
Transpositions des gros vaisseaux

Le point de vue du cardiopédiatre

Dr Daniela Laux, UE3C

M3C-HML-NEM- Centre des Malformations Congénitales Cardiaques complexes



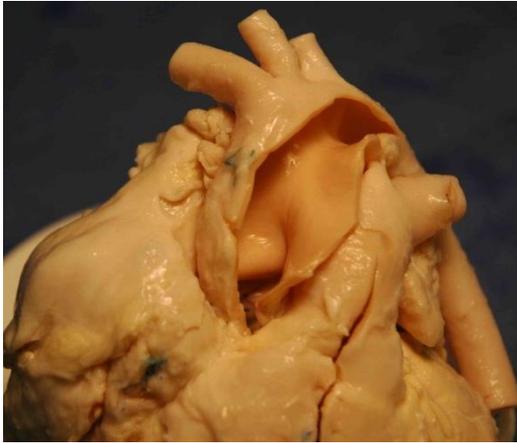
Cardiopathies congénitales humaines	Fréquence	Incidence
Communication interventriculaire (CIV)	30%	1500
Communication interauriculaire (CIA)	8%	400
Sténose pulmonaire (SP)	7%	350
Persistance du canal artériel (PCA)	7%	350
Coarctation de l'aorte (CoA)	6%	300
Tétralogie de Fallot (T4F)	6%	300
Transposition des gros vaisseaux (TGV)	5%	250
Sténose aortique (SA)	5%	250
Canal atrioventriculaire (CAV)	4%	200
Atrésie pulmonaire à septum intact (APSI)	2%	100
Atrésie pulmonaire à septum ouvert (APSO)	2%	100
Atrésie tricuspide (AT)	2%	100
Tronc artériel commun (TAC)	2%	100
Retour veineux pulmonaire anormal (RVPA)	2%	100
Malpositions vasculaires (MV)	1%	50
Syndrome d'hypoplasie du cœur gauche (SHCG)	1%	50
Interruption de l'arc aortique (IAA)	1%	50
Ventricule unique (VU)	1%	50
Anomalie d'Ebstein	1%	50
Discordances AV et VA	1%	50
Autres	6%	300

Transposition des gros vaisseaux

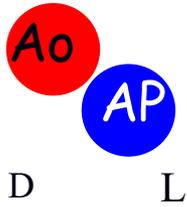
Définition:

- AP au dessus du ventricule G
 - Aorte au dessus du ventricule D
- = discordance ventriculo-artérielle
-
- La TGV n'est qu'une des malpositions vasculaires qui incluent: TGV, VDDI, VGDI, malposition anatomiquement corrigée.

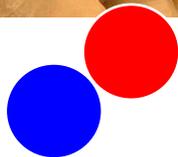
VX NORMOPOSES



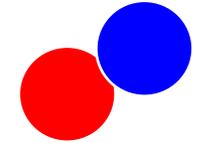
S = solitus



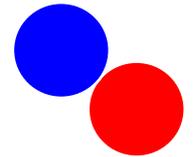
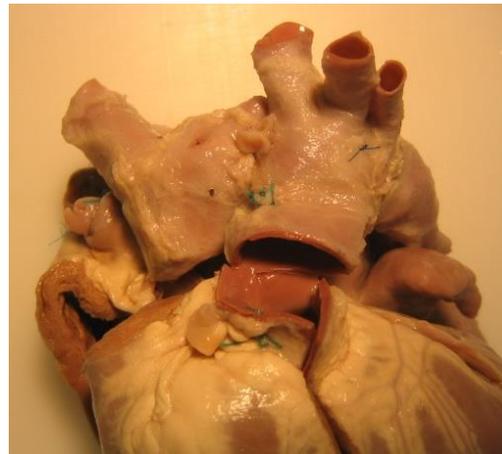
I = inversus



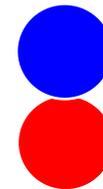
VX TRANSPOSES



D-TGV



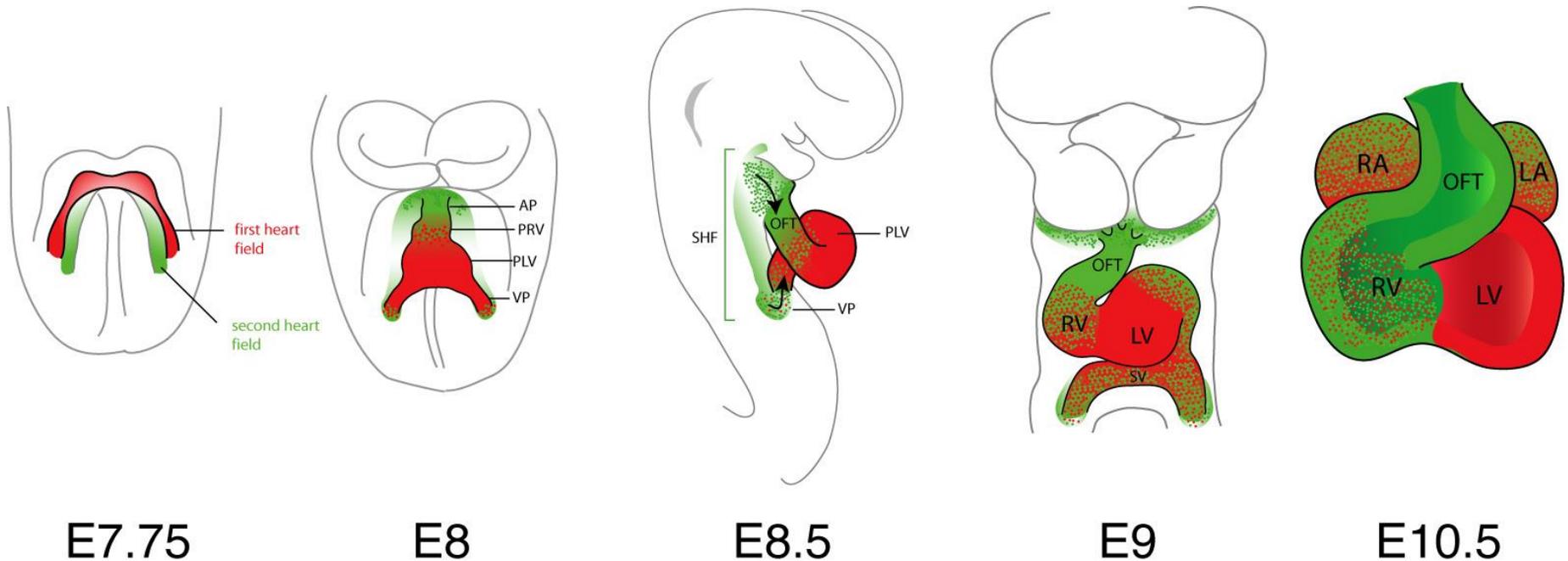
L-TGV



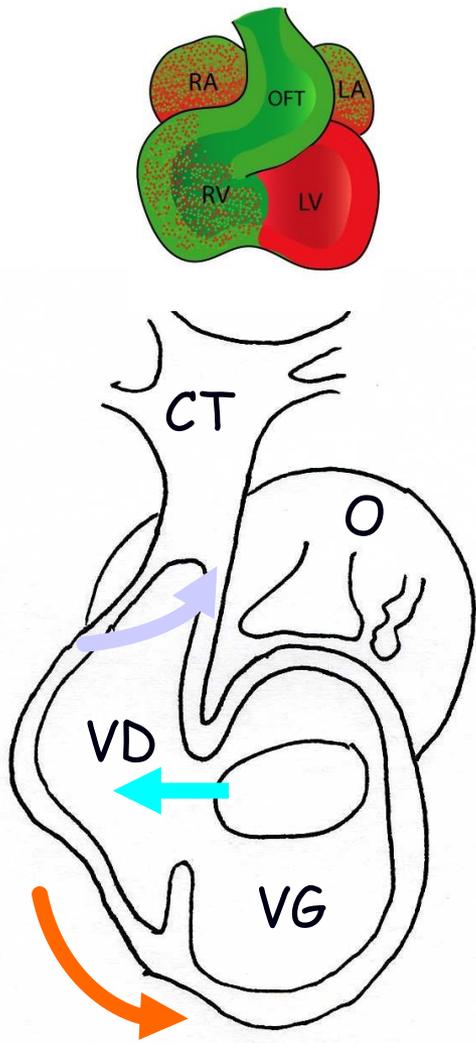
A = antéropostérieur

Rappel embryologique

Concept de morphogenèse cardiaque: Participation du second champ cardiaque

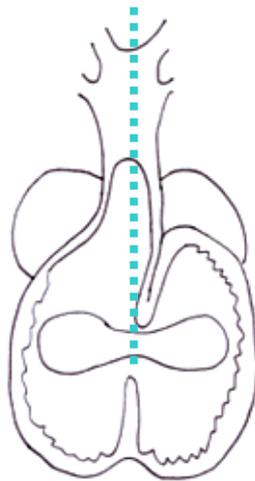


Premier champ cardiaque (cardiac crescent) = 1st lineage
Second champ cardiaque (anterior heart field) = 2nd lineage

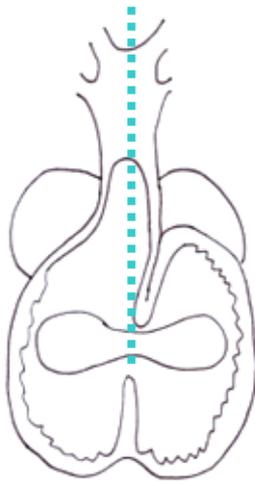


Early looping

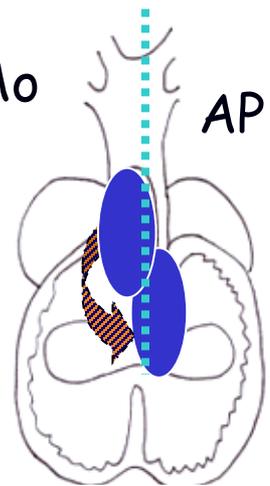
Rotation
« normale »



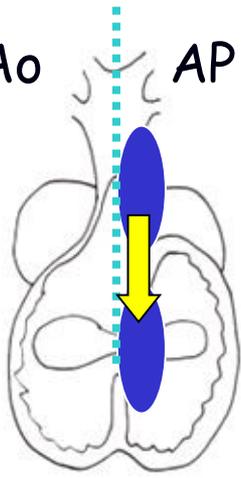
Rotation
« inversée »



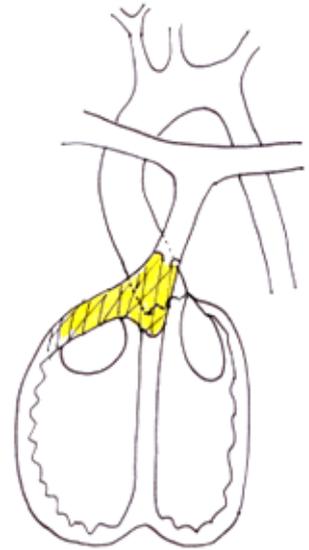
Ao AP



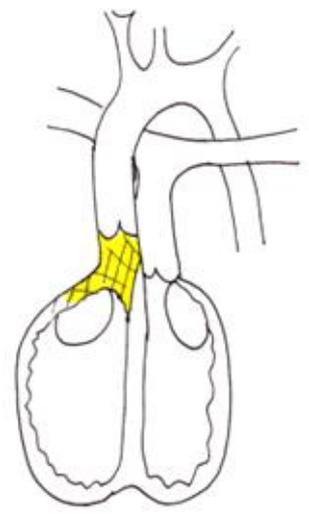
Ao AP



Cœur normal



TGV



Rotation

Courtesy L.Houyel



Types anatomiques: simples et complexes

- TGV « simple » – 60%: pas d'autre lésion associée
- TGV avec communication interventriculaire (CIV)
- TGV avec CIV et coarctation
- TGV avec CIV et sténose pulmonaire
- L-TGV (très rare)

- **Anomalies des valves AV:**
 - Fente mitrale et straddling mitral
 - Straddling tricuspide

Diagnostic prénatal

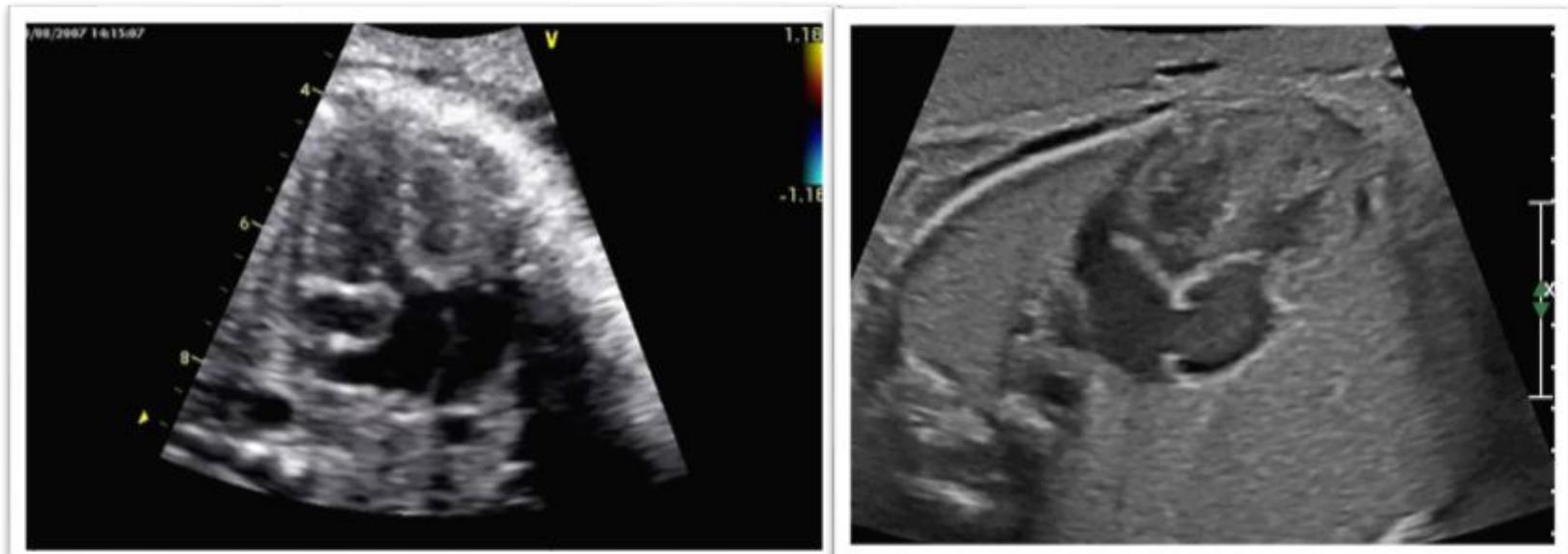
Table 3 - Prenatal diagnosis, pregnancy termination, perinatal and early neonatal mortality for selected (isolated) congenital heart anomalies - Paris Registry of Congenital Malformations, 1983-2000

Etude EPICARD

i) Transposition of Great Arteries

	1983 - 1988			1989 - 1994			1995 - 2000			p [‡]
	N	%	95 % CI*	N	%	95 % CI*	N	%	95 % CI*	
Prenatal Diagnosis	16	12.5	1.6 - 38.3	27	48.1	28.7 - 68.1	40	72.5	56.1 - 85.4	0.001
Pregnancy Termination	17	0	0 - 19.5	27	7.4	0.9 - 24.3	40	0	0 - 8.8	0.62
First Week Mortality	16	18.8	4.0 - 45.6	24	8.3	1.0 - 27.0	39	2.6	0.1 - 13.5	0.04
Perinatal Mortality	17	23.5	6.8 - 49.9	25	12.0	2.5 - 31.2	40	5.0	0.6 - 16.9	0.02

Khoshnood B et al 2012



Evolution du diagnostic prénatal et IMG

Figure 13. Transposition des gros vaisseaux sans anomalie génétique : DPN, IMG et mortalité infantile (remaPAR)

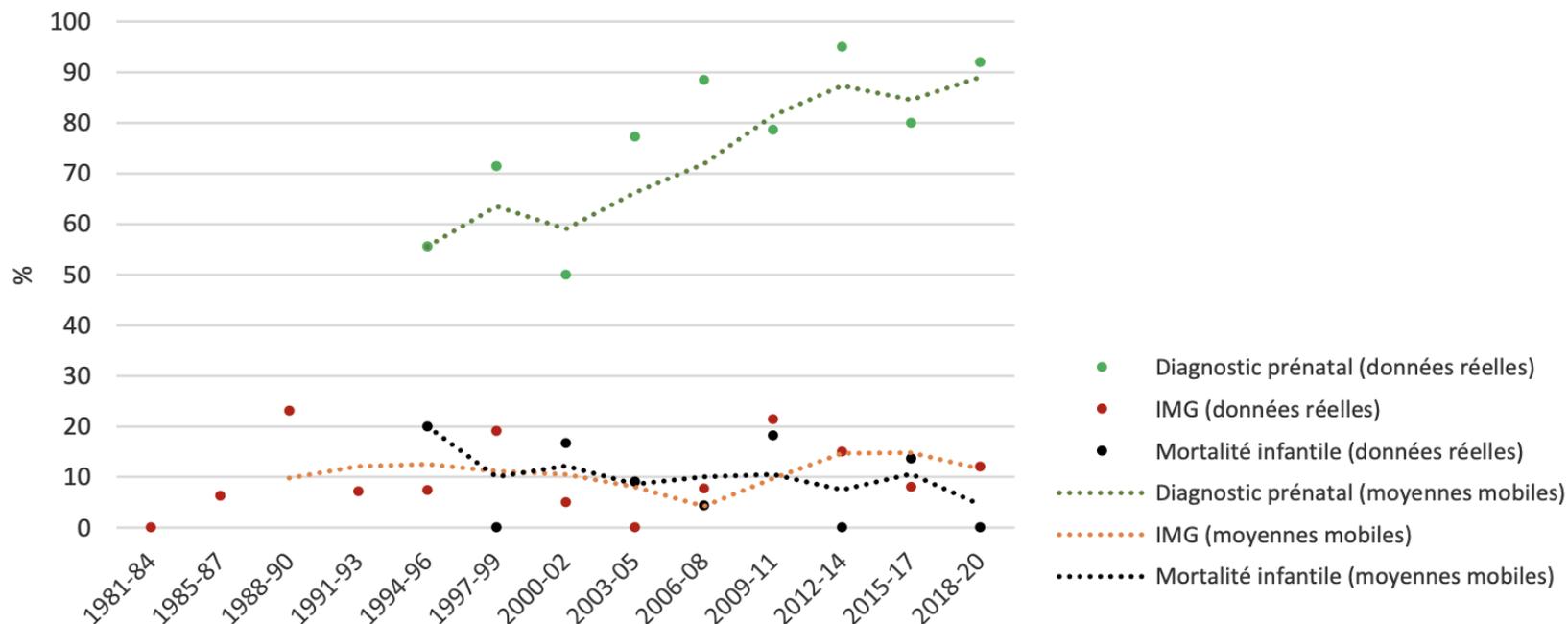


Tableau 10. Transposition des gros vaisseaux sans anomalie génétique : indicateurs de surveillance et DPN (remaPAR)

Années	NT ^a	NV ^a	Nb cas	Nb NV	Nb MN	Nb IMG	Prev tot ^b	Prev NV ^b	% DPN	% IMG	% MI
2018-20	72564	71707	25	22	0	3	3,4	3,1	92,0	12,0	0
Total	1022792	1013217	257	224	5	28	2,5	2,2	76,6	10,9	9,6

^a Source : Insee ; ^b Prévalence pour 10 000 naissances ; NT : naissances totales ; NV : naissances vivantes ; Nb : nombre ; MN : mort-né (mort fœtale) ; IMG : interruption médicale de grossesse ; Prev tot : prévalence totale ; DPN : diagnostic prénatal ; MI : mortalité infantile

Diagnostic prénatal ailleurs qu'en France

Table 5 Proportion (%) of CHD prenatally diagnosed, by CHD type and programme, International Classification for Birth Defects Surveillance and Research (ICBSR) Critical Congenital Heart Defects (CCHD) Prenatal Diagnosis Study 2000-2014*

ICBSR programme by geographic region	Selected CHD												
	HLHS	SV	PLMA	TRIAH	TOF	DTGA	DOV	PLA	IAA	COA	AS	TAPR	Overall
France-Pyrénées-Alpes	95.2	100.0	100.0	94.6	84.1	92.2	95.2	70.6	100.0	66.3	61.3	50.0	66.7
Italy-Cambrilly	100.0	50.0	100.0	100.0	65.7	50.0	75.0	100.0	57.1	66.7	78.4		
Italy-Emilia Romagna	81.9	68.6	48.6	64.9	50.6	58.6	74.5	75.0	28.6	42.4	28.0	27.8	57.6
Italy-Tuscany	94.3	78.9	56.3	71.4	48.9	36.8	82.1	54.5	50.0	28.0	36.3	0.0	58.3
USA-Atlanta	77.9	70.8	60.0	70.4	53.7	40.7	60.0	67.1	50.0	54.7	33.3	47.4	58.3
Canada	57.8	38.3	52.5	42.0	48.6	34.1	56.0	52.3	50.0	42.4	42.4	46.4	45.5
Czech Republic	72.2	59.5	61.4	37.9	28.0	29.9	55.3	53.3	80.7	28.3	39.9	19.5	49.9
UK-Wales	88.1	77.1	48.1	66.7	36.8	37.2	57.7	71.1	27.3	17.8	11.8	17.8	41.5
Argentina	54.0	55.1	38.1	40.0	36.7	21.6	53.3	28.6	38.9	31.5	25.0	20.0	38.6
Germany-Saxony-Anhalt	66.1	66.7	50.0	71.4	30.9	33.3	40.0	49.2	40.0	28.0	18.5	25.0	38.0
Netherlands-Northern	71.6	68.2	41.4	30.0	24.3	25.6	68.0	11.1	20.0	11.1	4.1	6.7	31.7
USA-Kansas	42.1	32.3	14.8	38.9	14.7	10.4	25.6	38.0	14.3	5.4	2.6	5.1	17.5
Malta	25.0	25.0	16.7	25.0	12.5	18.0	33.3	0.0	0.0	0.0	0.0	0.0	19.5
Slovak Republic	24.3	10.0	3.2	11.8	6.5	5.8	18.8	21.0	9.1	18.0	5.8	0.0	19.2

Detection of Transposition of the Great Arteries in Fetuses Reduces Neonatal Morbidity and Mortality

Damien Bonnet, MD; Anna Coltri, MD; Gianfranco Butera, MD; Laurent Fermont, MD;
 , MD

Comparison of Characteristics of Patients in the Prenatal and Postnatal Groups

	Postnatal Group	Prenatal Group	<i>P</i>
Isolated TGA	204	57	NS
Associated defects	46	11	NS
VSD	31	8	NS
VSD+CoA	14	3	NS
CoA	1	1	NS
Age at admission, h	73±210	2.2±2.8	<0.01
Mechanical ventilation	95 (38)	12 (17.6)	<0.01
Metabolic acidosis±MOF	56	8	<0.05
PGE ₁ infusion	95	32	NS
BAS	168	54	NS
Preoperative mortality	15	0	<0.05
Coronary artery pattern	233 ASO	68 ASO	
Normal	168	47	NS
Abnormal	65	21	NS
Postoperative mortality	20	0	<0.01
Hospital stay, d	30±17	24±11	<0.01

VSD indicates ventricular septal defect; CoA, coarctation; MOF, multiorgan failure; PGE₁, prostaglandin E₁; BAS, balloon atrioseptotomy; and ASO, arterial switch operation. Values are n (%).

Impact postnatal du diagnostic prénatal (?)

- **Mortalité périopératoire:** études contradictoires
 - Amélioration globale des résultats concomitante de l'augmentation du DAN partout dans le monde

Bonnet et al. 1999, Khosnood et al. 2017

- **Morbidité périopératoire:**
 - Amélioration des délais opératoires, ventilation mécanique, acidose

Chakraborty et al. 2018, Cloete et al. 2019

- **Devenir neurodéveloppemental:**
 - Association positive DAN démontrée dans la TGV

Calderon 2012, Selvanathan 2024

PEC pratique en France

- DAN TGV -> CPDPN
- Confirmation par un cardiopédiatre expert
- Accompagnement du couple:
information sur la pathologie/PEC/pronostic
- Soutien psychologique
- Accouchement déclenché en milieu spécialisé
- Cardiopédiatre sur place en SDN
- Evaluation postnatale hémodynamique immédiate
- Décision si Rashkind ou non
- Transfert en cardio/SI/ néona

Recommendation	Class ^a	Level ^b
It is recommended that the obstetric anomaly scan be performed at 18-22 weeks of gestation	I	C
To increase prenatal detection, it is recommended that outflow tract views, in addition to four-chamber views, be included in obstetric anomaly scans	I	C
It is recommended that the diagnosis be confirmed by a foetal cardiology specialist and that parental counselling should also be provided by a foetal cardiology specialist and other related health professionals (foetal medicine specialists, obstetricians, paediatric cardiac surgeons and neonatologists)	I	C
It is recommended that a detailed foetal anomaly scan be performed by a foetal medicine specialist	I	C
Because the risk for foetal karyotype abnormality is low in cases of TGA IVS, karyotyping may be considered on an individual basis where appropriate	IIb	C
After foetal diagnosis, follow-up to term is recommended for early detection of the development of high-risk features, which may require immediate intervention following delivery	I	C

Recommendation	Class ^a	Level ^b
It is recommended that delivery takes place at or near a tertiary-care paediatric cardiology and paediatric cardiac surgery centre	I	C
Vaginal delivery at term is recommended in most cases, whereas caesarean delivery is recommended when high-risk features are identified	I	C

^aClass of recommendation.

^bLevel of evidence.

Recommendations for perinatal management

AHA Scientific Statement

Diagnosis and Treatment of Fetal Cardiac Disease A Scientific Statement From the American Heart Association

Table 19. Level of Care Assignment and Coordinating Action Plan

LOC	Definition	Example CHD	Delivery Recommendations	DR Recommendations
P	CHD in which palliative care is planned	CHD with severe/fatal chromosome abnormality or multisystem disease	Arrange for family support/palliative care services Normal delivery at local hospital	
1	CHD without predicted risk of hemodynamic instability in the DR or first days of life	VSD, AVSD, mild TOF	Arrange cardiology consultation or outpatient evaluation Normal delivery at local hospital	Routine DR care Neonatal evaluation
2	CHD with minimal risk of hemodynamic instability in DR but requiring postnatal catheterization/surgery	Ductal-dependent lesions, including HLHS, critical coarctation, severe AS, IAA, PA/IVS, severe TOF	Consider planned induction usually near term Delivery at hospital with neonatologist and accessible cardiology consultation	Neonatologist in DR Routine DR care, initiate PGE if indicated Transport for catheterization/surgery
3	CHD with likely hemodynamic instability in DR requiring immediate specialty care for stabilization	d-TGA with concerning atrial septum primum (note: it is reasonable to consider all d-TGA fetuses without an ASD at risk) Uncontrolled arrhythmias CHB with heart failure	Planned induction at 38–39 wk; consider C/S if necessary to coordinate services Delivery at hospital that can execute rapid care, including necessary stabilizing/lifesaving procedures	Neonatologist and cardiac specialist in DR, including all necessary equipment Plan for intervention as indicated by diagnosis Plan for urgent transport if indicated
4	CHD with expected hemodynamic instability with placental separation requiring immediate catheterization/surgery in DR to improve chance of survival	HLHS/severely RFO or IAS d-TGA/severely RFO or IAS and abnormal DA Obstructed TAPVR Ebstein anomaly with hydrops TOF with APV and severe airway obstruction Uncontrolled arrhythmias with hydrops CHB with low ventricular rate, EFE, and/or hydrops	C/S in cardiac facility with necessary specialists in the DR usually at 38–39 wk	Specialized cardiac care team in DR Plan for intervention as indicated by diagnosis; may include catheterization, surgery, or ECMO
5	CHD in which cardiac transplantation is planned	HLHS/IAS, CHD including severe Ebstein anomaly, CHD, or cardiomyopathy with severe ventricular dysfunction	List after 35 wk of gestation C/S when heart is available	Specialized cardiac care team in DR

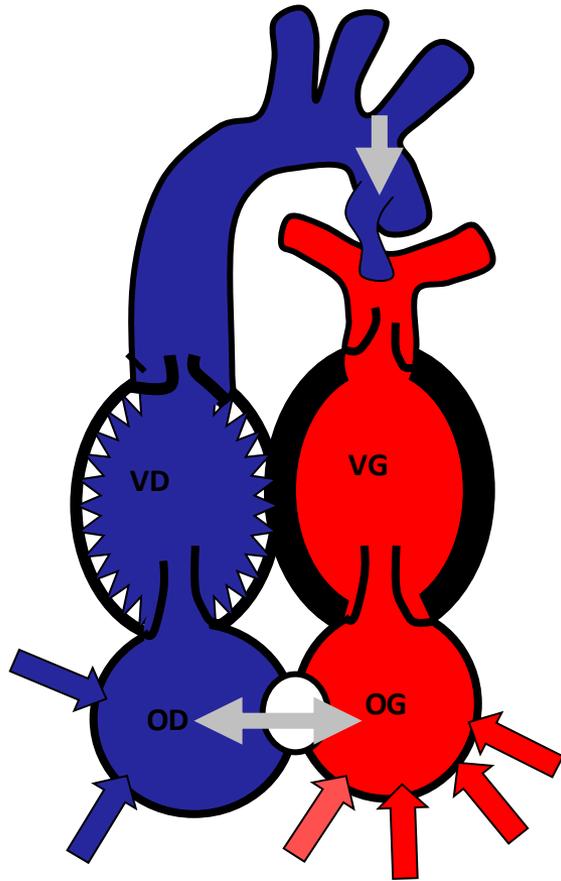


Clinique postnatal

Cyanose réfractaire en salle de naissance
sans détresse respiratoire

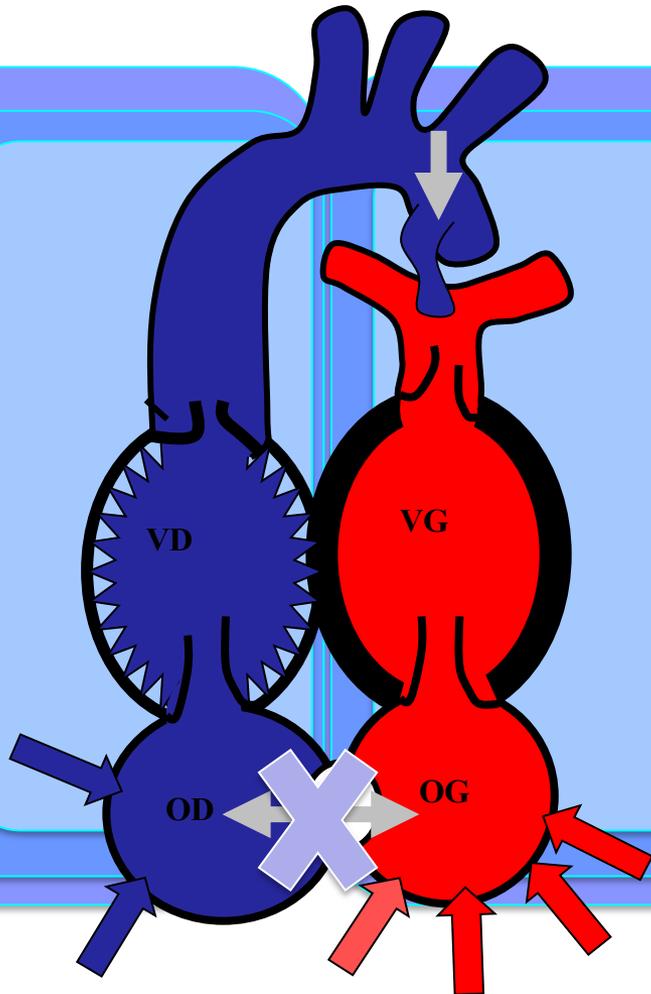
= TGV jusqu'à la preuve du contraire

Pathophysiologie TGV simple



- Cardiopathie cyanogène car aorte naît du VD !
- **Circulation en parallèle**
- CA et FOP obligatoire pour un mixing efficace
- CA shunte Ao-AP à cause des RVP basses
- FOP shunte G-D à cause des compliances ventriculaires

Le FOP restrictif avant Rashkind



- FOP restrictif ou fermé= Œdème pulmonaire
- Majoration de la cyanose
- Majoration de l'acidose
- Mixing inefficace jusqu'au décès

Prise en charge médicale néonatale

- **Rashkind**
 - Mixing
 - Déprécharge le VG
- **PGE1**
 - Effets secondaires: apnée, douleur, fièvre
 - Précharge le VG
- Surveillance glycémies
- Surveillance alimentation entérale: risque d'entéropathie/entérocolite
- Risque théorique d'AVC en cas de KTC: VD-aorte-cerveau

Clinical guidelines for the management of patients with transposition of the great arteries with intact ventricular septum

The Task Force on Transposition of the Great Arteries of the European Association for Cardio-Thoracic Surgery (EACTS) and the Association for European Paediatric and Congenital Cardiology (AEPC)

Recommendation	Class ^a	Level ^b	Ref ^c
Neonatal pulse oximetry screening is crucial for timely diagnosis of TGA	I	C	51
Echocardiography is the modality of choice for diagnosing TGA postnatally and allows accurate evaluation of the coronary artery pattern and exclusion of other relevant malformations in most cases	I	B	49, 50
Performance of BAS should be considered, under echocardiographic guidance	IIa	B	52–54

BAS: balloon atrial septostomy; TGA: transposition of the great arteries.

^aClass of recommendation.

^bLevel of evidence.

^cReferences

Recommendations for postnatal diagnosis

Recommendation	Class ^a	Level ^b
Immediately after birth, IV infusion of PGE1 is recommended to maintain ductal patency until the comprehensive series of postnatal echocardiograms is complete and all sites of intercirculatory mixing have been evaluated	I	C
Avoidance of elective intubation of infants on PGE1 during transport is recommended. The decision to intubate prior to transport must be individualized	I	C
An individualized management strategy for low birth weight and premature infants is recommended, taking into account patient and institutional factors. Management options include primary repair as late as 3 months of age, late single-stage repair with postoperative VAD or ECLS support and two-stage repair	I	C
A primary ASO may be considered the preferred management strategy for low-birth-weight and premature infants and can be performed with acceptable but increased early and mid-term risk	IIb	C

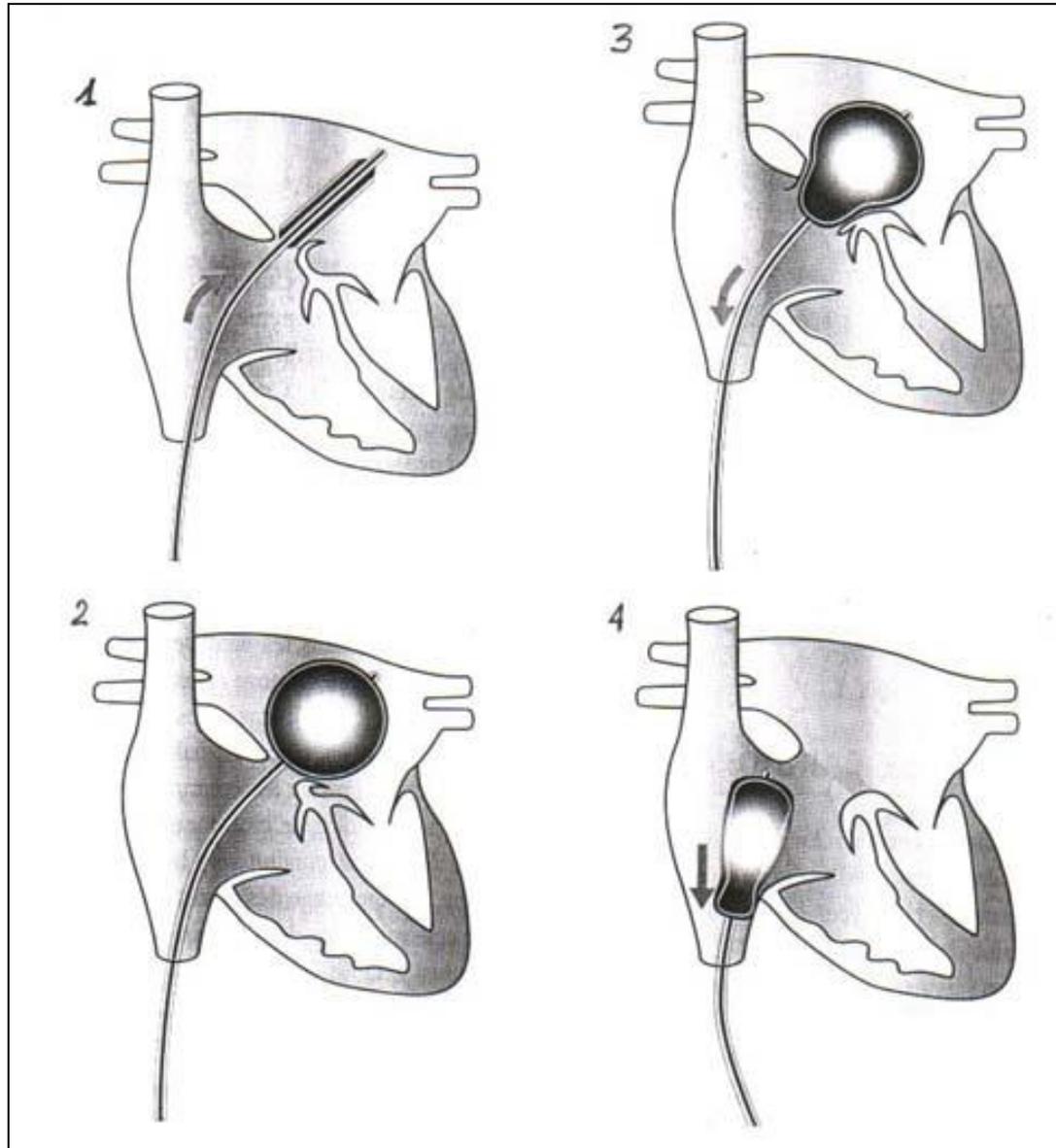
ASO: arterial switch operation; ECLS: extracorporeal life support; IV: intravenous; PGE1: prostaglandin E1; VAD: ventricular assist device.

^aClass of recommendation.

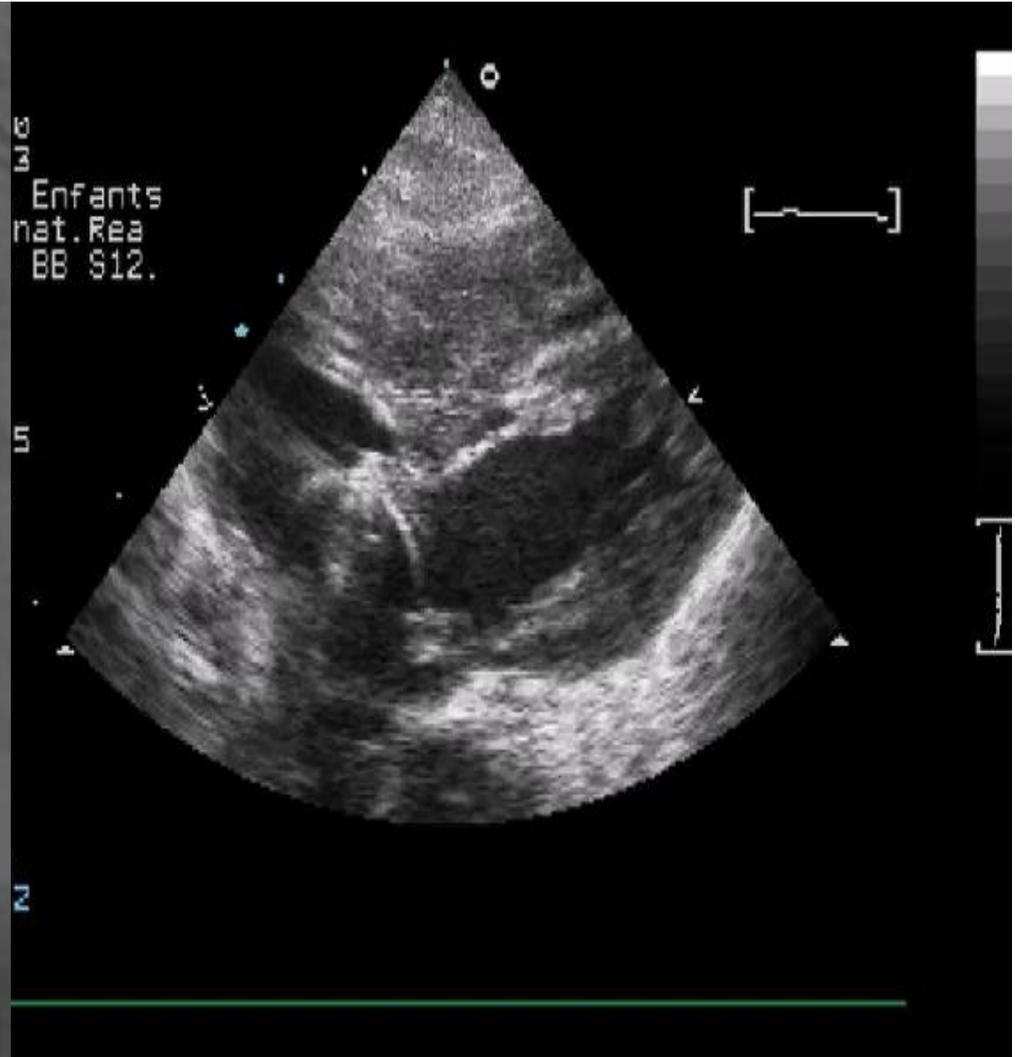
^bLevel of evidence.

Recommendations for perinatal management in a neonatal intensive care unit

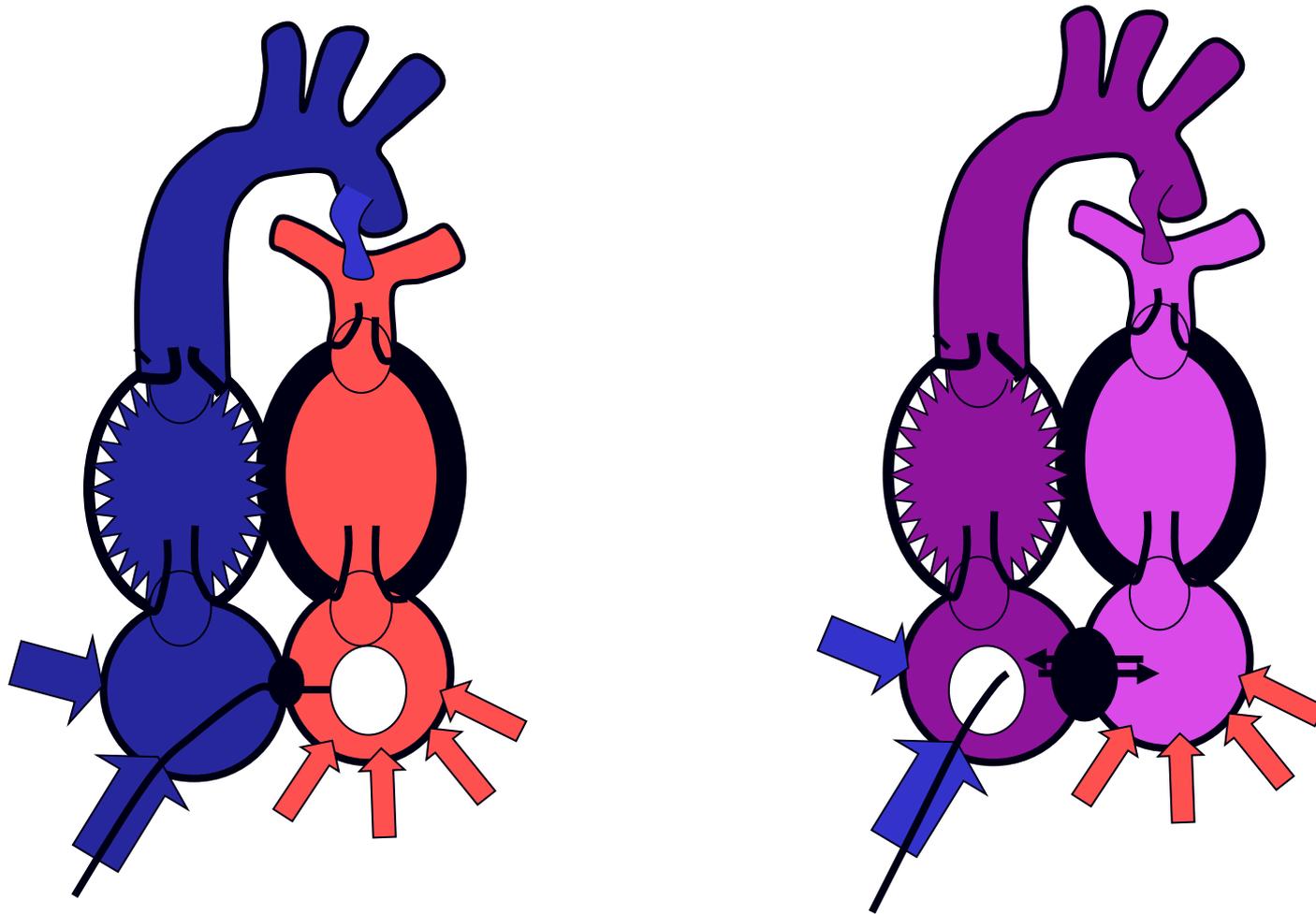
Manœuvre de Rashkind (1966)



Manœuvre de Rashkind : sous scopie ou écho



Rashkind: effet hémodynamique immédiat



Procédure réalisée dans 70% à la naissance ou dans les premiers jours

Preoperative Brain Injury in Transposition of the Great Arteries Is Associated With Oxygenation and Time to Surgery, Not Balloon Atrial Septostomy

N= 26 NN avec switch dont 14 avec Rashkind;
10/26 avaient une leucomalacie préopératoire

Petit et al. Circ 2009

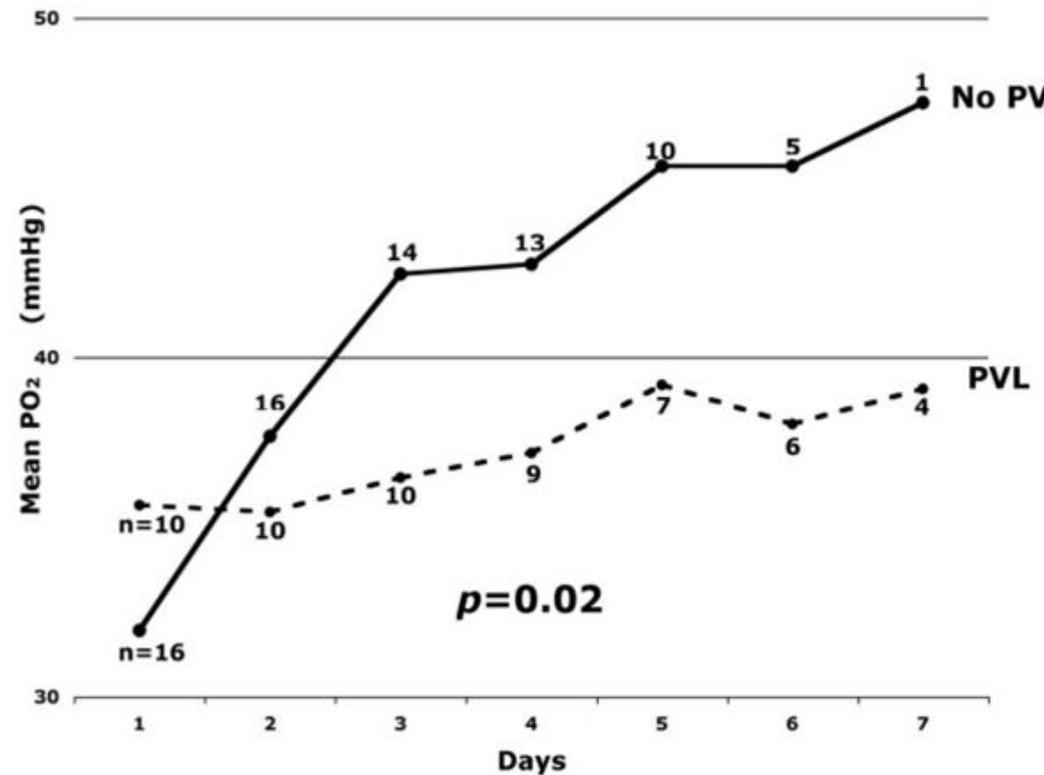
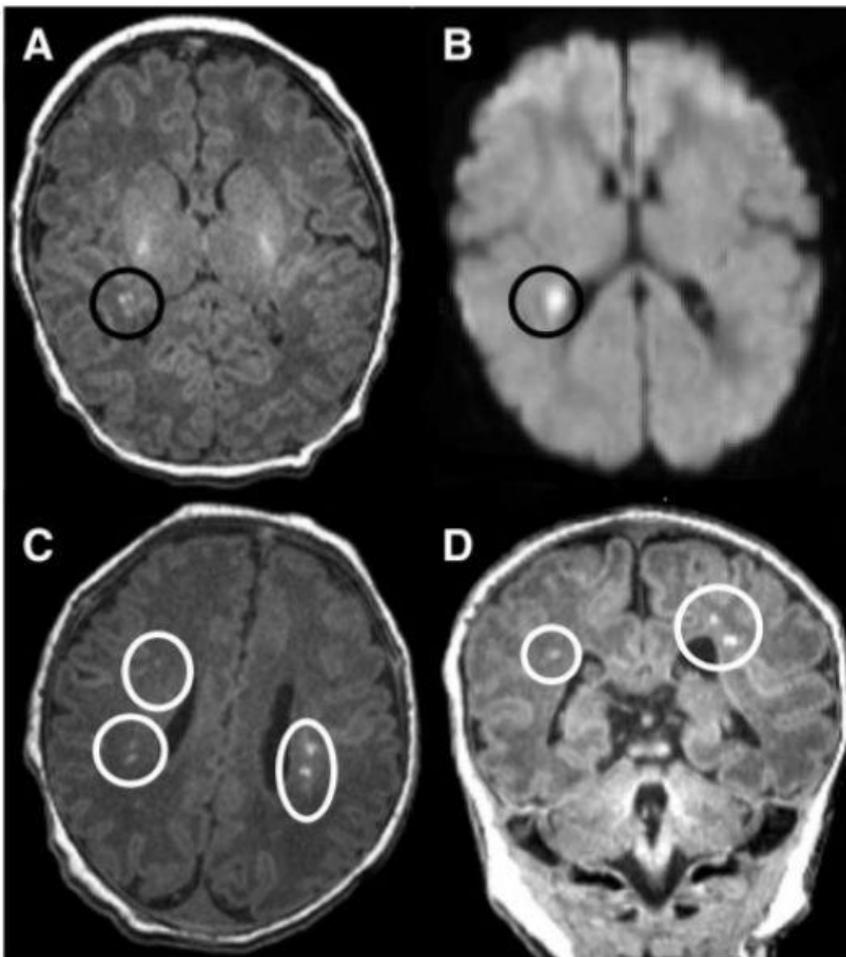


Figure 3. A daily mean P_{O_2} was calculated for the PVL and no-PVL groups. Repeated-measures ANOVA demonstrated a significant difference in mean daily P_{O_2} between the PVL group (dashed line) and the no-PVL group (solid line; $P=0.02$). The PVL group never achieved a mean daily $P_{O_2} >40$ mm Hg.

Check liste écho pré op

- CIA large ou restrictive et CA ouvert ou fermé
- **Equilibre des ventricules**
 - Petit VD : risque de coarctation
 - Petit VG : vérifier la voie pulmonaire
- **Anatomie de la valve mitrale**
 - Fente non commissurale
- **Cardiopathies associées** (CIV, coarctation aortique)
- Valve pulmonaire (futur aortique)
- Discongruence aortopulmonaire ?
- Malalignement commissural ?
- Anatomie des artères coronaires ?

La question du VG depréparé

- < 3 semaines: switch artériel
- > 3 semaines: évaluation forme du VG, présence CA/CIA/CIV, calcul de masse VG
- Deux stratégies
 - Switch avec ECMO postopératoire
 - Préparation du VG: cerclage + Blalock 7-10 jours puis switch
- Masse VG minimale : > 35 g/m² calculée en

TM

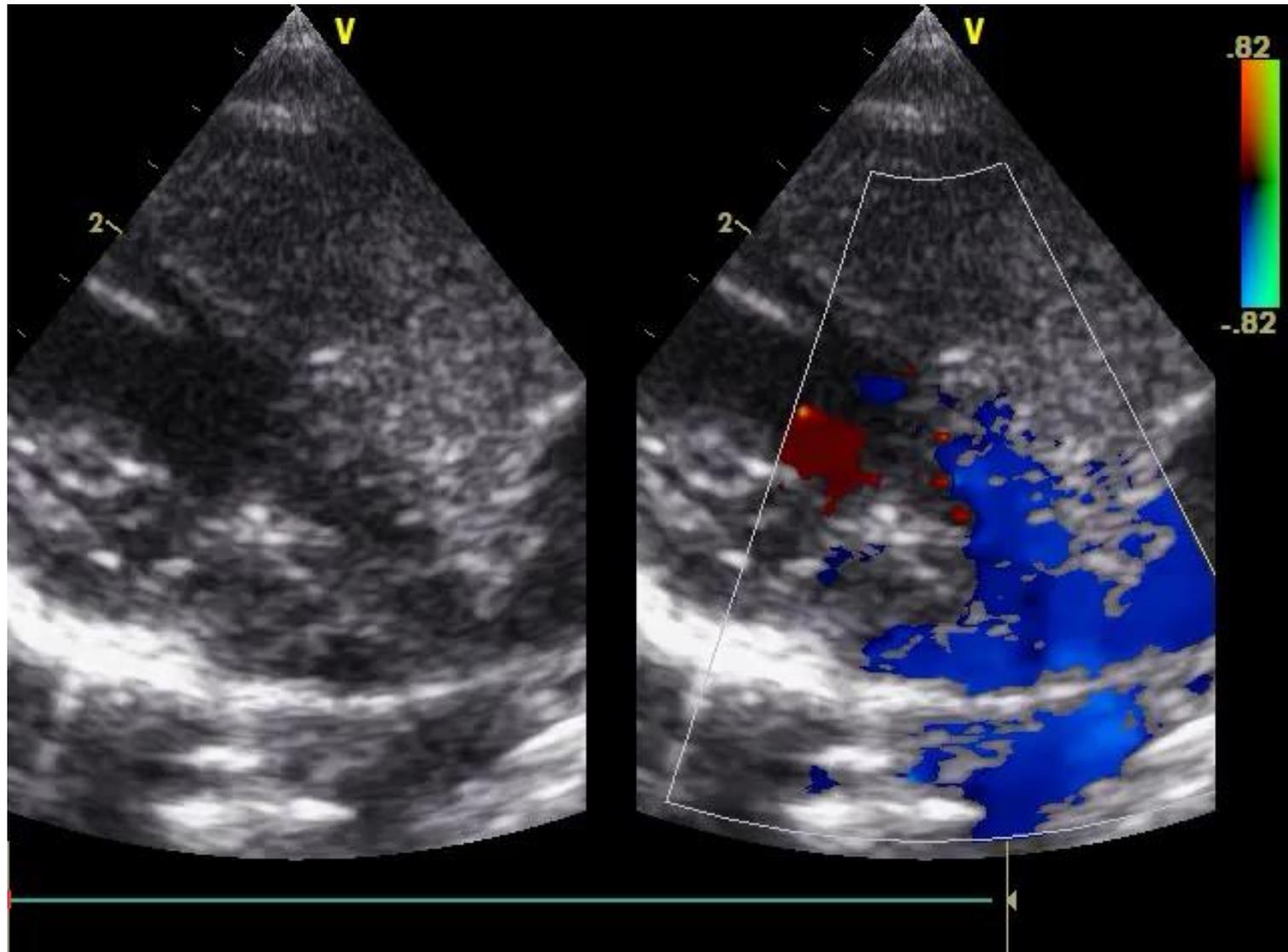
Table 1

$$\text{LV Mass (ASE)} = 1.04 * (\text{LVED d} + \text{LVPW d} + \text{IVS d})^3 - \text{LVED d}^{3a}$$

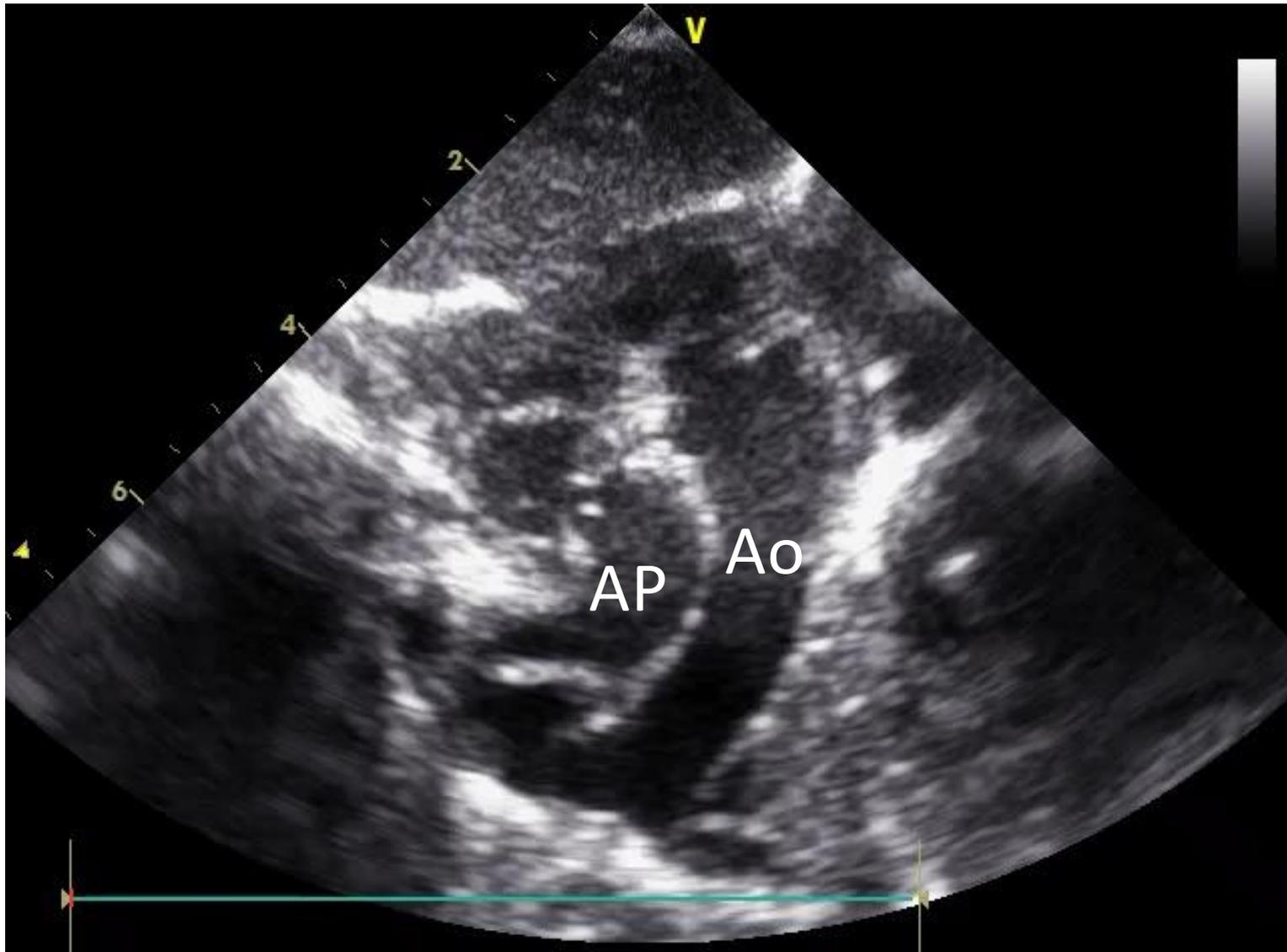
$$\text{Indexed LV Mass (G/m}^2\text{)} = [0.8 * (\text{LV Mass}) \text{ to } 0.6] / \text{BSA}$$

^a LVED d, left ventricle end diastolic diameter; LVPW d, left ventricle posterior wall thickness; IVS d, left ventricle interventricular thickness; ASE, American Society of Echography.

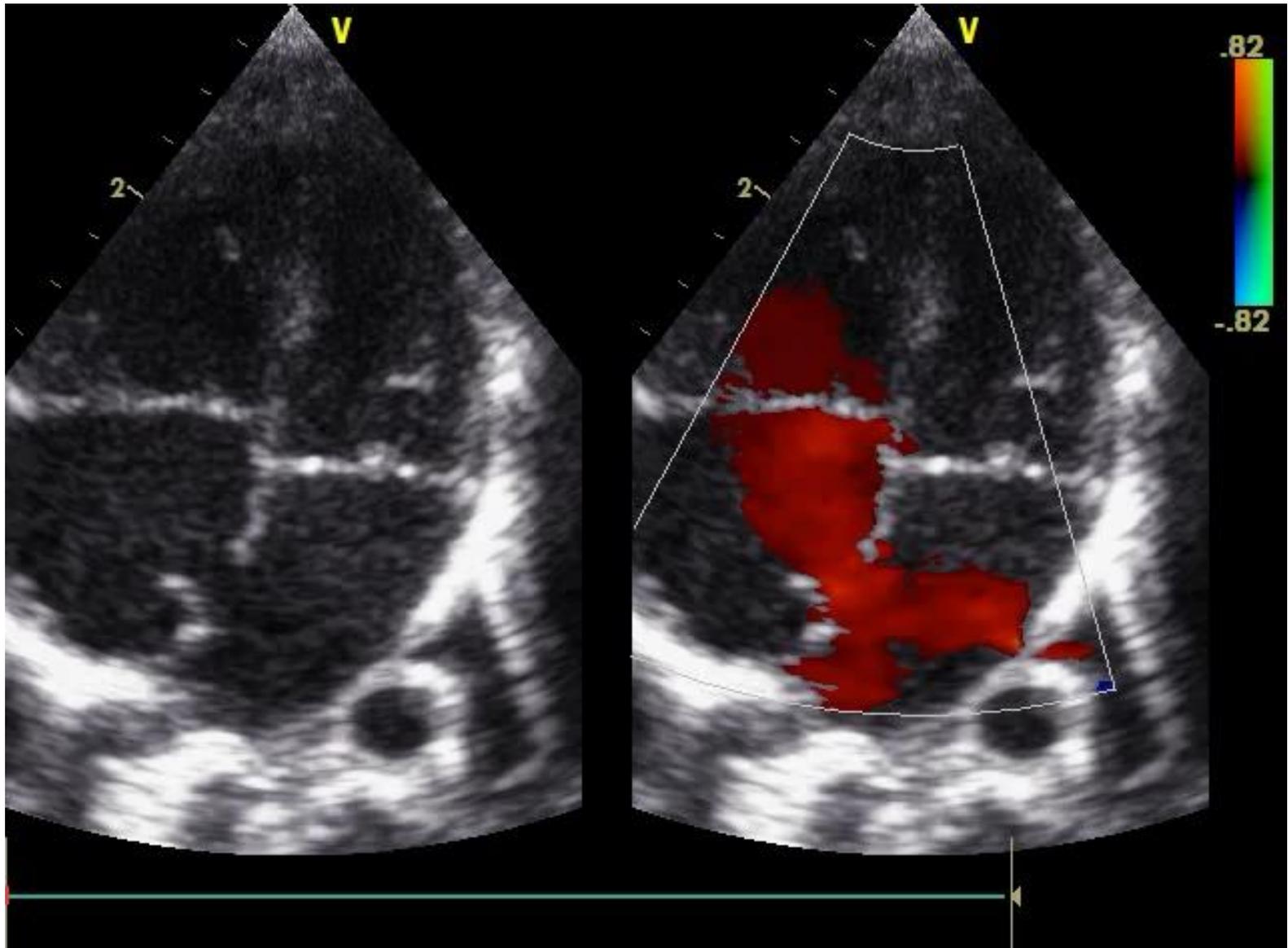
Vaisseaux parallèles: grand axe



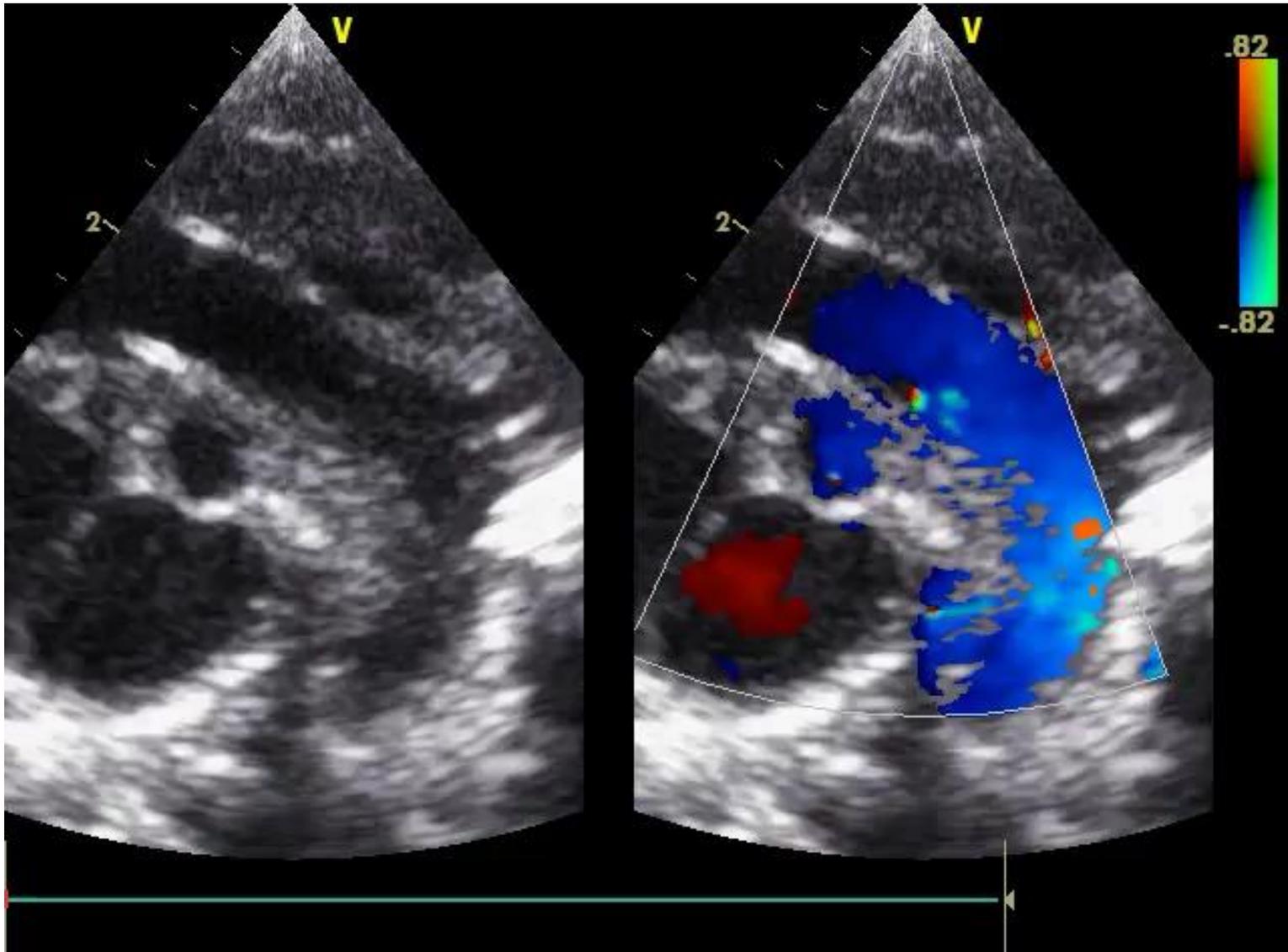
TGV en souscostal: vaisseaux parallèles



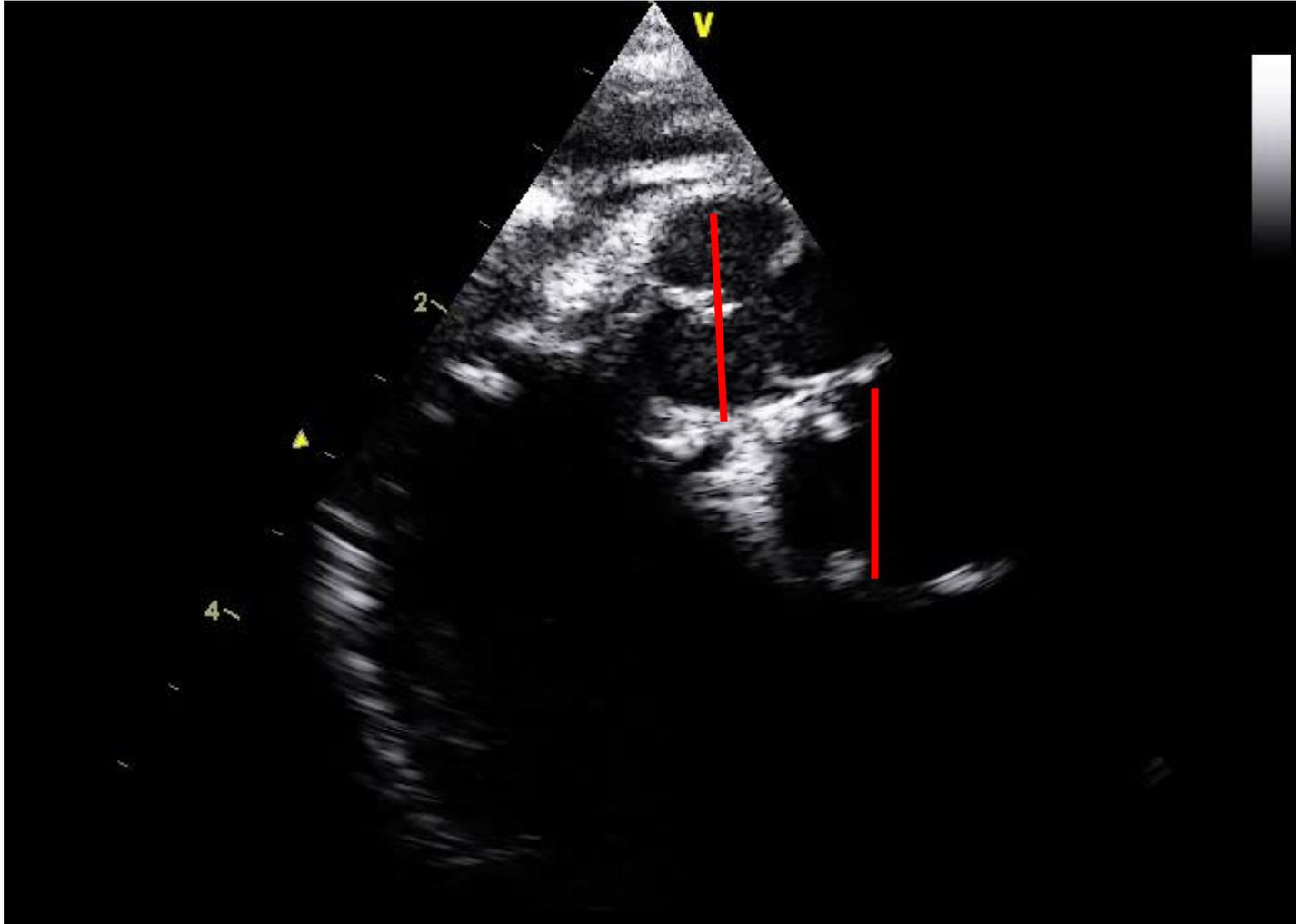
CIA post-RSK



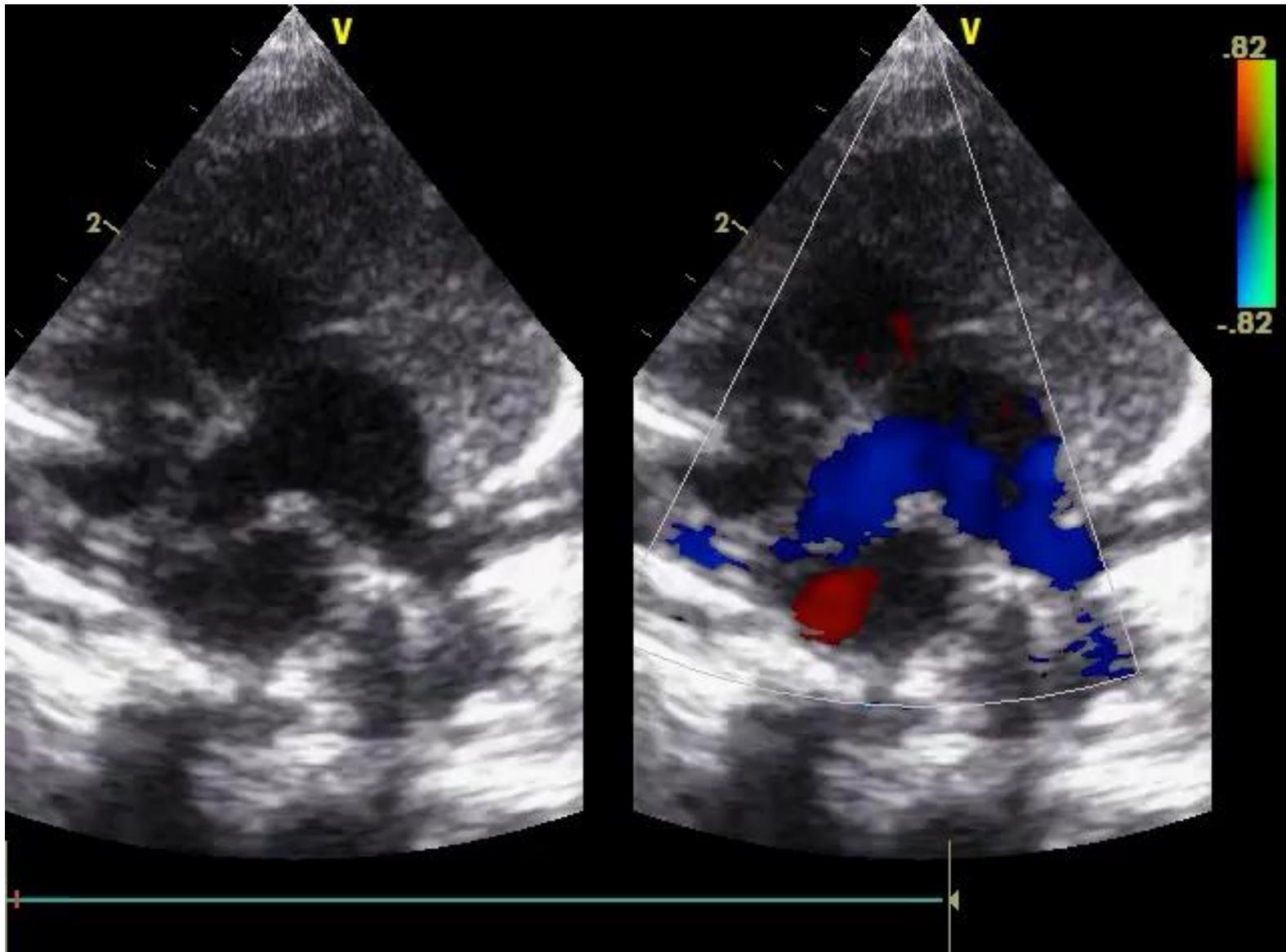
Canal artériel



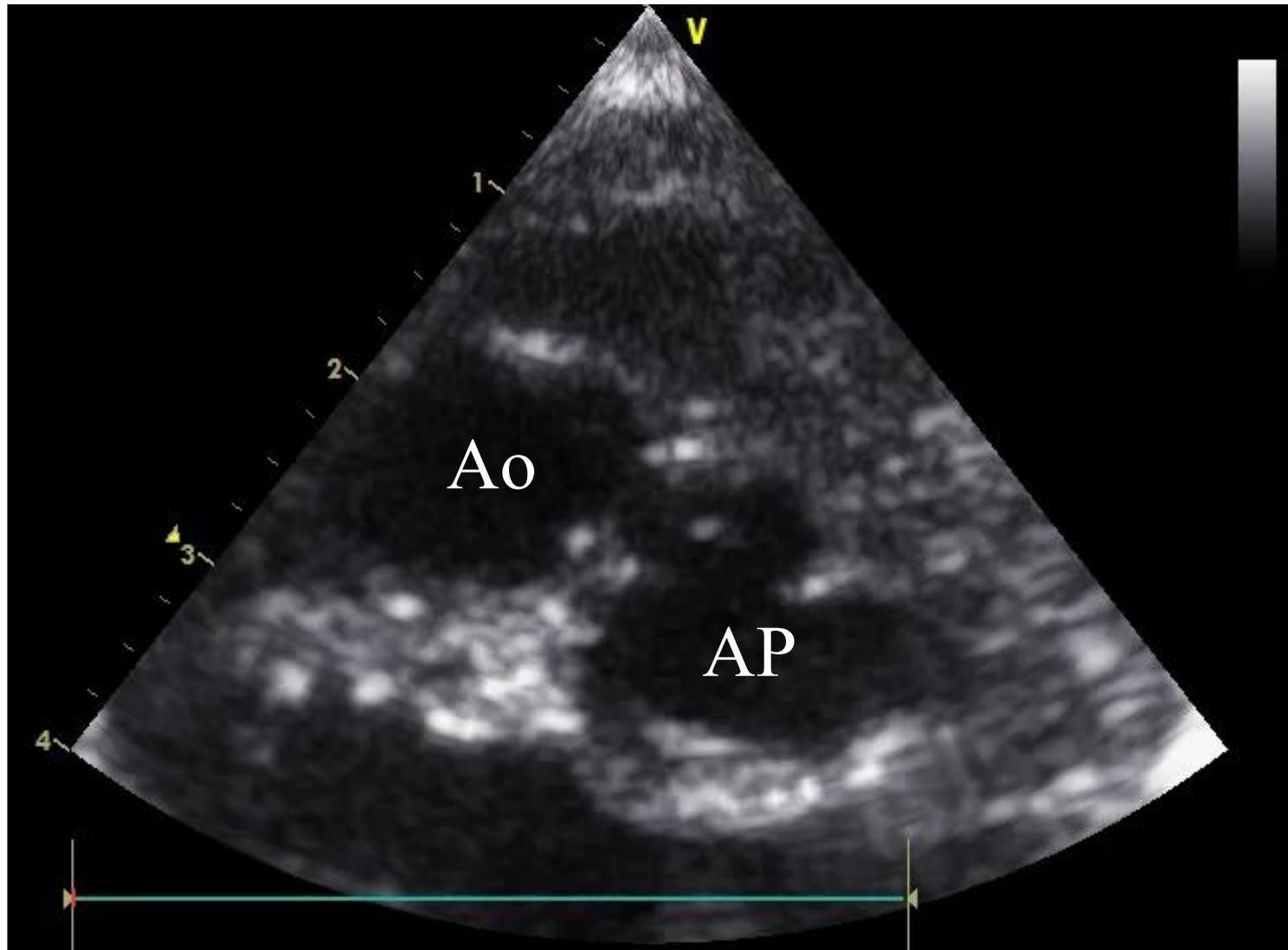
Congruence aortopulmonaire



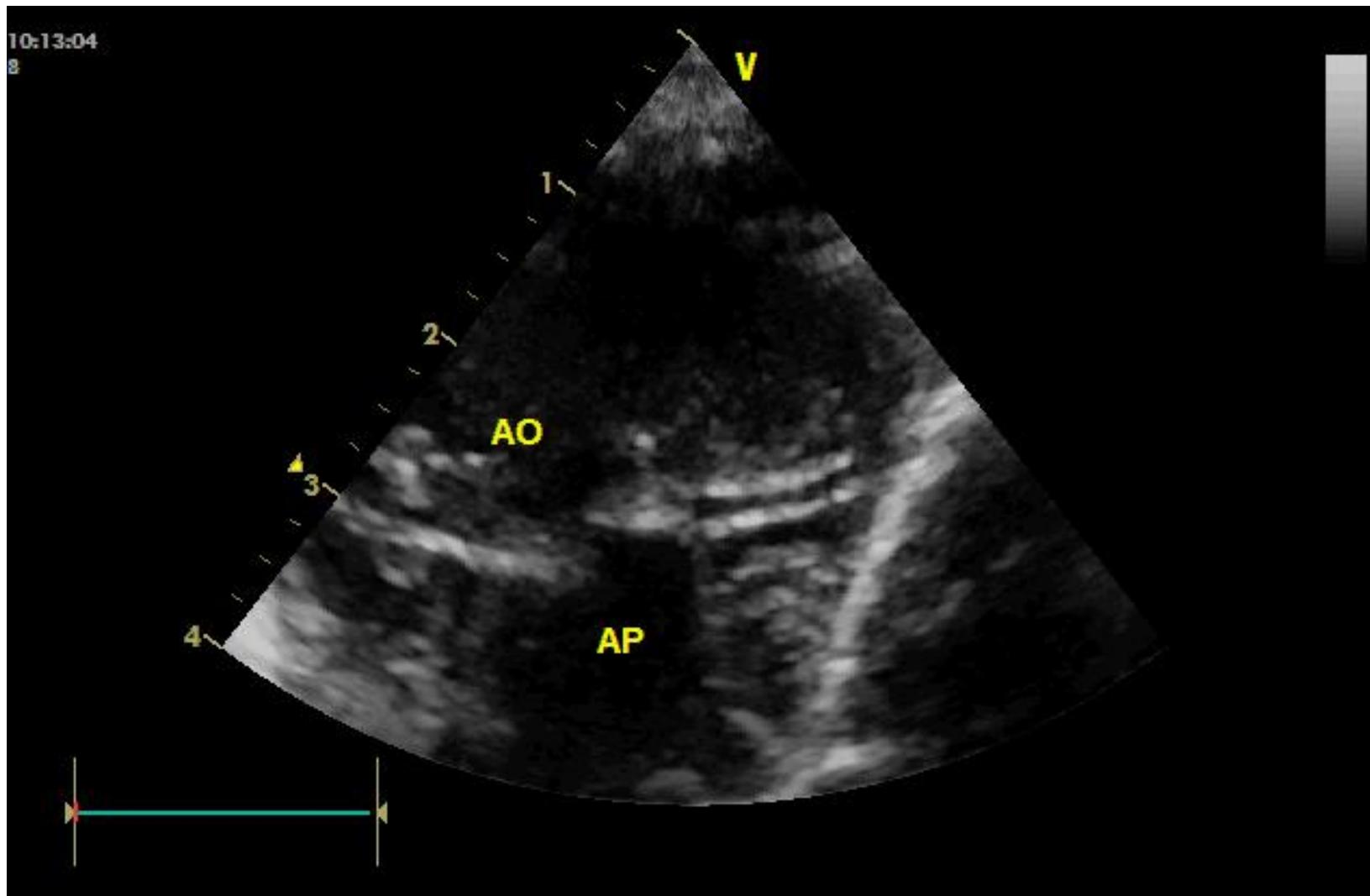
Position en D-TGV: aorte ant/AP post



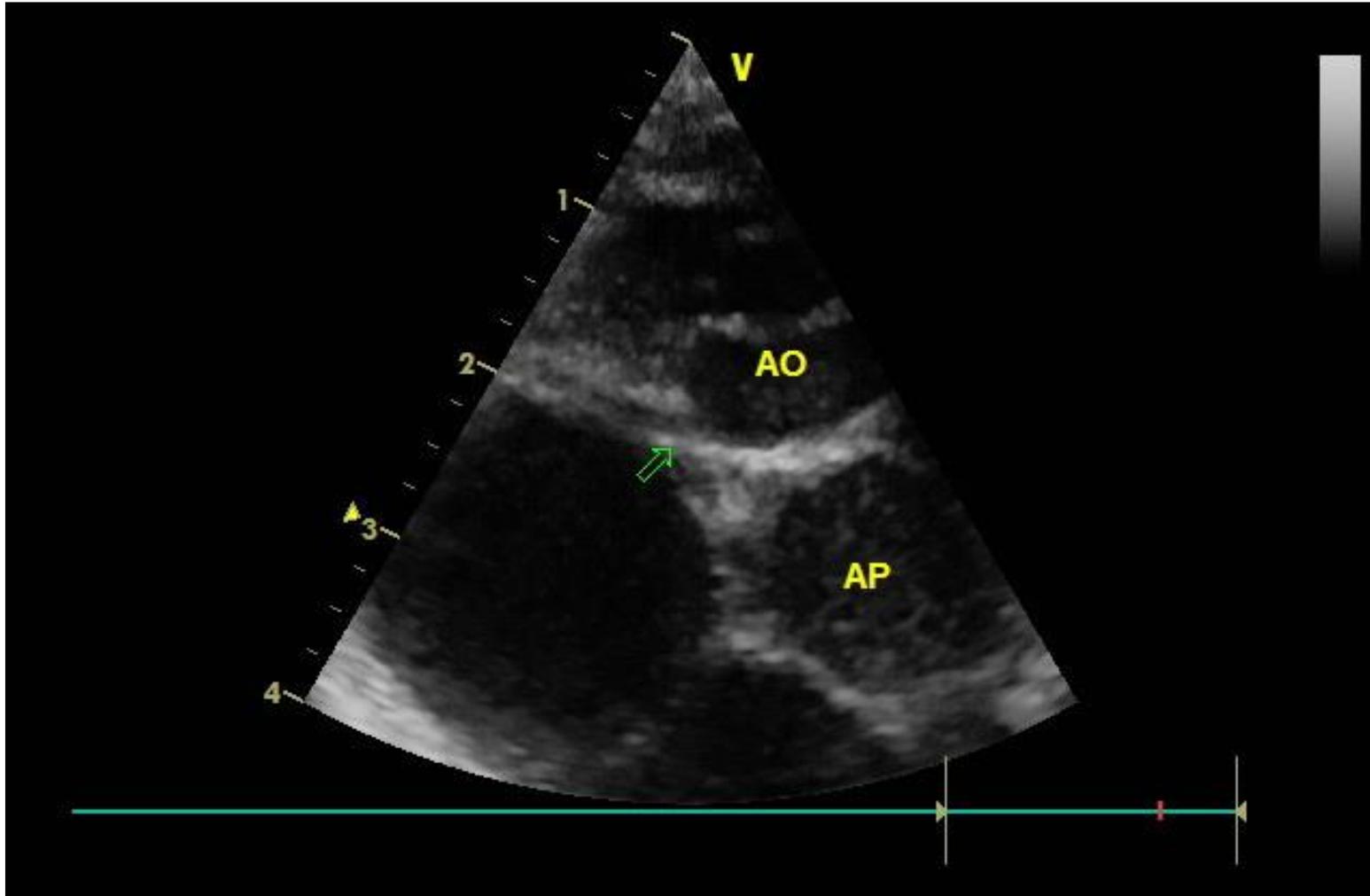
Alignement commissural



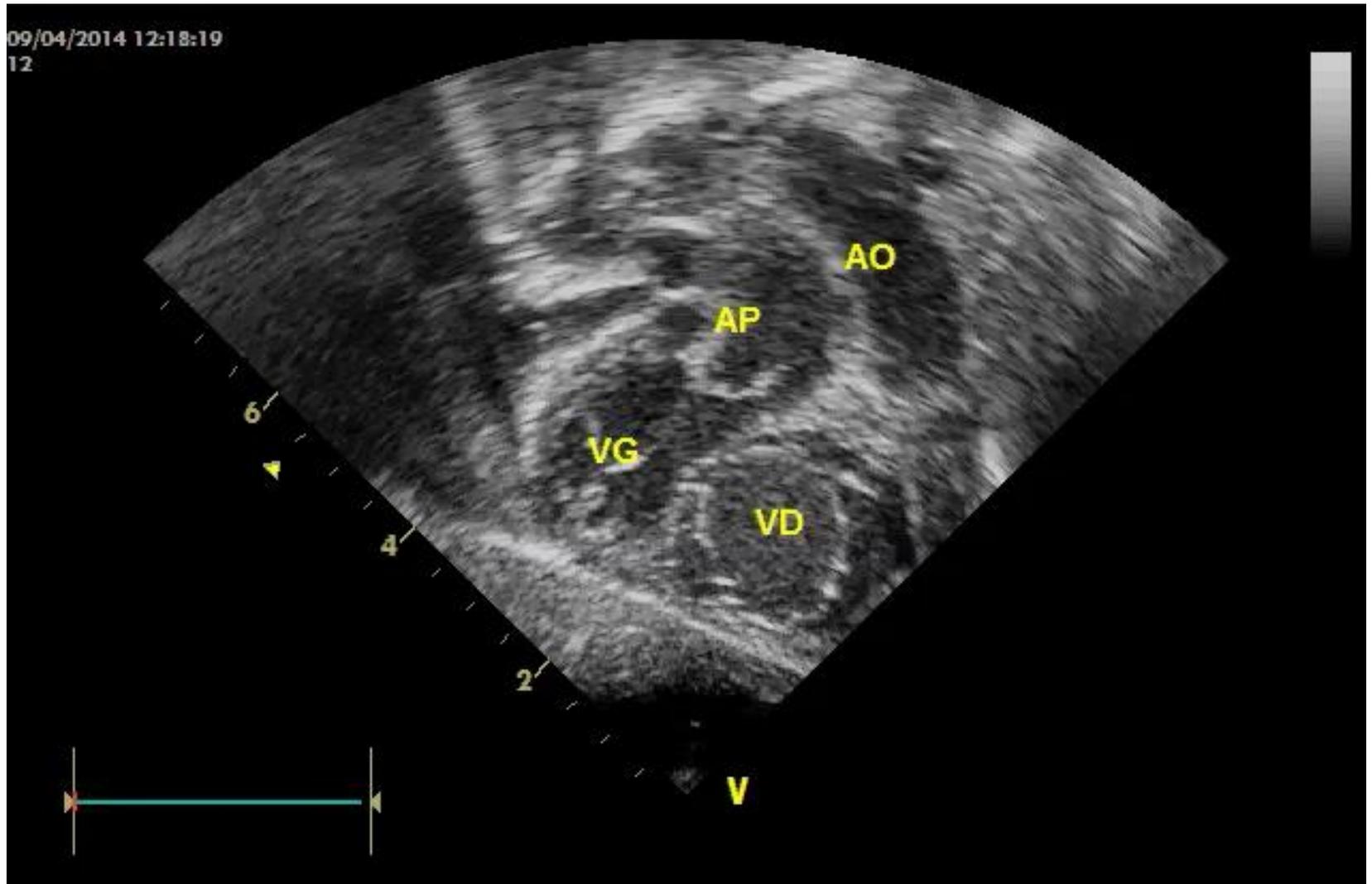
Coronaires Type A: CG



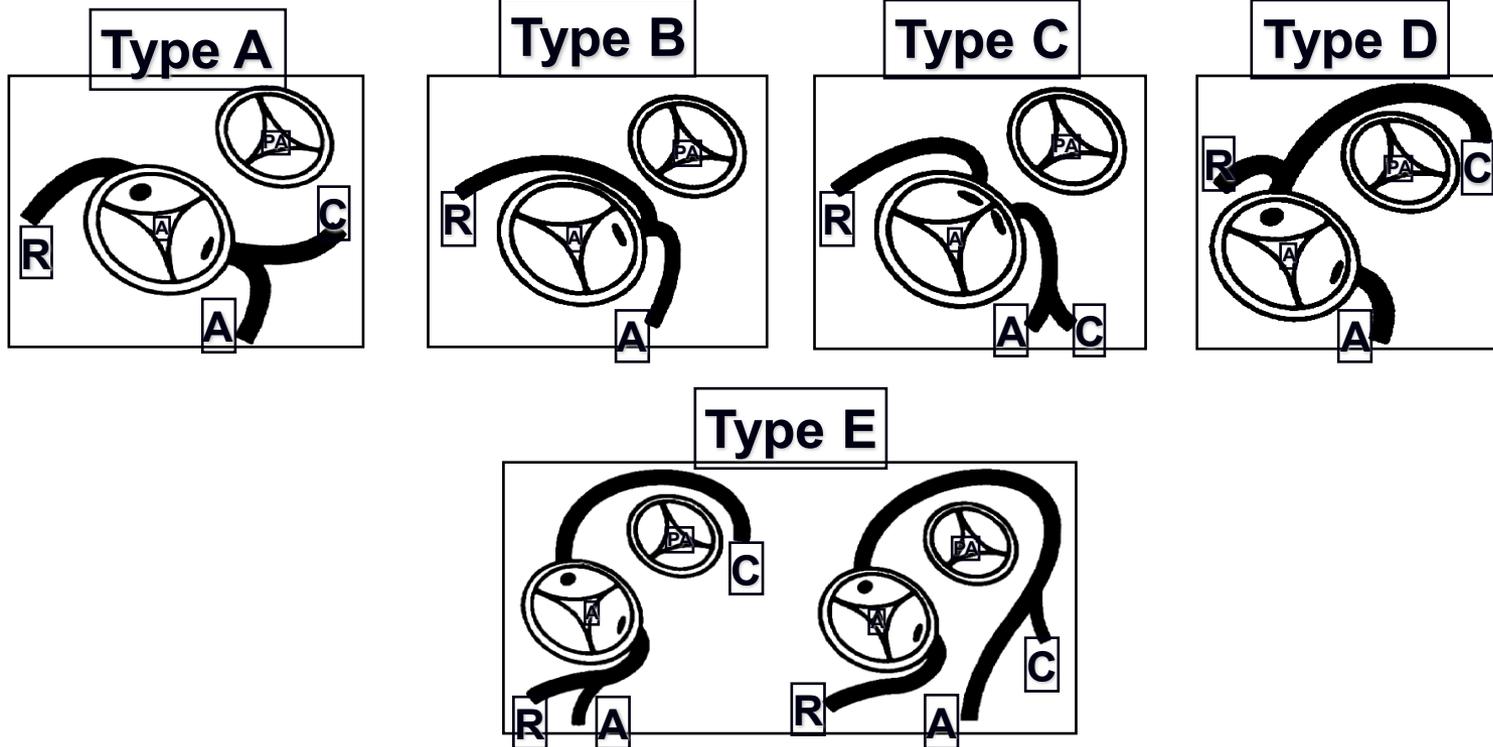
Coronaires Type A: CD



TGV avec CIV d'outlet



Classification de Yacoub



Habituel

Circonflexe
de l'ACD

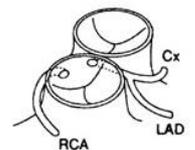
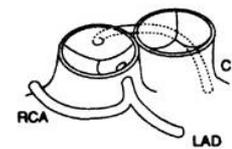
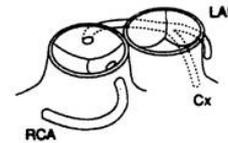
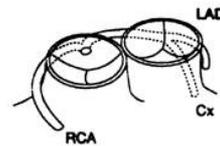
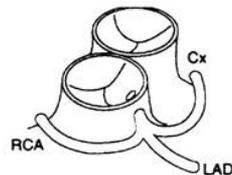
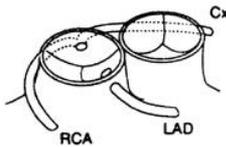
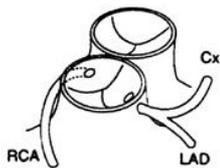
ACG
unique

ACD
unique

Inversée

ACD inversée
et circonflexe

Coronaires
Intramurales



66,9%

16,1%

1,7%

3,9%

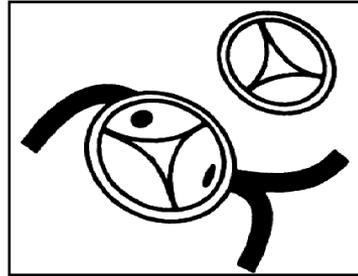
2,4%

4,2%

3,2%

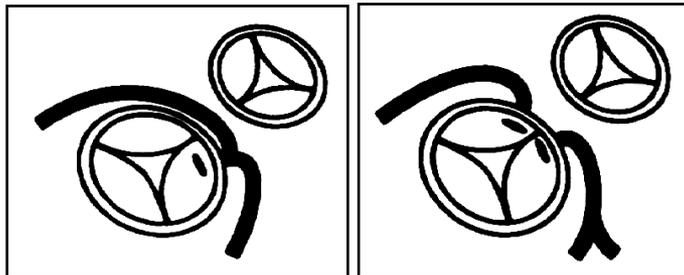
Anatomie coronaire

- « normale » : 60%



- boucle antérieure et/ou postérieure : 35%

- entre gros vaisseaux (intramurale) : 5%



Les lésions coronaires après switch artériel

Comment les détecter?

ECG et échographie (IM!!!)

Coroscanner si signe d'ischémie

Coronarographie si doute

Test d'ischémie (scintigraphie)

Coroscanner systématique à 5 ans

Que faire ?

Rappeler votre chirurgien...

Devenir

Mortalité précoce postopératoire

- TGV simple: 1-5%
- TGV + CIV: 3-6%
- TGV+CIV+ Coa: 6-10%

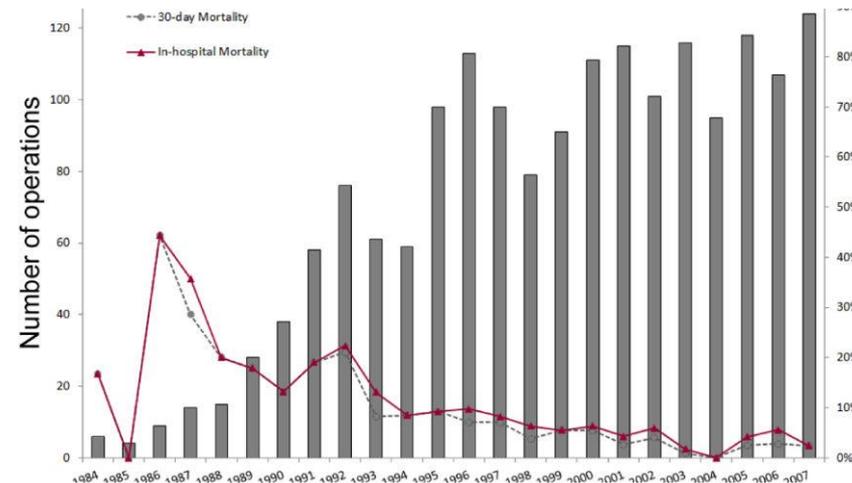
FdR de décès:
Anatomie coronaire
complexe

TABLE 2

Outcome and predictors of early mortality of patients who switch operation for TGA with IVS publications during the last decade.

Author, year	Inclusive years	n	% IVS	Early Survival For TGA IVS %	5 Year Survival%	10 Year Survival%	Coronary anatomic risk factors	Other predictors of early mortality
Sarris, 2006*	1998–2000	613	70	97	NA	NA	Single coronary (univariate analysis only)	Open sternum
Lalezari, 2011	1977–2007	332	60.8	88.6	85.8 [†]	85.2 [†]	Not a risk factor for early mortality	Technical problems with coronary transfer
Fricke, 2012	1983–2009	618	64	98.2	98	97	Not a risk factor for early mortality	Weight < 2.5 kg ECMO
Khairy, 2013	1983–1999	400	59.5	93.5 [†]	NA	92.7 [†]	Single right coronary artery	Postoperative heart failure
Cain, 2014	2000–2011	70	100	98.6	NA	NA	None identified	No predictors of early mortality but earlier repair < 4 days of age was associated with decrease resource utilization
Anderson, 2014	2003–2012	140	75	98.6	NA	NA	None identified	No predictors of early mortality but earlier repair < 4 days of age was associated with decrease resource utilization

Fricke et al. 2012
Villafane JACC 2014



Villafane JACC 2014

Long-term outcomes of the arterial switch operation

Long-term outcomes of the arterial switch operation

• 844 patients underwent an arterial switch operation at a single institution

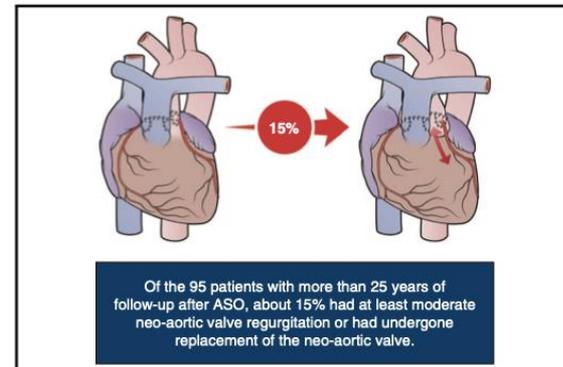
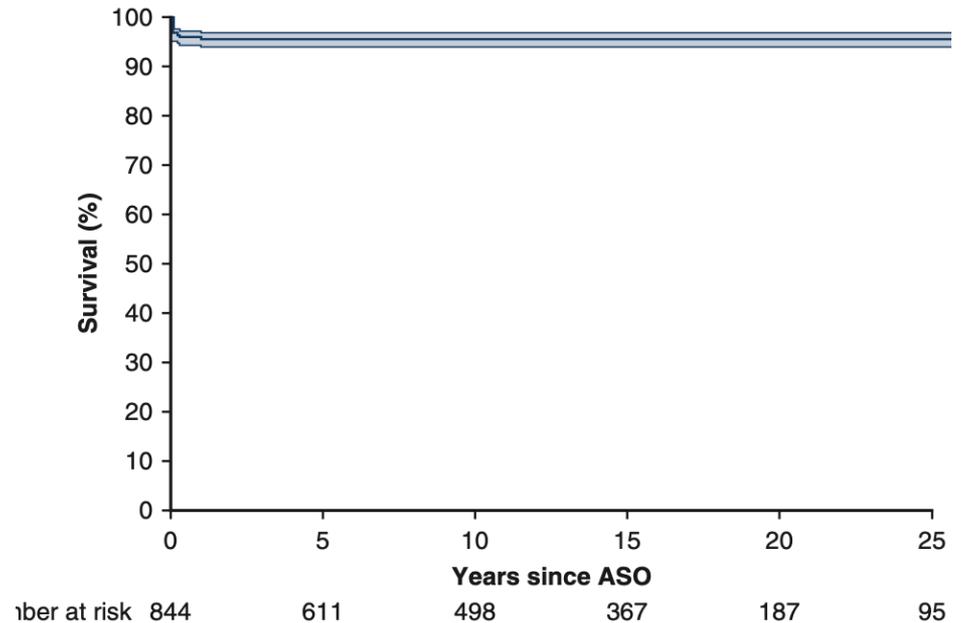
• Retrospective review of medical records

• 3.3% early mortality
• 187 patients with > 20 years of follow-up
• 95 patients with > 25 years of follow-up

• 95% survival at 25 years
• 77% freedom from reintervention at 25 years

• 15% of patients had moderate neo-aortic valve regurgitation or required neo-aortic valve replacement after 25 years

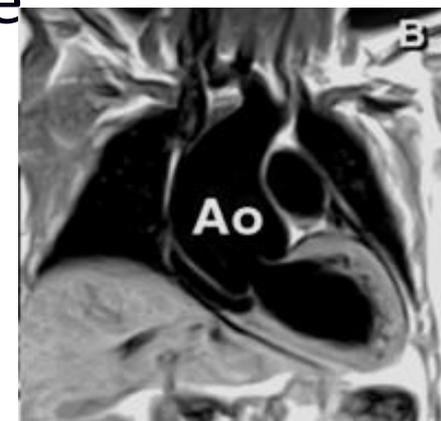
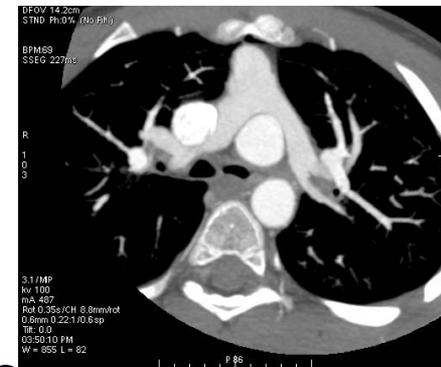
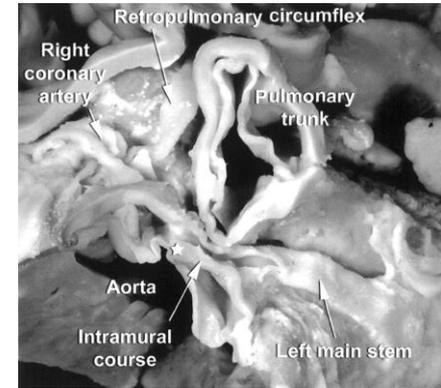
8% remplacement valve aortique
6% IAO modérée



Excellent long-term survival after the ASO is demonstrated.

Morbidité du switch artériel

- **Coronaires**
 - Coronaire intra-murale
 - Coronaire unique
- Voie droite (patch et Lecompte)
- IA sur néo-valve aortique, dilation Ao
- **HTAP primitive:**
 - 1/200 TGV soit 100 fois plus fréquente que dans la population générale
 - Étiologie inconnue
 - Traitement médical.....Potts



Cardiovascular Outcomes After the Arterial Switch Operation for D-Transposition of the Great Arteries

Paul Khairy, MD, PhD; Mathieu Clair, MD; Susan M. Fernandes, MHP, PA-C;
Elizabeth D. Blume, MD; Andrew J. Powell, MD; Jane W. Newburger, MD, MPH;
Michael J. Landzberg, MD; John E. Mayer Jr, MD

Functional capacity

New York Heart Association functional class, n (%)

Class I	290 (97.3)
Class II	8 (2.7)
Class III or IV	0 (0)
Peak heart rate, bpm	180±18
Peak percent heart rate predicted, %	90.7±7.0
Heart rate reserve, bpm	101±21
Chronotropic index, %	83.9±10.9
Respiratory exchange ratio (RER)	1.16±0.09
Peak oxygen uptake, mL/kg/min	35.1±7.6
Percent maximum predicted peak oxygen uptake, %	86.1±15.1

Recognized comorbidities

Coronary artery disease, n (%)	19 (5.2)
Hypertension, n (%)	12 (3.3)
Pulmonary stenosis	
Present, n (%)	171 (62.2)
Gradient in patients with pulmonary stenosis, mm Hg	25±17
At least moderate pulmonary stenosis, n (%)	28 (10.3)
Neoaortic stenosis	
Present, n (%)	37 (11.9)
Gradient in patients with neoaortic stenosis, mm Hg	19±7
At least moderate aortic stenosis, n (%)	10 (3.2)

Left ventricular function and exercise capacity after arterial switch operation for transposition of the great arteries: a systematic review and meta-analysis

Conclusion

Analysed eligible studies showed a reduced exercise capacity and a preserved left ventricular ejection fraction in the long term after an arterial switch operation for transposition of the great arteries.

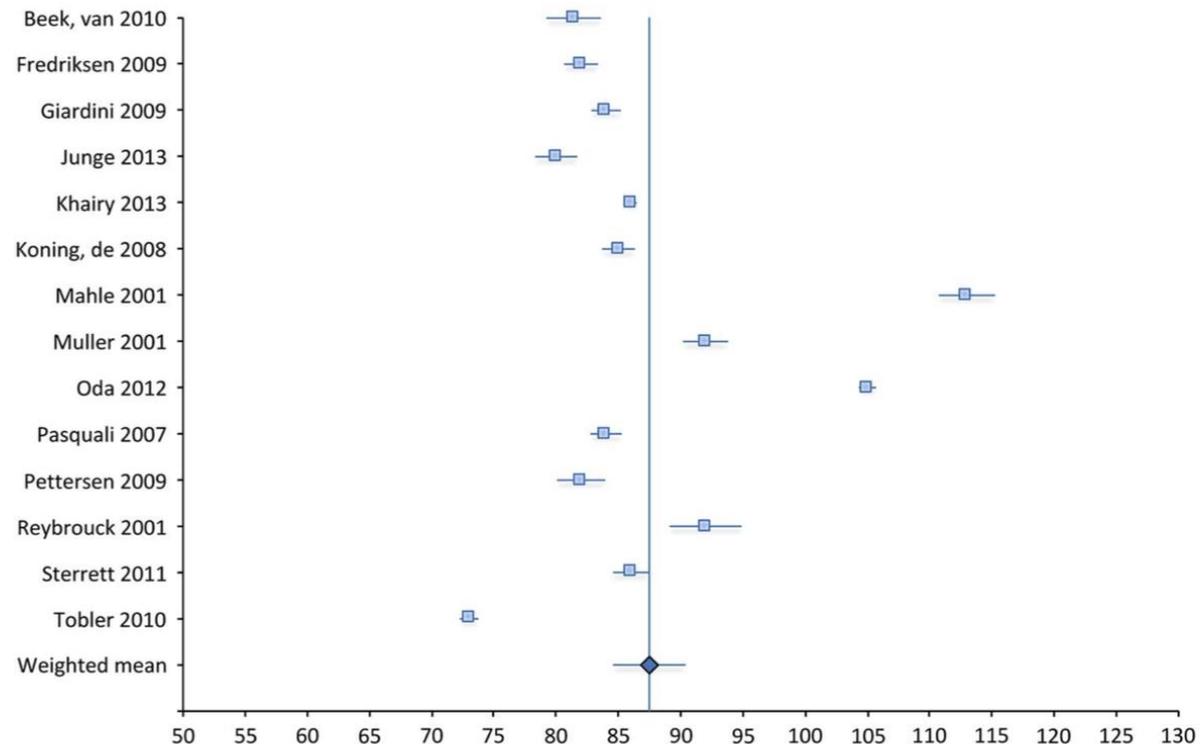


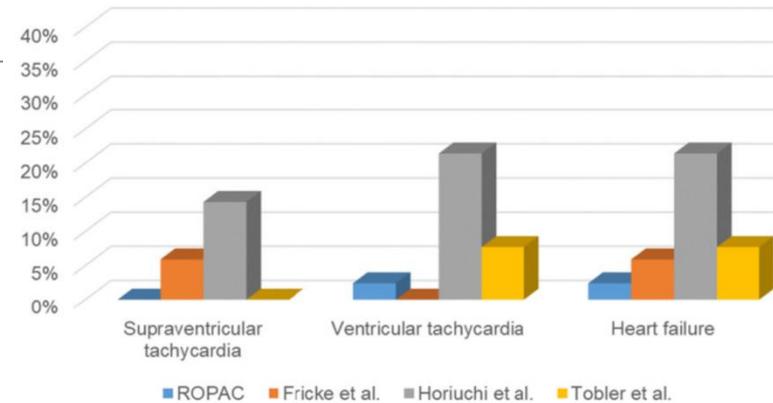
Figure 3. Meta-analysis of peak oxygen uptake (% of predicted).

Pregnancy Outcomes in Women After Arterial Switch Operation for Transposition of the Great Arteries: Results From ROPAC

Maternal Outcomes of Pregnancy

Outcome	TGA After Arterial Switch (n=41)	Other ROPAC (n=5698)	P Value
Maternal mortality \leq 6 mo postpartum	0 (0)	40 (0.7)	0.590
Hospital admission for a cardiac reason	1 (2.4)	757 (13.3)	0.041
Heart failure	1 (2.4)	654 (11.5)	0.070
Supraventricular tachycardia	0 (0)	95 (1.7)	0.404
Ventricular tachycardia	1 (2.4)	89 (1.6)	0.652
Thromboembolic events	0 (0)	87 (1.5)	0.425
Endocarditis	0 (0)	33 (0.6)	0.625
Acute coronary syndrome	0 (0)	24 (0.4)	0.677

Figure 3



CLINICAL PERSPECTIVE

What Is New?

- Women after arterial switch operation for transposition of the great arteries tolerate pregnancy well, on the basis of 41 pregnancies in a prospective worldwide registry.
- In this cohort, there was no maternal mortality, and major adverse cardiovascular events occurred in 4.9%, as heart failure (2.4%) and ventricular tachycardia (2.4%).
- Prematurity (17.1%) was the most important fetal complication, followed by low birth weight (14.6%), but fetal loss occurred in only 2.4%.

Outcome of Pregnancy in Women With D-Transposition of the Great Arteries: A Systematic Review

Jena Pizula, MD; Justin Devera, MD; Tien M. H. Ng ^{id}, Pharm.D; Samantha L. Yeung, Pharm.D; Jenica Thangathurai, MD; Nichole Herrick, MD; Amy J. Chatfield, MLS; Anil Mehra, MD; Uri Elkayam ^{id}, MD

D-TGA

Atrial Switch

Arterial Switch

Low maternal mortality rate- 0.06%

Main adverse events are arrhythmias and heart failure which can be associated with life threatening complications

Deterioration of RV function and degree of TR can occur and persist after delivery

Decreased functional capacity

Thromboembolic complications

High incidence of prematurity

Increased incidence of fetal and neonatal death

No maternal mortality

Arrhythmias are uncommon, mostly benign

Low incidence of heart failure

Very low rates of valvular dysfunction

Rate of premature delivery is comparable to the general pregnant population

Low incidence of fetal loss and no neonatal death

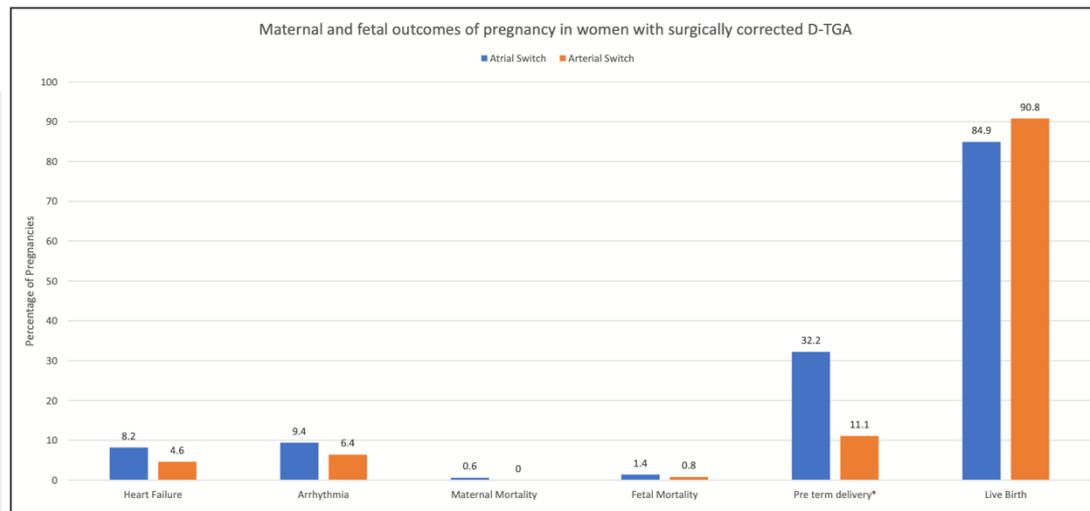


Figure 2. Maternal and fetal outcomes with pregnancy in women with corrected D-transposition of the great arteries (D-TGA).

*Indicates P value < 0.001.

L'enjeu développemental

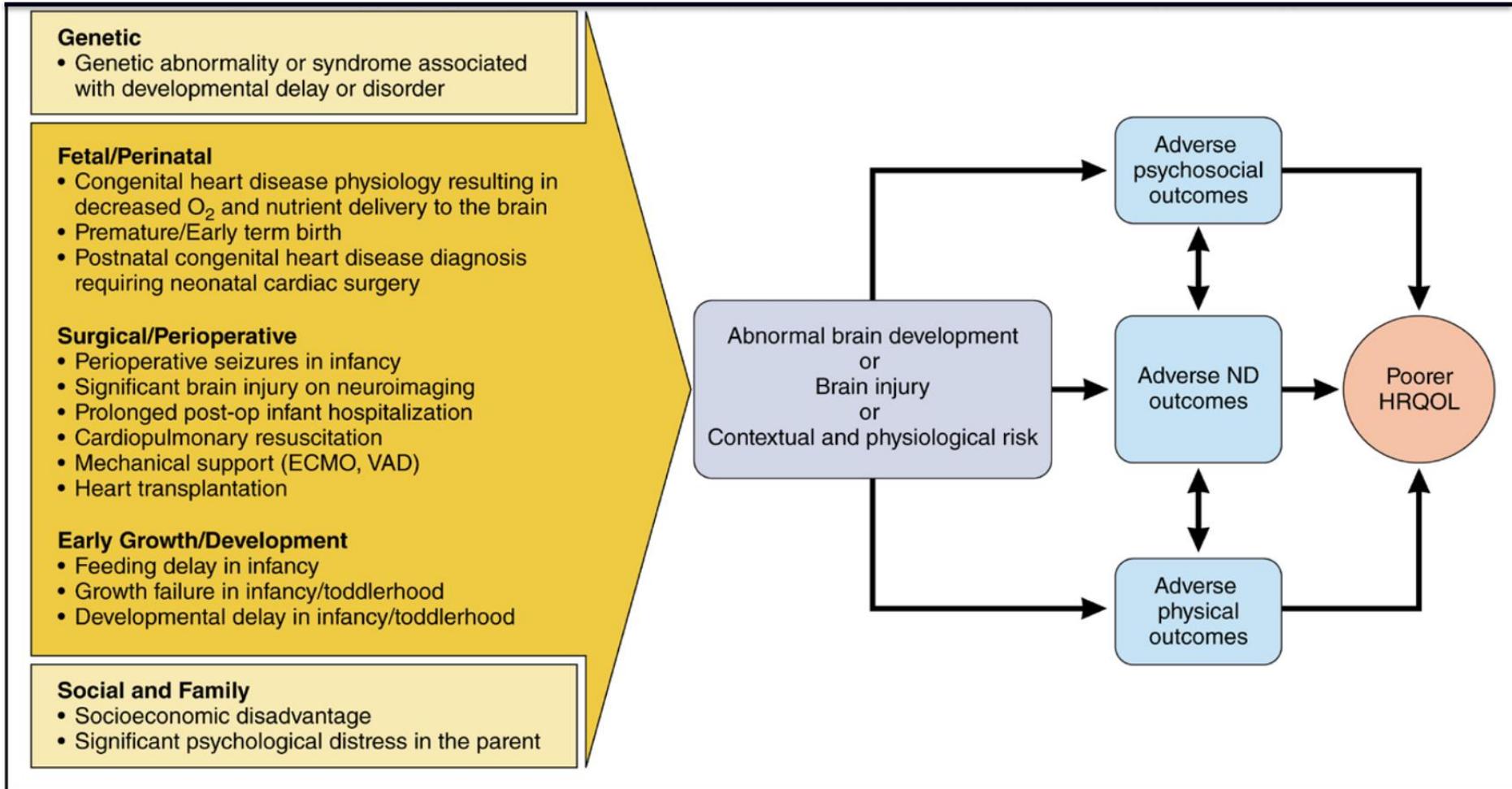
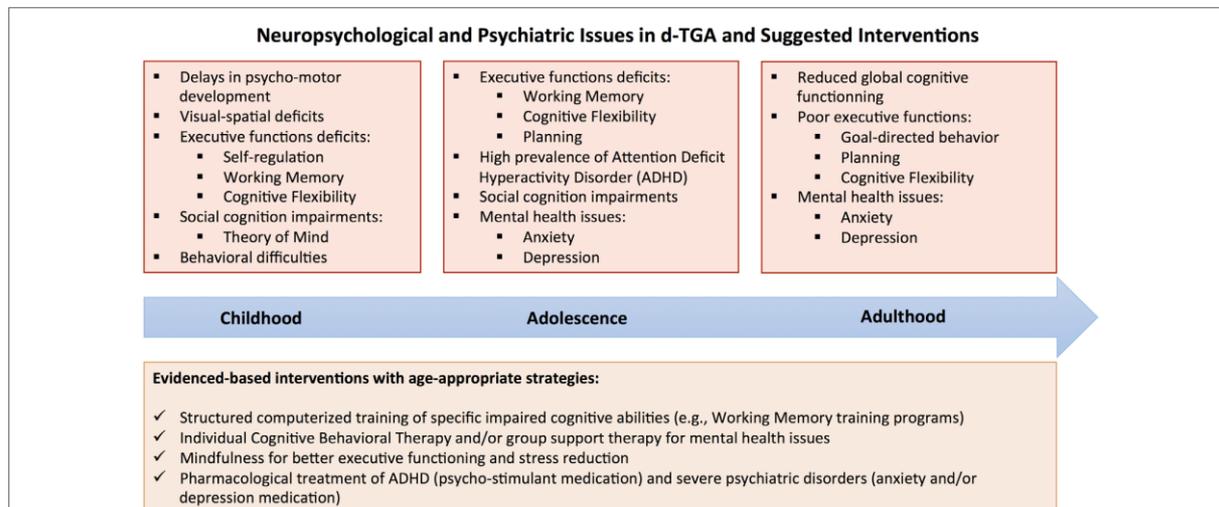


Figure 2. Factors that increase neurodevelopmental risk in individuals with congenital heart disease.

ECMO indicates extracorporeal membrane oxygenation; HRQOL, health-related quality of life; ND, neurodevelopmental; and VAD, ventricular assist device.

Devenir neurodéveloppemental

- TGV= une des cardiopathies le mieux exploré en neuropsychologie
- **Intelligence (sub)normale (IQ-testing)**
- Altération des fonctions cognitives supérieures: « theory of mind », visualisation temporo-spatiale etc.
- ADHS >> population de contrôle



Kalfa et al. 2017
Kasmi et al 2017
Calderon et al. 2010
Calderon et al. 2012
Calderon et al. 2014

FIGURE 1 | Neuropsychological and psychiatric issues in dextro-transposition of the great arteries (d-TGA) by age group and suggested interventions.

Family Socioeconomic Status and Neurodevelopment Among Patients With Dextro-Transposition of the Great Arteries

Adam R. Cassidy, PhD, LP, ABPP; Valerie Rofeberg, MSc; Emily M. Bucholz, MD, PhD; David C. Bellinger, PhD, MSc; David Wypij, PhD; Jane W. Newburger, MD, MPH

Figure 1. Selected Neurodevelopmental Outcomes by Socioeconomic Status (SES) Tertile

