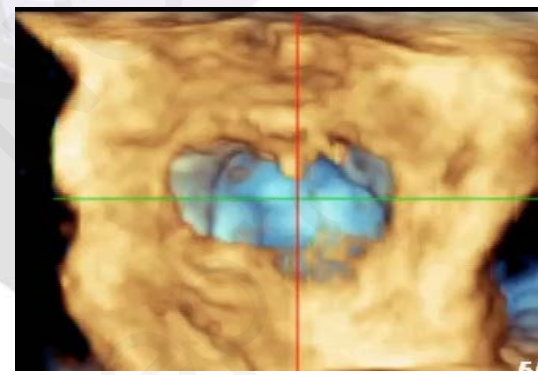
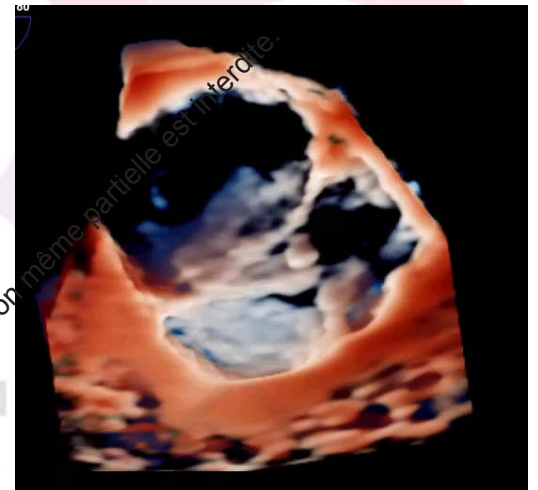


Groupe Imagerie - L'insuffisance aortique : Evaluation en imagerie et réparabilité

Quels sont les bons candidats à une chirurgie réparatrice, quelles sont les contre-indications ?

A. Berrebi





DÉCLARATION DE LIENS D'INTÉRÊT POTENTIELS

Intervenant : Alain Berrebi, Paris

Je n'ai pas de lien d'intérêt potentiel à déclarer

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Contemporary Presentation and Management of Valvular Heart Disease

The EURObservational Research Programme Valvular Heart Disease II Survey

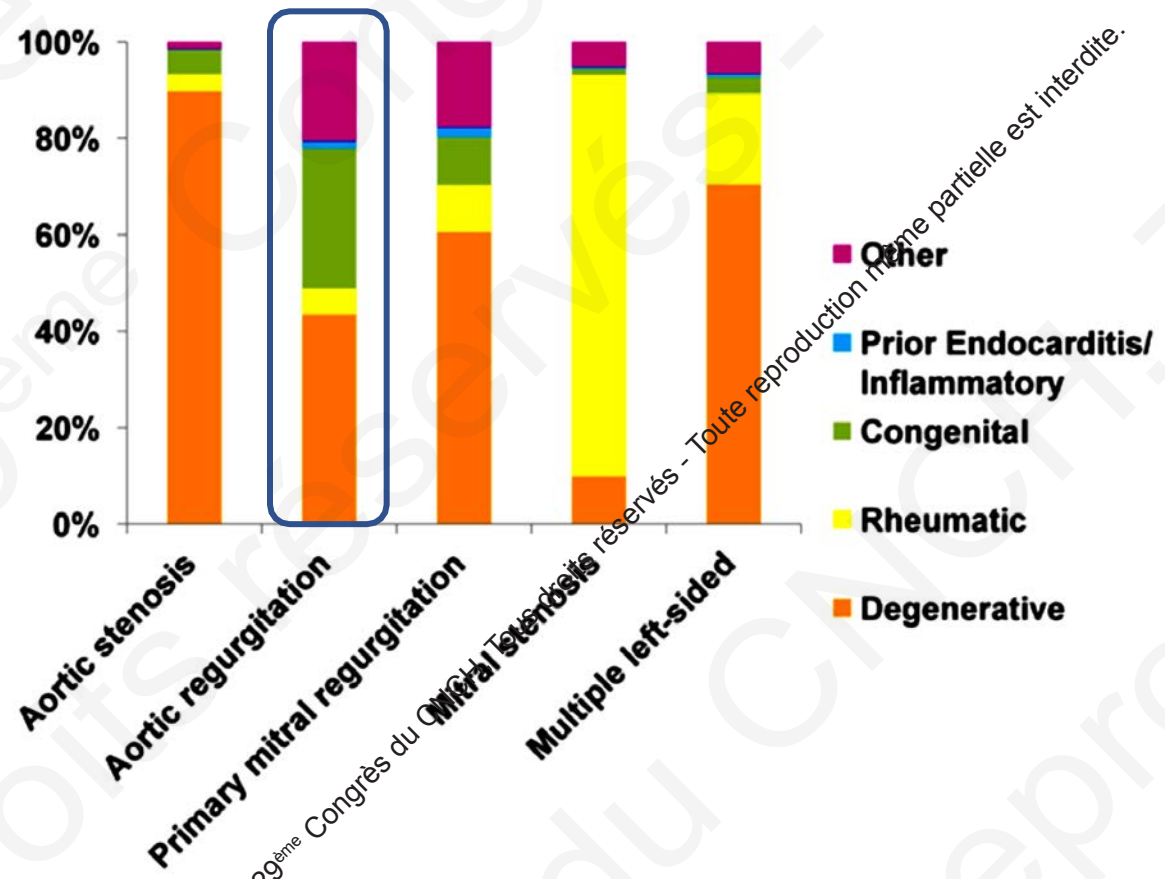
Less frequent than AS and MR (5.7%)

Dystrophic and Congenital

Associated Aorta Disease

Young adults (mean age 57 yrs)

Repair in only 21.5 %





29^{ème} CONGRES CNCH



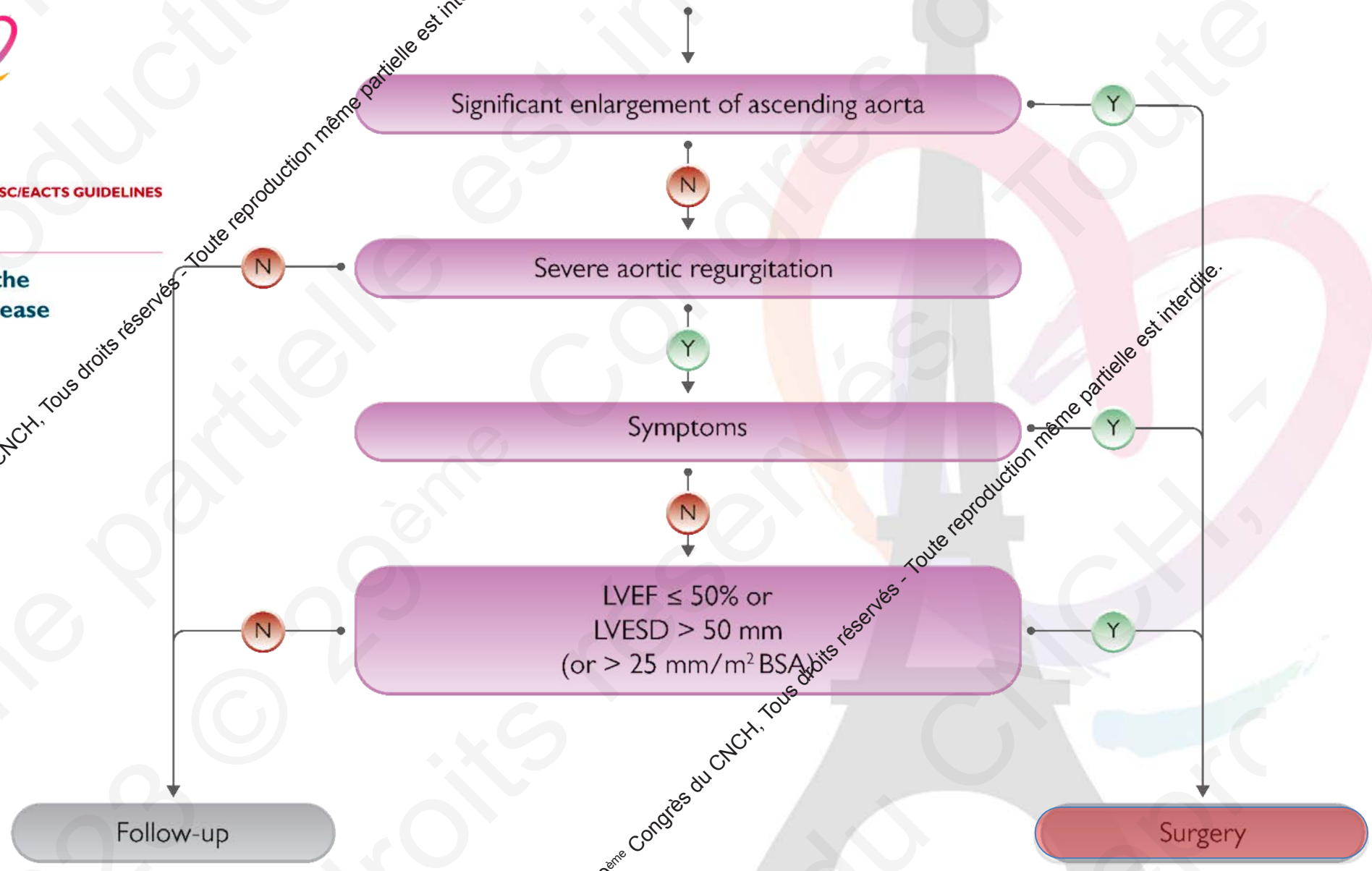
Management of patients with aortic regurgitation

ESC European Society of Cardiology
European Heart Journal (2021) 00, 1–72
doi:10.1093/eurheart/ehab395

ESC/EACTS GUIDELINES

2021 ESC/EACTS Guidelines for the management of valvular heart disease

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2021 ESC/EACTS Guidelines for the management of valvular heart disease

Recommendations	Class	Level
Valve-sparing aortic root replacement is recommended in young patients with aortic root dilation, if performed in experienced centres and durable results are expected.	I	B
Aortic valve repair may be considered in selected patients at experienced centres when durable results are expected.	IIb	C

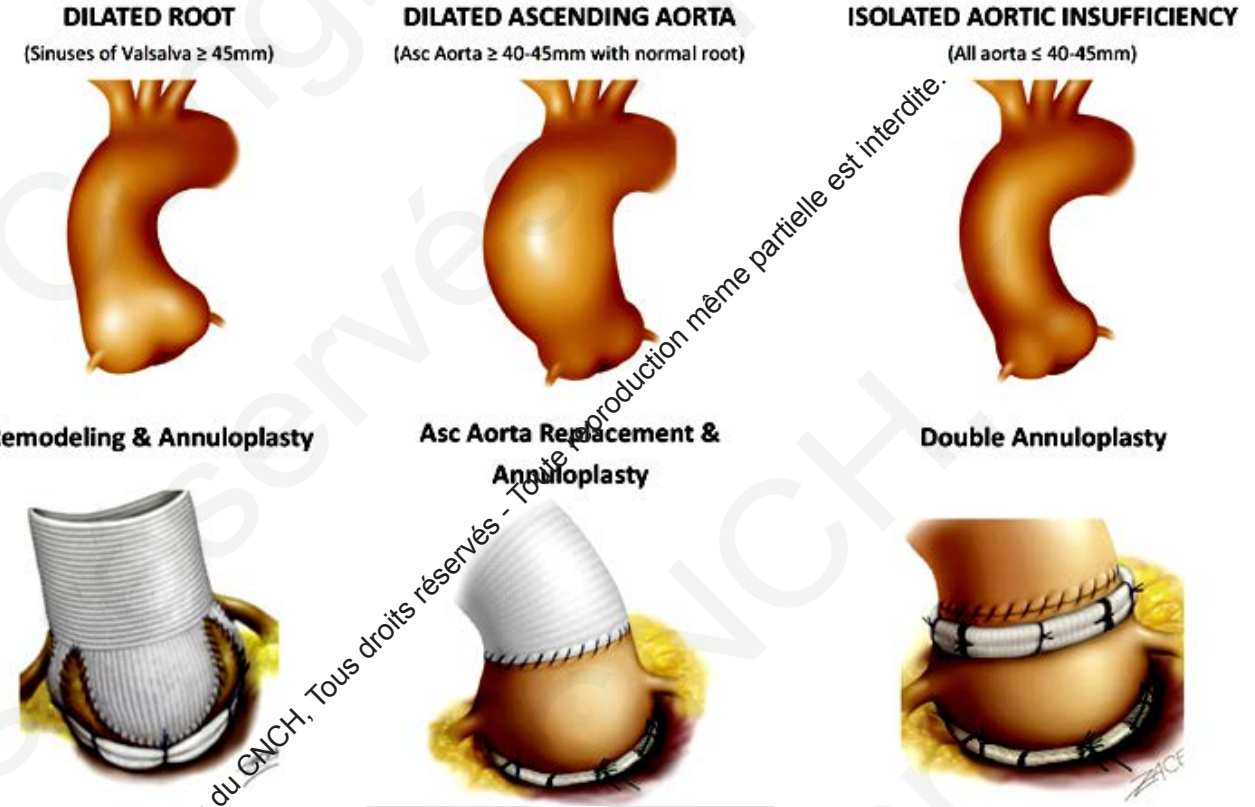
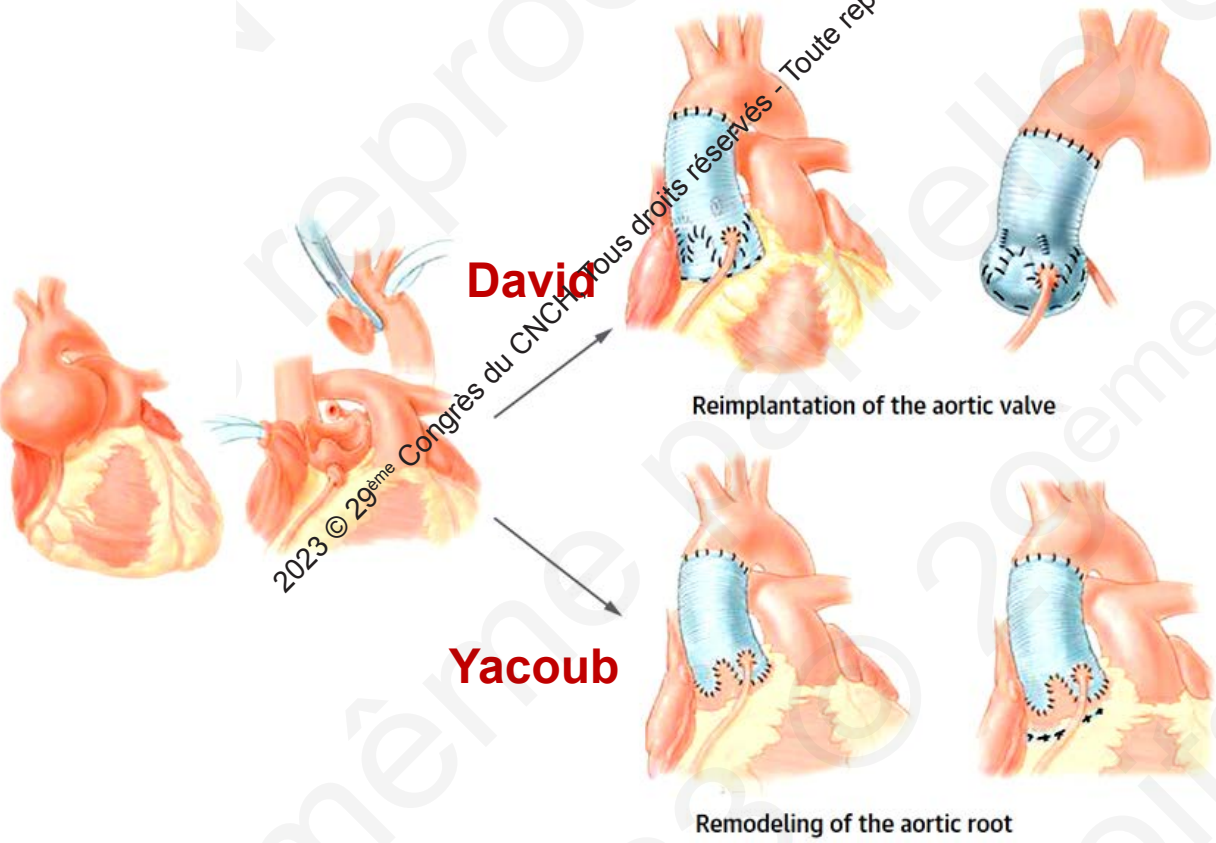
**Heart
Team
evaluation**

**Optimal local
resources**

**Availability and expected outcomes of a
given intervention at a given centre**



Valve Sparing aortic root replacement



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Need for echo standardization

Keynote Lecture Series

Systematic echocardiographic assessment of aortic regurgitation – what should the surgeon know for aortic valve repair?

Alain Berrebi, Jean-Luc Monin, Emmanuel Lansac

Department of Cardiac Pathology, Institut Mutualiste Montsouris, Paris, France

Correspondence to: Alain Berrebi, Department of Cardiac Pathology, Institut Mutualiste Montsouris, 42 Boulevard Jourdan, 75014 Paris, France.

Email: alain.berrebi@imm.fr.

Aortic valve (AV) repair is the preferred surgical treatment in young patients with aortic regurgitation (AR) and/or proximal aorta aneurysm, as noted in the recent European Society of Cardiology (ESC) guidelines. However, this surgical option is still underused in clinical practice. This emphasizes the need to build a heart team dedicated to AV repair with expert surgeons and echocardiographers. Surgical techniques are now standardized in their approaches to enhance the reproducibility and expansion of AV repair. The objective of this keynote is to also demonstrate the need for a standardized pre-pump intra-operative echocardiography protocol to fulfill surgeon's needs in providing a road map and predicting techniques to be used for an effective and durable repair.

Ann Cardiothorac Surg 2019;8(3):331-341



2D/3D Echo and surgeon's needs

➤ 2D/3D Echo protocol

- basic views and measurements
- aorta phenotype
- etiology: tricuspid or bicuspid
- dysfunction
- lesion: amount and quality of tissue

➤ Impact on repair strategy



2D/3D Echo and surgeon's needs

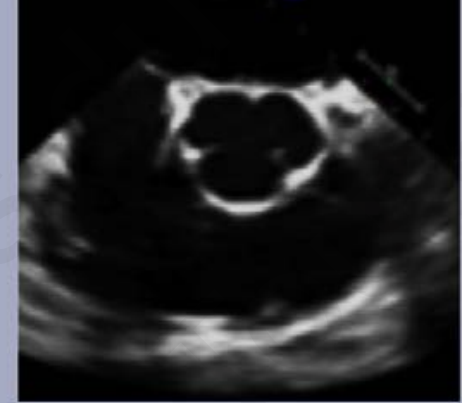
➤ 2D/3D Echo protocol

- **basic views and measurements**
- **aorta phenotype**
- **etiology: tricuspid or bicuspid**
- **dysfunction**
- **lesion: amount and quality of tissue**

➤ Impact on repair strategy



Short Axis

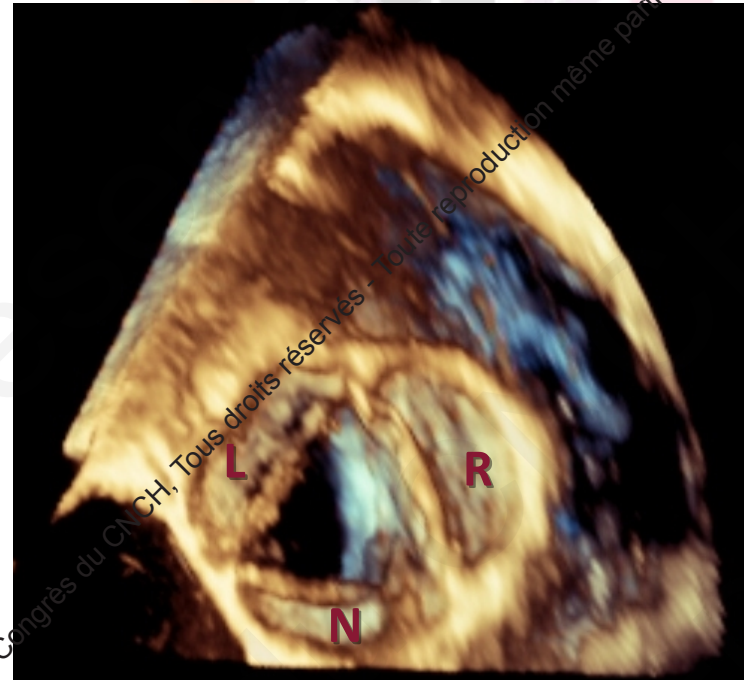


TEE view



45°

Surgical view



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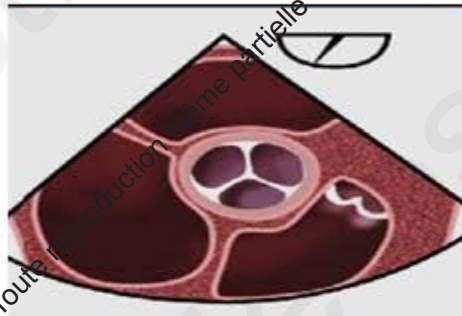
reproduction même partielle est interdite. Tous droits réservés - Toute reproduction même partielle est interdite.

Protocole Plastique Aortique

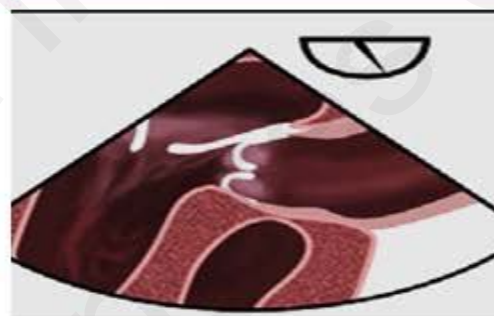
Coupes et Mesures

Bilan pré-op

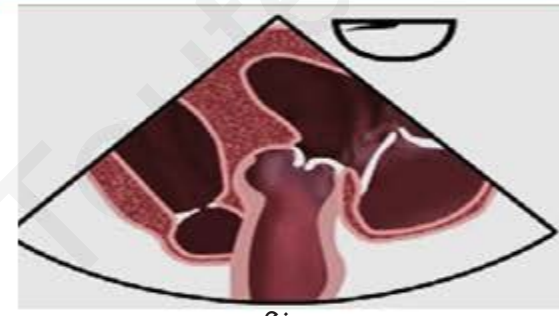
Petit axe
45°-60°



Long axe
120-140°

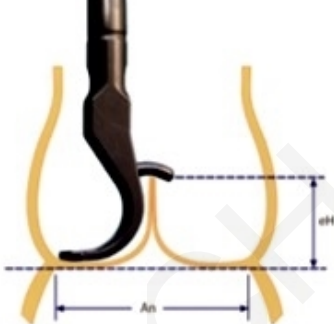


Transgastrique basse
0-15°



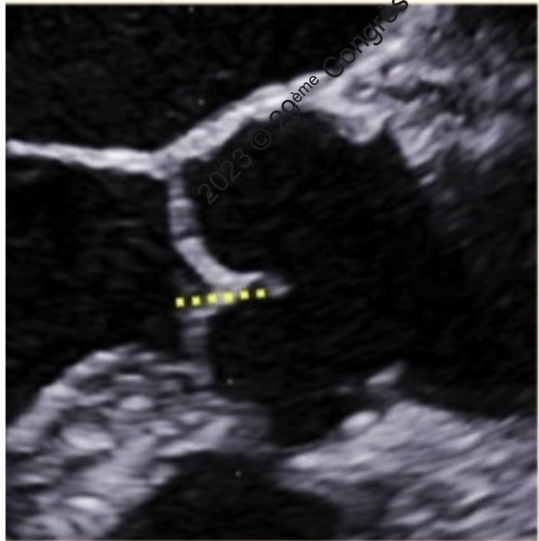
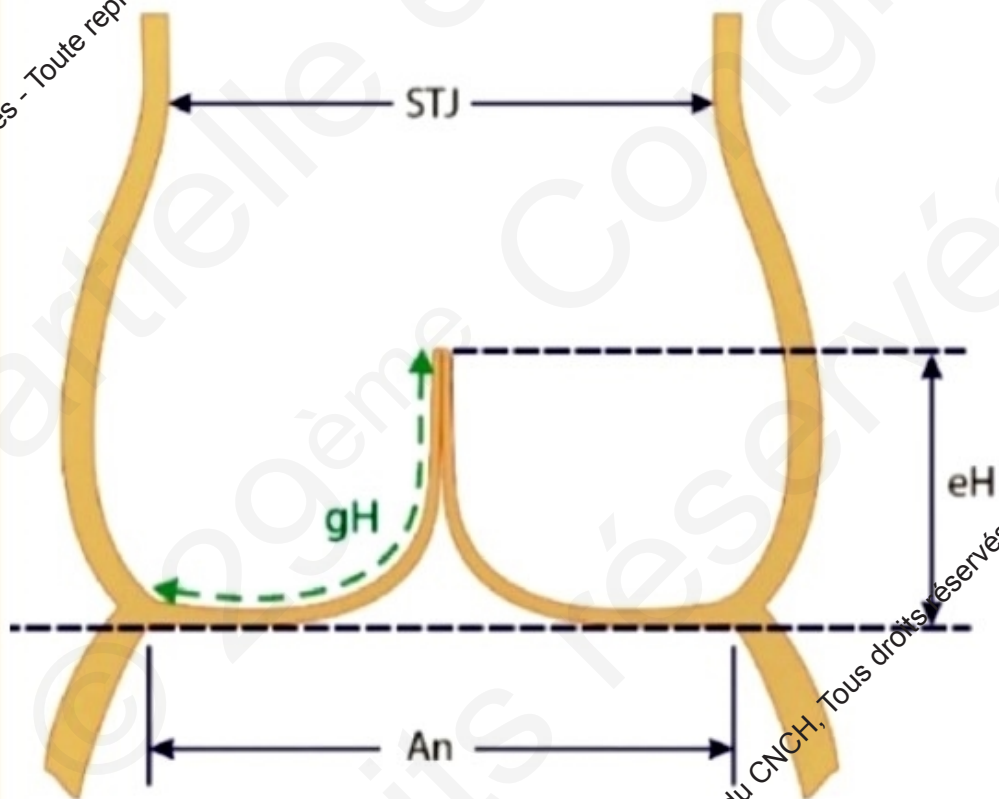
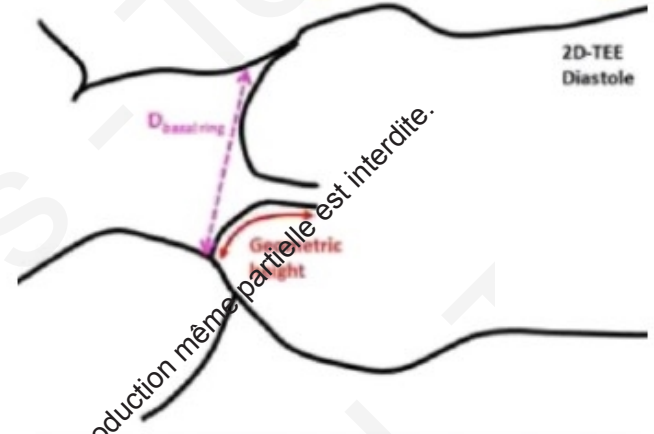
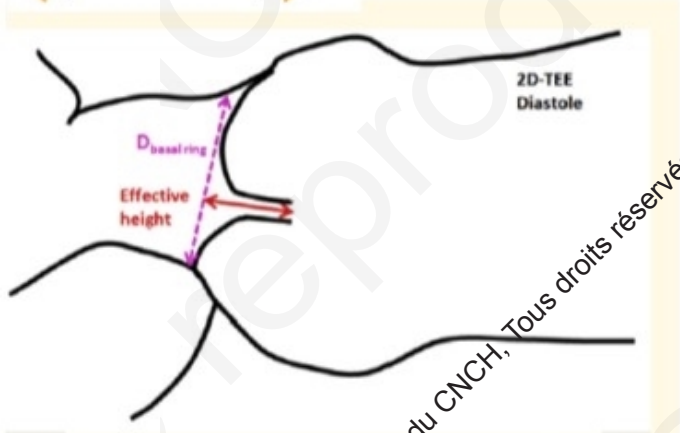
Mesures et analyse	Petit Axe	Long axe	Transgastrique basse
Phénotype aortique	-	+++	++
Etiologie: Tricuspid vs Bicuspidie	+++	+	+
Dysfonction: mouvements cusps	+	+++	+++
Jet: origine et extension	+++	-	-
Jet: direction centrale vs excentrée	-	+++	+++
Géométrie cusp: hauteur effective	-	+++	+++
Géométrie cusp: hauteur géométrique	-	+++	+++
Orientation bi-commissurale	+++	-	-
Fenestrations	+	+++	+

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Hauteur effective eH

Hauteur géométrique gH



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2D/3D Echo and surgeon's needs

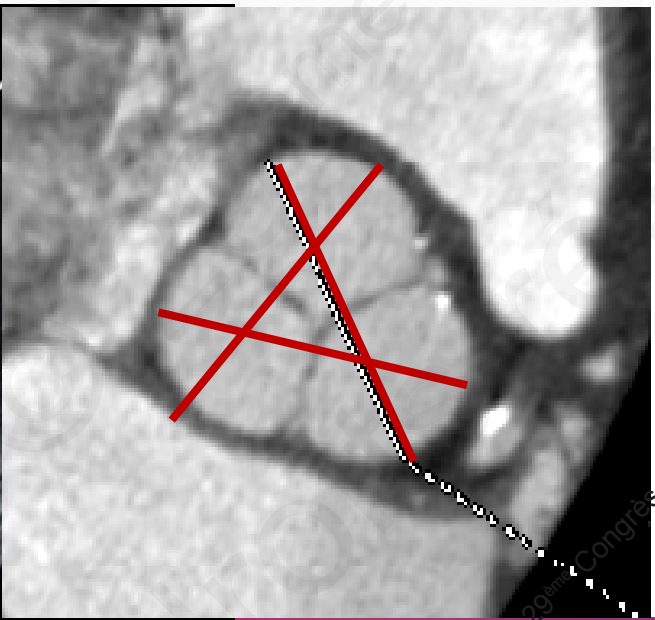
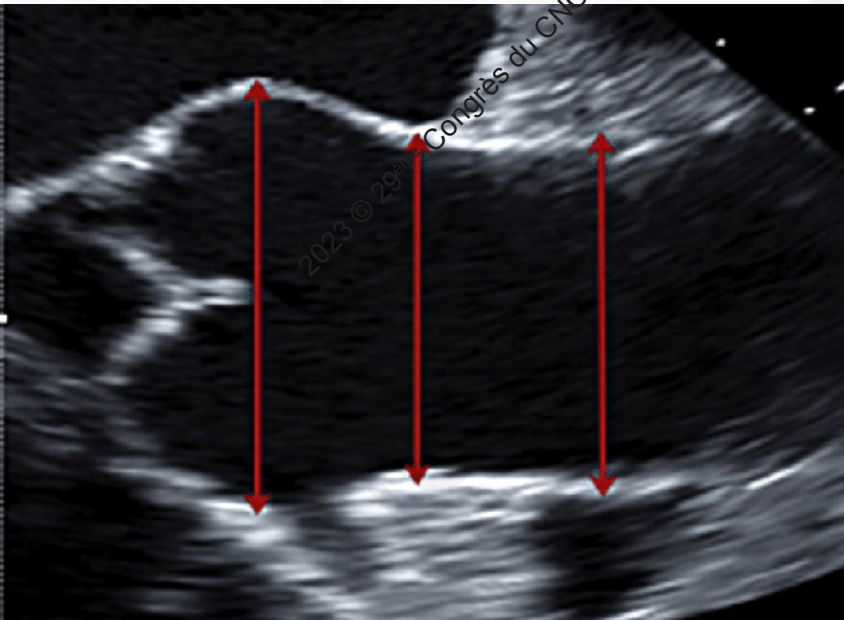
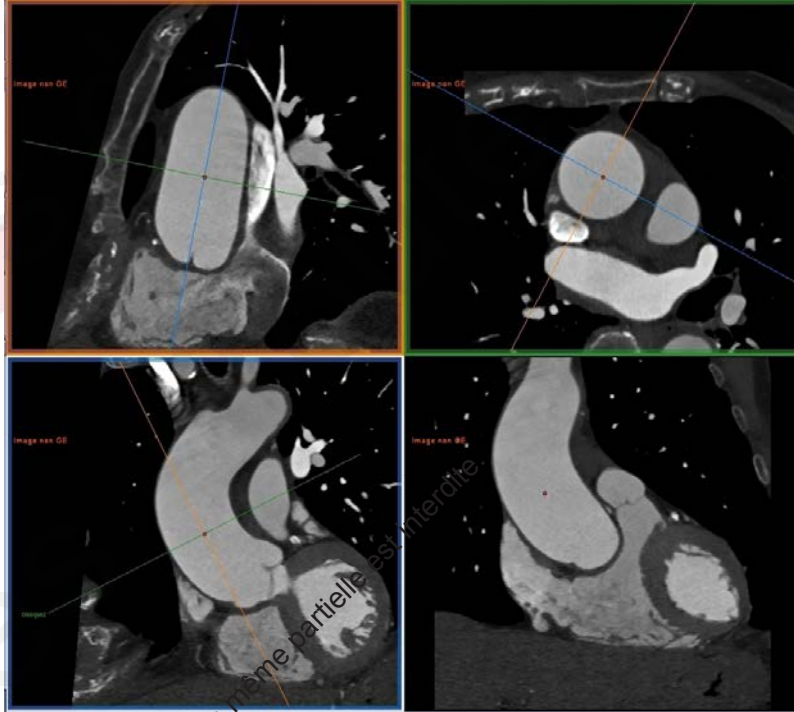
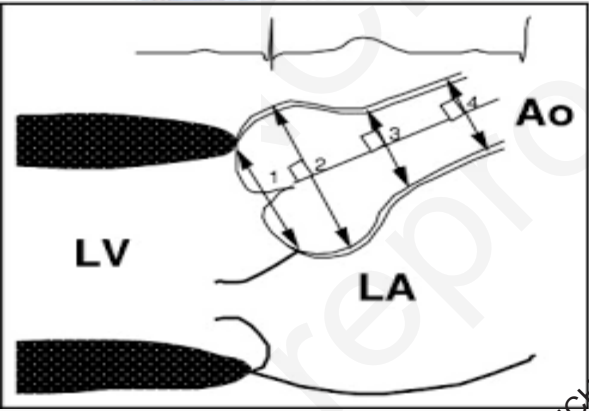
➤ 2D/3D Echo protocol

- basic views and measurements
- **aorta phenotype**
- etiology: tricuspid or bicuspid
- dysfunction
- lesion: amount and quality of tissue

➤ Impact on repair strategy

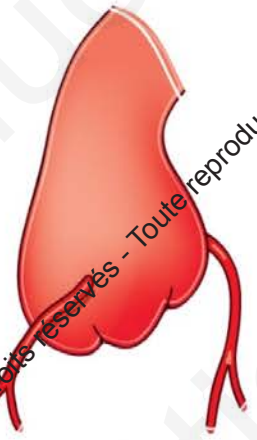
Aorta

Echo and Gated CT Scan



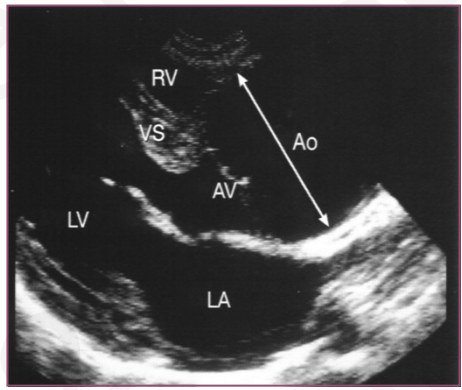


3 Phenotypes of the ascending aorta



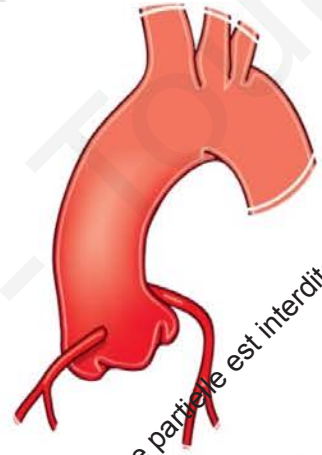
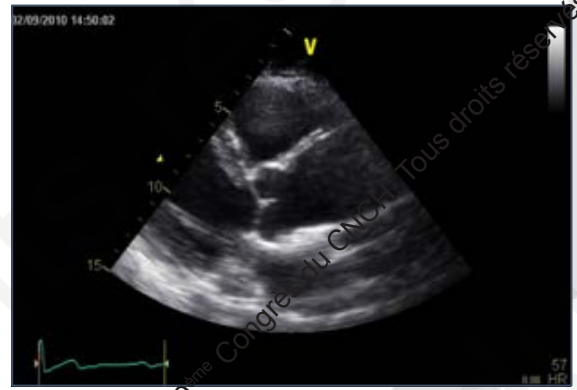
Anévrisme de la racine aortique

Aortic root aneurysm
Valsalva ≥ 45 mm



Anévrisme sus-coronaire

Supra-coronary aneurysm
Valsalva < 40 mm
Supra coronary aorta > 45 mm



IA isolée

Isolated AR
All $\varnothing < 40$ mm



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2D/3D Echo and surgeon's needs

➤ 2D/3D Echo protocol

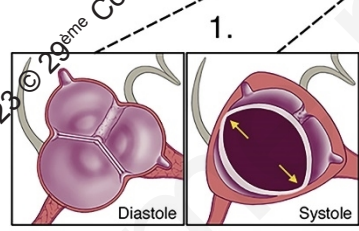
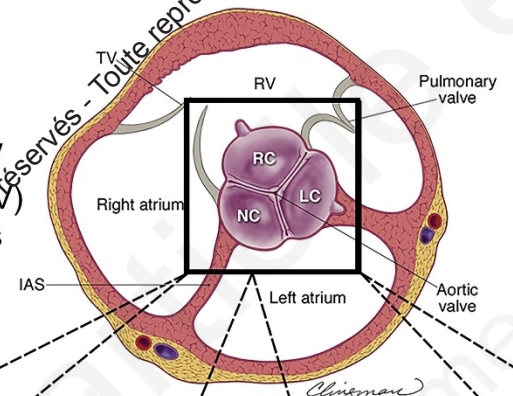
- basic views and measurements
- aorta phenotype
- **etiology: tricuspid or bicuspid**
- **dysfunction**
- **lesion: amount and quality of tissue**

➤ Impact on repair strategy

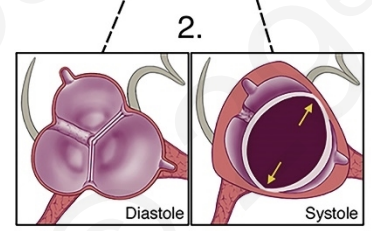


Fused type L/R: 3D TEESurgical View

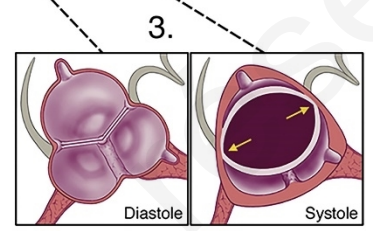
Fused BAV
(90-95% of BAV)
3 Phenotypes



Right – Left Cusp Fusion
(70-80%)

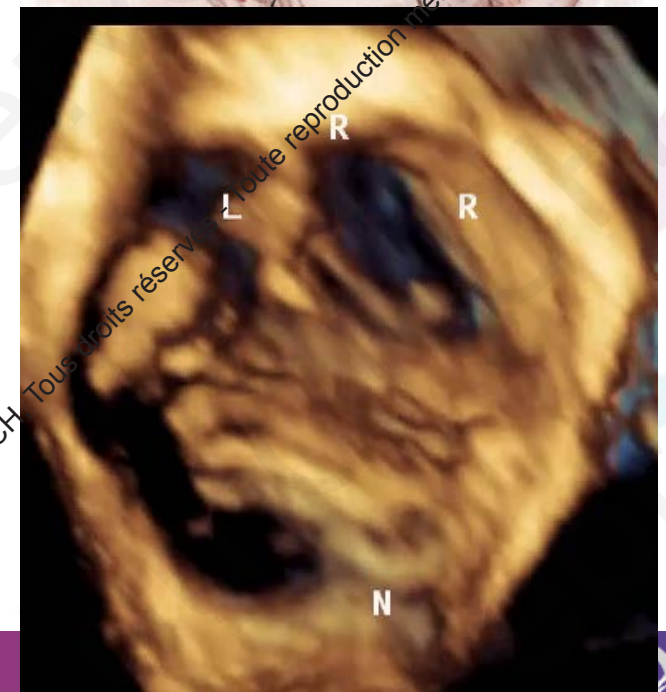


Right – Non Cusp Fusion
(20-30%)



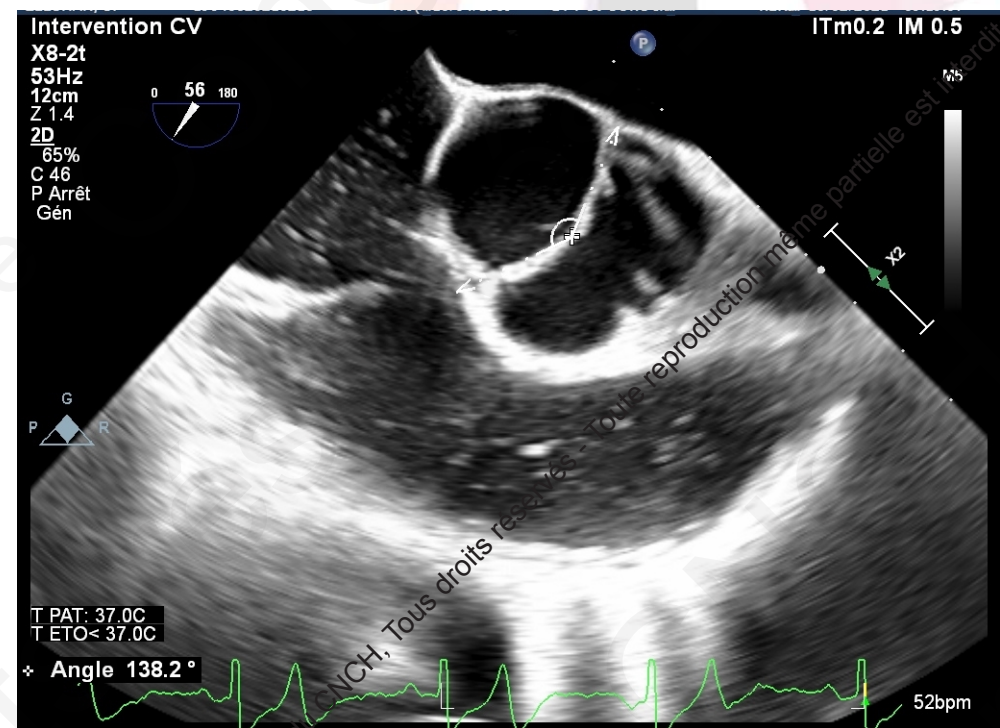
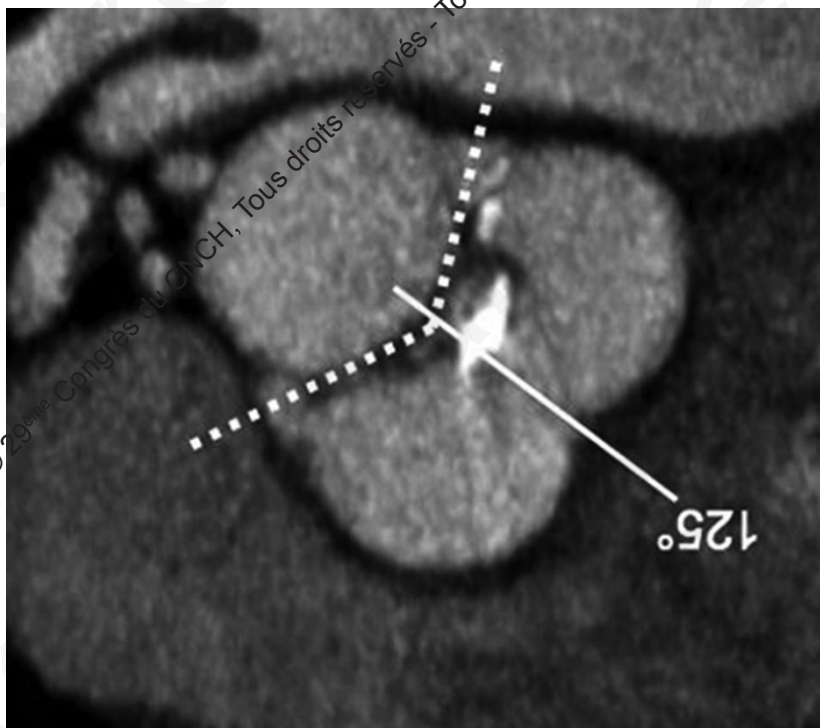
Left – Non Cusp Fusion
(3-6%)

(J Thorac Cardiovasc Surg 2021;162:e383-414)





Fused type: Commissural orientation (angle between 2 functional commissures)



Aicher et al. Circulation 2011, 123:178-185



2D/3D Echo and surgeon's needs

➤ 2D/3D Echo protocol

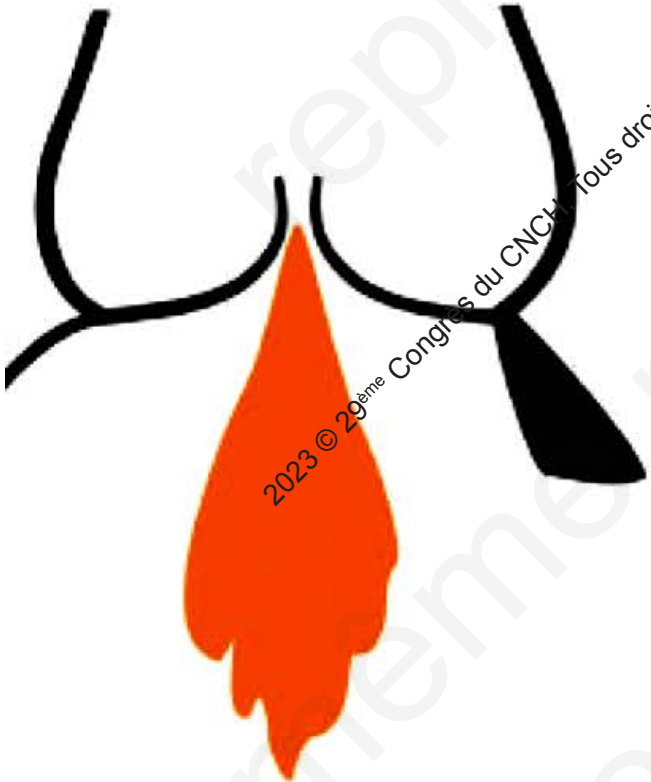
- basic views and measurements
- aorta phenotype
- etiology: tricuspid or bicuspid
- **dysfunction**
- lesion: amount and quality of tissue

➤ Impact on repair strategy

Mechanisms of AI Classification

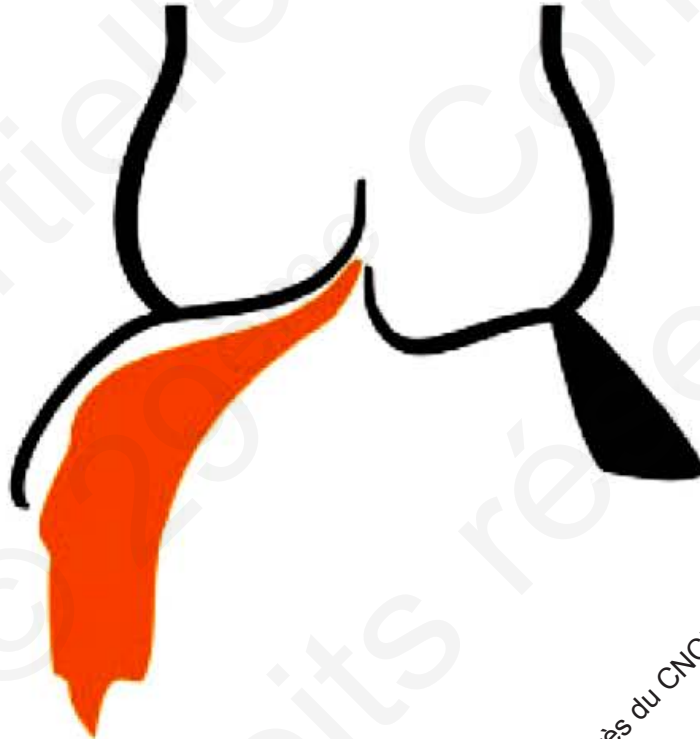
Type I

Normal cusp movements
related to aortic root
or ascending aorta dilation
with central jet



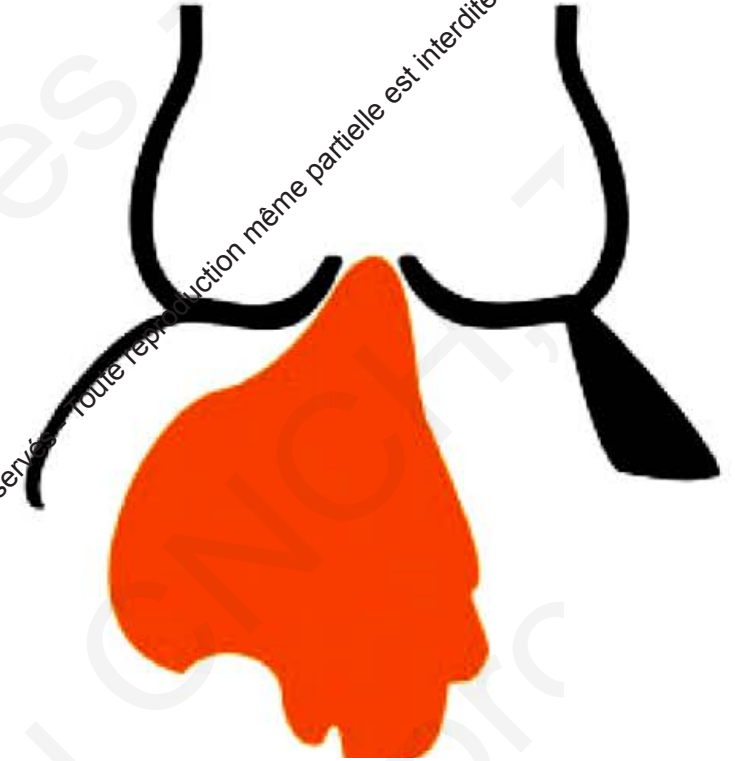
Type II

Cusp prolapse
with eccentric jet



Type III

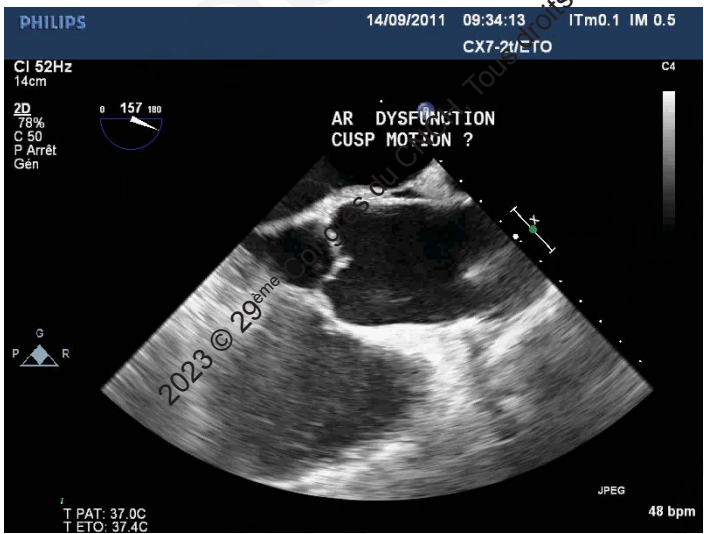
Cusp retraction
with poor tissue quality or quantity
with large central
and/or eccentric jet



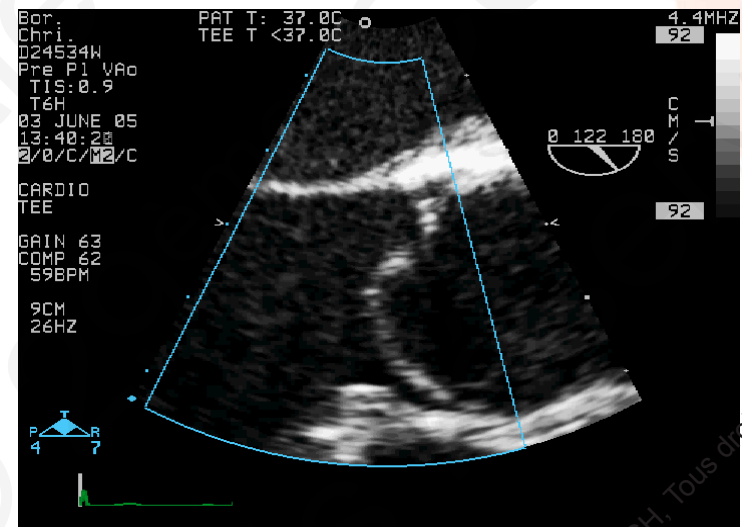
European Journal of Cardio-Thoracic Surgery 53 (2018) 1101-1107

Cusp motion

Normal (I)



Excessive (II)



Restrictive (III)



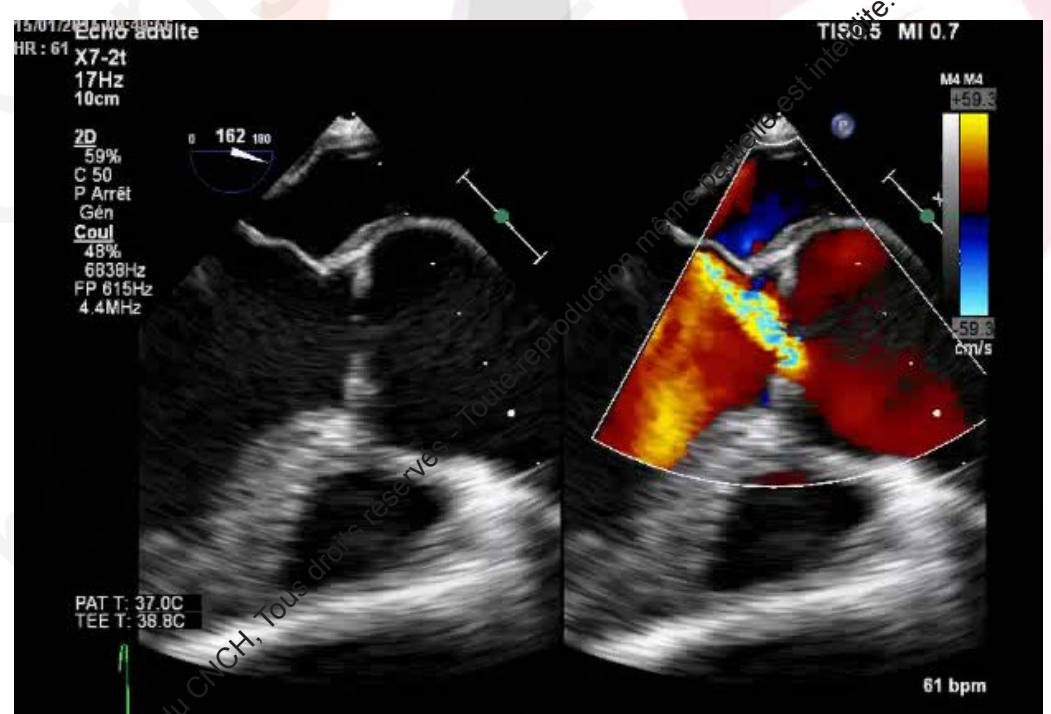
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Cusp Prolapse: quantitative assessment with eH

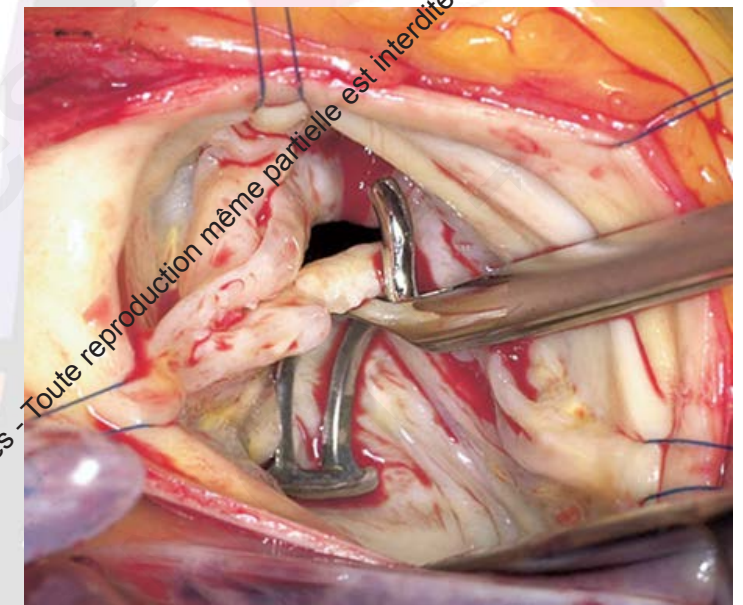
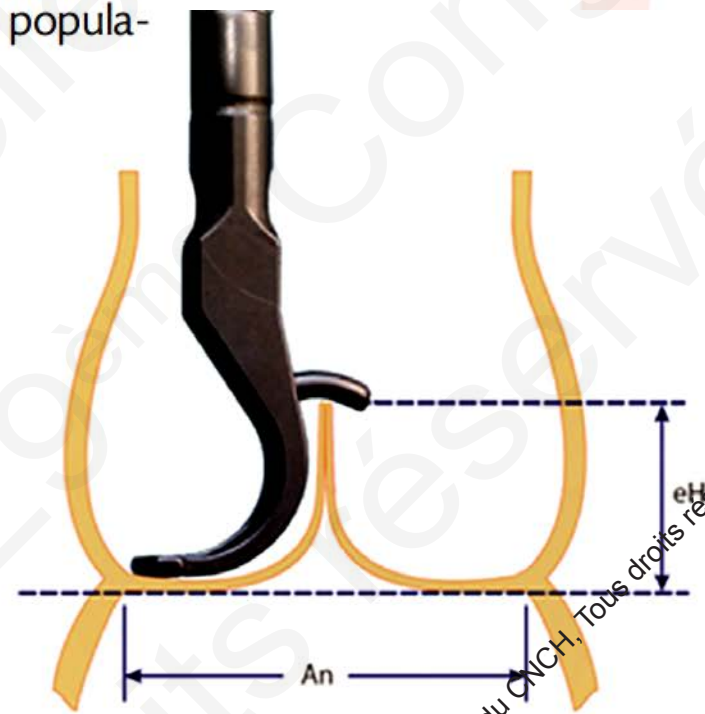
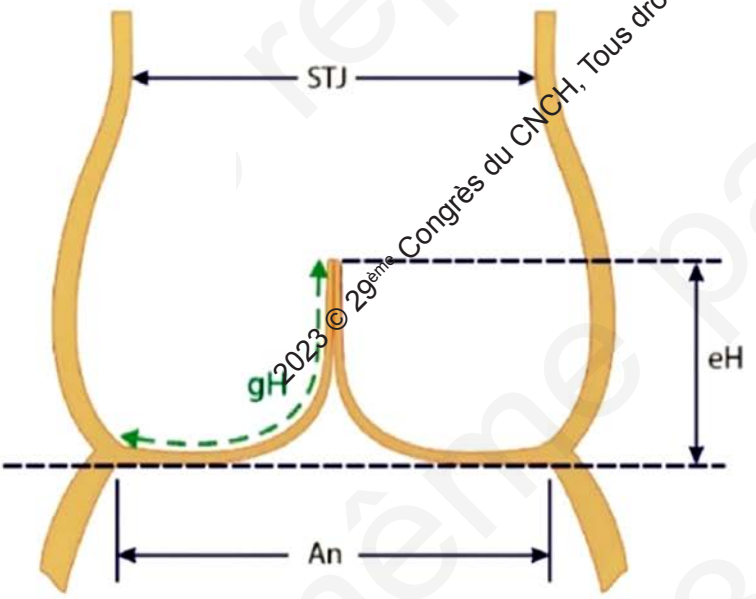
Complete (eH < 0)

Incomplete (eH < 9 mm)



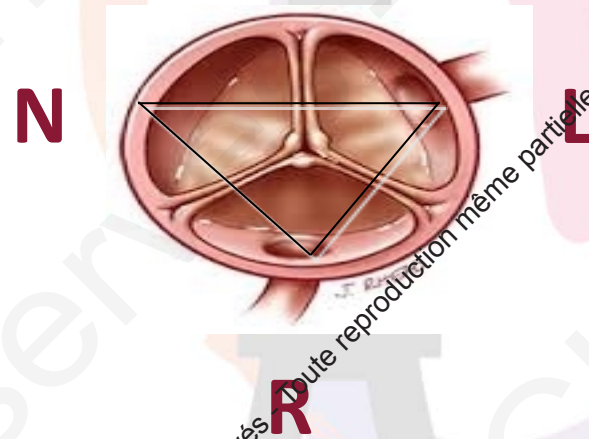
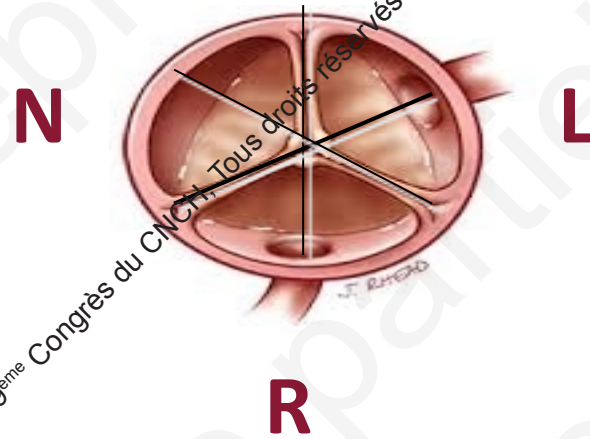
Dysfunction: Effective Height

The effective height (eH) is the orthogonal distance from the annulus to the middle of the free margin of the cusp. The eH can be measured by echocardiography and intraoperatively with a dedicated caliper. The normal eH in the adult population is close to 9 mm (8-10) [7].





Effective Height vs Coaptation length



Individual cusp

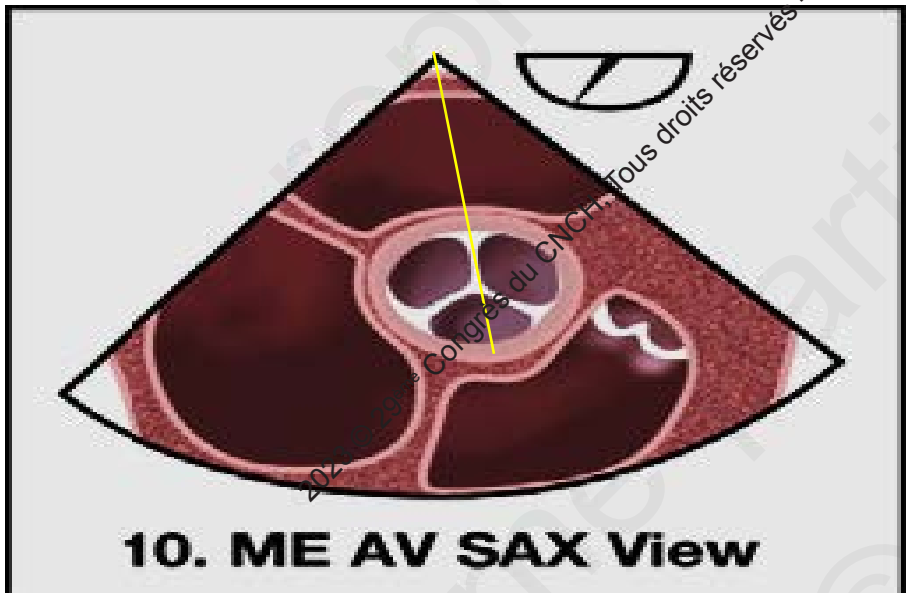
$\geq 9 \text{ mm}$

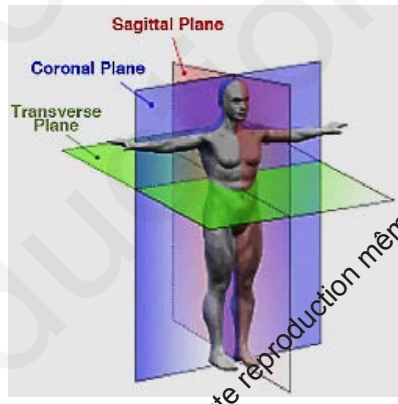
Two cusps

$\geq 5 \text{ mm}$

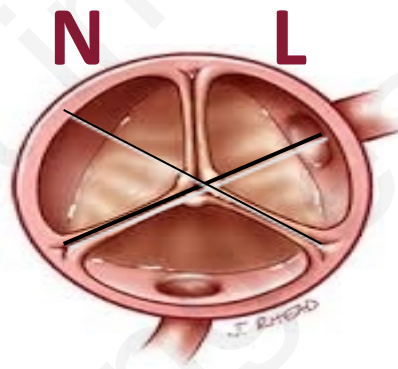


X Plane: only valid for eH of RCC



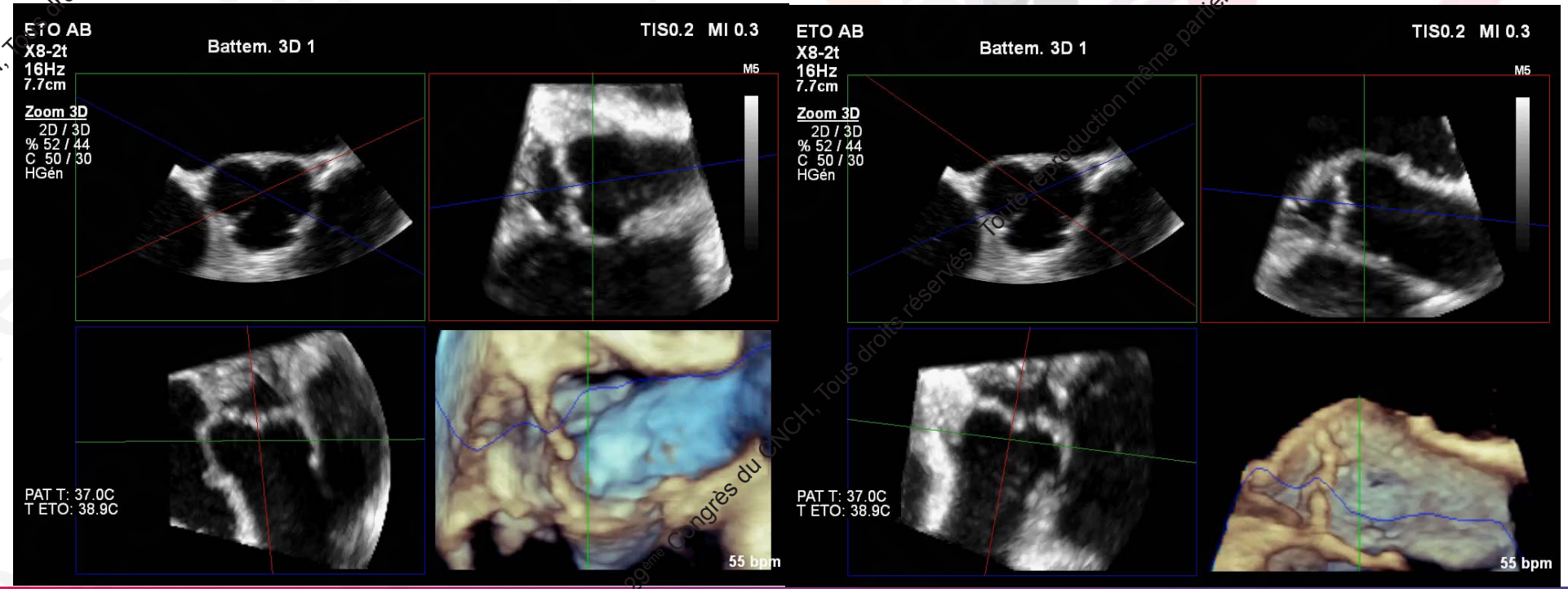


Multi Planar Reconstruction



LCC

NCC



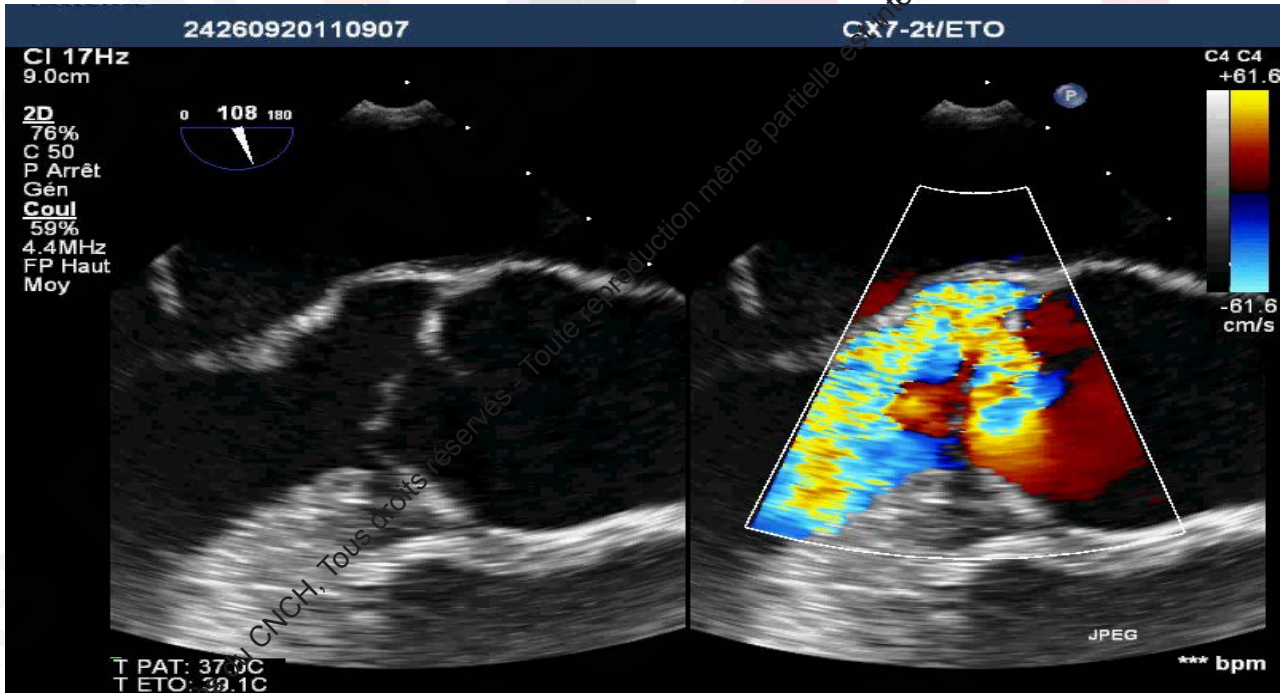
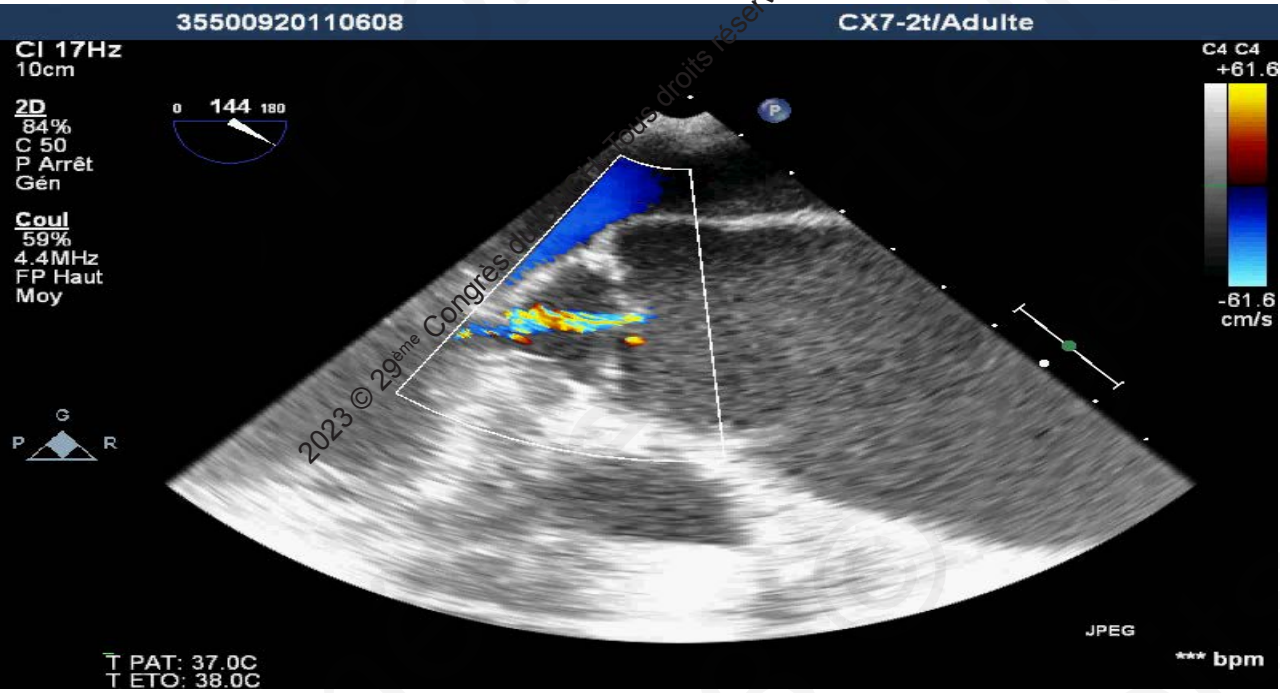
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Jet direction

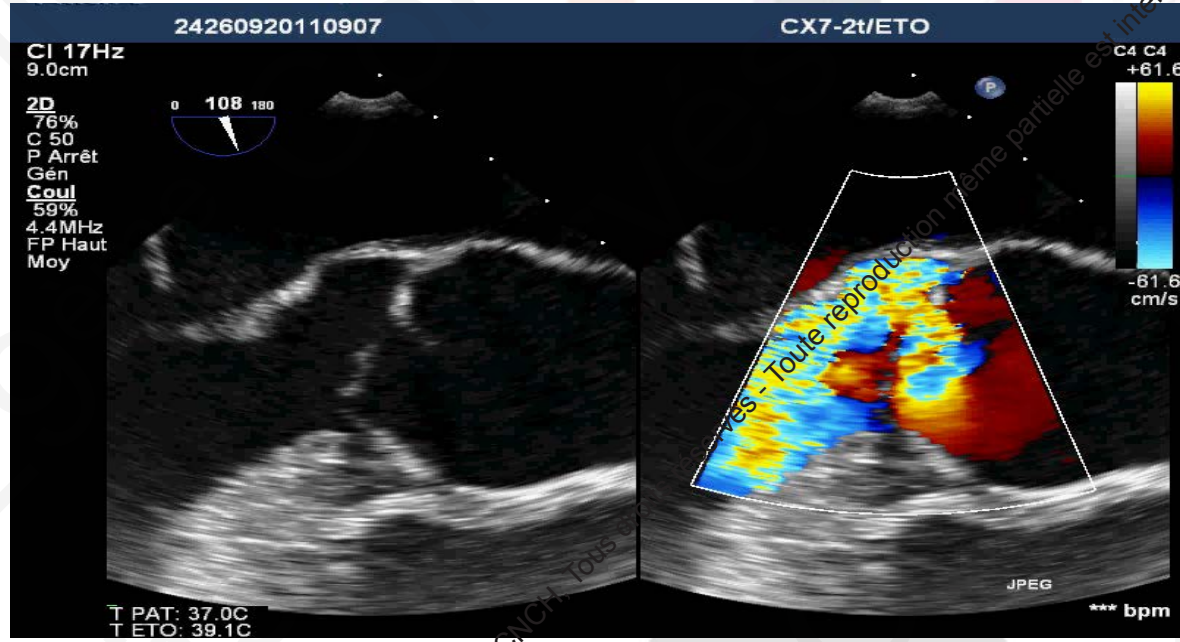
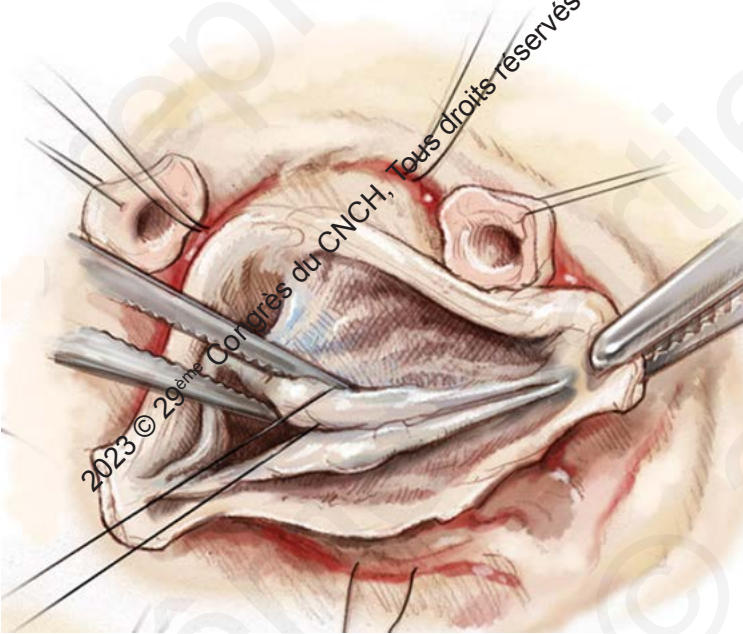
Central (type I or III)

Eccentric (type II or III)





Mechanism AR in Bicuspid fused type L/R (prolapse: eH < 9 mm)



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2D/3D Echo and surgeon's needs

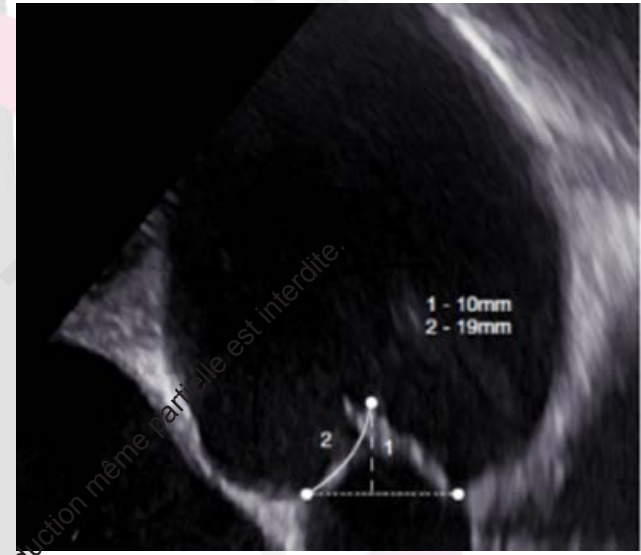
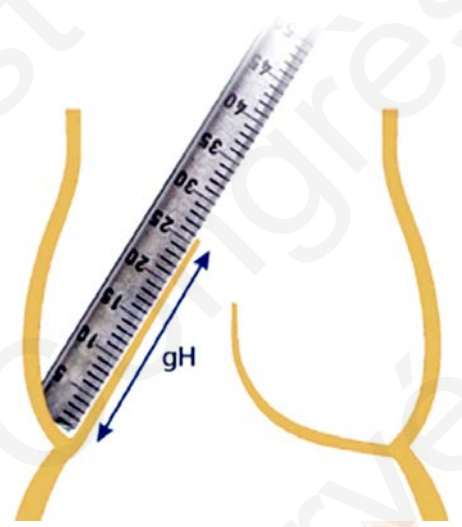
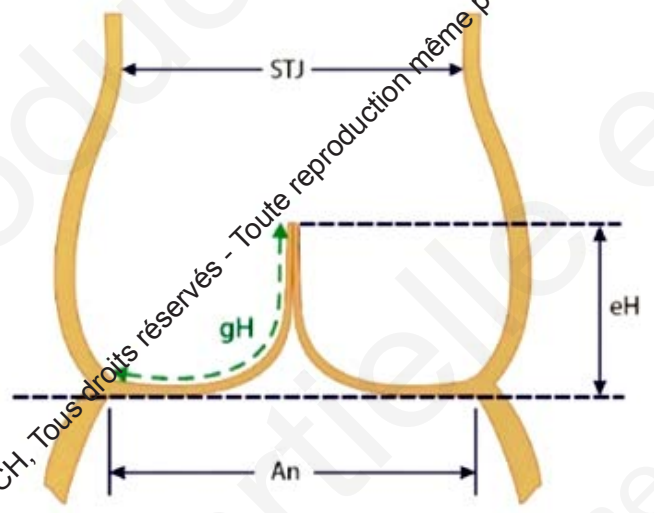
➤ 2D/3D Echo protocol

- basic views and measurements
- aorta phenotype
- etiology: tricuspid or bicuspid
- dysfunction
- **lesion: amount and quality of tissue**

➤ Impact on repair strategy



Lesion: Geometric Height (gH)

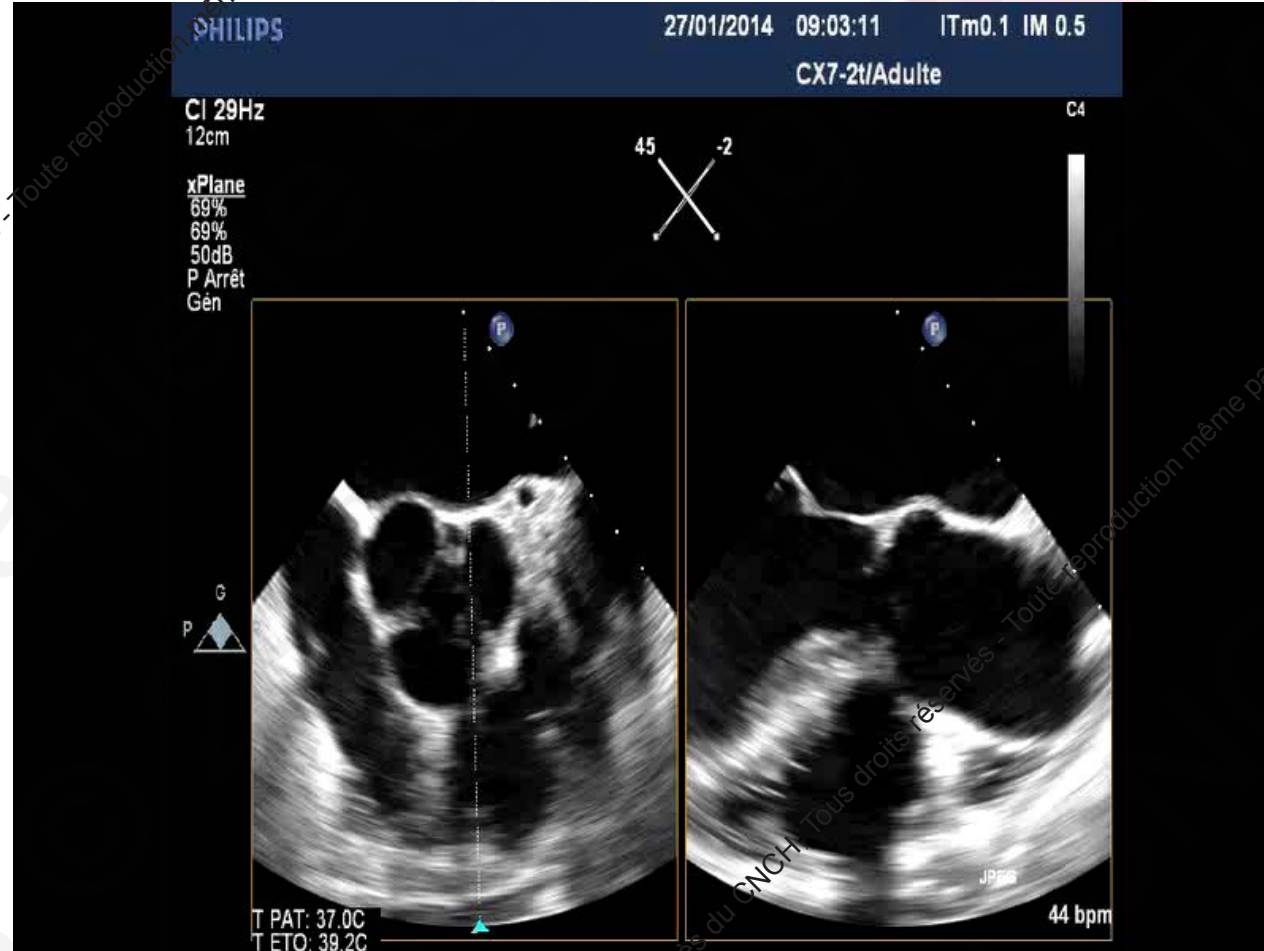


The geometric height (gH), also called the cusp height, is defined as the distance between the cusp nadir and the middle of the free margin. Intraoperatively, the gH is measured with a straight ruler along the aortic side of the cusp by applying gentle traction on the free margin to straighten the cusp tissue along the ruler. In adults, the cusp is considered retracted when the gH is 16 mm or less in TAVs and 19 mm or less in the bicuspid non-fused aortic cusp [8].



Lesion: amount and quality of tissue available

Restrictive motion with retraction*

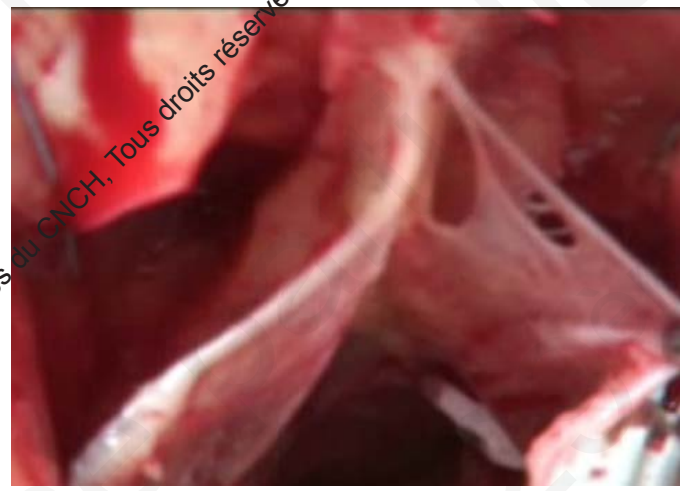


*retraction if geometric height: ≤ 16 mm (tricuspid) or ≤ 19 mm (bicuspid)

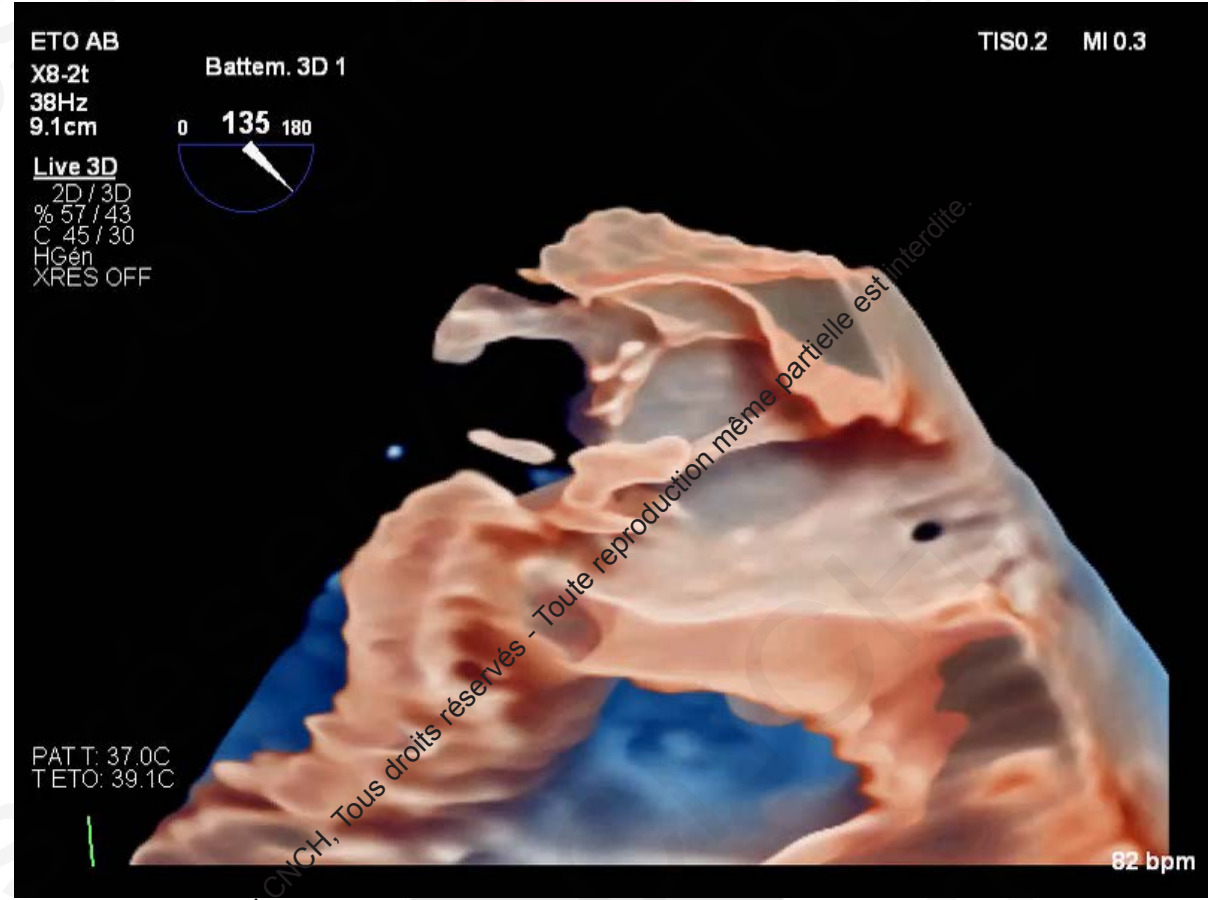


Fenestrations

Congenital lesions Para-commissural coaptation zone



Pericardial patch if
« fragile » or ruptured



Schäfers et al, JTCVS 2009



2D/3D Echo and surgeon's needs

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➤ Impact on repair strategy

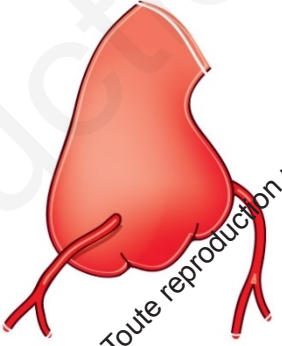
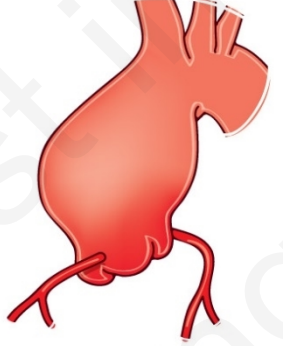
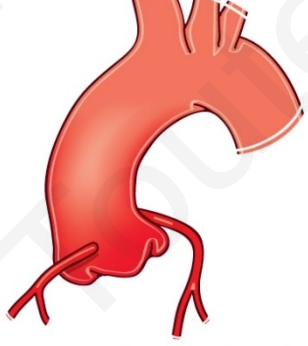


Impact in Aortic Valve Repair Strategy

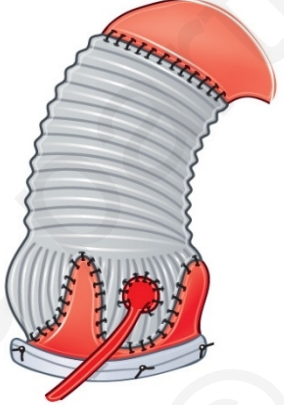
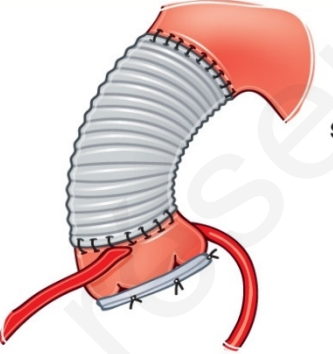

- **Individual cusp:**
 - **geometric height: retraction - repair or replace ?**
< 16 mm (tricuspid) or < 19 mm (bicuspid)
 - **effective Height (eH)**
 - **pre-op: < 9 mm: prolapse - resuspension**
 - **post-op: > 9 mm - durable result**
- **Two cusps:**
 - **coaptation length: > 5mm - durable result**
 - **Commisural orientation (Bicuspid): < 160° ?**
 - **Fenestrations: number – fragility – repair with patch ?**



Phénotypes de l'aorte ascendante

 <p>Anévrisme de la racine aortique</p> <p>Valsalva \geq 45 mm</p>	 <p>Anévrisme sus-coronaire</p> <p>Valsalva $<$ 40 mm</p>	 <p>IA isolée</p> <p>Tous les \varnothing $>$ 40 mm</p>
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Approche standardisée et physiologique de la plastie aortique

Reconstruction de la racine aortique		
 <p>Remodeling</p> <p>+ annuloplastie sous-valvulaire</p>	 <p>Tube sus-coronaire</p>	 <p>Annuloplastie sus-valvulaire</p> <p>+ annuloplastie sous-valvulaire</p>

Optimal candidates: all root phenotypes, bicuspid or tricuspid with any dysfunction but **without retraction**

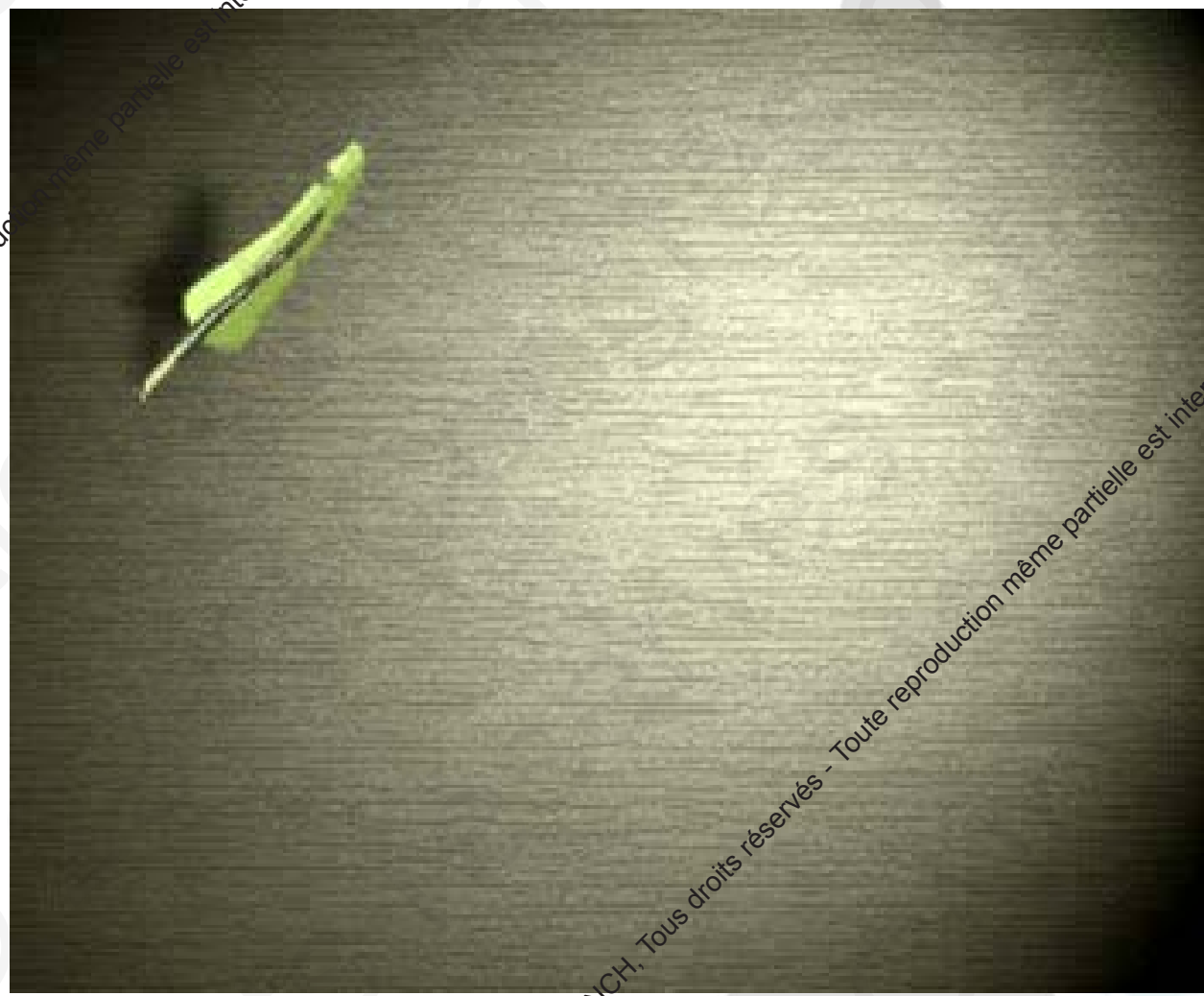
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