Le Rétrécissement Mitral a-t-il disparu ?

F Levy

ACCA 8 Avril 2025

Amicale des Cardiologues de la Côte d'Azur

Objectifs pédagogiques

- Connaître l'épidemiologie actuelle du RM
- Reconnaître et quantifier les RM dégénératifs
- Quand proposer un traitement et lequel?

Histoire du RM

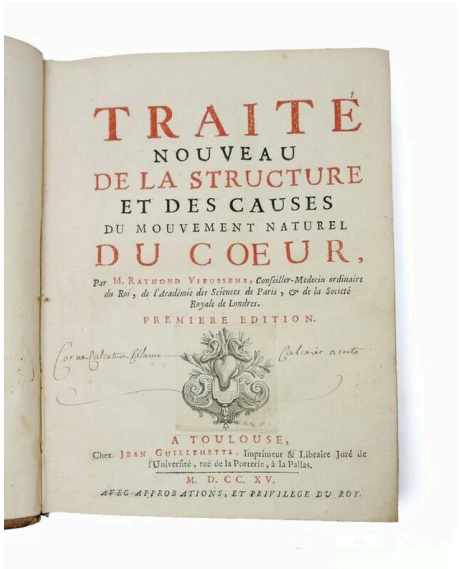

R de Vieussens

- Noté en 1669 by John Mayow (1640-79) médecin anglais

- Mais description complète en 1715 par Raymond De Vieussens (1641-1716)


Louis XIV

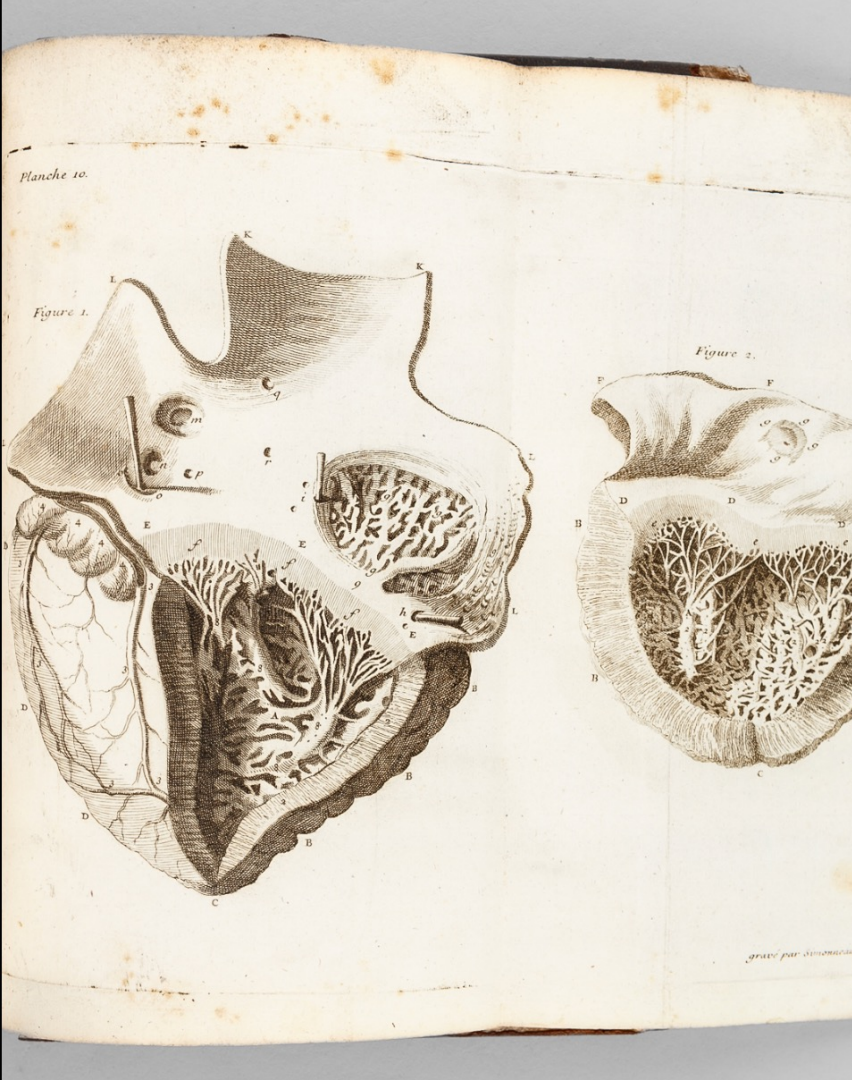
Description du RM publiée en 1715


TRAITÉ
NOUVEAU
DE LA STRUCTURE
ET DES CAUSES
DU MOUVEMENT NATUREL
DU COEUR,
Par M. RAYMOND VIEUSSENS, Conseiller-Medecin ordinaire du Roi, de l'Académie des Sciences de Paris, & de la Société Royale de Londres.
PREMIERE EDITION.
A TOULOUSE,
Chez JEAN GUILLEMETTE, Imprimeur & Libraire Juré de l'Université, rue de la Porterie, à la Pallas.
M. D. CC. XV.
AVEC APPROBATIONS, ET PRIVILEGE DU ROY.

Il décrit le cas d'un jeune patient appelé Thomas d'Asssis admis à l'hôpital St Eloi de Montpellier en novembre 1705
Vieussens décrit:

« Je trouve un patient allongé sur son lit, la tête haute, il semblait avoir de grandes difficultés à respirer et son cœur était agité de violentes palpitations. Son pouls paraissait très faible, faible et tout à fait irrégulier. Ses lèvres étaient couleur de plomb et ses yeux enfoncés ; ses jambes et ses cuisses étaient gonflées et froides plutôt que chaudes. »

De Vieussens donnait un pronostic sombre. Une semaine plus tard le patient décède.

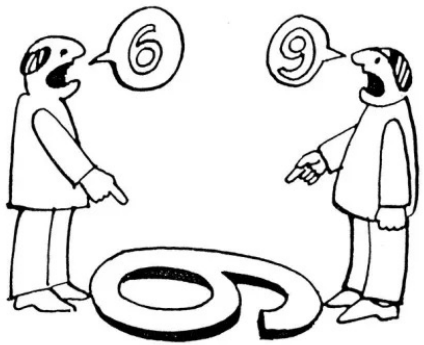


Autopsie

- *la valve mitrale de ce ventricule était vraiment osseuse*
- *A mesure qu'elles s'étaient durcies, les cuspides étaient devenues suffisamment épaisses et rugueuses pour provoquer un rétrécissement sévère de la lumière*

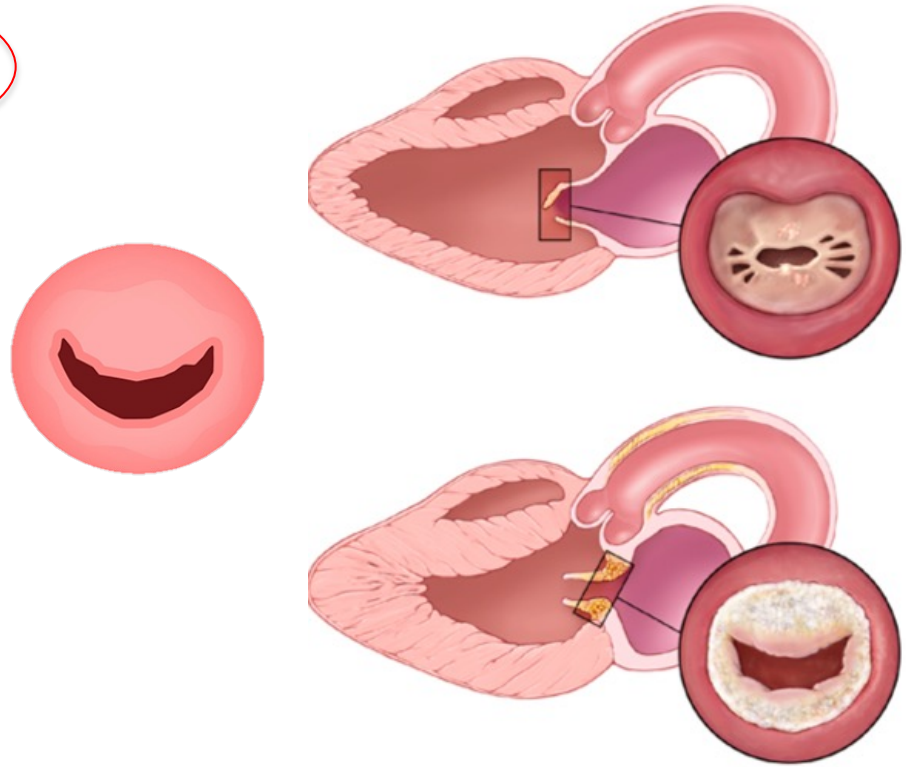
Le Rétrécissement Mitral a-t-il disparu ?

- Place de la maladie rhumatismale dans le monde
- Le RM rhumatismal cède sa place au RM dégénératif dans les pays développés

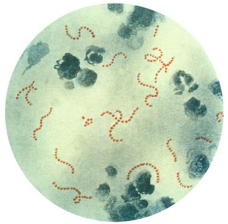


Étiologies Principales

- Rhumatisme articulaire aigu (85% des cas)
- Dégénérescence calcifiée (MAC)
- Autres causes (radiothérapie, médicamenteuses)



La maladie Rhumatismale



group A Streptococcus
(Streptococcus pyogenes)

Mais similarités au niveau
Des cellules cardiaques et des articulations

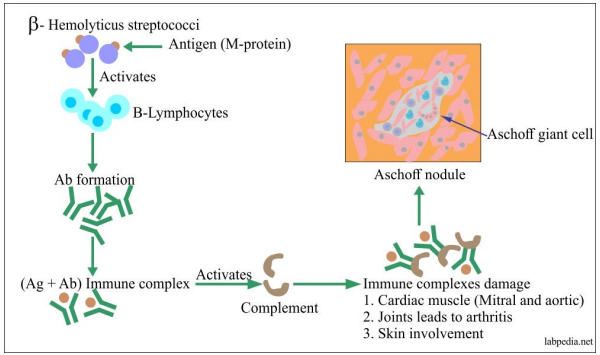
Anticorps contre la paroi du strepto A

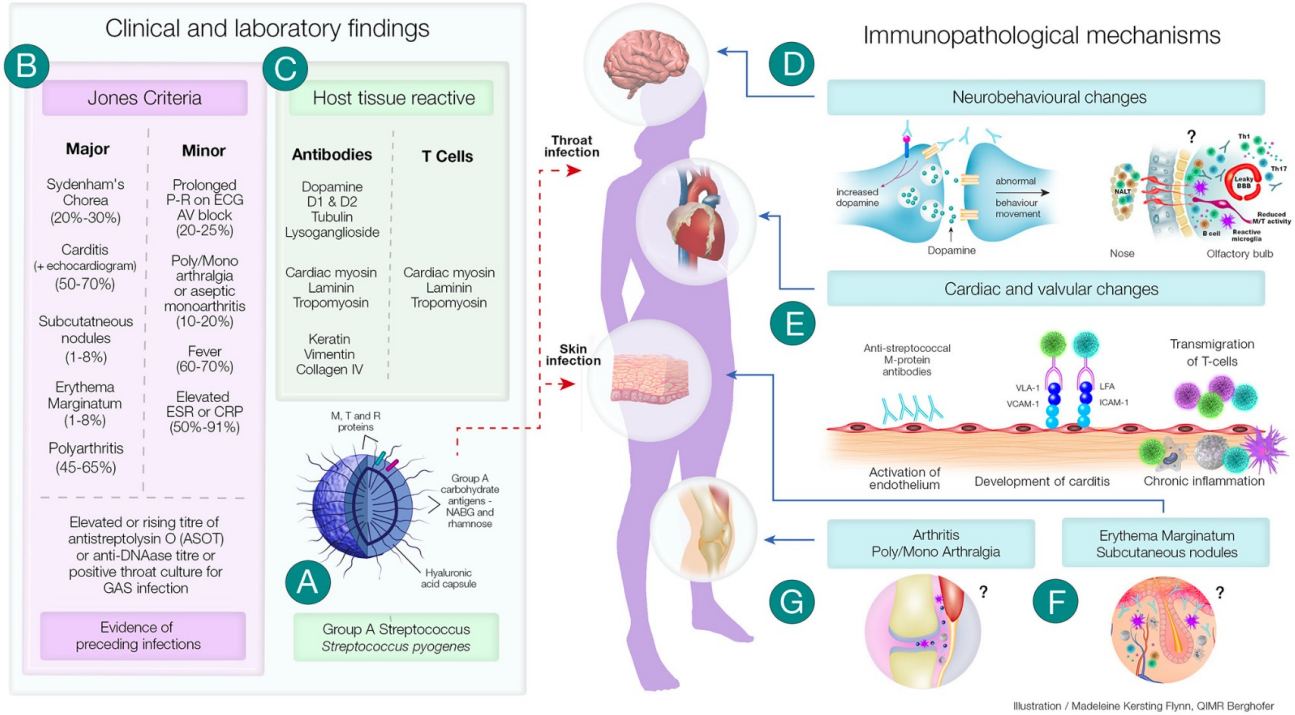
streptolysin O
DNase B

Complexes immuns

Génétique

Inflammation chronique

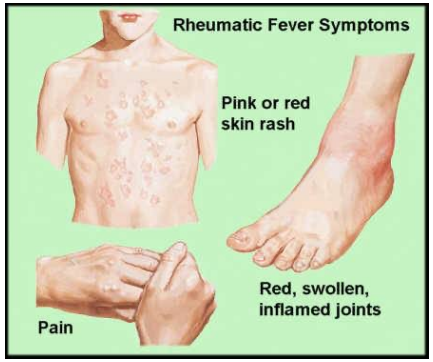




Neuro:
chorée de Sydenham

Cardio:
Pancardite

Articulaire et cutanée



Danse de Saint Guy ou Chorée de Sydenham

La Chorée de Sydenham est une affection post-streptococcique

Elle touche les enfants de 7 à 14 ans

fièvre, caractérisée par des mouvements involontaires et contractions des muscles du tronc et des extrémités

antigènes streptococciques

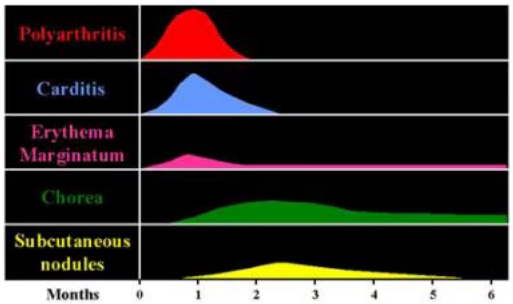
Curable (corticoides et atb)

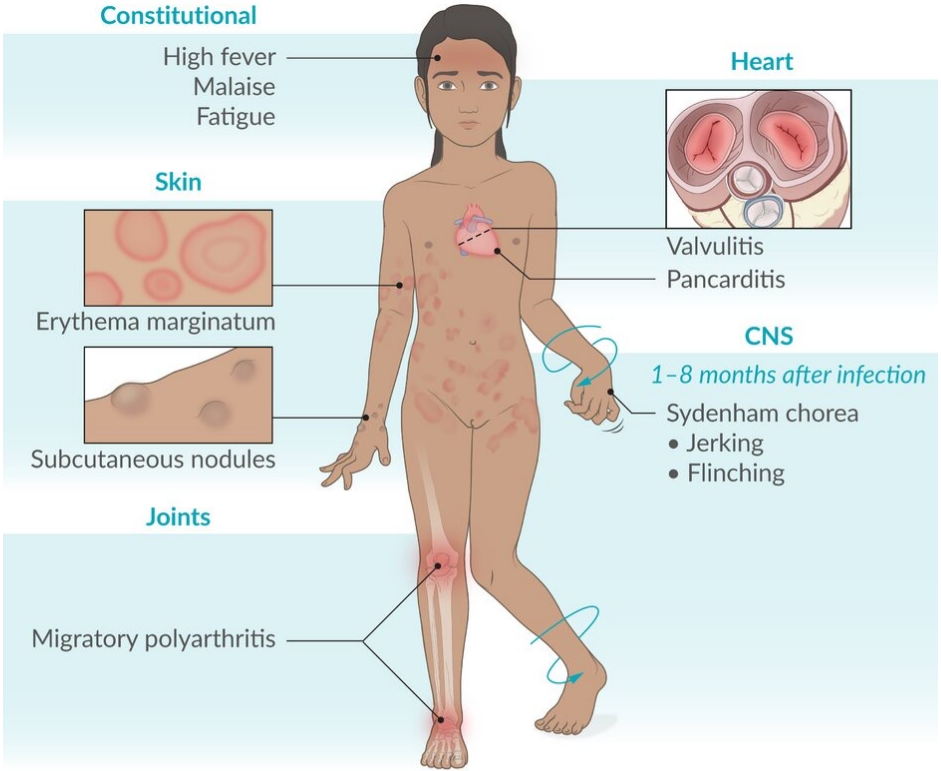
A.C.C.A.

Pathophysiology and disease course

Untreated GAS pharyngitis/tonsillitis	Development of antibodies	Molecular mimicry	Type II hypersensitivity reaction	Inflammation and cell damage
Acute infection		Latent period (2–4 weeks)		Rheumatic fever onset

Clinical Manifestations of Acute Rheumatic Fever





Atteinte valvulaire

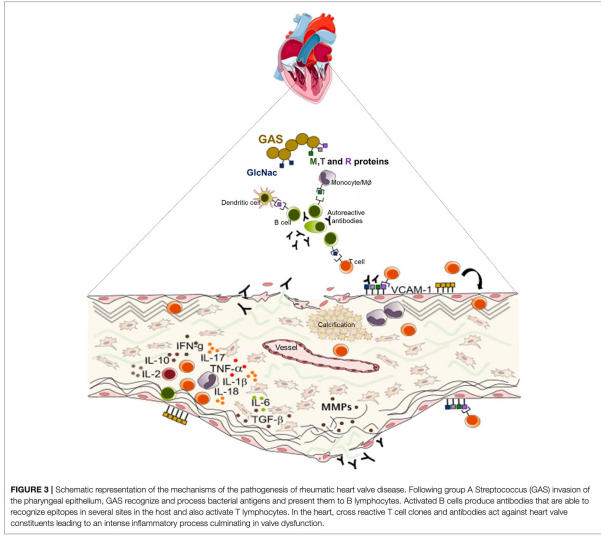


FIGURE 3 | Schematic representation of the mechanisms of the pathogenesis of rheumatic heart valve disease. Following group A Streptococcus (GAS) invasion of the pharyngeal epithelium, GAS recognize and process bacterial antigens and present them to B lymphocytes. Activated B cells produce antibodies that are able to recognize epitopes in several sites in the host and also activate T lymphocytes. In the heart, cross reactive T cell clones and antibodies act against heart valve constituents leading to an intense inflammatory process culminating in valve dysfunction.

Front.Cardiovasc.Med.7:612716.

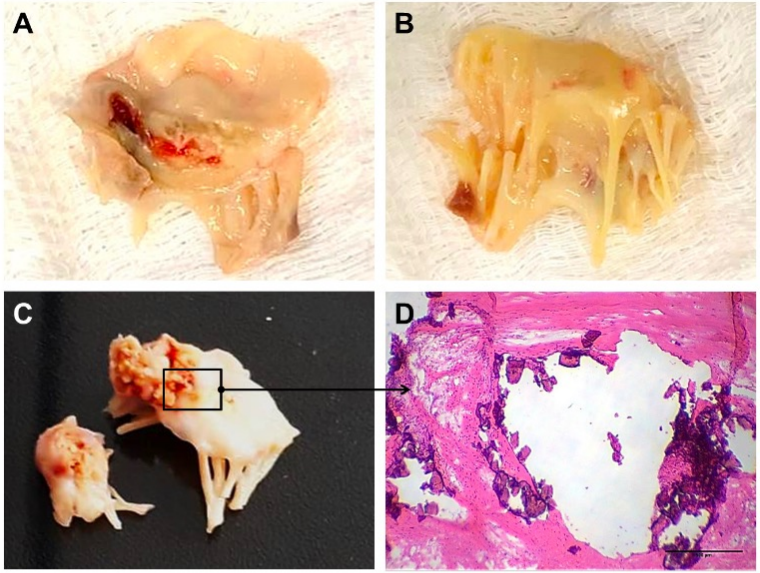
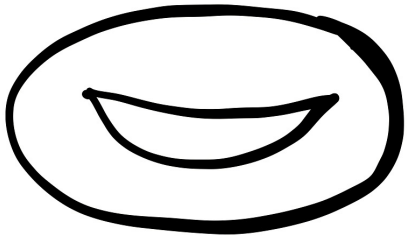
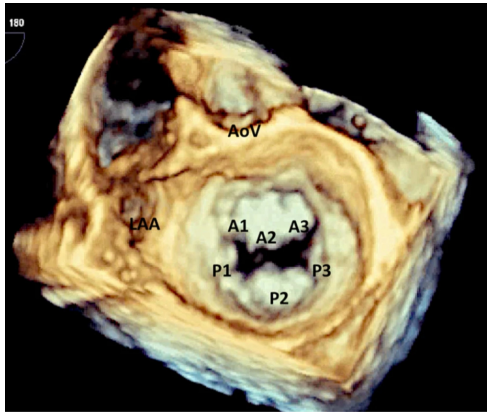
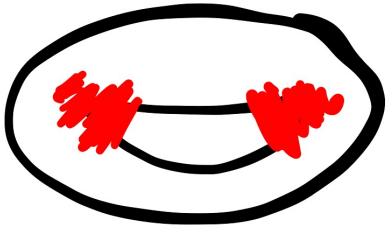


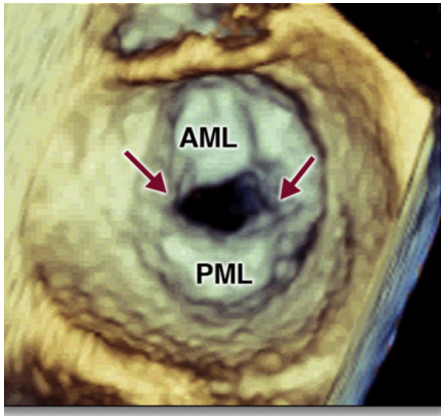
FIGURE 1 | Gross pathology and histological aspects of rheumatic mitral valve at the end stage of RHVD. **(A,B)** Atrial and ventricular sides of mitral valves excised from female, 49 year-old patient, showing thick leaflets with retraction. **(C)** Mitral valve excised from male, 61 year-old, showing calcification. **(D)** Representative Hematoxylin and Eosin staining of anterior mitral valve leaflet showing presence of nodular calcification. Scale bar = 500 μm.

Fusion commissurale







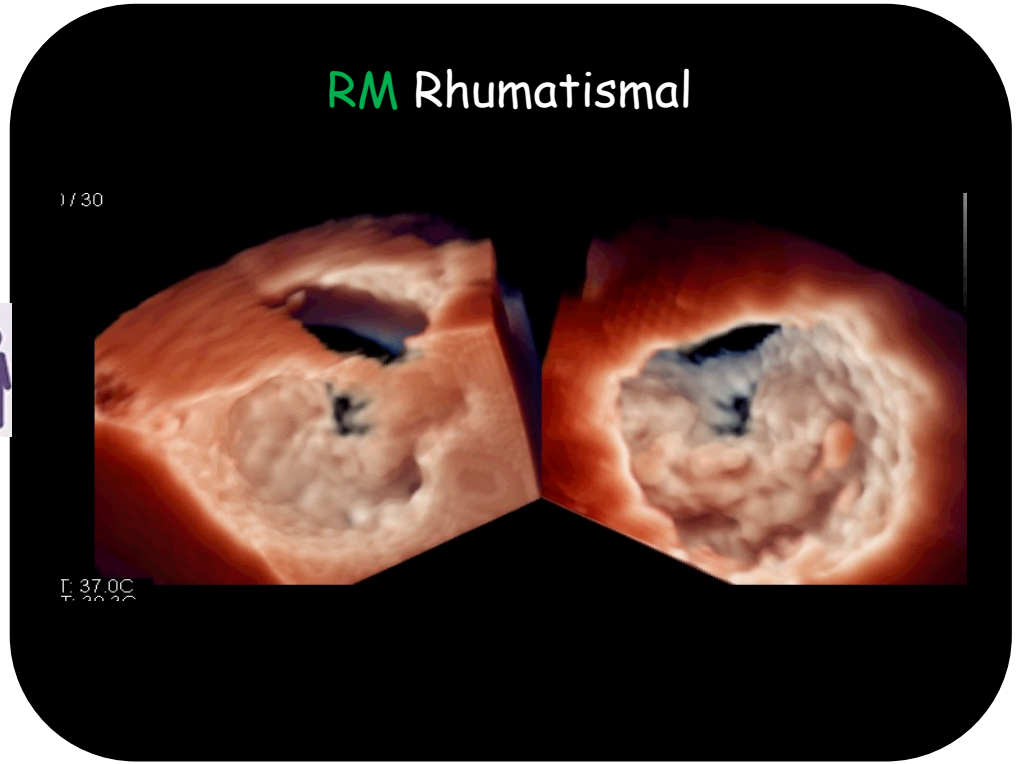


A.C.C.A.

Regurgitation in the early stages and stenosis in later stages

IM Rhumatismale

RM Rhumatismal



A.C.C.A.

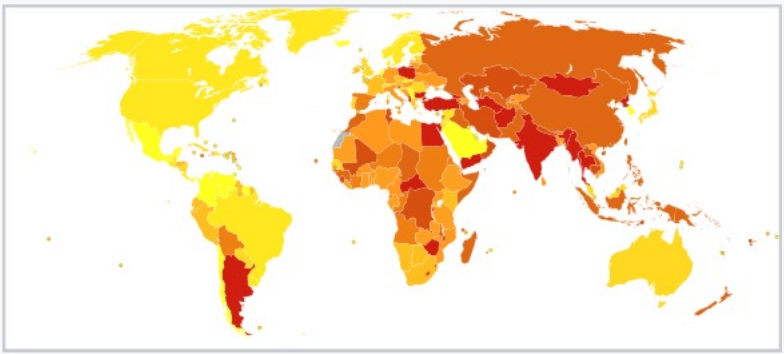
La maladie rhumatismale dans le monde

- Diminution drastique de la prévalence dans les pays développés ces 50 dernières années….

- Mais elle reste de loin la 1ere cause de valvulopathie primaire dans le monde…

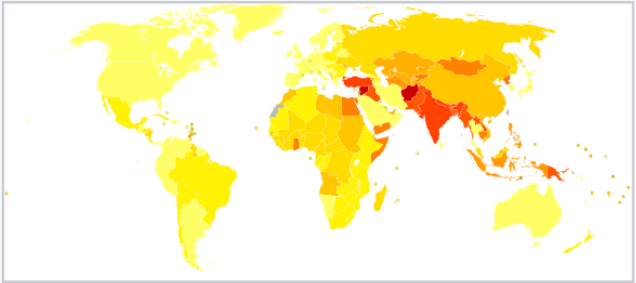
Elle toucherait 40 millions de personnes dans le monde en 2019

La maladie rhumastimale tue et handicape



Deaths from rheumatic heart disease per million persons in 2012

0–7	33–38
8–14	39–45
15–20	46–52
21–25	53–63
26–32	64–250

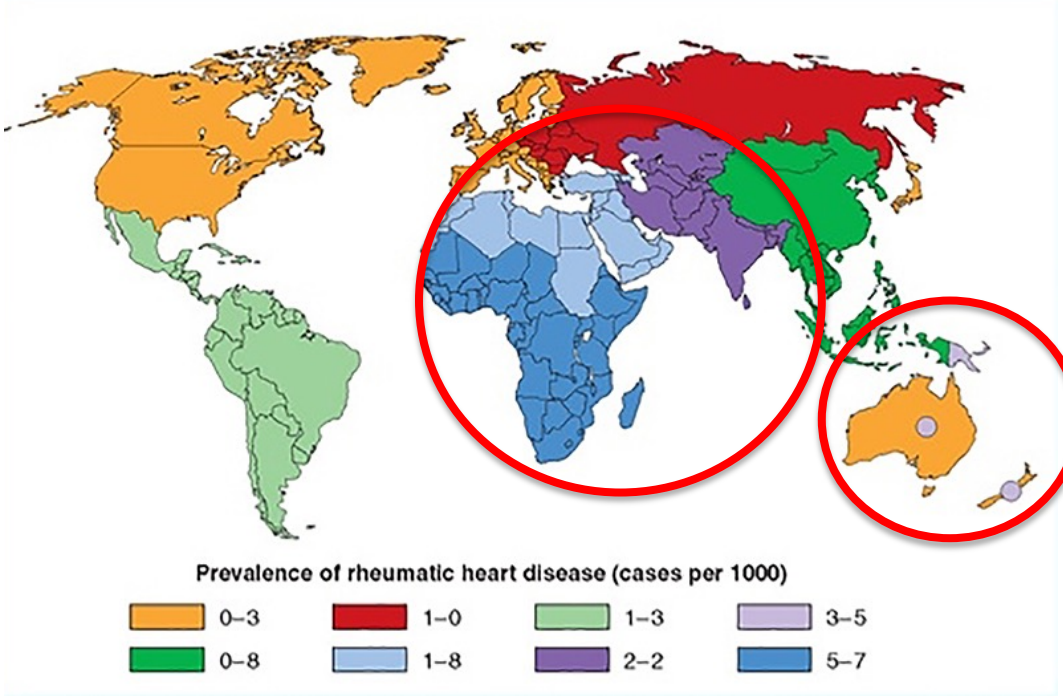


Disability-adjusted life year for rheumatic heart disease per 100,000 inhabitants in 2004.[56]

no data	120–140
less than 20	140–160
20–40	160–180
40–60	180–200
60–80	200–330
80–100	more than 330
100–120	

Prévalence de la maladie rhumatismale dans le monde

The global prevalence of RHD is around 1 per 1,000 in children aged 5-14 years

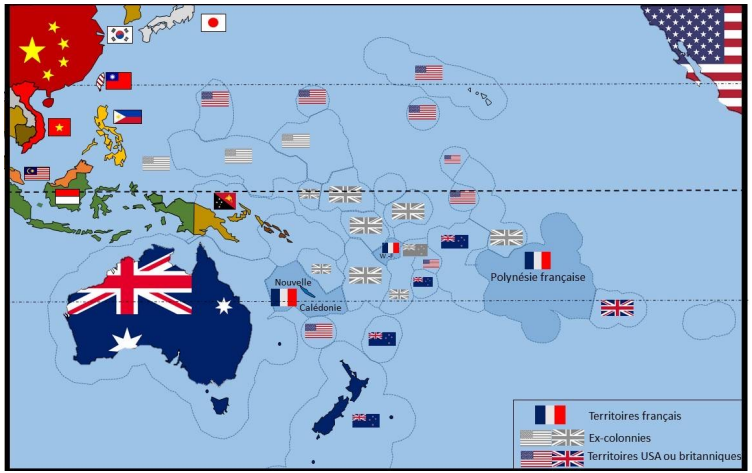


Africa
India
Nouvelle calédonie

Prevalence of rheumatic heart disease in children aged 5-14 year

Polynésie et Nouvelle Calédonie

- Le RAA reste fréquent en Polynésie française notamment chez les jeunes de 4 à 15 ans et les jeunes adultes.
- En 2016, 243 nouveaux cas avaient été déclarés.



Dépistage des cardiopathies rhumatismales chez les enfants de CM2.

J Korean Med Sci. 2024 May 6;39(17):e152
https://doi.org/10.3346/jkms.2024.39.e152
eISSN 1598-6357-pISSN 1011-8934

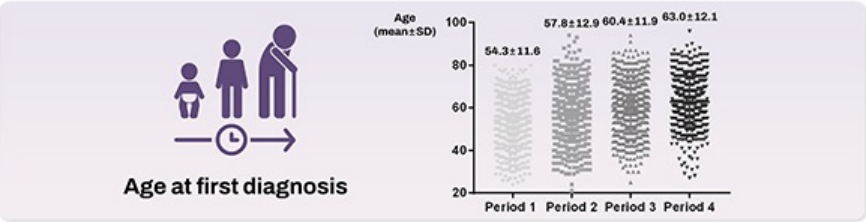
JKMS

Original Article
Cardiovascular Disorders

Check for updates

Shifts in Clinical Characteristics, Treatment, and Outcome for Rheumatic Mitral Stenosis: Insights From a 20-Year Multicentre Registry Study in Korea

Registre sur 20ans : 2001-2020
N= 2337 patients



Event-free survival of clinical outcomes for 5-year post-diagnosis by each period

This study observed an increase in patient age, comorbidities, and valve disease severity as the country transitioned from a developing to developed status.

Contemporary Presentation and Management of Valvular Heart Disease

The EURObservational Research Programme Valvular Heart Disease II Survey

Bernard Iung, MD
et al

7247 Patients with severe native VHD or previous valvular intervention were enrolled prospectively across 28 countries over a 3-month period in 2017.

mitral stenosis in 234 (4.5%)

Rheumatic >> Degenerative

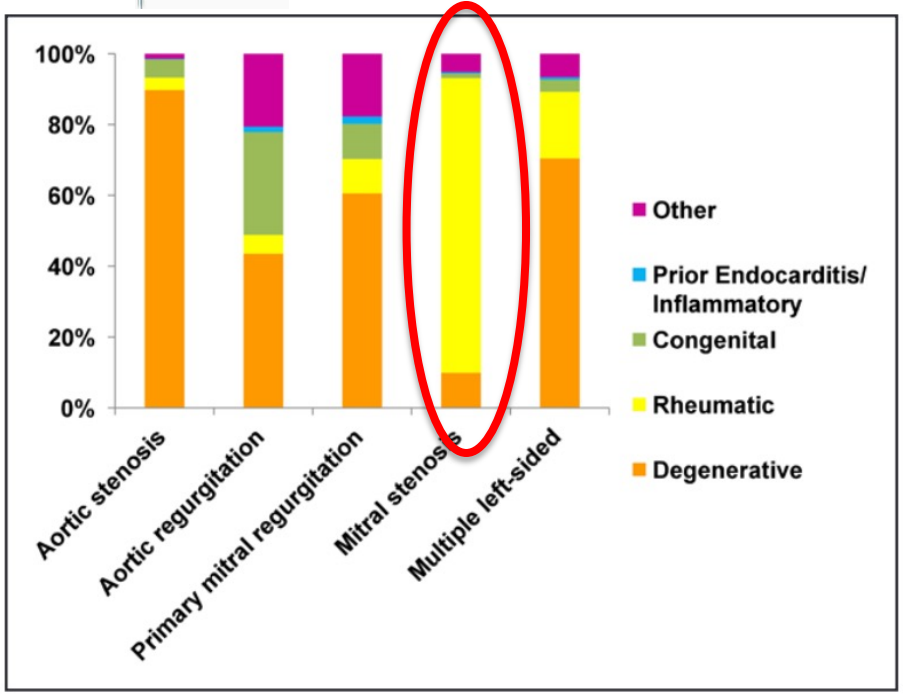
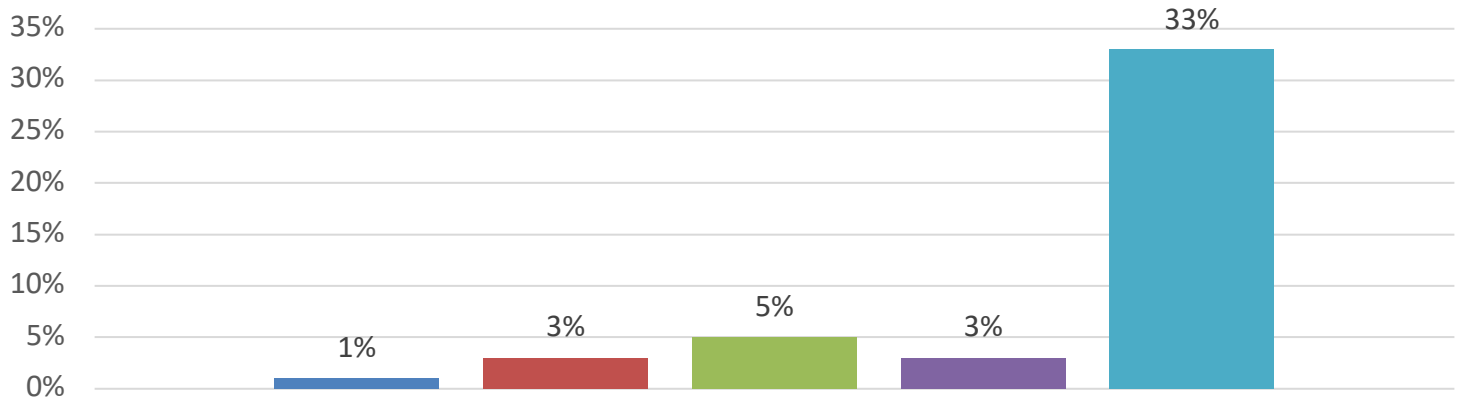


Figure 1. Types of left-sided native valvular heart diseases.

Circulation. 2019;140:1156–1169.

Répartition selon les pays de l'étude

	Northern Europe (n=327)	Western Europe (n=1493)	Eastern Europe (n=1901)	Southern Europe (n=1340)	North Africa (n=158)
Type of native valve disease, n (%)					
AS	138 (42.2)	713 (47.8)	738 (38.8)	549 (41.0)	14 (8.9)
AR	11 (3.4)	62 (4.2)	114 (6.0)	86 (6.4)	6 (3.8)
MS	3 (0.9)	44 (2.9)	88 (4.6)	46 (3.4)	53 (33.5)
Primary MR	66 (20.2)	234 (15.7)	261 (13.7)	161 (12.0)	24 (15.2)
Secondary MR	25 (7.6)	78 (5.2)	152 (8.0)	103 (7.7)	10 (6.3)



Circulation. 2019;140:1156–1169

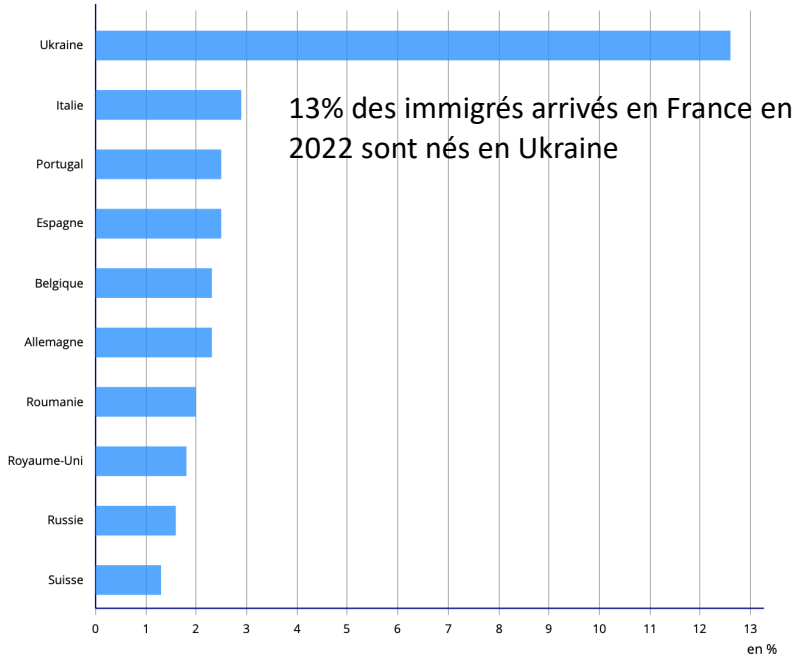
Immigration en 2022: sources INSEE

Immigrés arrivés en France en 2022 selon leur continent de naissance

Lecture : en 2022, 40,4 % d'immigrés arrivés en France sont nés en Europe.
Champ : France.
Source : Insee, estimations des flux d'entrées 2022.

Europe et Afrique ++

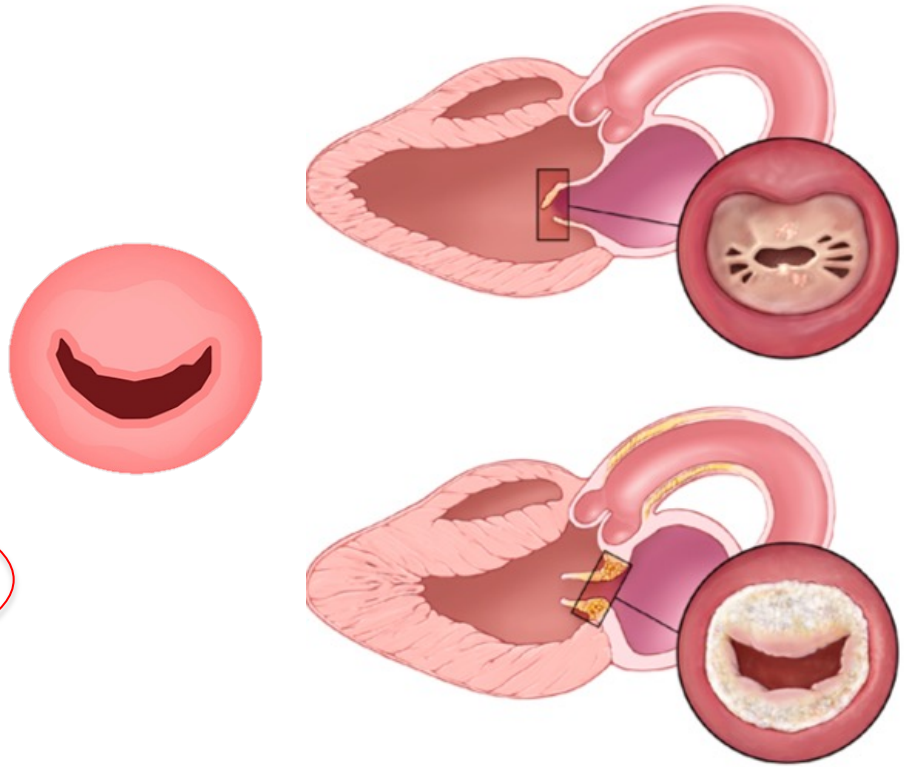
Immigrés arrivés en France en 2022 selon leur pays de naissance

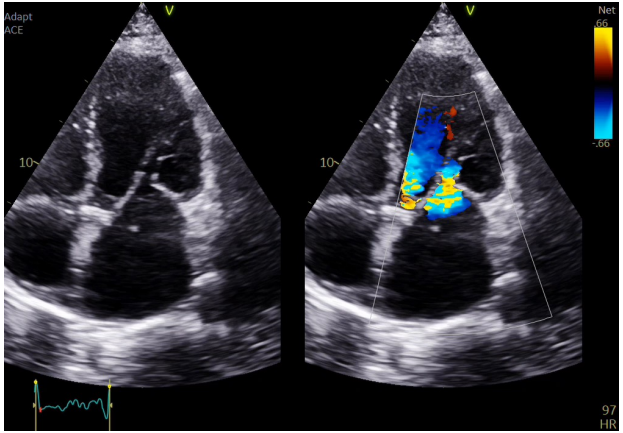


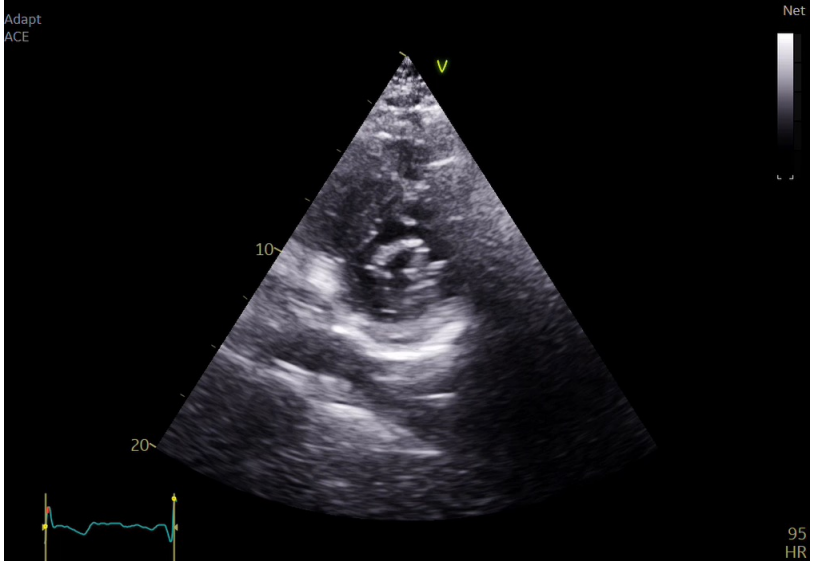
Lecture : 12,6 % des immigrés arrivés en France en 2022 sont nés en Ukraine.
Champ : France.
Source : Insee, estimations des flux d'entrées 2022.

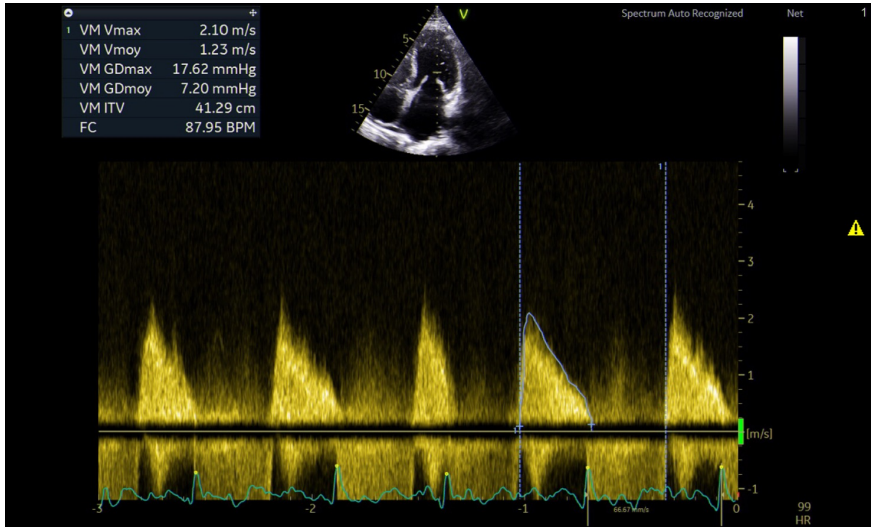
Étiologies Principales

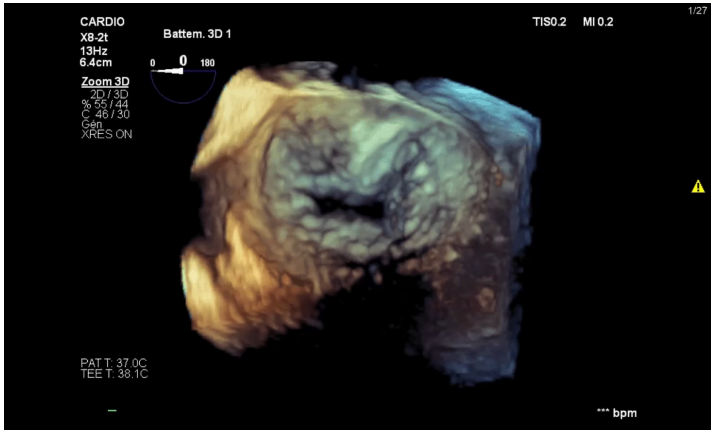
- Rhumatisme articulaire aigu (85% des cas)
- Dégénérescence calcifiée (MAC)
- Autres causes (radiothérapie, médicamenteuses)

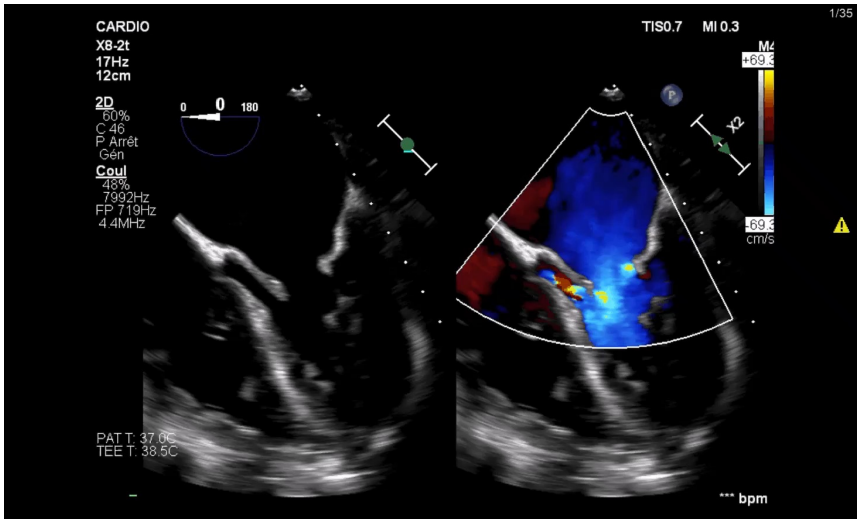


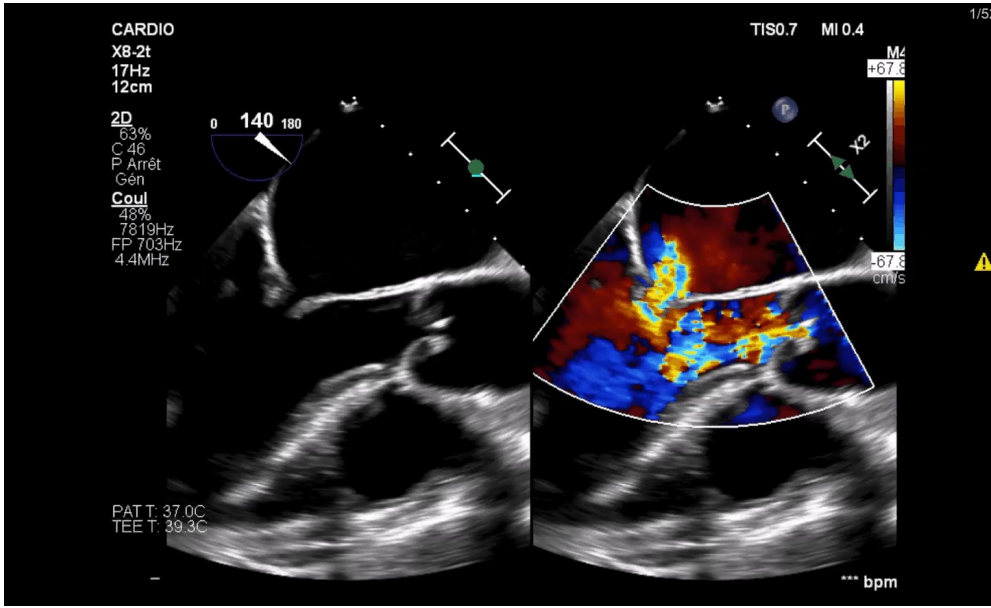

Adapt
ACE
Net
66
-66
10
10
97
HR

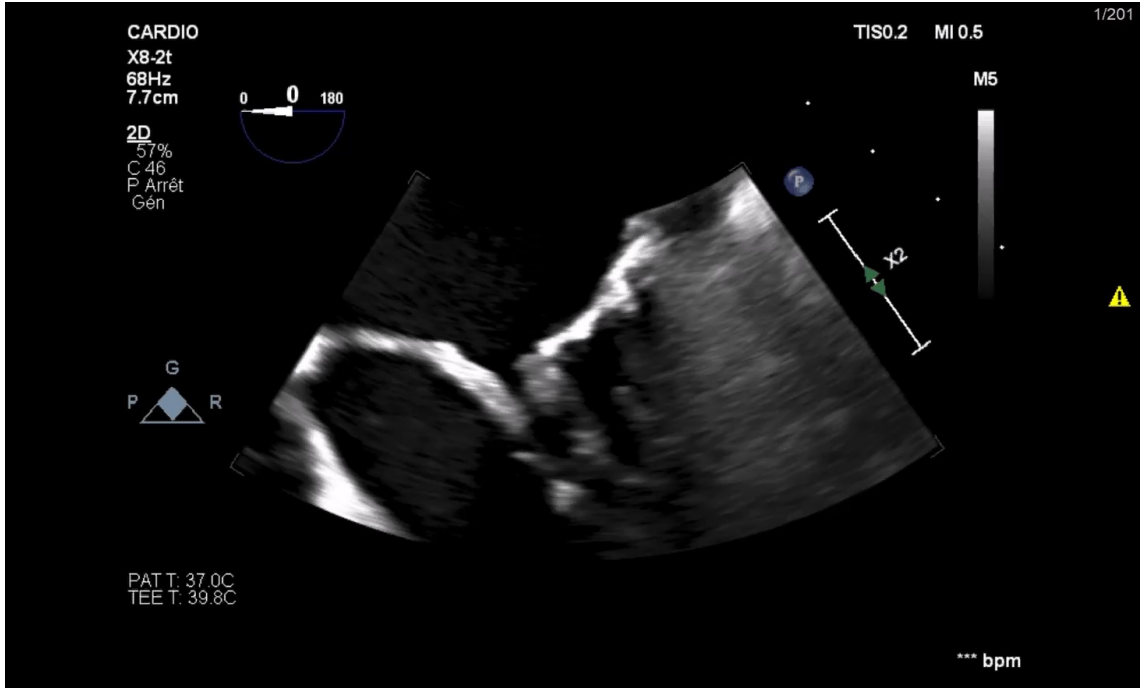

Adapt
ACE
Net
10
20
95
HR


VM Vmax 2.10 m/s
VM Vmoy 1.23 m/s
VM GDmax 17.62 mmHg
VM GDmoy 7.20 mmHg
VM ITV 41.29 cm
FC 87.95 BPM
Spectrum Auto Recognized
Net
1
5
10
15
[m/s]
99
HR


CARDIO
X8-2t
13Hz
6.4cm
Zoom 3D
2D / 3D
% 55 / 44
C 46 / 30
Gen
XRES ON
Battem. 3D 1
TIS0.2 MI 0.2
1/27
PAT T: 37.0C
TEE T: 38.1C
*** bpm


CARDIO
X8-2t
17Hz
12cm
2D
60%
C 46
P Arrêt
Gén
Coul
48%
7992Hz
FP 719Hz
4.4MHz
TIS0.7 MI 0.3
1/35
0 0 180
X2
cm/s
PAT T: 37.0C
TEE T: 38.5C
*** bpm

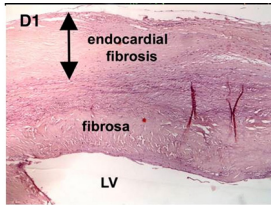

CARDIO
X8-2t
17Hz
12cm
2D
63%
C 46
P Arrêt
Gén
Coul
48%
7819Hz
FP 703Hz
4.4MHz
TIS0.7 MI 0.4
0 140 180
X2
cm/s
PAT T: 37.0C
TEE T: 39.3C
*** bpm

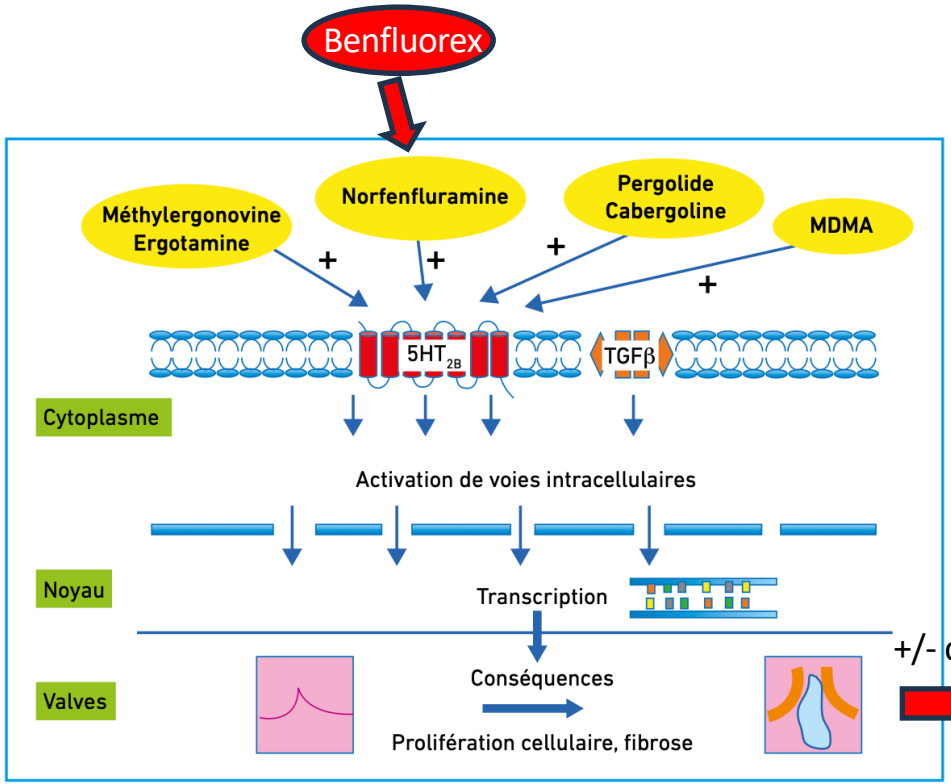

CARDIO
X8-2t
68Hz
7.7cm
2D
57%
C 46
P Arrêt
Gén
0
0
180
TIS0.2
MI 0.5
M5
1/201
X2
G
P
R
PAT T: 37.0C
TEE T: 39.8C
*** bpm

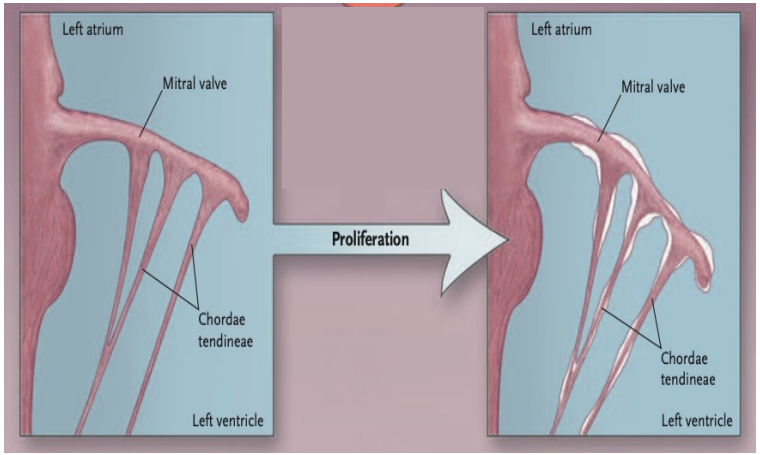
A.C.C.A.

Effet agoniste du médicament sur les récepteurs sérotoninergiques cardiaques 5HT2B

Effet carcinoïde - like







+/- calcification

Régurgitation mais aussi Sténose !

réalités Cardiologiques n° 327_Avril 2017

Médicaments et valvulopathies

- Alcaloïdes de l'ergot
  (methysergide, ergotamine (gynergène) : migraines)

- Agonistes dopaminergiques: parkinson

- Metabolites de la norfenfluramine
- Amphétamines (MDMA) :Ecstasy

Quels médicaments rechercher?

Classe	DCI	Nom commercial	Commercialisation	1re publication de valvulopathie	Retrait
Antimigraineux	Méthysergide	Desernil	1961	1967	2015
	Ergotamine	Gynergène	1948	1973	Non
Anorexigènes	Fenfluramine	Pondéral	1965	1997	1997
	Dexfenfluramine	Isoméride	1985	1997	1997
Antiparkinsoniens	Pergolide	Celance	2000	2002	2011
	Cabergoline	Dostinex	1997	2004	Non
Antidiabétique	Benfluorex	Mediator	1976	2003	2009
Amphétamine	MDMA	Ecstasy	1990	2007	Interdit

réalités Cardiologiques n° 327_Avril 2017

Echocardiographic data in benfluorex induced VHD

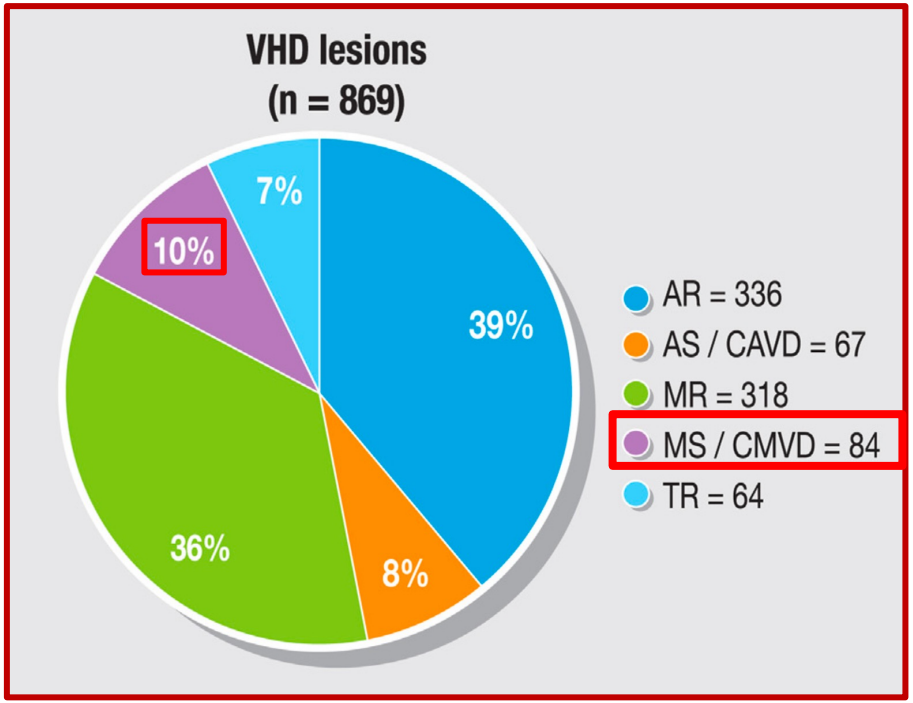
- Aortique et mitrale ++. Peu d'atteinte du cœur droit ! (≠ carcinoïdes)
- Atteintes multi valvulaires évocatrices+++
- le plus caractéristique : aspect restrictif pour les fuites
- **Sténose v**alvulaire possible, **fusion commissurale possible,**
- prolapse aortique possible
- Calcifications possibles
  - ✓Préexistantes
  - ✓Apparaissant secondairement à la prise médicamenteuse

Mitral stenosis or combined mitral valve disease

Cardiac valvular surgery and history of anorectic drug intake: A retrospective study of a large population of benfluorex-exposed patients☆

Chirurgie valvulaire cardiaque et antécédents de prise de médicaments anorexigènes : une étude rétrospective d'une large population de patients exposés au benfluorex

Marcel Laurent[a,*,1], Pierre Vladimir Ennezat[a,**,1], Marie-Christine Malergue[a], Patrick Bruneval[b], on behalf of the Members of the Benfluorex Committee for the Office National d'Indemnisation des Accidents Médicaux (ONIAM)



85% de femmes

Age median 58 ans

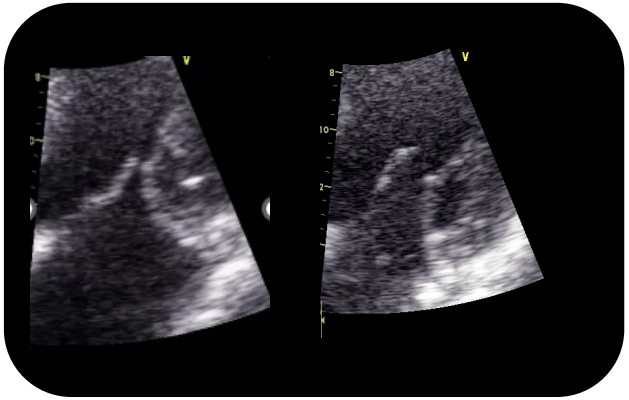
Median benfluorex exposure 5.8 years

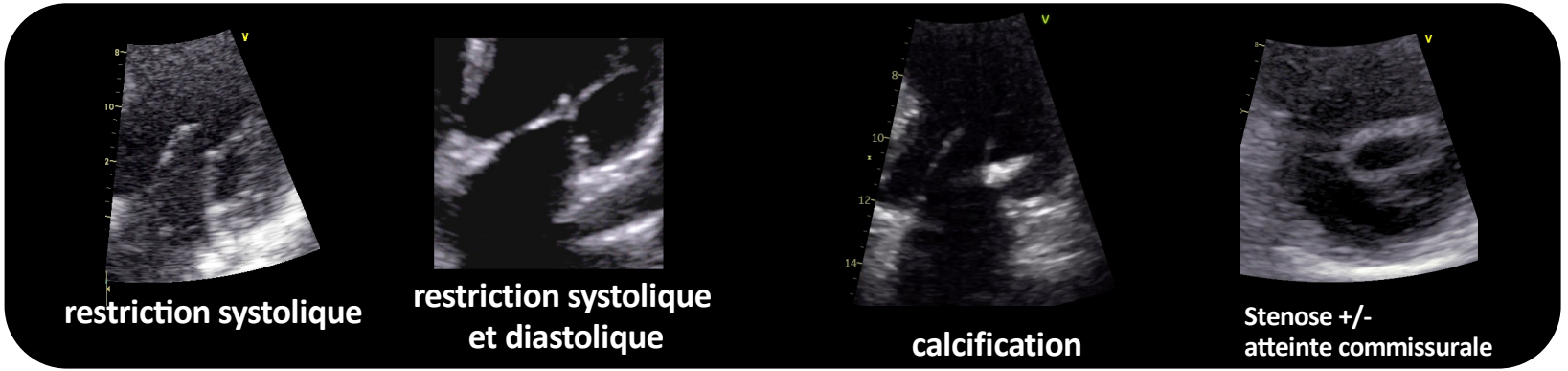
Archives of Cardiovascular Disease 115 (2022) 348—358

Echocardiographic criteria

Mitral

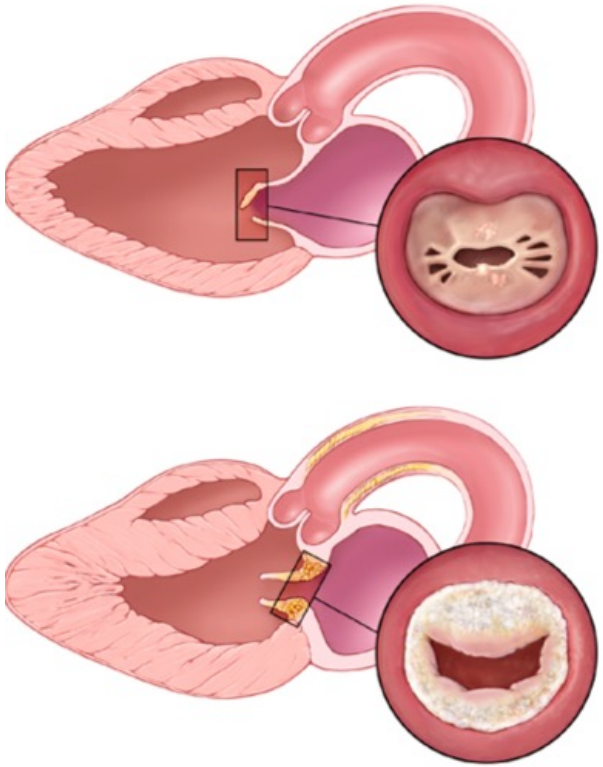
- both the leaflets and the **subvalvular apparatus** may be affected.
- The leaflets are **thickened**, show **reduced mobility**, and are more retracted towards the apex during systole (**leaflet tenting)** resulting in valve regurgitation.





Étiologies Principales

- Rhumatisme articulaire aigu (85% des cas)
- Dégénérescence calcifiée (MAC)
- Autres causes (radiothérapie, médicamenteuses)



Physiopathologie du MAC

Proche du RAC…

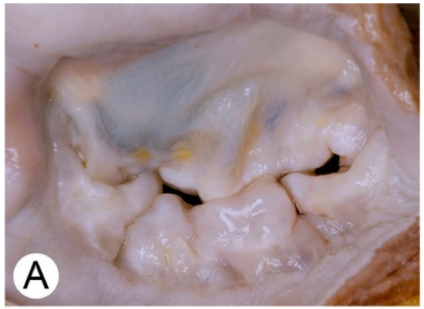
Le MAC est caractérisé par un processus fibreux, dégénératif aboutissant à une calcification située le long et sous l'anneau mitral.

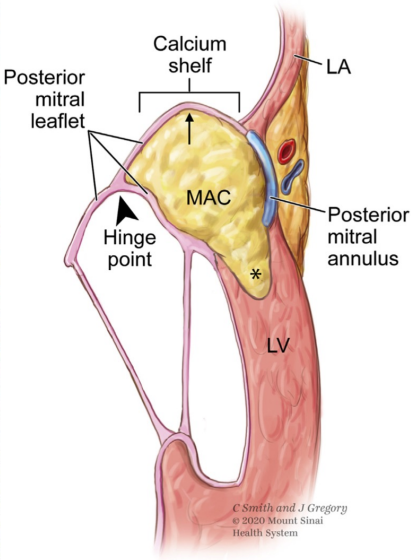
Processus actif et pas uniquement lié au vieillissement:

- situé dans les zones de stress hémodynamique
- lésion endothéliale guidant le processus inflammatoire
- ostéogénése, dépôt de calcium

Conditionné et influencé par les conditions générales:

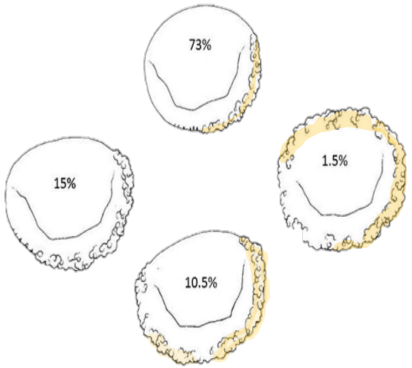
- athérosclerose, hypertension, diabète, tabac
- surpoids
- insuffisance rénale +++ (métabolisme P calcique)

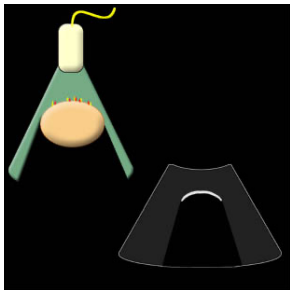


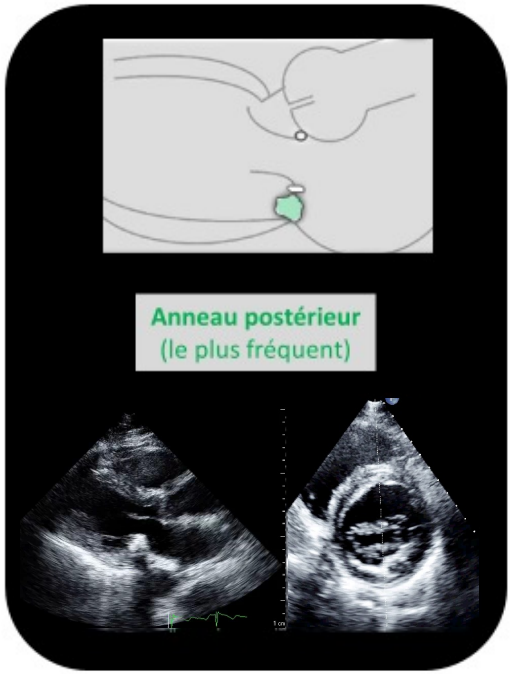


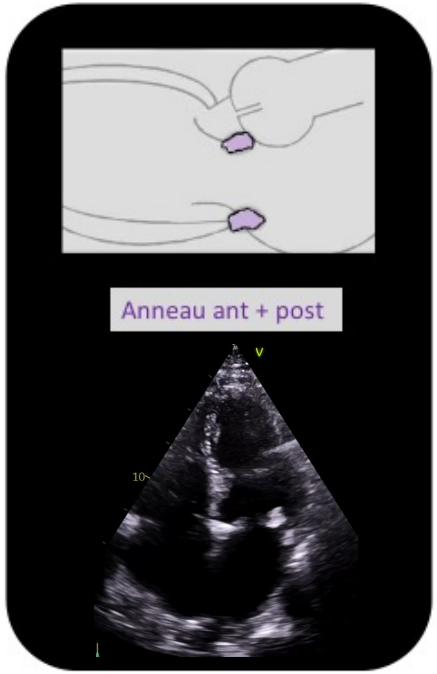
Localisation du MAC

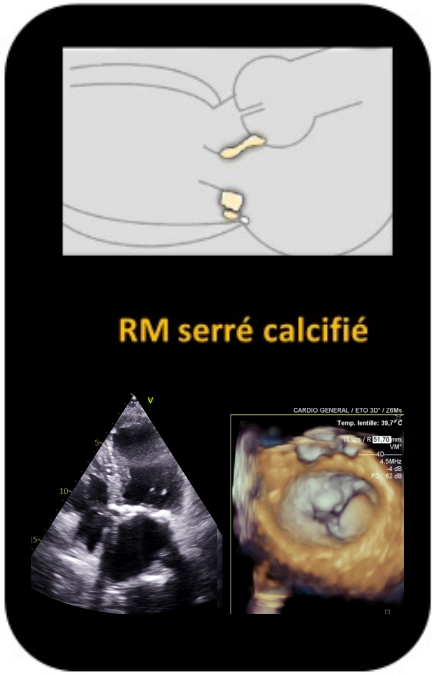
A.C.C.A.











J Am Soc Echocardiogr 2013;26:1135-42

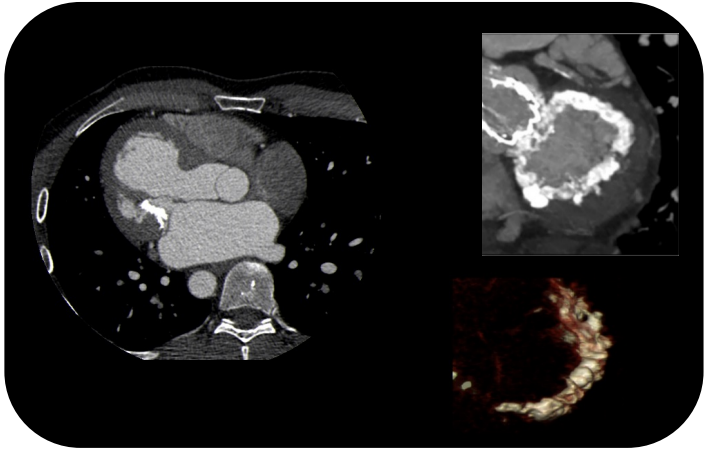
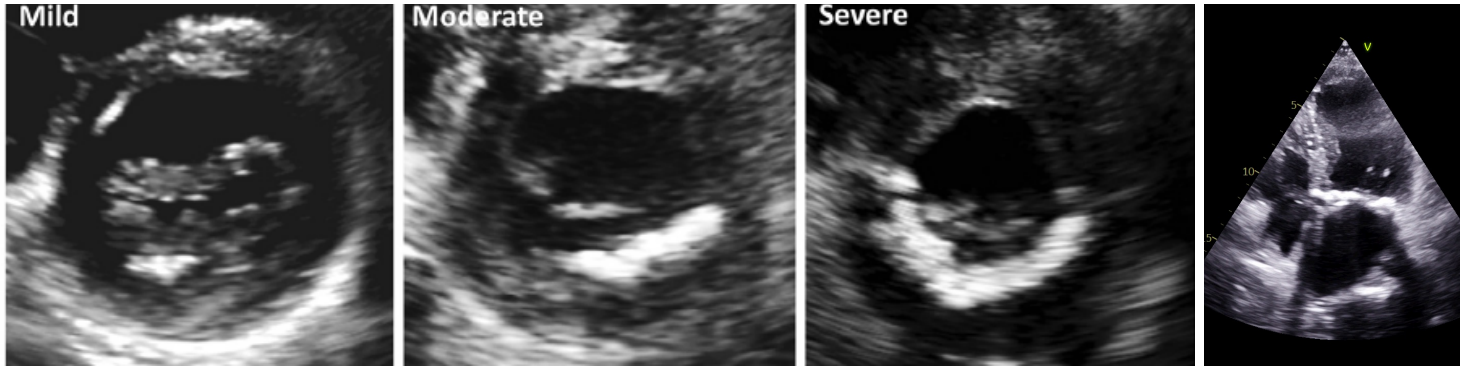


Table 2 **Proposed multi-parametric grading system for MAC, based on echocardiographic and cardiac CT quantification, and evaluation of associated special MAC features**

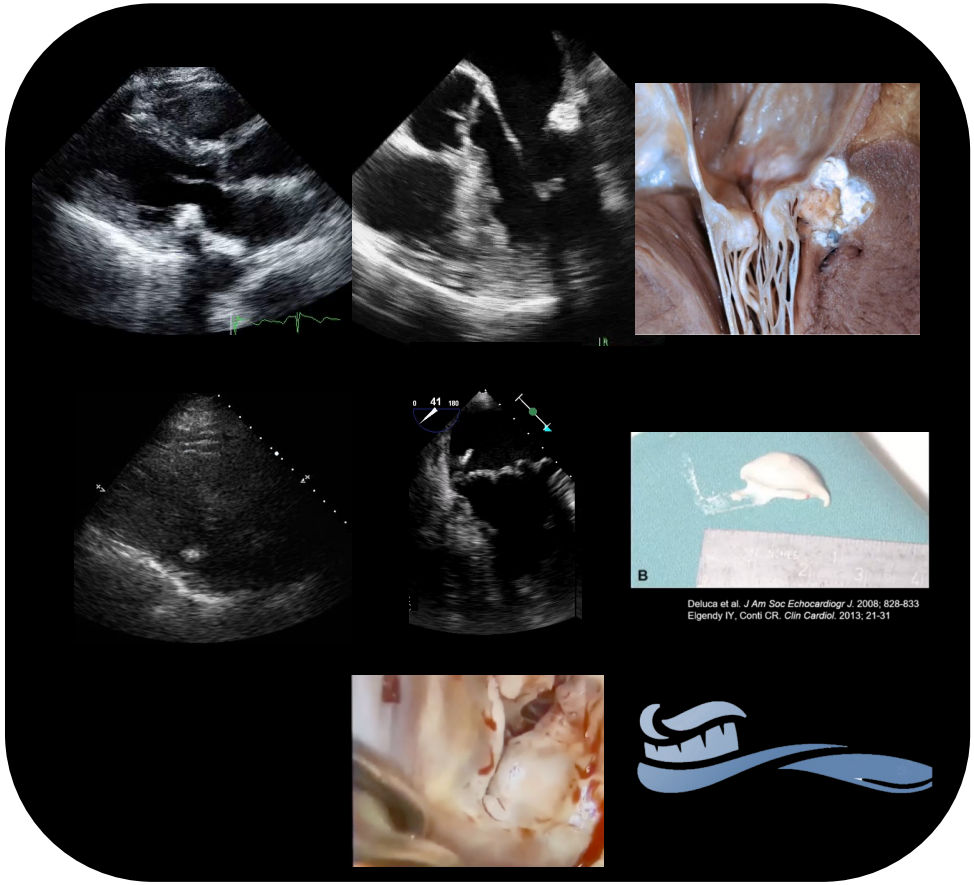
Overall MAC grade	Qualitative echocardiographic grading (based on parasternal short-axis imaging at mitral annulus level)	Quantitative CT grading (based on quantification of calcium score of mitral annulus using gated non-contrast CT)	Special features grade
Grade 1	<90° and non-contiguous	<1000 Agatston units	None
Grade 2	90°–<180°	1000–<3000 Agatston units	Calcification of subvalvular structures and leaflets by CT Involvement of one trigone
Grade 3	180°–<270°	3000–5000 Agatston units	Extension into LVOT Mobile MAC Involvement of both trigones
Grade 4	270° to circumferential	>5000 Agatston units	Heavy extension into LVOT Infiltration into myocardium

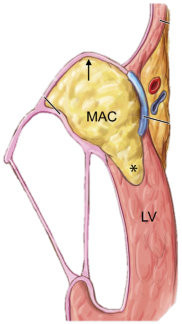
CT, computed tomography; LVOT, left ventricular outflow tract; MAC, mitral annular calcification.
For instance, a prominent chunk of posterior MAC may have <90% extent on short-axis echocardiographic imaging (echocardiographic Grade 1); however, due to the bulkiness of MAC, the elevated Agatston score (4500 Agatston units) will cause it to be classified as Grade 3.

European Heart Journal - Cardiovascular Imaging (2022) 23, e111–e122



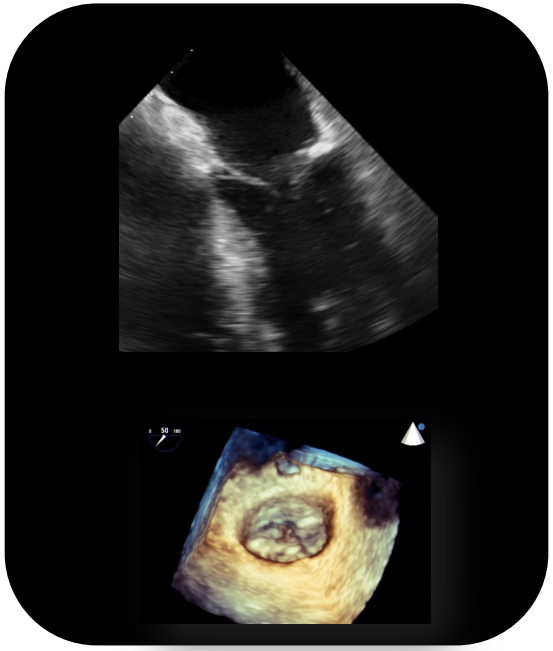
Caseous MAC Stroke





MAC

Endocarditis



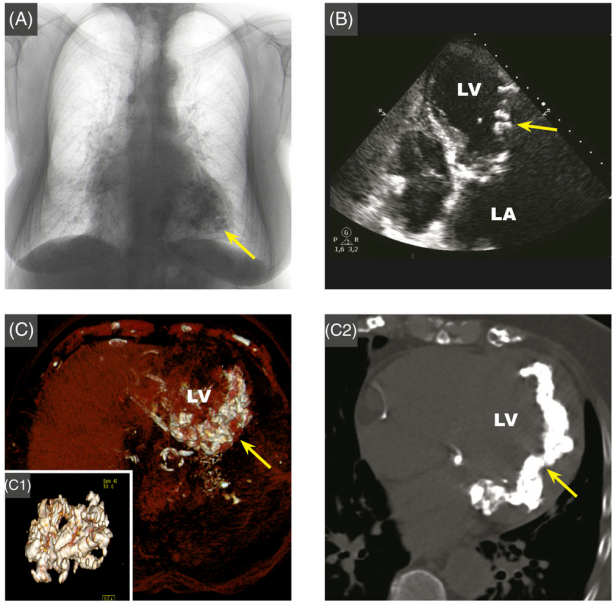
Echocardiography
A Journal of Cardiovascular Imaging and Intervention

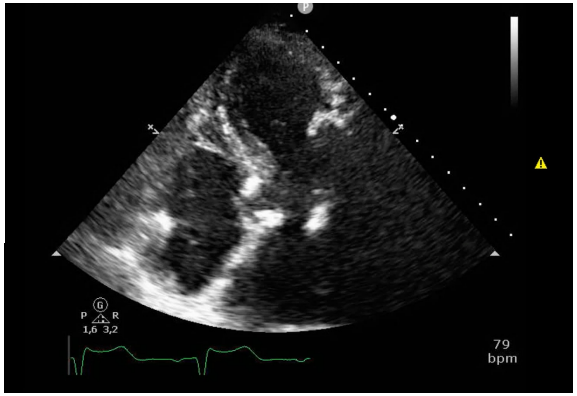
CASE IMAGE | Open Access

Extensive intra-myocardial calcifications: Value of multimodality imaging

Fabiola B. Sozzi MD, Laura Iacuzio MD, Marco Schiavone MD, Filippo Civaia MD, Stefano Carugo MD, Ciro Canetta MD, Franck Levy MD, Armand Eker MD

First published: 03 May 2022 | https://doi.org/10.1111/echo.15357





Sévérité de la MAC

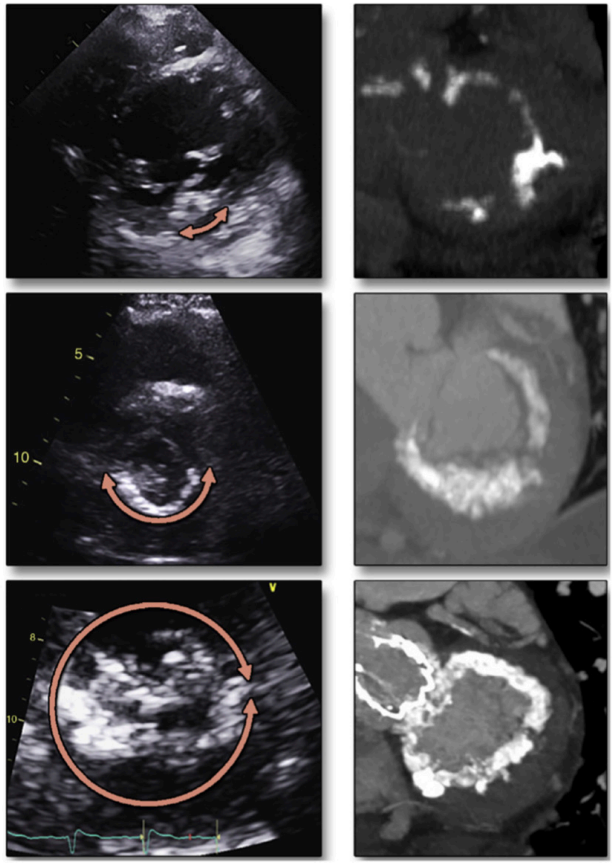
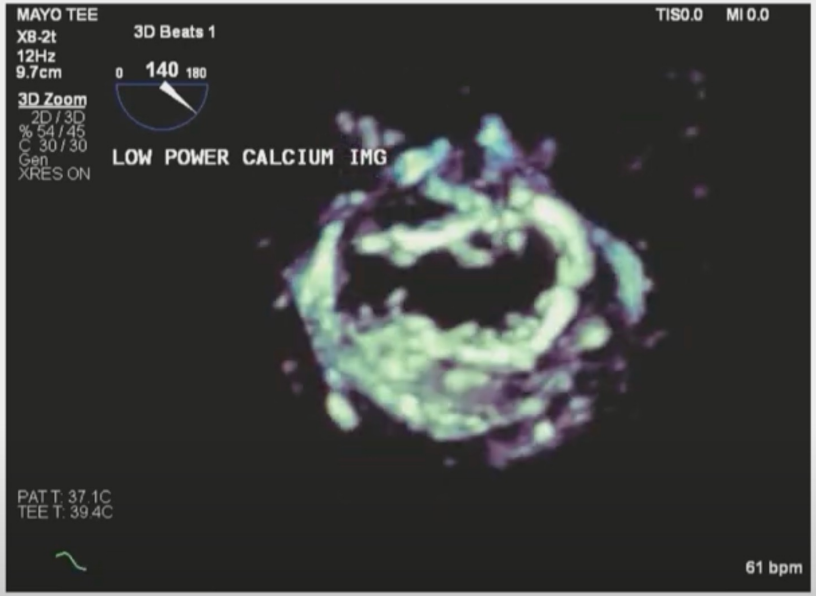
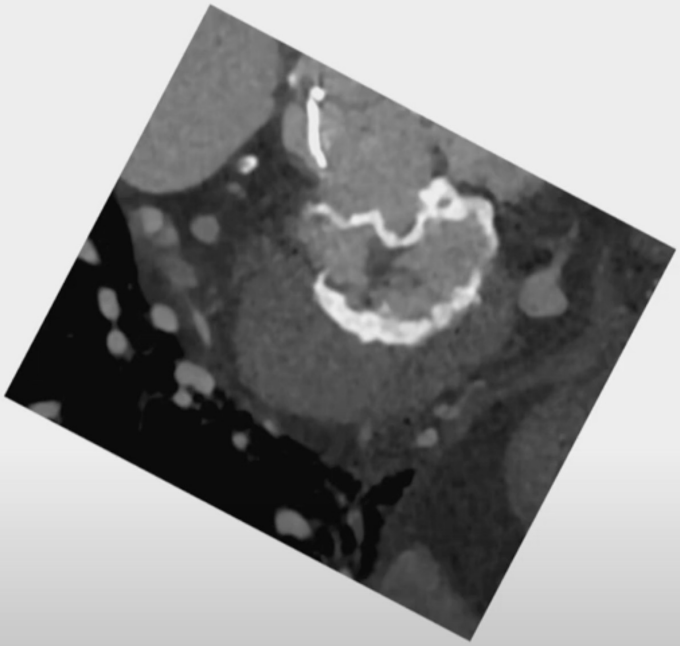


Figure 1. Proposed grading of mitral annular calcification. Short-axis parasternal transthoracic echocardiography images (left panels) and CT angiography images (right panels) show mild mitral annular calcification (*arrow*) with scattered calcification <180° (top), moderate mitral annular calcification with dense continuous calcification (*arrow*) <270° (middle), and severe mitral annular calcification with circumferential (*arrow*) >270° dense calcification (bottom) (reproduced from: Eleid MF et al. *JACC Cardiovasc Imaging*. 2016 Nov;9(11):1318-1337. 10.1016/j.jcmg.2016.09.001, with permission from Elsevier) [18].

Evaluation de l'extension des calcifications

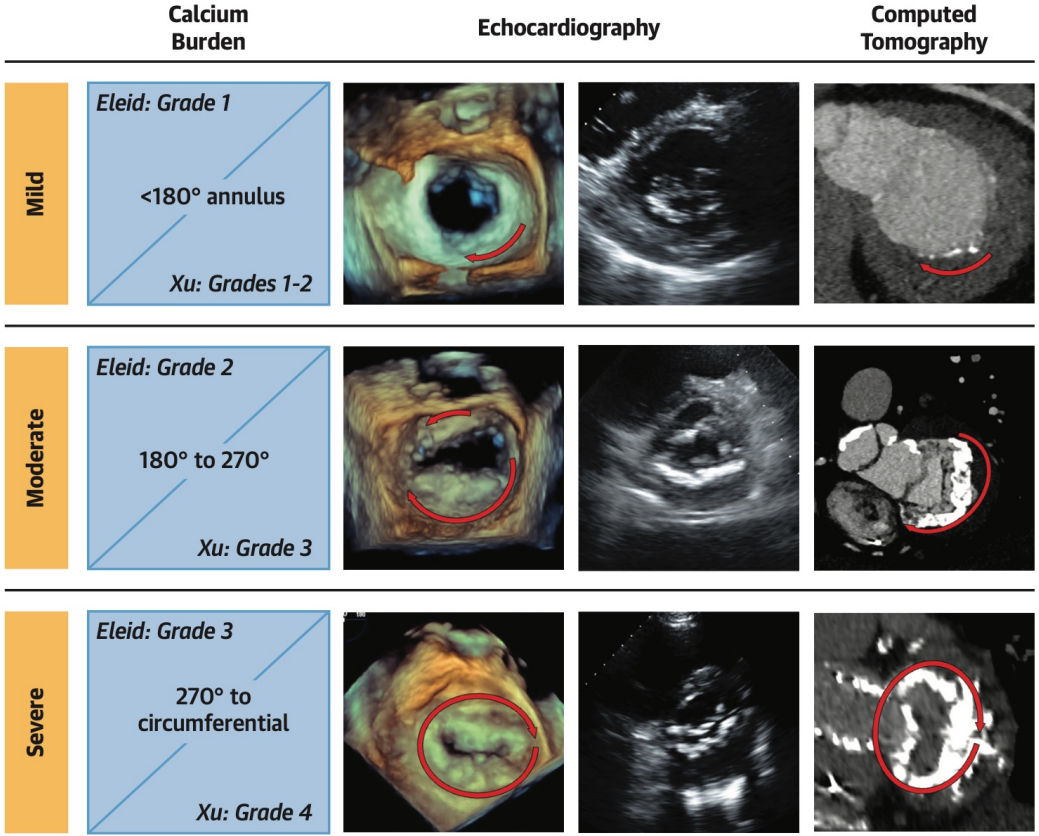
3D IMAGING





- Decrease gain
- Decrease mechanical index (MI) / power
- Adjust chroma map to accentuate calcium

Extension et localisation des calcifications



J Am Coll Cardiol 2022;80:739–751

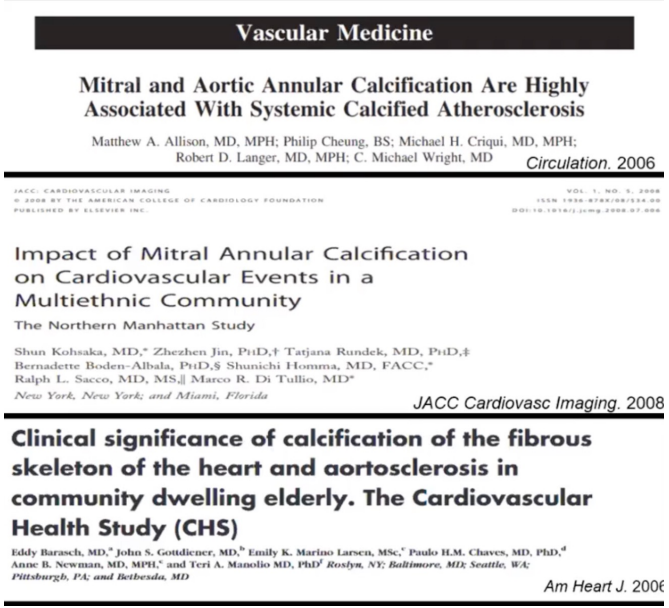
Prévalence du MAC

Le MAC le plus souvent asymptomatique et sous estimé

1242 patients entre 50 et 60 ans : 8%

1955 patients > 40ans: 27%

Cardiovascular health study : 42%



Vascular Medicine

Mitral and Aortic Annular Calcification Are Highly Associated With Systemic Calcified Atherosclerosis

Matthew A. Allison, MD, MPH; Philip Cheung, BS; Michael H. Criqui, MD, MPH; Robert D. Langer, MD, MPH; C. Michael Wright, MD

Circulation. 2006

Impact of Mitral Annular Calcification on Cardiovascular Events in a Multiethnic Community

The Northern Manhattan Study

Shun Kohsaka, MD,* Zhezhen Jin, PhD,† Tatjana Rundek, MD, PhD,‡ Bernadette Boden-Albala, PhD,§ Shunichi Homma, MD, FACC,* Ralph L. Sacco, MD, MS,‖ Marco R. Di Tullio, MD*

New York, New York; and Miami, Florida

JACC Cardiovasc Imaging. 2008

Clinical significance of calcification of the fibrous skeleton of the heart and aortosclerosis in community dwelling elderly. The Cardiovascular Health Study (CHS)

Eddy Barasch, MD,[a] John S. Gottdiener, MD,[b] Emily K. Marino Larsen, MSc,[c] Paulo H.M. Chaves, MD, PhD,[d] Anne B. Newman, MD, MPH,[e] and Teri A. Manolio MD, PhD[f] *Roslyn, NY; Baltimore, MD; Seattle, WA; Pittsburgh, PA; and Bethesda, MD*

Am Heart J. 2006

Original article

Prevalence and clinical characteristics of degenerative mitral stenosis

Yasuyuki Ukita (MT)[a], Satoshi Yuda (MD, PhD, FJCC)[b,c,*], Hideaki Sugio (MT)[a], Ayaka Yonezawa (MT)[a], Yuka Takayanagi (MT)[a], Hitomi Masuda-Yamamoto (MD)[d], Norie Tanaka-Saito (MD)[d], Hirofumi Ohnishi (MD, PhD)[e], Tetsuji Miura (MD, PhD, FJCC)[c]

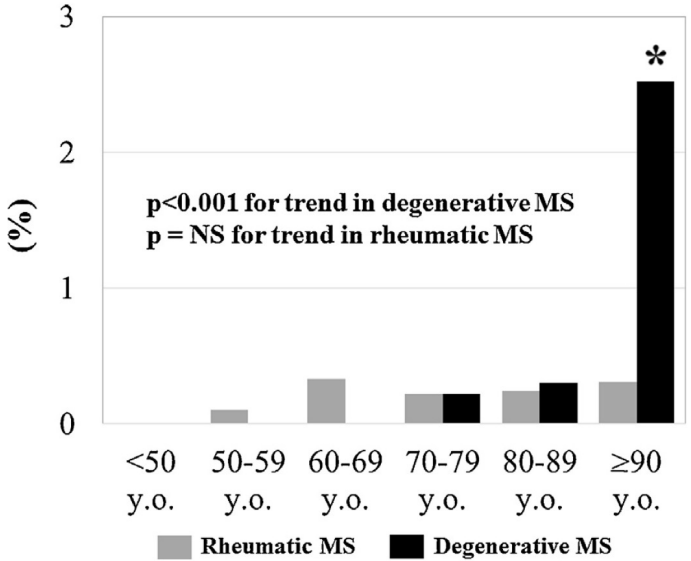


Fig. 2. Relation to age and prevalence rate of patients with degenerative mitral stenosis (MS) and rheumatic MS. NS, not significant. *$p < 0.001$ vs. all other age groups of degenerative MS.

Progression du MAC au cours du temps

Natural History of Mitral Annular Calcification and Calcific Mitral Valve Disease

Nadav Willner, MD, Ian G. Burwash, MD, Luc Beauchesne, MD, Vince Chan, MD, MPH, Branka Vulcsevic, PhD, Kathy Ascah, MD, Thais Coutinho, MD, Steve Promislow, MD, Ellamae Stadnick, MD, Kwan L. Chan, MD, Thierry Mesana, MD, PhD, and David Messika-Zeitoun, MD, PhD, *Ottawa, Ontario, Canada*

Background: The natural history of mitral annular calcification (MAC) and risk for developing calcific mitral valve disease (CMVD) have been poorly defined. The aim of this study was to evaluate the progression rate of MAC and of the development of CMVD.

Methods: Patients with MAC and paired echocardiograms ≥1 year apart between 2005 and 2019 were included. Progression rates from mild or moderate to severe MAC and to CMVD (defined as severe MAC and significant mitral stenosis and/or regurgitation) were assessed, along with potential association with sex.

Results: A total of 11,605 patients (mean age, 73 ± 10 years; 51% men) with MAC (78% mild, 17% moderate, 5% severe) were included and underwent follow-up echocardiography at 4.2 ± 2.7 years. Among patients with mild or moderate MAC, 33% presented with severe MAC at 10 years. The rate of severe MAC was higher in women than in men (41% vs 24% [$P < .001$]; hazard ratio, 1.3; $P < .001$) and in patients with moderate versus mild MAC (71% vs 22% [$P < .001$]; hazard ratio, 6.1; $P < .001$). At 10 years, 10% presented with CMVD (4%, 23%, and 60% in patients with mild, moderate, and severe MAC, respectively), which was predicted by female sex (15% vs 5%; $P < .0001$), even after adjustment for MAC severity (hazard ratio, 1.9; $P < .001$).

Conclusion: In this large cohort of patients with MAC, progression to severe MAC was common and frequently resulted in CMVD. Female sex was associated with higher progression rates. MAC and CMVD are expected to dramatically increase as the population ages, highlighting the importance of a better understanding of the pathophysiology of MAC to develop effective preventive medical therapies. (J Am Soc Echocardiogr 2022;■:■-■.)

JASE may 2022

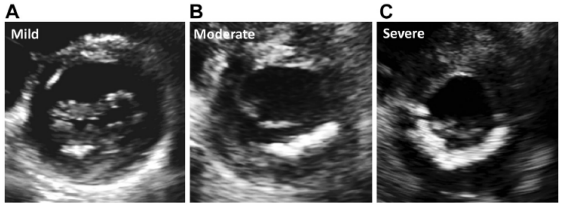


Figure 1 Examples of grades of MAC. The severity of MAC was assessed on the basis of the extent of annular calcification relative to the posterior mitral annular circumference in the parasternal short-axis view and graded as **(A)** mild (less than one third), **(B)** moderate (up to two thirds), and **(C)** severe (more than two thirds).

At 10 years,

33% from mild /moderate to severe MAC + svt severe chez la femme

10% have calcific mitral valve disease

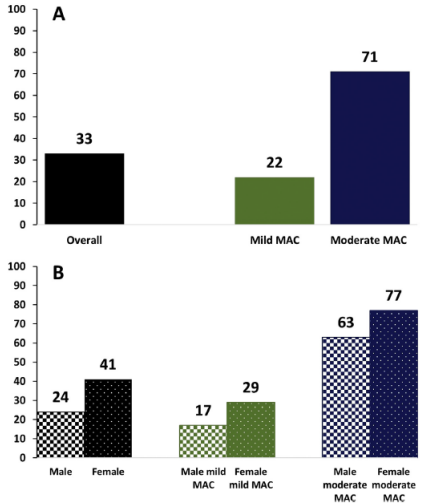
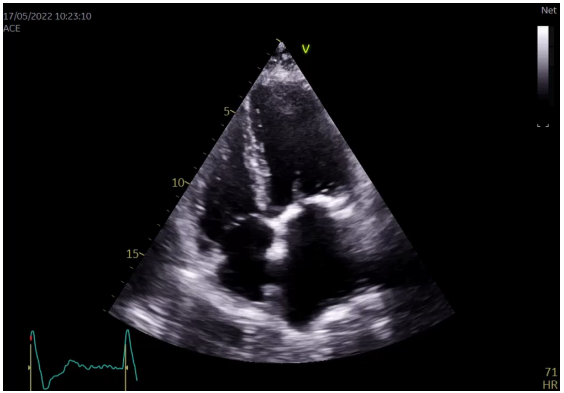
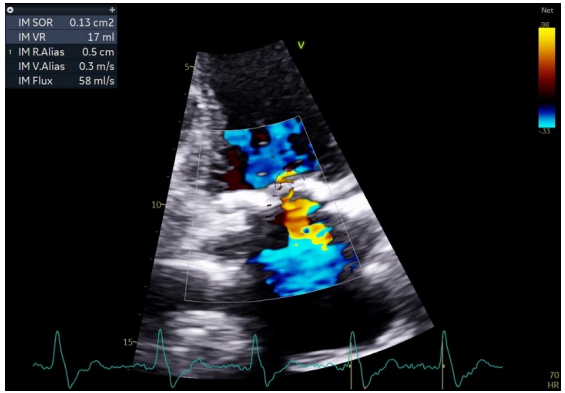
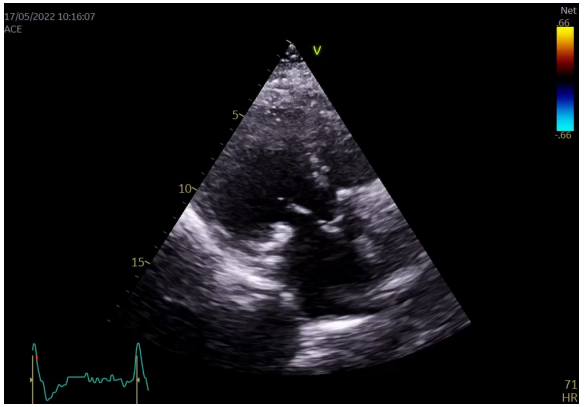


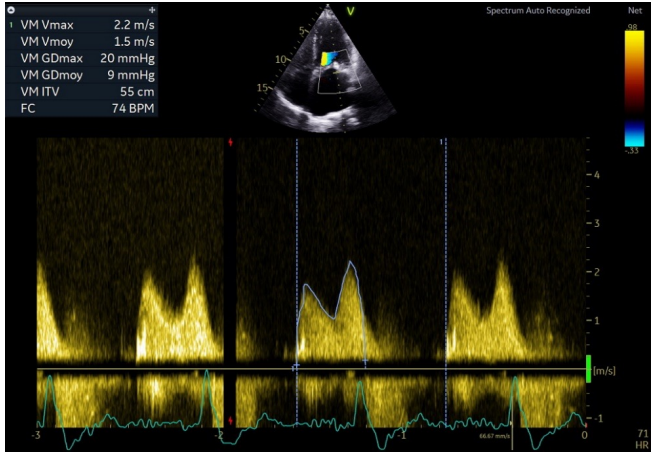
Figure 2 Progression rate at 10 years to severe MAC. **(A)** Overall and according to MAC severity. **(B)** According to sex and MAC severity.

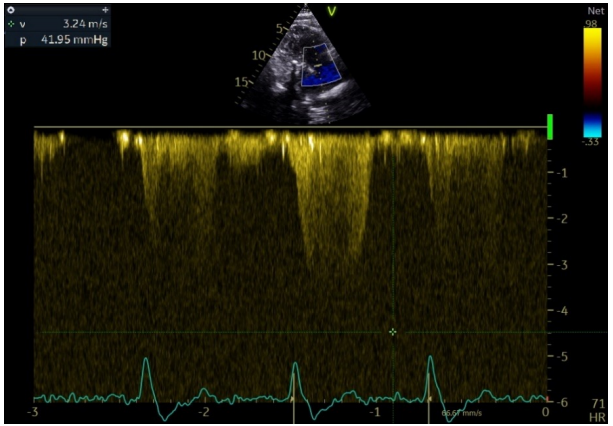
Exemple: une patiente de 79ans











A.C.C.A.

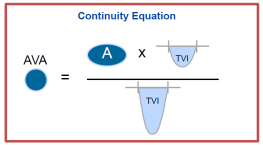
Comment évaluer la sévérité du RM?

Evaluation des sténoses valvulaires

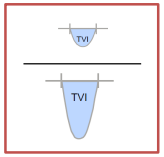
Aortic stenosis

V max

Surface valvulaire



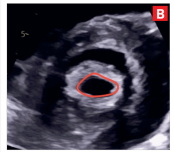
IP



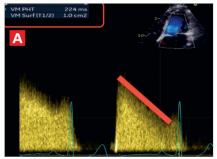
Gradient moyen

Mitral stenosis

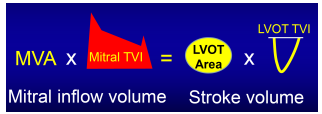
Surface



planimétrie

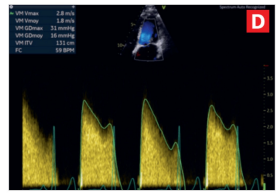


PHT



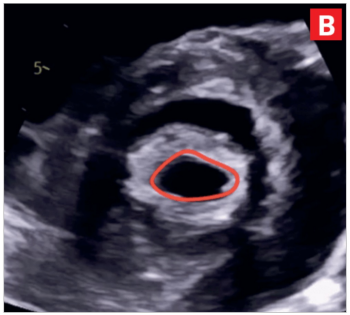
Equation de continuité/ IP

Gradient moyen

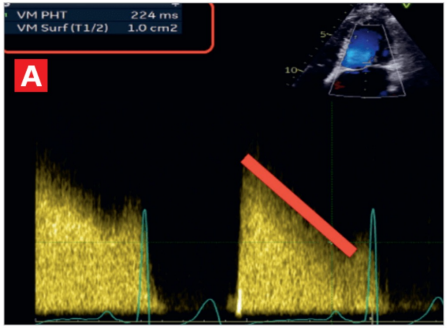


Comment évaluer la sévérité du RM?

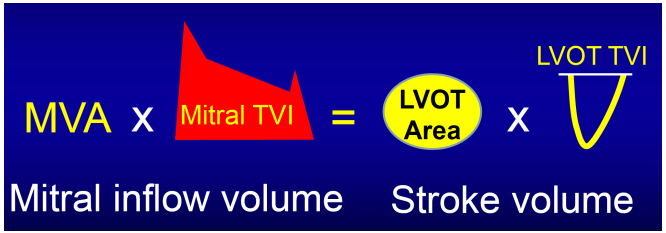
Surface



planimétrie

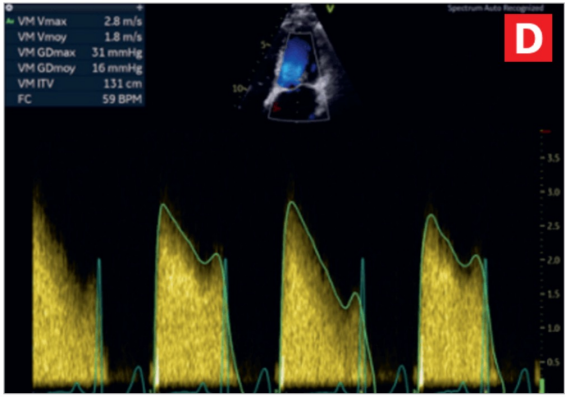


PHT

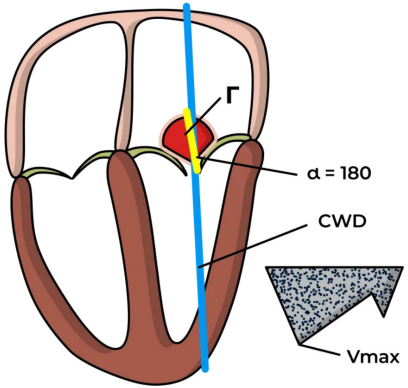


Equation de continuité/ IP

Gradient moyen



PISA et RM



$$MVA = \frac{2 \times pi \times r^2 \times V_A \times \alpha / 180}{Vmax}$$

Formula:

MVA = (2 * Π r^2 * VA * α / 180) / Vmax

Comment évaluer la sévérité du RM sur MAC?

Table 9 Recommendations for classification of mitral stenosis severity

	Mild	Moderate	Severe
• Specific findings			
Valve area (cm^2)	>1.5	1.0–1.5	<1.0
• Supportive findings			
Mean gradient (mmHg)[a]	<5	5–10	>10
Pulmonary artery pressure (mmHg)	<30	30–50	>50

[a]At heart rates between 60 and 80 bpm and in sinus rhythm.

ASE guidelines

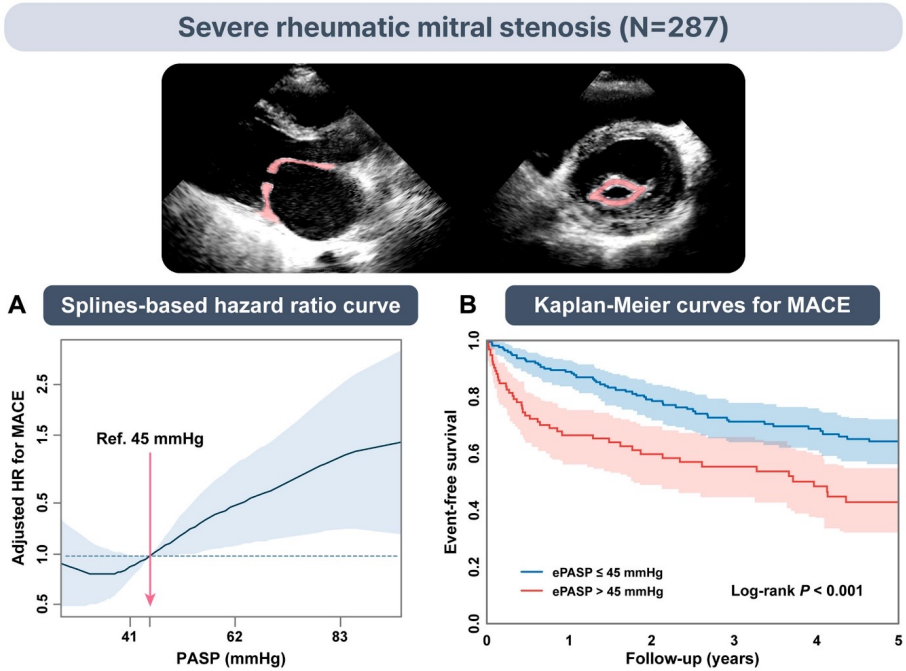
Young (rheumatic) : 3D > PHT > continuity

Old (calcific): continuity > planimetry ~~PHT~~

Prognostic Value of Pulmonary Artery Systolic Pressure in Severe Rheumatic Mitral Stenosis

N = 287 China
prognostic significance of PASP, rather than atrial fibrillation, in relation to MACE among patients with severe rheumatic MS.

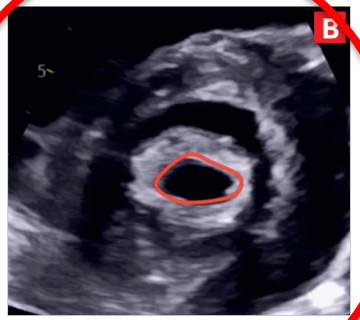
Additionally, lower ePASP threshold (>45 mm Hg) as a predictor of an unfavorable prognosis.



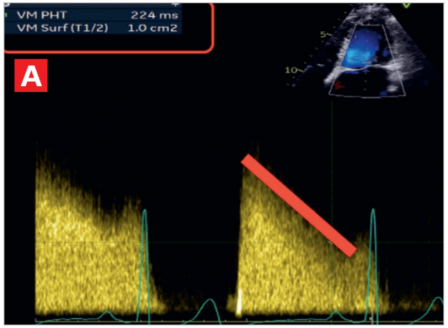
Circ Cardiovasc Imaging 2024 Oct;17

Comment évaluer la sévérité du RM?

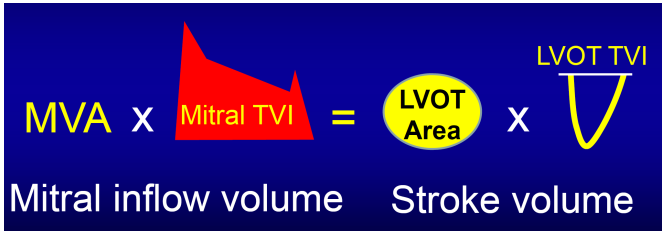
Surface



planimétrie

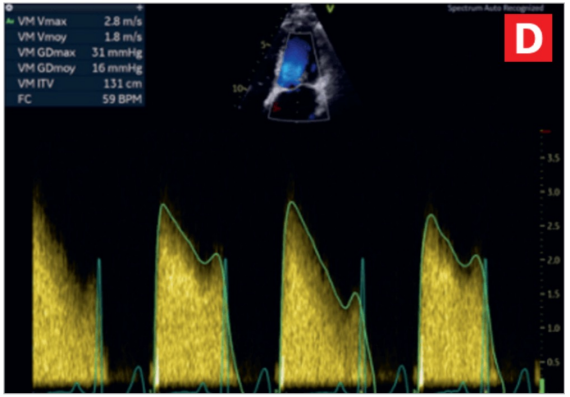


PHT



Equation de continuité/ IP

Gradient moyen



A.C.C.A.

La planimétrie dans le RM

MVA PLANIMETRY

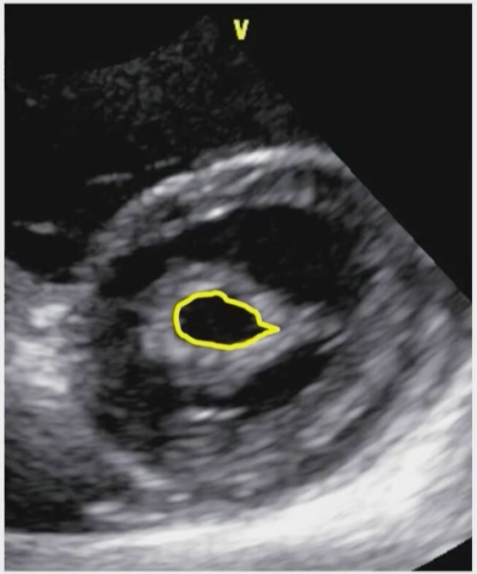
- Considered as the reference measurement
- Zoomed PSAX image
- Sufficient gain to visualize whole contour of orifice
- Excessive gain may underestimate area

A.C.C.A.

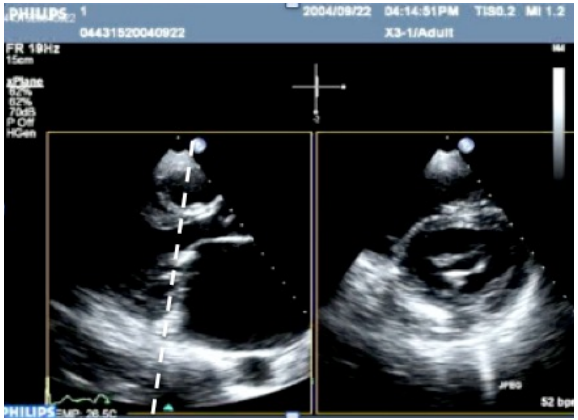
Geler l'image en mid diastole

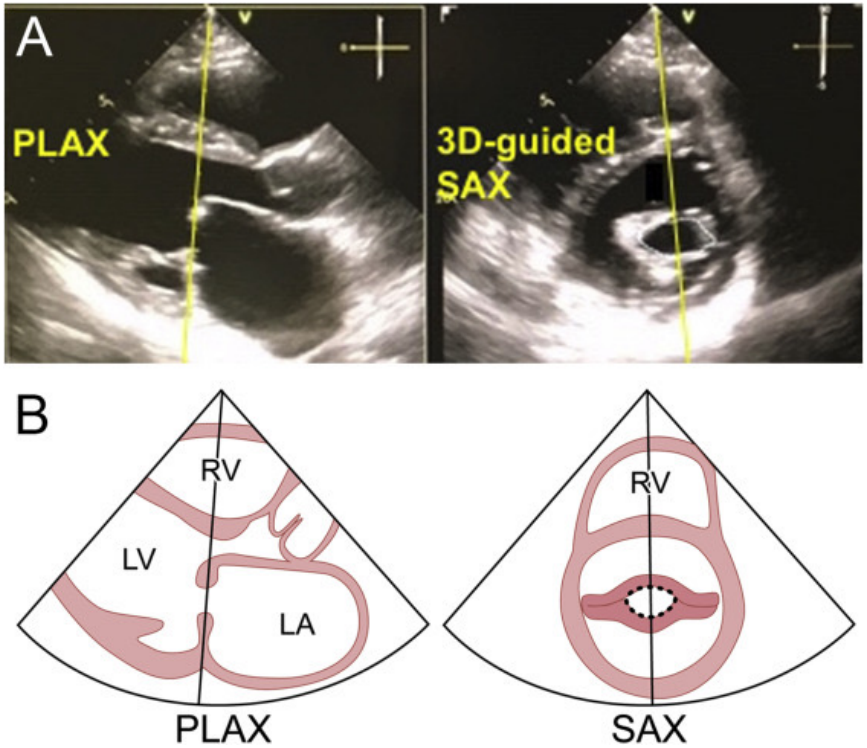
MVA PLANIMETRY

- Measure at leaflet tips perpendicular to orifice
- Include open commissures
- Measure in mid-diastole
- Biplane or 3D imaging may be useful

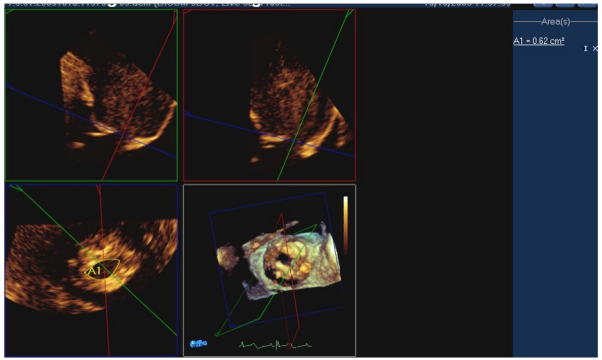


Multiplan et RM





Planimetrie 3D



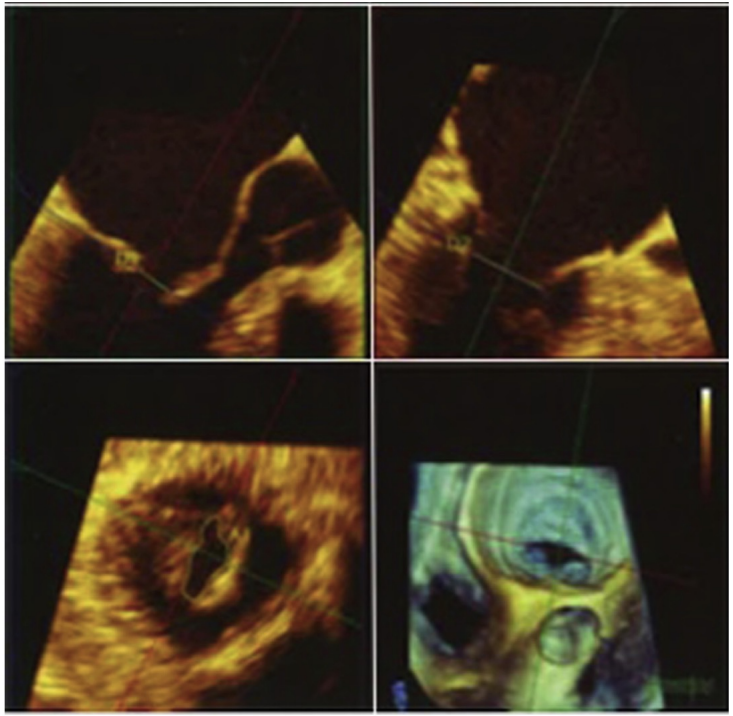
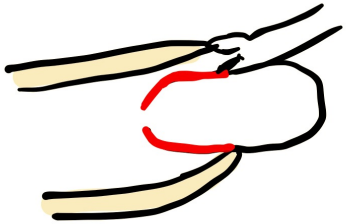
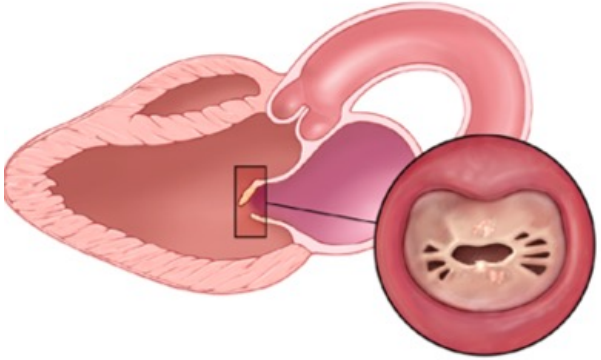
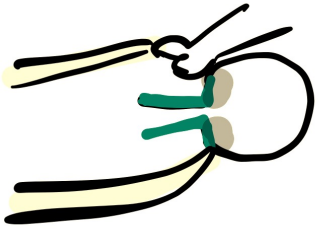


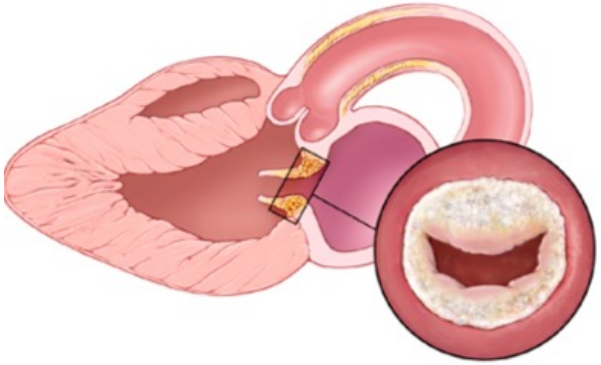
Figure 4 Real-time three-dimensional measurement of MV area. Multiplane reconstruction allows precise identification of the narrowest opening of the MV. Images courtesy of Gila Perk, MD, Mount Sinai Medical Center.

Ne pas utiliser la planimétrie dans le MAC

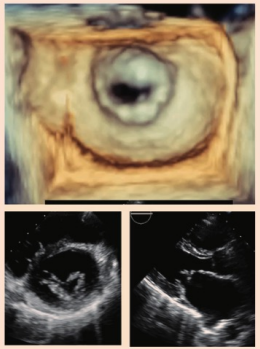
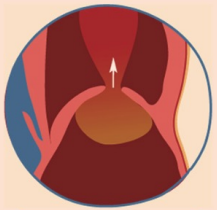
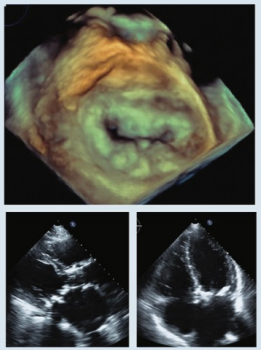






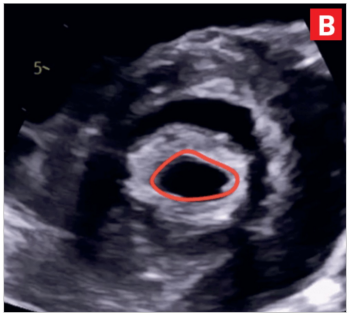


Entonnoir vs tube

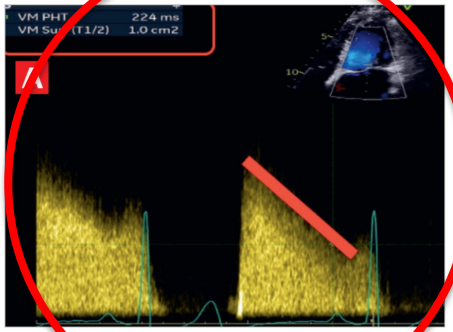
Rheumatic Mitral Valve Disease		MAC-Related Mitral Valve Dysfunction
  Funnel-shaped geometry	Anatomy	 Tubular orifice geometry 
Commissural fusion Funnel-shaped geometry	Anatomy	Commissures spared Tubular orifice geometry
Younger population	Epidemiology	Elderly, comorbid population
MVA quantification validated	Assessment	MVA quantification challenging
Percutaneous balloon mitral valvuloplasty	Treatment	Poor valvuloplasty candidates; medical therapy vs valve repair or replacement

Comment évaluer la sévérité du RM?

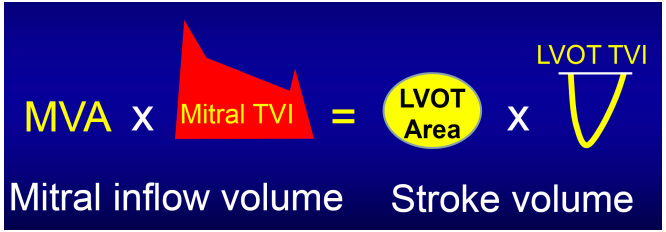
Surface



planimétrie

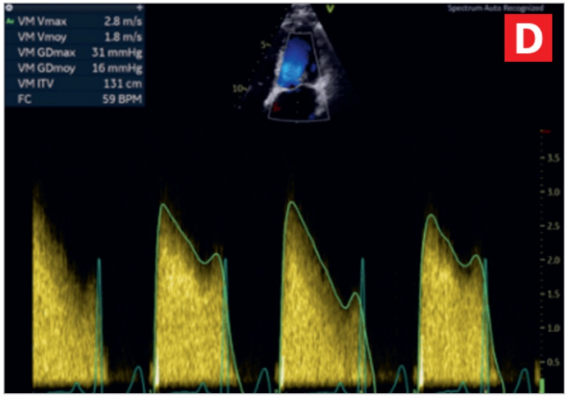


PHT



Equation de continuité/ IP

Gradient moyen



ESC European Society of Cardiology
European Heart Journal - Cardiovascular Imaging (2023) **24**, 1425–1429
https://doi.org/10.1093/ehjci/jead206

OBITUARY

In memoriam: Liv Hatle 1936–2023, pioneering echocardiologist

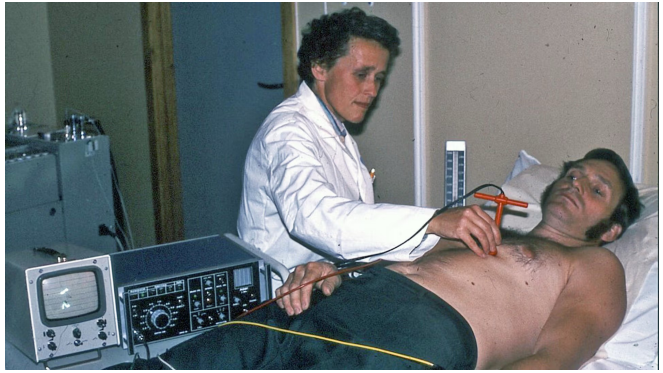


Figure 1 Professor Liv Hatle.

Table 1 Key clinical investigations and haemodynamic insights

Year	Topic	Main findings
1978	Mitral stenosis[7]	Simultaneous ultrasonic measurements and pressure recordings during heart catheterization in 10 patients; relation between the velocity and pressure drop given accurately by a modification of the Bernoulli equation.
1979	Atrioventricular pressure half-time[8]	Prolonged pressure half-time in mitral stenosis, relatively independent of cardiac output. Correlation 0.82 with mitral valve area calculated from cardiac catheterization data. Stenosis best assessed by combining velocity and pressure half-time.
1980	Aortic stenosis[9]	Peak pressure drop can be calculated from the maximal velocity, but may be underestimated when it is difficult to record a clear signal. A late peak of the maximal velocity indicates more severe stenosis.
1981	Ventricular septal defect[10]	High velocities of interventricular flow recorded. PA systolic pressure estimated from the time interval between pulmonary valve closure and tricuspid valve opening. The RV pre-ejection period indicated if diastolic pressure was normal or raised.
1981	Pulmonary artery pressure[11]	Delayed opening of the tricuspid valve was a reliable marker of pulmonary arterial hypertension. No false positives or negatives.
1981	LV outflow tract obstruction[12]	Pulsed Doppler discriminates between subvalvar and valvar obstruction. Velocity profiles optimized using audio signals.
1985	Aortic valve area[13]	Valve area calculated from Doppler signals and LVOT dimension using the continuity equation, correlated well (0.89) with valve area estimated from invasive data using the Gorlin formula, in 30 patients with aortic stenosis or combined AS and AR, so the technique is relatively independent of stroke volume.
1985	Tricuspid regurgitation[14]	Systolic retrograde flow in the inferior caval vein was more sensitive that contrast echocardiography in detecting and quantifying tricuspid regurgitation.
1986	RV systolic pressure[15]	Excellent correlations (>0.95) between RV peak pressures estimated from tricuspid regurgitation and directly measured pressures, whether regurgitation was mild or severe. Studied using IREX machine with 2D imaging and incorporating PEDOF.
1988	Cardiac tamponade[16]	Increased respiratory variation in transvalvar flows, with inspiratory increases in LV ejection and isovolumic relaxation times, and reduced augmentation of SVC flow, that disappeared after pericardiocentesis. Recorded with nasal thermistor for respiration, and simultaneous phonocardiogram.
1988	Restrictive ventricular physiology[17]	Characterized by short IVRT, abrupt premature cessation of early diastolic LV and RV inflow, a reduced integral of atrial filling, increased inspiratory reversal of central venous flow during atrial contraction, and mid-diastolic mitral and/or tricuspid regurgitation.
1988	LV diastolic function[18]	Mitral flow velocity profiles compared with haemodynamic measurements demonstrated a range of abnormal patterns including impaired early filling, normalization of the profile when left atrial pressure is elevated, and an abnormal pattern related to reduced LV compliance.
1989	Pericardial constriction[19]	Only patients with constrictive pericarditis showed marked changes in LV IVRT and early mitral and tricuspid flow velocities at the onset of inspiration and expiration. Only patients with restrictive cardiomyopathy showed a further shortening of their already short tricuspid deceleration time with inspiration.
1989	Aortic regurgitation[20,21]	In severe AR, there was increased mitral E velocity, shortened mitral deceleration time, and diastolic mitral regurgitation.[20]

Norvégienne
Pionnière du doppler
Contribution exceptionnelle au développement de l'écho

A.C.C.A.

Noninvasive Assessment of Atrioventricular Pressure Half-time by Doppler Ultrasound

LIV HATLE, M.D., BJØRN ANGELSEN, DR. TECHN., AND ARVE TROMSDAL, M.D.

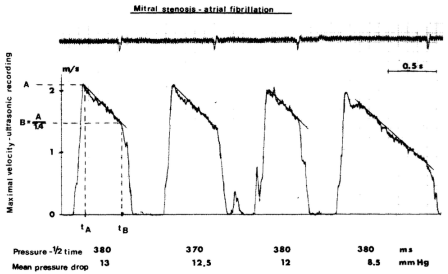


FIGURE 3. *Ultrasonic recording of mitral flow in mitral stenosis. Maximal velocity with measured pressure half-time and calculated pressure drop for each beat.*

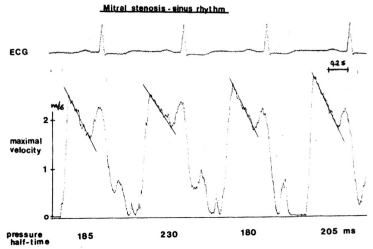


FIGURE 4. *Ultrasonic recording of mitral flow with maximal velocity in mitral stenosis and sinus rhythm. Pressure half-time 180/230 msec; calculated mean pressure drop 23 mm Hg.*

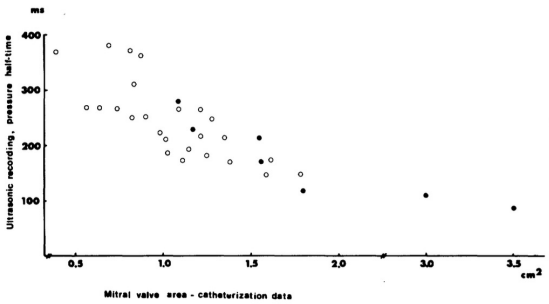


FIGURE 7. *Pressure half-time obtained from ultrasonic recording of maximal velocity in mitral flow related to mitral valve area calculated from catheterization data; r = − 0.74. ○ = mitral stenosis; ● = mitral stenosis and regurgitation.*

R=0.74

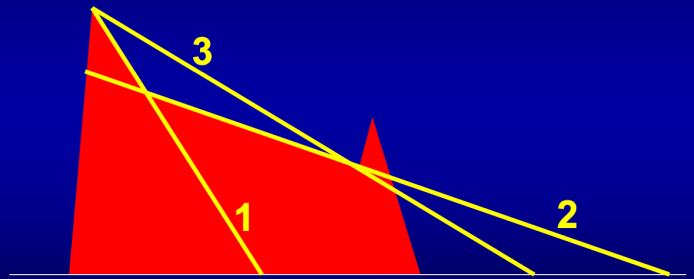
Circulation. 1979 Nov;60(5):1096-104

Formule de Hatle

Surface mitrale = 220/PHT

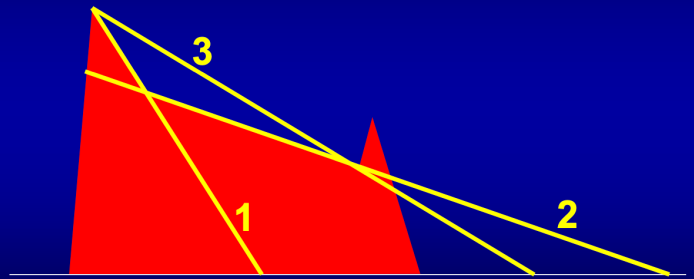
PHT à 220ms correspond à une surface à 1cm2

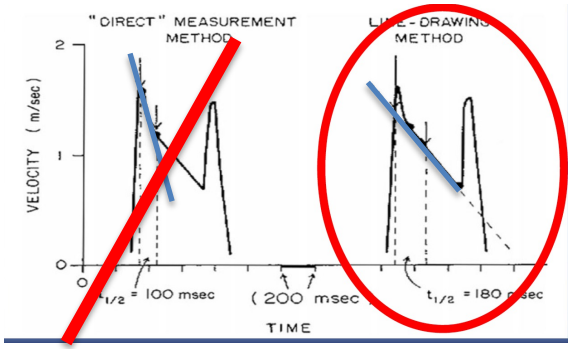
Which PHT is correct?



MAYO CLINIC

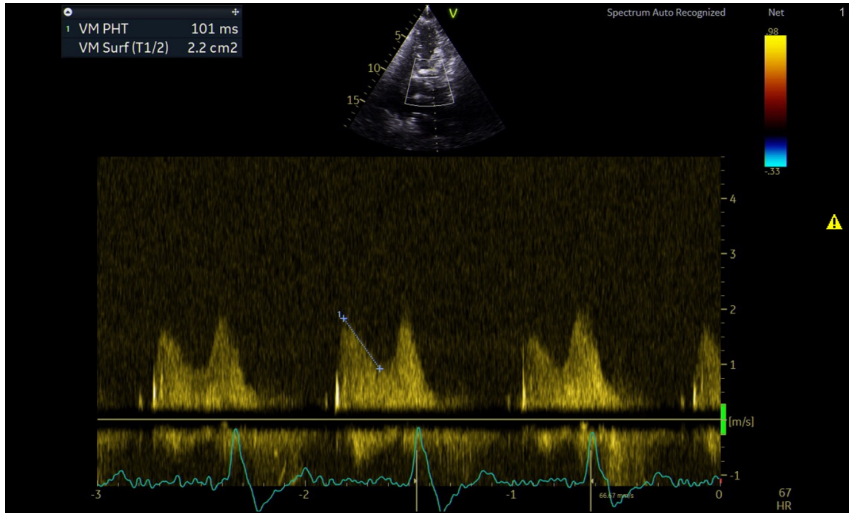
Which PHT is correct?





Ne pas utiliser le PHT dans le MAC

- reduced LV compliance, common among older individuals, may decrease mitral valve pressure half-time (P½t), resulting in overestimation of mitral valve area (MVA) when the Hatle formula (MVA = 220/P½t) is used



Brief report

Inaccuracy of Pressure Half-Time Method for Valve Area in Mitral Stenosis Related to Annular Calcification

William R. Miranda, MD[a,*], Abdallah El Sabbagh, MD[b], C. Charles Jain, MD[a], Patricia A. Pellikka, MD[a], Jae K. Oh, MD[a], and Rick A. Nishimura, MD[a]

22 Patients
Mayo clinic
Entre 2011 et 2021
Kt et echo

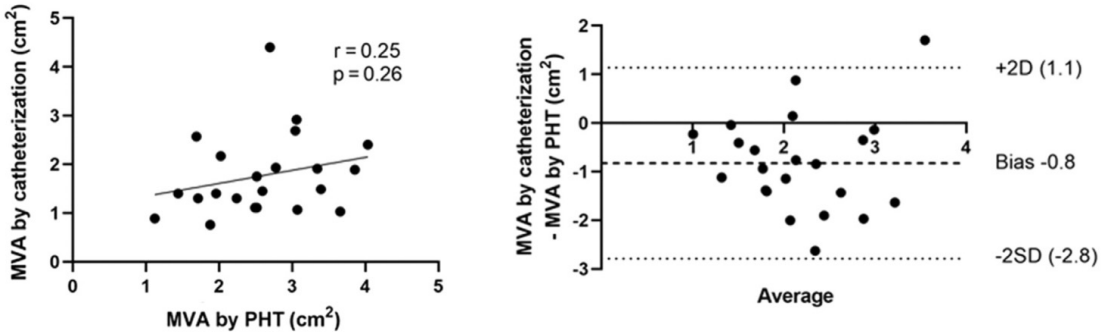


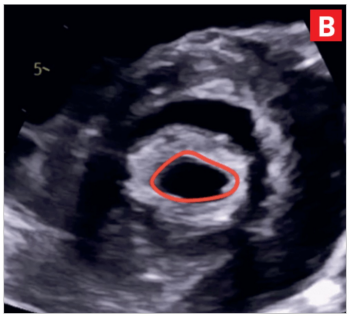
Figure 1. Correlation between Doppler-derived and measured MVA.

In our cohort, the MVA by PHT was significantly overestimated compared with the conventional Gorlin equation.

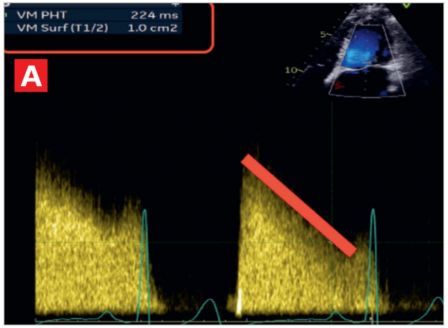
Am J Cardiol . 2024 Nov 1:230:1-2

Comment évaluer la sévérité du RM?

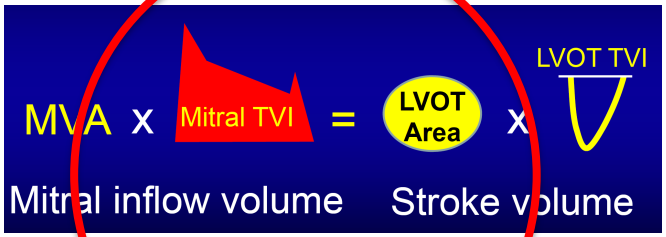
Surface



planimétrie

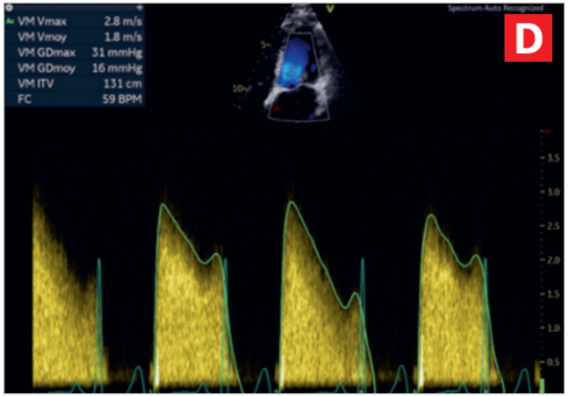


PHT

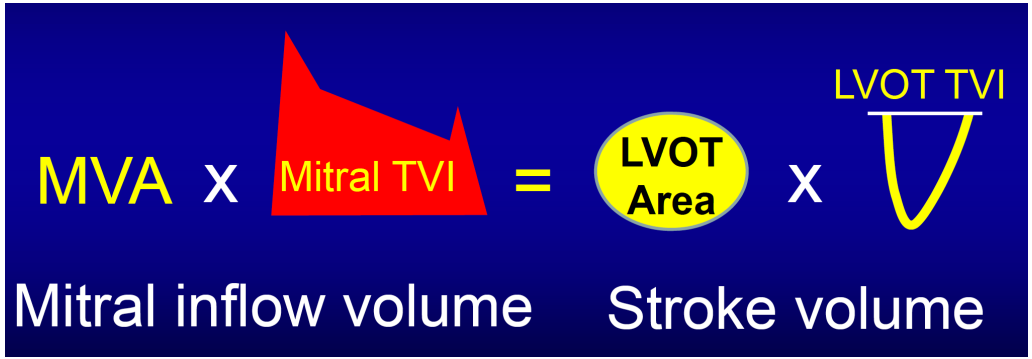


Equation de continuité/ IP

Gradient moyen



Equation de continuité



pas fiable si FA, IM ou IAo

Evaluation de la sévérité du MAC

Equation de continuité

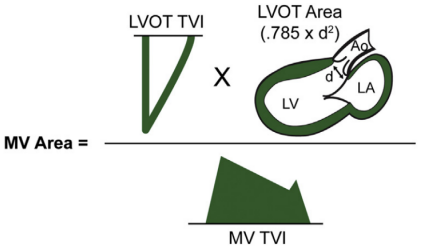


Figure 3 Continuity equation for calculating MVA. If both sides of the equation are multiplied by the transmitral time-velocity integral (TVI), it becomes apparent that flow through the mitral and aortic valves is equal. *Ao*, Aorta; *LA*, left atrium; *LV*, left ventricle; *MV*, mitral valve.

Indice de perméabilité

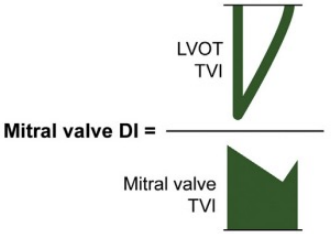


Figure 4 The mitral valve dimensionless index (DI) is calculated by dividing the time-velocity integral (TVI), obtained on pulsed-wave Doppler at the LVOT, by the TVI across the mitral valve obtained using continuous-wave Doppler.

a DI of 0.35 to 0.50 is consistent with severe calcific MS (MVA # 1.5 cm2)

a DI < 0.35 suggests very severe calcific MS (MVA # 1.0 cm2)

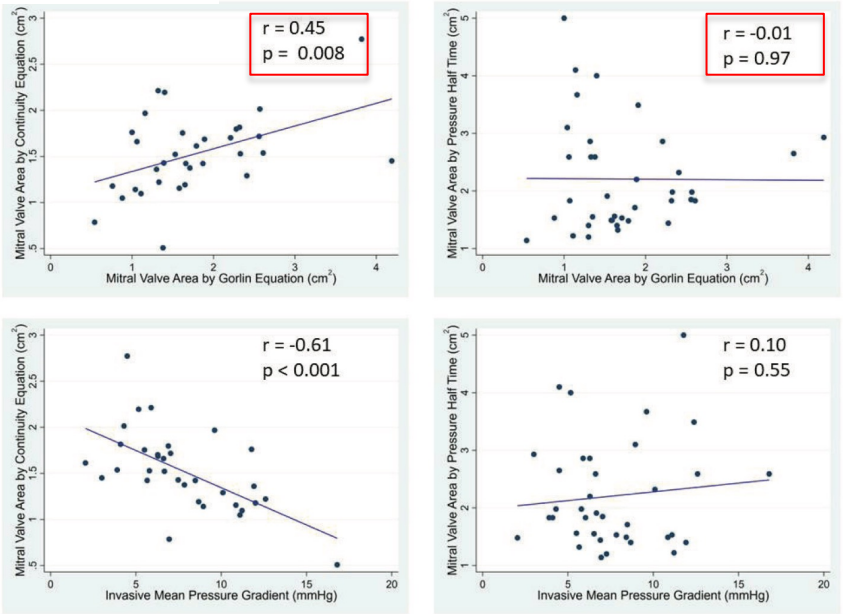
A.C.C.A.

The continuity equation is superior to the pressure half-time method in calcific mitral stenosis: a comparison with cardiac catheterization

Get access

Jean Michel Saad, Sina O'Sullivan, Abdallah El Sabbagh, William A Zoghbi

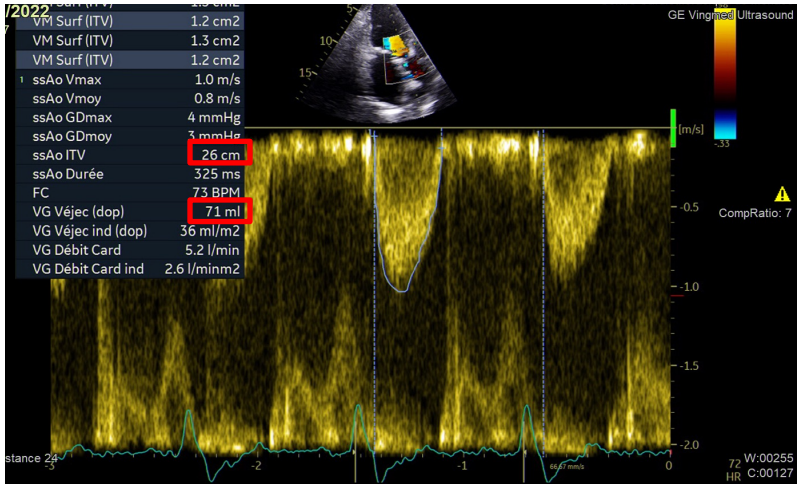
European Heart Journal - Cardiovascular Imaging, Volume 26, Issue 2, February 2025, Pages 313–315, https://doi.org/10.1093/ehjci/jeae253

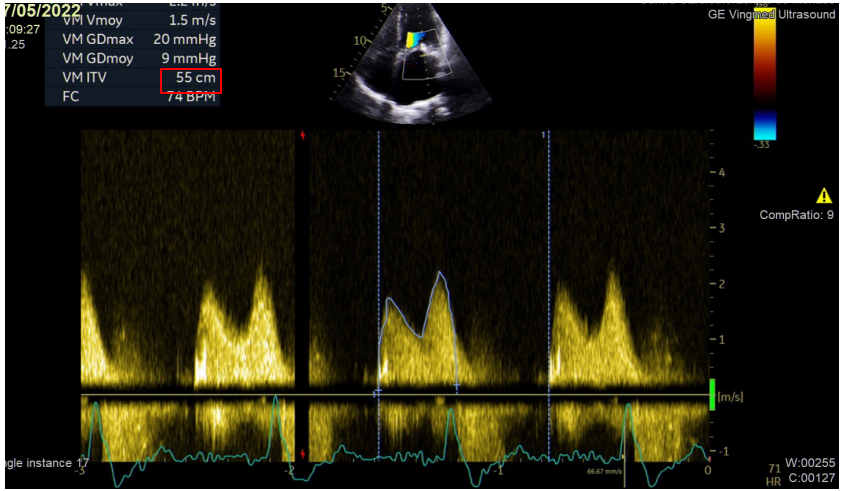


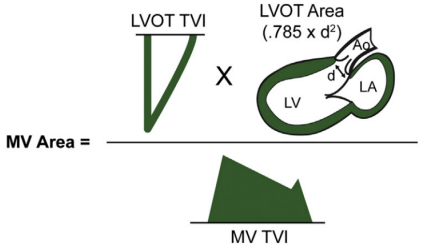
40 patients avec RM sur MAC
Bonne corrélation entre
surface mitrale par Eq de continuité et Gorlin (r=0.45)
Mais pas par le PHT (r=-0.01)

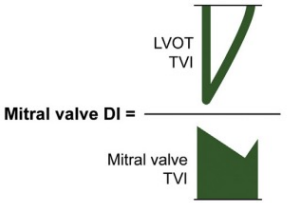
Bonne corrélation entre SMeq et gdt moyen kt

Notre patiente







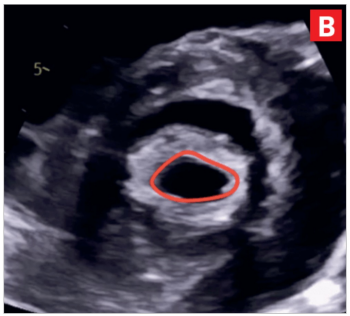


SM eq de continuité = 71/55= 1,3cm²

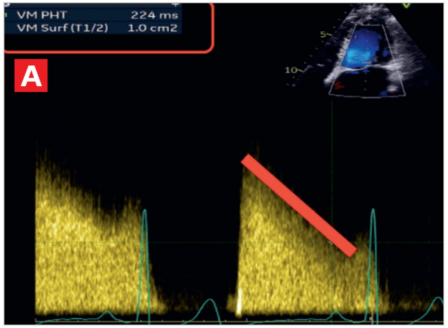
DI 26/55 = 0,47

Comment évaluer la sévérité du RM?

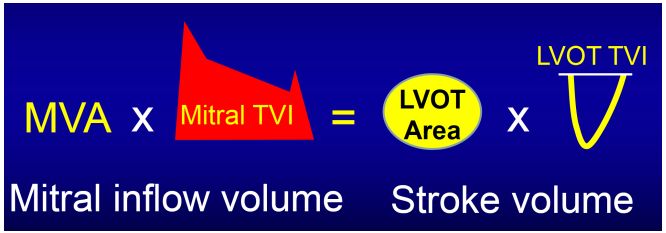
Surface



planimétrie

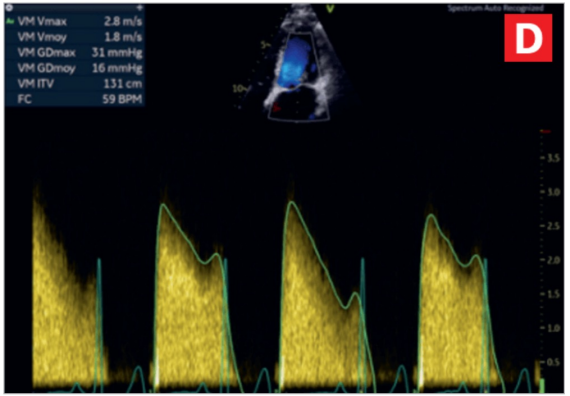


PHT



Equation de continuité/ IP

Gradient moyen



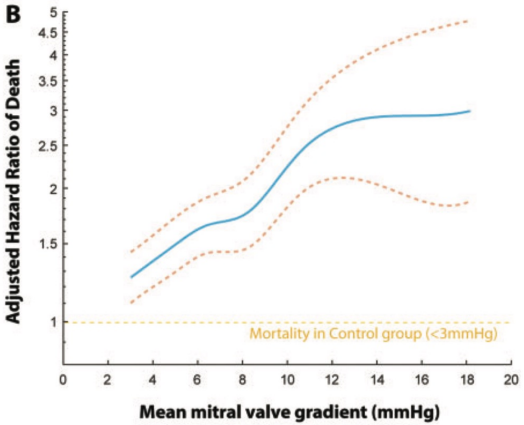
Pronostic des Mac selon le gradient moyen

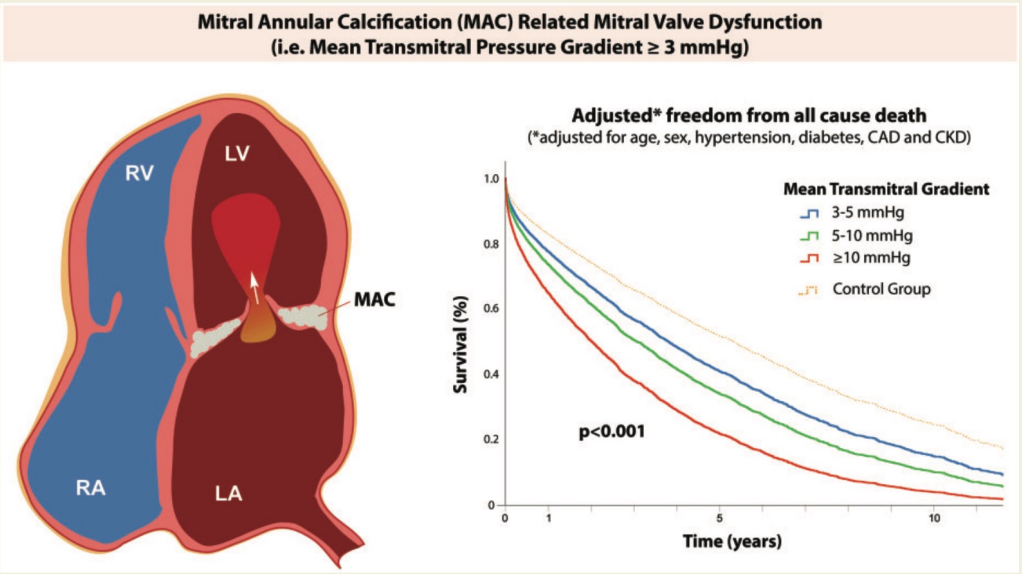
ESC European Society of Cardiology
European Heart Journal (2020) **41**, 4321–4328
doi:10.1093/eurheartj/ehaa819

CLINICAL RESEARCH
Valvular heart disease

Prognostic importance of the transmitral pressure gradient in mitral annular calcification with associated mitral valve dysfunction

Philippe B. Bertrand †, Timothy W. Churchill †, Evin Yucel, Mayooran Namasivayam, Samuel Bernard, Yasufumi Nagata, Wei He, Carl T. Andrews, Michael H. Picard, Arthur E. Weyman, Robert A. Levin





European Heart Journal (2020) 41, 4321–4328

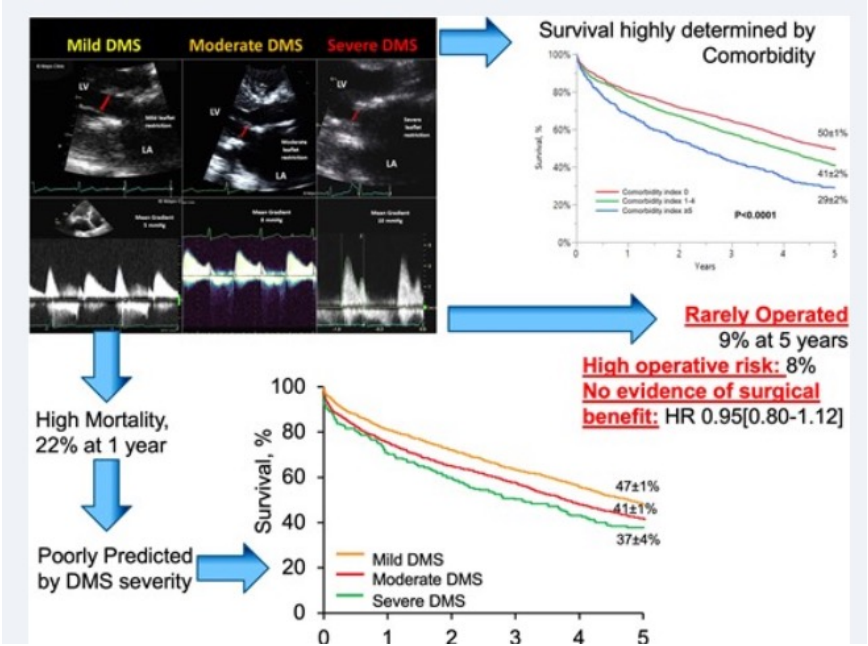
A.C.C.A.

Degenerative mitral stenosis by echocardiography: presentation and outcome

Get access >

Roberta Batista, Giovanni Benfari, Benjamin Essayagh, Joseph Maalouf, Prabin Thapa, Patricia A Pellikka, Hector I Michelena, Maurice Enriquez-Sarano ✉

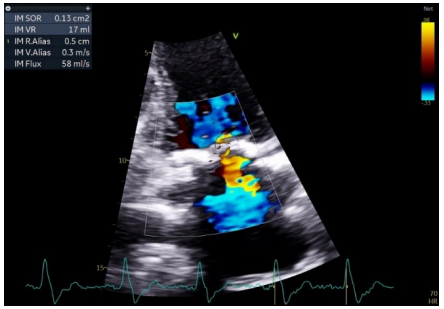
European Heart Journal - Cardiovascular Imaging, Volume 26, Issue 1, January 2025, Pages 118–125, https://doi.org/10.1093/ehjci/jeae246

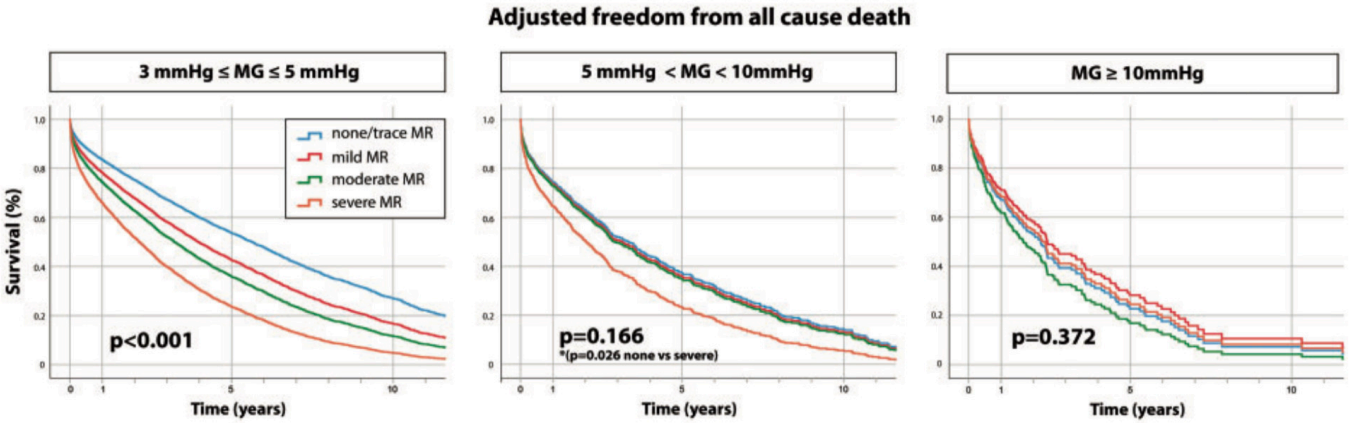


Impact pronostic de l'IM associée au MAC

L'IM associée a un rôle pronostique quand le gradient moyen est < 5mmhg

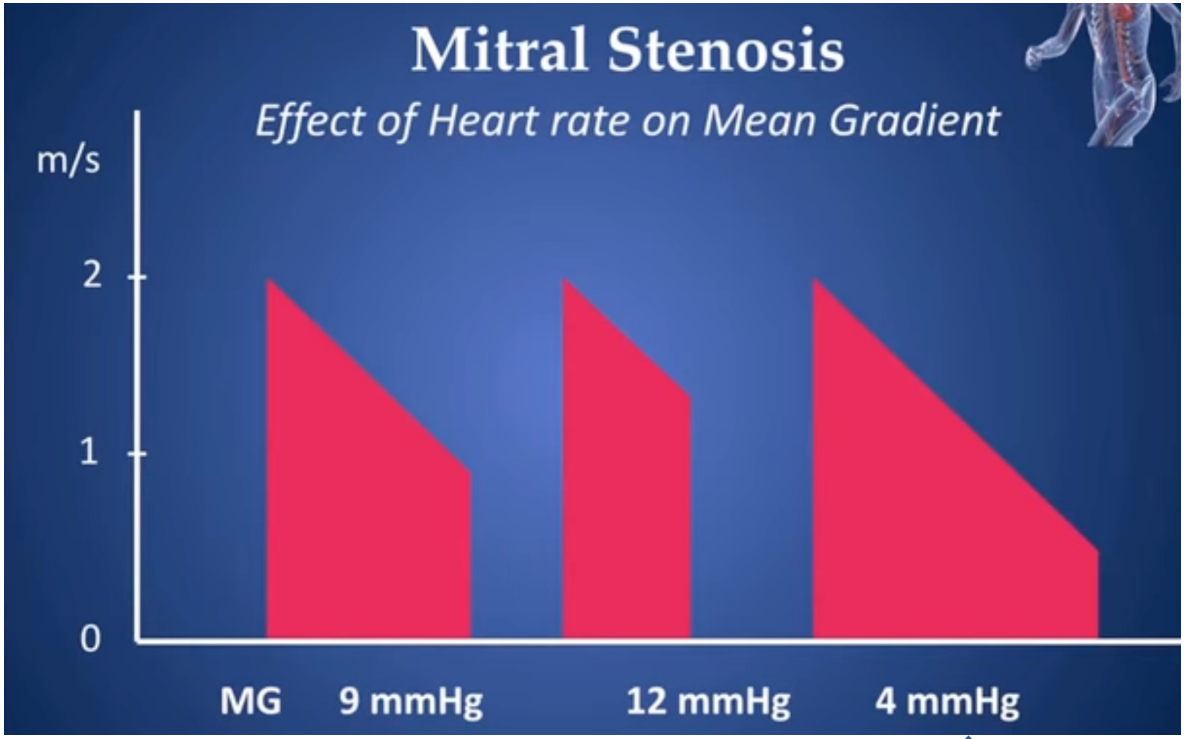
puis son role diminue quand le gradient est plus élevé





European Heart Journal (2020) 41, 4321–4328

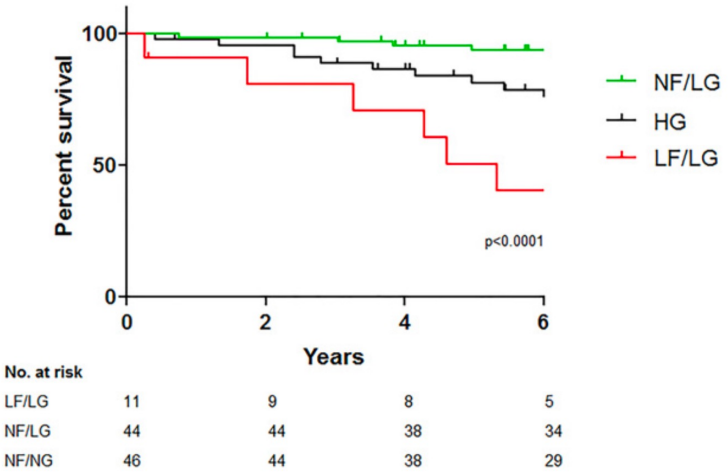
influence de la fréquence cardiaque



Low flow low gradient rhumatismal MS

LF LG MS : Gdt moyen < 10mmhg et Svi <35ml/m² sc

Souvent en FA



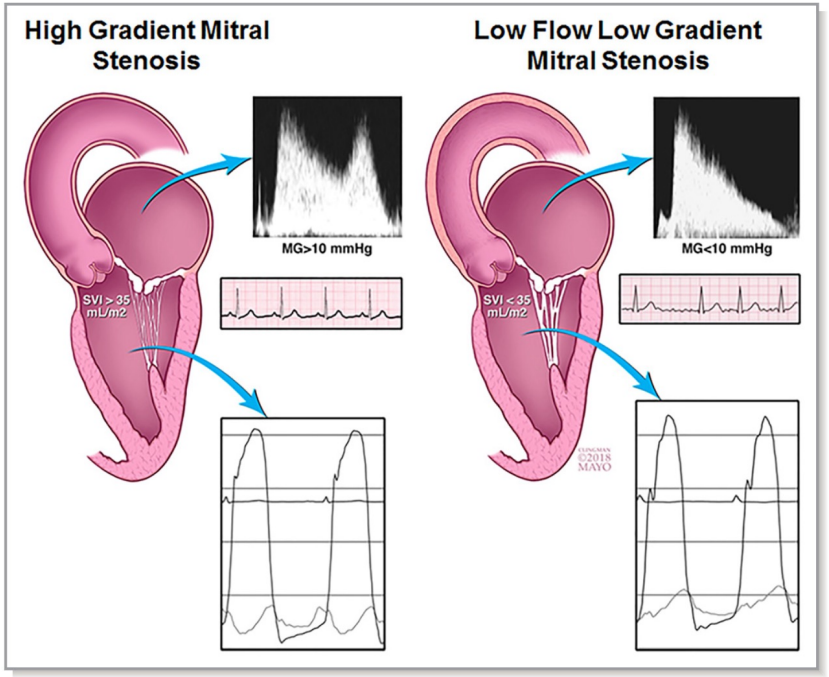
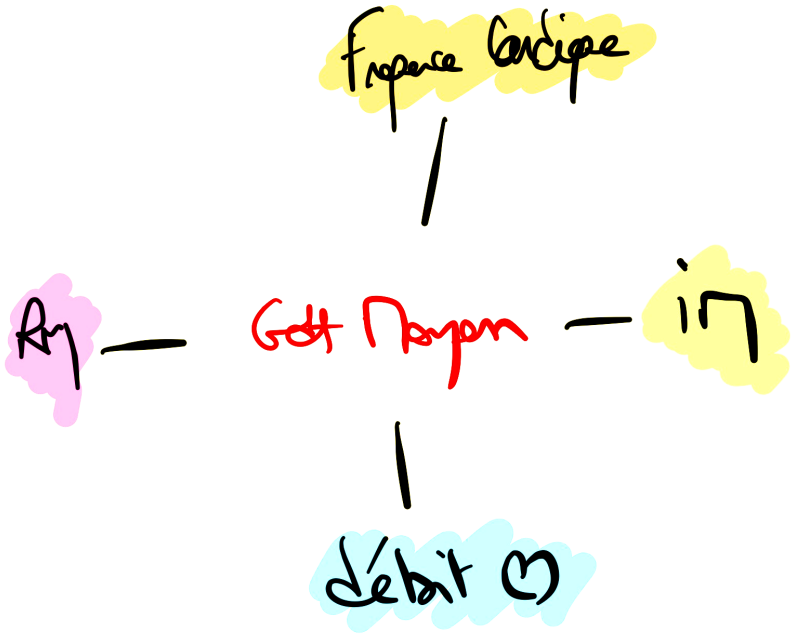


Figure 6. Stroke volume determinants in patients with low-flow (LF), low-gradient (LG) (right) vs high-gradient mitral stenosis (MS) (left). Patients with LF/LG MS have prevalent atrial fibrillation, subvalvular thickening, and higher afterload caused by increased arterial elastance and decreased ventricular compliance. MG indicates mean gradient; SVI, stroke volume index.

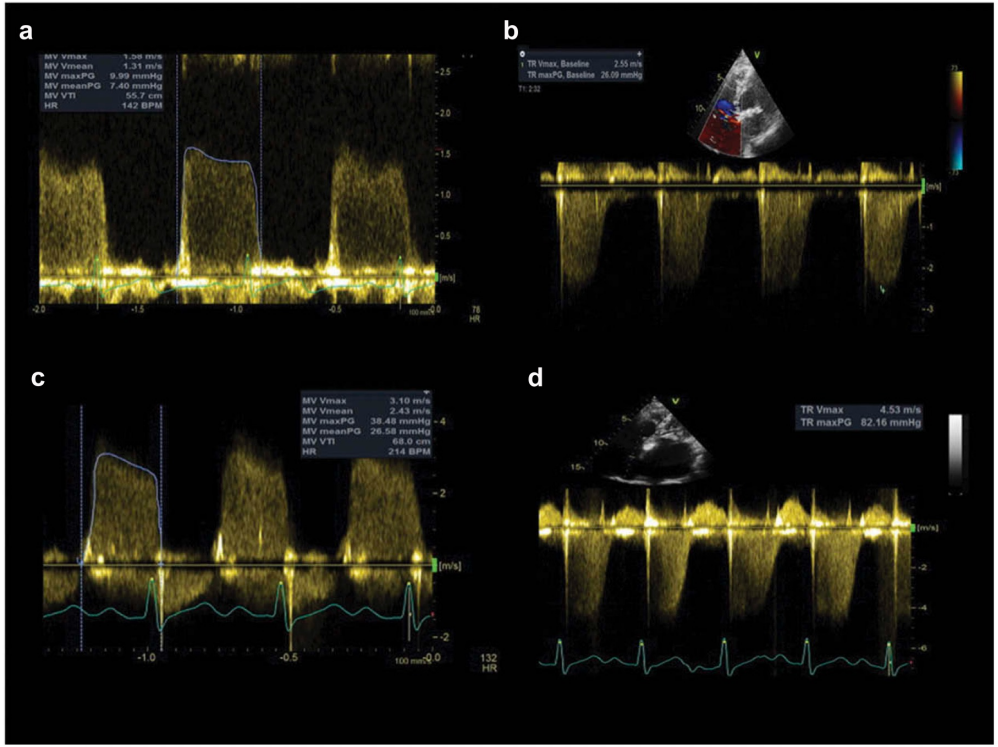
J Am Heart Assoc. 2019;8: e010736.

Facteurs influençant le gradient moyen



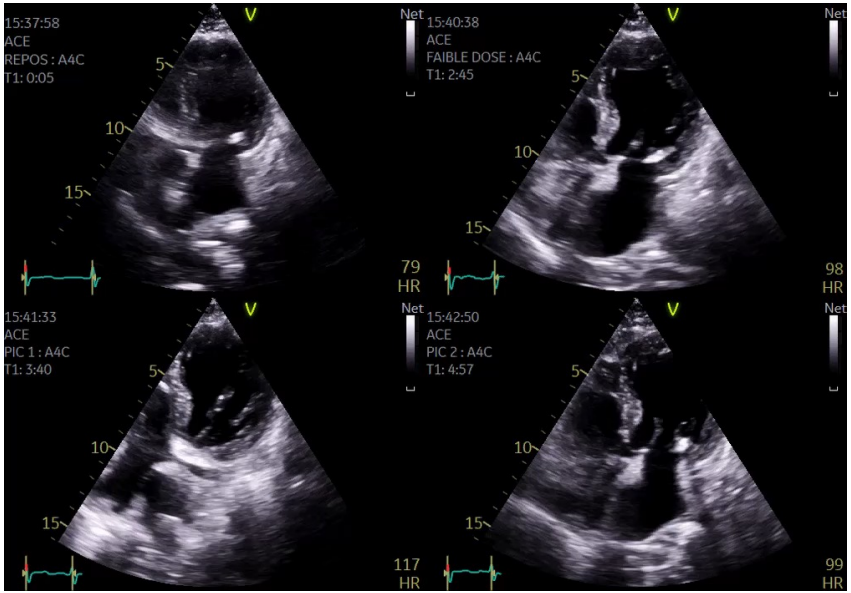
A.C.C.A.

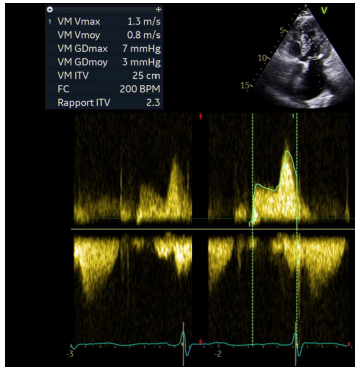
Echo d'effort

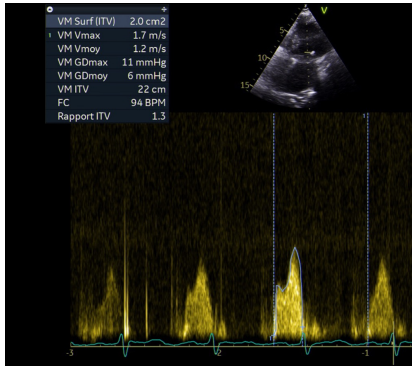


Review of Cardiovascular Therapy, 17:7, 473-477

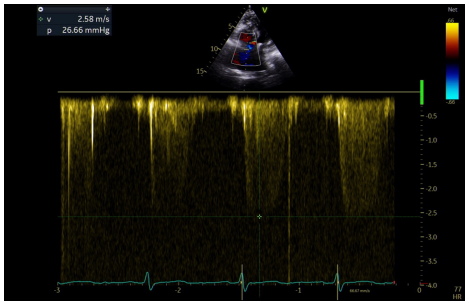
Exemple : Sténose mitrale lâche à l'effort

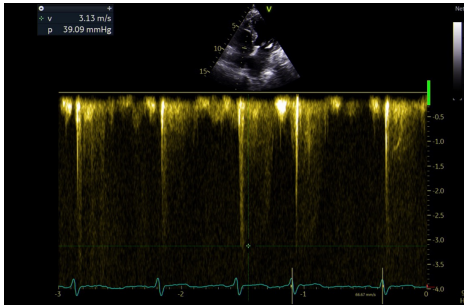






3mmhg → 6mmhg

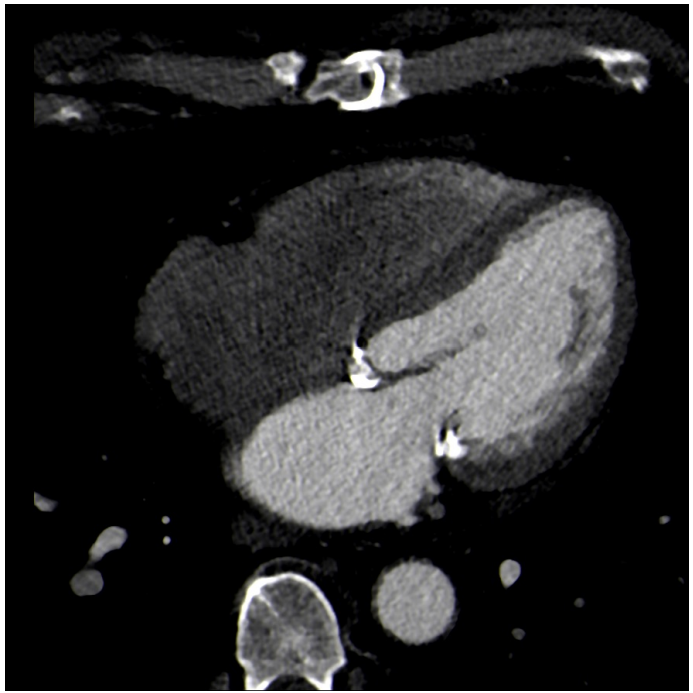


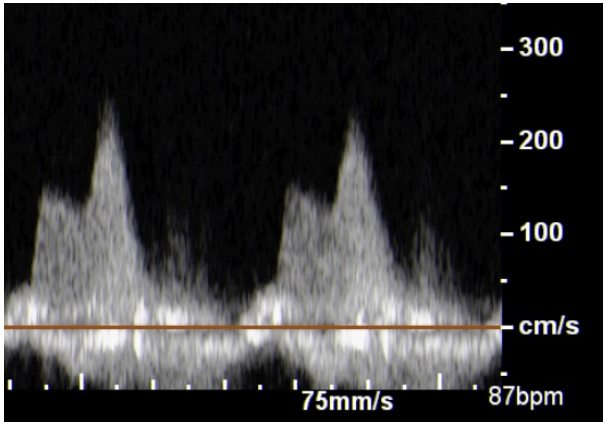


26+5mmhg → 39+5mmhg

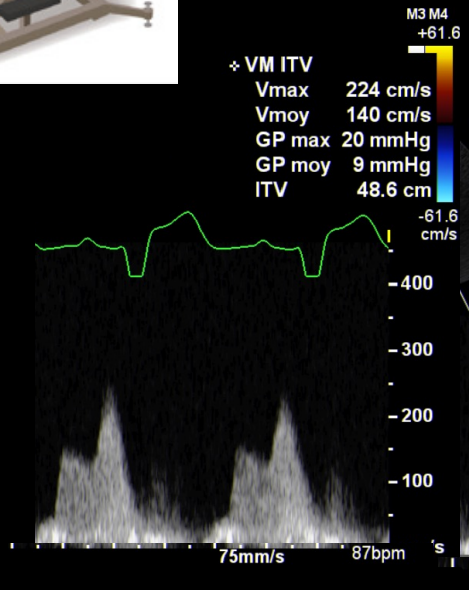
Exemple: Sténose mitrale serrée à l'effort

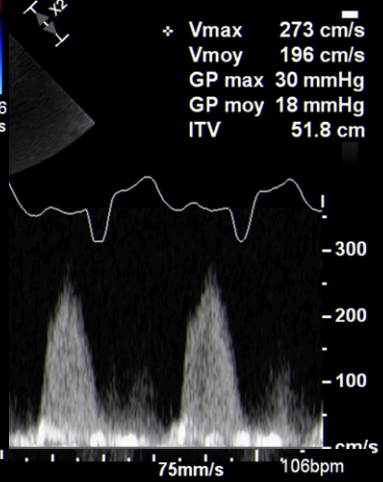
RM calcifié semblant serré

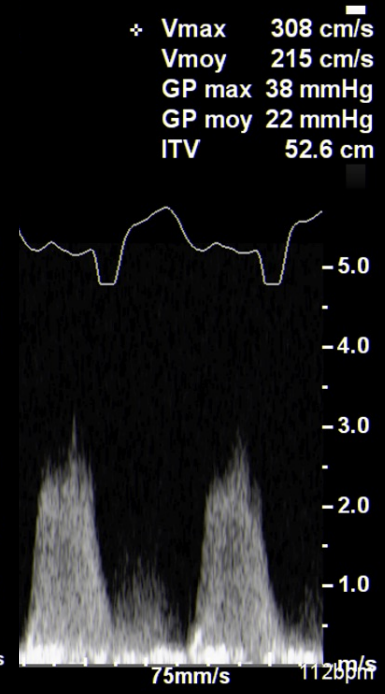


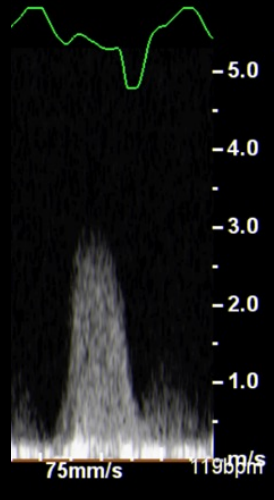


Gdt moyen 9mmhg









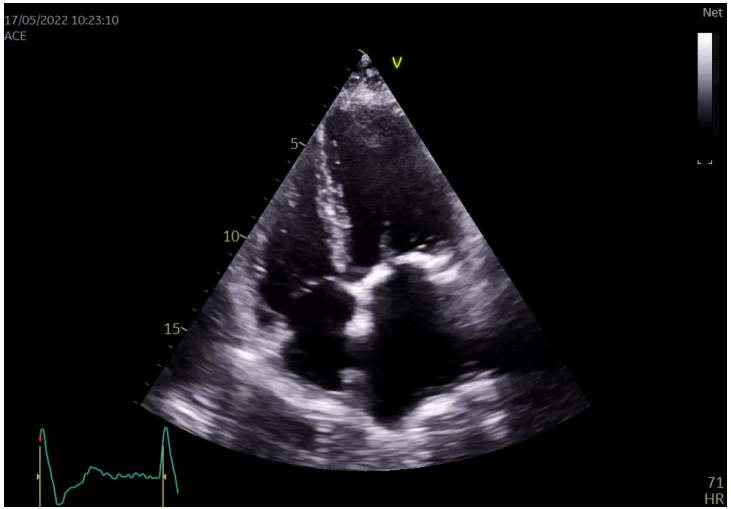
Gdt moyen 9mmhg

Gdt moyen 18mmhg

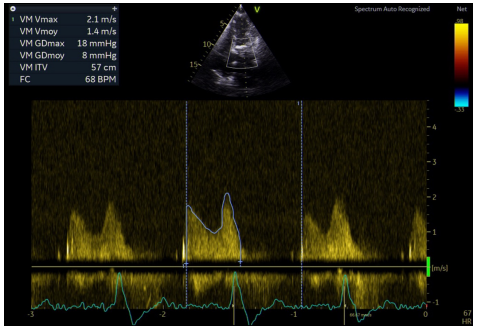
Gdt moyen 22mmhg

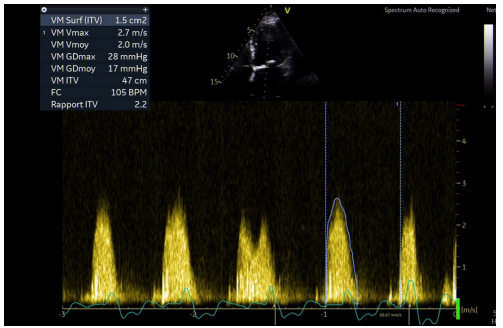
Gdt moyen 26mmhg

Notre patiente

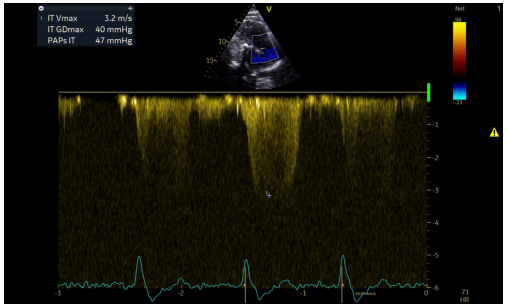


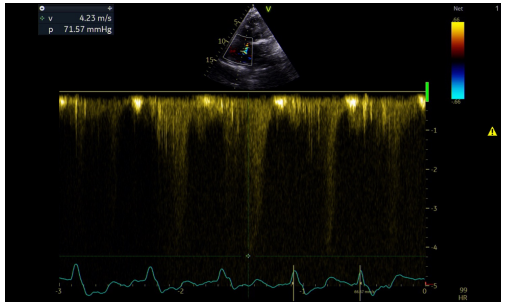
50W



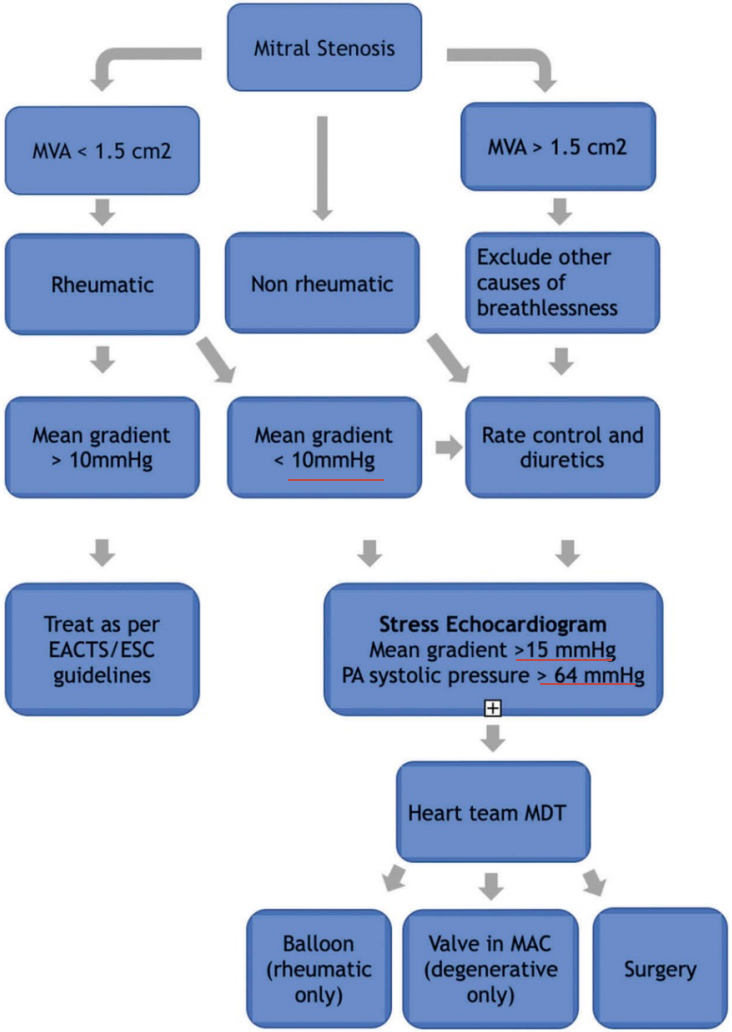


8mmhg → 17mmhg





42+5mmhg → 71+5mmhg

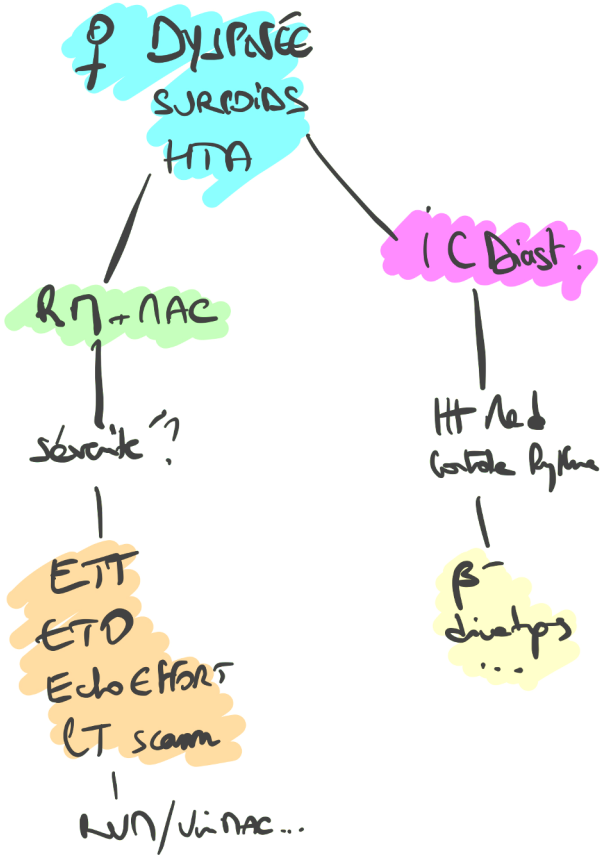


A l'effort
gdt moyen > 15mmhg
paps > 64mmhg

Review of Cardiovascular Therapy, 17:7, 473-477

A.C.C.A.

Prise en charge du RM dégénératif sur MAC



Quel traitement?

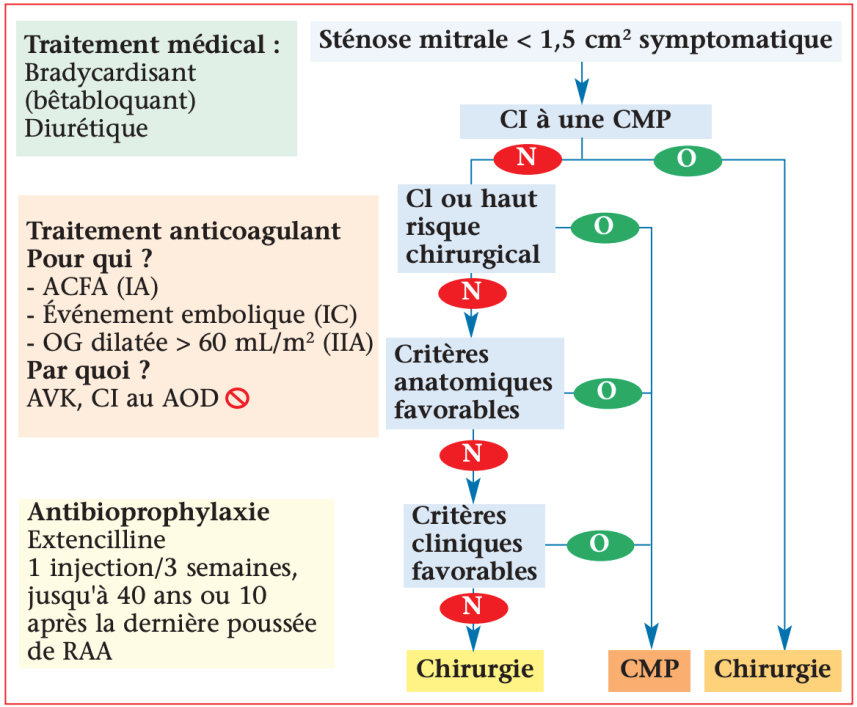
Quel traitement?

Traitement médical :
Bradycardisant
(bêtabloquant)
Diurétique

Traitement anticoagulant
Pour qui ?
- ACFA (IA)
- Événement embolique (IC)
- OG dilatée > 60 mL/m² (IIA)

Par quoi ?
AVK, CI au AOD ⊘

Antibioprophylaxie
Extencilline
1 injection/3 semaines, jusqu'à 40 ans ou 10 après la dernière poussée de RAA



Cardiologie pratique fev 2025

ESC Guidelines VHD: new 2025 guidelines are on the way….

ESC European Society of Cardiology
European Heart Journal (2022) 43, 561–632
https://doi.org/10.1093/eurheartj/ehab395

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

Recommendations on indications for percutaneous mitral commissurotomy and mitral valve surgery in clinically significant (moderate or severe) mitral stenosis (valve area ≤1.5 cm^2)

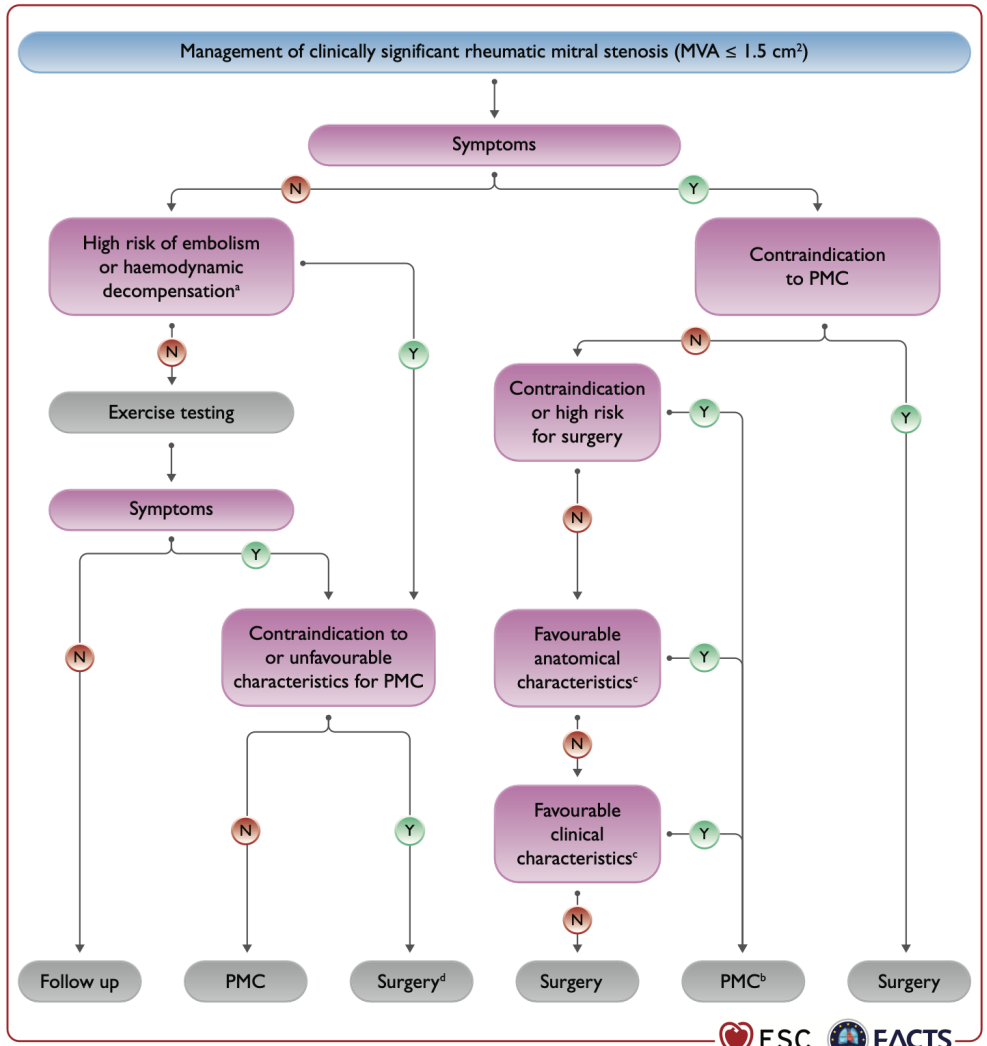
Recommendations	Class[a]	Level[b]
PMC is recommended in symptomatic patients without unfavourable characteristics[c] for PMC.[360,363–365,367]	I	B
PMC is recommended in any symptomatic patients with a contraindication or a high risk for surgery.	I	C
Mitral valve surgery is recommended in symptomatic patients who are not suitable for PMC in the absence of futility.	I	C
PMC should be considered as initial treatment in symptomatic patients with suboptimal anatomy but no unfavourable clinical characteristics for PMC.[c]	IIa	C
PMC should be considered in asymptomatic patients without unfavourable clinical and anatomical characteristics[c] for PMC and: • High thromboembolic risk (history of systemic embolism, dense spontaneous contrast in the LA, new-onset or paroxysmal AF), and/or • High risk of haemodynamic decompensation (systolic pulmonary pressure >50 mmHg at rest, need for major NCS, desire for pregnancy).	IIa	C

Table 8 Contraindications for percutaneous mitral commissurotomy in rheumatic mitral stenosis[a]

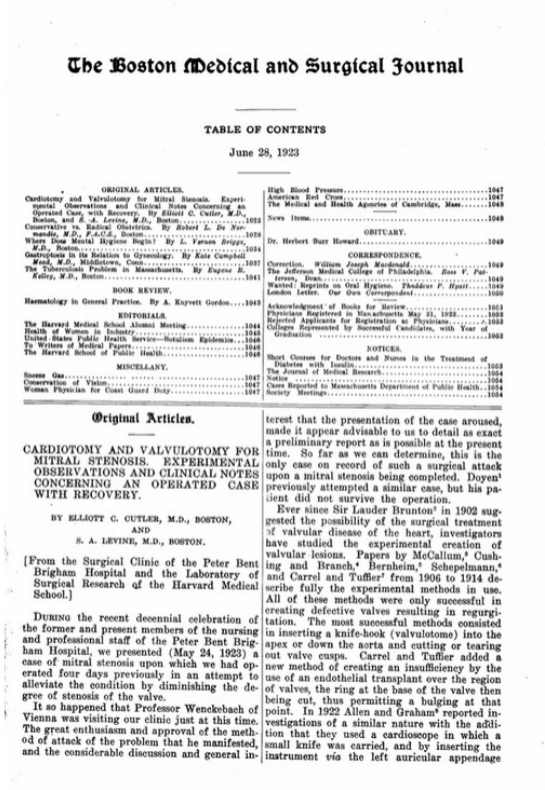
Contraindications
MVA >1.5 cm^2[a]
LA thrombus
More than mild mitral regurgitation
Severe or bi-commissural calcification
Absence of commissural fusion
Severe concomitant aortic valve disease, or severe combined tricuspid stenosis and regurgitation requiring surgery
Concomitant CAD requiring bypass surgery

ESC European Society of Cardiology
European Heart Journal (2022) 43, 561–632
https://doi.org/10.1093/eurheartj/ehab395

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



1923 : Elliott Cutler: the first closed-chest mitral valvotomy



The Boston Medical and Surgical Journal

TABLE OF CONTENTS

June 28, 1923

Original Articles.

CARDIOTOMY AND VALVULOTOMY FOR MITRAL STENOSIS. EXPERIMENTAL OBSERVATIONS AND CLINICAL NOTES CONCERNING AN OPERATED CASE WITH RECOVERY.

BY ELLIOTT C. CUTLER, M.D., BOSTON,
AND
S. A. LEVINE, M.D., BOSTON.

[From the Surgical Clinic of the Peter Bent Brigham Hospital and the Laboratory of Surgical Research of the Harvard Medical School.]

DURING the recent decennial celebration of the former and present members of the nursing and professional staff of the Peter Bent Brigham Hospital, we presented (May 24, 1923) a case of mitral stenosis upon which we had operated four days previously in an attempt to alleviate the condition by diminishing the degree of stenosis of the valve.

It so happened that Professor Wenckebach of Vienna was visiting our clinic just at this time. The great enthusiasm and approval of the method of attack of the problem that he manifested, and the considerable discussion and general interest that the presentation of the case aroused, made it appear advisable to us to detail as exact a preliminary report as is possible at the present time. So far as we can determine, this is the only case on record of such a surgical attack upon a mitral stenosis being completed. Doyen[1] previously attempted a similar case, but his patient did not survive the operation.

Ever since Sir Lauder Brunton[2] in 1902 suggested the possibility of the surgical treatment of valvular disease of the heart, investigators have studied the experimental creation of valvular lesions. Papers by McCallum,[3] Cushing and Branch,[4] Bernheim,[5] Schepelmann,[6] and Carrel and Tuffier[7] from 1906 to 1914 describe fully the experimental methods in use. All of these methods were only successful in creating defective valves resulting in regurgitation. The most successful methods consisted in inserting a knife-hook (valvulotome) into the apex or down the aorta and cutting or tearing out valve cusps. Carrel and Tuffier added a new method of creating an insufficiency by the use of an endothelial transplant over the region of valves, the ring at the base of the valve then being cut, thus permitting a bulging at that point. In 1922 Allen and Graham[8] reported investigations of a similar nature with the addition that they used a cardioscope in which a small knife was carried, and by inserting the instrument *via* the left auricular appendage

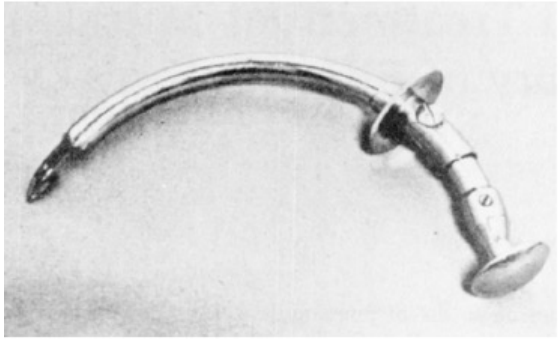


Fig. 1 Image of the valvotome Cutler and Levine used in 1923 for the first closed mitral stenosis procedure. The instrument, similar to a knife, was introduced through the left ventricular apex to blindly cut the valve commissures.

Mais par la suite…90% de mortalité….

1948 Charles Bailey : 1st mitral surgery

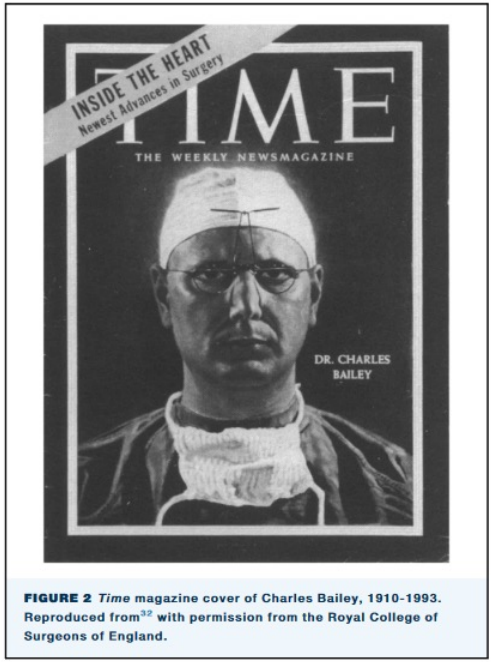


FIGURE 2 *Time* magazine cover of Charles Bailey, 1910-1993. Reproduced from[32] with permission from the Royal College of Surgeons of England.

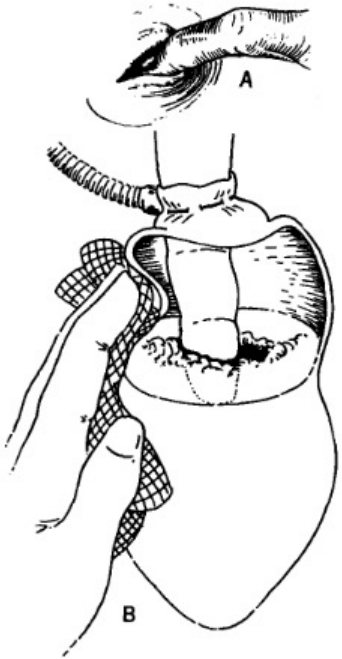


Fig 2. Finger dilation of the mitral valve. (Reprinted with permission from Bailey CP. Surgery of the heart. London: Henry Kimpton, 1955.)

A.C.C.A.

INSTRUMENTAL DILATATION USING THE TRANSATRIAL APPROACH IN THE TREATMENT OF MITRAL STENOSIS

A Survey of 1,000 Cases

Ch. Dubost, M.D., Ph. Blondeau, M.D., and A. Piwnica, M.D., Paris, France*

1961 en France…

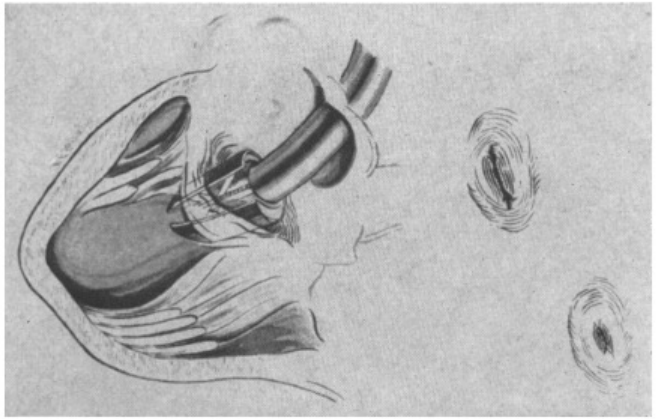


Fig. 1.—Dilator inserted into the mitral ring through the left atrium.

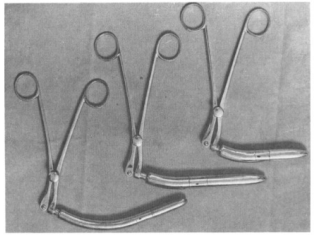


Fig. 2.—The three types of mitral dilator in current use.

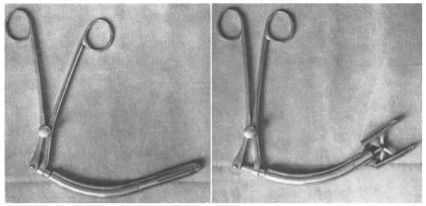


Fig. 3.—Regular mitral dilator closed and fully opened.

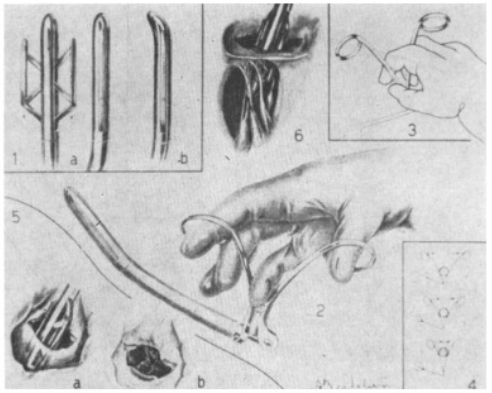


Fig. 4.—The different steps of insertion of the mitral dilator.

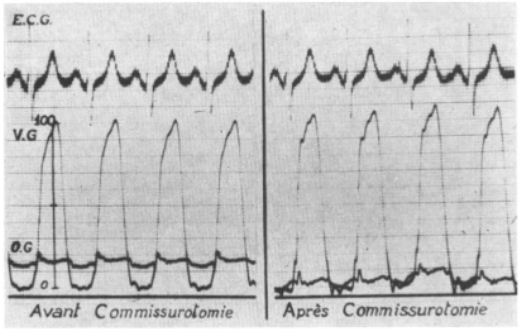
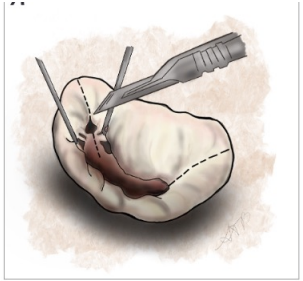


Fig. 5.—Pressure controls before and after commissurotomy.

1960's :Commissurotomie mitrale à cœur ouvert sous CEC



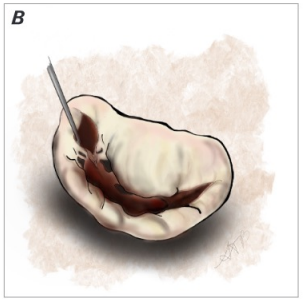


Fig. 4 Drawing showing the basic steps of open mitral commissurotomy. **A)** A No. 11 scalpel blade separates the fused commissures up to 1 to 2 mm from the mitral annulus; the commissures are cut following the dotted line. **B)** When needed, splitting the head of a papillary muscle or the fused chordae can be added.

1ère valvulopathie traitée en percutané !

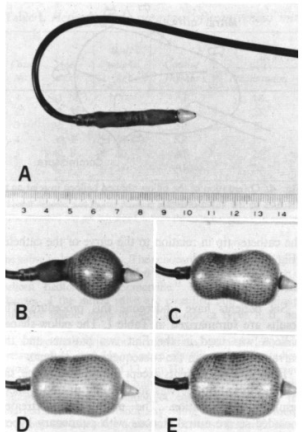
1984

J Thorac Cardiovasc Surg 87:394-402, 1984

Clinical application of transvenous mitral commissurotomy by a new balloon catheter

A new balloon catheter was developed which allows mitral commissurotomy without thoracotomy. The procedure has been successful in five of the six patients with mitral stenosis so treated. In the remaining patient, the procedure could not be performed because of technical difficulties. The balloon is reinforced with a nylon micromesh and its shape changes in three stages, depending on the extent of inflation. It is inserted from the saphenous vein into the mitral orifice transseptally, fixed across the mitral orifice with partial inflation, and finally inflated to full its extent, separating the fused commissures by its expansile force. After the procedure, catheterization revealed a significant reduction in the mean diastolic pressure gradient across the mitral valve without resultant mitral regurgitation in each patient. Two-dimensional echocardiograms showed a marked to moderate degree of dilatation of the mitral orifice in each patient. All five patients are well with remarkable clinical improvements 2 to 16 months after the procedure.

Kanji Inoue, M.D., Takane Owaki, M.D., Takasumi Nakamura, M.D., Fumio Kitamura, M.D., and Nobuaki Miyamoto, M.D., *Kochi, Japan*



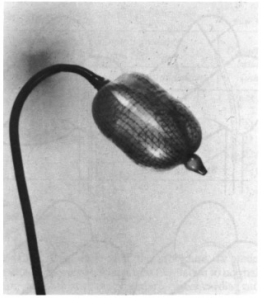
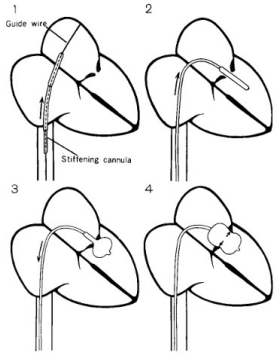
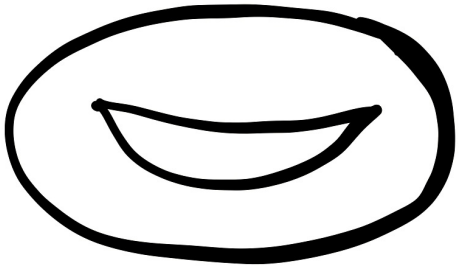
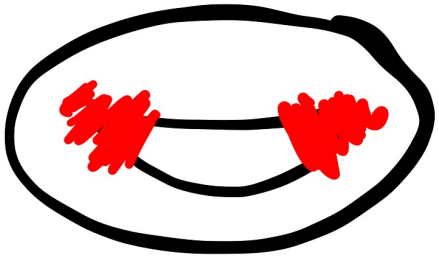


Fig. 2. Orientation of the pillow-shaped balloon on the catheter tip in relation to the curvature of the catheter. The catheter segment inside this balloon is rigid and a thread band is wound around the balloon longitudinally along one axis. Thus, the expansion of the balloon in that axis is more restricted than in the other axis to attain a pillow-like shape.

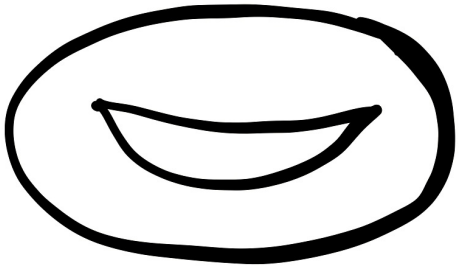


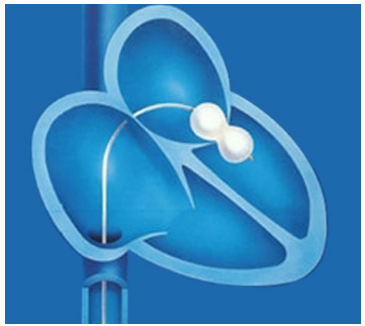
Principe de la valvuloplastie percutanée

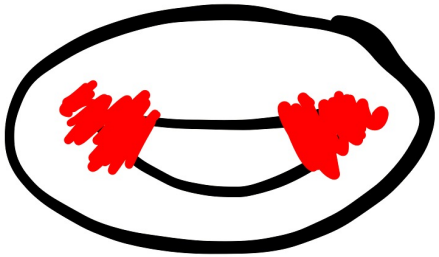


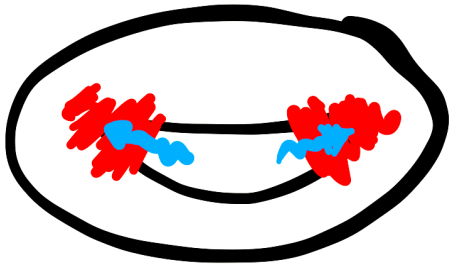


Principe de la valvuloplastie percutanée

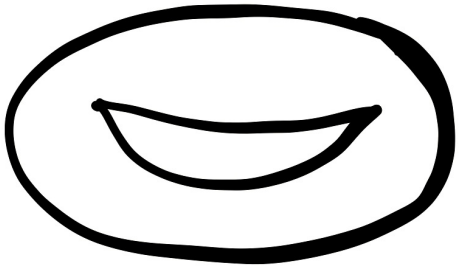


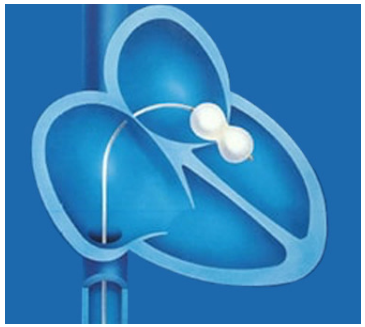


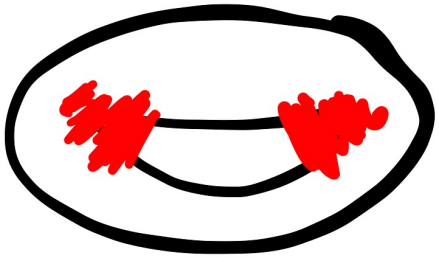


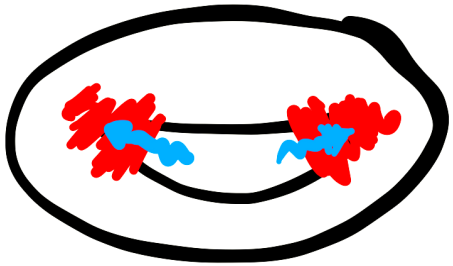


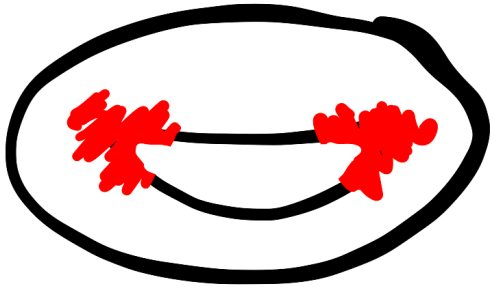
Principe de la valvuloplastie percutanée











Ouverture des commissures: exemples

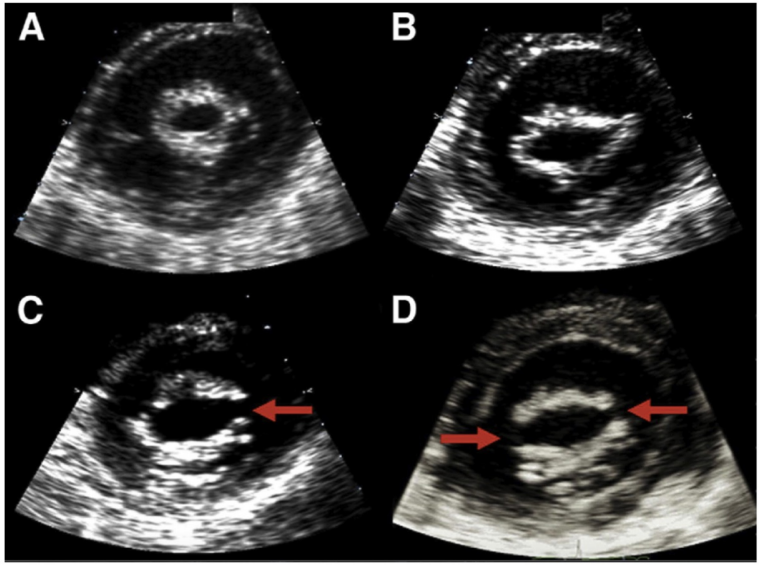


Figure 12 Two-dimensional imaging of the mitral commissures. When the commissures are partially open, the point of fusion can be detected within a few millimeters of the leaflets' free margins. When the commissures are fully open, there is no evidence of fusion to the level of the annulus. **(A)** Both commissures are fused. **(B)** Partially open commissures. **(C)** One commissure is open (*arrow*). **(D)** Both commissures are open (*arrows*). Reproduced with permission from Messika-Zeitoun *et al.*[51]

Déchirure d'une commissure: exemple

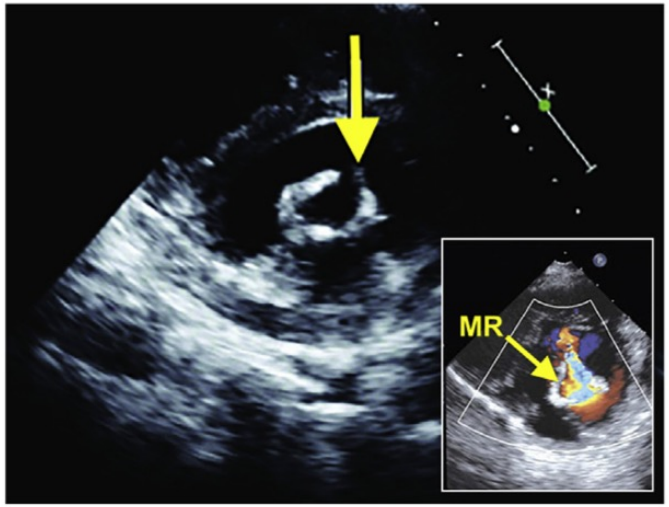
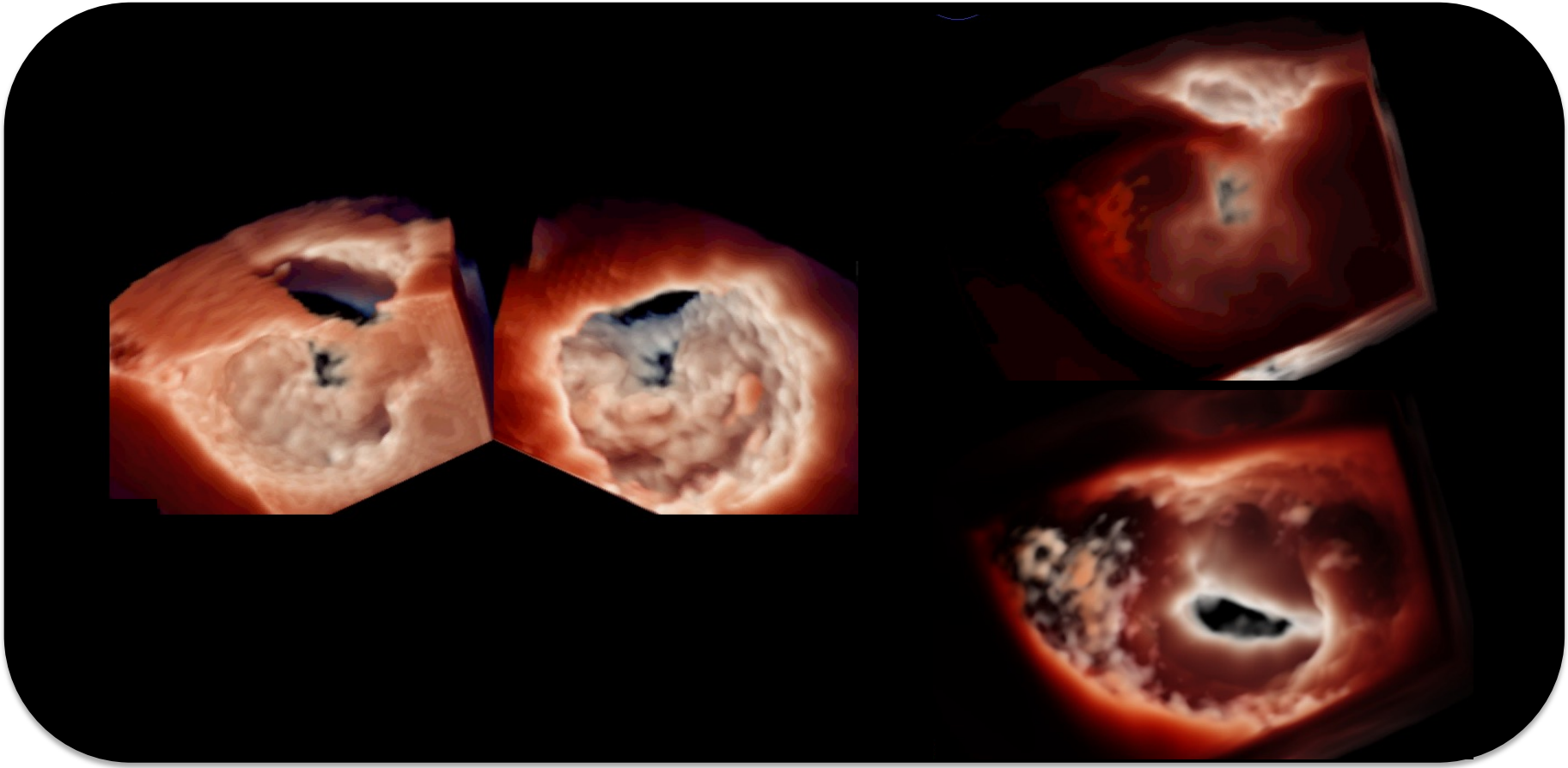
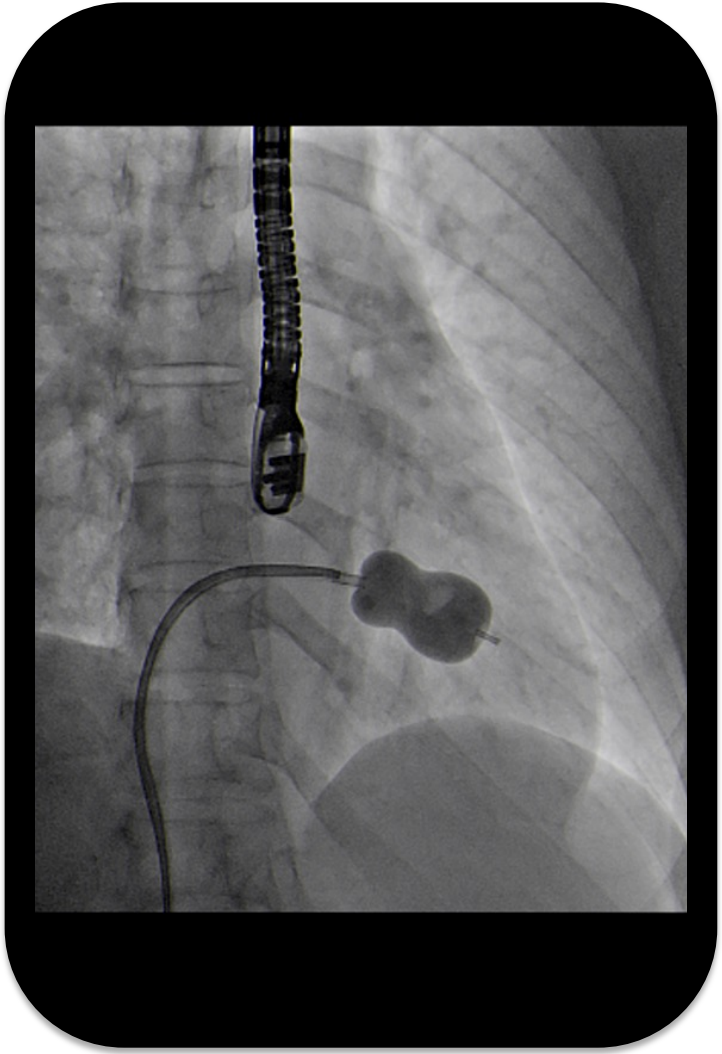
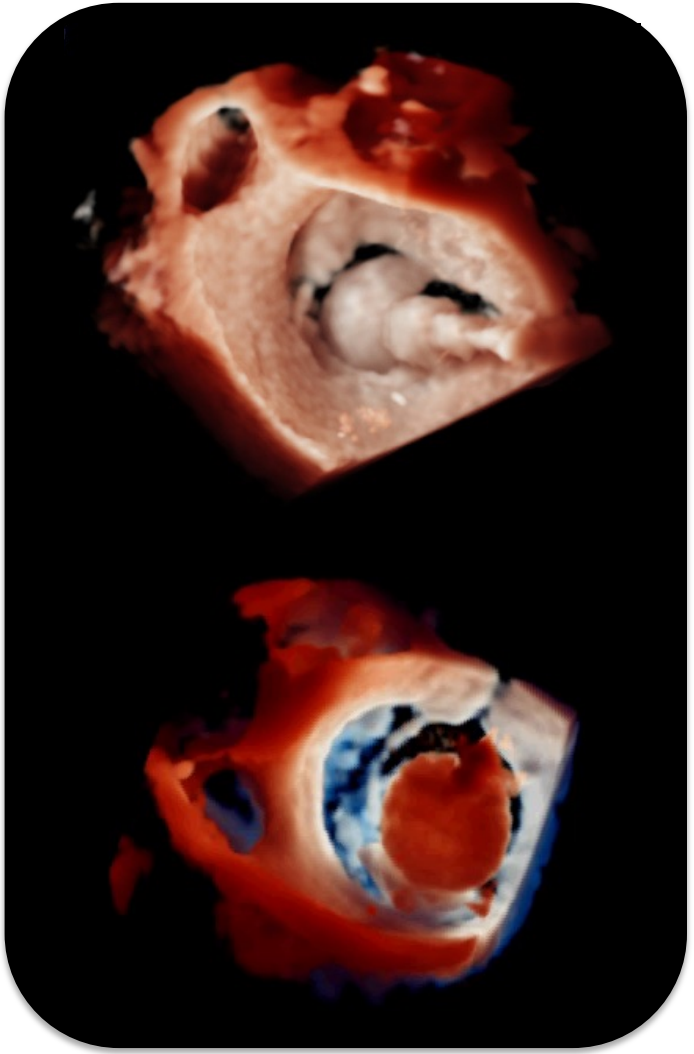


Figure 11 Short-axis image of a MV following balloon valvuloplasty. Note dropout in the anterior leaflet, representing a tear *(arrow)*. Inset reveals severe MR.

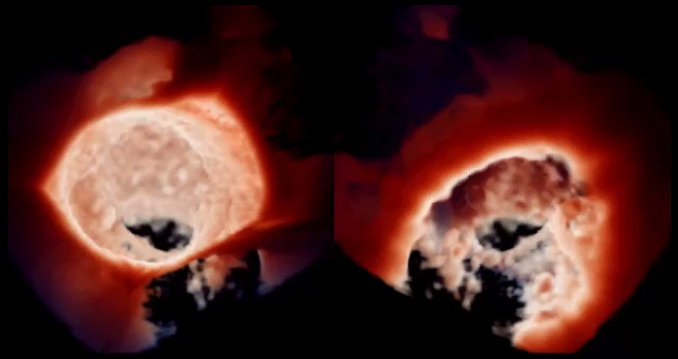
RM avec calcification de la CP

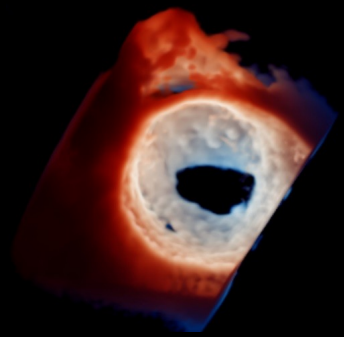




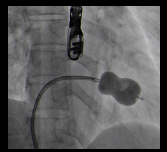


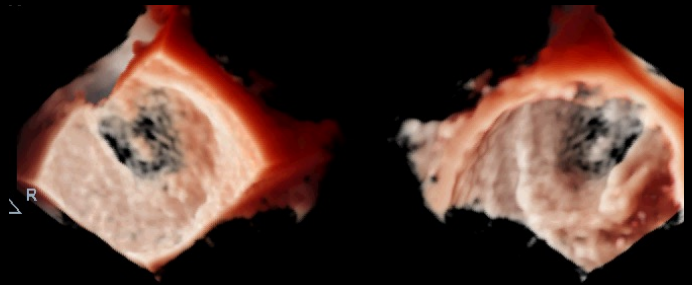
Pré

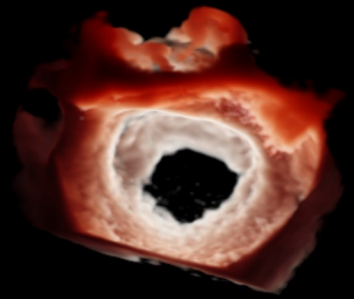




Post







La valvuloplastie percutanée: pour qui?

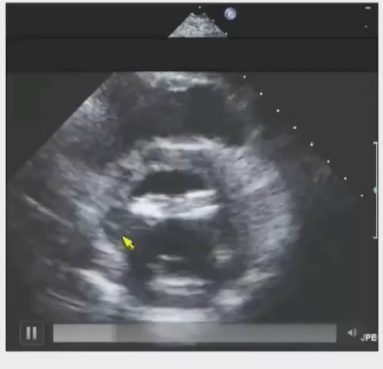
Key Questions: Valvuloplasty

- Chance of Success?
  - Commissural calcification
    - Wilkins/Abascal Score
      - Valve mobility 1-4
      - Valve thickening 1-4
      - Valve calcification 1-4
      - Sub-valvular thickening 1-4
- Contraindications?
  - MR >2+
  - Thrombus in LAA

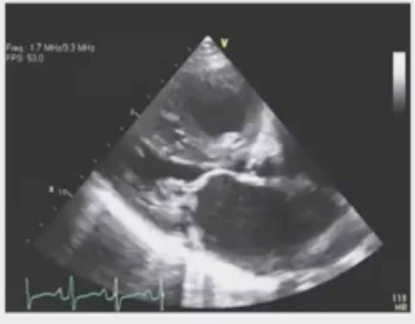
MAYO CLINIC

FAVORABLE

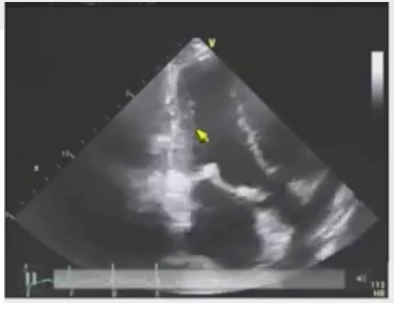
UNFAVORABLE



FAVORABLE



UNFAVORABLE



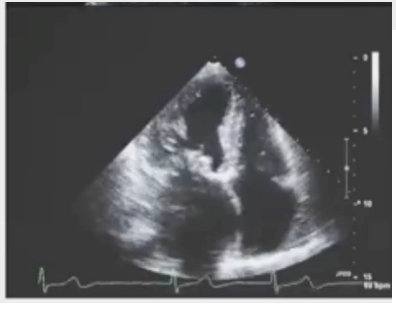


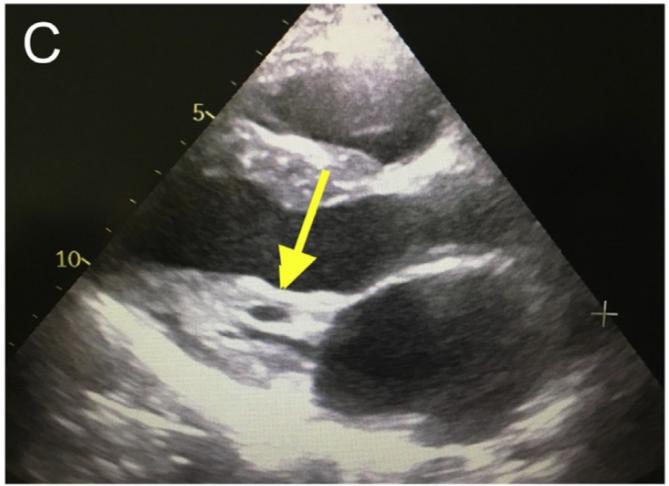
Table 5 Assessment of mitral valve anatomy according to the Wilkins score[64]

Grade	Mobility	Thickening	Calcification	Subvalvular Thickening
1	Highly mobile valve with only leaflet tips restricted	Leaflets near normal in thickness (4–5 mm)	A single area of increased echo brightness	Minimal thickening just below the mitral leaflets
2	Leaflet mid and base portions have normal mobility	Midleaflets normal, considerable thickening of margins (5–8 mm)	Scattered areas of brightness confined to leaflet margins	Thickening of chordal structures extending to one-third of the chordal length
3	Valve continues to move forward in diastole, mainly from the base	Thickening extending through the entire leaflet (5–8 mm)	Brightness extending into the mid-portions of the leaflets	Thickening extended to distal third of the chords
4	No or minimal forward movement of the leaflets in diastole	Considerable thickening of all leaflet tissue (>8–10 mm)	Extensive brightness throughout much of the leaflet tissue	Extensive thickening and shortening of all chordal structures extending down to the papillary muscles

The total score is the sum of the four items and ranges between 4 and 16.

Table 6 Assessment of mitral valve anatomy according to the Cormier score[48]

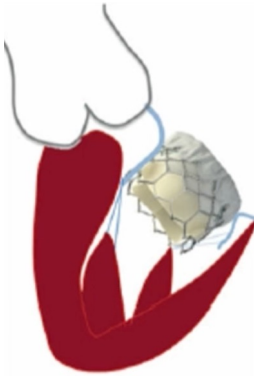
Echocardiographic group	Mitral valve anatomy
Group 1	Pliable non-calcified anterior mitral leaflet and mild subvalvular disease (i.e. thin chordae ≥10 mm long)
Group 2	Pliable non-calcified anterior mitral leaflet and severe subvalvular disease (i.e. thickened chordae <10 mm long)
Group 3	Calcification of mitral valve of any extent, as assessed by fluoroscopy, whatever the state of subvalvular apparatus

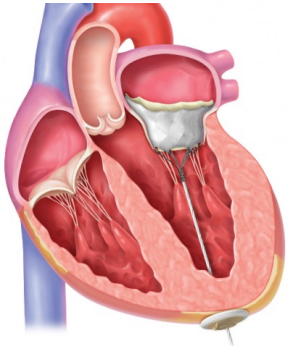


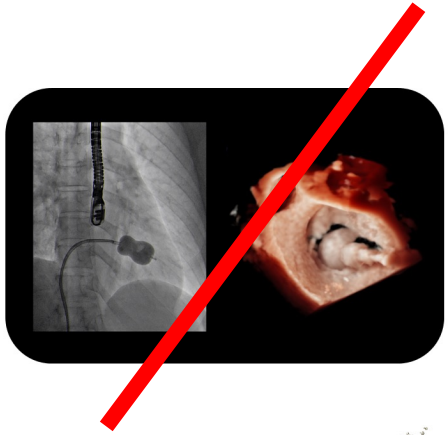
Coupe off axis pour déterminer l'épaississement des cordages

MAC: quelles options thérapeutiques ?

Rupture d'anneau
Fuite paraprothétique
Risque opératoire



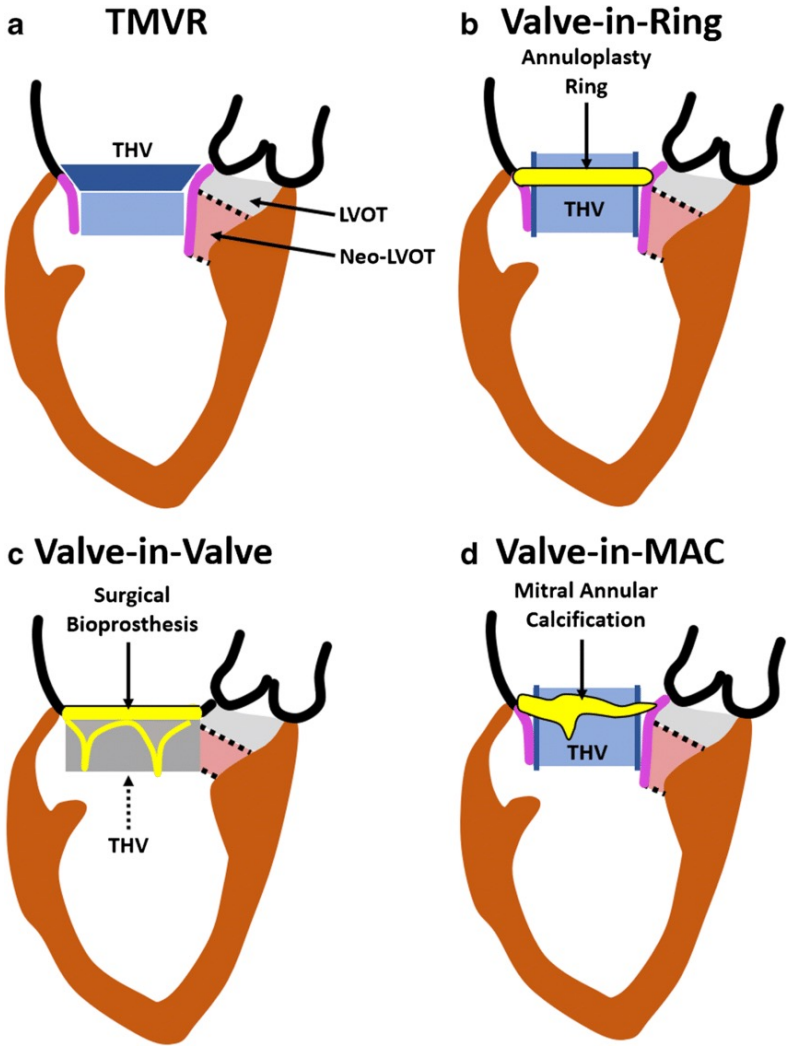




Décès
Embolisation
AVC
LVOT obstruction
Fuite paraprothétique

A.C.C.A.

A.C.C.A.


a TMVR
THV
LVOT
Neo-LVOT
b Valve-in-Ring
Annuloplasty
Ring
THV
c Valve-in-Valve
Surgical
Bioprosthesis
THV
d Valve-in-MAC
Mitral Annular
Calcification
THV

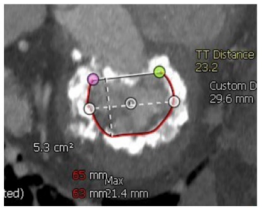
TMVR

Key Questions: TMVR

- Chance of Success?
  - Circumferential Calcification
- Contraindications?
  - Neo-LVOT
  - Thrombus in LAA

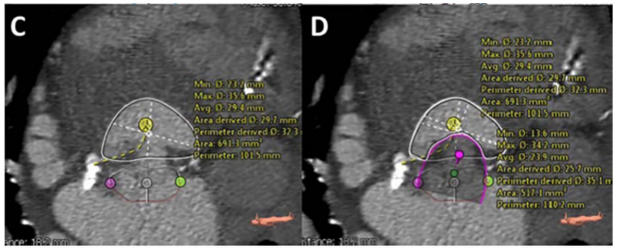
MAYO CLINIC

Cardiac CT



- Measure annular dimensions
- Determine fluoroscopy deployment angle
- Determine Landing zone
- Transeptal puncture location
- Estimate risk of LVOT obstruction

Estimate Risk of LVOT Obstruction

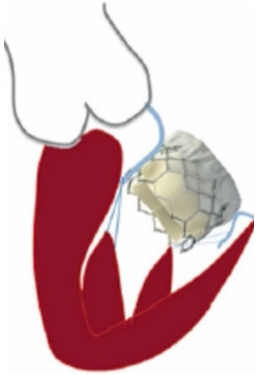


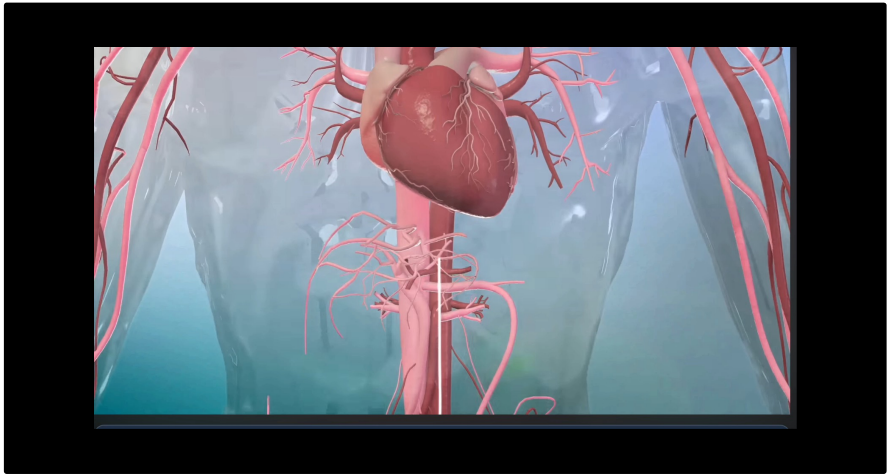
LVOT in systole

Neo-LVOT
with virtual valve in place

>250mm² low risk but <190mm is high risk (Wang et al, JACC 2016)

Gestes associés?

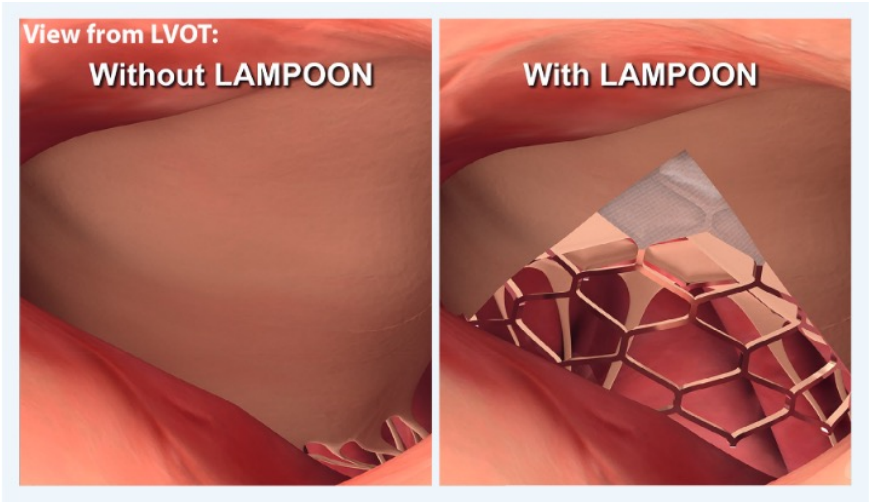


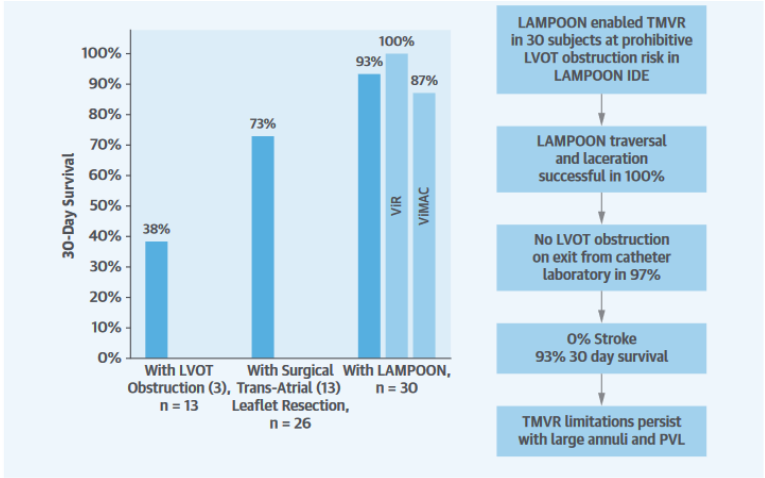


Alcoolisation septale

Anterior Leaflet Laceration to Prevent Ventricular Outflow Tract Obstruction During Transcatheter Mitral Valve Replacement

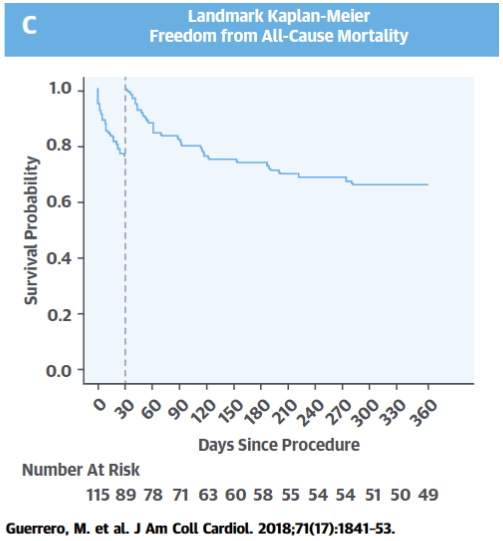
Jaffar M. Khan, BM, BCH,[a,*] Vasilis C. Babaliaros, MD,[b,*] Adam B. Greenbaum, MD,[b,c] Jason R. Foerst, MD,[d] Shahram Yazdani, MD,[e] James M. McCabe, MD,[f] Gaetano Paone, MD,[c] Marvin H. Eng, MD,[c] Bradley G. Leshnower, MD,[b] Patrick T. Gleason, MD,[b] Marcus Y. Chen, MD,[a] Dee Dee Wang, MD,[c] Xin Tian, PHD,[g] Annette M. Stine, RN,[a] Toby Rogers, BM, BCH, PHD,[a,h] Robert J. Lederman, MD[a]





Khan, J.M. et al. J Am Coll Cardiol. 2019;73(20):2521-34.

Results of TMVR in MAC



Guerrero, M. et al. J Am Coll Cardiol. 2018;71(17):1841-53.

N=116
30 day mortality: 25% !
1 year mortality: 53% !

Futility?

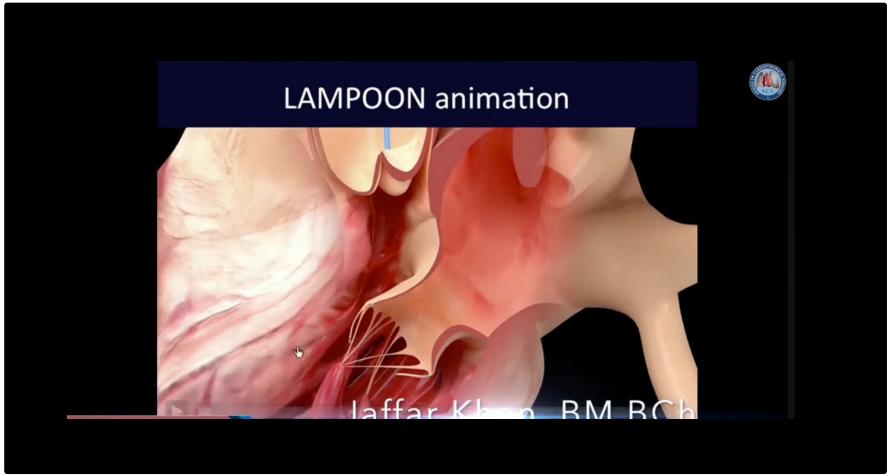
conclusion

- Le RM rhumatismal n’a pas disparu
- Méfiez vous des MAC
- Gradient ++ / Eq de continuité / effort
- chir vs Valve in mac?

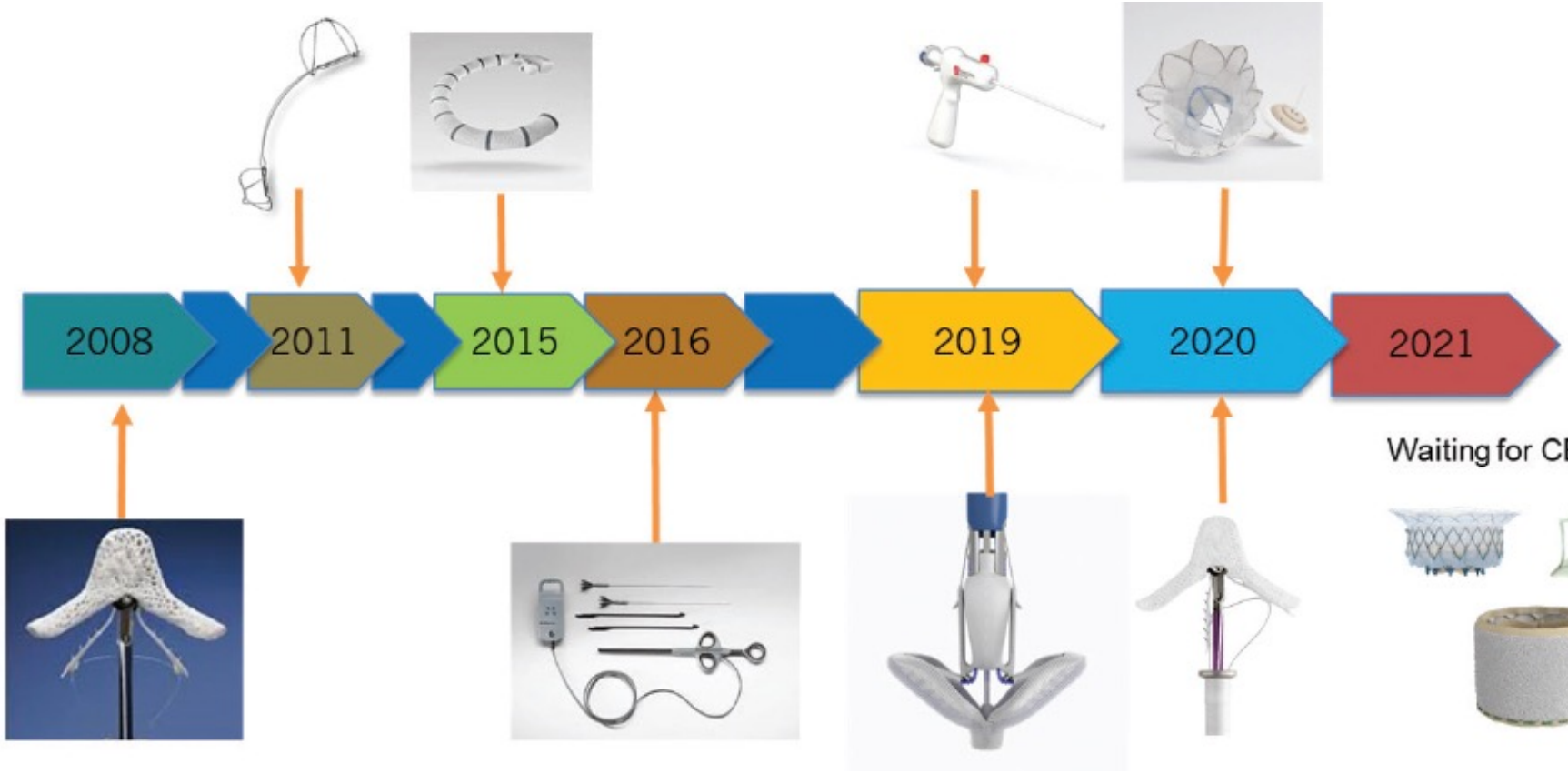
A.C.C.A.

Merci

Gestes associés?



Lacération valve antérieure


2008
2011
2015
2016
2019
2020
2021
Waiting for CE approval:

Native leaflet engagement

Tiara (Neovasc)

Mitral annulus clamping

EVOQUE (Edwards)

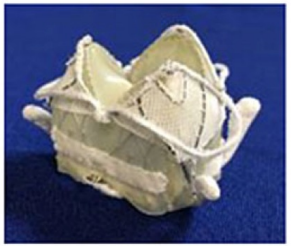
Radial force

Intrepid (Medtronic)

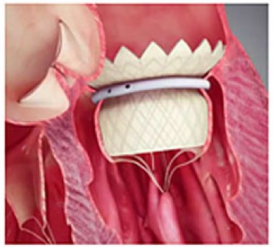
Apical theter

Tendyne (Abbott)

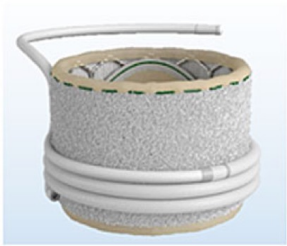
External anchor



Caisson (LivaNova)



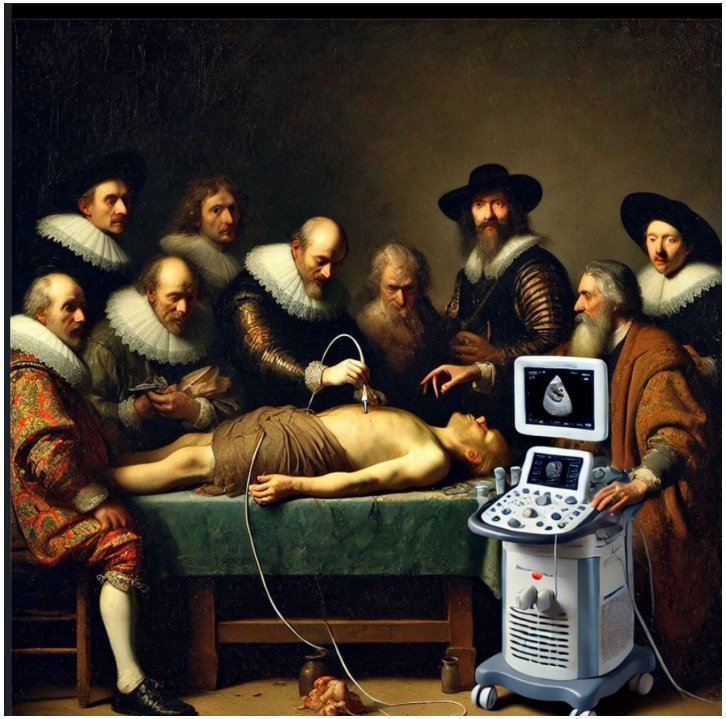
HighLife (HighLife)



Sapien M3 (Edwards)

A.C.C.A.

merci



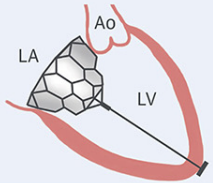
CENTRAL ILLUSTRATION Transcatheter Mitral Valve Replacement for Native Mitral Regurgitation

Challenges of Transcatheter Therapies for Mitral Regurgitation

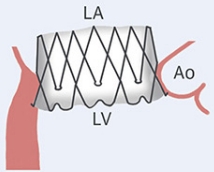
- Mitral Valve Position
- Valve Sealing
- Proximity of LVOT
- Patient Selection
- Complex Anatomy
- Delivery System
- Valve Thrombogenicity, Long-term Durability
- Prosthesis Anchoring and Annular Retention

Transcatheter Mitral Valve Prosthesis Anchoring Mechanisms

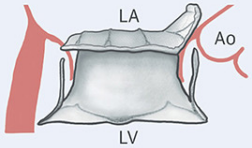
Apical Tether



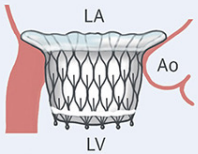
Annular Winglets



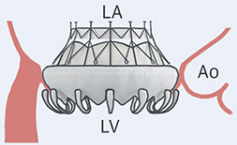
Native Leaflet Engagement



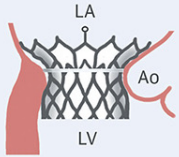
Radial Force



Mitral Annulus Clamping



External Anchor



Regueiro, A. et al. J Am Coll Cardiol. 2017;69(17):2175-92.

(Top) Main challenges for transcatheter mitral valve replacement for treating native mitral regurgitation. **(Bottom)** Anchoring mechanisms of transcatheter mitral valve prostheses. Ao = aorta; LA = left atrium; LV = left ventricle; LVOT = left ventricular outflow track.

En résumé

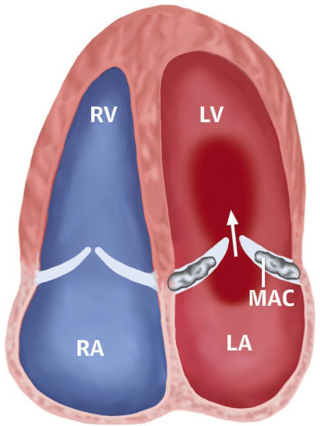
Mitral Annular Calcification (MAC)-Related Mitral Valve Dysfunction (MVD)

Epidemiology

- MAC: 8%-15% of population
- MVD: in 8%-16% of MAC patients
- Often mixed stenosis and regurgitation
- Female predominance
- Associated with comorbidities

Diagnosis

- MAC Extent: Multimodality
- MVD Severity: Echocardiography
  - Transmitral gradient (TMG)
  - MVA by continuity equation or 3D (PHT & 2D planimetry not reliable)
  - MR severity, pulmonary pressure
- "Severe MVD": MVA ≤1.5cm² or TMG >8-10 mm Hg or >moderate MR



Prognosis & Outcomes

- Poor outcome in MAC (comorbidities)
- Incremental mortality with MVD related to MVD severity
- At TMG >10 mm Hg:
  1 year survival <70%
  5 year survival 25%

Management

- Medical Therapy:
  - Diuretics
  - Rate control
  - HFpEF therapy
- Valvular Intervention*:
  - Surgery
  - Transcatheter ("Valve-in-MAC")

**Case-by-case discussion in comprehensive Heart Valve Team*

Stenosis — Mixed Disease — Regurgitation

Churchill TW, et al. J Am Coll Cardiol. 2022;80(7):739-751.

Valve percutanée: la tendyne

SAPIEN M3