



Canal artériel-Corrélations anatomo-échographiques

Damien Bonnet

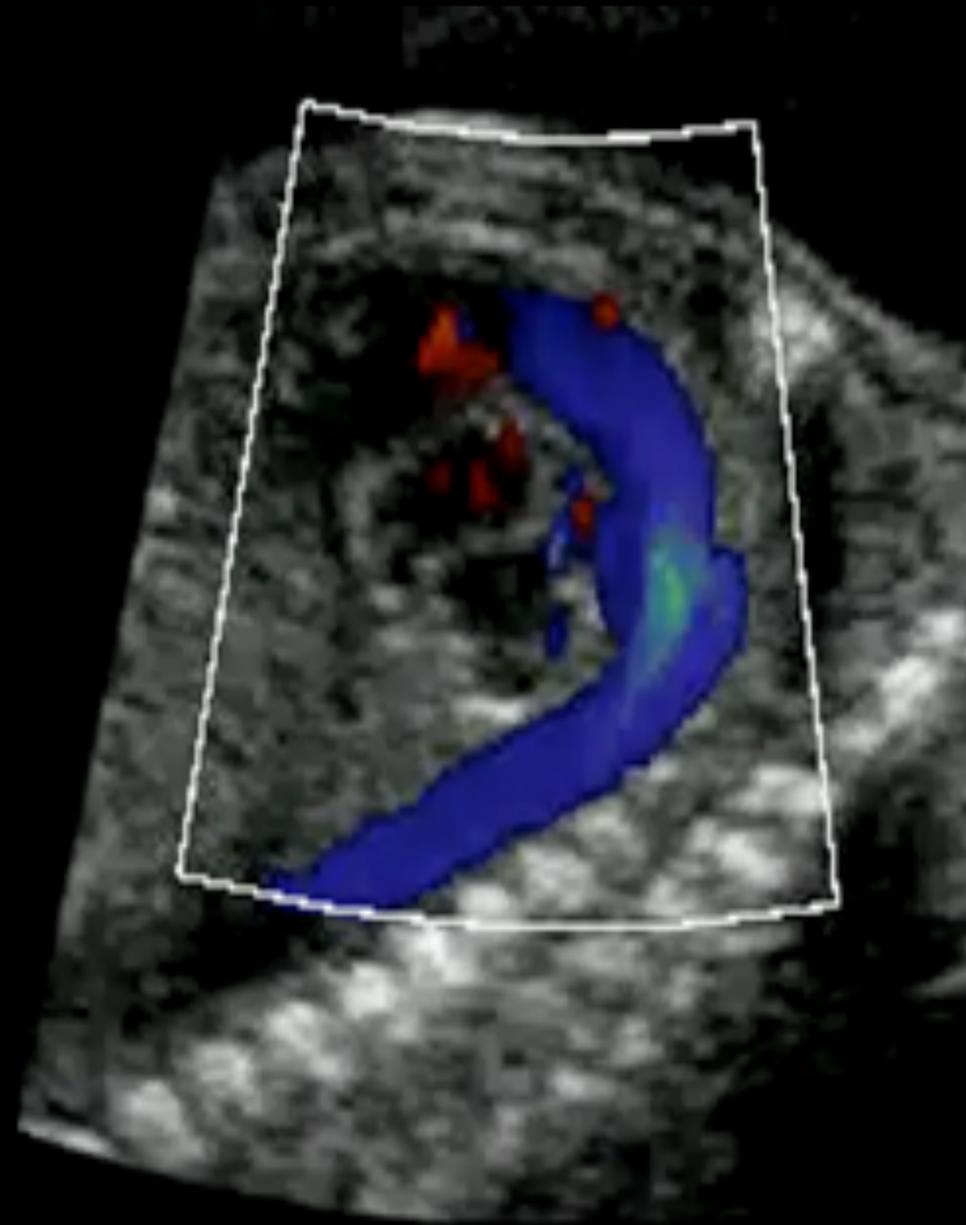
Unité médico-chirurgicale de Cardiologie Congénitale et Pédiatrique
Hôpital Universitaire Necker Enfants malades – APHP, Université Paris Descartes, Sorbonne Paris Cité
IcarP Cardiology, Institut Hospitalo-Universitaire IMAGINE

Centre de Référence Maladies Rares
Malformations Cardiaques Congénitales Complexes-M3C

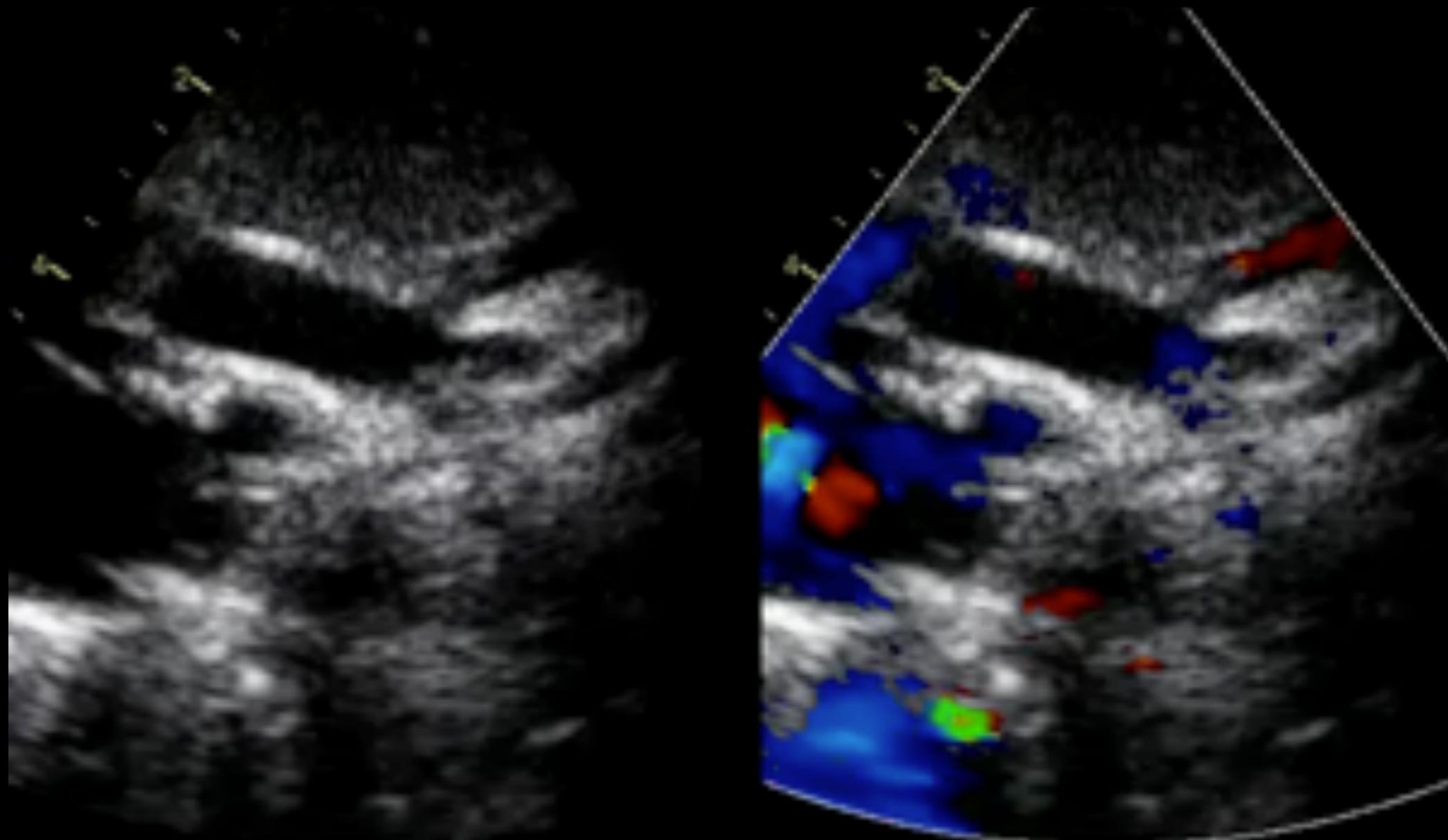
Centre de Référence Maladies Rares
Maladies Cardiaques Héritaires- CARDIOGEN



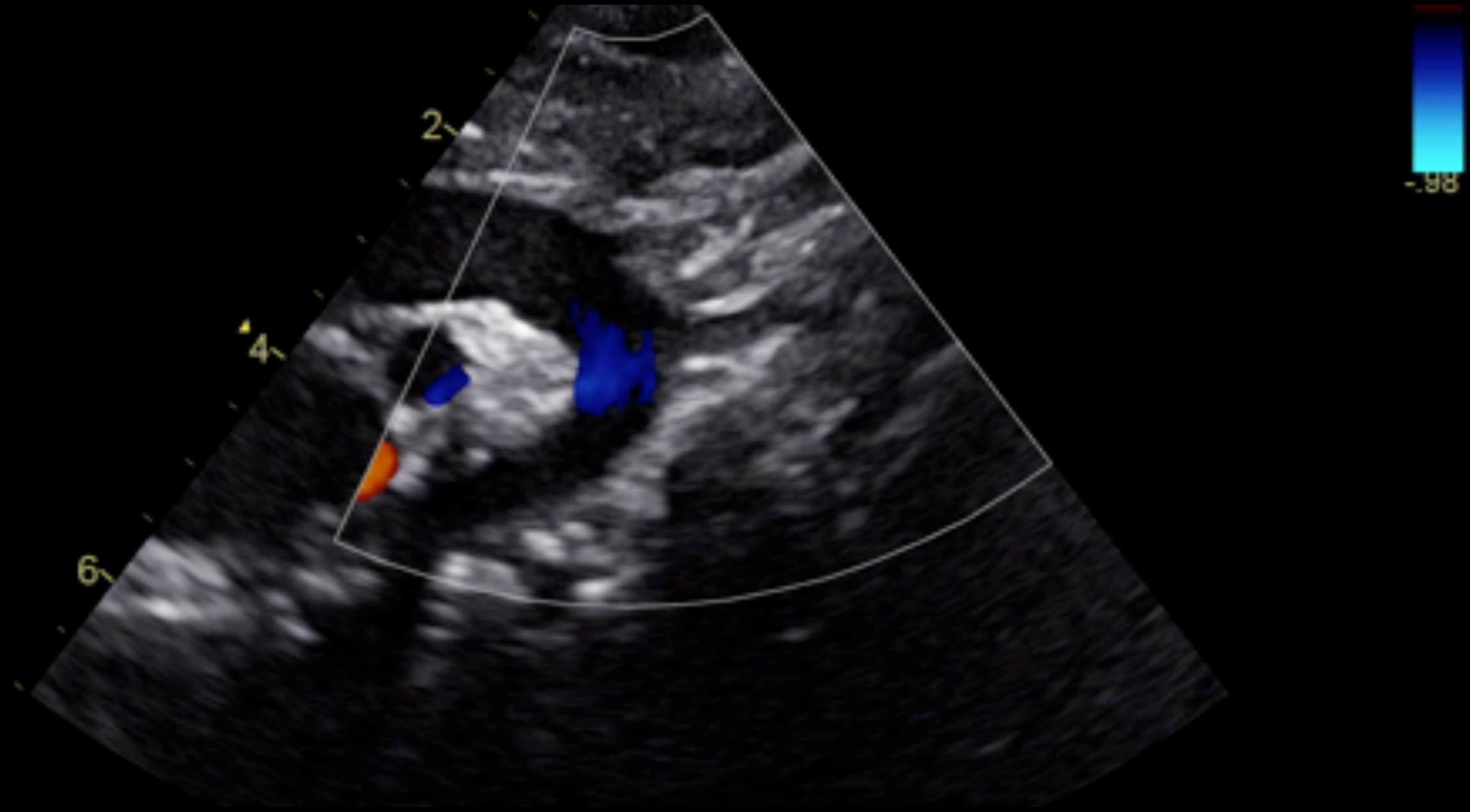
Le canal artériel foetal



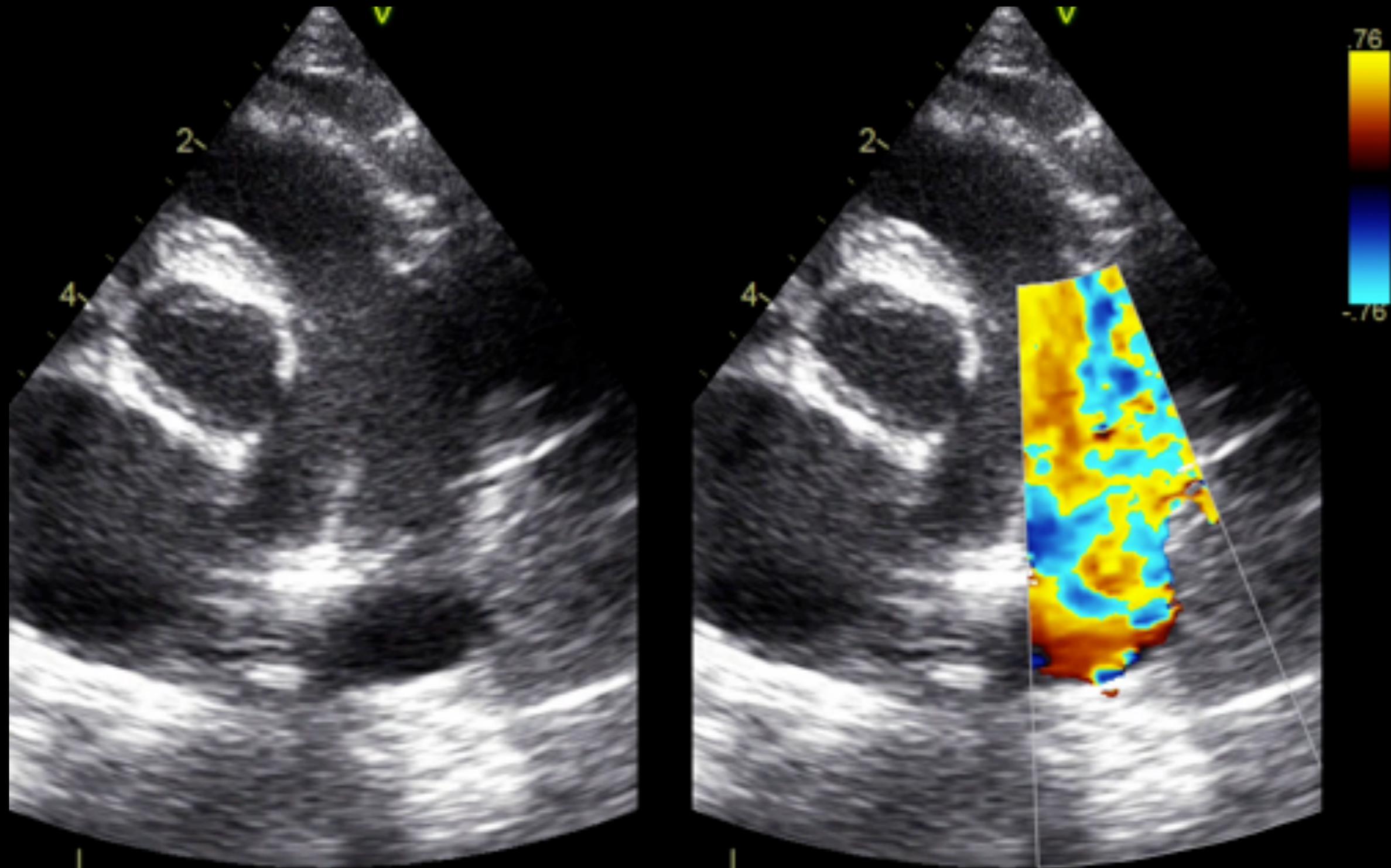
Canal artériel néonatal



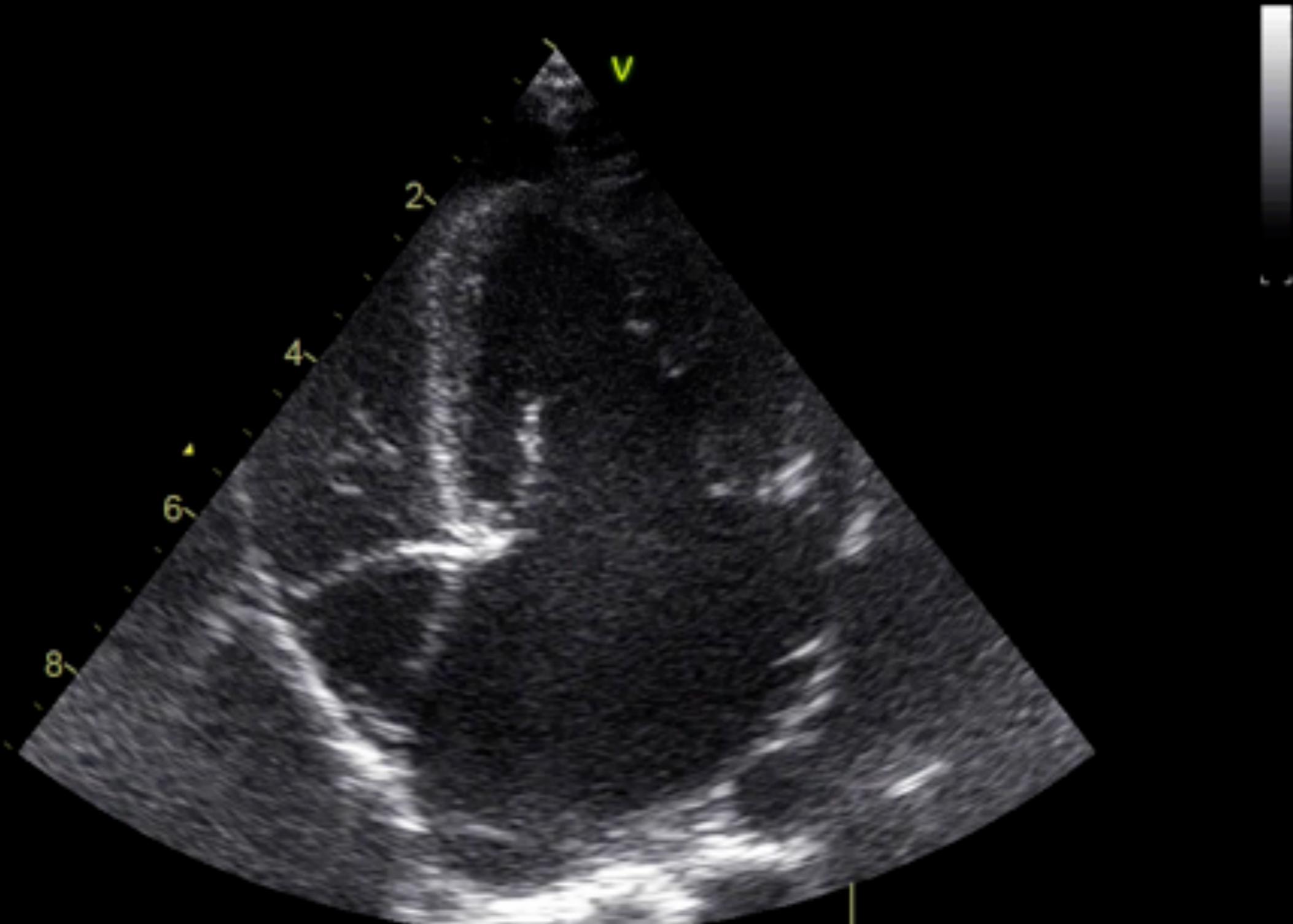
Canal artériel néonatal



Canal artériel néonatal



Canal artériel néonatal



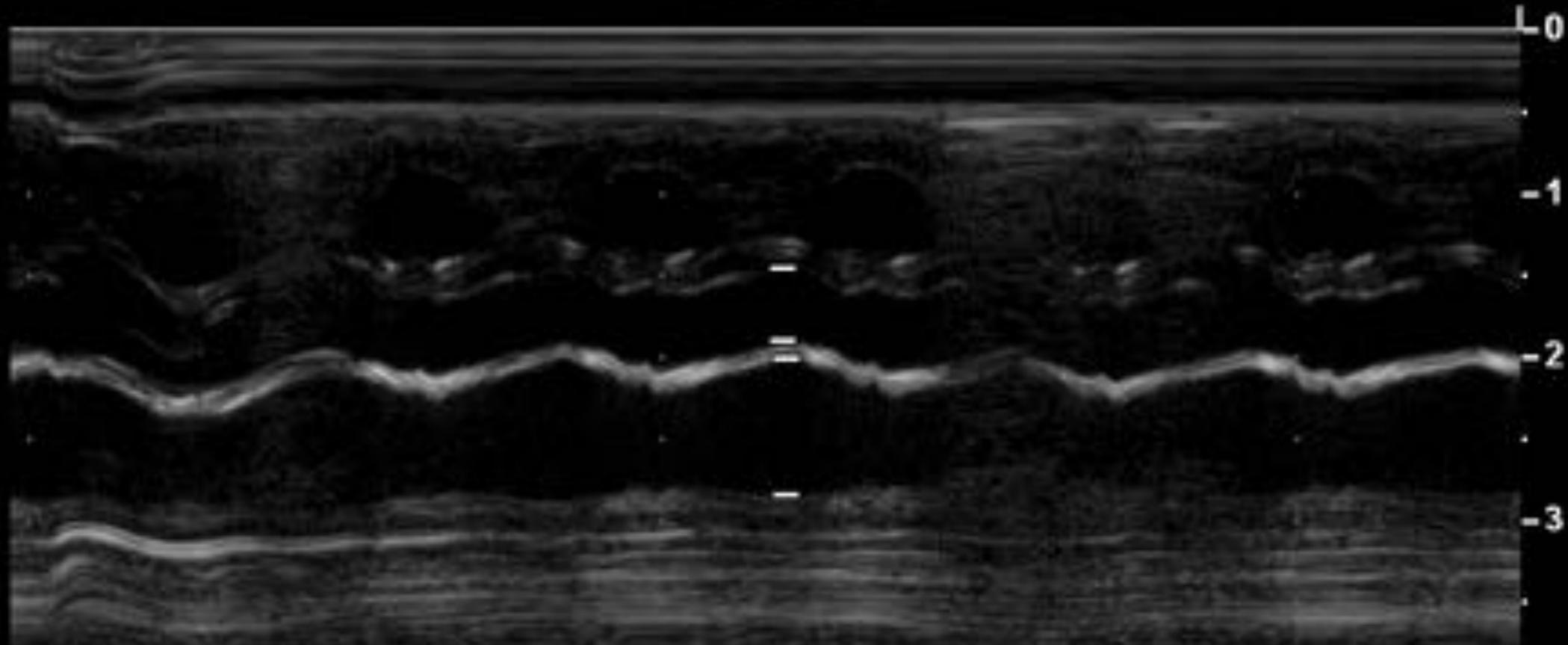
Canal artériel néonatal

S12-4
121Hz
4.0cm

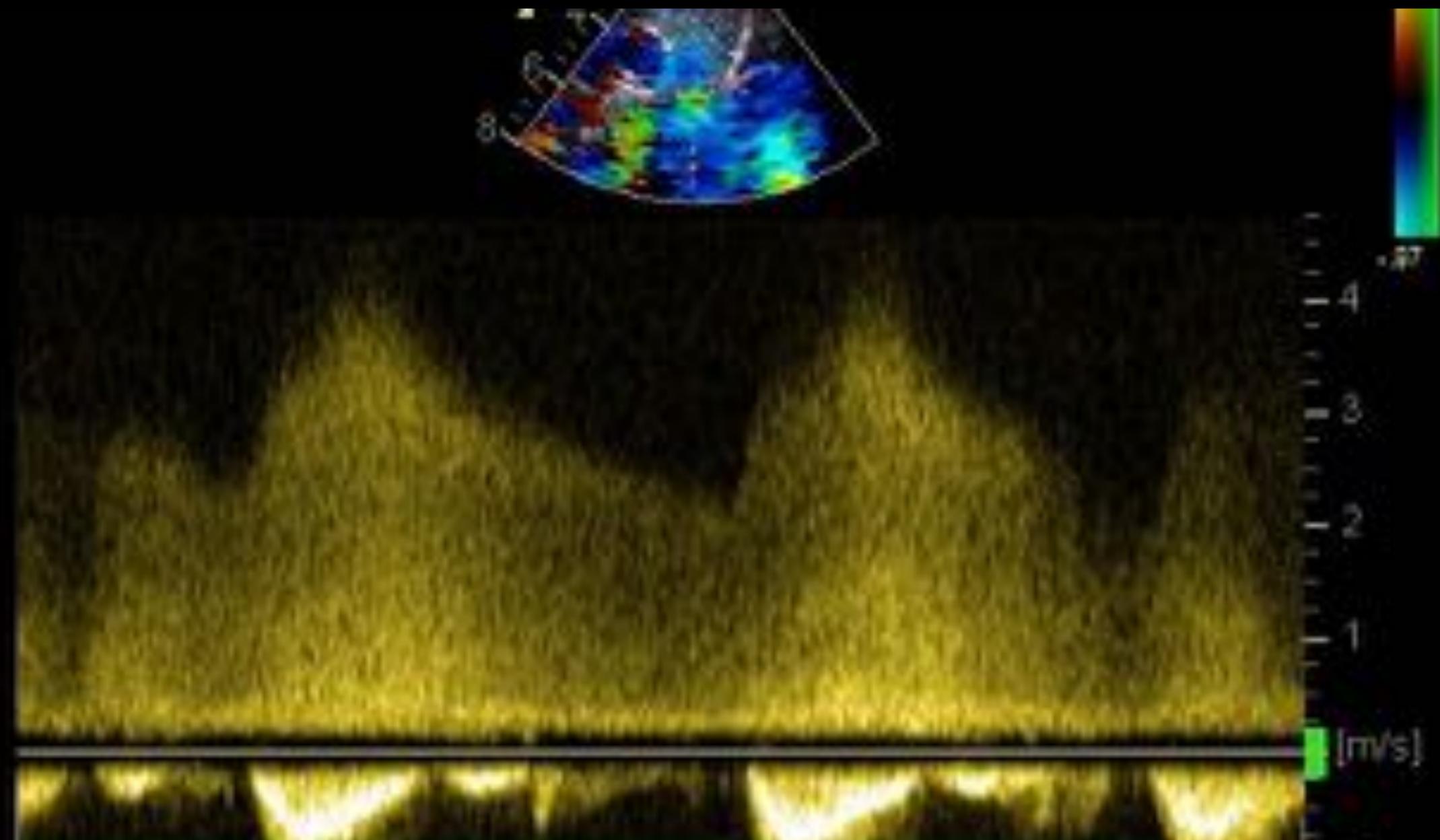
2D / TM
79% 79%
C 52
P Arrêt
Gén



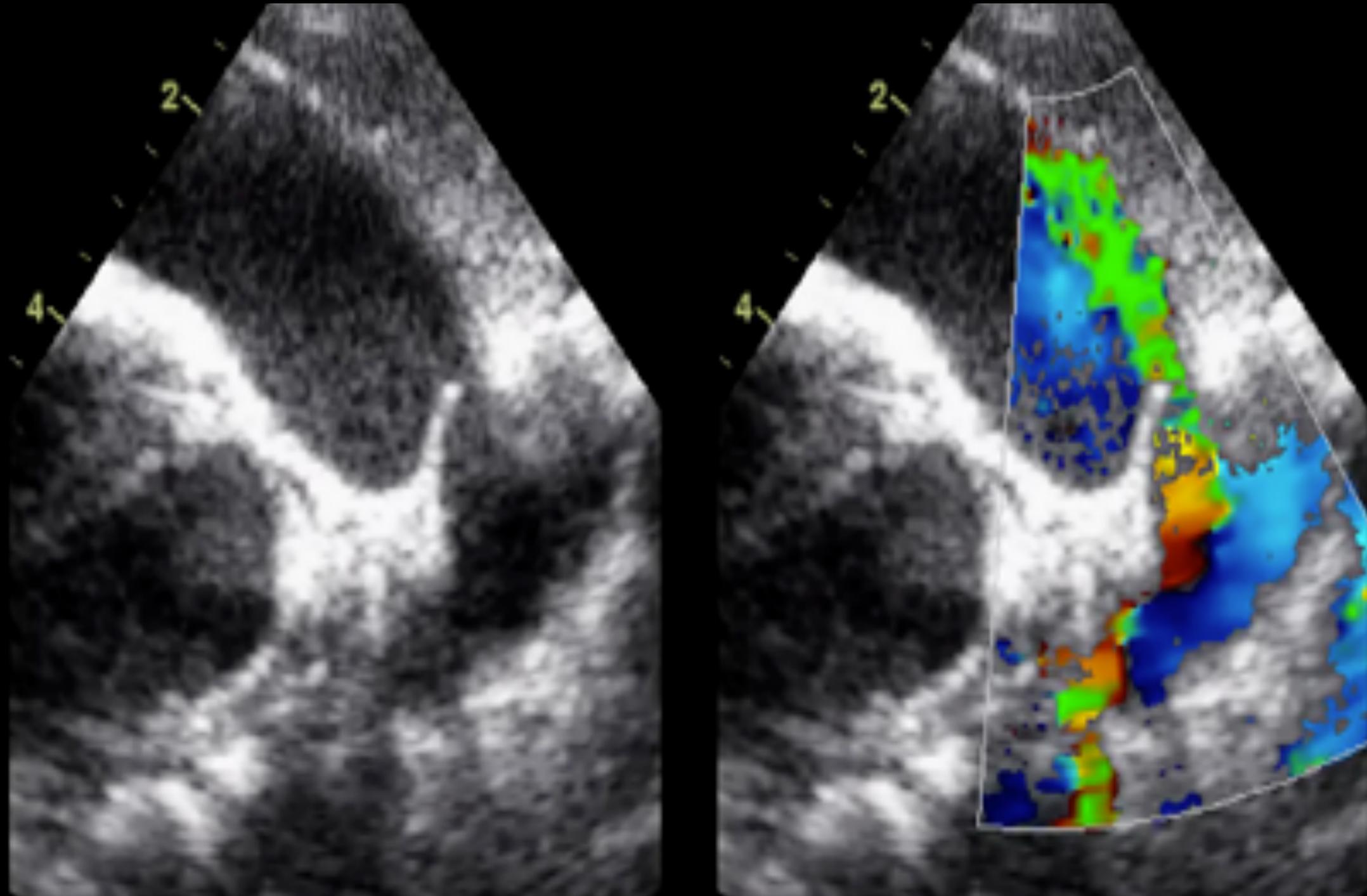
M4
- Dimens OG 0.8 cm
- Diam racine Ao 0.4 cm
OG/Ao (TM) 2.00



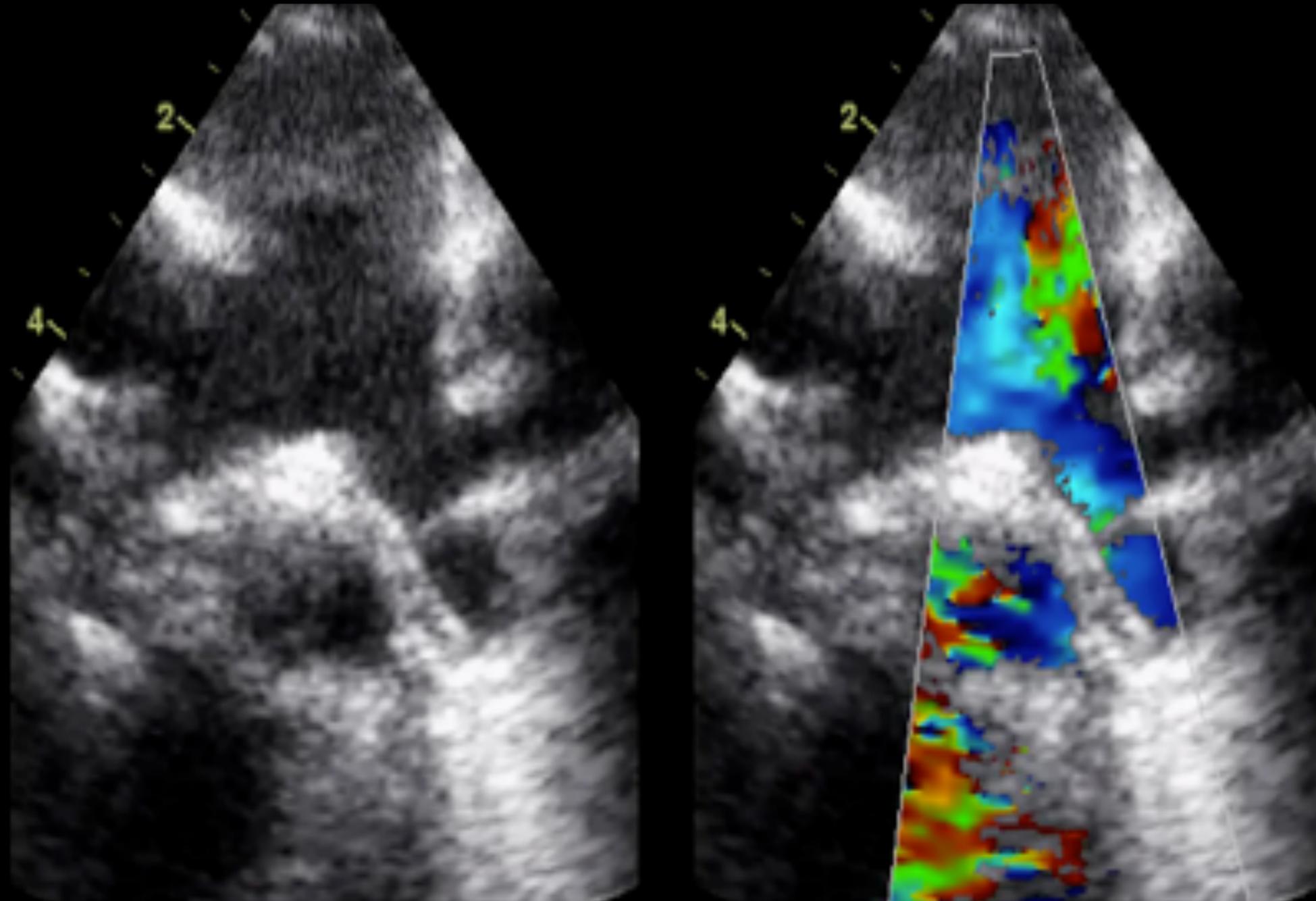
Canal artériel



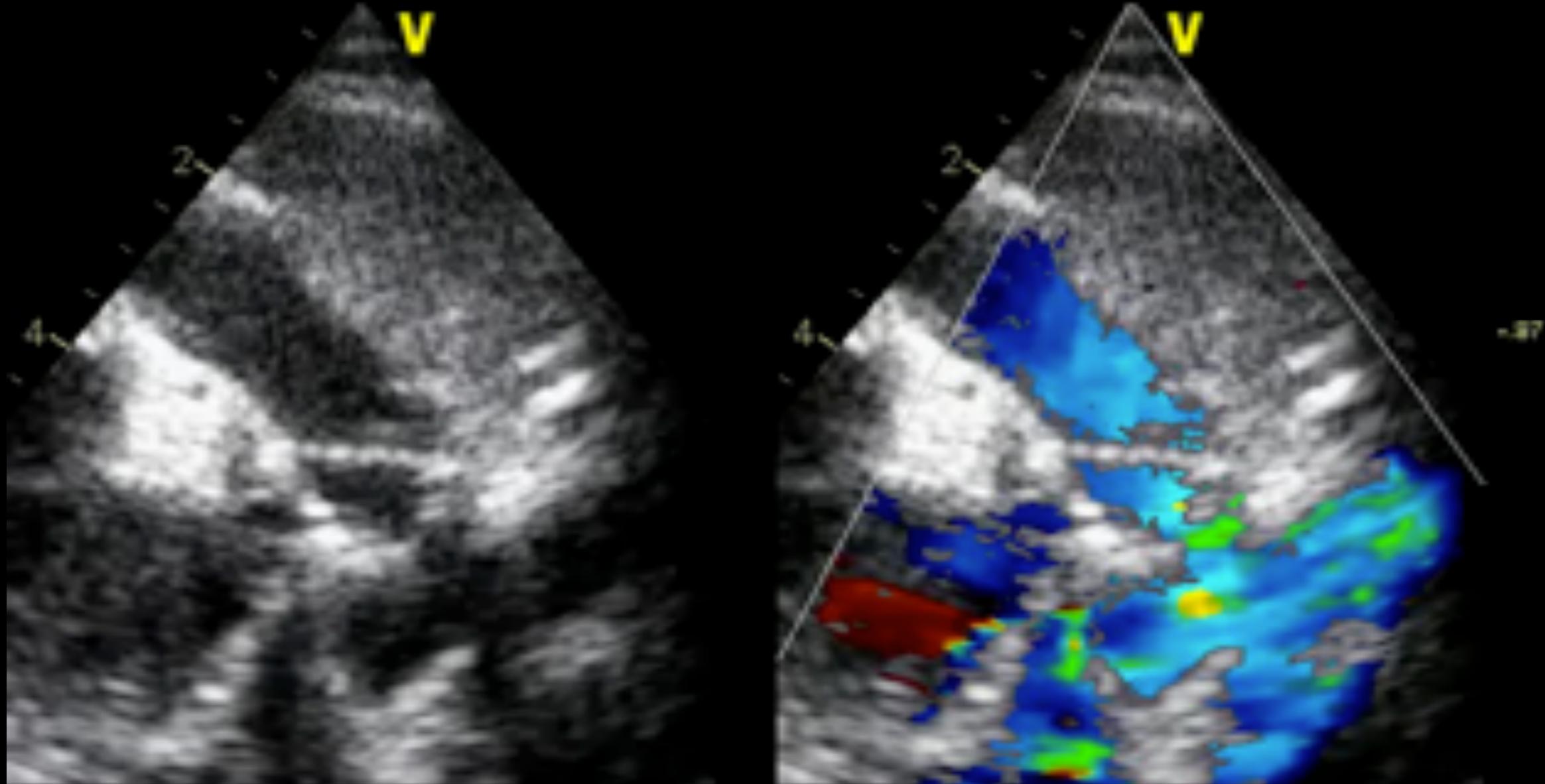
Canal artériel néonatal : évolution de la forme



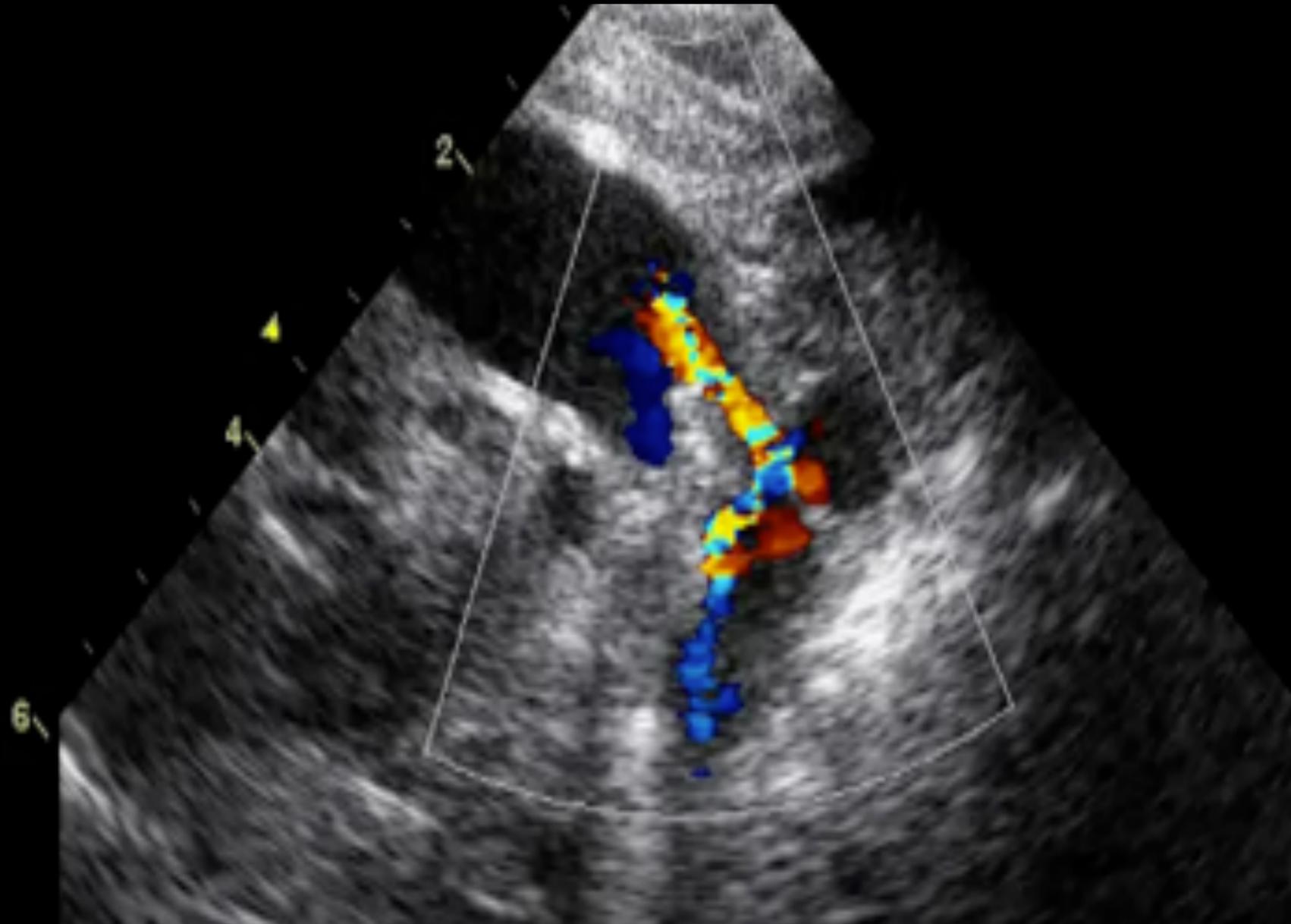
Canal artériel néonatal : évolution de la forme



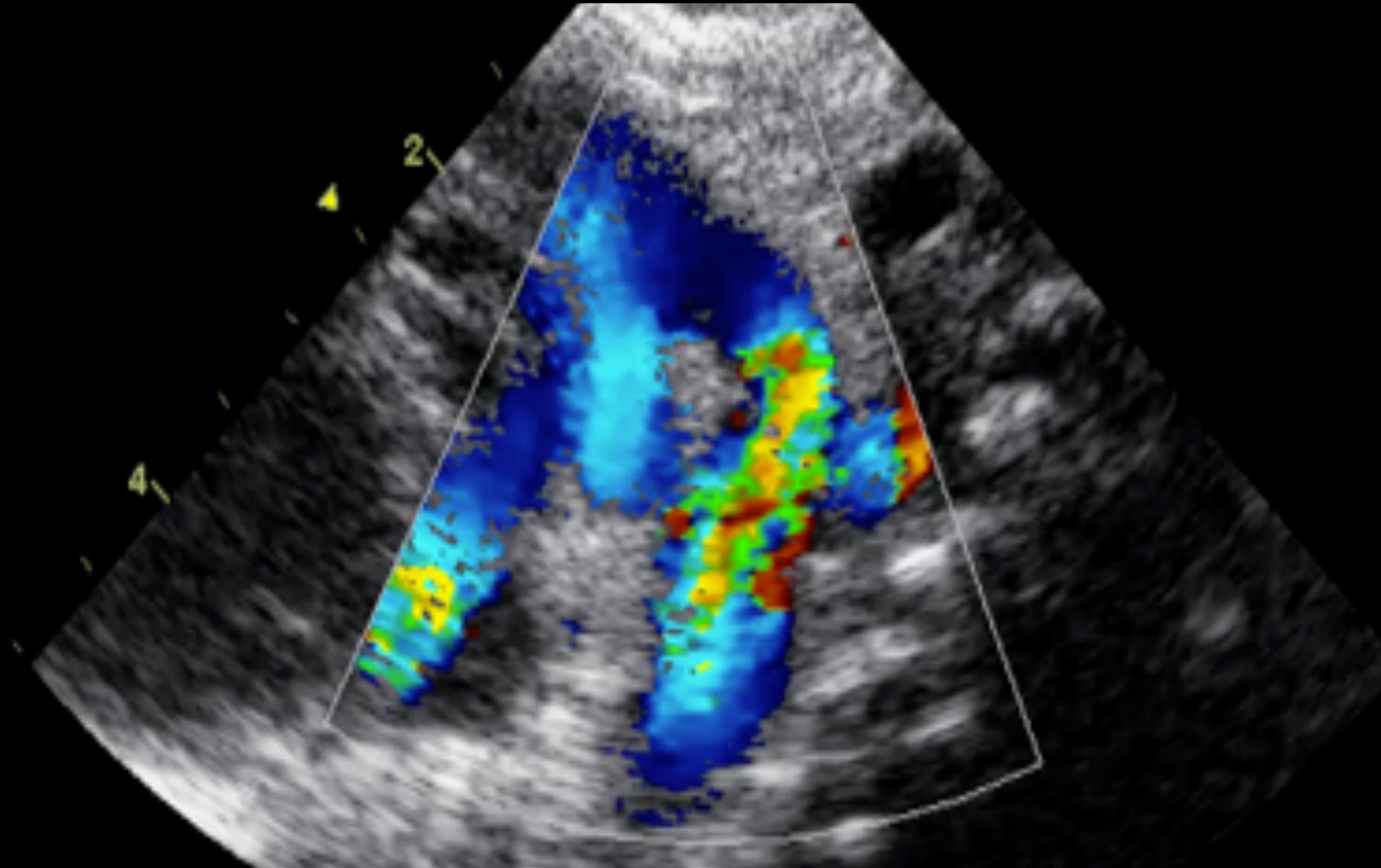
Canal artériel néonatal : évolution de la forme



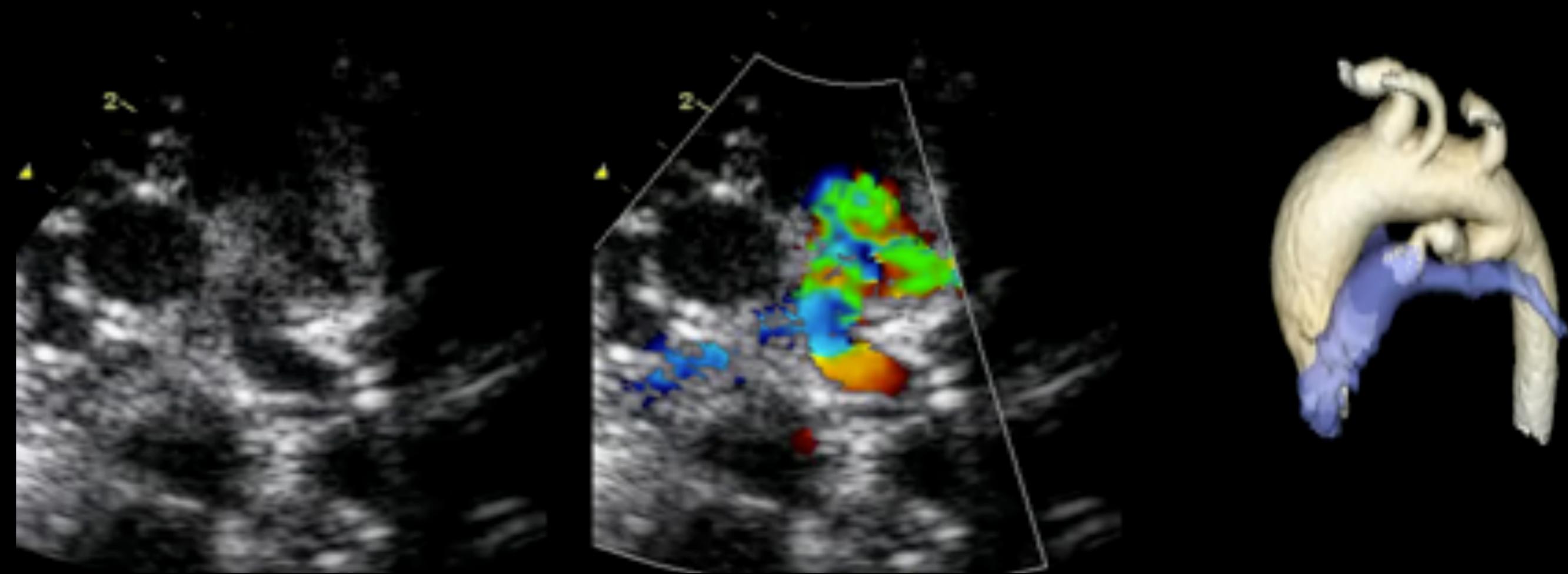
Canal artériel néonatal : évolution de la forme et coarctation



Canal artériel systémique

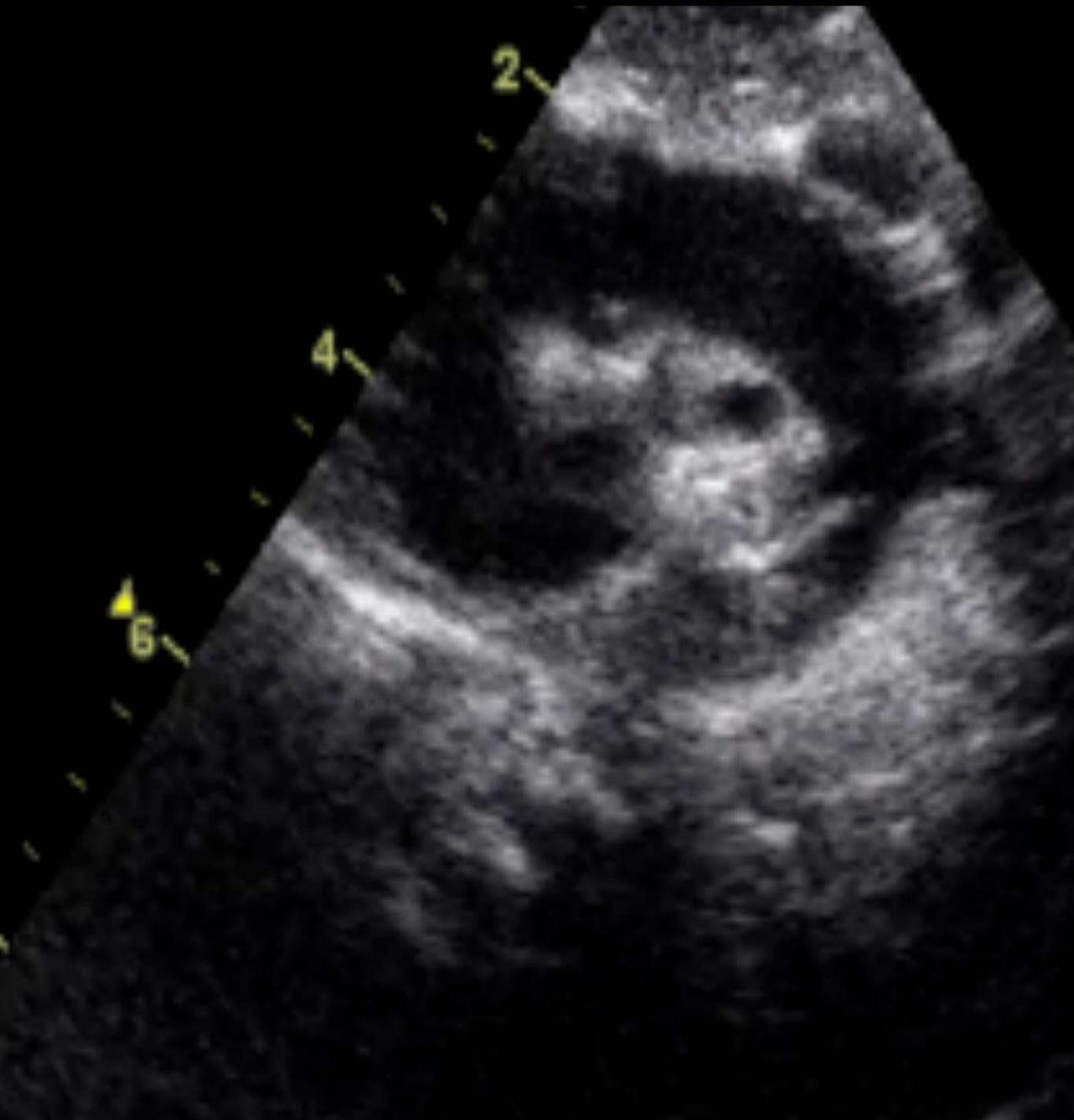


Canal artériel: anomalies de forme et d'origine



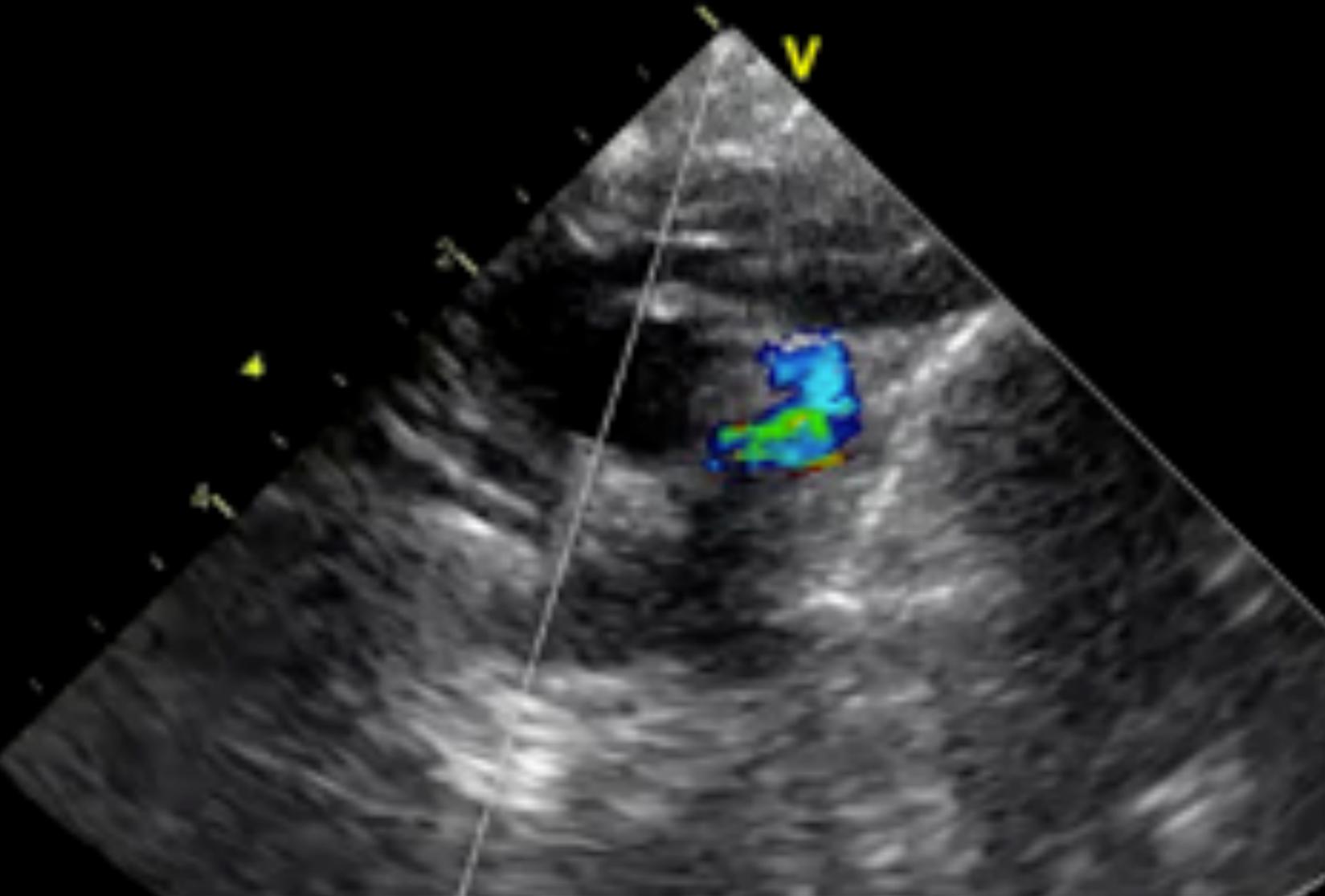
Pulmonary atresia VSD-Left aortic arch-PDA

Canal artériel: anomalies de forme et d'origine



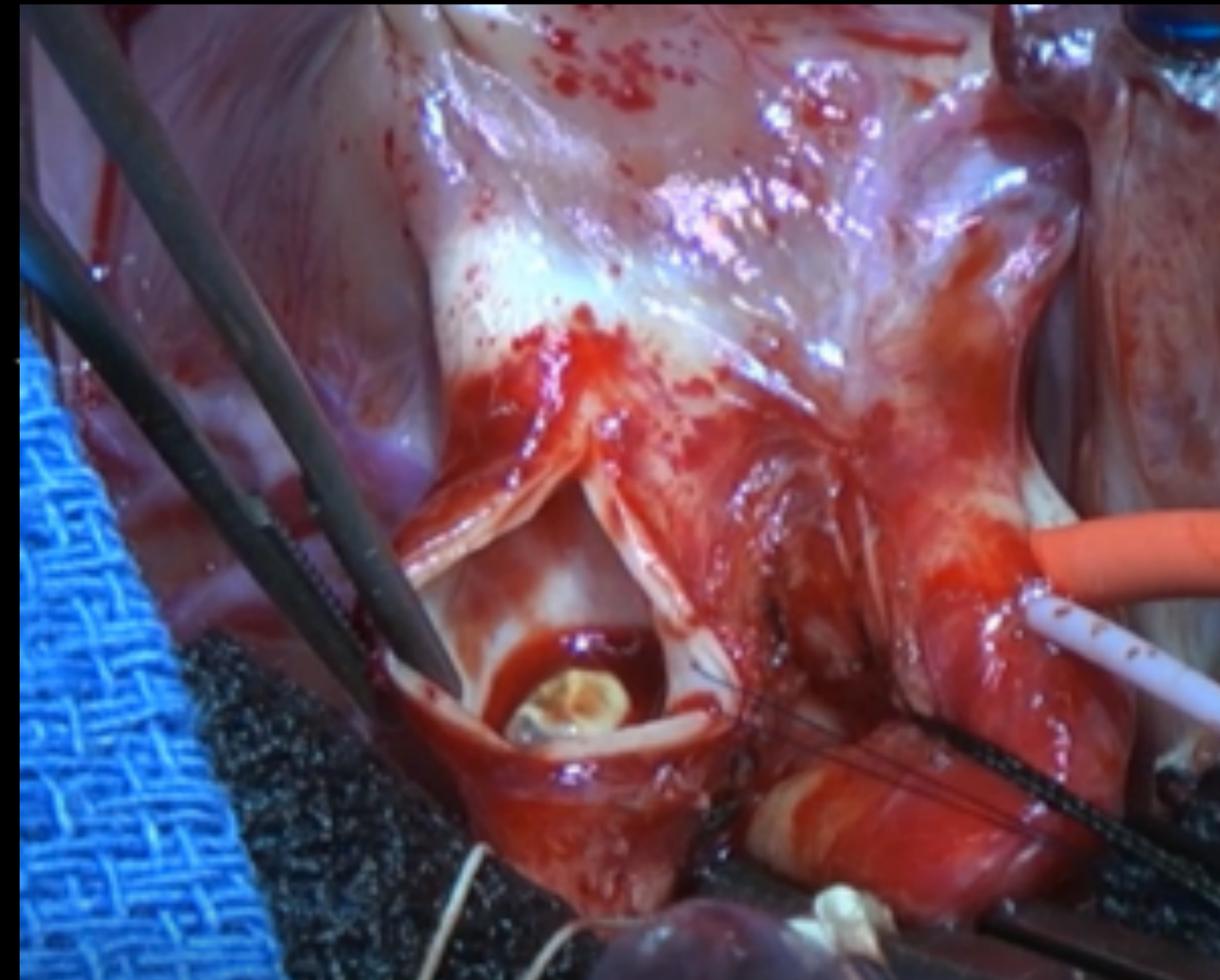
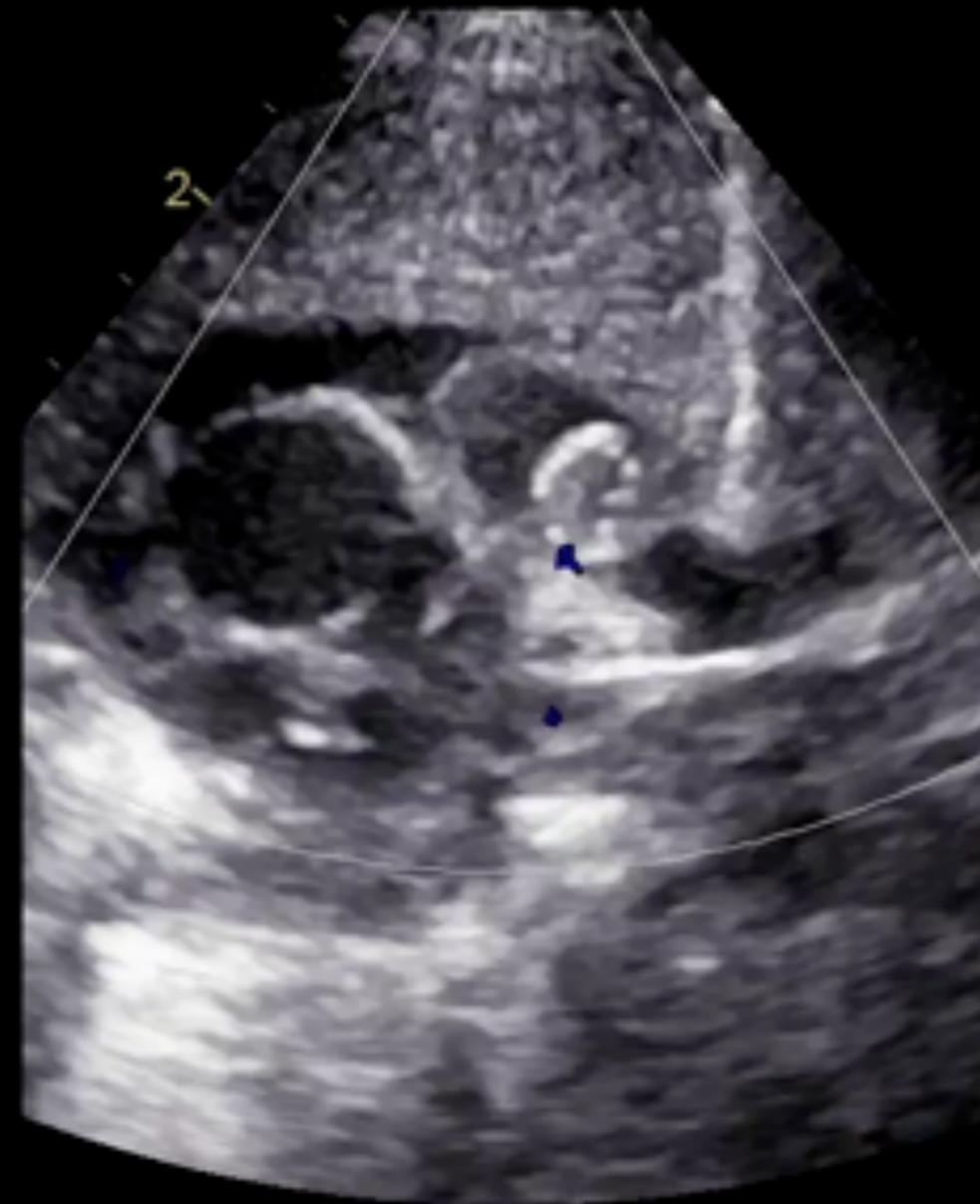
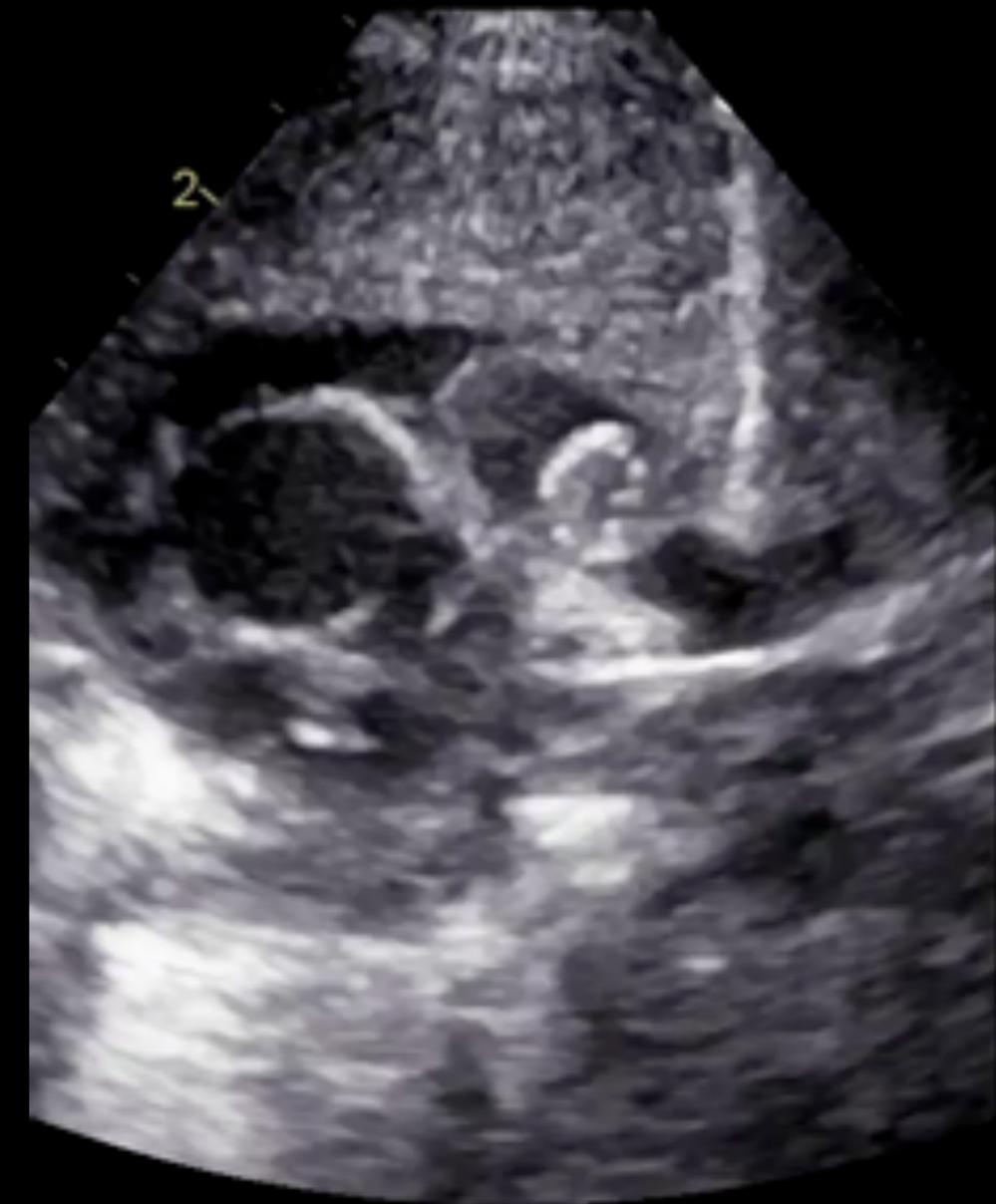
Pulmonary atresia VSD-Left aortic arch-PDA

Canal artériel: anomalies de forme et d'origine

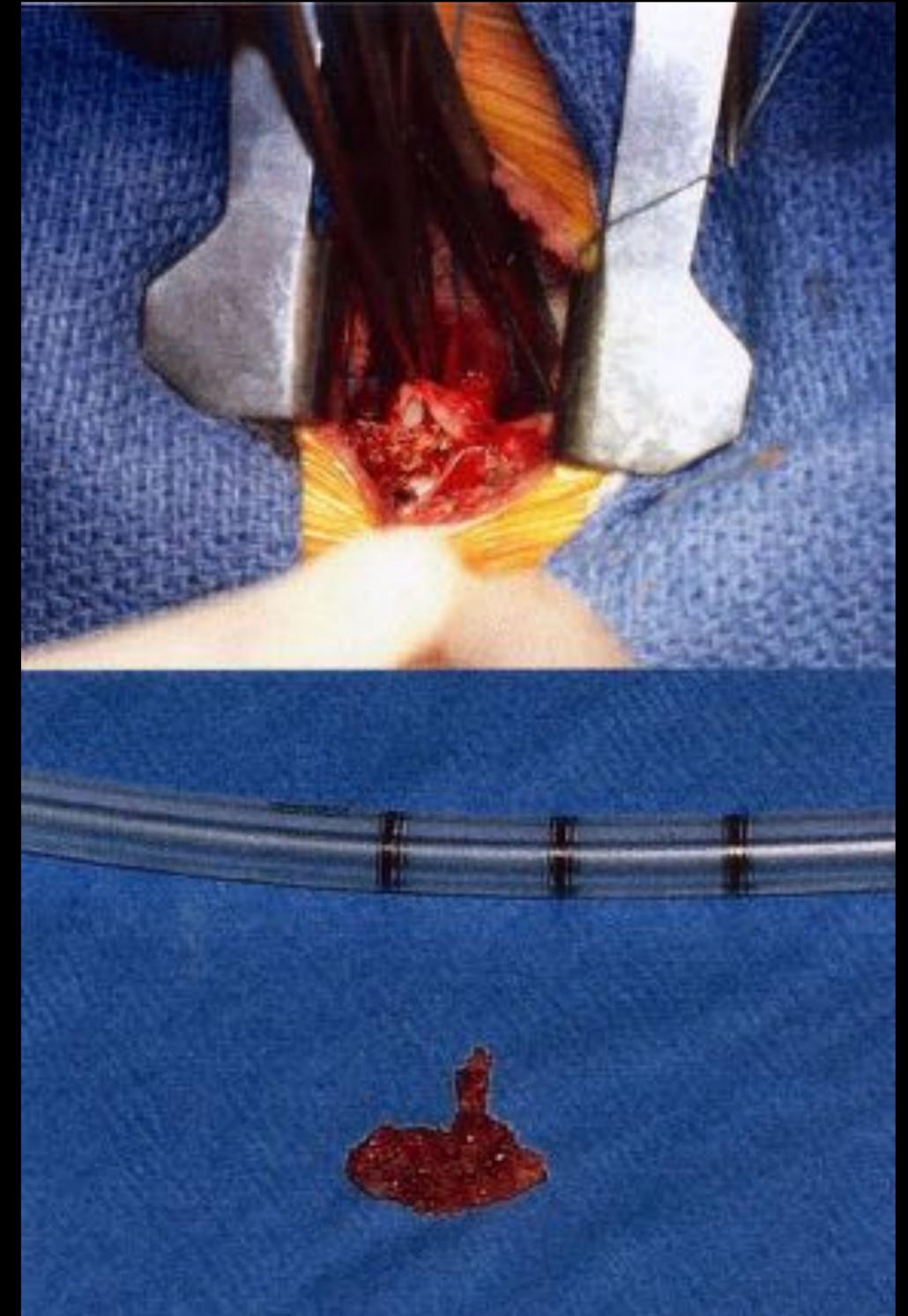


Pulmonary atresia VSD-Right aortic arch-PDA

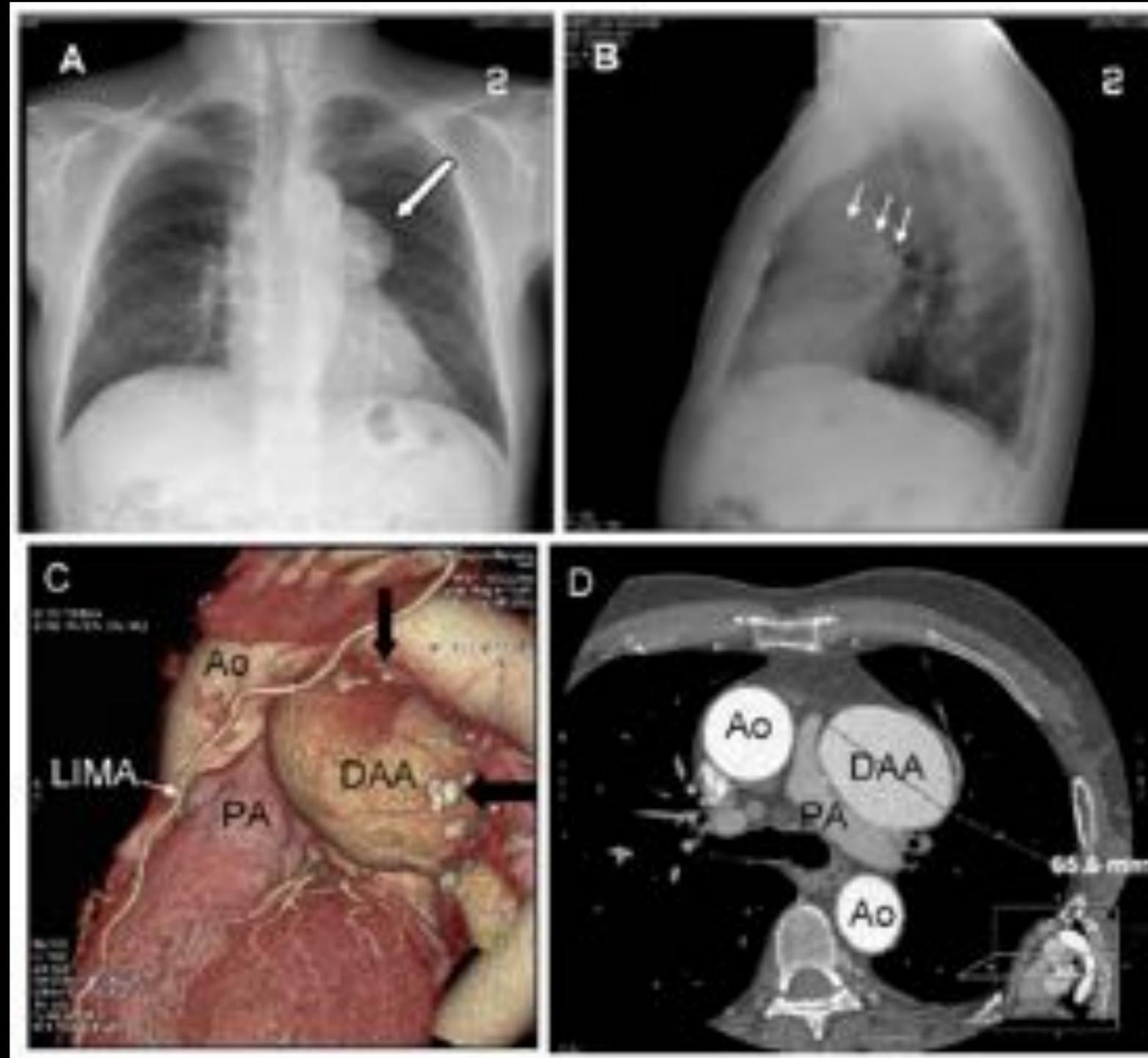
Canal artériel: Thrombose



Canal artériel: tumeur



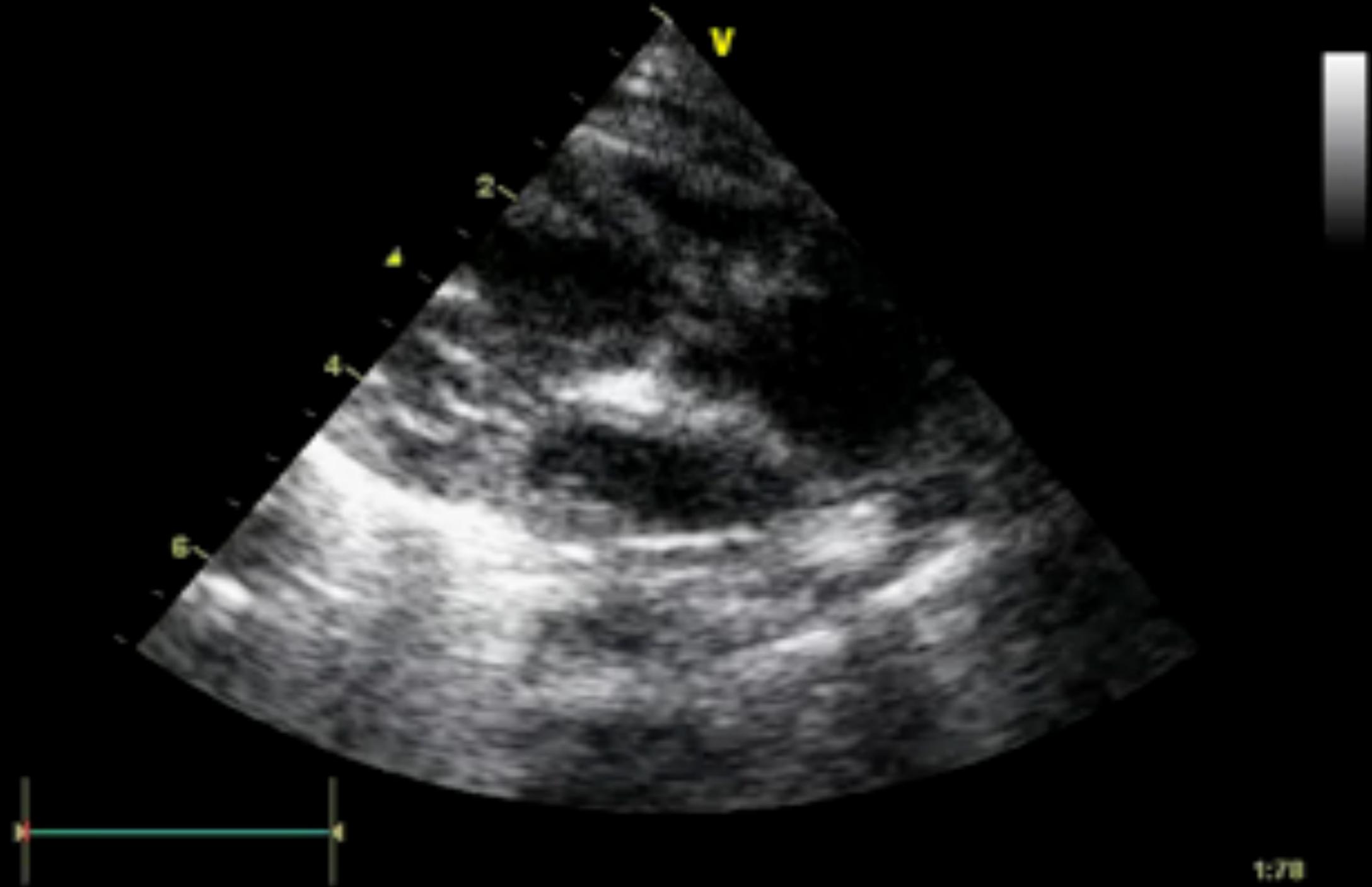
Canal artériel: anévrisme



Canal artériel: Stenting



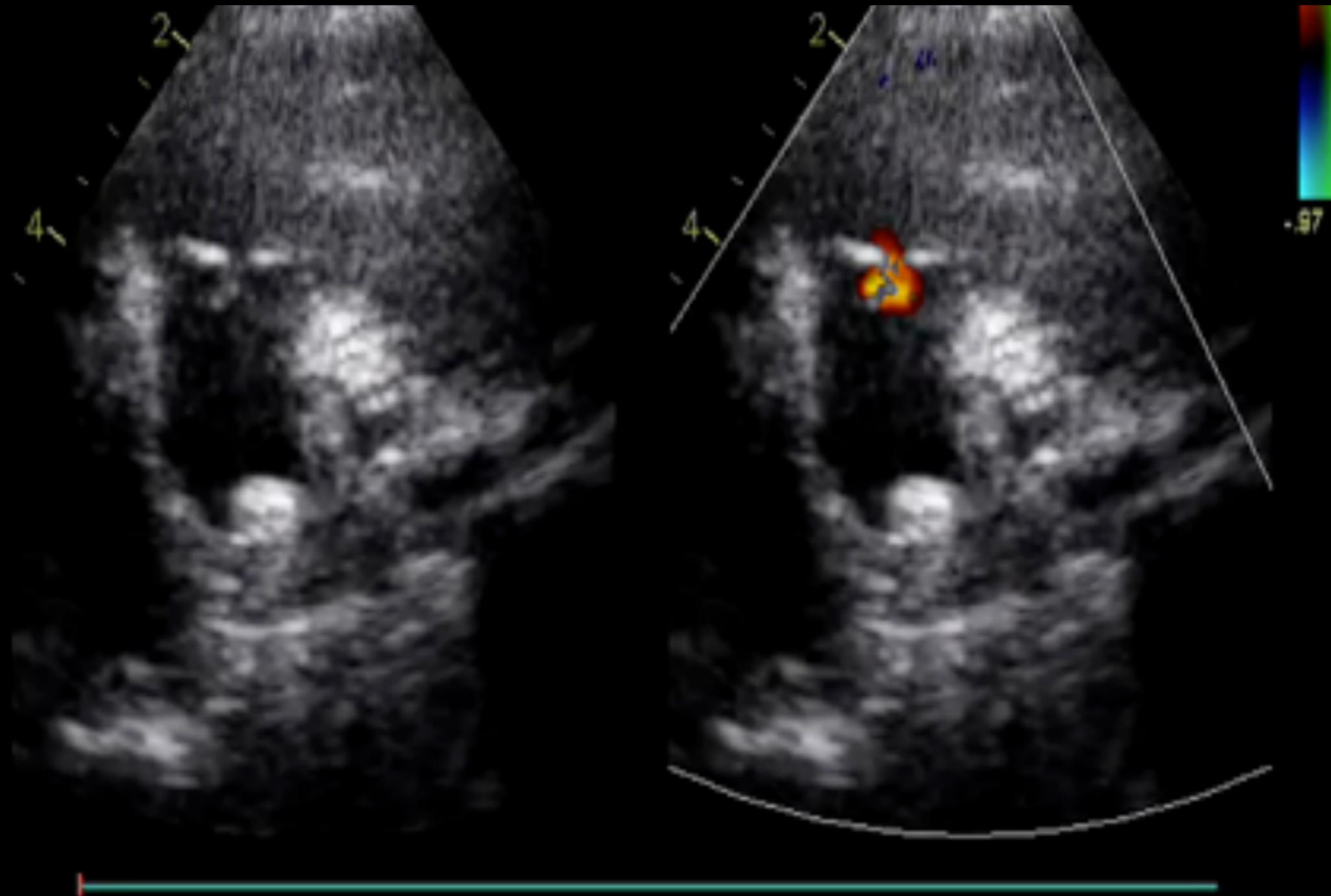
Canal artériel: Stenting



Canal artériel: Fermeture percutanée



Canal artériel: Fermeture percutanée



Options thérapeutiques

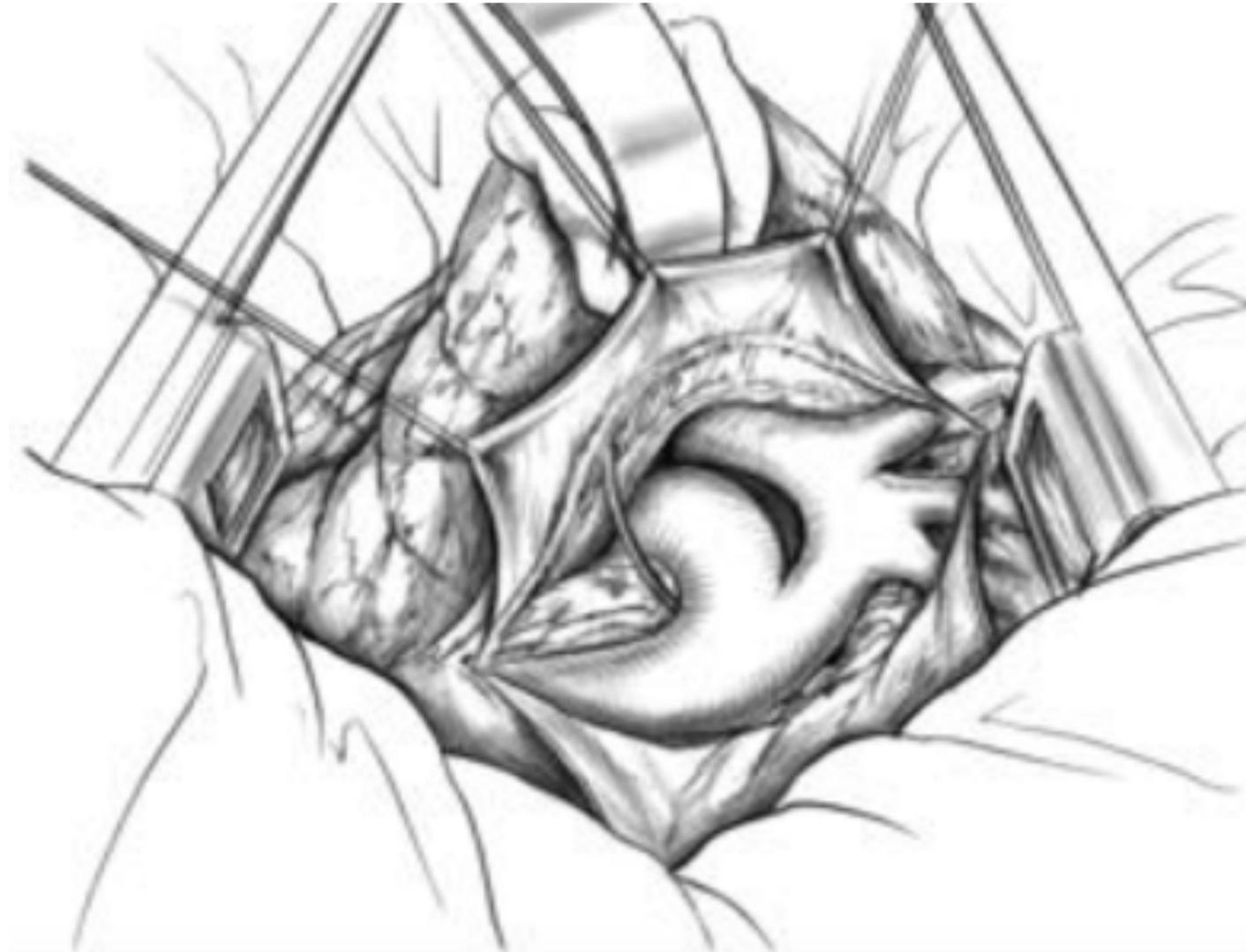
Historique : chirurgie



Options thérapeutiques

Historique : chirurgie

- Thoracotomie postéro-latérale gauche
- Ligature chez les prématurés
- Section-suture chez les autres



Fermeture du canal artériel

Pour qui ? Pourquoi ?

- Prématuré: problème des néonatalogues pour l'indication/chirurgie ancienne ou percutanée dans centres experts
- Enfants: canaux symptomatiques ou soufflants/ Petits enfants <6kgs plutôt chirurgie et > 6kgs percutanée : hyperdébit-HTAP-Risque Osler
- Grands enfants et au-delà : percutanée : Risque Osler

Options thérapeutiques

Historique : chirurgie

Complications :

- Hémorragie
- Lésion du nerf récurrent G = paralysie corde vocale G
- Lésion nerf phrénique G = paralysie de coupole diaphragmatique G
- Plaie du canal thoracique = Chylothorax
- Coarctation
- Ligature APG/Ao descendante.....
- Chez les prématurés, fermeture du canal souvent suivie d'une dégradation sévère sur le plan hémodynamique et respiratoire

Options thérapeutiques

Standard of care : cathétérisme

In 1966, Forstmann^{1,2} was the first to successfully apply a new method by which a patent ductus arteriosus (PDA) was closed by a plug transported by catheters through the femoral artery. Hereafter, he reported successful procedures in 56 of 61 patients. Takamiya³ had used this method in ten patients by October, 1971. Lack of mortality, minor morbidity, and no recurrence of shunting in their long-term follow-up studies encouraged us to use this method in our patients.⁴

To date, we have successfully accomplished the transfemoral plug closure of PDA in 58 of 61 patients. Although the principle of the method has been un-

changed, as our experience broadened the technical

selecting candidates, except for the size of patients and the shape and size of the ductus underwent ductus and femoral artery angiography to evaluate the shape and the relative lumens. The diameter of the plug should be less than that of the ductus. Particular attention was given out all other associated heart anomalies.

The principle of Forstmann's method is as follows. A long catheter is inserted through the femoral artery, and across the ductus. The artery is caught in the right heart by a catching wire passed through a femoral vein. The arterial catheter is drawn by the venous catheter through the right ventricle, the inferior vena cava, and out the femoral vein. A steel guide wire, lying within the lumen of the mentioned arterio-transductal-venous catheter, is used as a track over which a closure plug will be

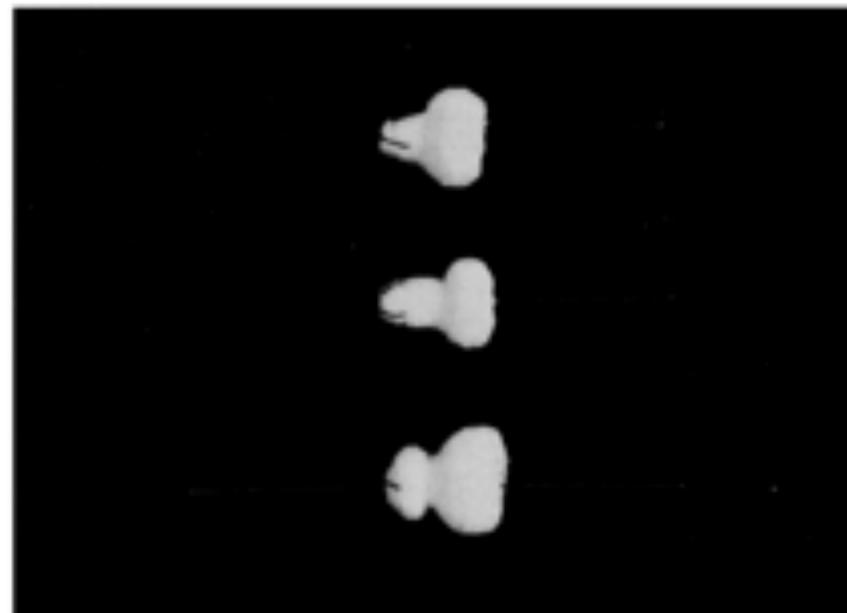


Figure 1

Options thérapeutiques

Standard of care : cathétérisme

Recommendations for Transcatheter PDA Occlusion

Class I

1. Transcatheter PDA occlusion is indicated for the treatment of a moderate-sized or large PDA with left-to-right shunt that results in any of the following: Congestive heart failure, failure to thrive, pulmonary overcirculation (with or without pulmonary hypertension), or an enlarged left atrium or left ventricle, provided the anatomy and patient size are suitable (*Level of Evidence: B*).

Class IIa

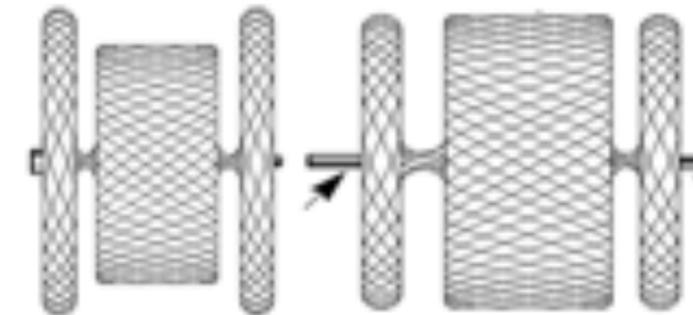
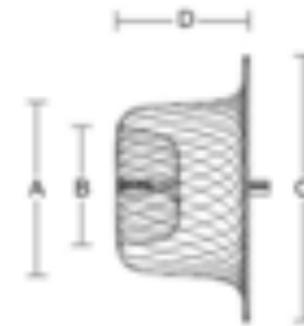
1. Transcatheter PDA occlusion is reasonable in the presence of a small left-to-right shunt with normal-sized heart chambers when the PDA is audible by standard auscultation techniques (*Level of Evidence: C*).

Class IIb

1. In rare instances, transcatheter PDA occlusion may be considered in the presence of a bidirectional PDA shunt due to pulmonary hypertension and obstructive pulmonary vascular disease but reversible to pure left-to-right shunting with pulmonary vasodilator therapy (*Level of Evidence: C*).
2. Transcatheter PDA occlusion may be considered in a PDA associated with a small left-to-right shunt with normal heart size and an inaudible murmur (*Level of Evidence: C*).

Class III

1. Transcatheter PDA occlusion should not be attempted in a patient with a PDA with severe pulmonary hypertension associated with bidirectional or right-to-left shunting that is unresponsive to pulmonary vasodilator therapy (*Level of Evidence: C*).



ADO



ADO II AS



AVP



ADO II



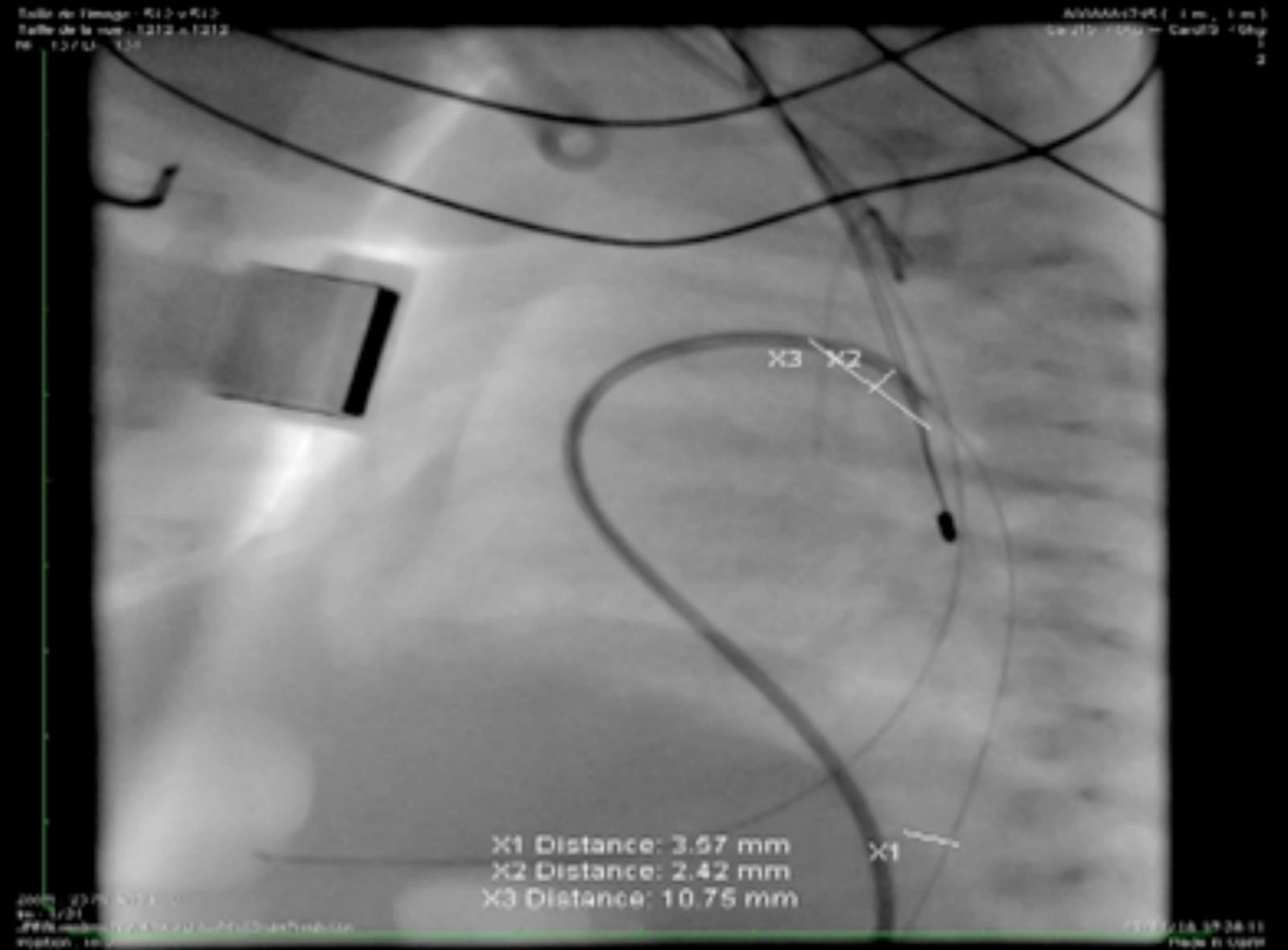
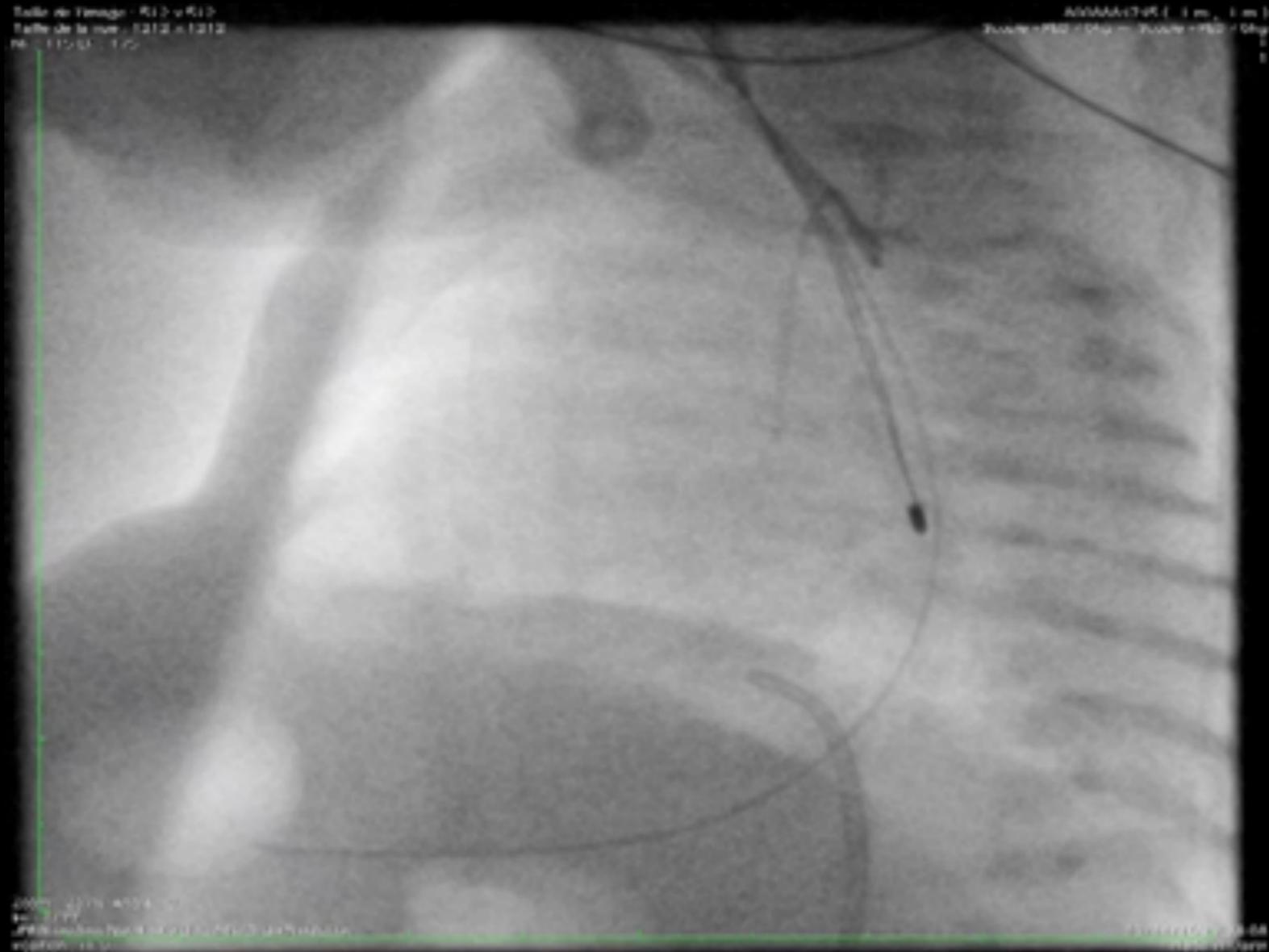
Options thérapeutiques

Standard of care : cathétérisme

Complications :

- Migration/Embolisation
- Coarctation
- Sténose APG
- Shunt résiduel
- Hémolyse
- Point de ponction

Taux de fermeture > 95%



Fermeture par ADO II

Options thérapeutiques

Standard of care : cathétérisme

Passé

- Accès veineux
- Standardisation
- Miniaturisation
- Nombreuses prothèses

- Plus petits poids
- Canaux plus larges

Futur

- Fermeture PCA prématuré gold standard
- Fermeture écho-guidée à la couveuse

Surgical management of a patent ductus arteriosus: Is this still an option?

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^b Department of Newborn and Developmental Paediatrics, Sunnybrook Health Sciences Centre, Toronto, Canada

^c Division of Neonatology, Department of Paediatrics, Hospital for Sick Children, Toronto, Canada

CA du prématuré

- Reste ouvert à 4 jours de vie chez 10% des enfants nés entre 30 et 37 SA, 80% des enfants entre 25 et 28 SA, et 90% des 24 SA (à 7 jours : 2, 67 et 85% respectivement)
- Perméabilité prolongée associée avec ventilation assistée prolongée, dysplasie bronchopulmonaire, hémorragie pulmonaire, ECUN, HIV, leucomalacie périventriculaire et paralysie cérébrale.

CA du prématuré

Risques :

- Court Terme (< 72h) :
 - Hémorragie intra-ventriculaire
 - Hémorragie pulmonaire
- Moyen terme :
 - ECUN
 - Insuffisance rénale
 - Ré aggravation de la MMH
- Long terme :
 - Insuffisance cardiaque
 - Bronchodysplasie

CA du prématuré

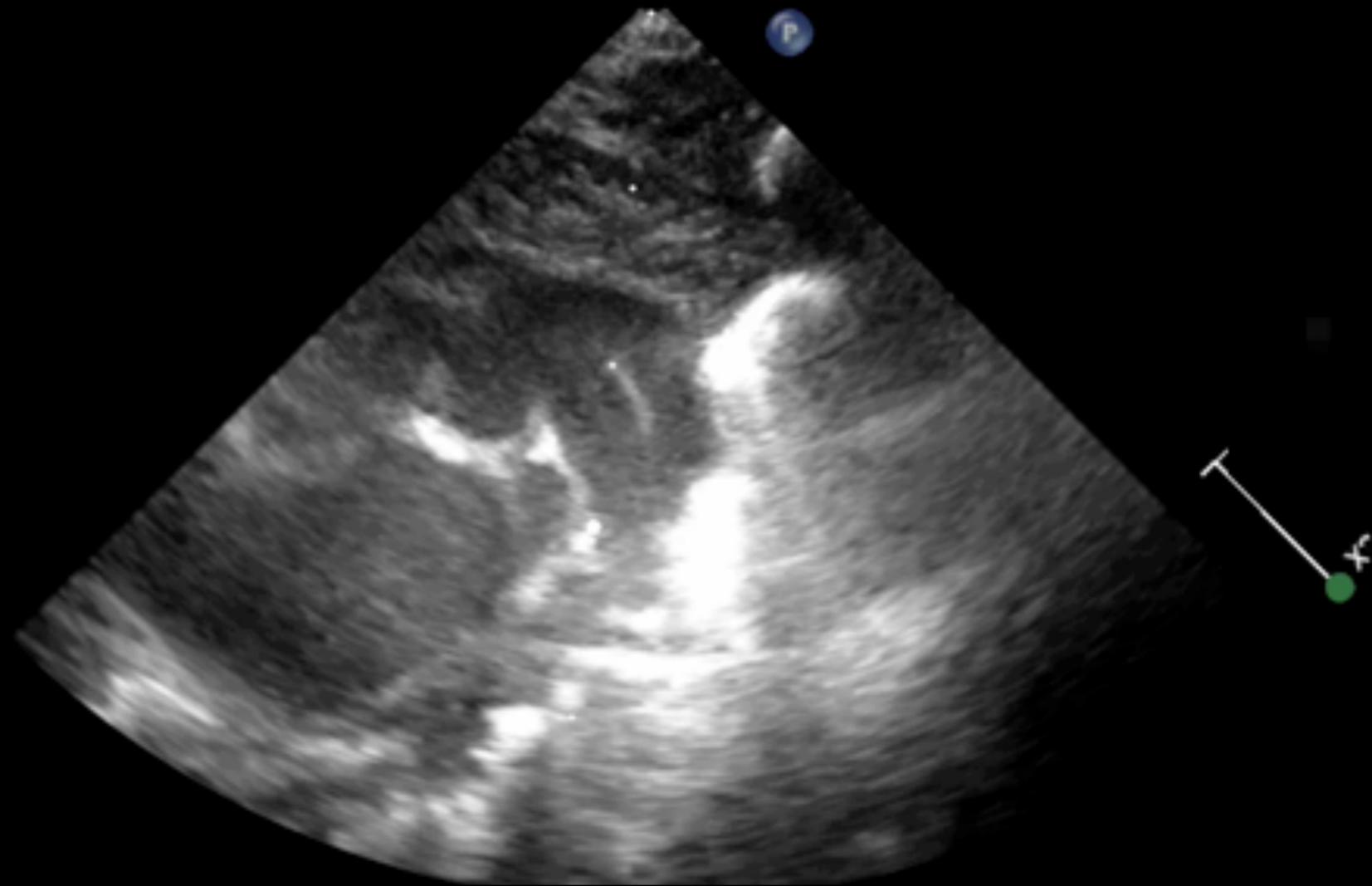
- La fermeture précoce du canal artériel permet-elle de diminuer l'incidence de toutes ces complications ?
 - Non
 - Ibuprofène prophylactique réduit risque d'HIV et d'hémorragie pulmonaire mais aucune différence sur pronostic neurodéveloppemental ou respiratoire à long terme
- Complications du traitement ?
 - Oui quelque soit la thérapeutique utilisée
- « hémodynamiquement significatif »... ?
- En première intention devant PCA avéré : Ibuprofène ou Indométacine ou paracétamol
- En deuxième intention : cathétérisme ou chirurgie

CA du prématuré

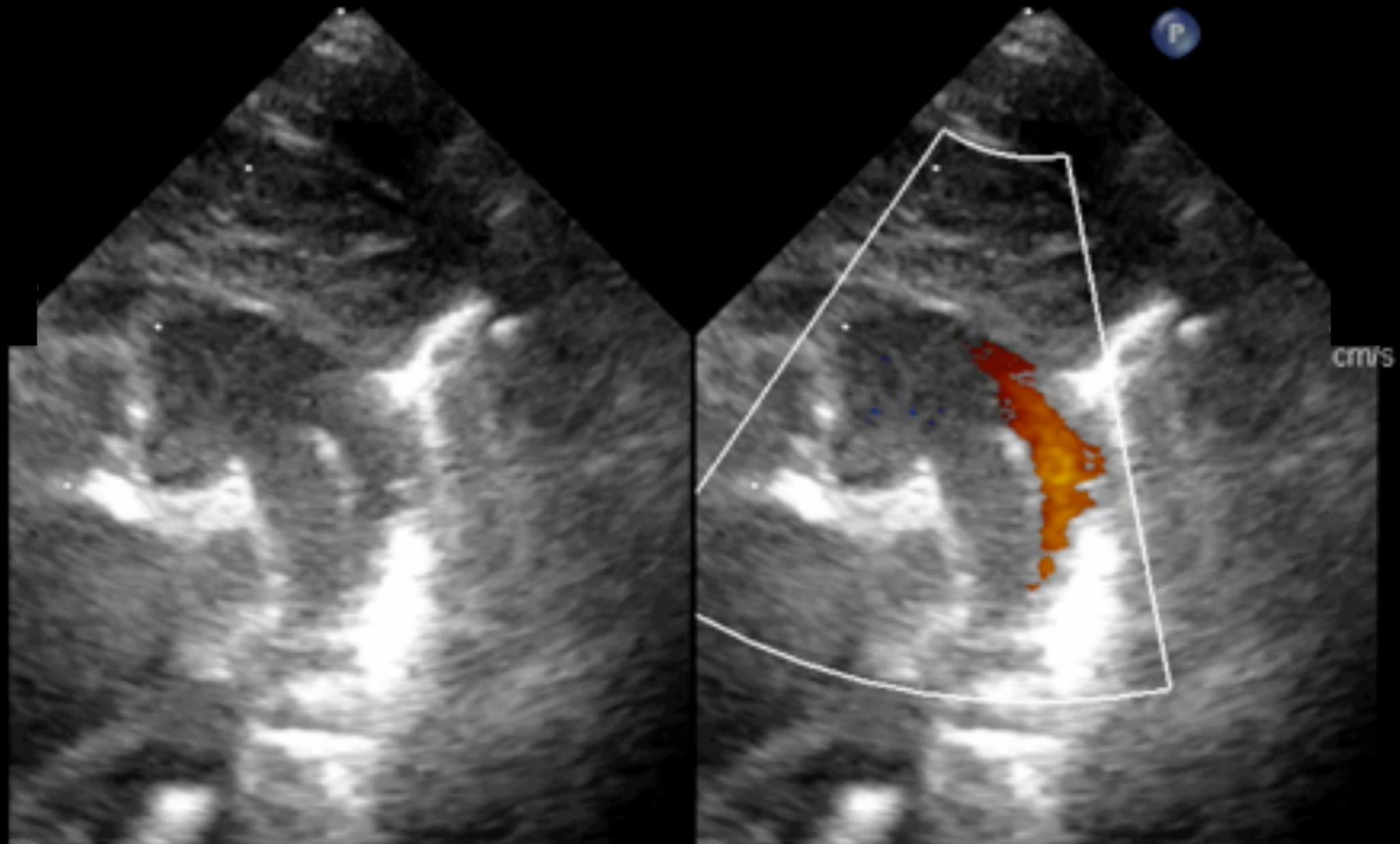
Hémodynamiquement significatif :

- Cliniquement :
 - dépendance à la ventilation, RP, signes d'hypodébit systémique, pouls amples, TA diastolique basse
- Échographiquement :
 - Diamètre CA au bout pulmonaire > 2 mm
 - Vitesse du shunt
 - OG/Aorte $> 1,5$, moins sensible que VOG ou SOG indexé
 - DTDVG $> Z$ -score + 2
 - Vmoyenne dans l'APG $> 45-50$ cm/s et Vtélédiastolique > 20 cm/s
 - Diastole nulle ou vol diastolique dans Ao abdo/AMS ou ACM
 - Importance du retour veineux pulmonaire, du shunt par FOP ou CIA

Canal artériel du prématuré



Canal artériel du prématuré



CA du prématuré

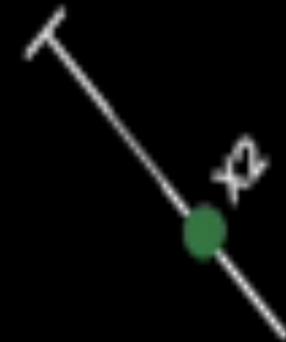
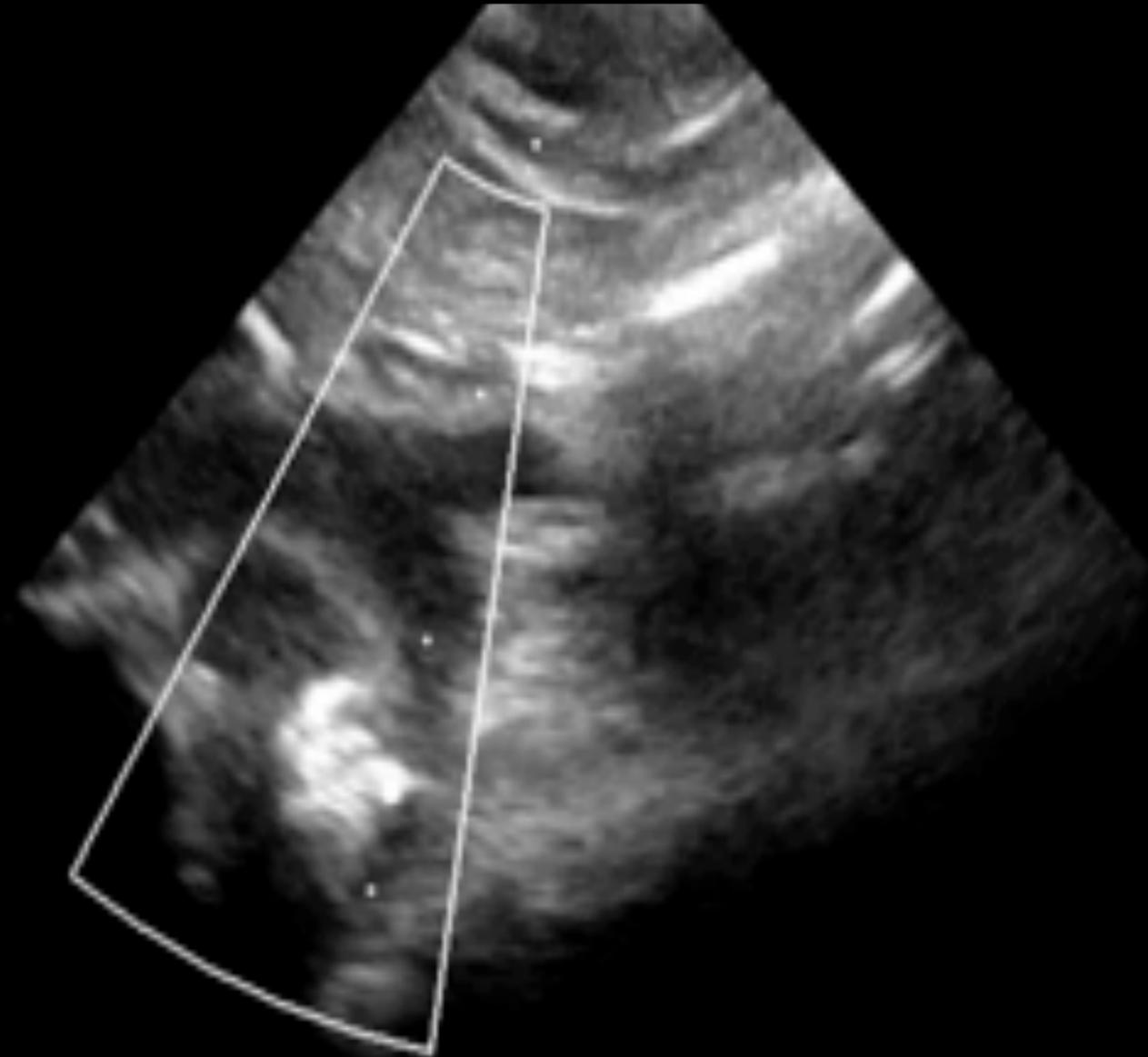
Transcatheter Closure of Hemodynamic Significant Patent Ductus Arteriosus in 32 Premature Infants by Amplatzer Ductal Occluder Additional Size-ADOIIAS

Patrice Morville^{1*}  and Ahmad Akhavi²

CCI 2017



Canal artériel du prématuré



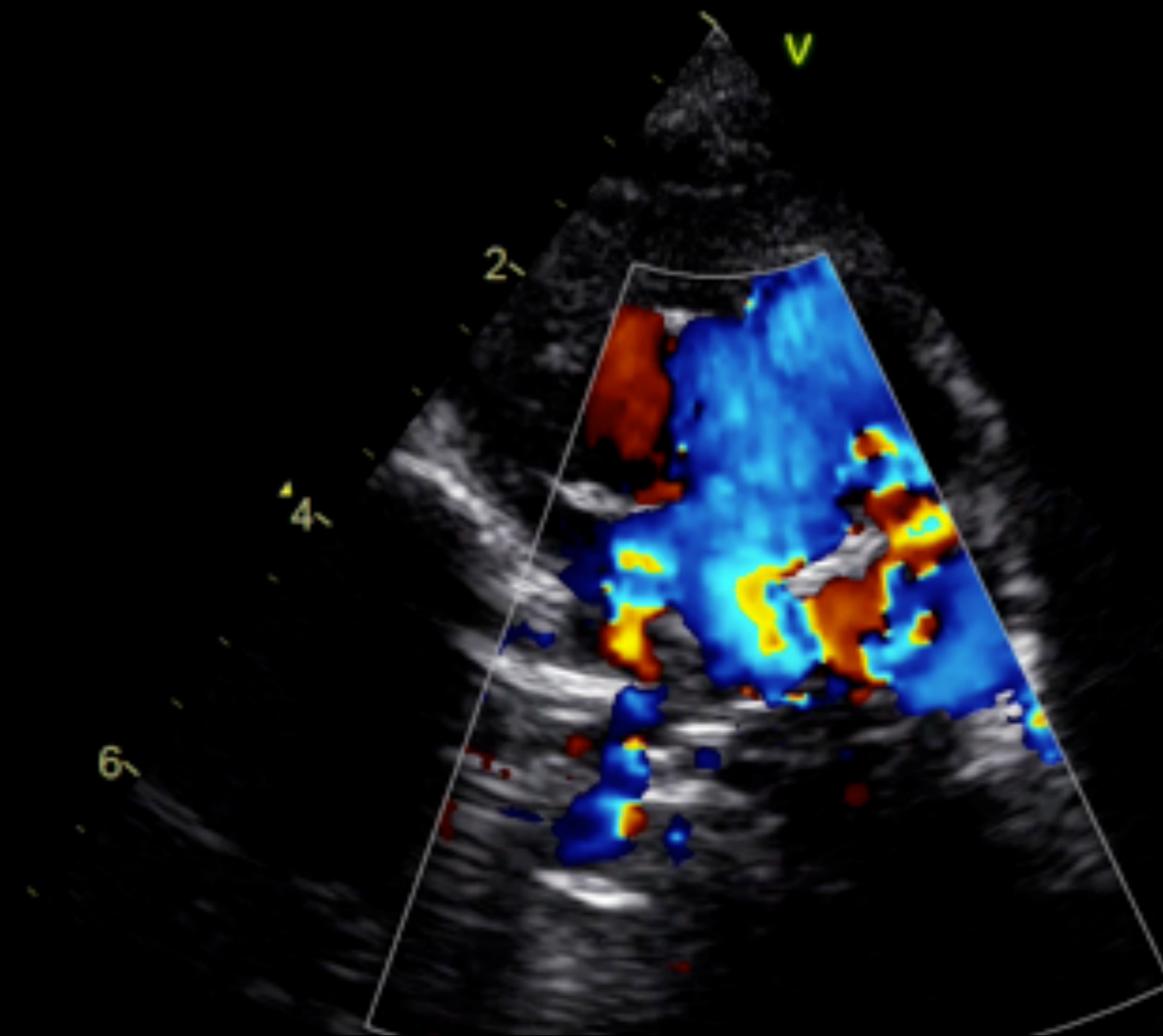
Risques de la procédure

Complications

- Instabilité hémodynamique et respiratoire : désaturations/bradycardies sévères/ACR
- Rupture de cordage tricuspide → fuite tricuspide
- Échec de fermeture du canal
- Embolisation de prothèse
- Sténose APG
- Coarctation de l'aorte
- Complications au point de ponction (thrombose veineuse, hématome)
- Infection post-cathétérisme

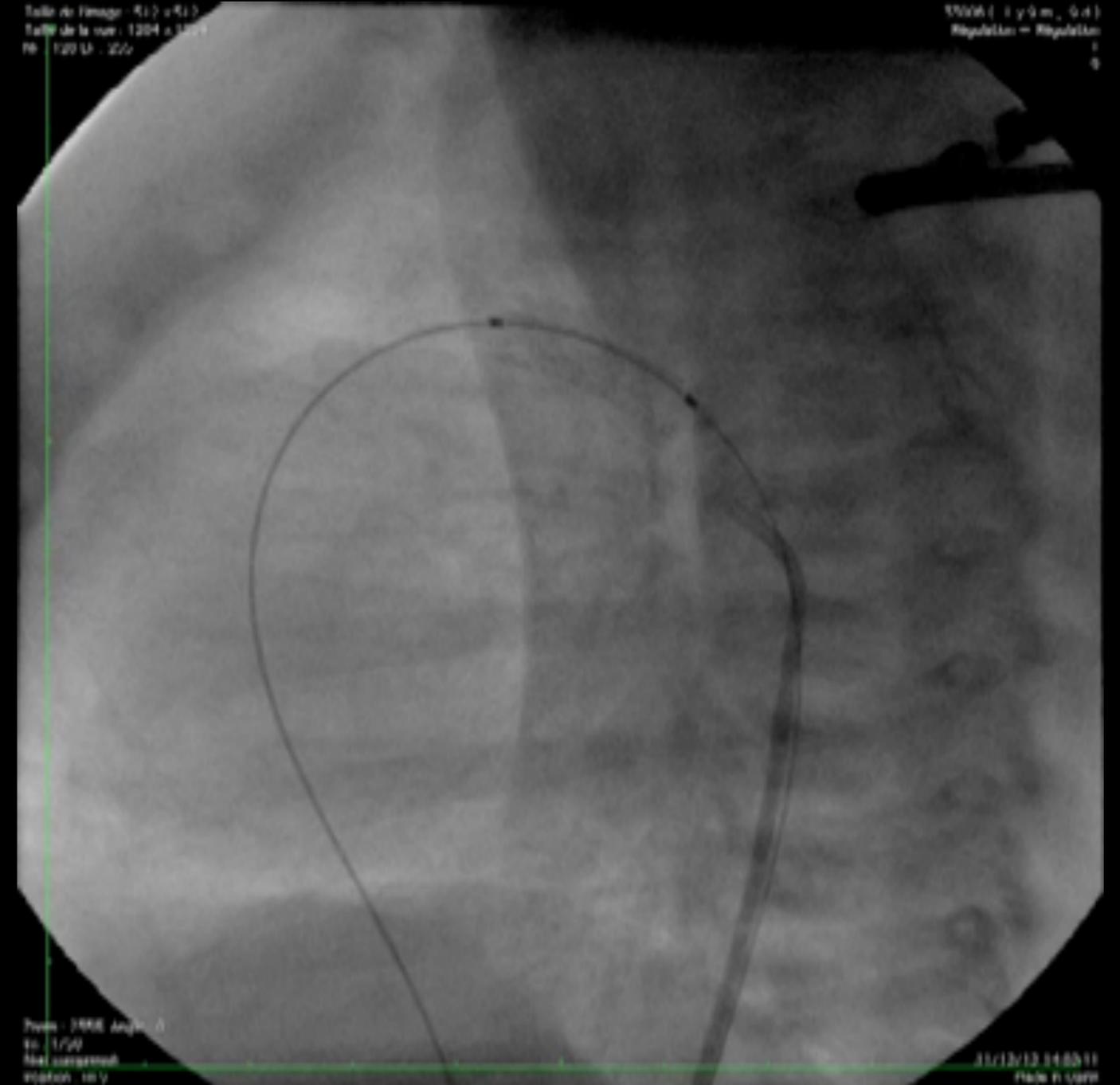
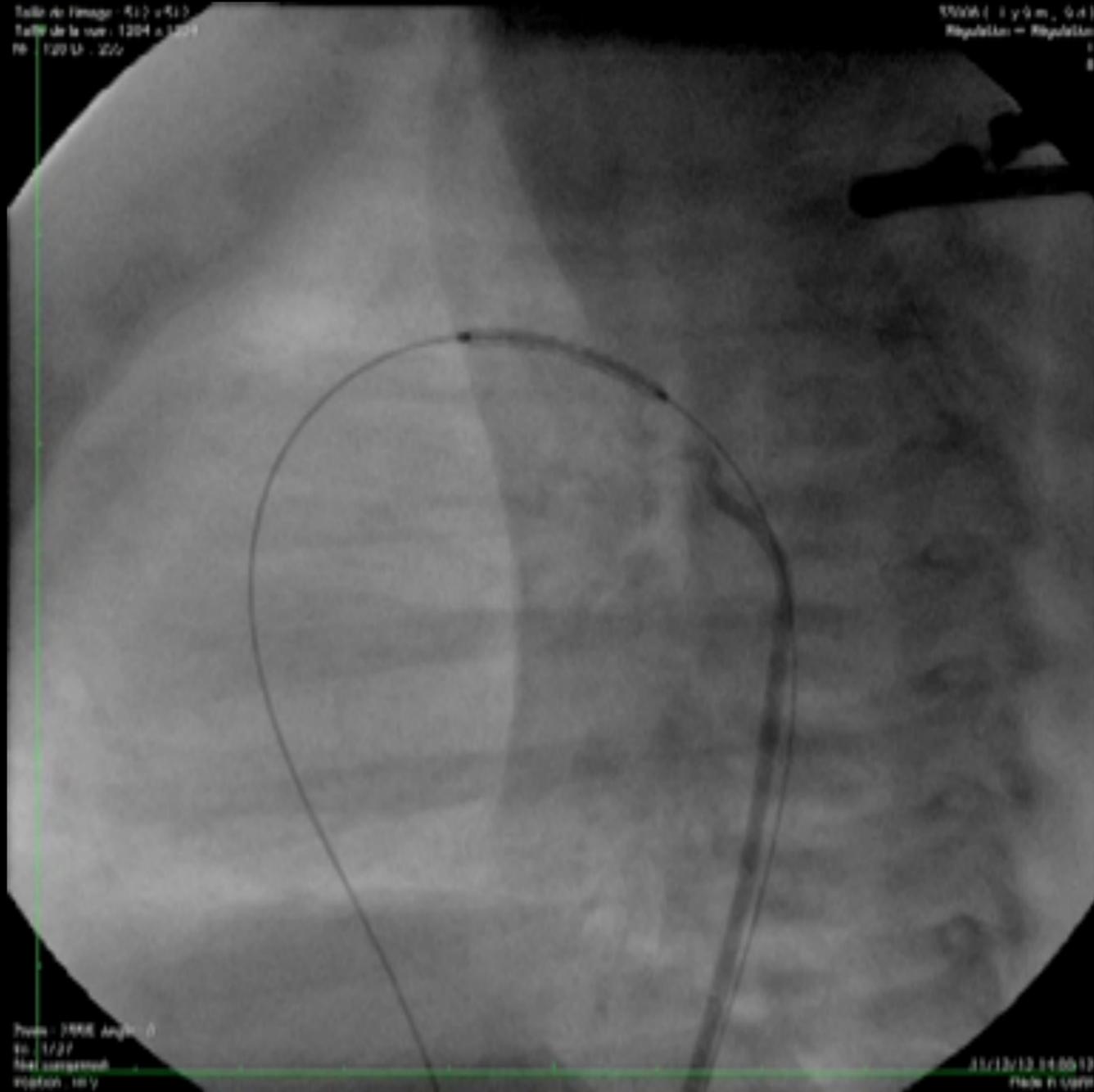
Le canal artériel dans tous ses états...

Quizz !



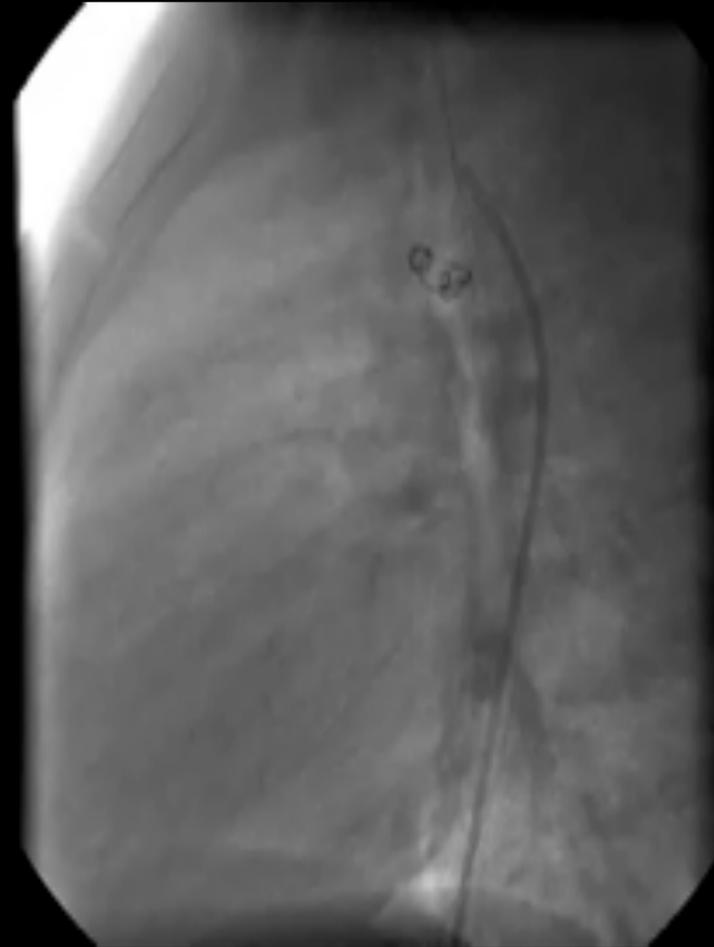
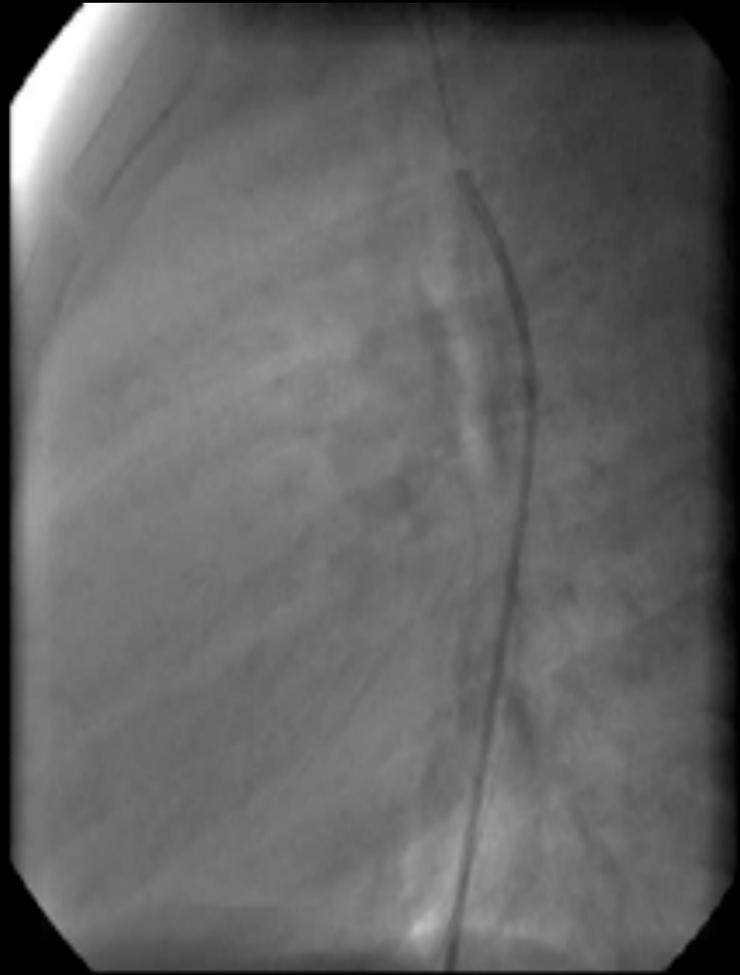
Canal artériel

stent du canal artériel



Canal artériel

Spasme





Merci