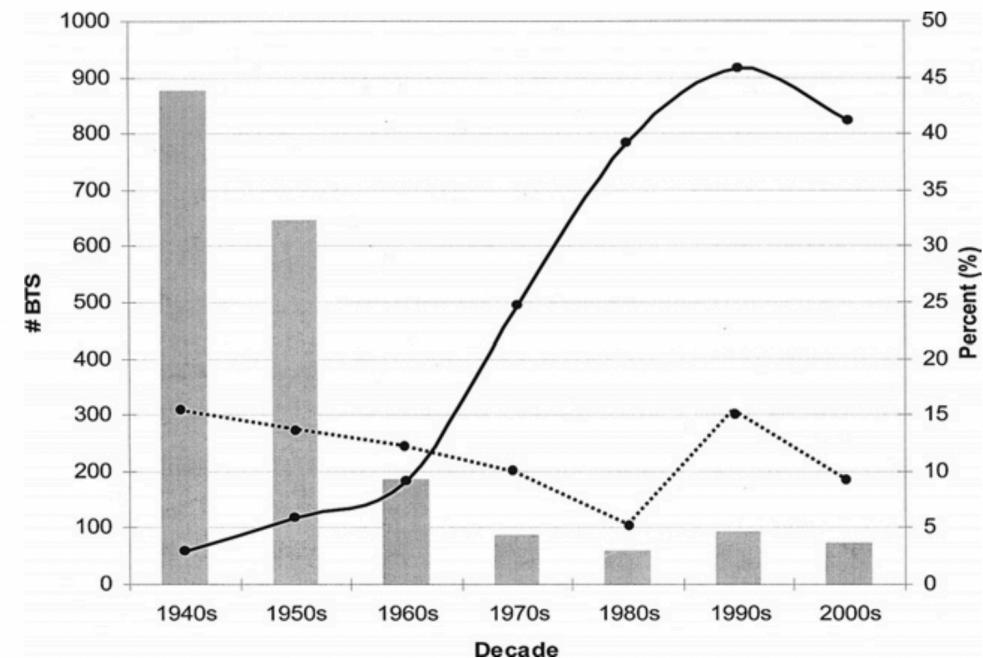


Fig 5. Number of Blalock-Taussig shunt (BTS; gray bars) procedures, percentage of operative mortality (dashed line), and percentage of single-ventricle patients (solid line) by decade.

Ductodépendance pulmonaire

Quel shunt ?



BTT shunt

Stenting CA

Stenting canal artériel

Br Heart J 1992;67:240–5

Stenting of the arterial duct: a new approach to palliation for pulmonary atresia

John L Gibbs, Martin T Rothman, Michael R Rees, Jonathan M Parsons,
Mike E Blackburn, Carlos E Ruiz

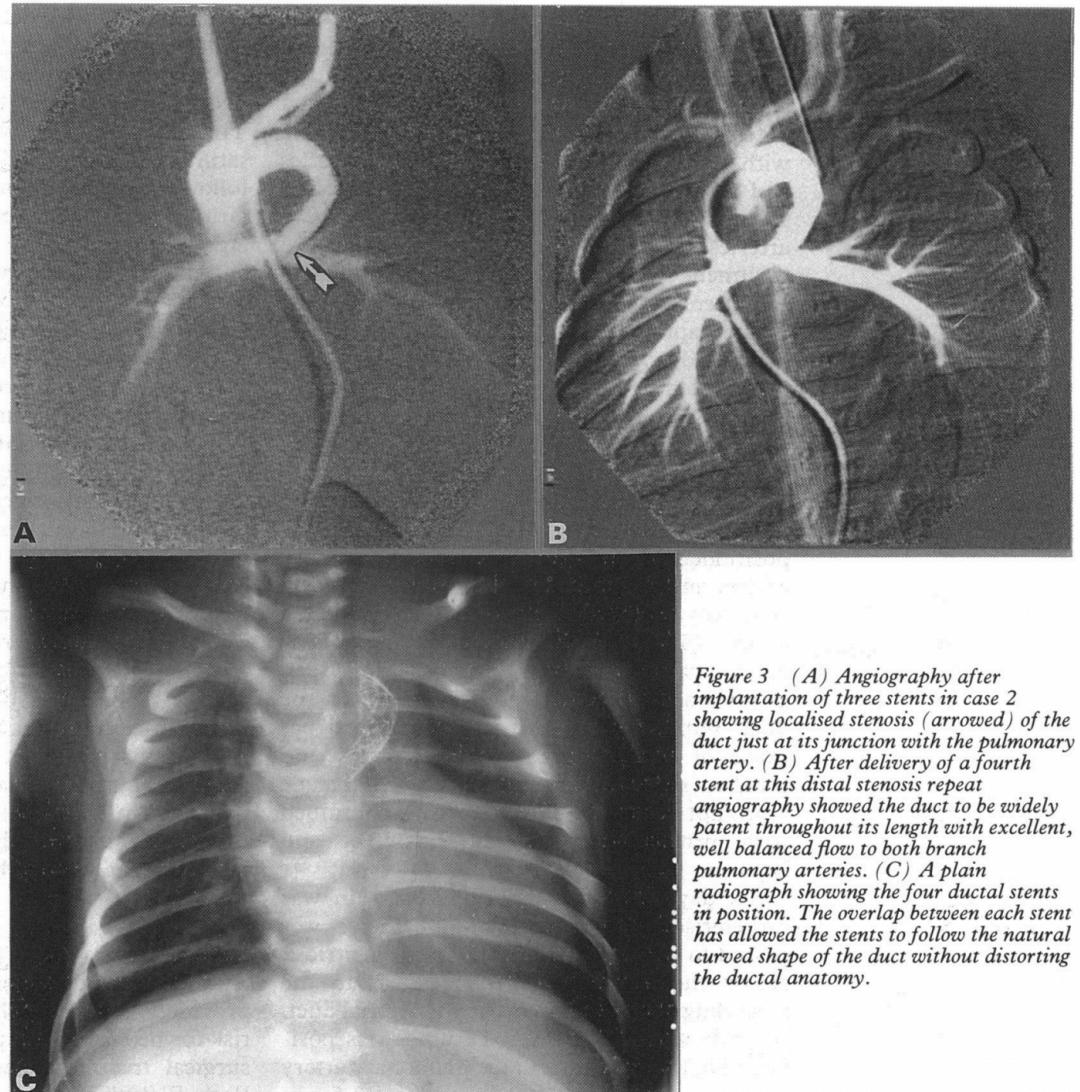
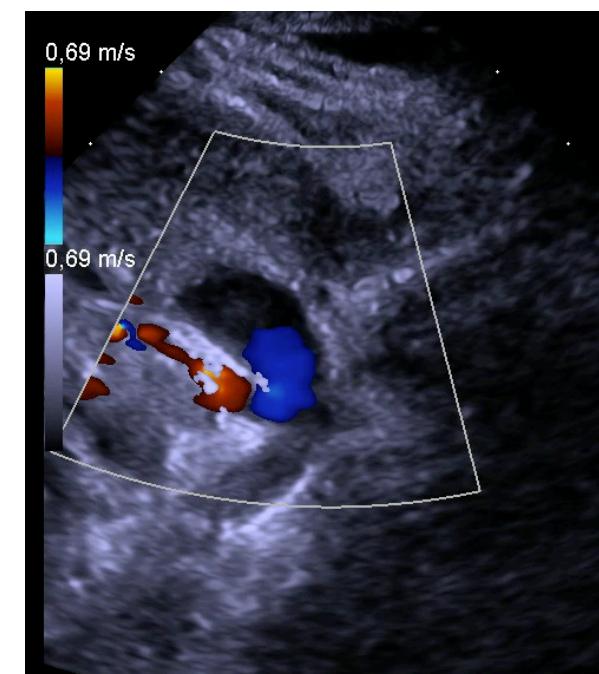
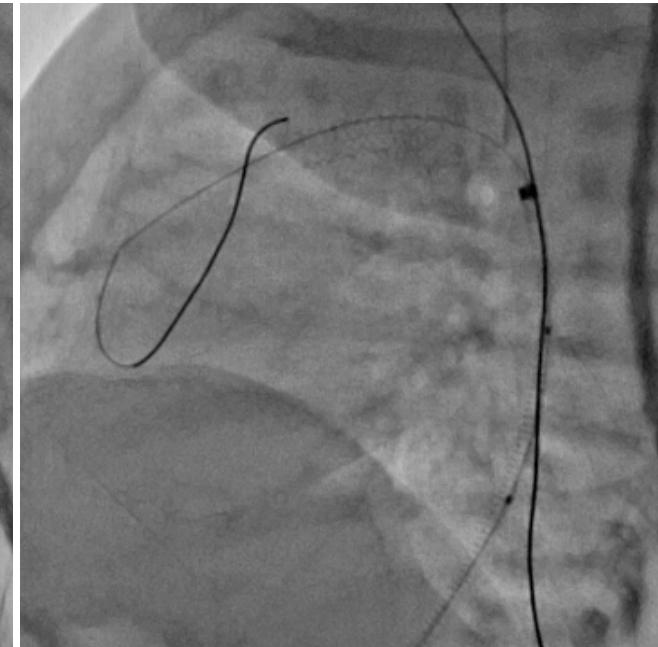
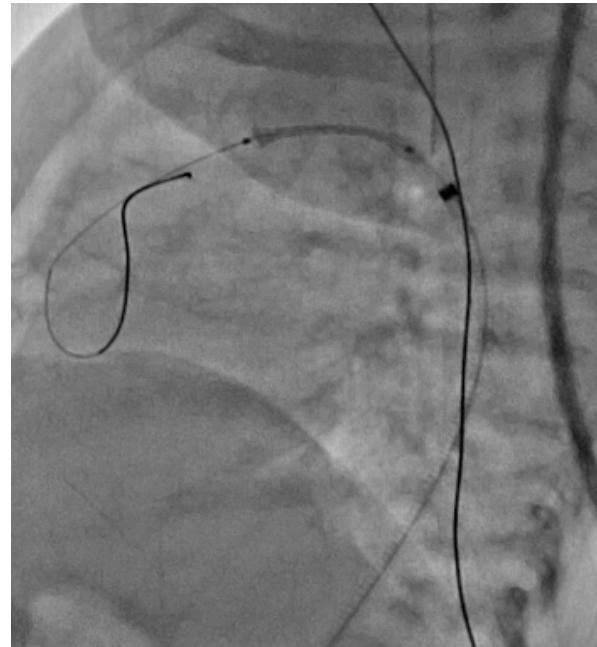


Figure 3 (A) Angiography after implantation of three stents in case 2 showing localised stenosis (arrowed) of the duct just at its junction with the pulmonary artery. (B) After delivery of a fourth stent at this distal stenosis repeat angiography showed the duct to be widely patent throughout its length with excellent, well balanced flow to both branch pulmonary arteries. (C) A plain radiograph showing the four ductal stents in position. The overlap between each stent has allowed the stents to follow the natural curved shape of the duct without distorting the ductal anatomy.

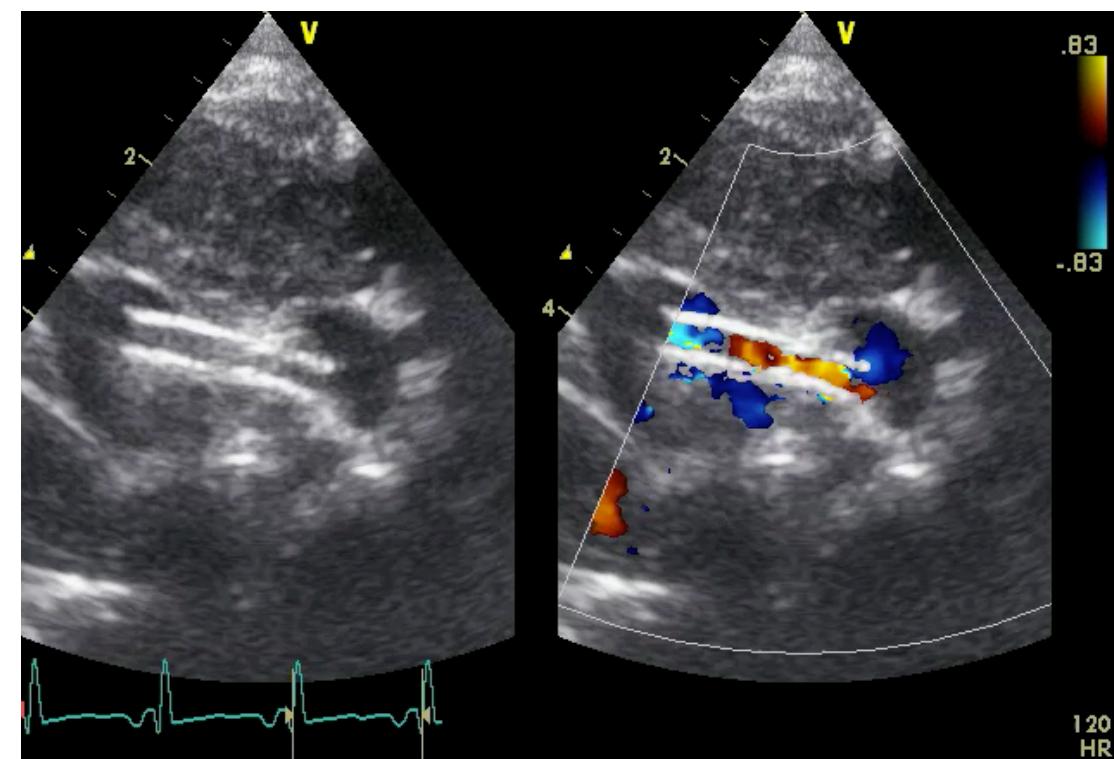
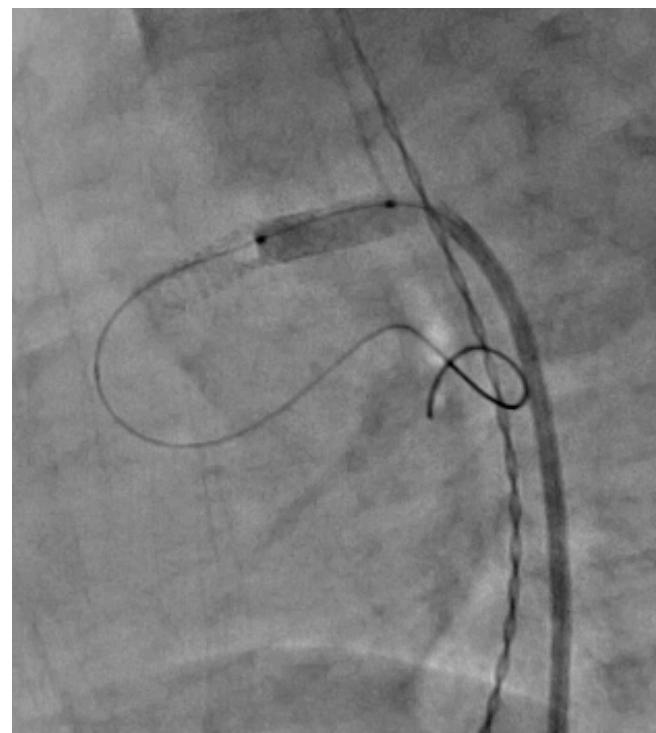
Stenting canal artériel

- Cathétérisme
- Pas de sternotomie
- Risque de prolifération intrastent
- Déplacement du stent
- Abord retrograde, parfois carotidien
- Stents coronaires



- Même patient à 3 mois
- Désaturations importantes
- Sténose origine CA sur zone non couverte par le stent

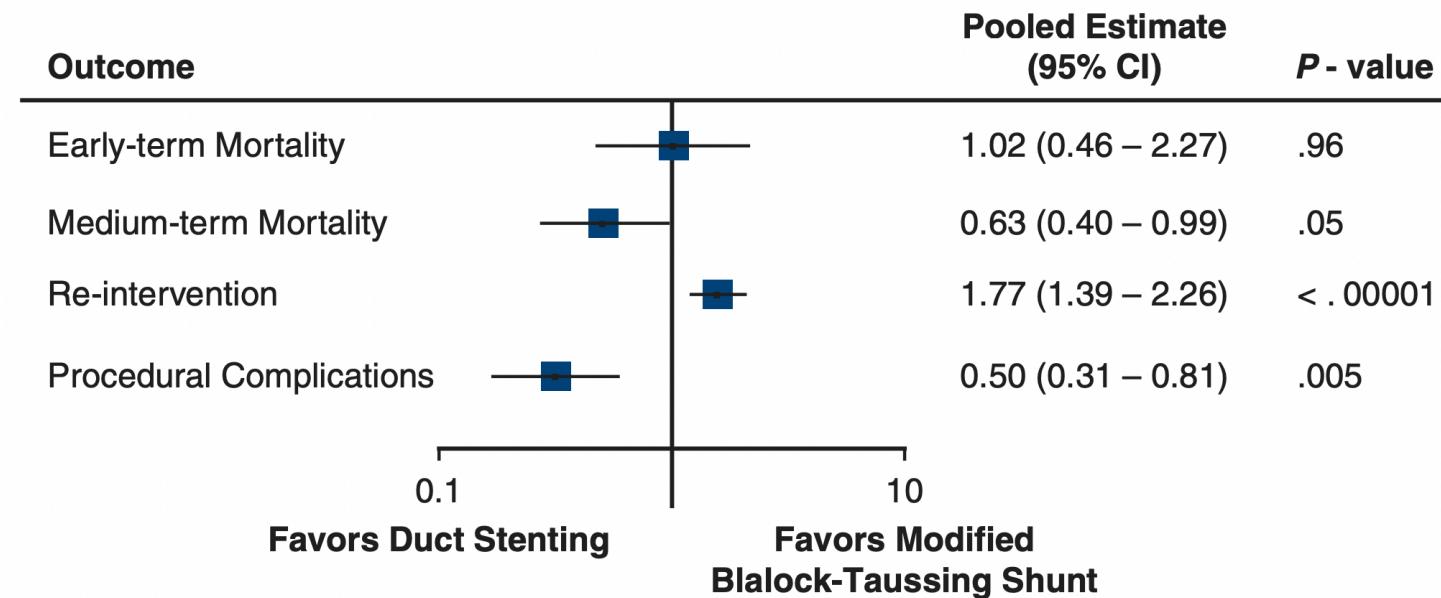
→ Stent additionnel dans le CA





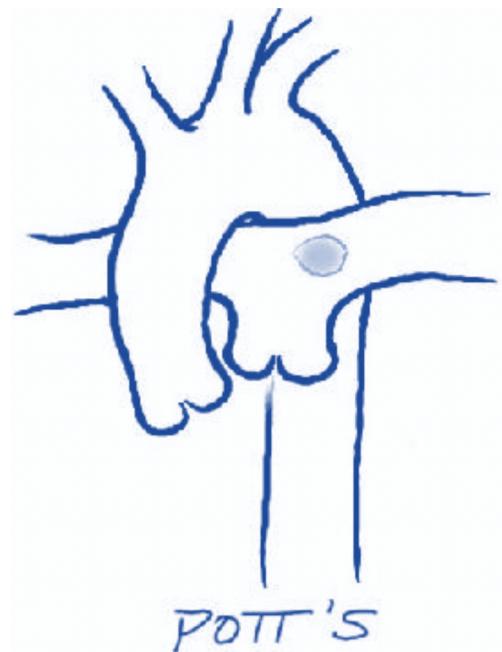
Duct stenting versus modified Blalock–Taussig shunt in neonates and infants with duct-dependent pulmonary blood flow: A systematic review and meta-analysis

Ali Alsagheir, MBBS, MSc,^{a,b} Alex Koziarz, MSc,^c Ahmad Makhdoum, MBBS, MSc,^d
Juan Contreras, MD,^e Hatim Alraddadi, MBBS,^a Tasnim Abdalla, BHSc,^c Lee Benson, MD,^f
Rajiv R. Chaturvedi, MD, PhD,^f and Osami Honjo, MD, PhD^e



Potts

Aorte descendante – APG
1946



Waterston

Aorte ascendante – APD
1964



Moins bons résultats de ces shunt centraux : distorsion des AP,
hyperdébit pulmonaire, mauvaise croissance TAP et AP contro-latérale,
calibrage difficile, ...



Reverse Potts shunt in severe pulmonary hypertension: A 20-year retrospective review

Wei Jiang, Zhongshi Wu, Can Huang, Ting Lu, Haoyong Yuan, Yuhong Liu, Tao Qian^{*}

Department of Cardiovascular Surgery, The Second Xiangya Hospital of Central South University, Changsha, Hunan, China

ARTICLE INFO

Keywords:

Pulmonary arterial hypertension
Reverse Potts shunt
Surgical treatment

ABSTRACT

Pulmonary arterial hypertension (PAH) is a multifactorial heterogeneous condition characterized by elevated pulmonary artery pressure, leading to increased right ventricular afterload and ultimately resulting in right heart failure. Despite major advances in the management of pediatric PAH in recent years with the development of PAH-specific drug therapy and therapeutic strategies, prognosis still remains unsatisfactory for many children. The Potts shunt, as a palliation in patients with cyanotic congenital heart defects first, receives its 'second life' in treating PAH by creating a shunt between the pulmonary artery and the descending aorta to alleviate right heart burden. Over the past 20 years, accumulated clinical experience have revealed that reverse Potts shunt (RPS) can effectively improve cardiac function and survival time in PAH patients, with midterm survival rates comparable to those of lung transplantation. However, RPS is confronted with some issues that limit its development and application in clinical practice, such as identifying the suitable patient population, determining the optimal timing of intervention, and selecting the appropriate shunt type and size. This review aims to retrospectively summarize the experience of RPS in the treatment of PAH, discuss the main challenges faced in its clinical application, and help to guide clinical practice.

Quand ?

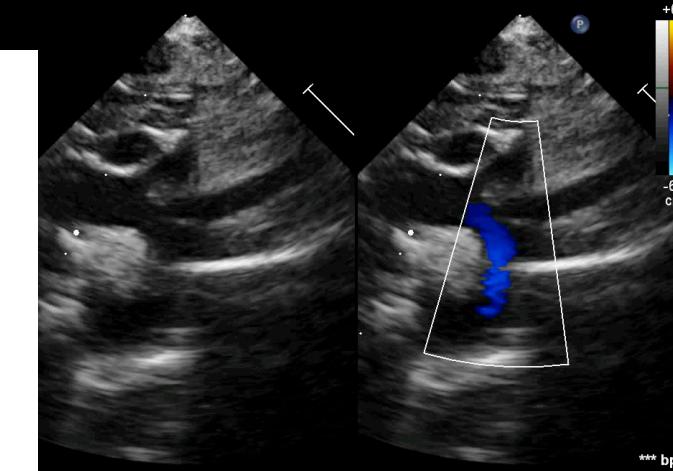
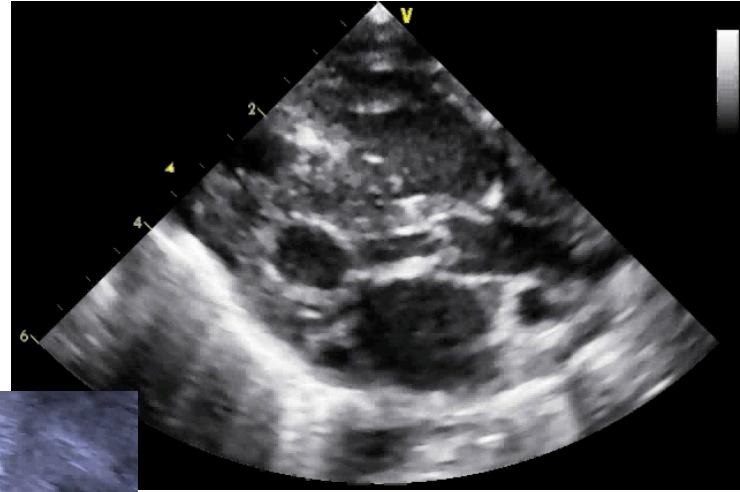
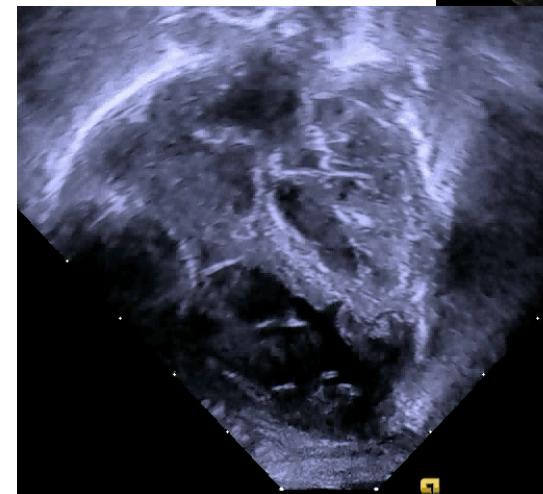
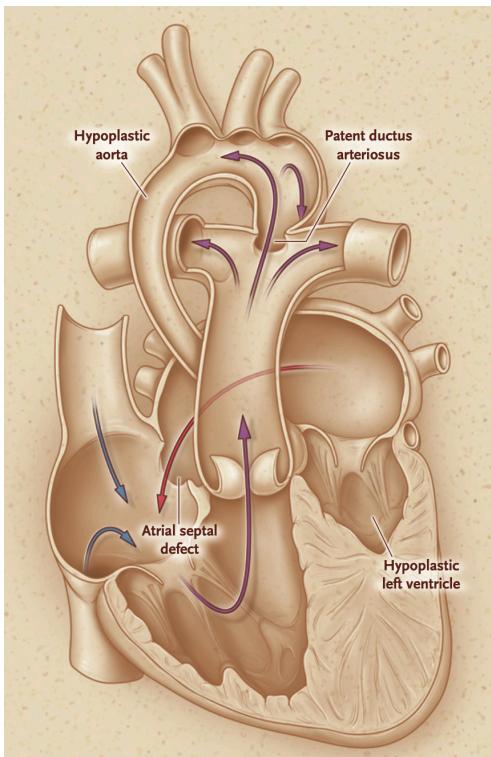


Ductodépendance
pour la perfusion
pulmonaire

Ductodépendance
pour la perfusion
systémique

Ductodépendance systémique

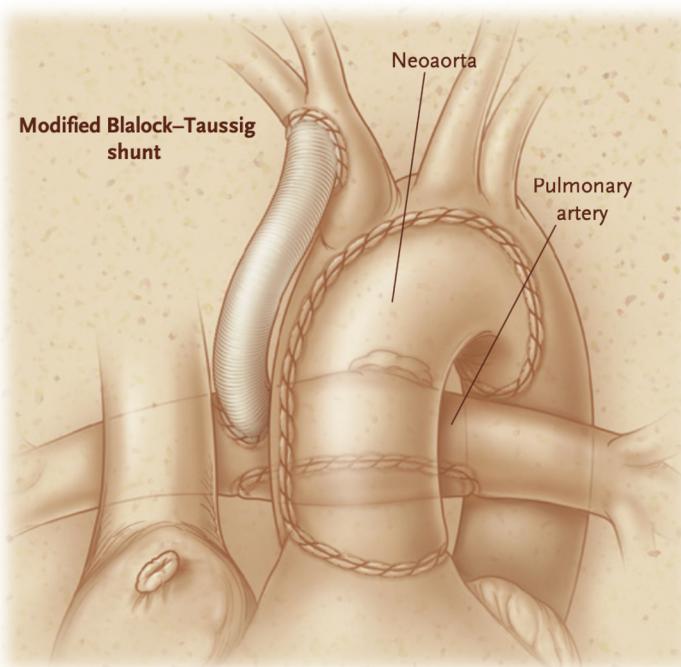
- Spectre large des **HLHS** (hypoplasie du cœur gauche)
- **Prise en charge initiale :** Prostine
→ Maintenir CA ouvert pour la perfusion systémique
- **Prise en charge + durable :**
 - Norwood Classique
 - Norwood-Sano
 - Hybride



Syndrome d'hypoplasie du cœur gauche

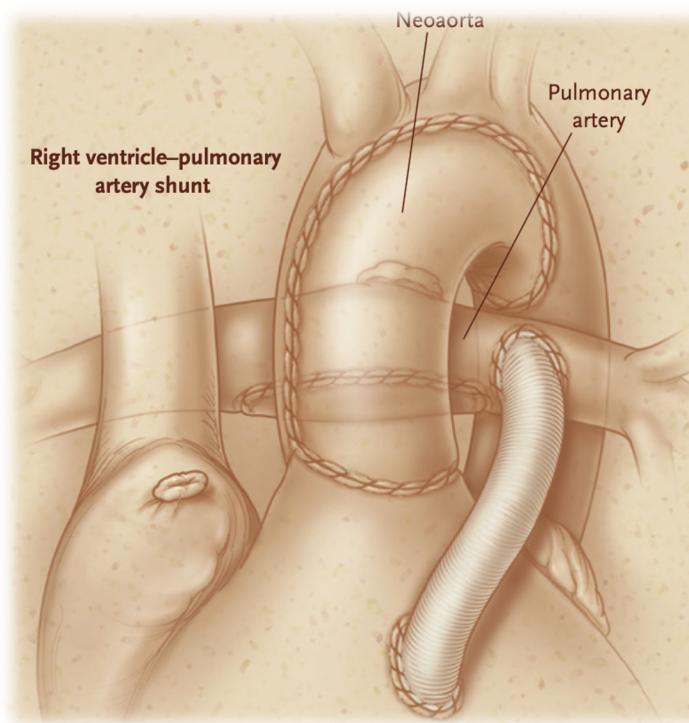
- **Norwood Classique :**

- Reconstruction aortique : Damus-Kaye-Stansel
- mBTTS pour perfusion pulmonaire



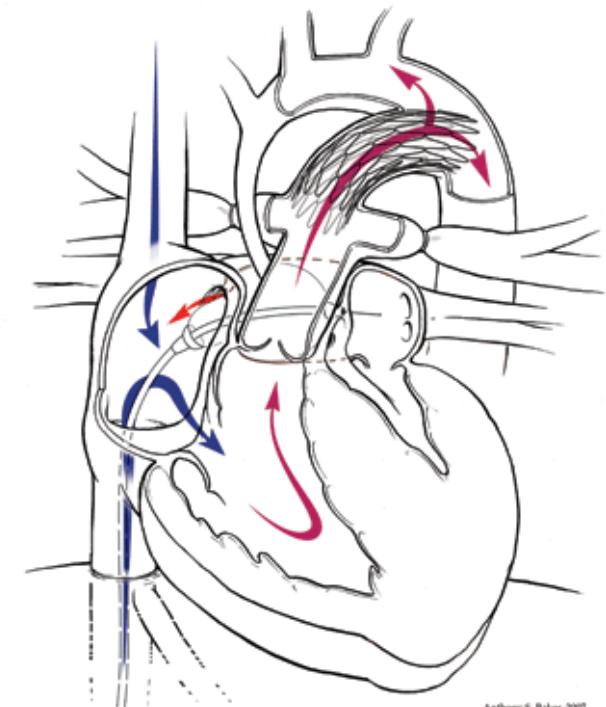
- **Norwood-Sano**

- Reconstruction aortique
- Sano pour perfusion pulmonaire



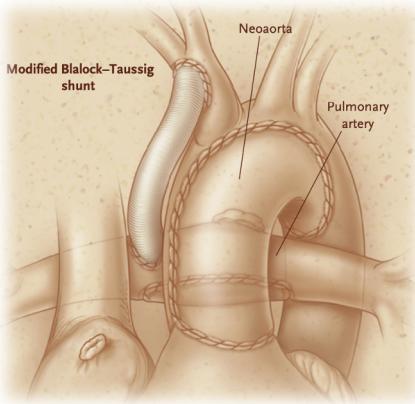
- **Hybride**

- Stenting CA
- Cerclage des AP



Syndrome d'hypoplasie du cœur gauche

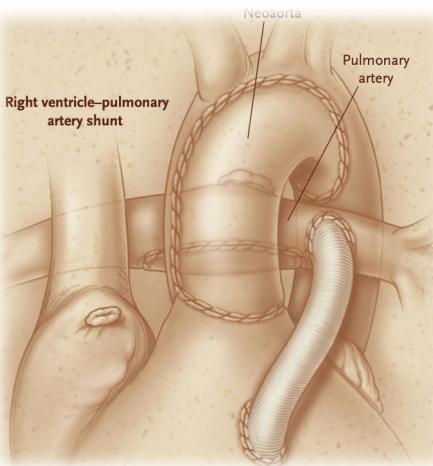
Norwood Classique :



Flux continue systolo-diastolique

→ Vol coronaire

Norwood-Sano :



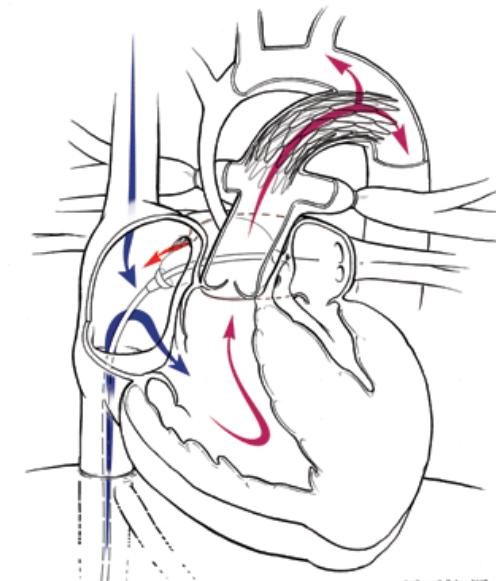
Ciatrice de ventriculotomie :

- Arythmie
- Altération FEVU

Fuite pulmonaire :

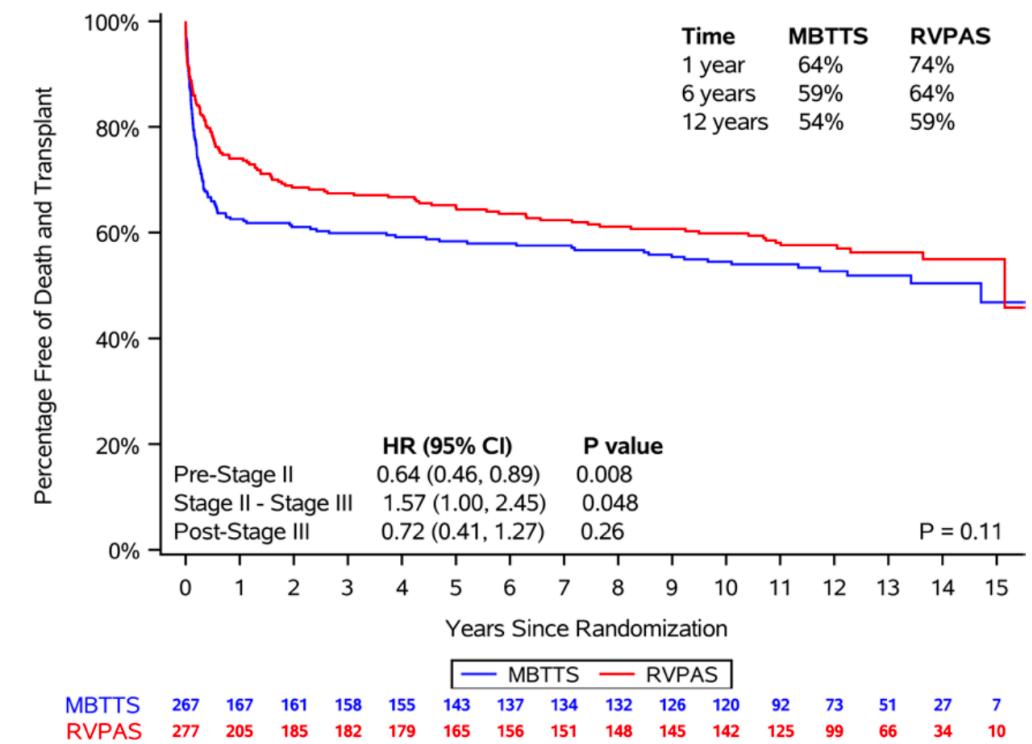
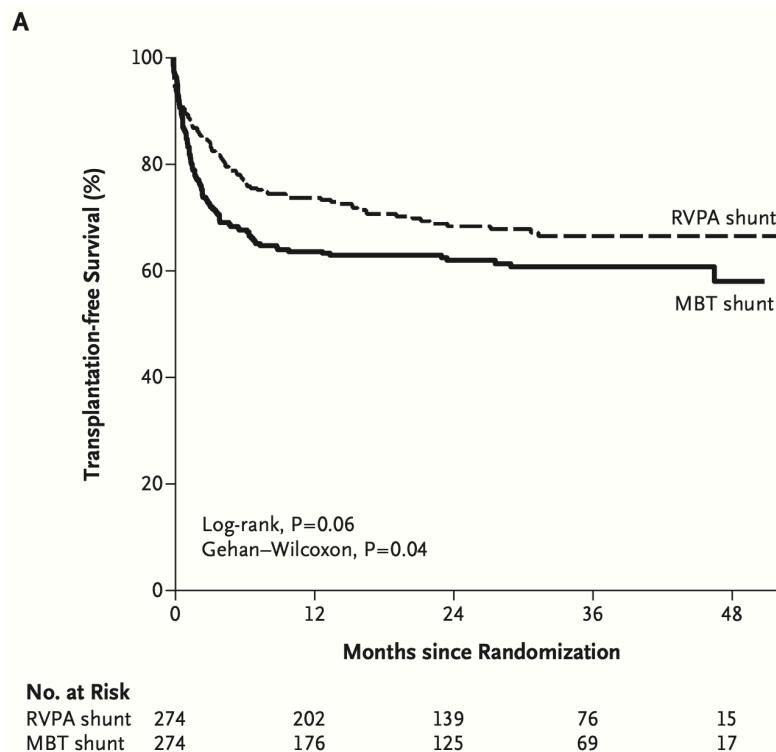
- Surcharge diastolique
- Défaut croissance AP

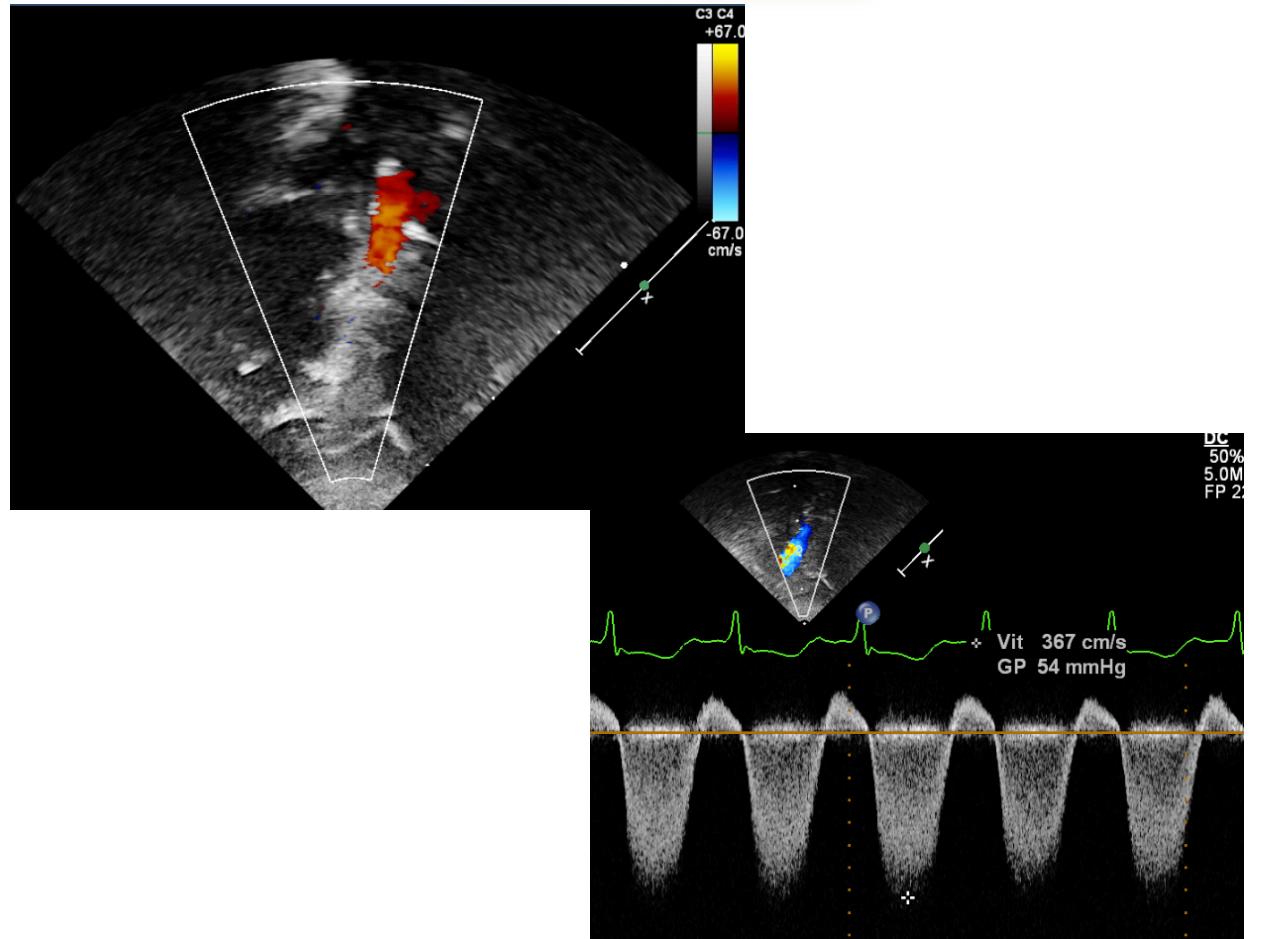
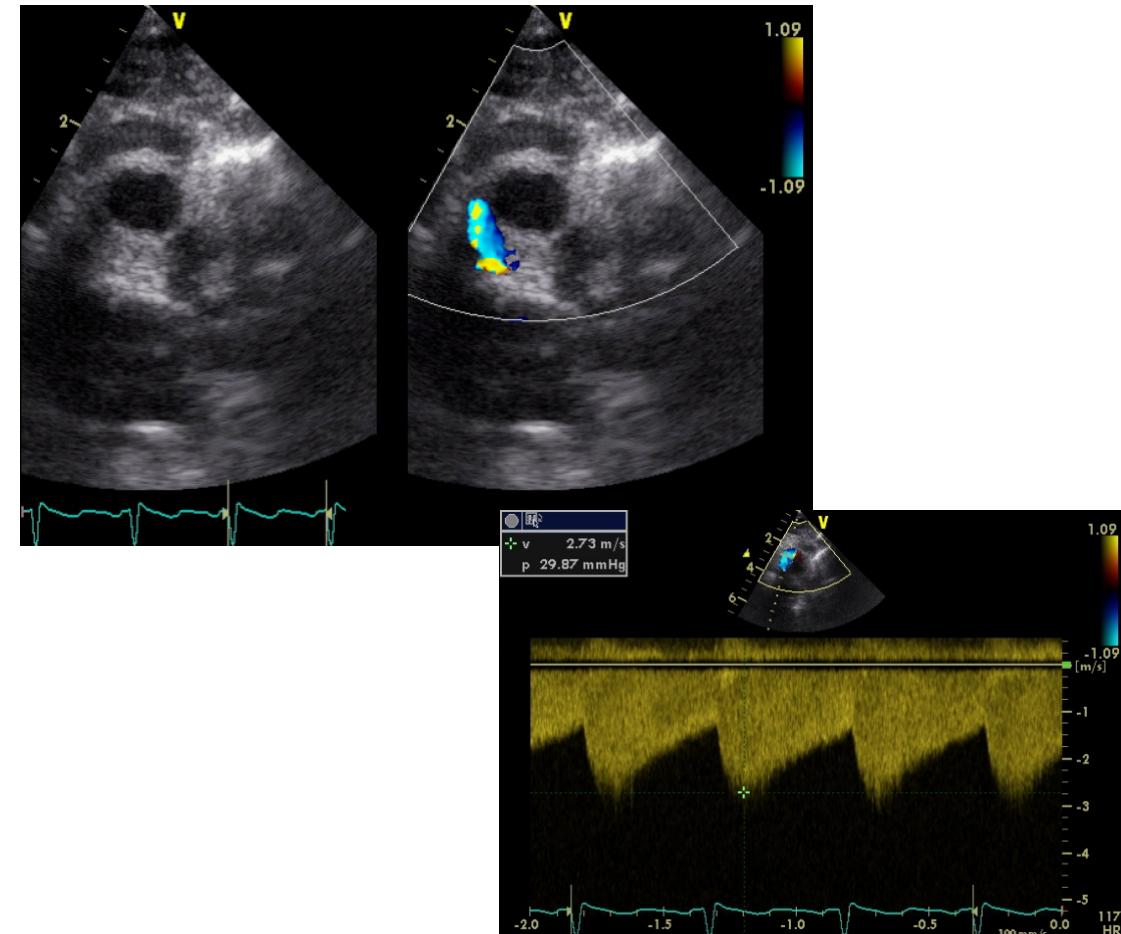
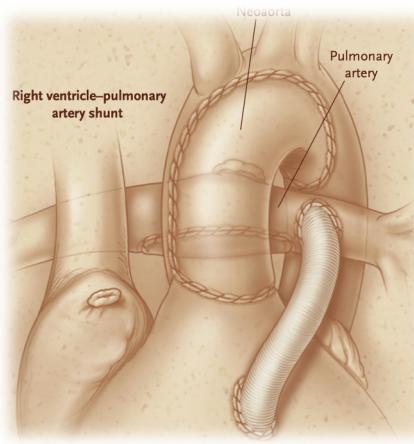
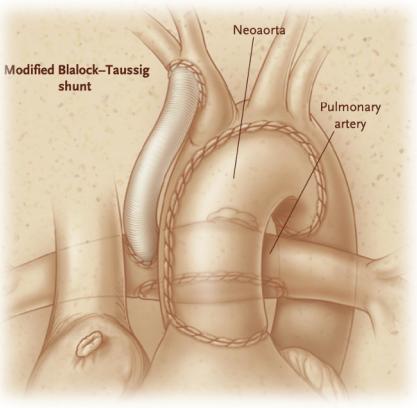
Hybride :



ORIGINAL ARTICLE

Comparison of Shunt Types in the Norwood Procedure for Single-Ventricle Lesions

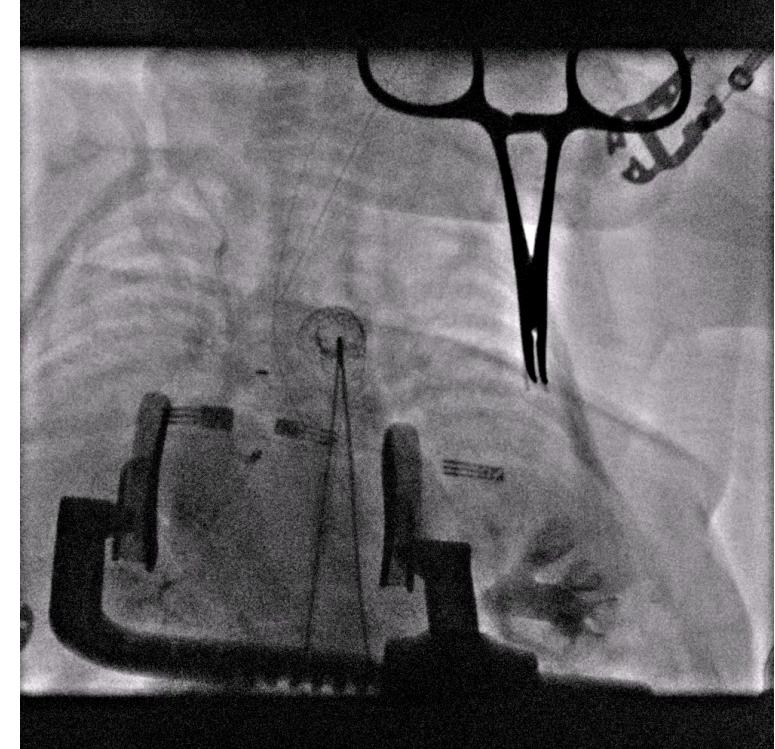
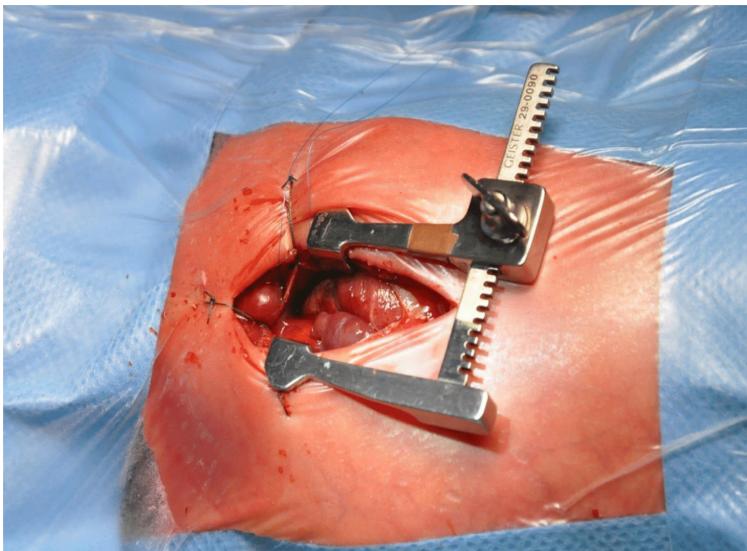
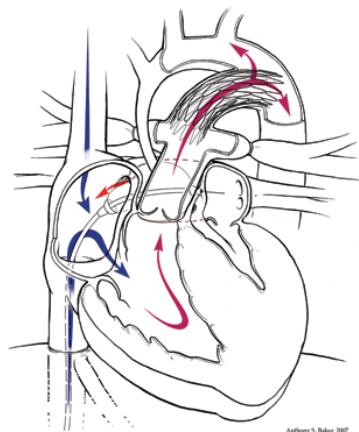




HLHS – Hybride

- Stenting CA
 - Cerclage des AP

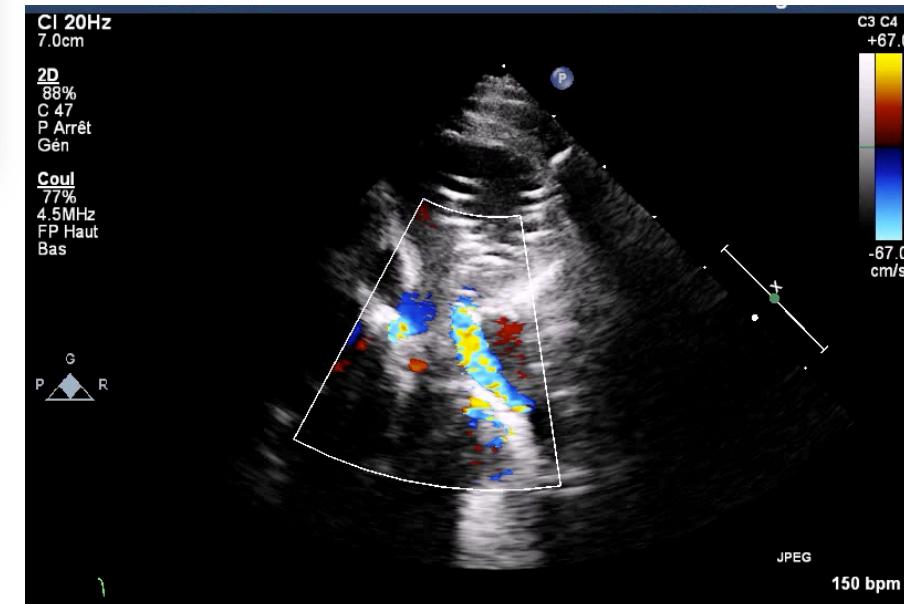
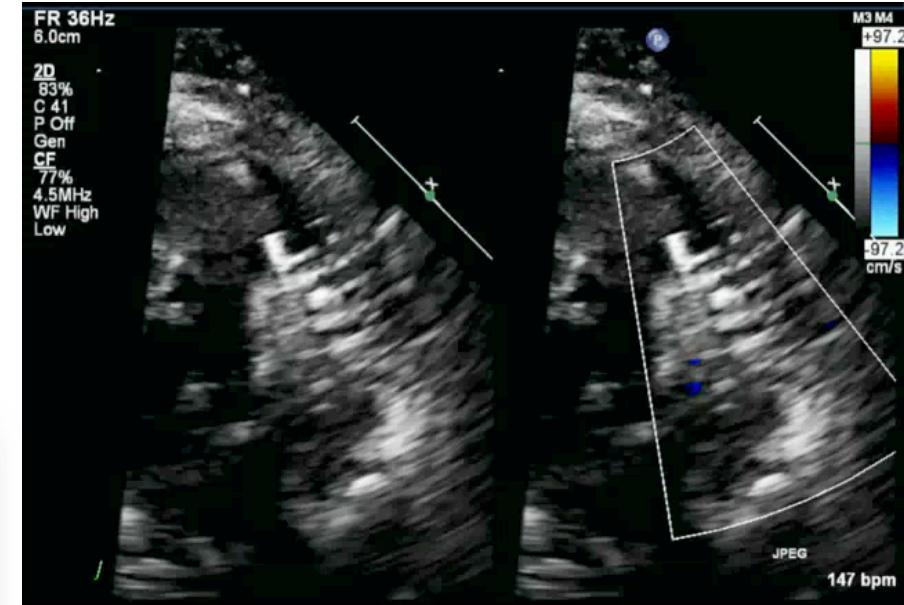
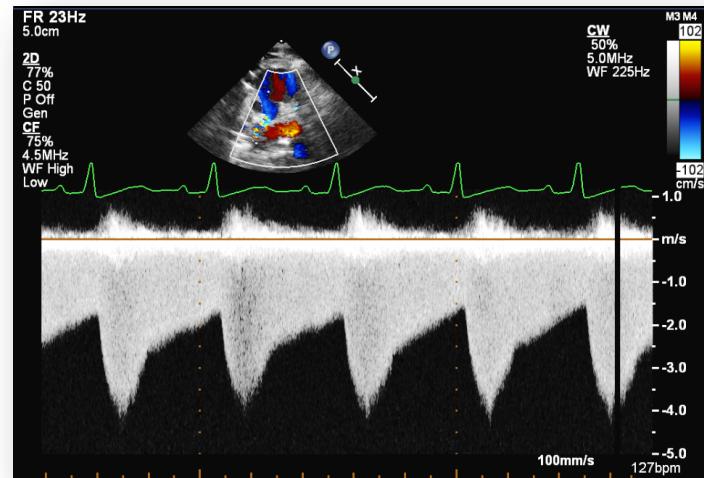
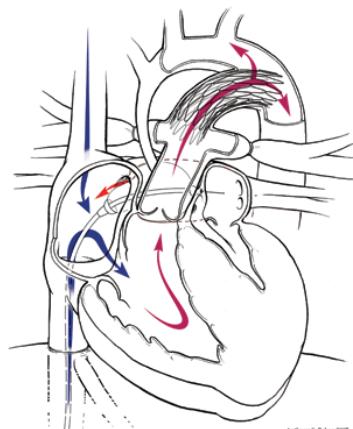
→ Reconstruction aortique avec CEC
= décallée à l'étape 2



HLHS – Hybride

- Stenting CA
- Cerclage des AP

→ Reconstruction aortique avec CEC
= décallée à l'étape 2



Et après ?



**Réparation
biventriculaire**



**Programme
univentriculaire**

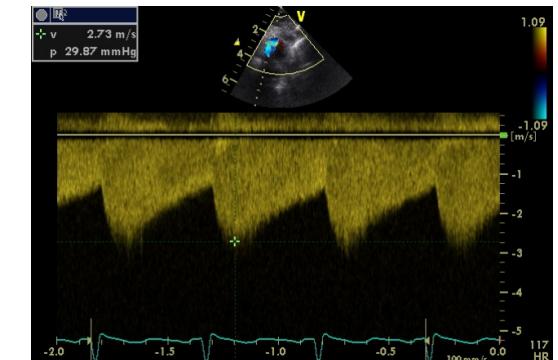
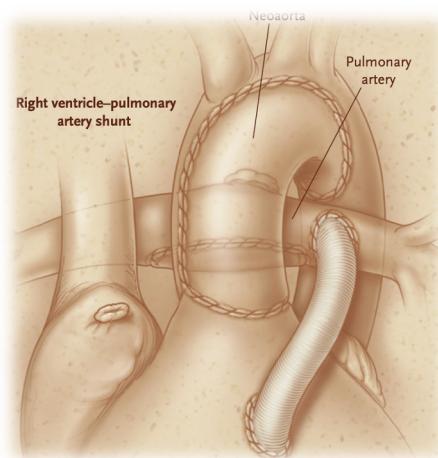
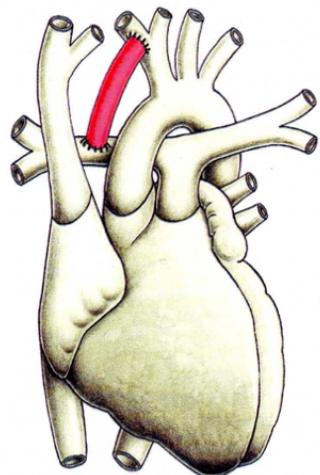
DCPP

DCPT

Conclusion

- **Ductodépendance pulmonaire :**
 - Prostine
 - Blalock vs Stenting du CA
- **Ductodépendance systémique :**
 - HLHS
 - Norwood (Sano ou Blalock) ou hybride
- **Equilibre du Qp/Qs !**

Création de shunt



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