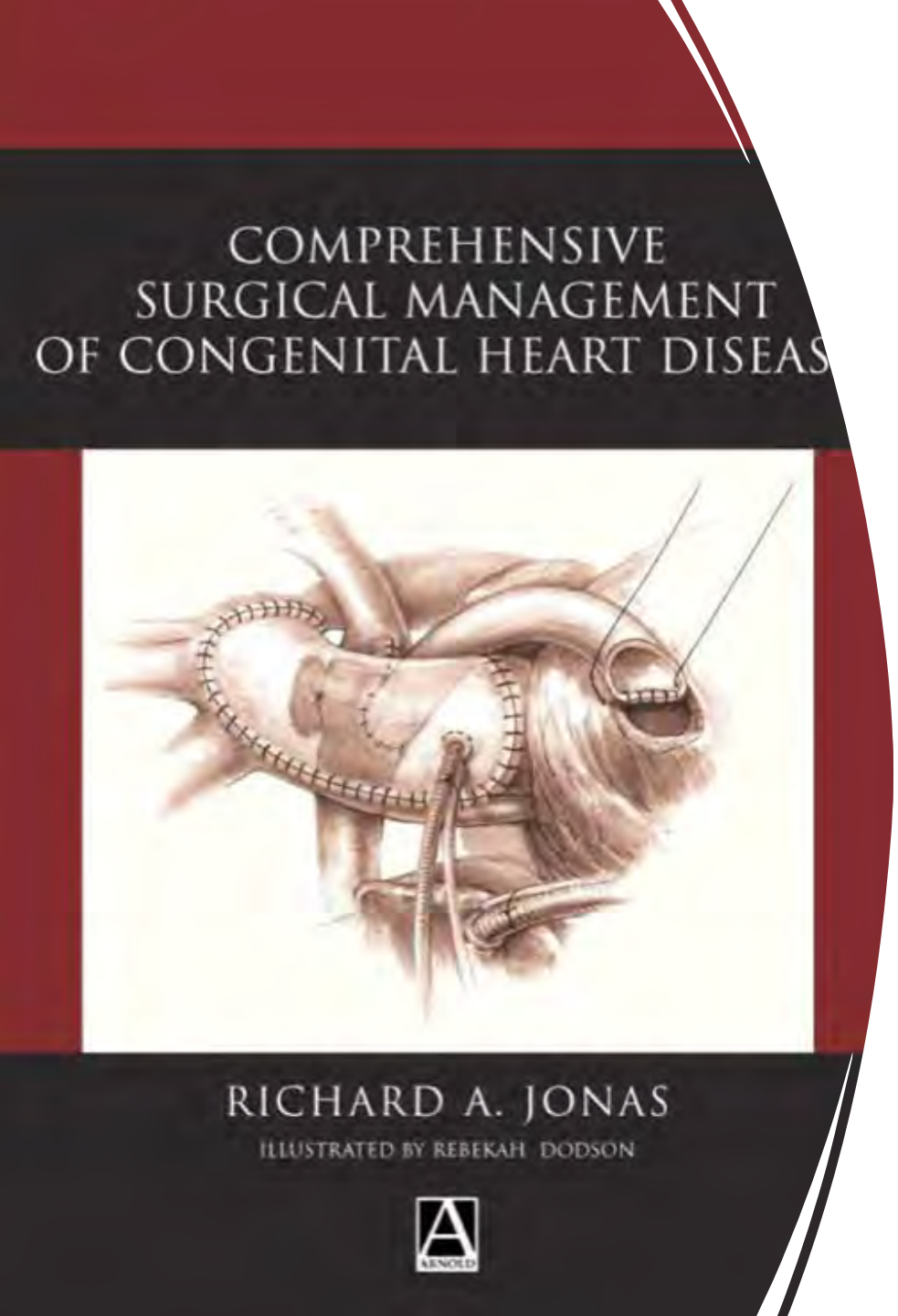
CHIRURGIE CARDIAQUE PEDIATRIQUE

DU de Cardiologie Pédiatrique

Vendredi 26 Janvier 2024

Dr Margaux PONTAILLER



Sommaire

Généralités

Techniques chirurgicales

Spécificités des GUCH

Assistance circulatoire

Transplantation

Cicatrices

Généralités

Voies d’abord

Deux grandes voies

- Sternotomie médiane
- Thoracotomie (droite ou gauche)

Avantages / inconvénients

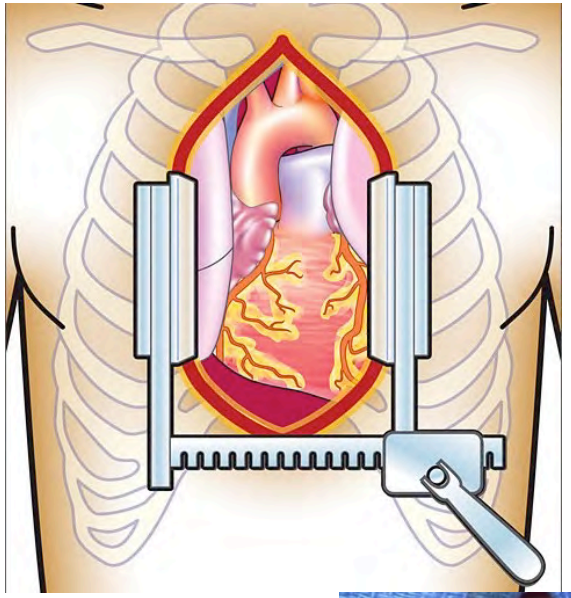
- Types de cardiopathie / chirurgie
- Exposition
- Douleur
- Esthétique

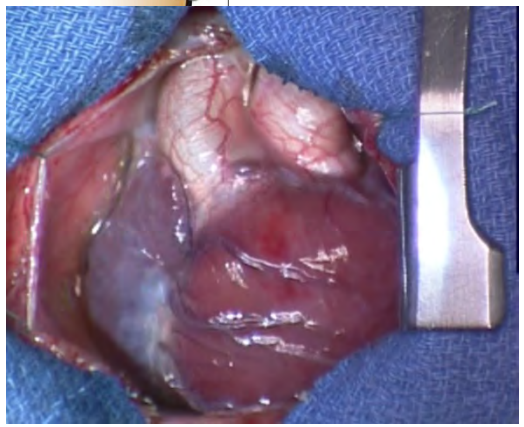
Installation

- Installation décubitus dorsal, billot sous les épaules
- Intubation oro ou naso trachéale
- Scope, saturomètre
- 1 à 2 VVP
- KTA
- KTC
- Sonde urinaire
- Sonde thermique
- Plaque de BE
- Plaques de défibrillateur externe si redux

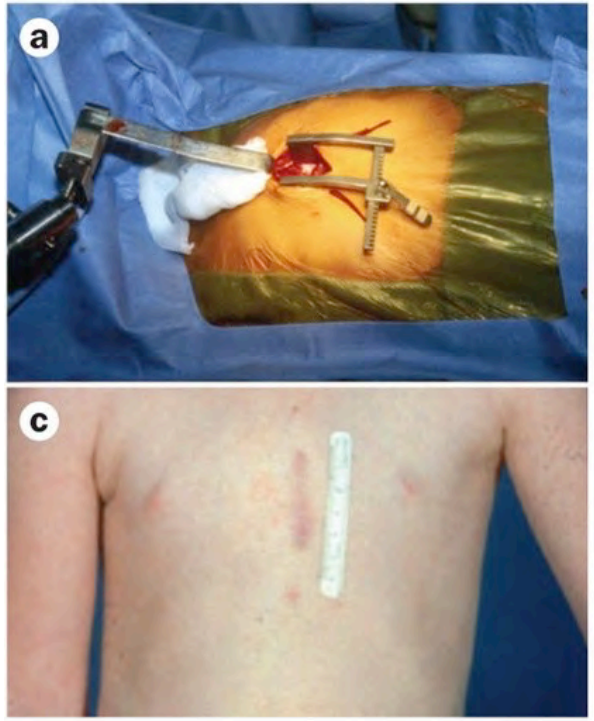
Tout cela sur 0.2 m² de surface corporelle
=
Protection points d'appui

Sternotomie



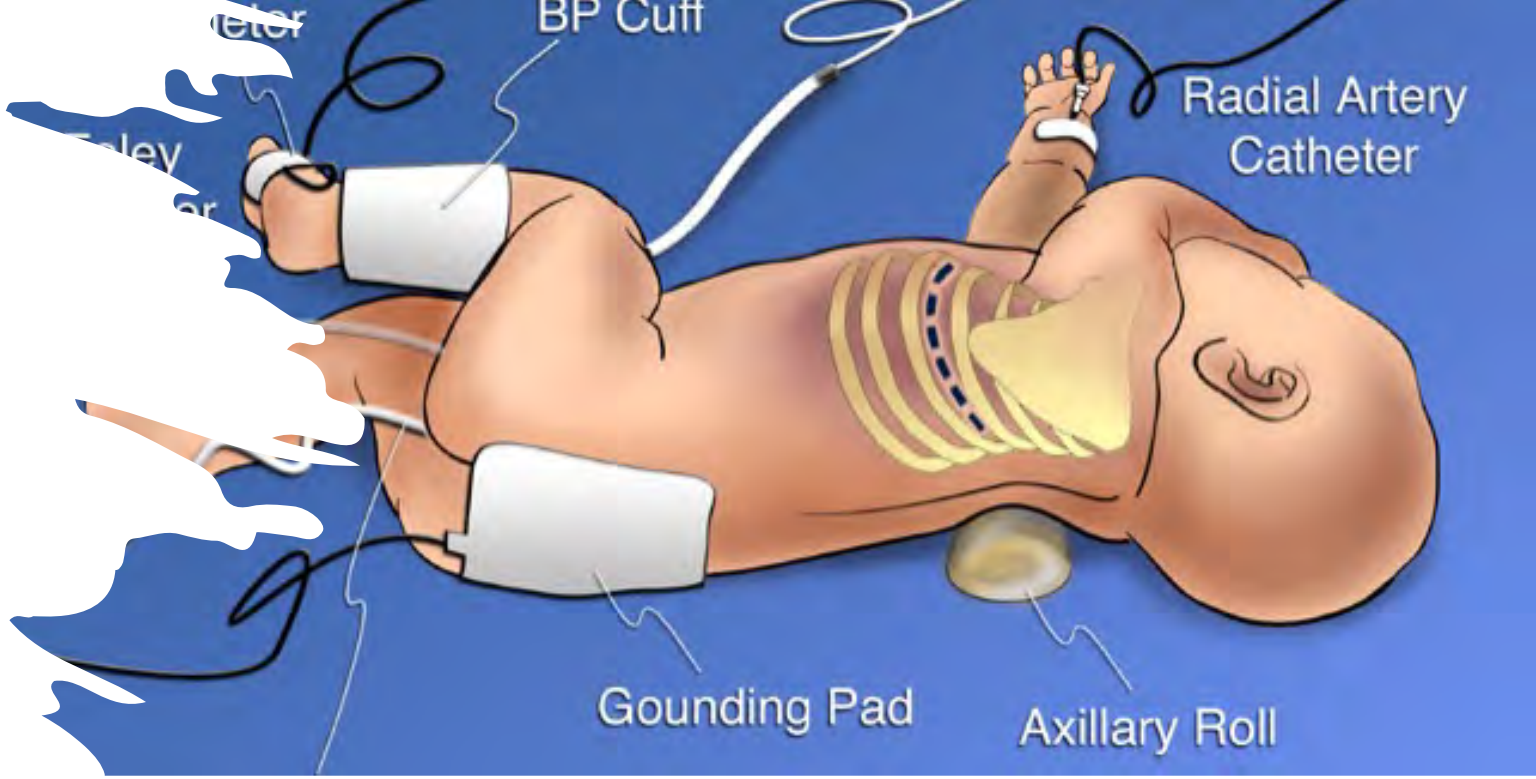


Sternotomie

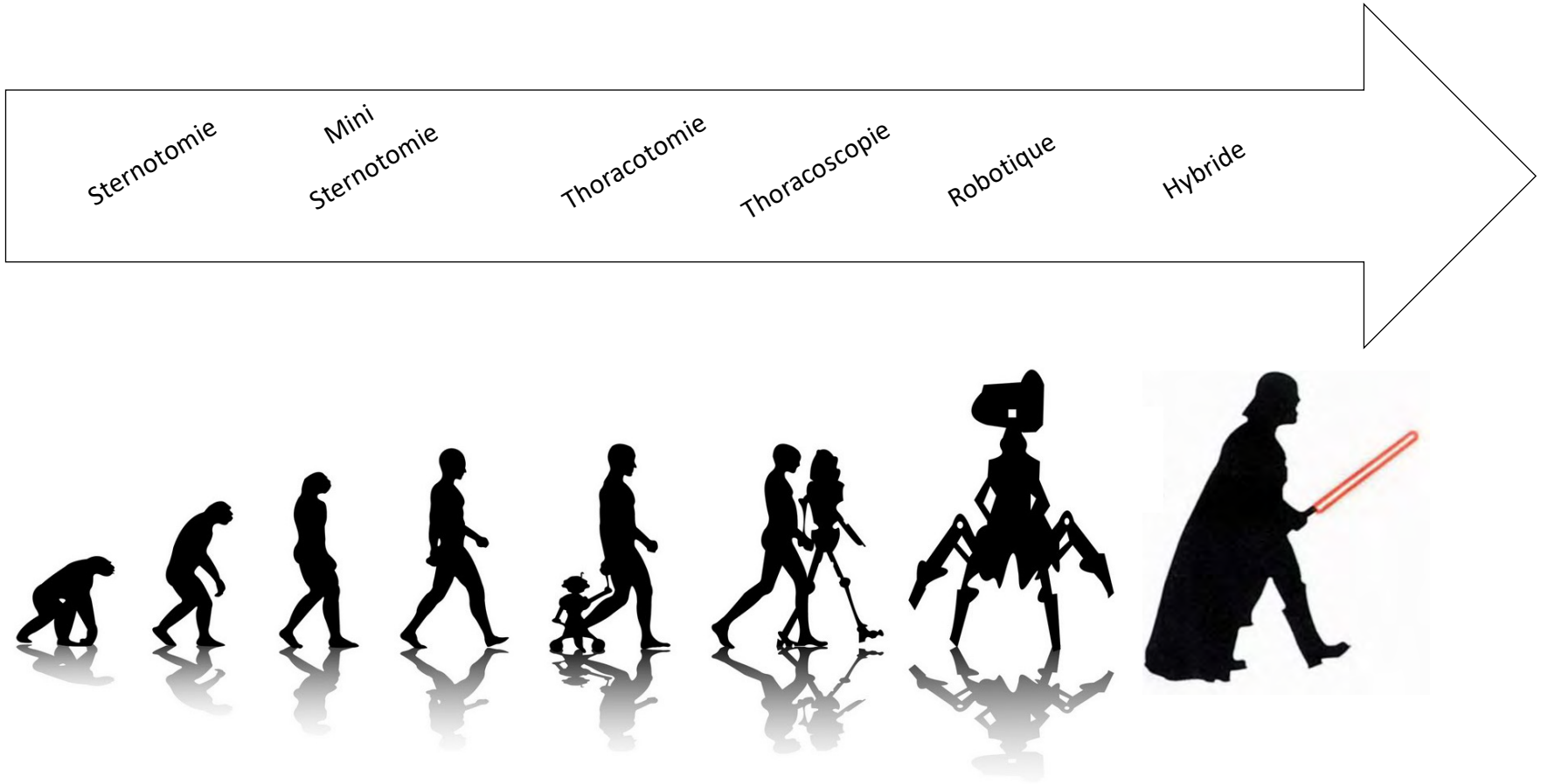


Thoracotomie

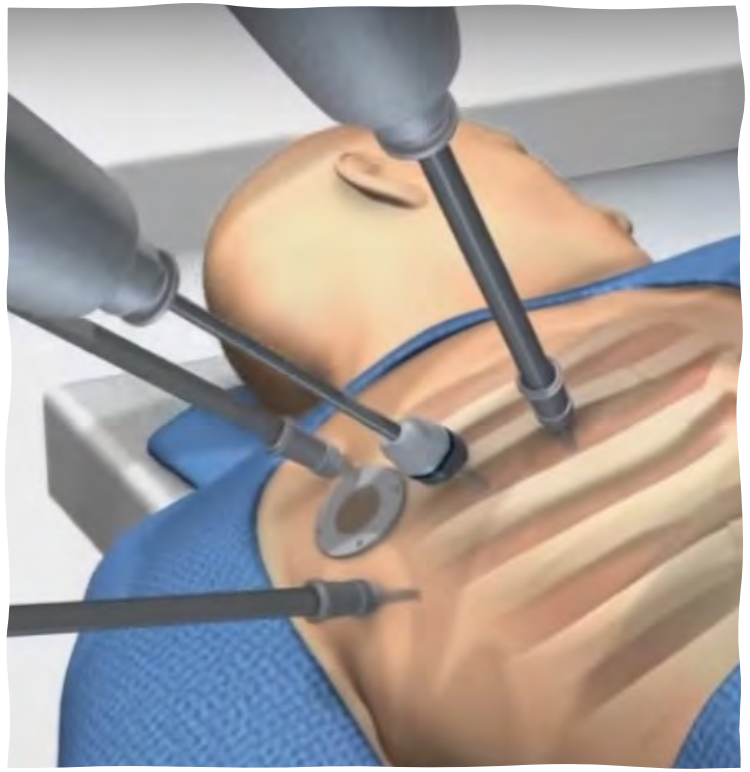
- Techniquage idem
- Installation en décubitus latéral D/G
- Main sur la tête
- Jambes en PLS
- Billot sous les côtes
- Protection points d’appui +++



Thoracotomie



Chirurgie mini invasive



Chirurgie mini invasive

Principes de la chirurgie

Cœur fermé

versus

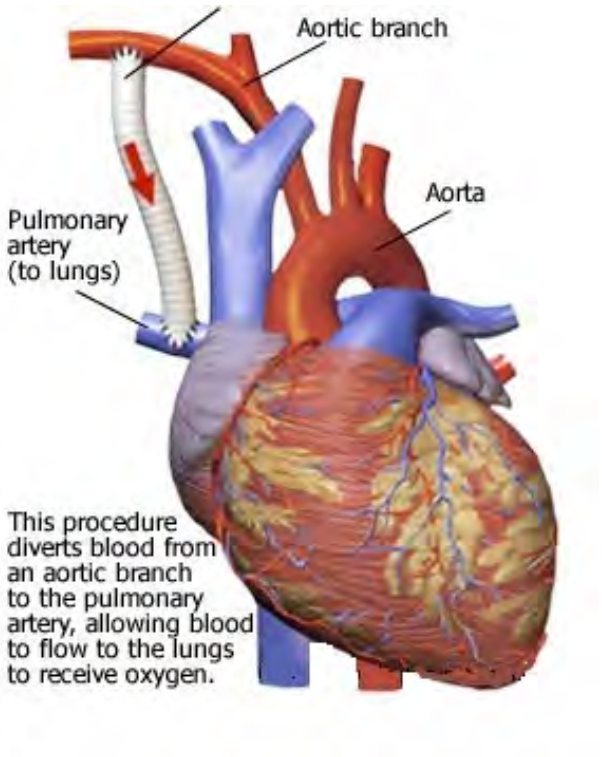
Cœur ouvert

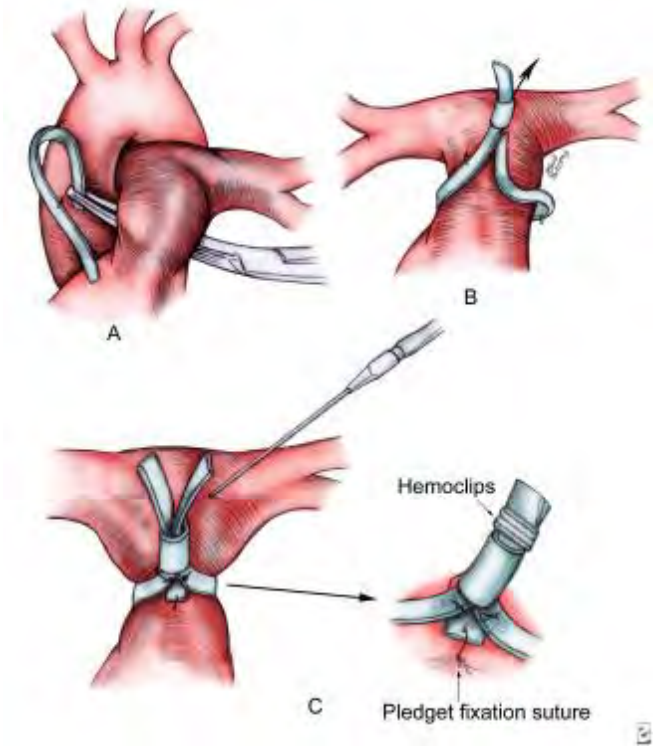
Cure complète

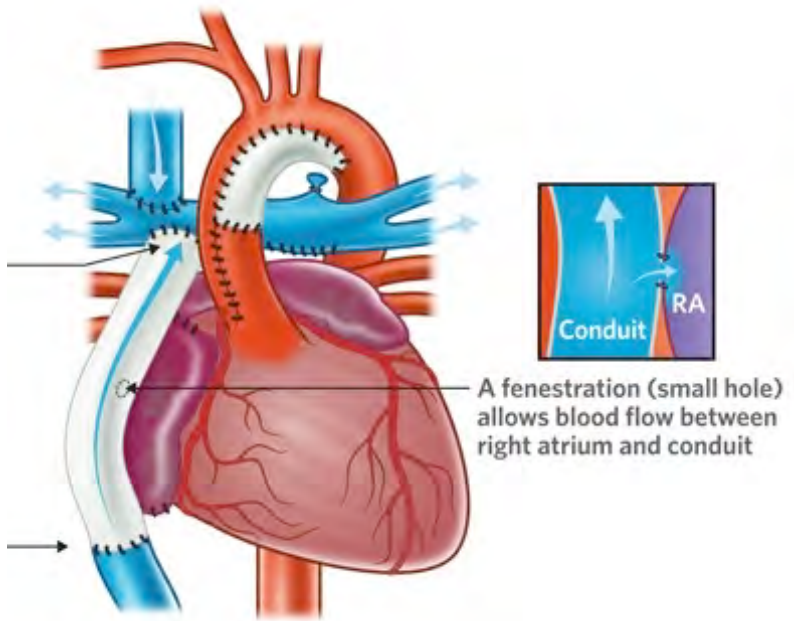
Versus

Chirurgie palliative

Chirurgie palliative





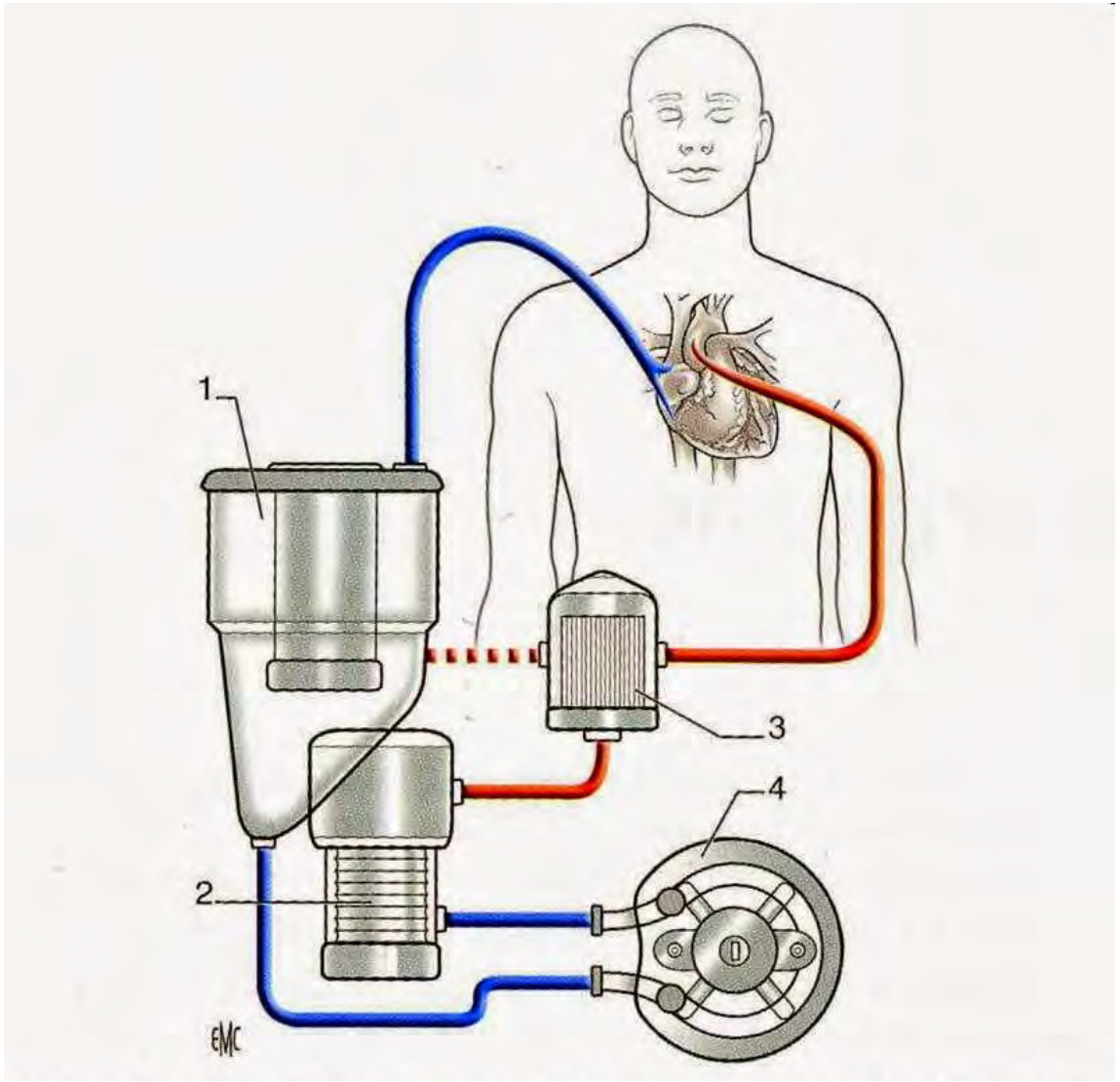


Cœur fermé = Pas de CEC

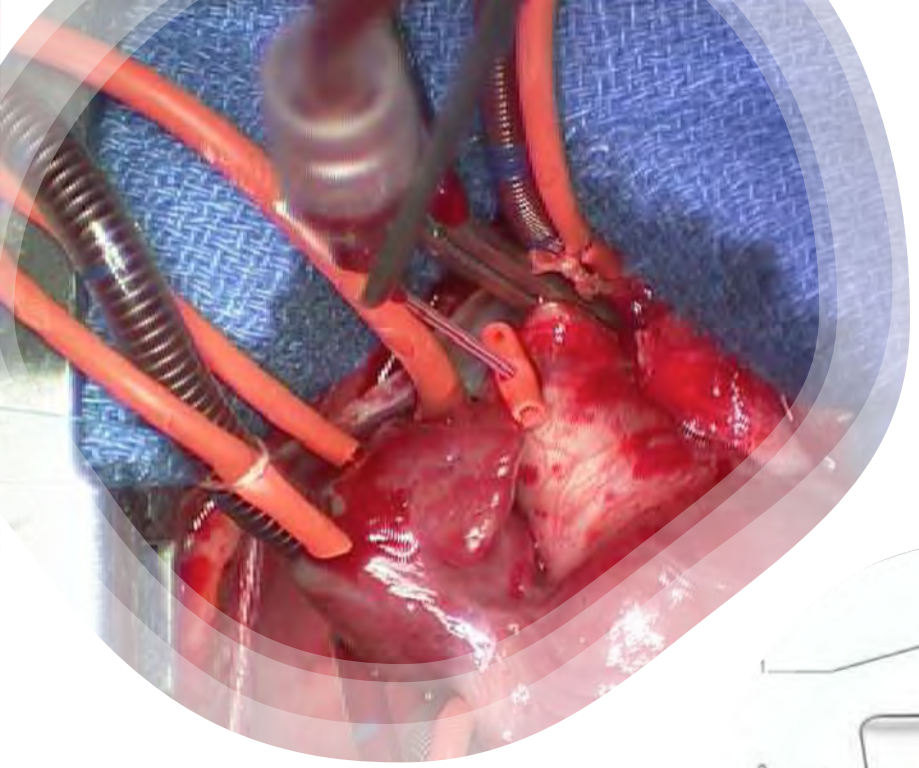
- Canal artériel
- Coarctation
- Pacemaker, défibrillateur
- Anastomose systémico-pulmonaire (Blalock)
- Anomalies arcs aortiques

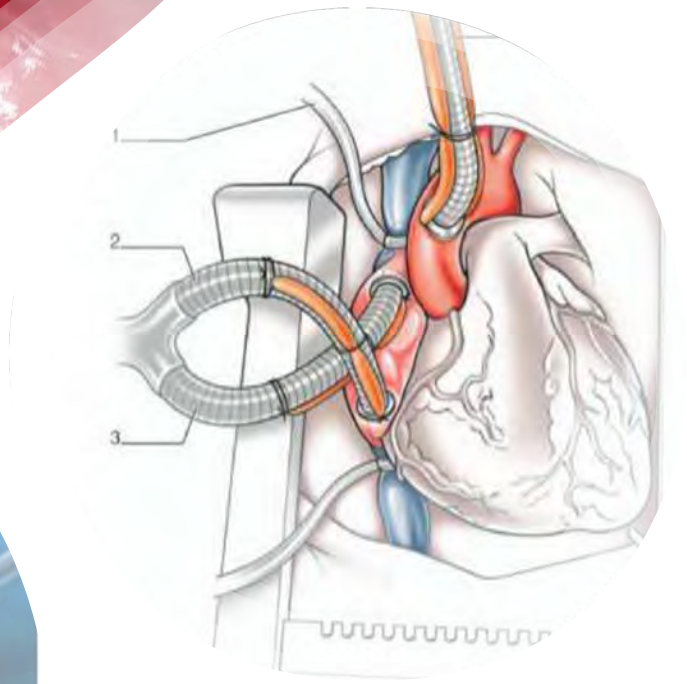
Cœur ouvert = CEC

- Principes de la CEC
  - Assurer rôle du cœur
  - Assurer rôle du poumon
  - Visibilité des lésions
- Canules
  - Drainage
  - Réinjection
- Circuit
  - Réservoir
  - Filtre
  - Pompe
  - Oxygénateur
  - Echangeur thermique



Canulation

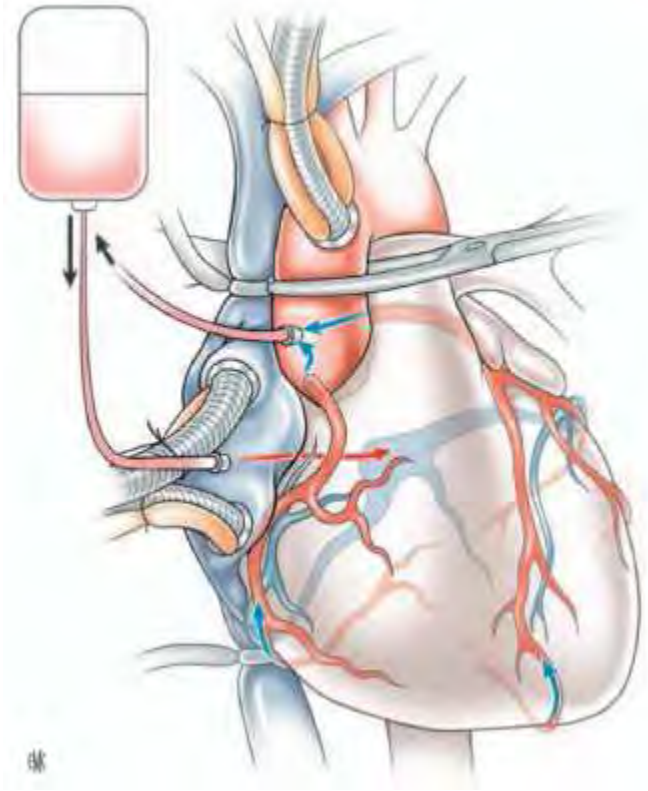




- Canule artérielle
  - Ao ascendante : réinjection
- Canule(s) veineuse(s)
  - OD ou 2 veines caves : drainage
- +/- Canule de décharge gauche
  - OG : drainage
- +/- Canule de cardioplégie

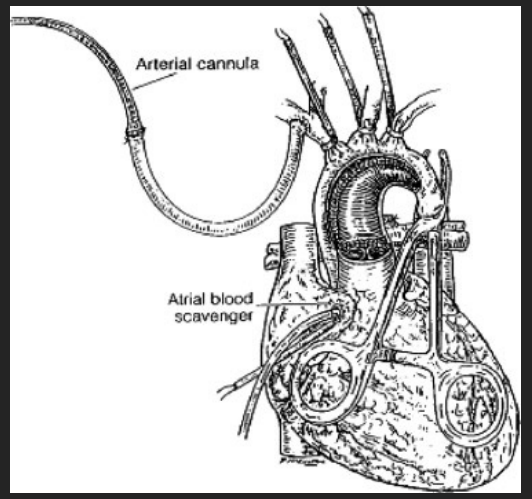
Cardioplégie

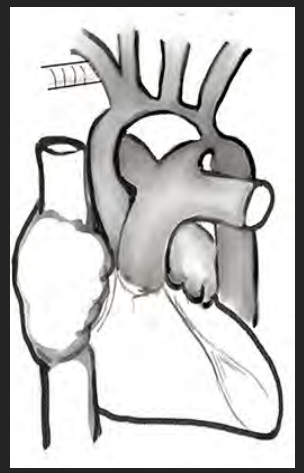
- Arrêter le cœur
- Perfuser le coeur



Cristalloïde / Sanguine
Chaude / Froide
Unique / Répétée / Continue
Antérograde / Rétrograde / Combinée

Normo ou hypothermie



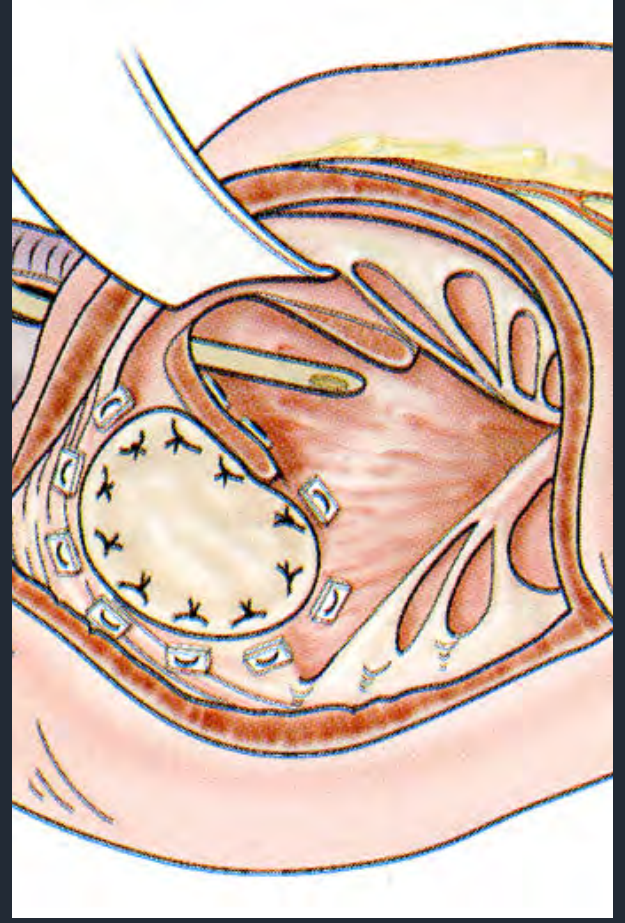


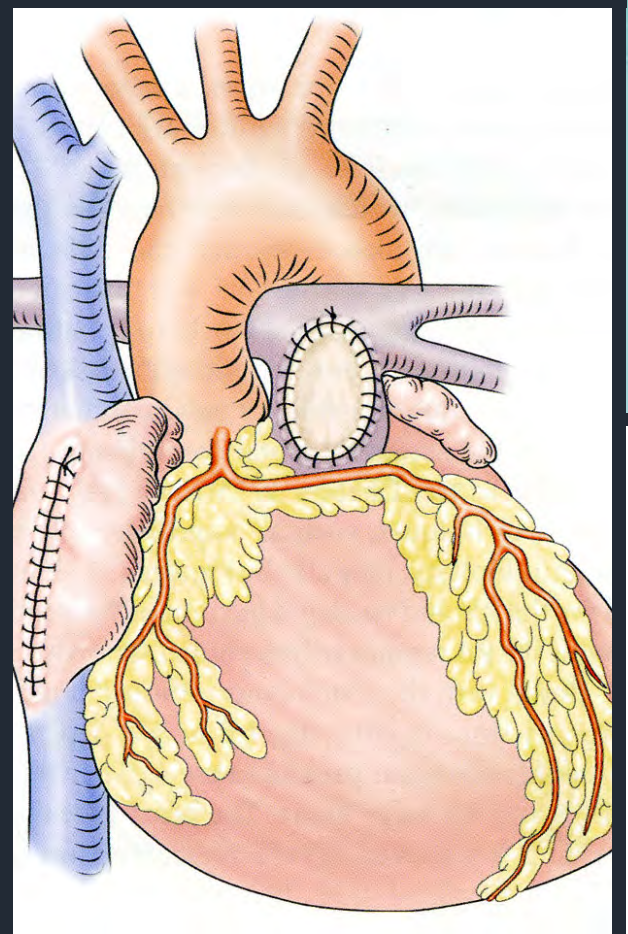
- Normothermie
- Hypothermie modérée
- Hypothermie profonde
- Arrêt circulatoire
- Perfusion cérébrale sélective

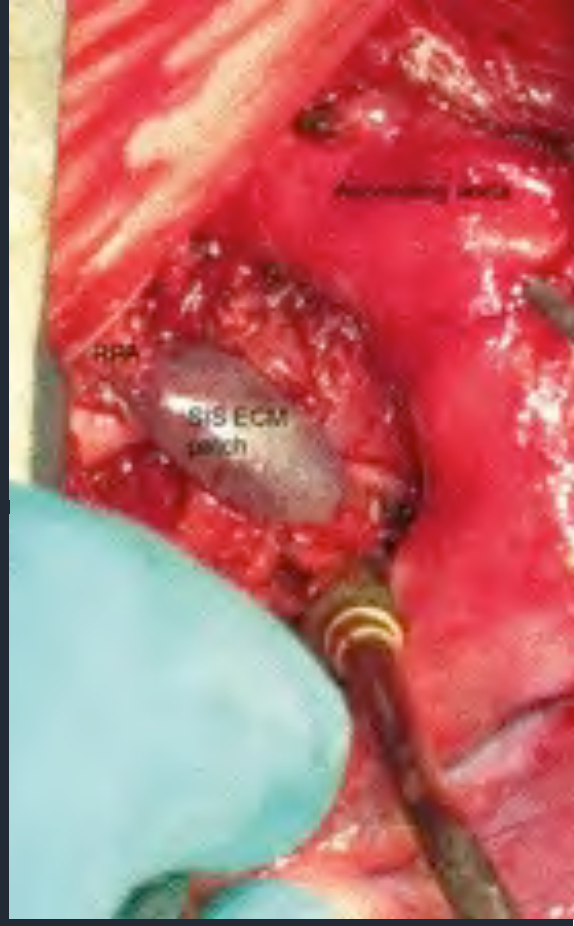
Risques de la CEC

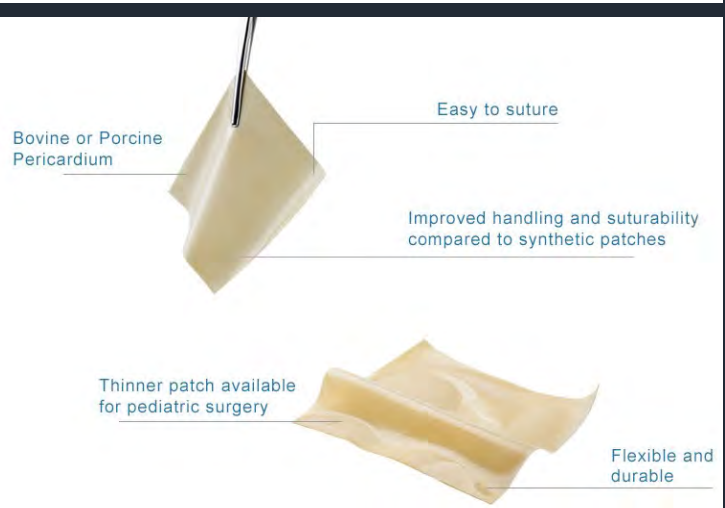
Hémodilution	Priming Transfusion
Inflammation	Durée de CEC Matériel
Ischémie myocardique	Cardioplégie Temps de clampage
Problème technique	Décanulation Bullage

Patchs






SIS ECM
patch


Bovine or Porcine
Pericardium
Easy to suture
Improved handling and suturability
compared to synthetic patches
Thinner patch available
for pediatric surgery
Flexible and
durable

Valves

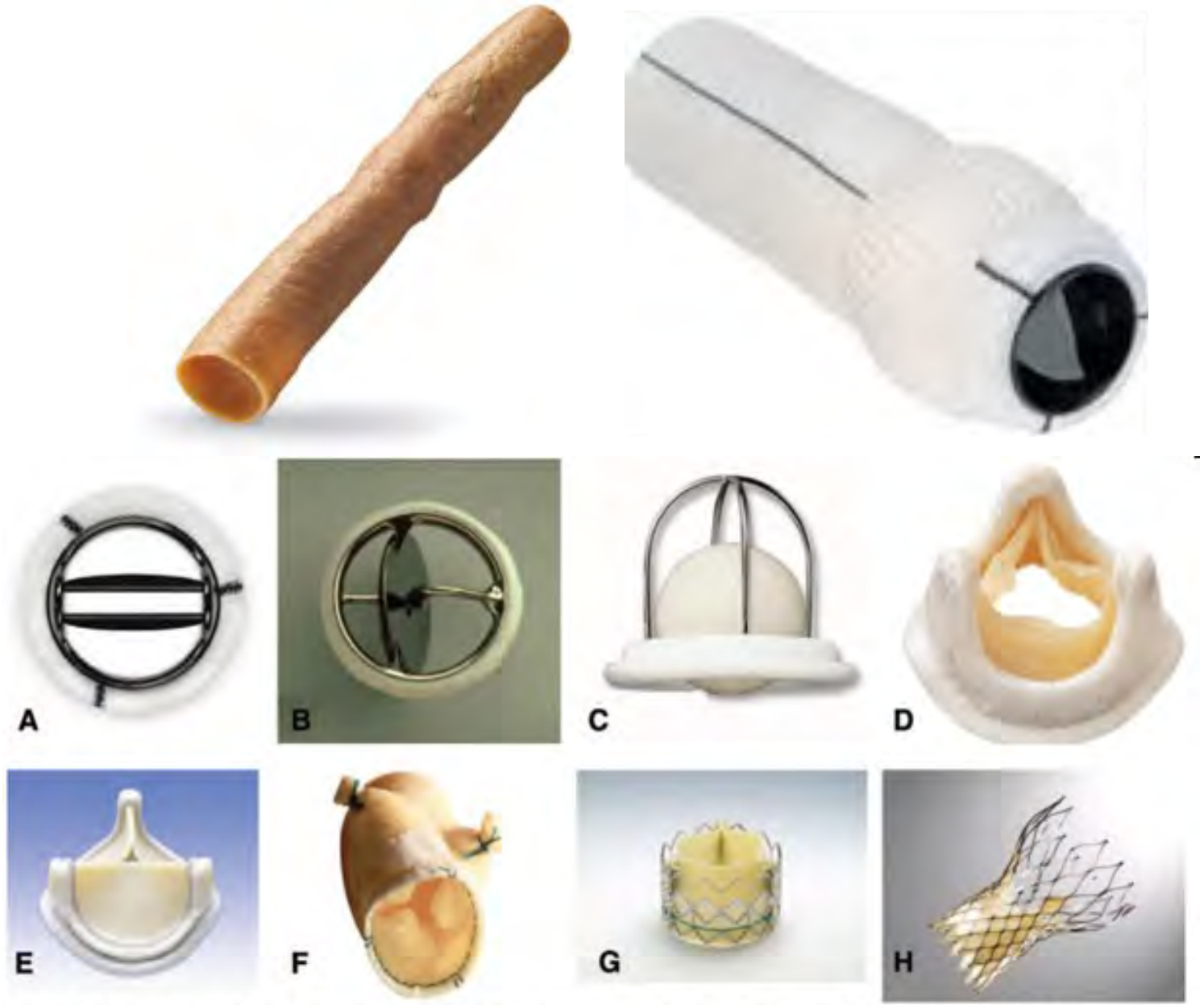
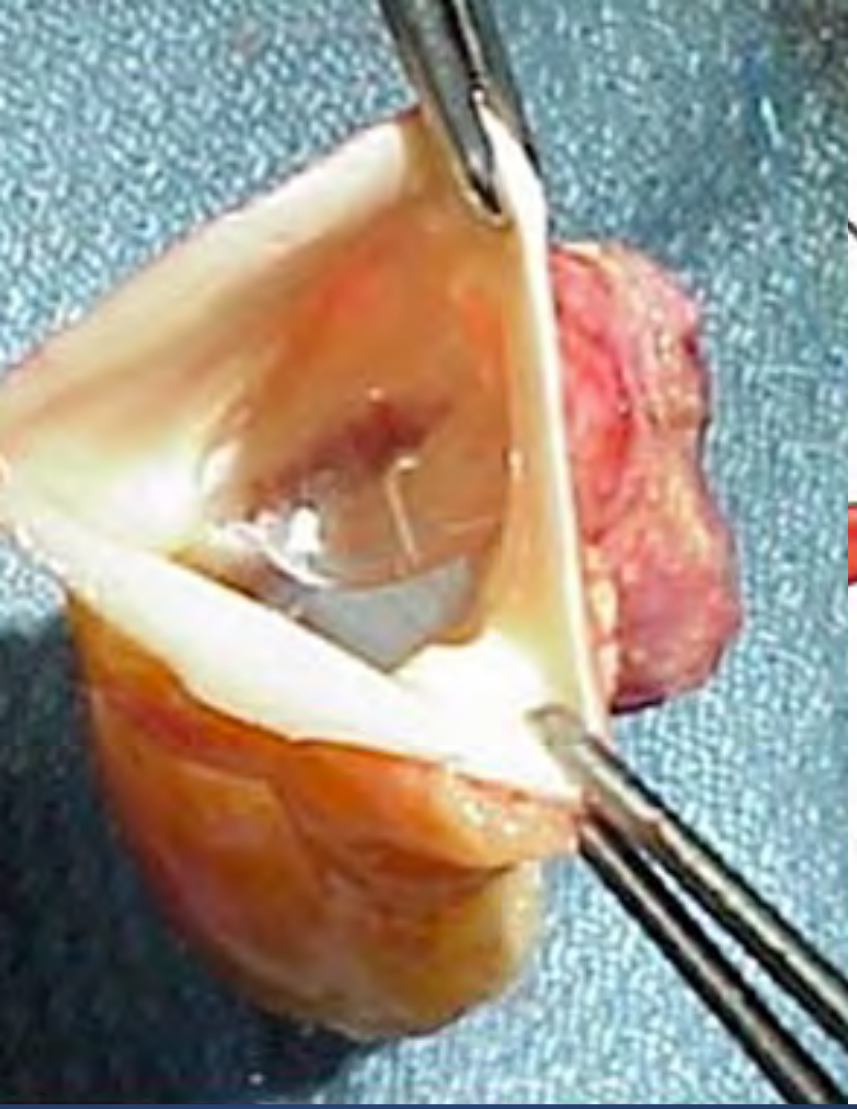
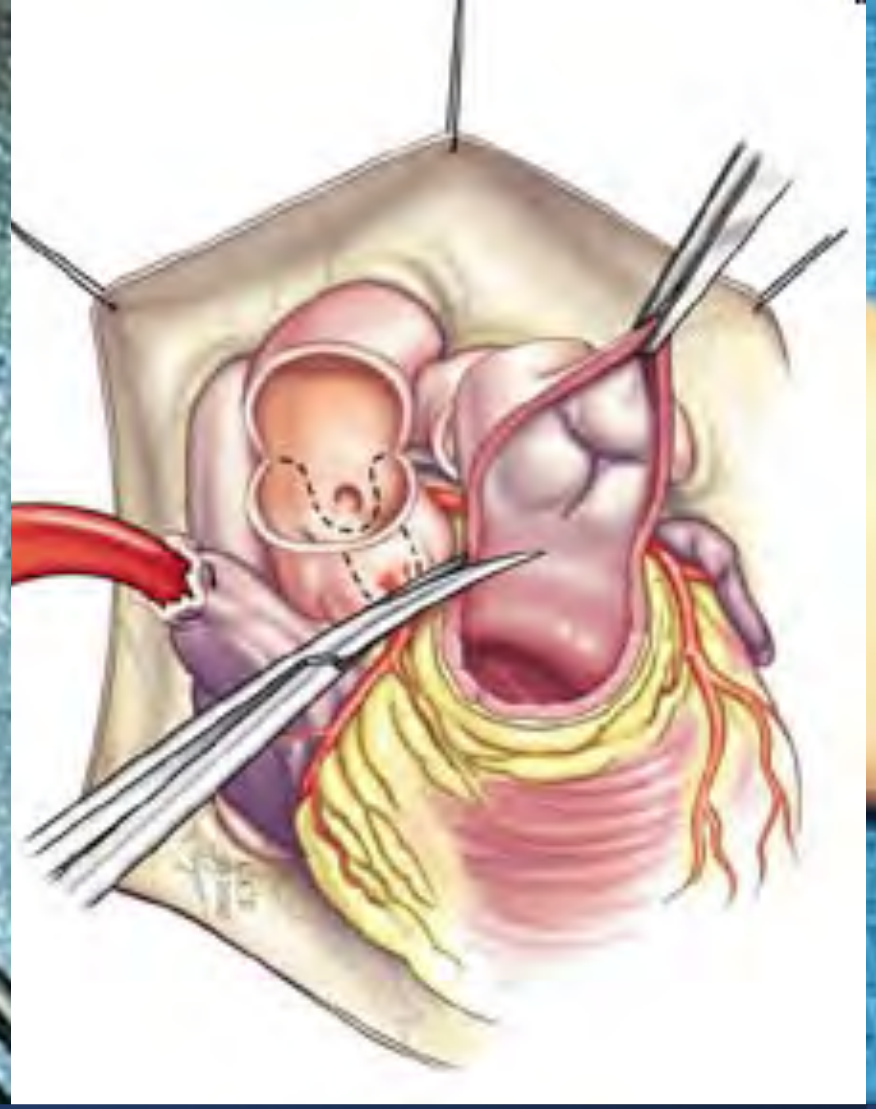


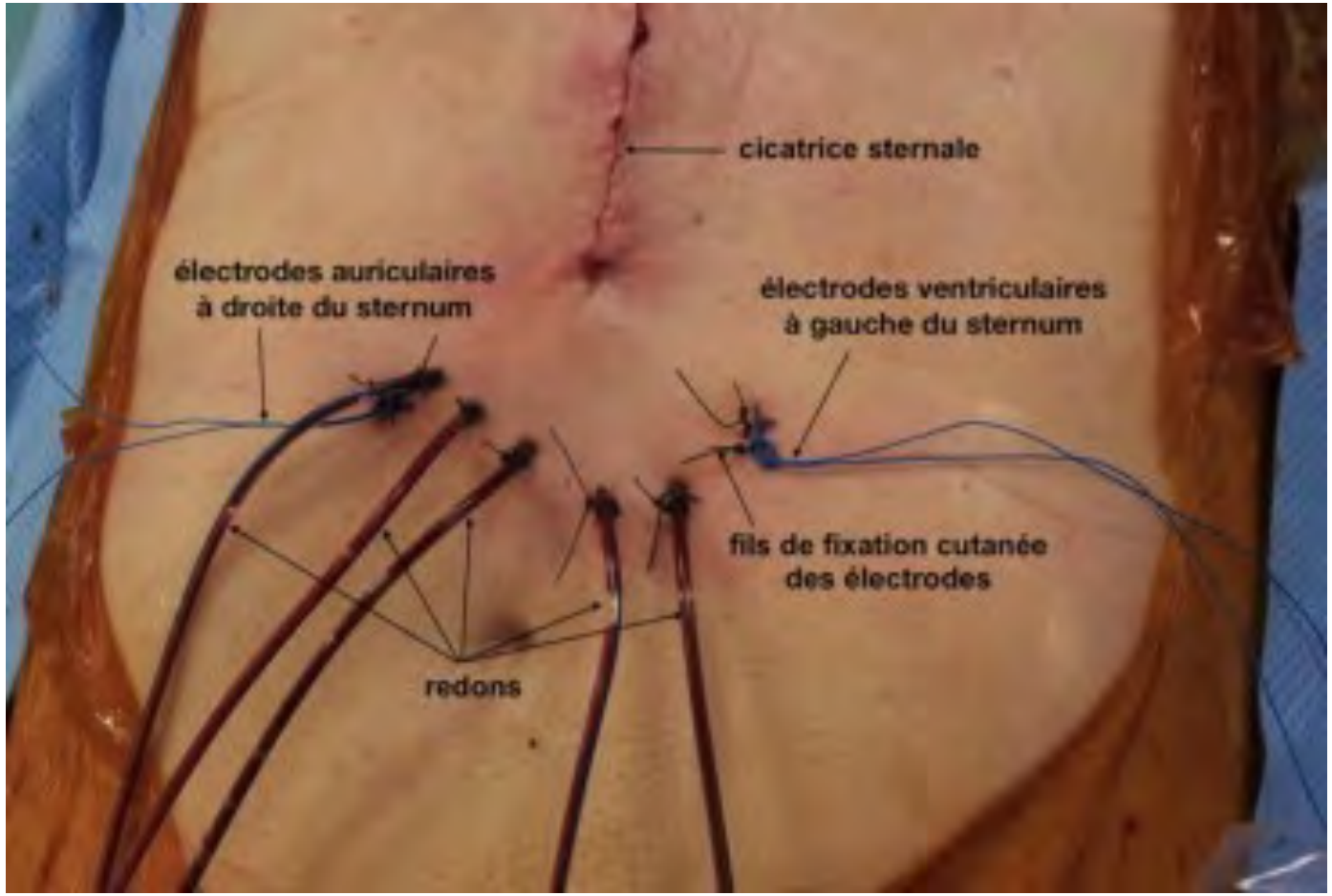
Figure 1. Different types of prosthetic valves. A, Bileaflet mechanical valve (St Jude); B, monoleaflet mechanical valve (Medtronic Hall); C, caged ball valve (Starr-Edwards); D, stented porcine bioprosthesis (Medtronic Mosaic); E, stented pericardial bioprosthesis (Carpentier-Edwards Magna); F, stentless porcine bioprosthesis (Medtronic Freestyle); G, percutaneous bioprosthesis expanded over a balloon (Edwards Sapien); H, self-expandable percutaneous bioprosthesis (CoreValve).


Valves

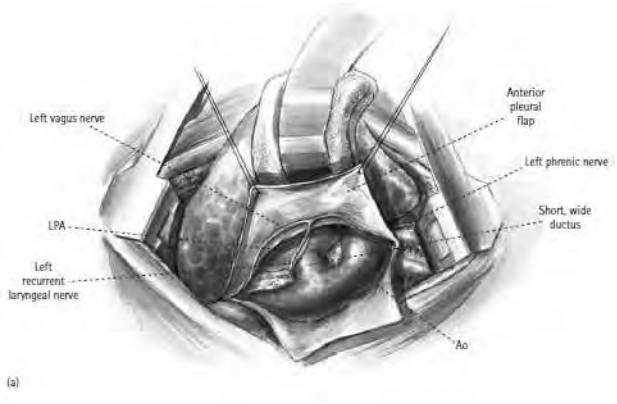
Matériel intra-thoracique

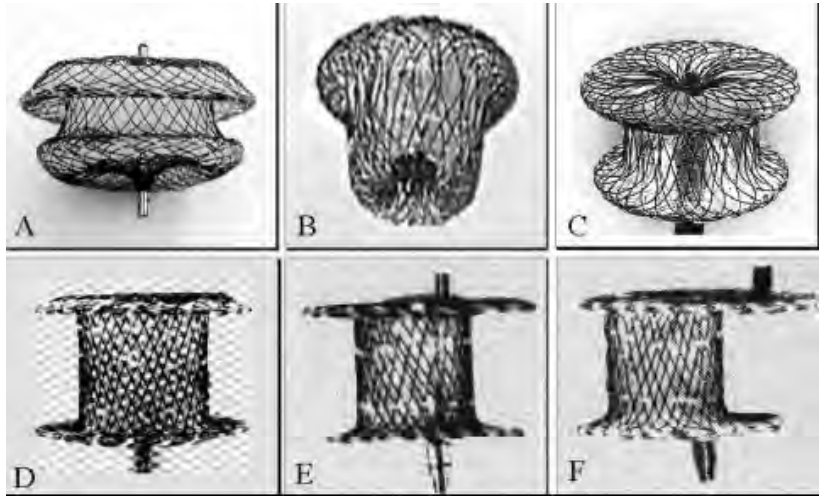
- Electrodes de stimulation
  - Auriculaires, ventriculaires
- Drainage
  - Redon ou drain pleural, médiastinal
- KT transthoracique
  - KT OG, KT AP

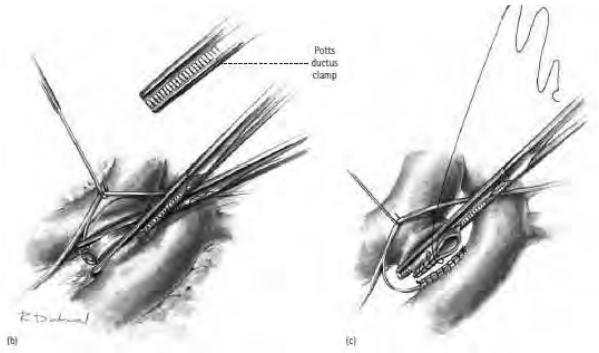


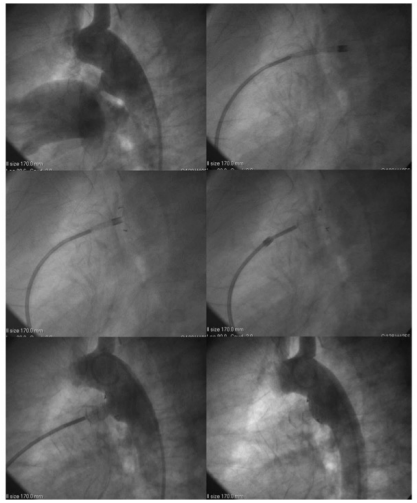
Techniques Chirurgicales

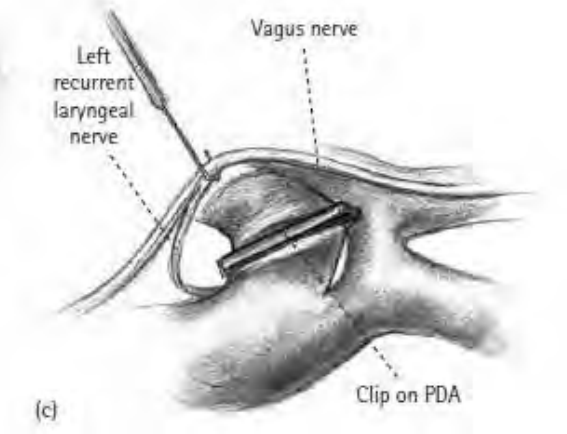
Canal Artériel



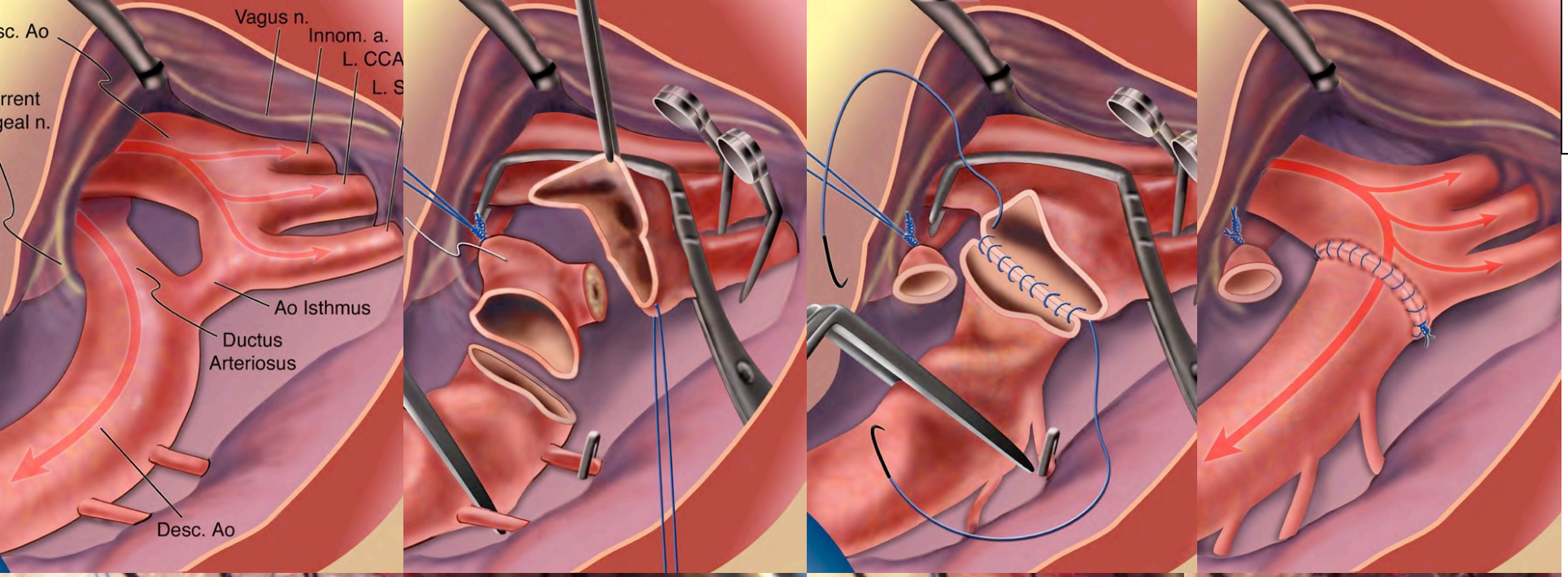


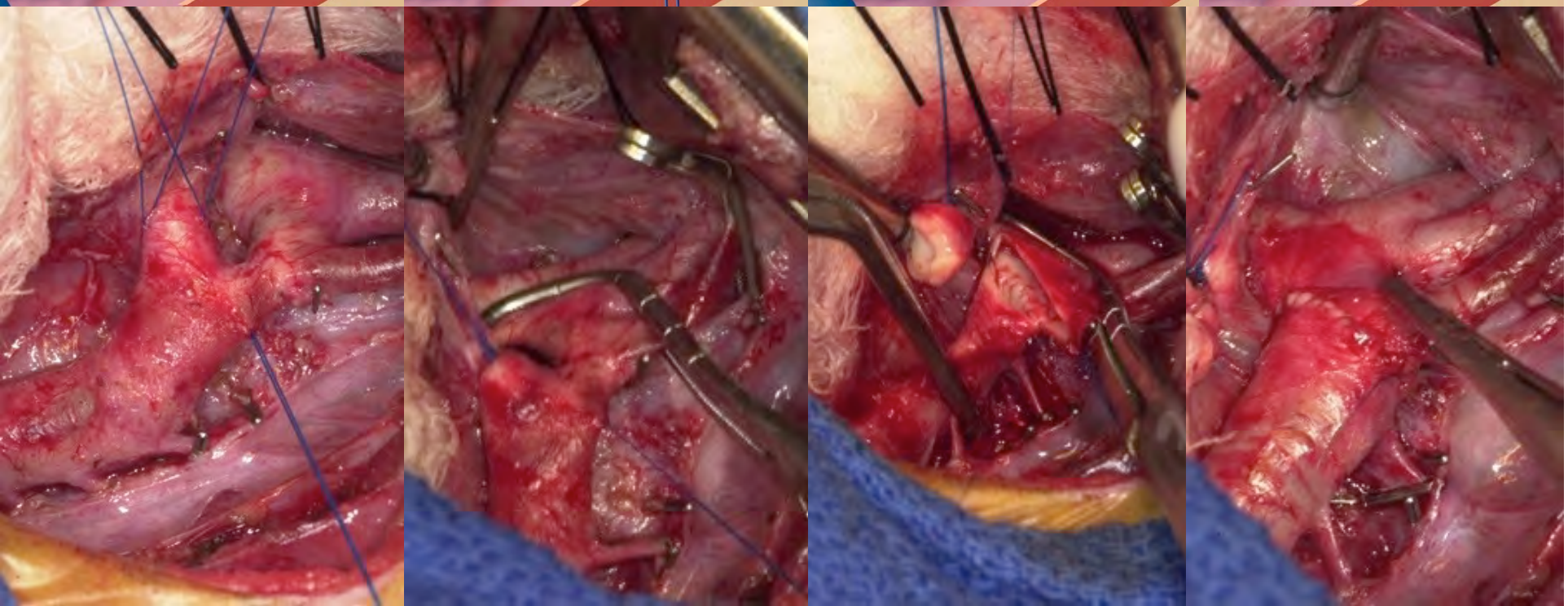


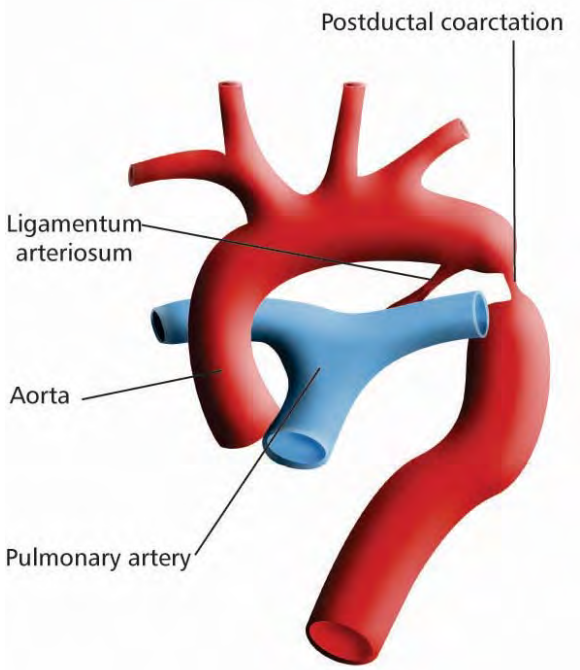


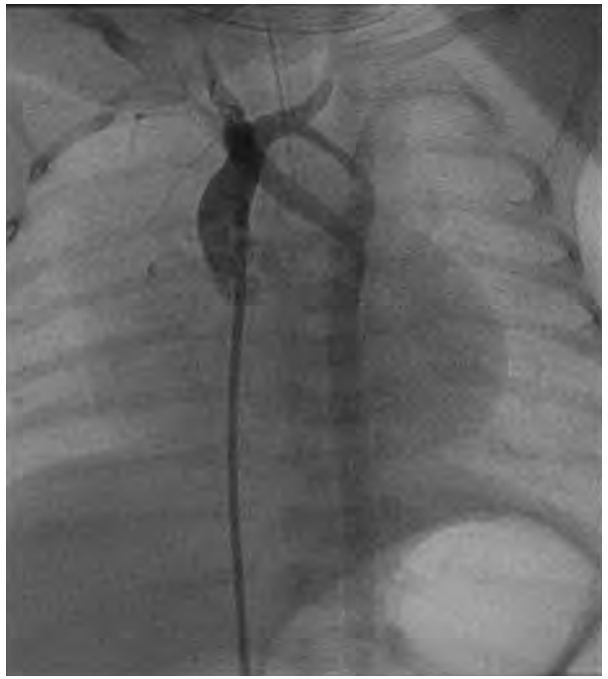


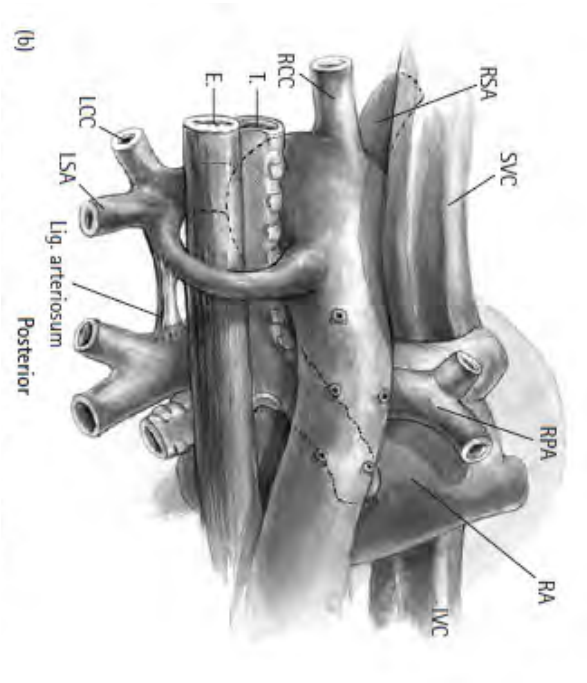
Coarctation



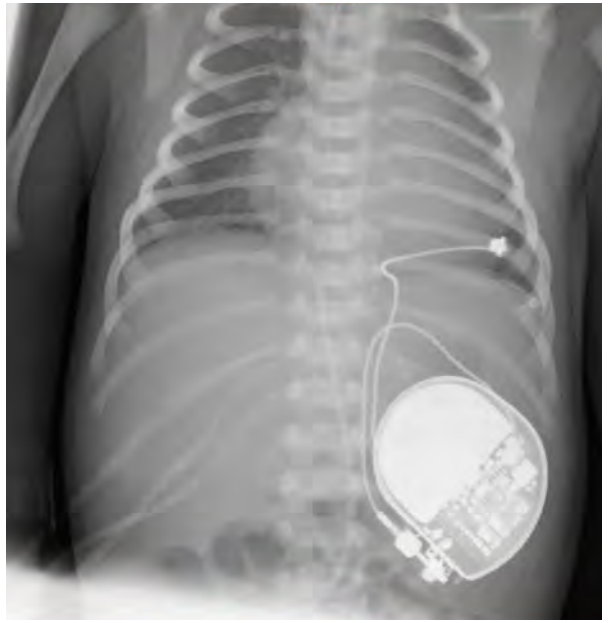
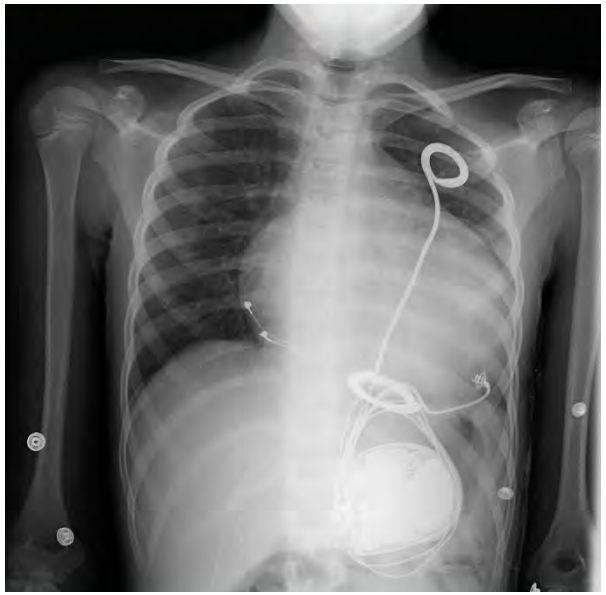


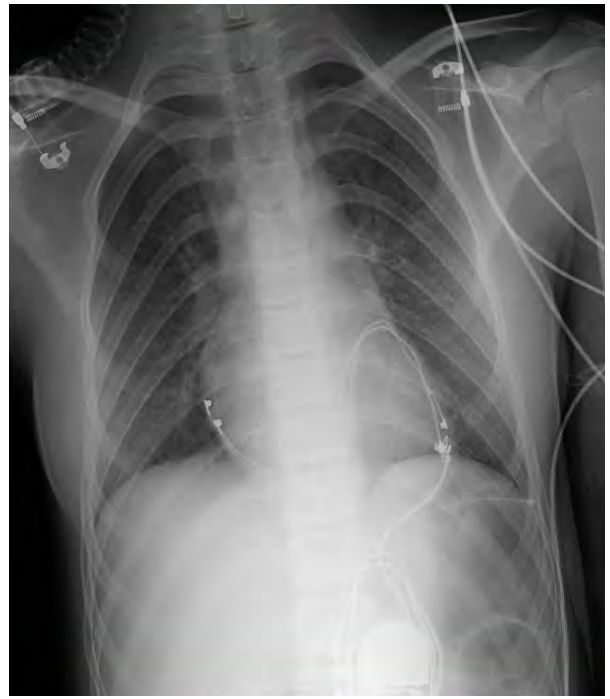






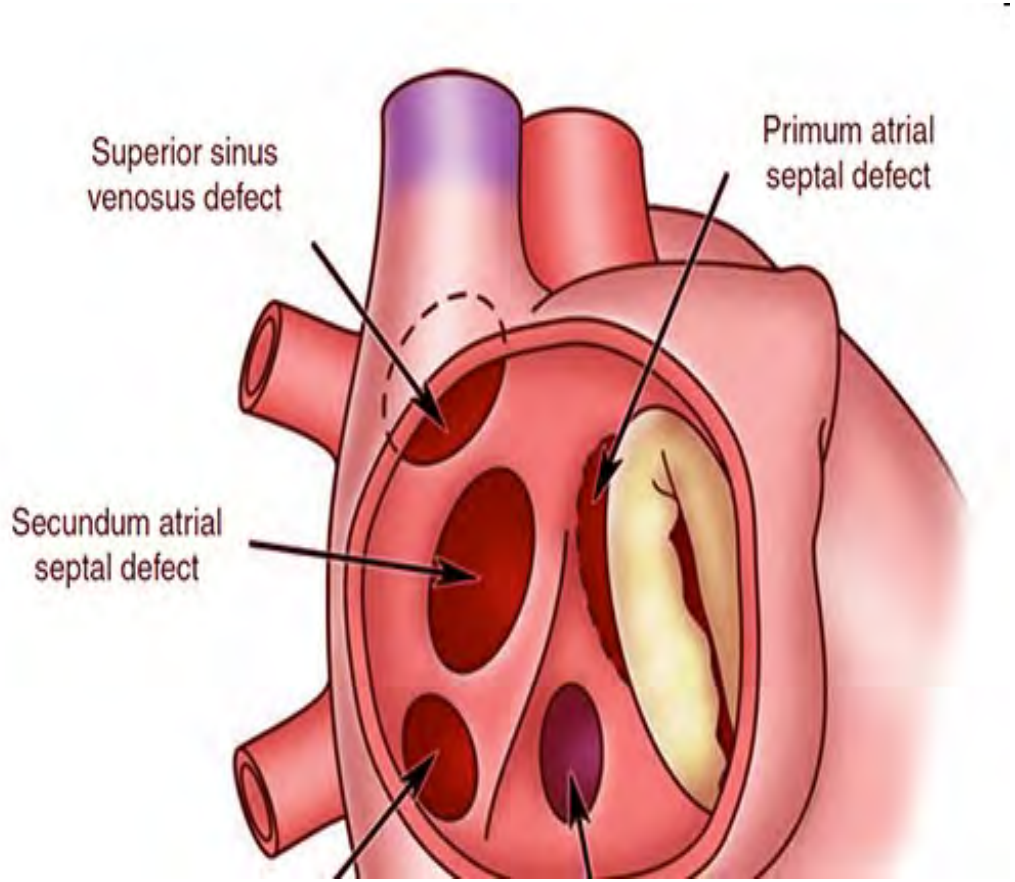
Anomalies des arcs aortiques

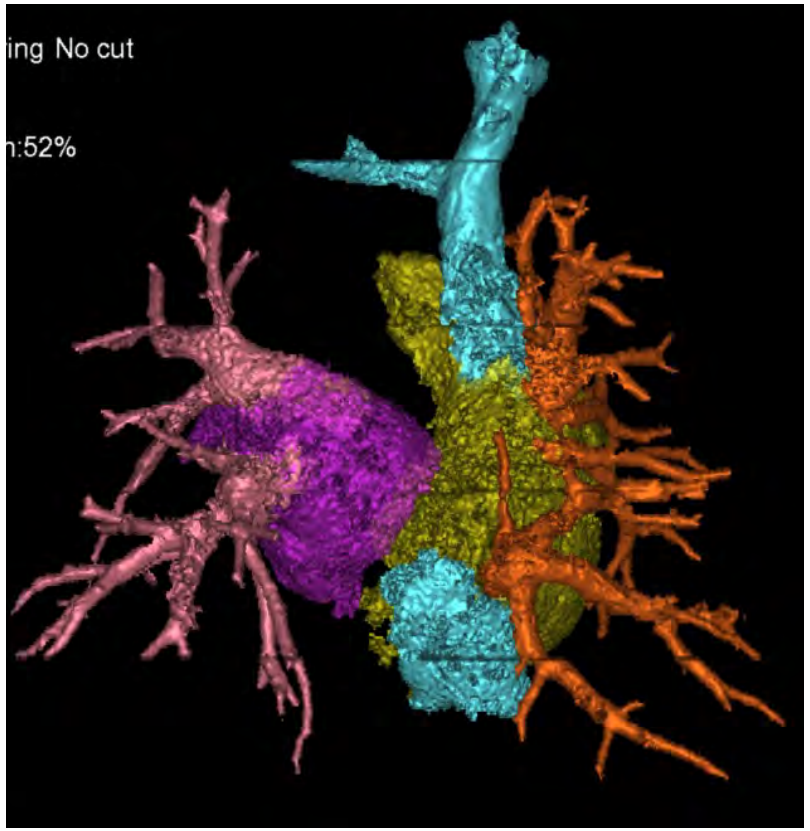



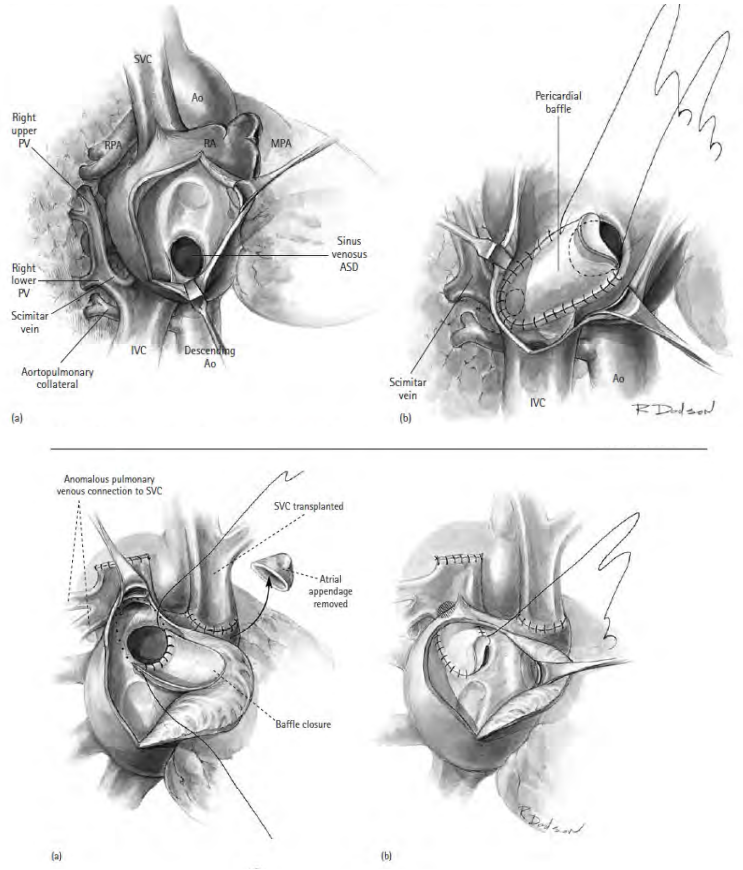


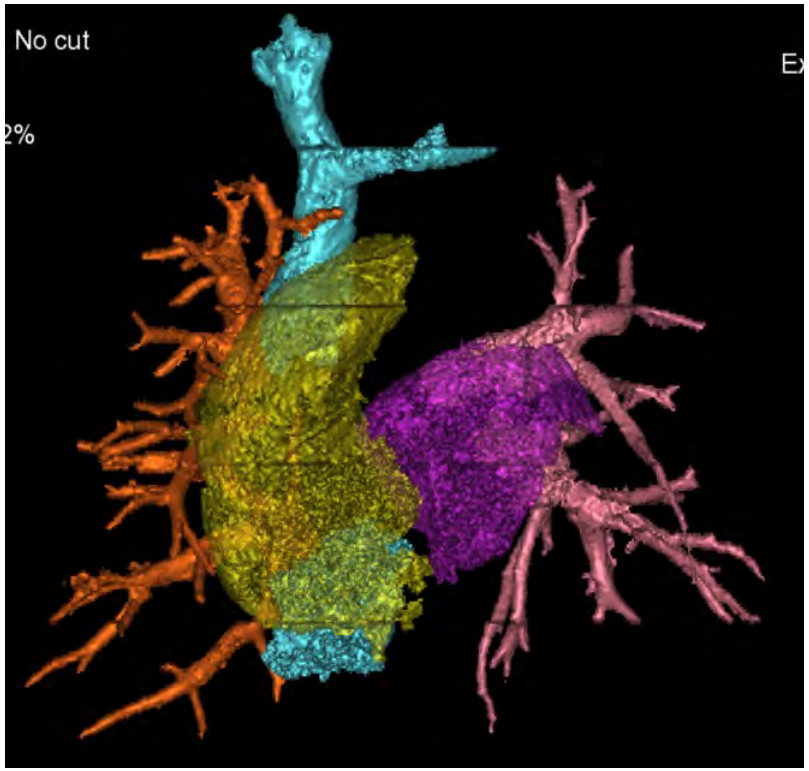
Rythmologie pédiatrique

CIA


Superior sinus
venosus defect
Primum atrial
septal defect
Secundum atrial
septal defect


ing No cut
:52%


SVC
Ao
Right upper PV
RPA
RA
MPA
Sinus venosus ASD
Right lower PV
Scimitar vein
IVC
Descending Ao
Aortopulmonary collateral
(a)
Pericardial baffle
Scimitar vein
IVC
Ao
(b)
Anomalous pulmonary venous connection to SVC
SVC transplanted
Atrial appendage removed
Baffle closure
(a)
(b)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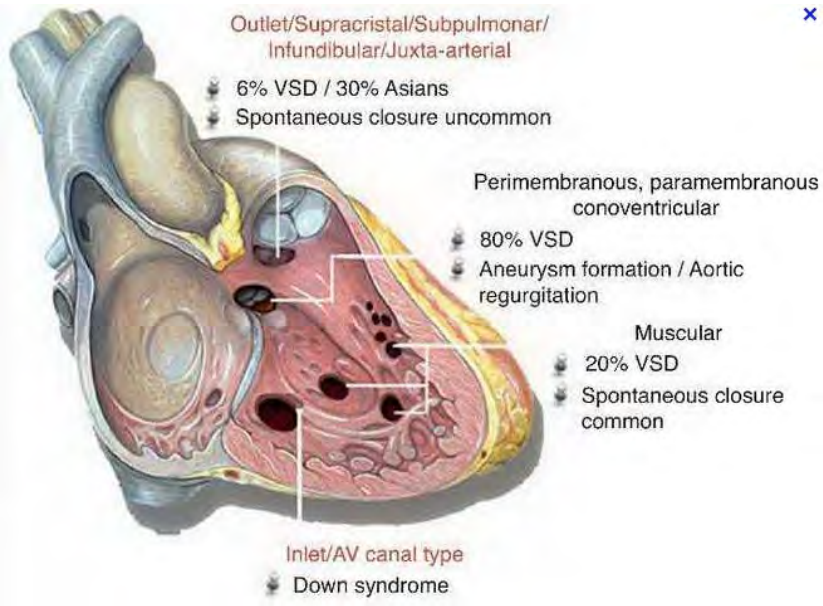
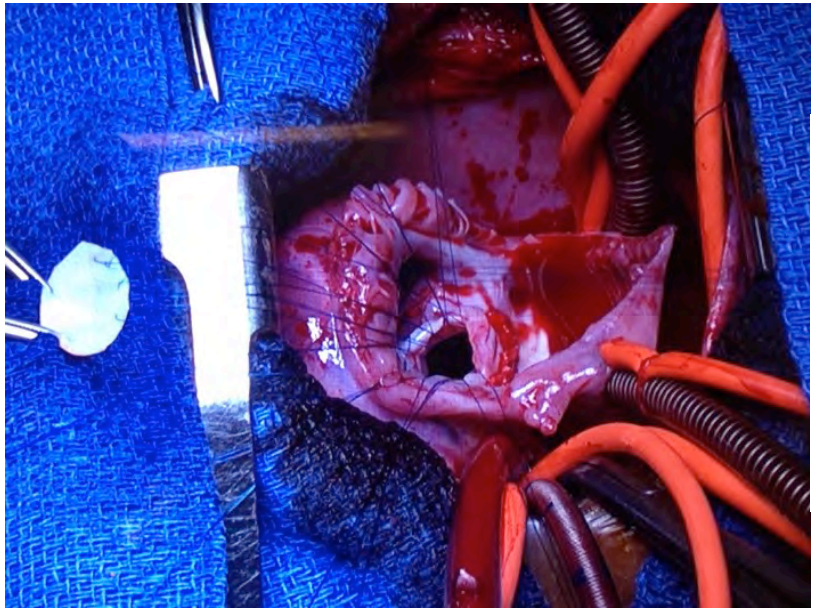
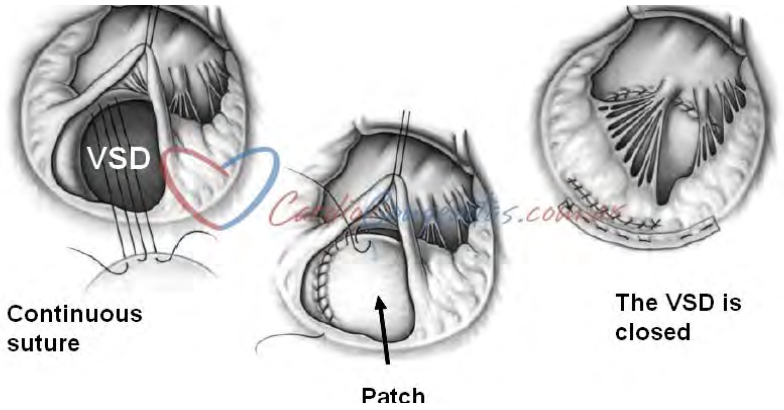
CIA et RVPAP

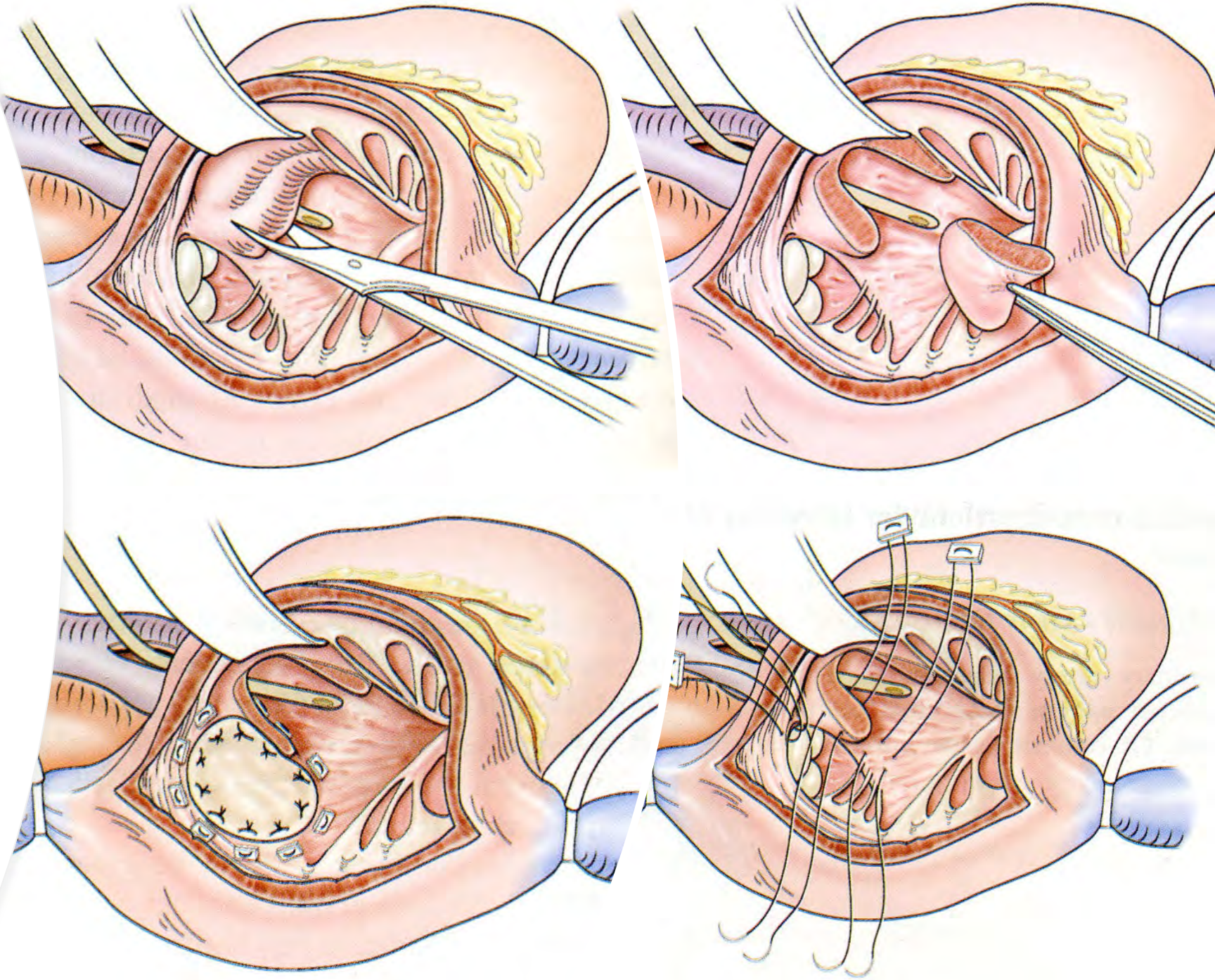
CIV

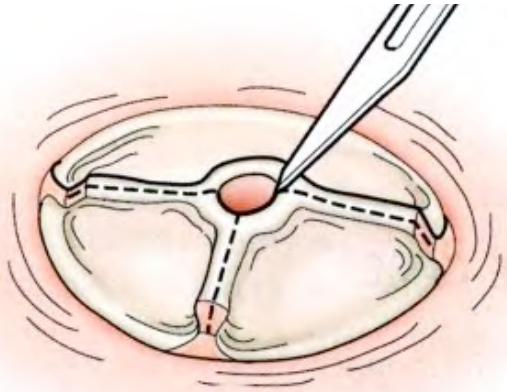

Outlet/Supracristal/Subpulmonar/
Infundibular/Juxta-arterial
6% VSD / 30% Asians
Spontaneous closure uncommon
Perimembranous, paramembranous
conoventricular
80% VSD
Aneurysm formation / Aortic
regurgitation
Muscular
20% VSD
Spontaneous closure
common
Inlet/AV canal type
Down syndrome

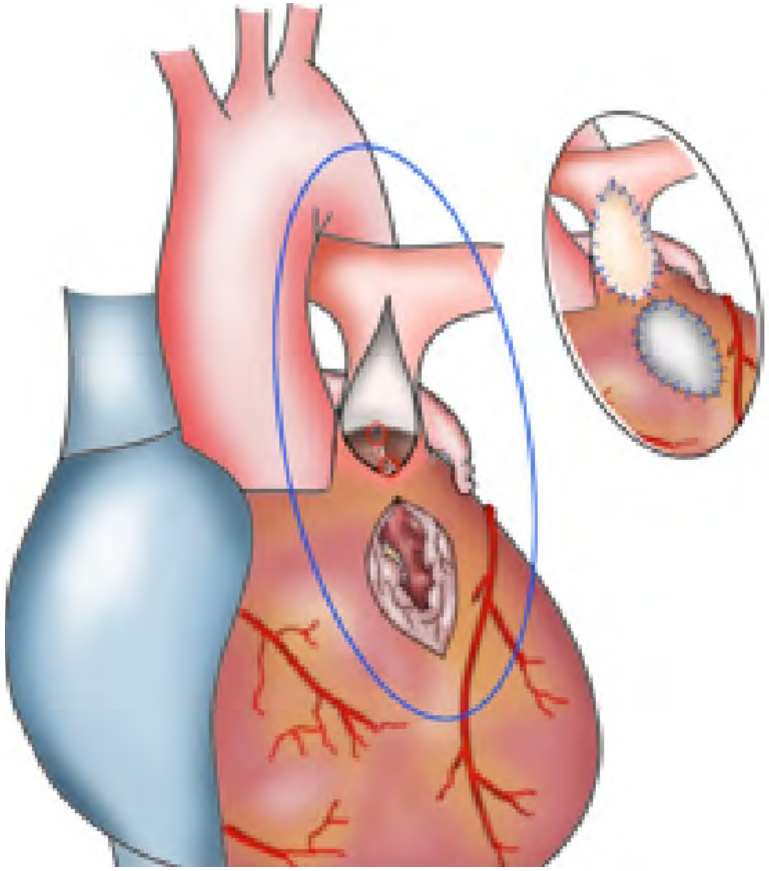


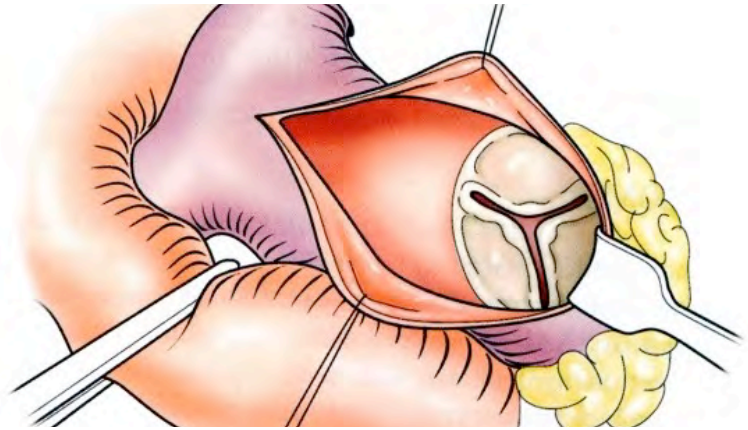

VSD
Continuous
suture
Patch
The VSD is
closed

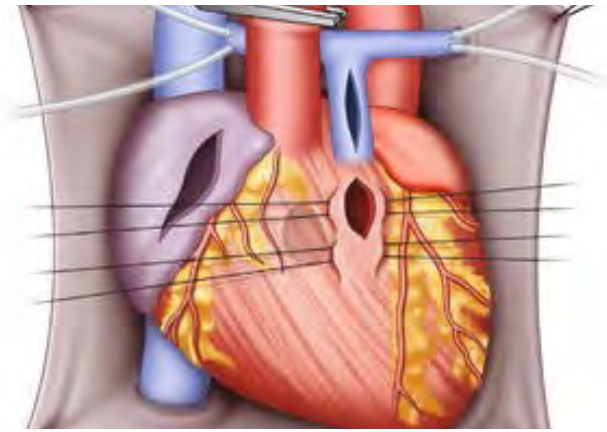
Tétralogie de Fallot

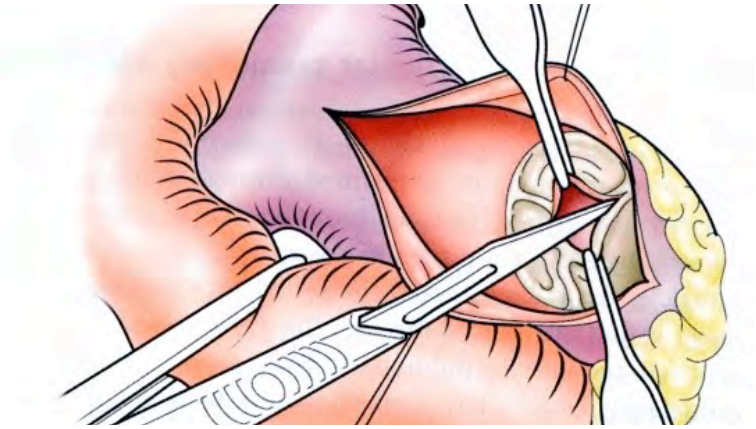


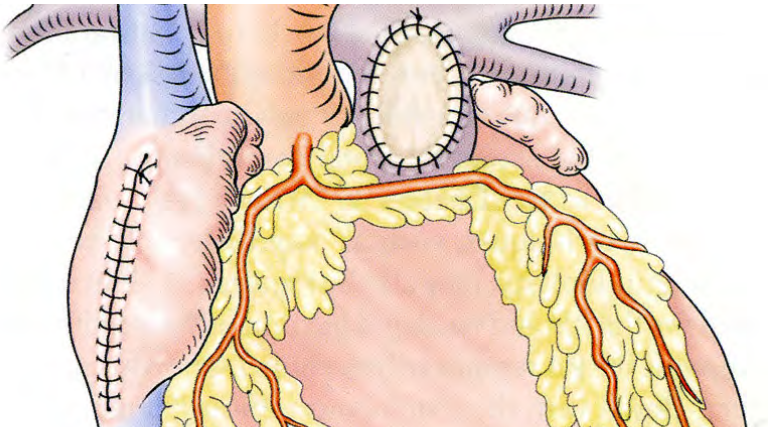






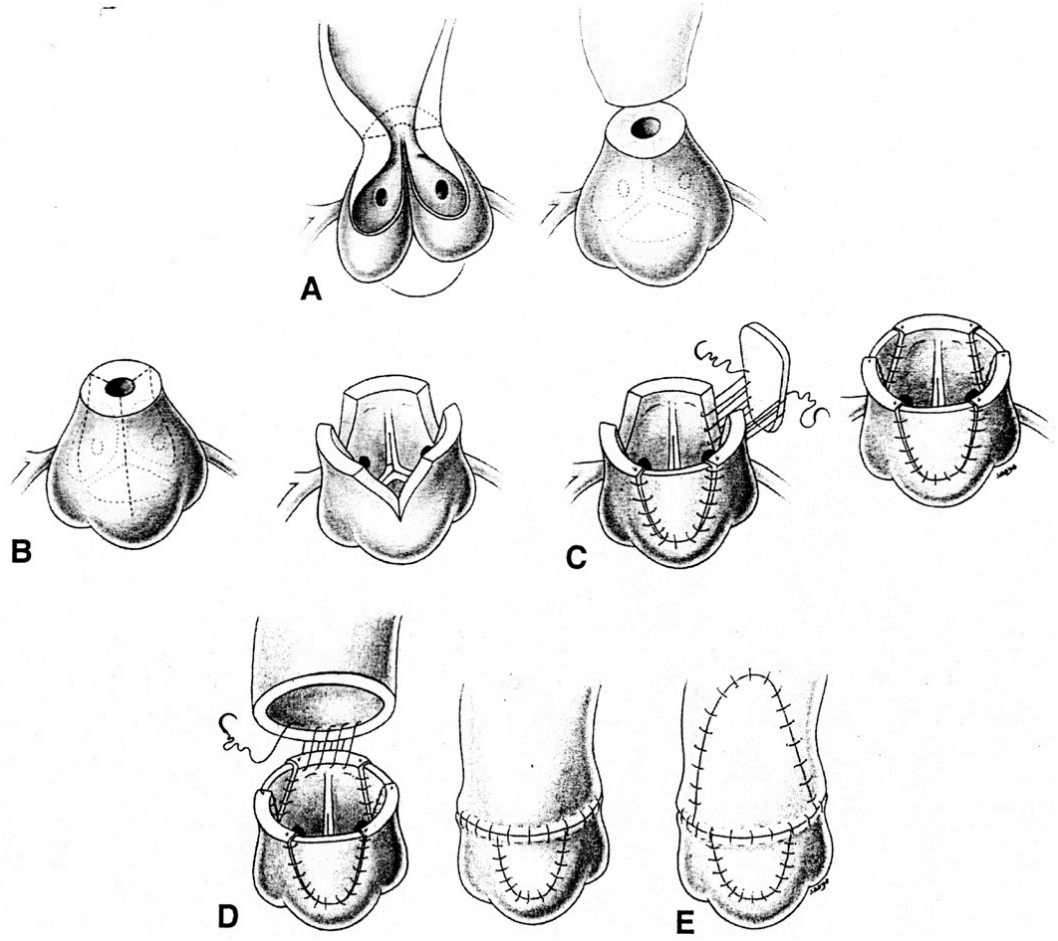


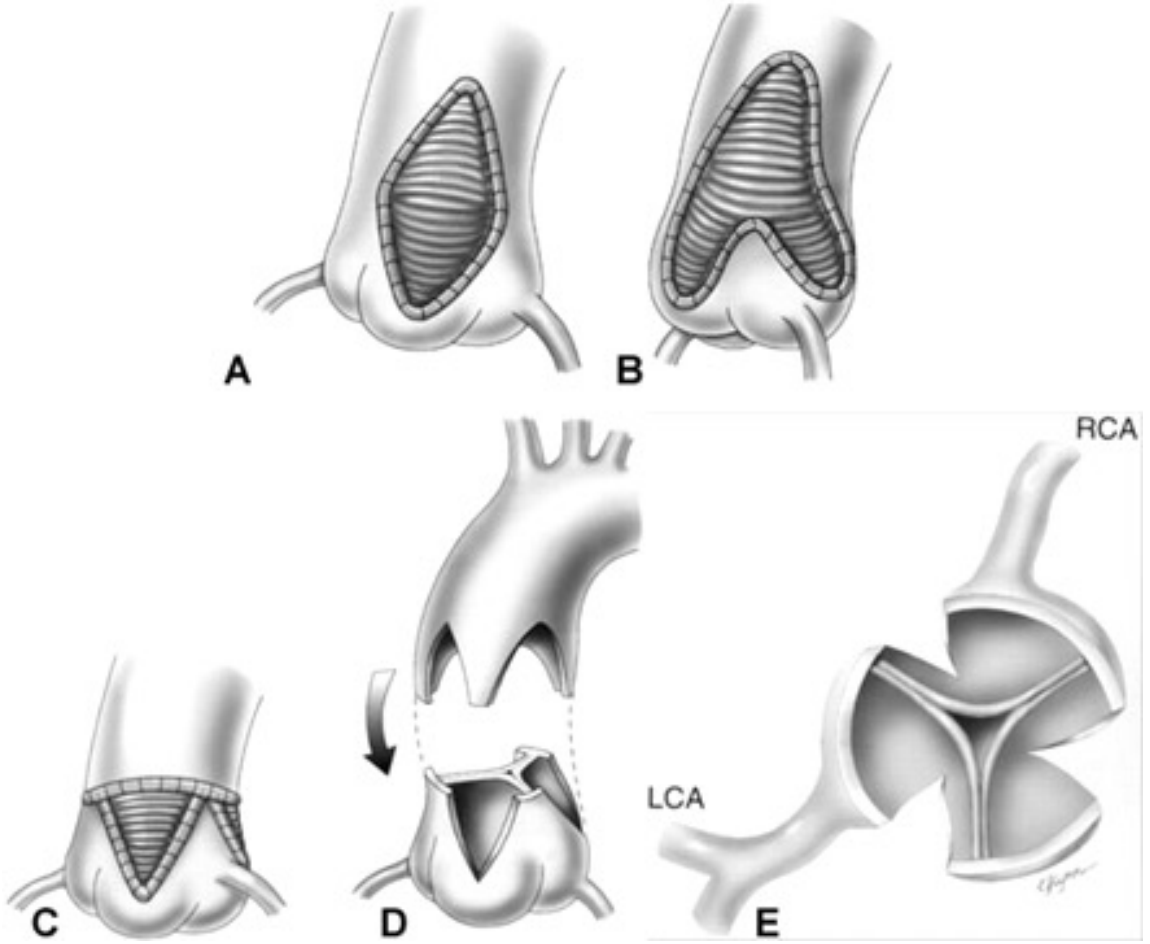




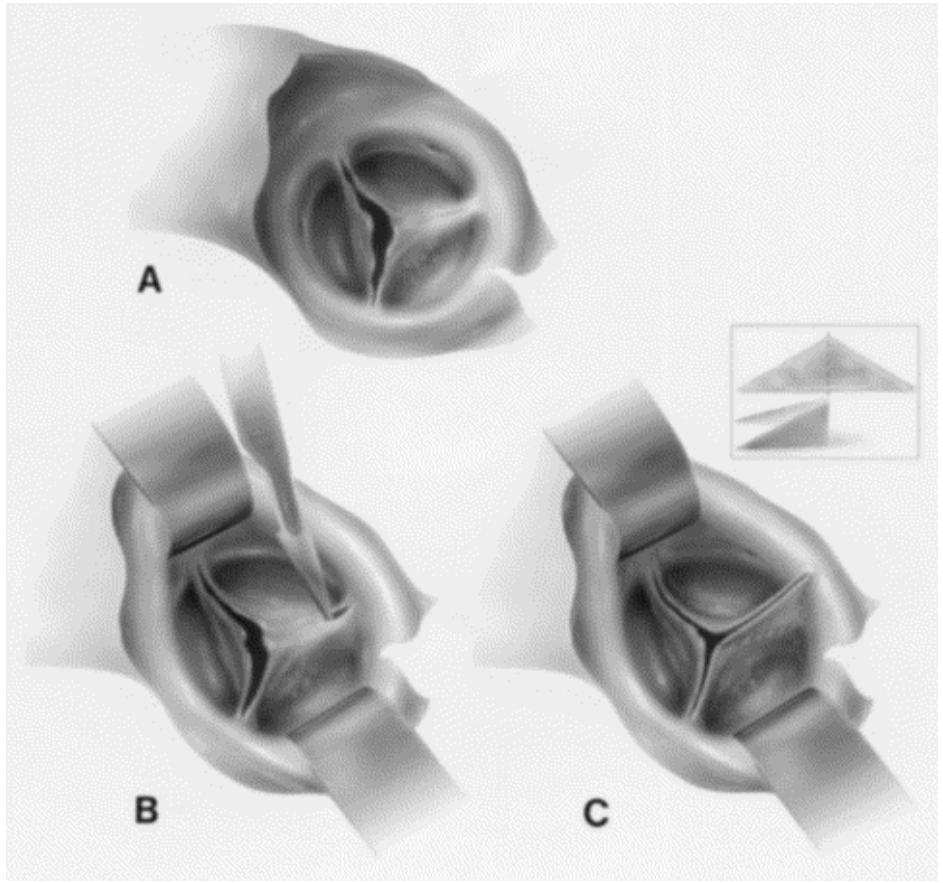
Tétralogie de Fallot – Voie droite

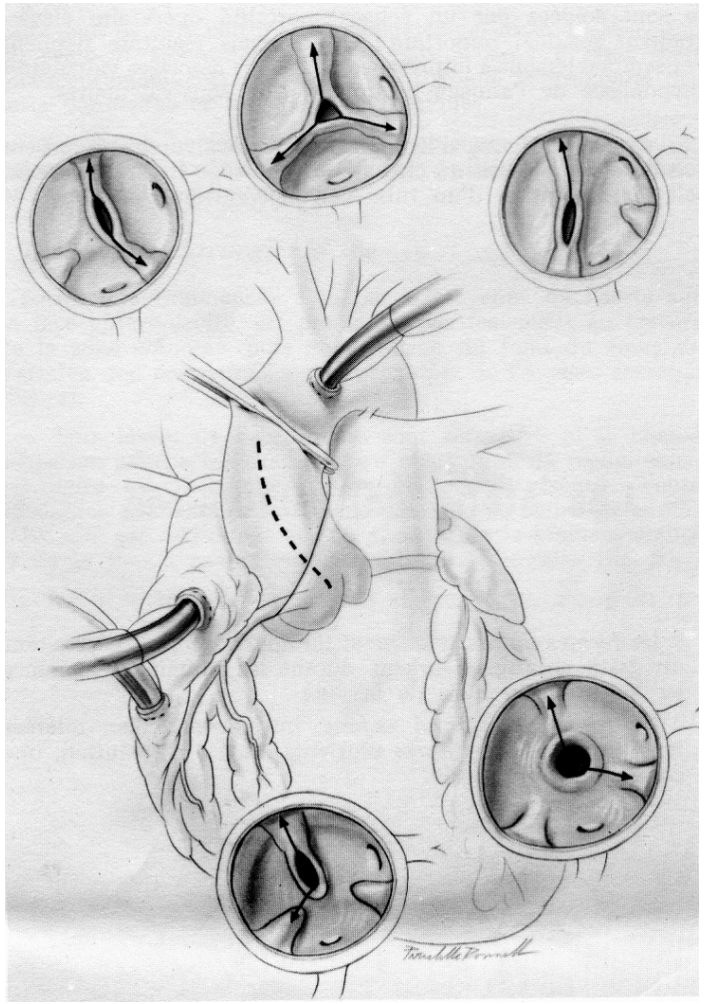
Sténoses Supra-Valvulaires



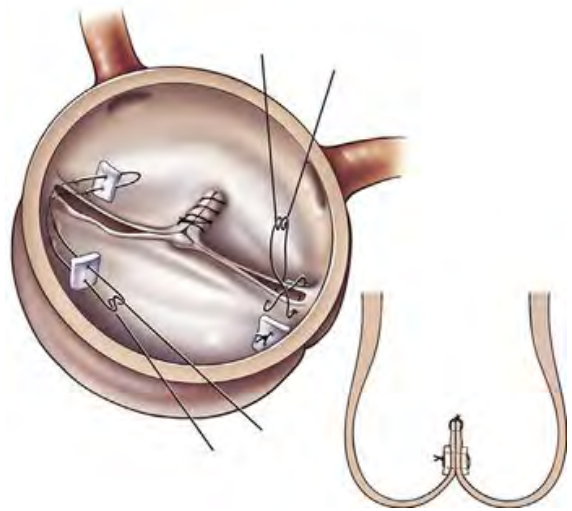


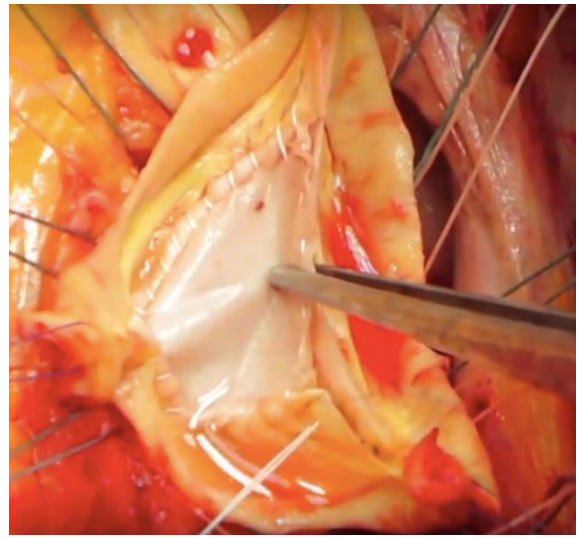
Sténoses Valvulaires Aortiques - Commissurotomie

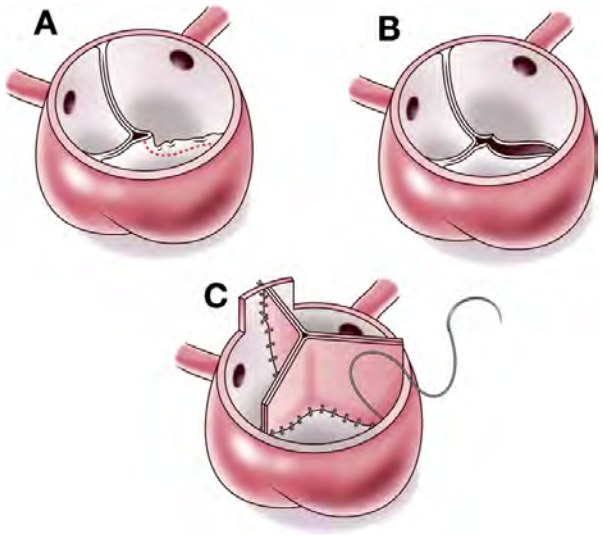


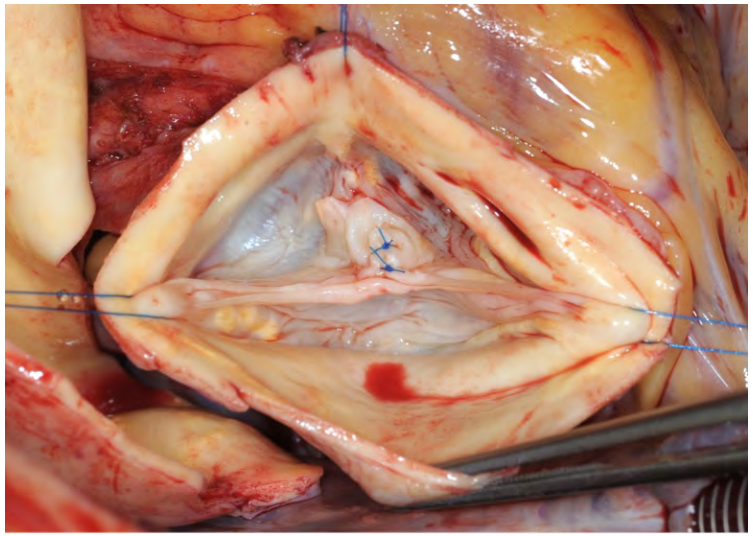


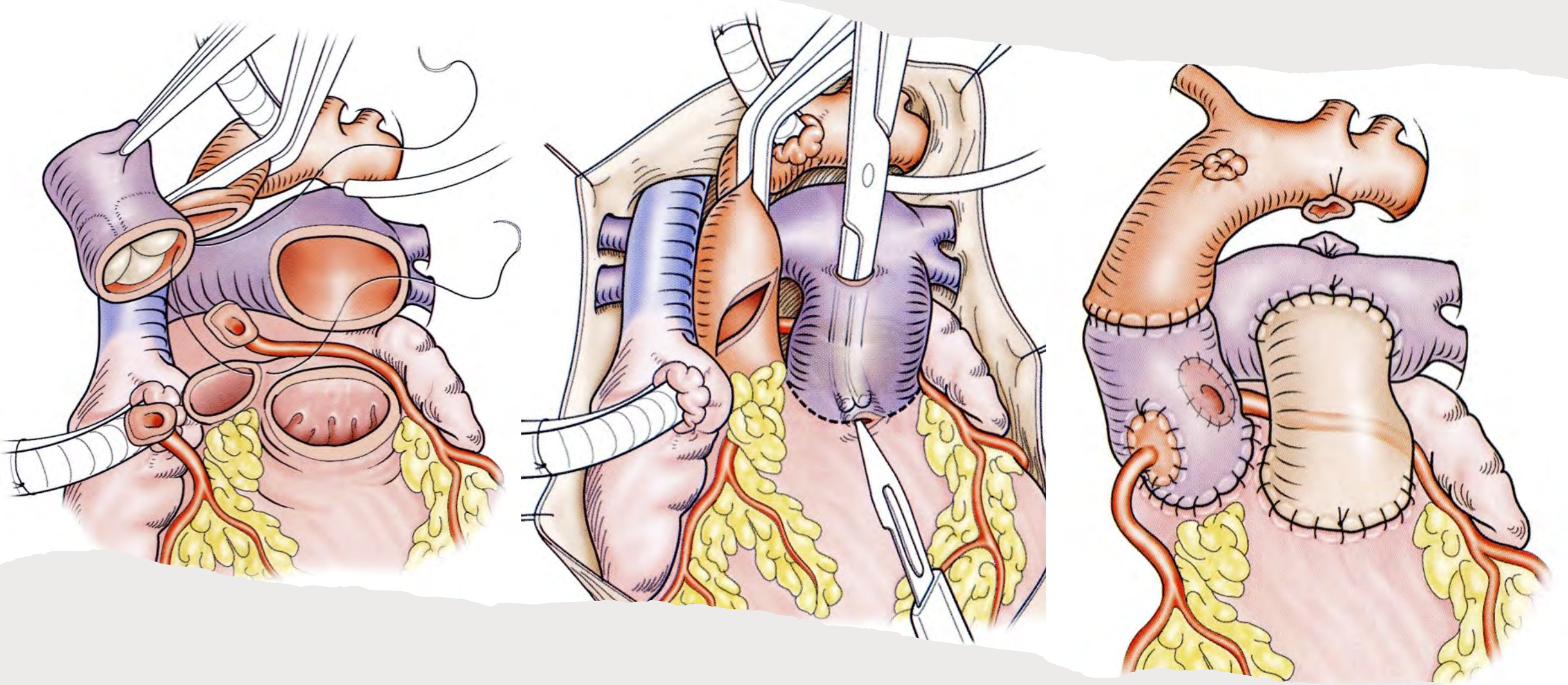
Sténoses Valvulaires Aortiques - Plastie





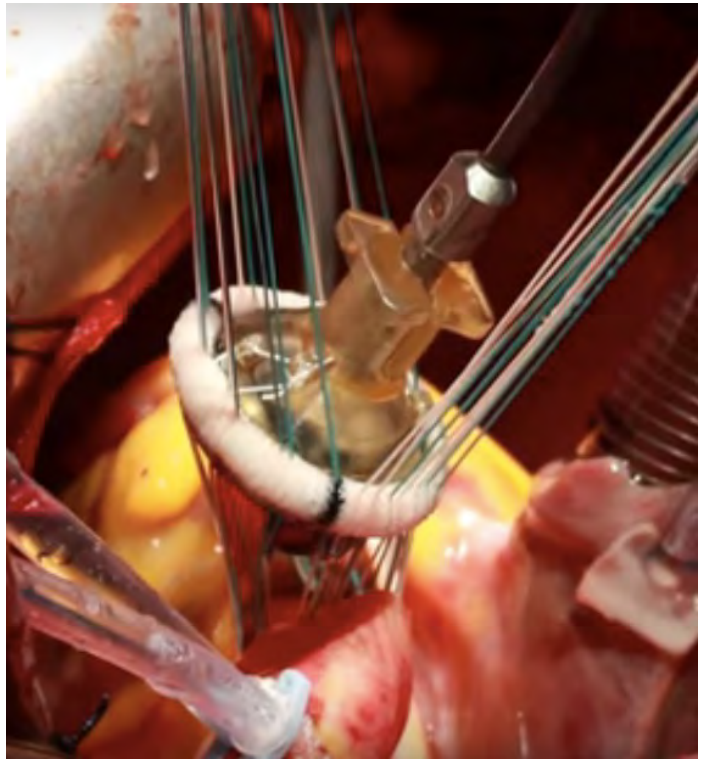


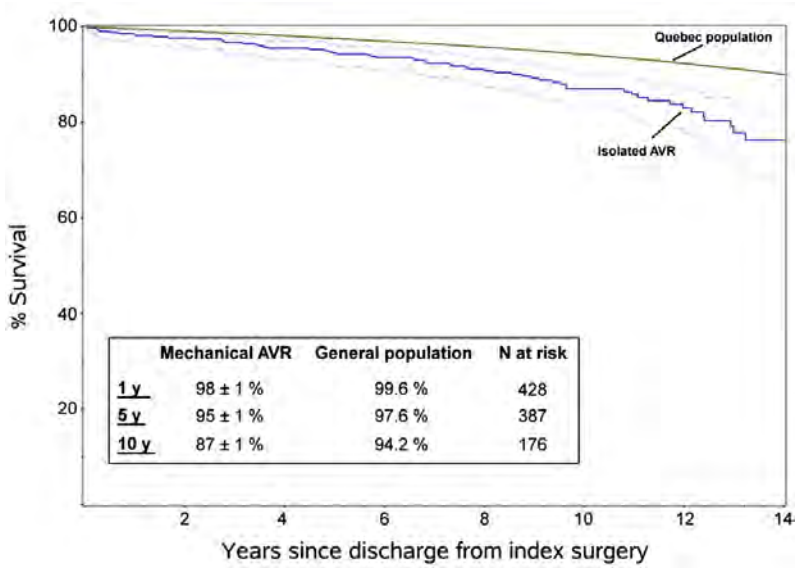




Sténoses Valvulaires Aortiques - Ross

Sténoses Valvulaires Aortiques - RVAo





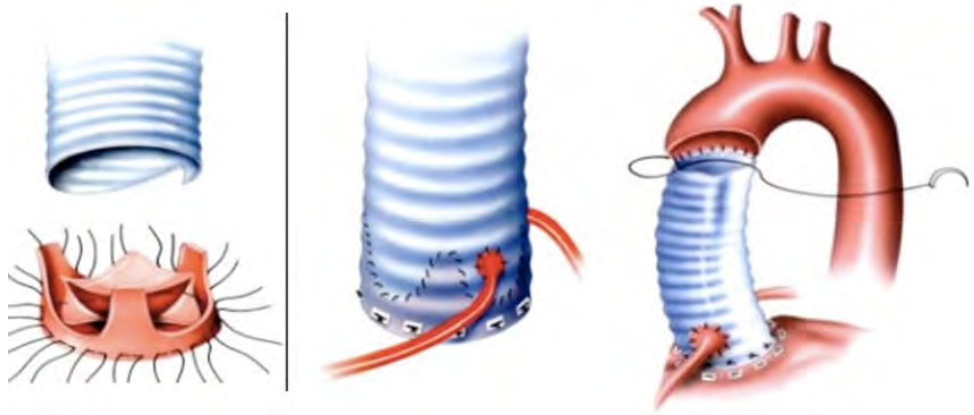
The Journal of Thoracic and Cardiovascular Surgery
Volume 148, Issue 4, October 2014, Pages 1341-1346.e1

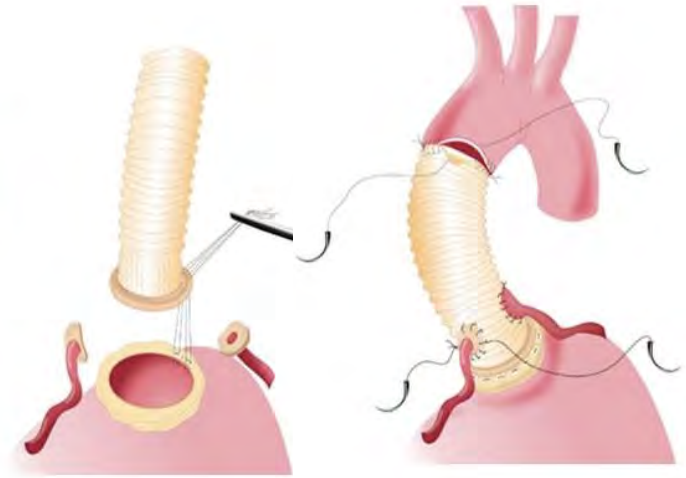
Acquired cardiovascular disease

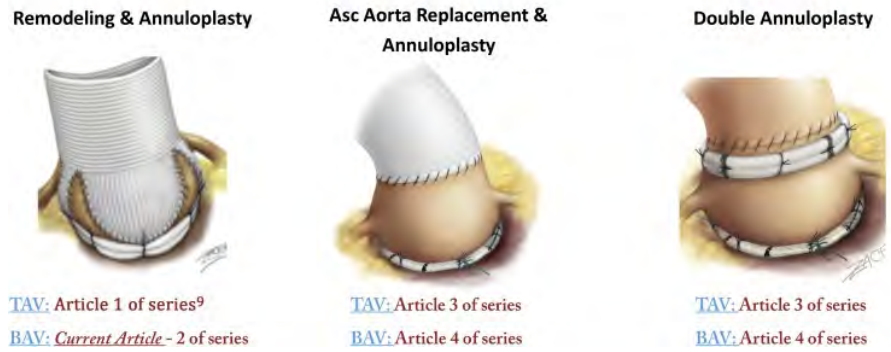
Long-term outcomes after elective isolated mechanical aortic valve replacement in young adults

Ismail Bouhout MSc [a], Louis-Mathieu Stevens MD, PhD [b], Amine Mazine MSc [a], Nancy Poirier MD [a], Raymond Cartier MD [a], Philippe Demers MD [a], Ismail El-Hamamsy MD, PhD [a]

Insuffisance Valvulaire Aortique





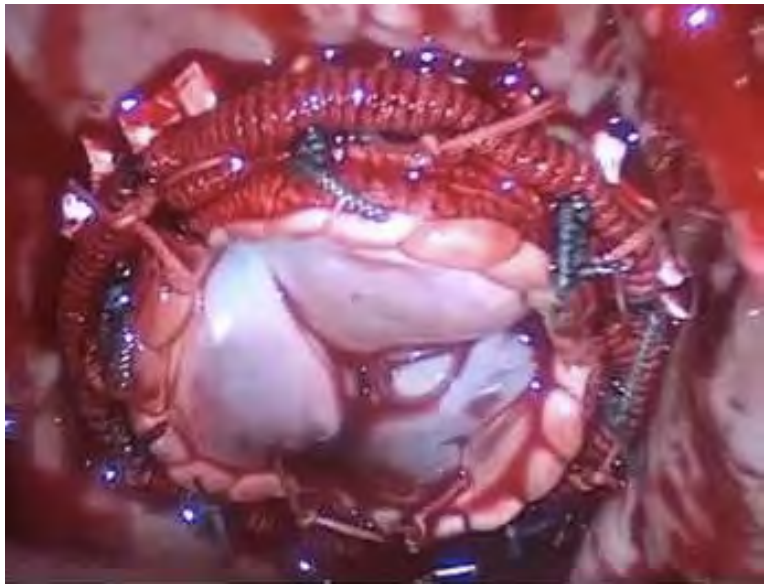


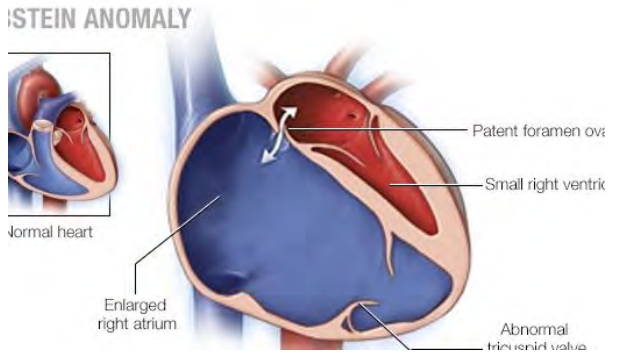
Remplacement valvulaire mécanique

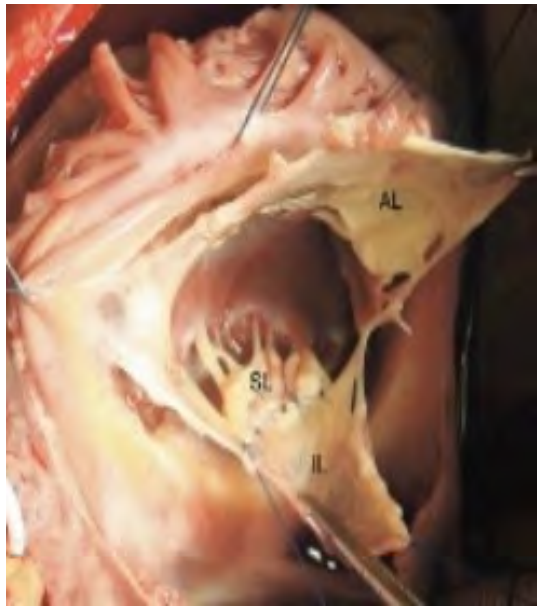
- RVA mécaniques
  - Mortalité précoce 5%
  - Survie moyenne 93% à 5 ans et 10 ans
  - Survie sans réintervention 87% à 10 ans
- RVM mécaniques
  - Mortalité précoce 9%
  - Survie moyenne 82% à 5 ans, 79% à 10 ans
  - Survie sans réintervention 68% à 10 ans
- PM 11%, 3,5% endocardite, 2% thrombose de valve, 7% saignement grave, 6% embolie

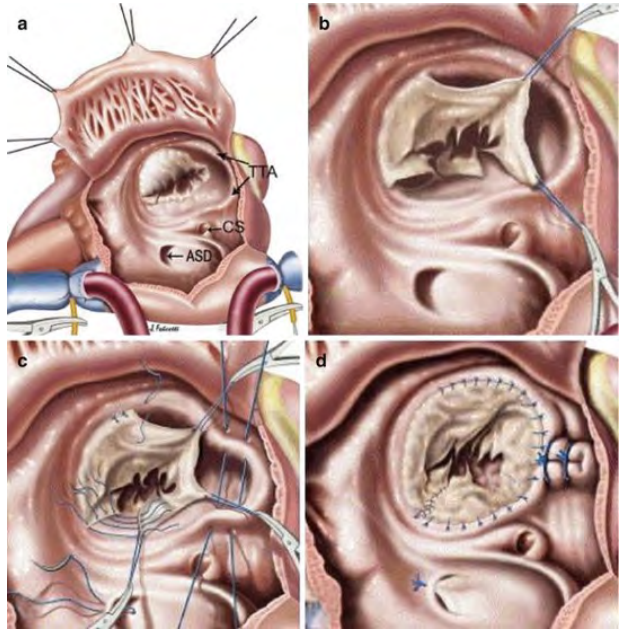
Necker. Dr Moreau de Bellaing. Dr Bajolle

Pathologie tricuspide

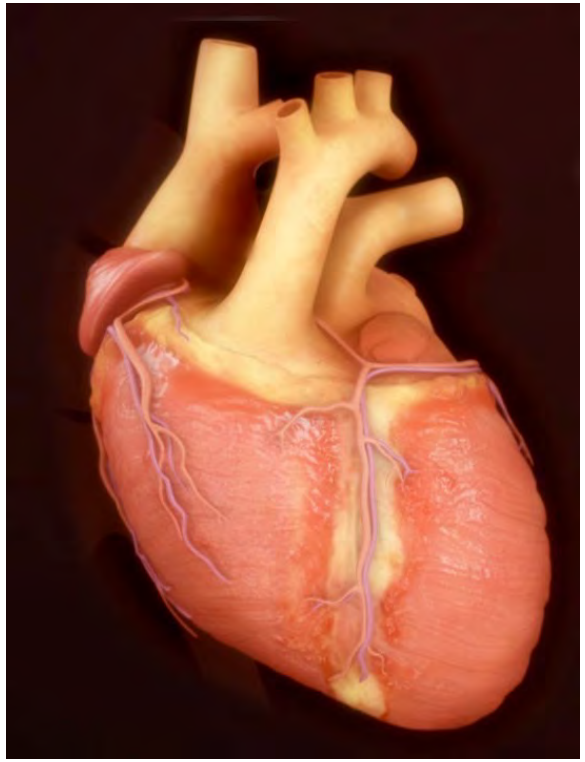


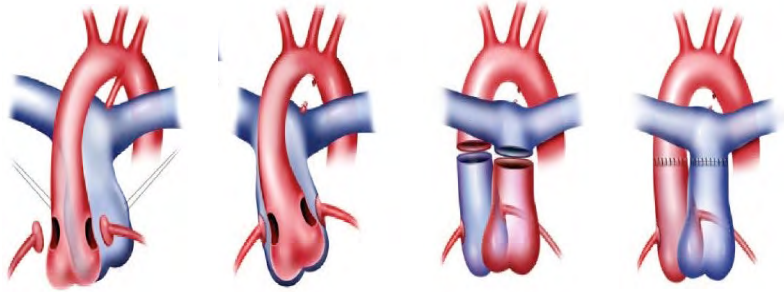






Transposition des Gros Vaisseaux



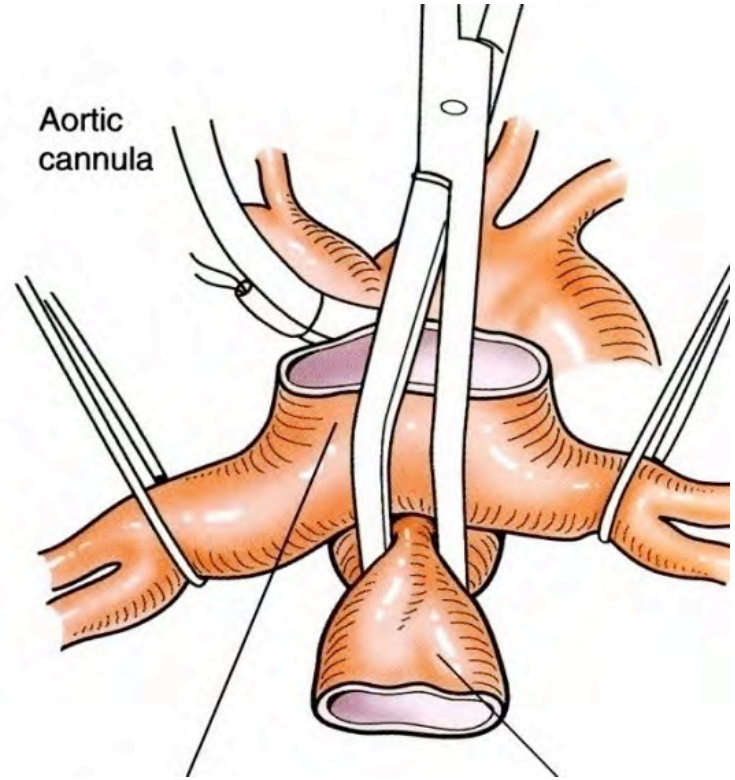


TGV – Section Aortique et Pulmonaire

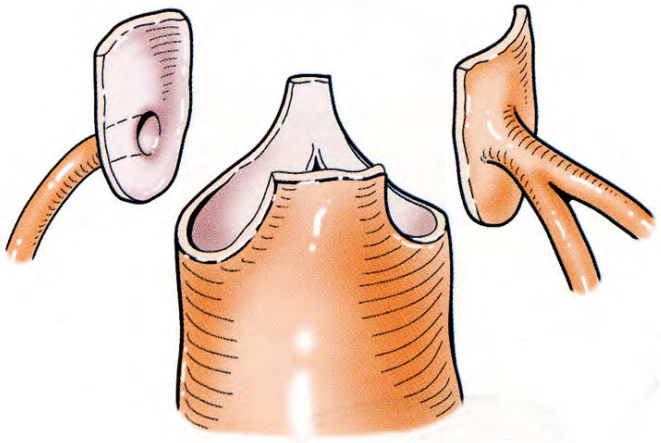
- Aortique:
  - à distance de la néo-valve pulmonaire
- Pulmonaire:
  - au dessus des commissures
  - exploration des néo-cusp aortique
  - recherche d’un malignement commissural

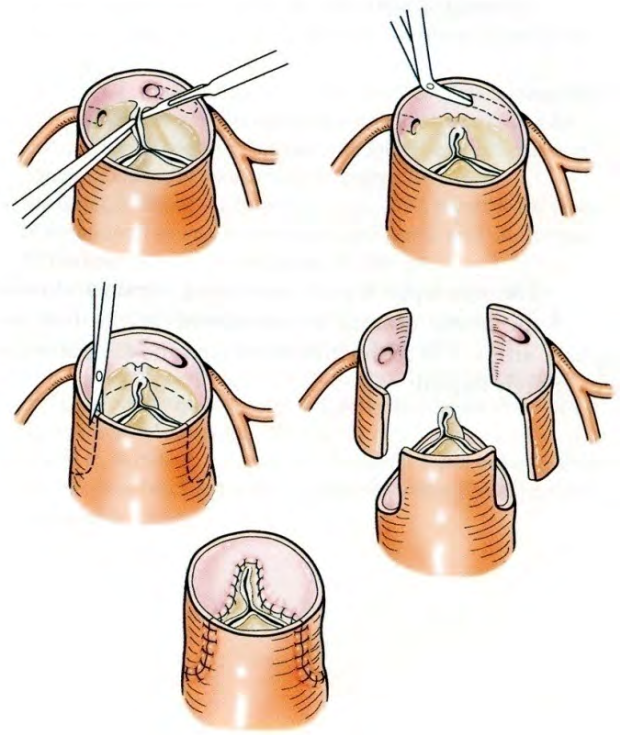
TGV - Manœuvre de Lecompte

- Mobilisation extensive des AP
- Section distale de l’aorte
- Néo-aorte courte

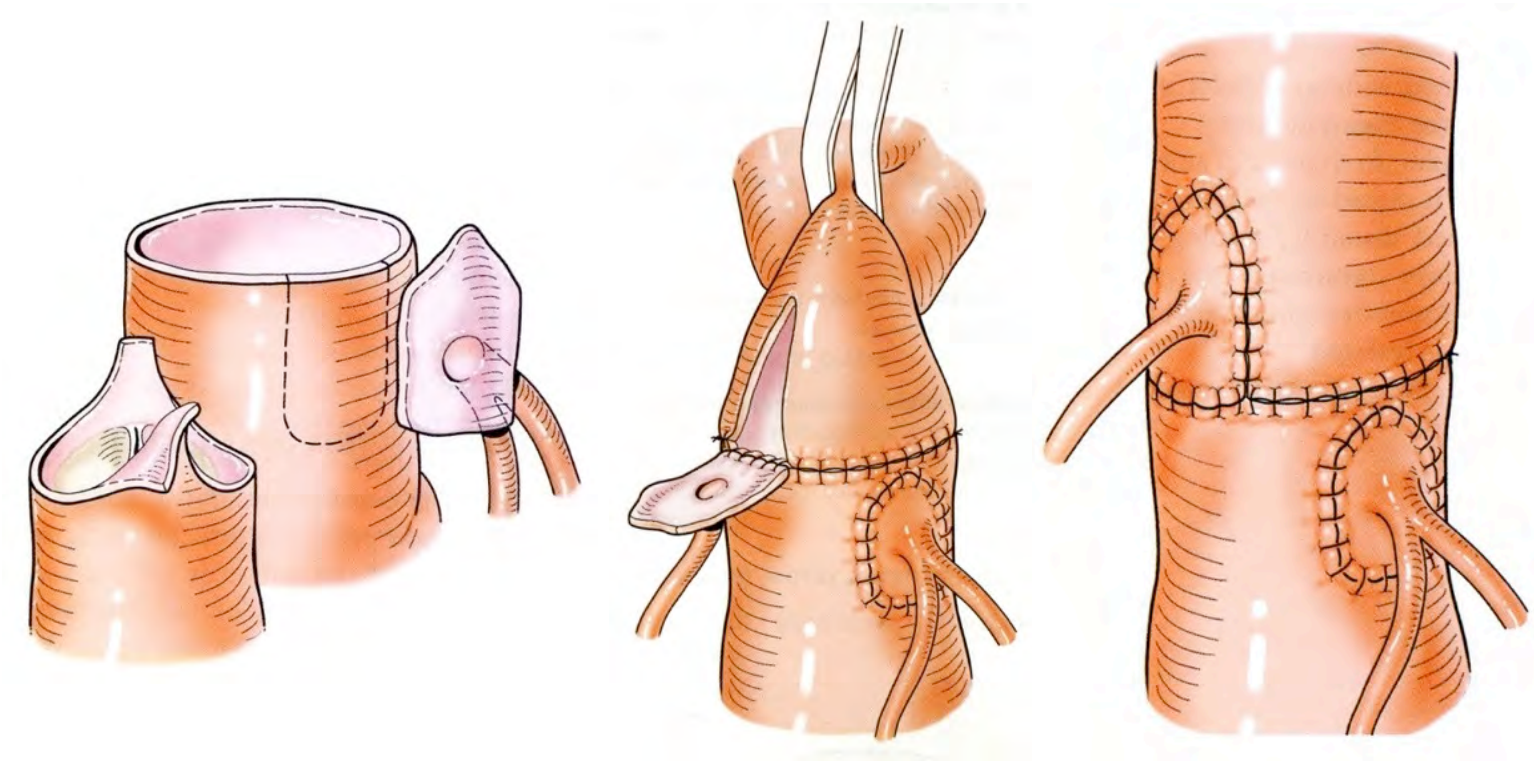


TGV - Prélèvement des coronaires

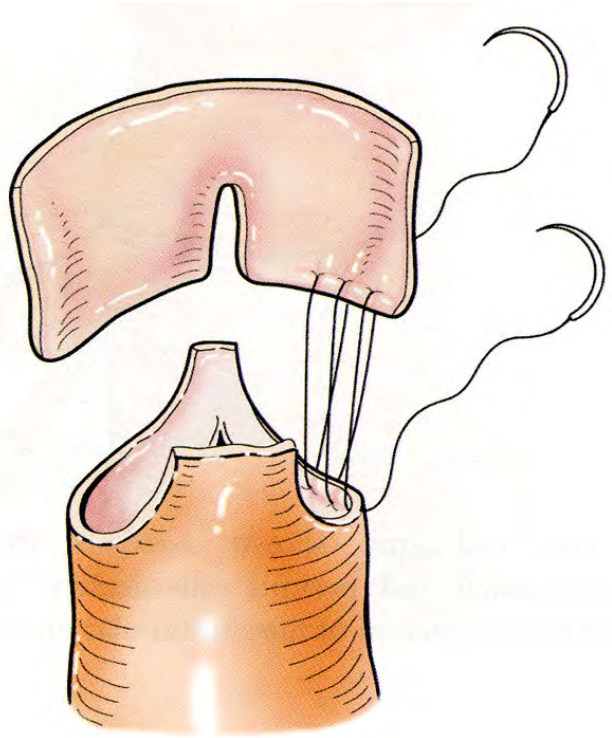




TGV – Réimplantation des Coronaires



TGV – Reconstruction Pulmonaire



Spécificités des GUCH

Chirurgie des cardiopathies congénitales chez l'adulte

- GUCH : Grown up Congenital Heart Disease
  -> ACHD : Adult Congenital Heart Disease
- Cardiopathie vieillie découverte tardivement
- Redux, tridux, quadridux… multiopéré

Due to medical, surgical, and technological evolutions,
>90% of individuals with CHD who are born, now survive into adulthood

2020. ESC Guidelines. European Heart Journal

Chirurgie des cardiopathies congénitales chez l'adulte

ESC
European Society of Cardiology

European Heart Journal (2021) **42**, 563–645
doi:10.1093/eurheartj/ehaa554

ESC GUIDELINES

2020 ESC Guidelines for the management of adult congenital heart disease

The Task Force for the management of adult congenital heart disease of the European Society of Cardiology (ESC)

Endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC), International Society for Adult Congenital Heart Disease (ISACHD)

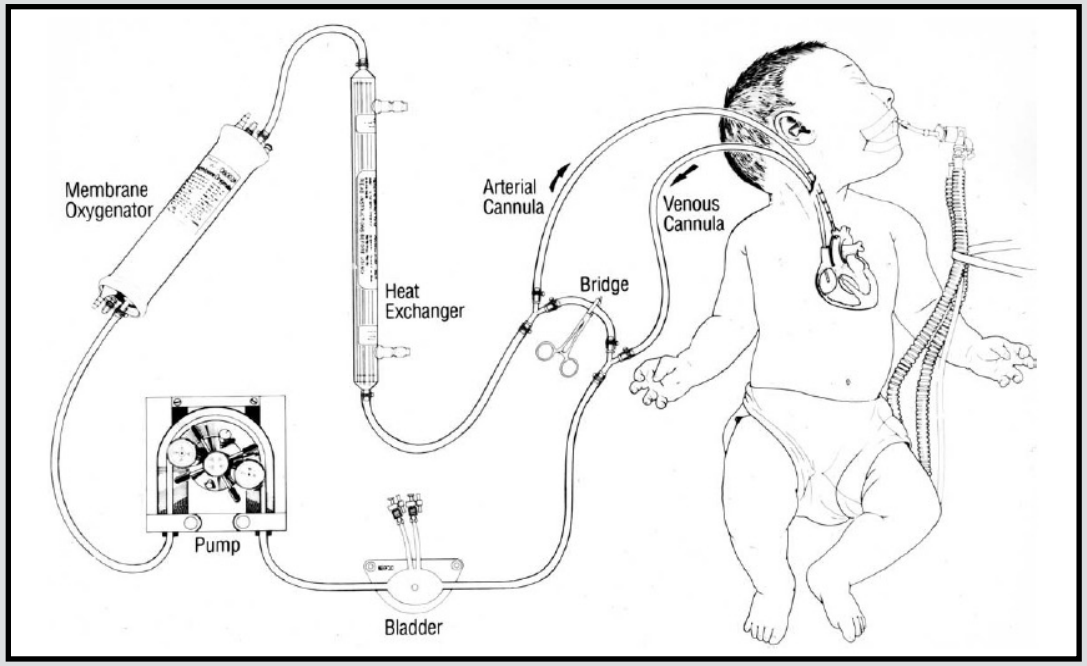
Chirurgie des cardiopathies congénitales chez l'adulte

- Principalement chirurgie de la voie droite
  - Fallot, APSO
- Evaluation imagerie ++
  - Proximité des structures cardiaques avec sternum : TDM !
  - Accès vasculaire : Echo doppler !
  - Shunt persistant : ETO test aux bulles !

Assistance Circulatoire

Les assistances circulatoires

V-A ECMO support cardio-respiratoire



V-V ECMO support respiratoire

ECMO VV

- Jugulaire unique
- Jugulo-fémorale

ECMO VA

- Jugulo-carotidienne
- Fémoro-fémorale
- Centrale OD/Ao

Indications de l'ECMO

Défaillance post-cardiotomie

- Dysfonction myocardiaque pré-opératoire (ALCAPA, hypoVG, TGV vieillie)
- Dysfonction myocardiaque post-opératoire (clampage Ao prolongé, cardioprotection, dysfct VD, lésion résiduelle)
- Post-transplantation

Défaillance circulatoire « médicale »

- Myocardite, décompensation CMD
- Intoxication médicamenteuse
- Arythmies réfractaires
- ACR
- Hypoxémie et CHD

THE JOURNAL OF PEDIATRICS • www.jpeds.com

ORIGINAL ARTICLES

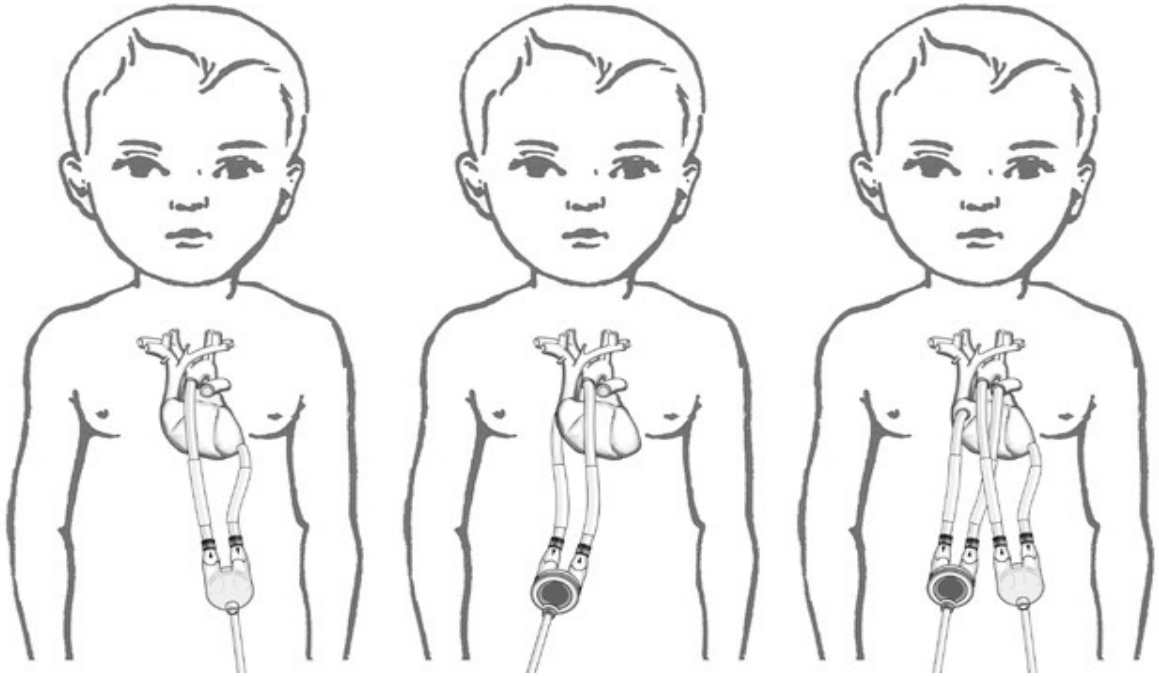
Should Extracorporeal Membrane Oxygenation Be Offered? An International Survey

Kevin W. Kuo, MD[1], Ryan P. Barbaro, MD[1], Samir K. Gadepalli, MD[2], Matthew M. Davis, MD[3], Robert H. Bartlett, MD[2], and Folafoluwa O. Odetola, MD[1]

Contre-indications de l'ECMO

- Réanimation cardio-pulmonaire prolongée (+de 5 à 30 min dans les recommandations de l'ECLSO)
- Cardiopathie irréversible inopérable
- Atteinte neurologique sévère (acquise ou congénitale)
- Saignement actif important
- Terrain (sd polymalformatif, trisomie 18...)
- Nouveau né - de 2kg / - de 35 SA
- Canulation impossible sur un patient en arrêt

Assistance de longue durée - Berlin Heart



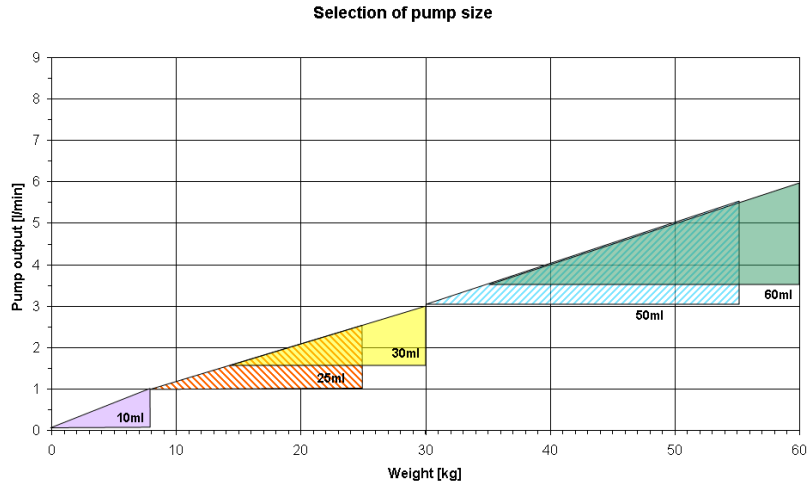
VAD
mono G
VG/Ao

VAD
mono D
OD/AP

biVAD

Berlin Heart

Ventricules de 10 à 80ml : patients de 3kg jusqu'aux adultes



Transplantation

Indications

En 2014, 586 Tx sur 112 centres (soit 5/centre/an)

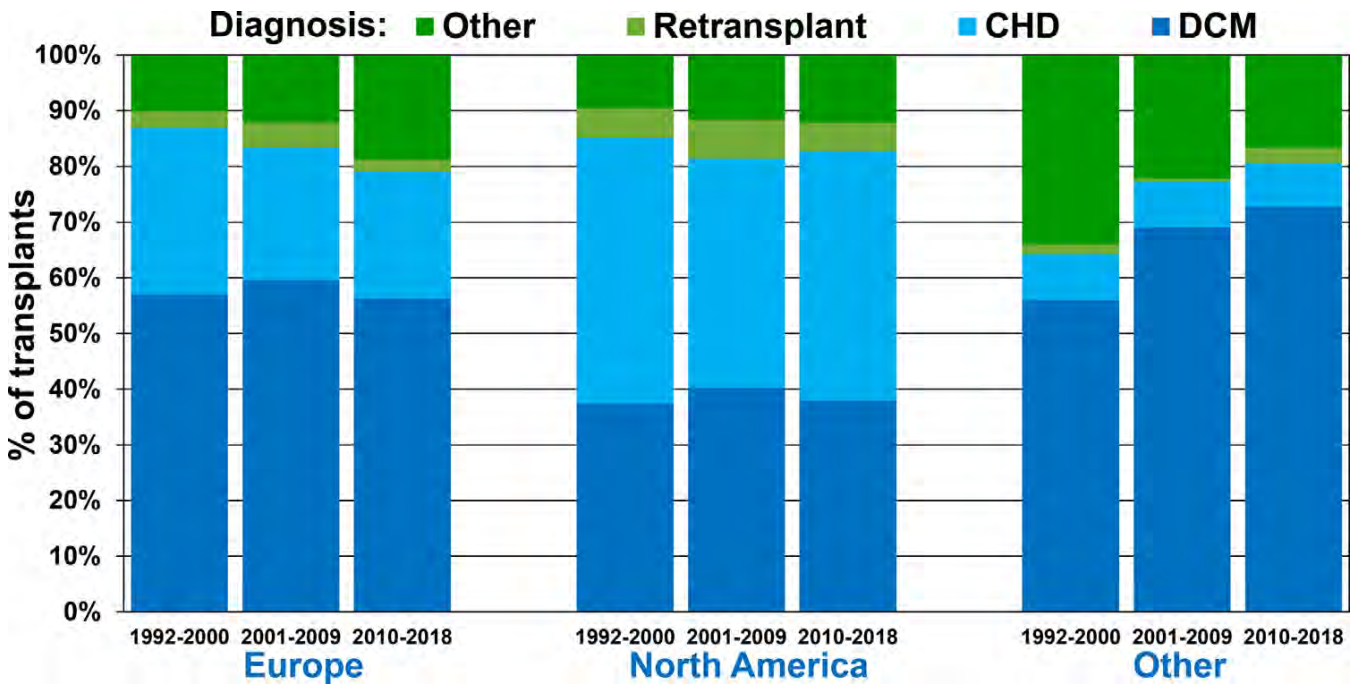


Figure 1 Recipient diagnosis by location and era (January 1992-June 2018).

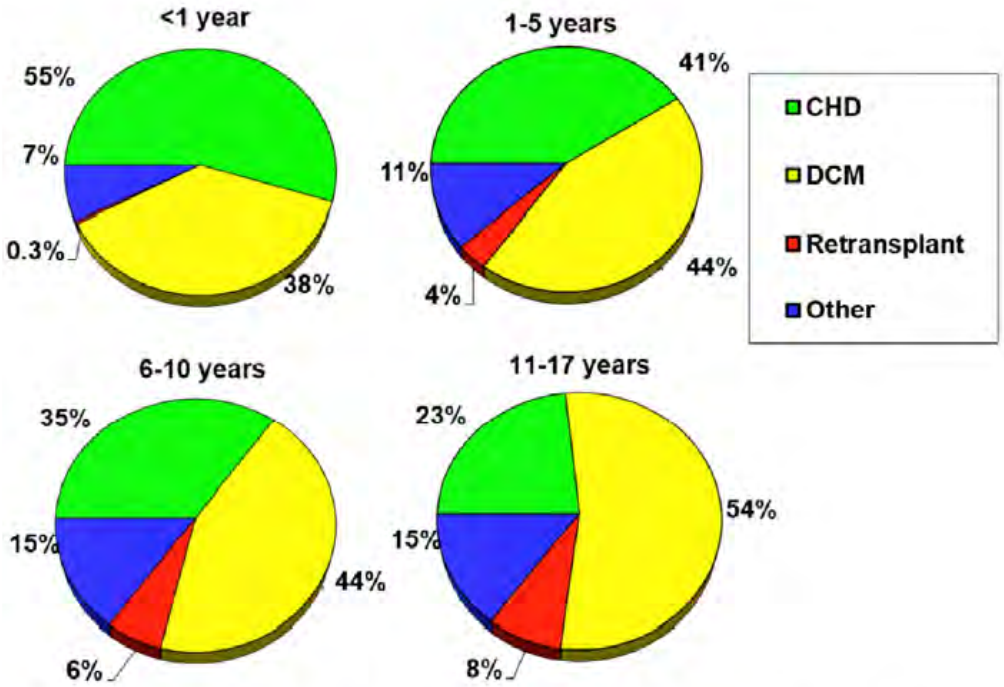


Figure 20 Recipient diagnosis by age group.

2016. Rossano. ISHLT

Statut des receveurs

Table 1 Distribution of Recipient Characteristics by Transplant Era (Transplants: January 1992 — June 2018)

	Jan 1992-Dec 2000(n = 3,666)	Jan 2001-Dec 2009(n = 4,476)	Jan 2010-Jun 2018(n = 5,307)	p-value
Age (years)	6 (0 - 17)	7 (0 - 17)	7 (0 - 17)	0.0005
Age <1 year	25.5%	22.7%	21.9%	0.0003
Male	58.2%	54.6%	54.5%	0.0009
BMI (kg/m^2)	19.9 (16.1 - 30.0)	20.9 (16.3 - 32.4)	21.1 (16.4 - 31.7)	<0.0001
PRA ≥20%	6.7%	15.1%	23.8%	<0.0001
PRA ≥80%	1.3%	5.1%	5.9%	<0.0001
History of malignancy	3.2%[a]	2.4%	2.2%	0.0653
Pre-transplant dialysis	1.9%[a]	4.1%	3.3%	0.0002
Bilirubin (mg/dl)	0.8 (0.2 - 3.2)[a]	0.7 (0.2 - 3.4)	0.6 (0.2 - 2.9)	<0.0001
Creatinine (mg/dl)	0.6 (0.3 - 1.3)[a]	0.5 (0.2 - 1.4)	0.4 (0.2 - 1.1)	<0.0001
GFR (ml/min/1.73 m^2)[c]	80.7 (39.6 - 127.2)[a]	82.6 (39.4 - 138.8)	94.0 (50.8 - 164.2)	<0.0001
PVR (woods unit)	3.0 (0.8 - 11.8)[a]	3.0 (0.8 - 12.2)	2.6 (0.6 - 11.8)	0.0046
Inotrope use	42.2%[a]	49.6%	50.5%	<0.0001
PGE use, age <1 year[d]	32.2%[b]	11.6%	8.7%	<0.0001
ECMO use	4.4%[b]	8.6%	4.4%	<0.0001
MCS use:				
- None	-	86.3%	74.3%	<0.0001
- VAD	-	9.8%	20.0%	
- TAH	-	0.2%	0.3%	
- BIVAD	-	3.7%	5.4%	
Ventilator use	17.4%	21.2%	16.6%	<0.0001
Hospitalized	64.7%	69.3%	72.2%	<0.0001

Le donneur idéal

CONDITIONS GENERALES

- Age < 40-50 ans
- Pas de tabac ou <10-20 PA
- Pas d'ATCD de néoplasie, traumatisme thoracique, chirurgie cardio-thoracique
- Distance (ischémie)

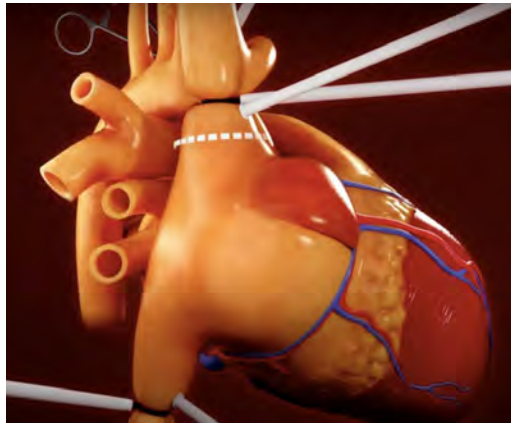
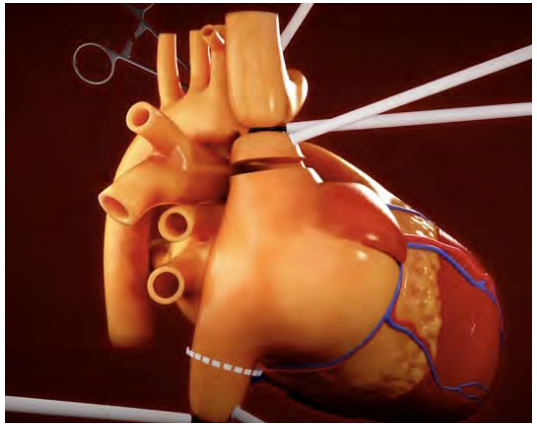
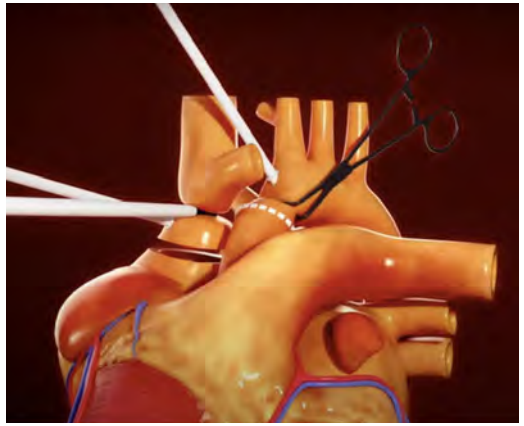
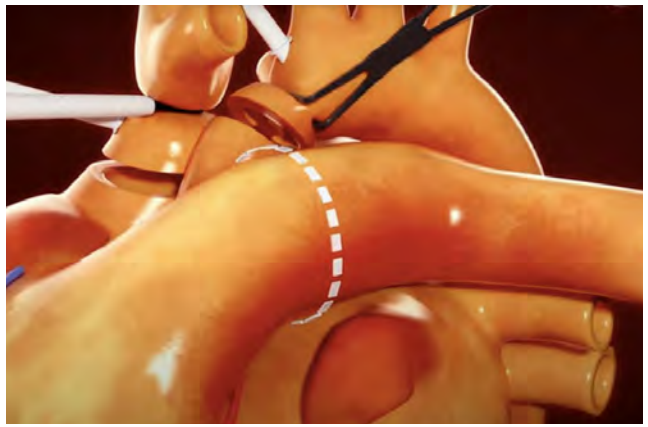
CONDITIONS SPECIFIQUES

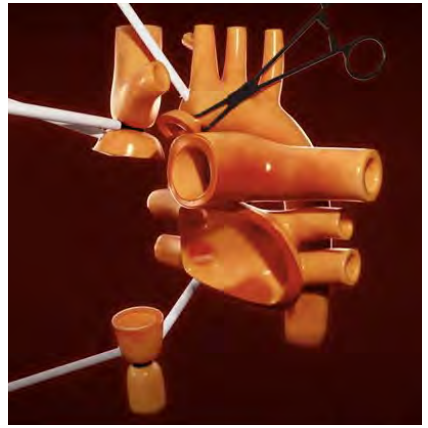
- Pas ou peu d'amines
- Pas ou peu de troponine
- ETT normale
- Coronaires saines

Choix du greffon : selon le patient

- CRITERES GENERAUX
  - Groupe sanguin
  - CMV et EBV
  - Antigènes interdits
- CRITERES SPECIFIQUES
  - Morphologie – Poids
  - Indication - Poids

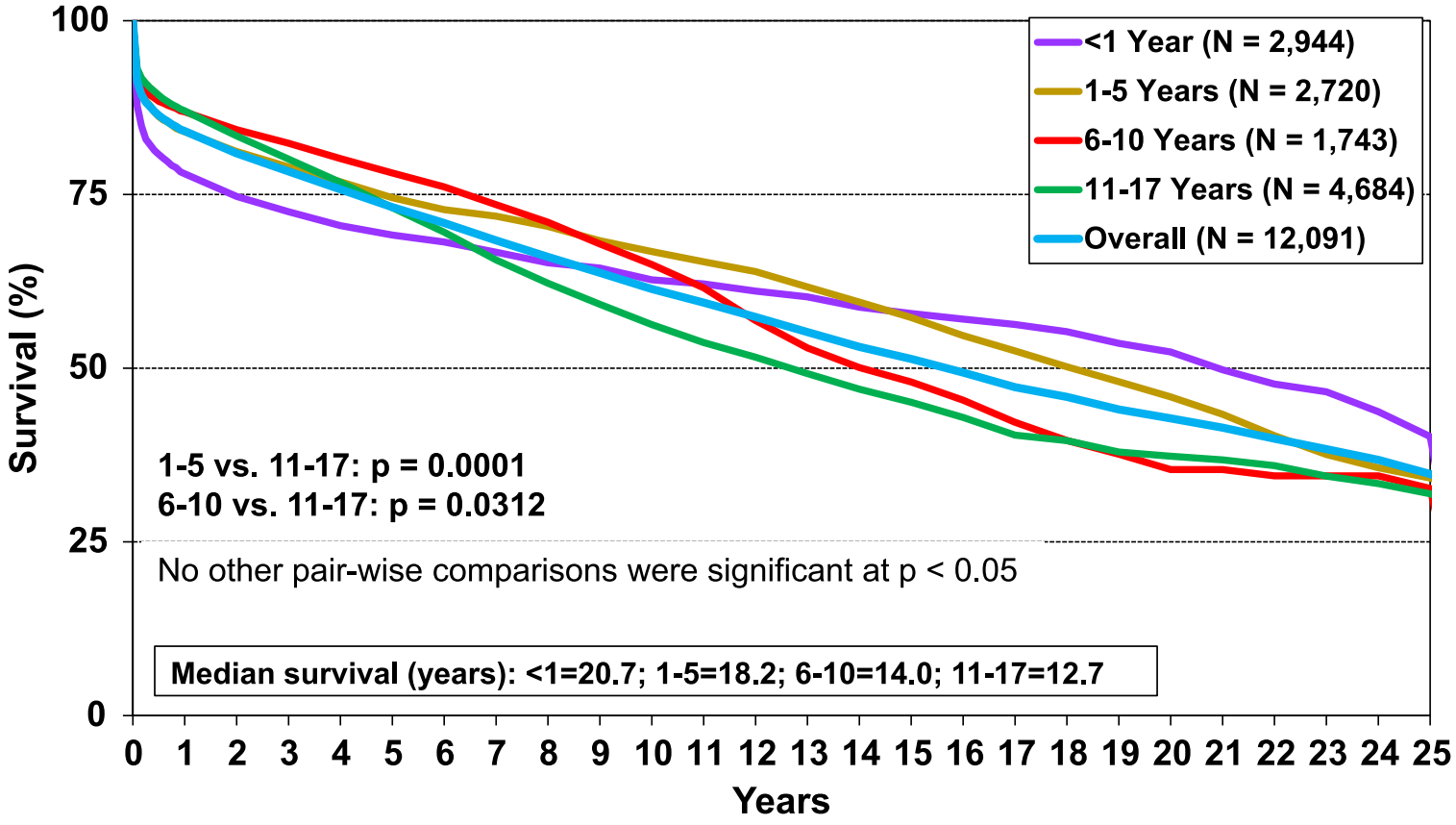
Explantation cardiaque receveur



https://www.youtube.com/watch?v=VGZRMHA4ics

Survie après Transplantation cardiaque

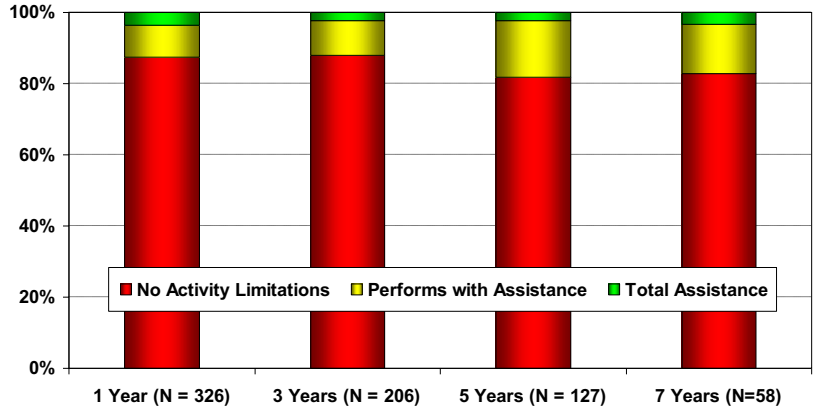


Médiane de survie de 15 ans

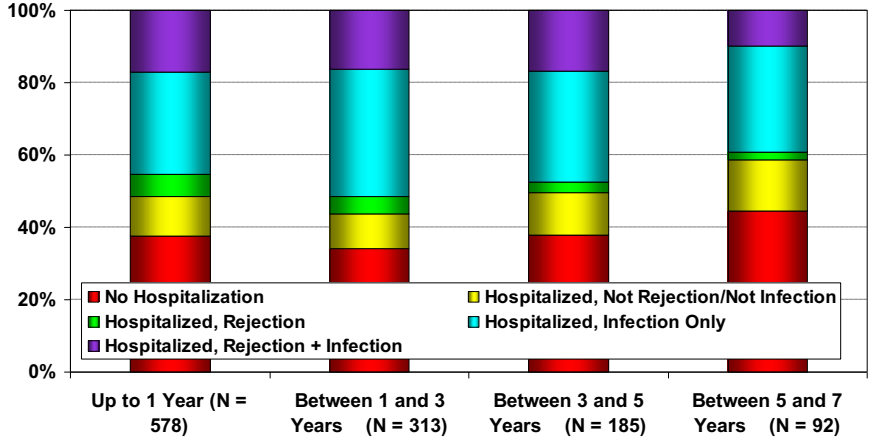
2016. Rossano. ISHLT

Comment vont-ils ?

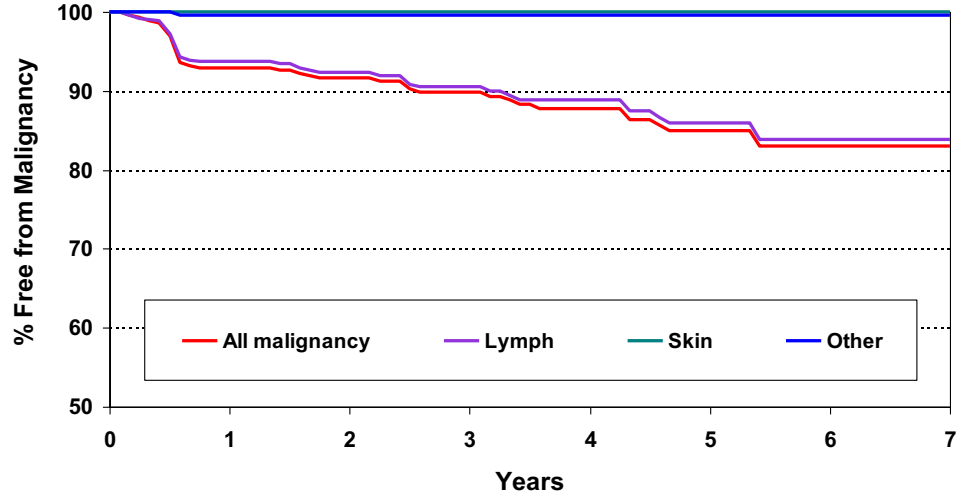
Statut fonctionnel



Réhospitalisation



Morbi-mortalité



2010. ISHLT

Alternative ?

Cerclage prophylactique et cardiomyopathie dilatée

Early prophylactic pulmonary artery banding in isolated congenitally corrected transposition of the great arteries☆

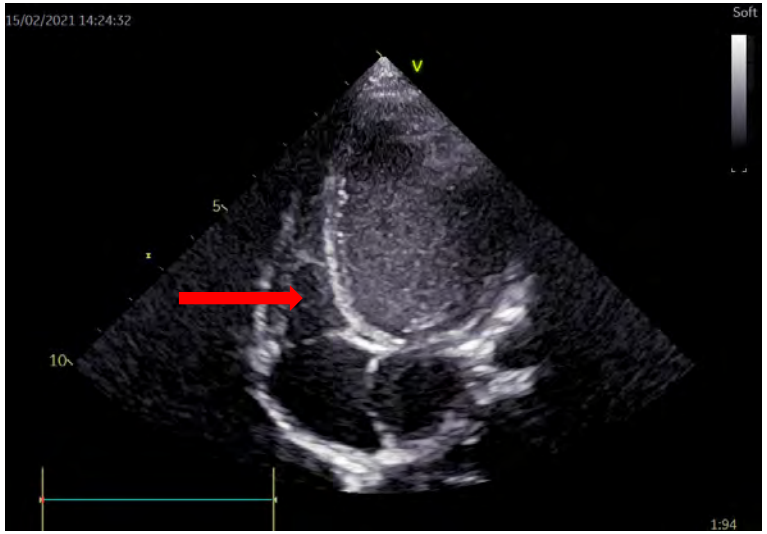
European Journal of Cardio-thoracic Surgery 38 (2010) 728–734

Pulmonary artery banding in infants and young children with left ventricular dilated cardiomyopathy: A novel therapeutic strategy before heart transplantation

The Journal of Heart and Lung Transplantation, Vol 32, No 5, May 2013

Cerclage prophylactique

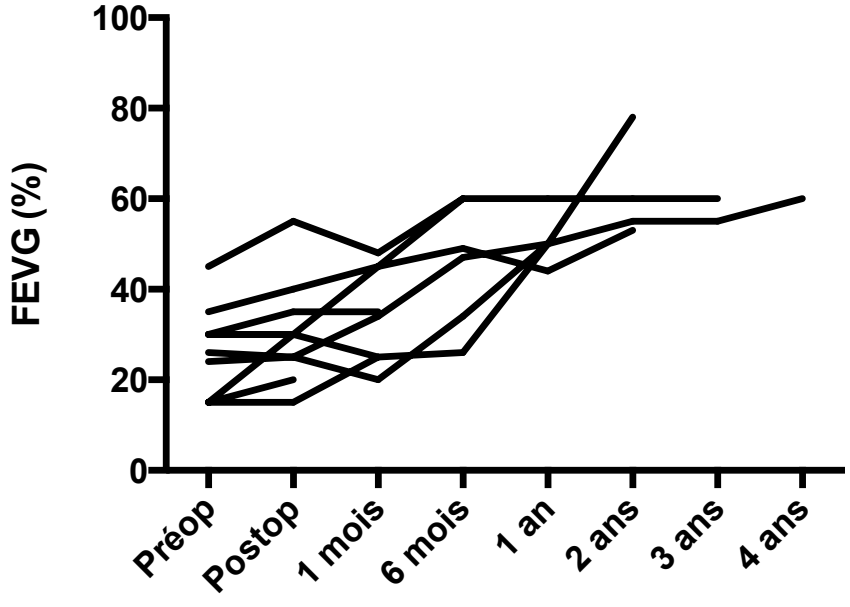
- Monitorage ETO en continu
- Incision limitée du péricarde
- Cerclage sous Adrénaline et Milrinone
- Objectif PVD 60-70%

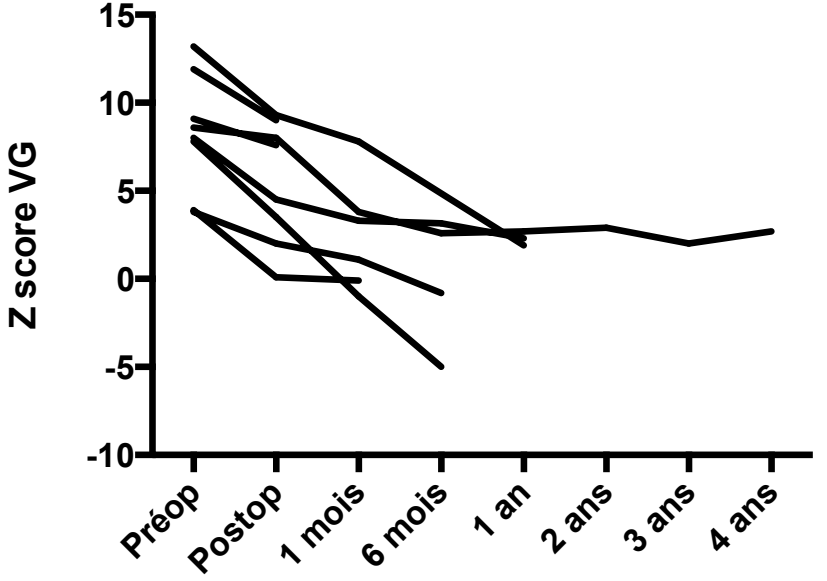


Cerclage prophylactique

FEVG :

- 26% avant cerclage
- 50% (+ 22.6%) au dernier suivi





DTDVG :

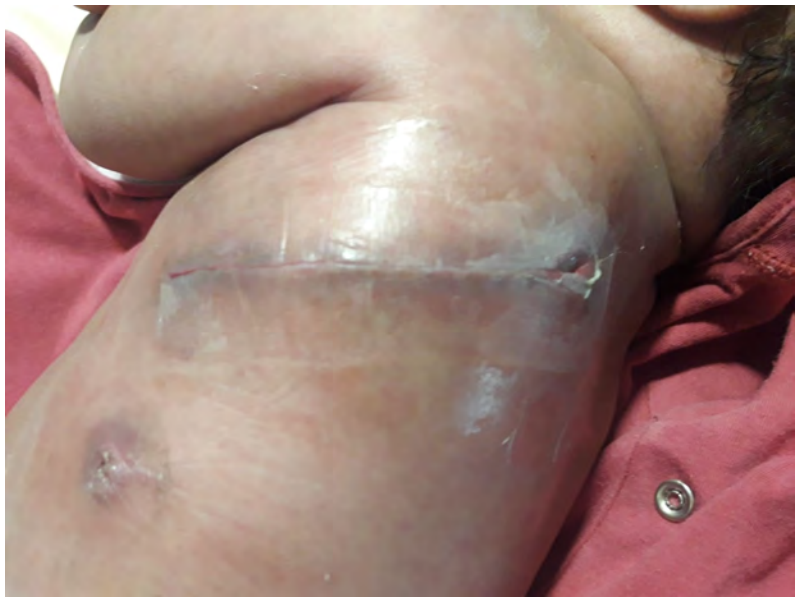
- 44.5mm avant cerclage
- 38 mm (- 6.4 mm) au dernier suivi

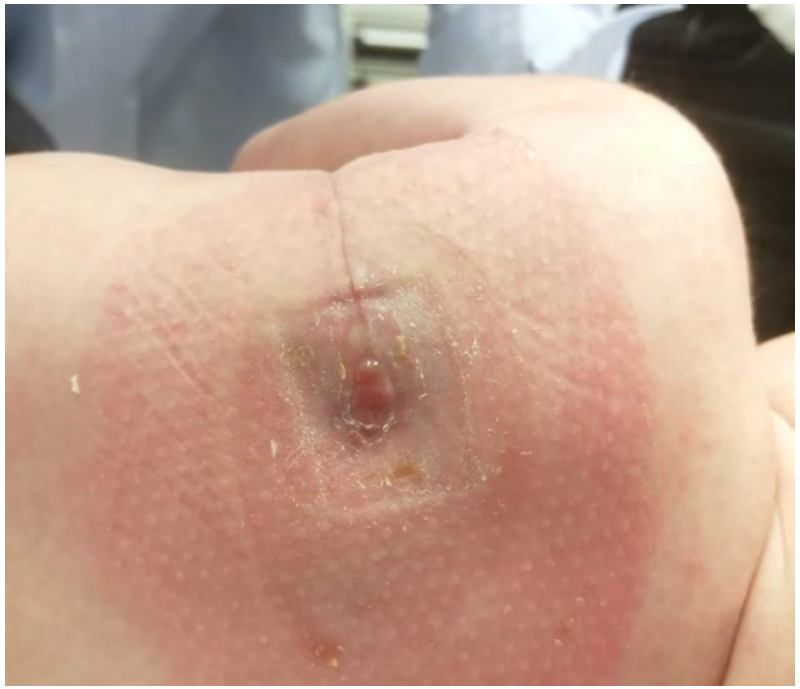
Z score :

- + 8.5 avant cerclage
- + 1.8 (- 6) au dernier suivi

Cicatrices

Cicatrice de Thoracotomie





Cicatrice de Thoracotomie

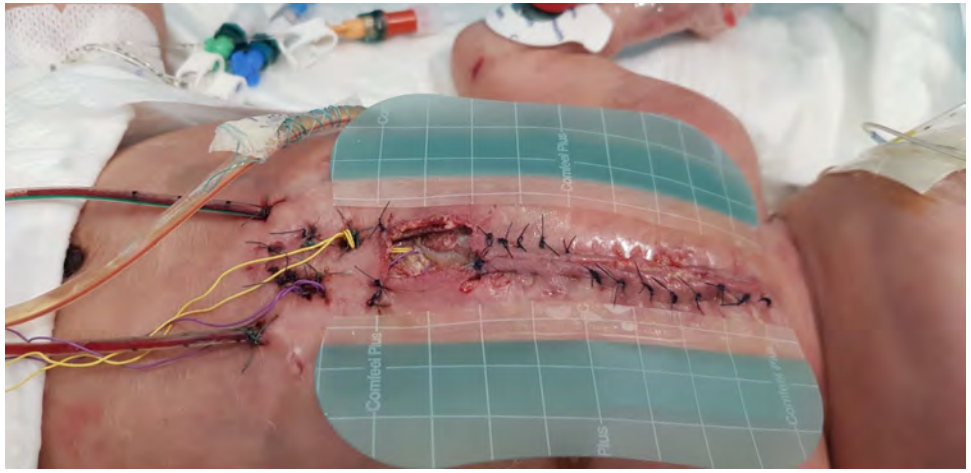
Cicatrice de Sternotomie

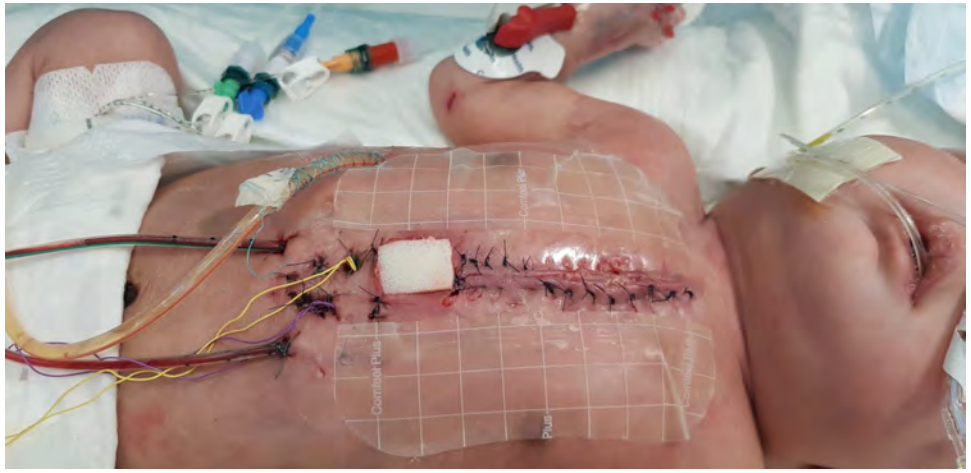
Cicatrice de Sternotomie

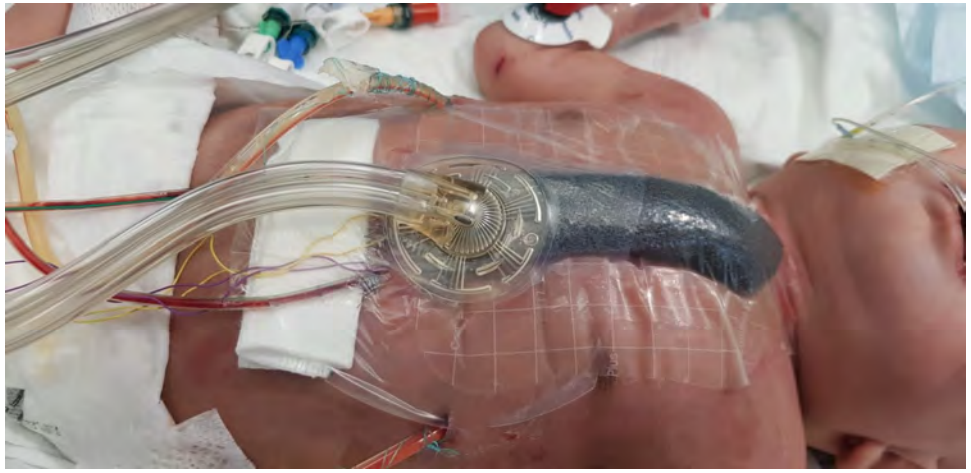



Cicatrice de Sternotomie

Cicatrice de Sternotomie








Merci de votre attention
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