

Hypertrophic Obstructive Cardiomyopathy

Gilles D. DREYFUS, MD, PhD, FRCS, FESC

Professor of Cardiothoracic Surgery

Cardio Thoracic Center of Monaco



HOCM

- 1. The most frequent inherited cardiovascular disease : prevalence in the general population of 1/500**
- 2. Pathophysiology of HOCM is complex and includes :**
 - Dynamic obstruction of LVOT**
 - Mitral regurgitation**
 - Impaired diastolic function**
 - Ventricular arrhythmias**
 - Atrial fibrillation**
 - Ischemia**

Most common cause of sudden cardiac death among young people and young athletes.

HOCM

SEPTAL HYPERTROPHY

+

Mitral disease

OR

MITRAL DISEASE

+

Septal hypertrophy

HOCM

Surgical Technique

TWO STEP PROCEDURE:

Step 1: Septal myectomy through a double approach (aortic and mitral)

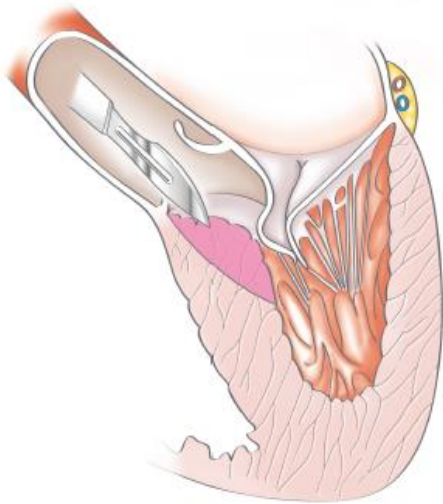
Step 2: Mitral valve repair and radical modification of the mitral anatomy

HOCM

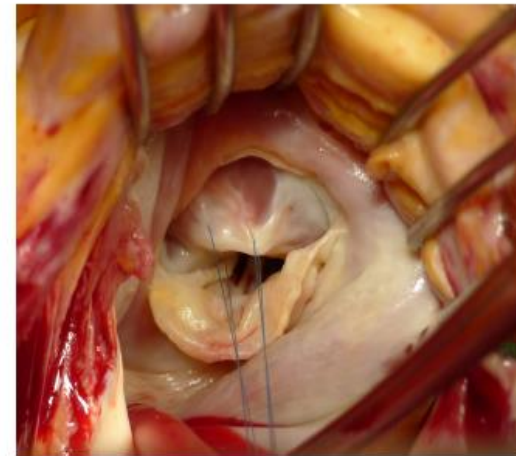
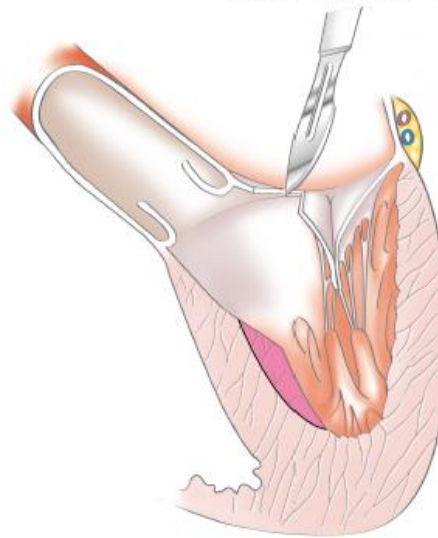
Surgical Technique

STEP 1 : SEPTAL MYOMECTOMY THROUGH

An aortic approach



A mitral approach

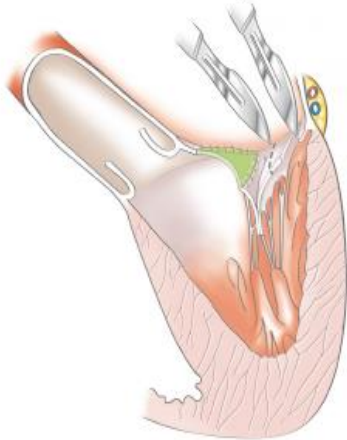


HOCM

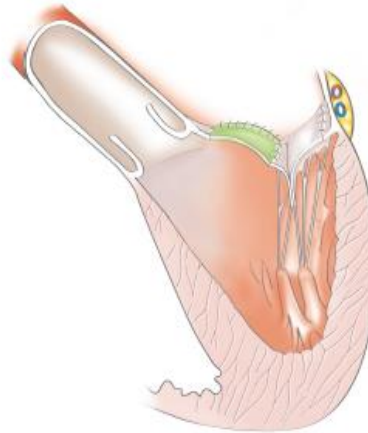
Surgical Technique

STEP 2 : MITRAL VALVE REPAIR

Increased anterior leaflet surface
and motion pushing away the
coaptation plane from the septum



Restricted posterior
leaflet motion

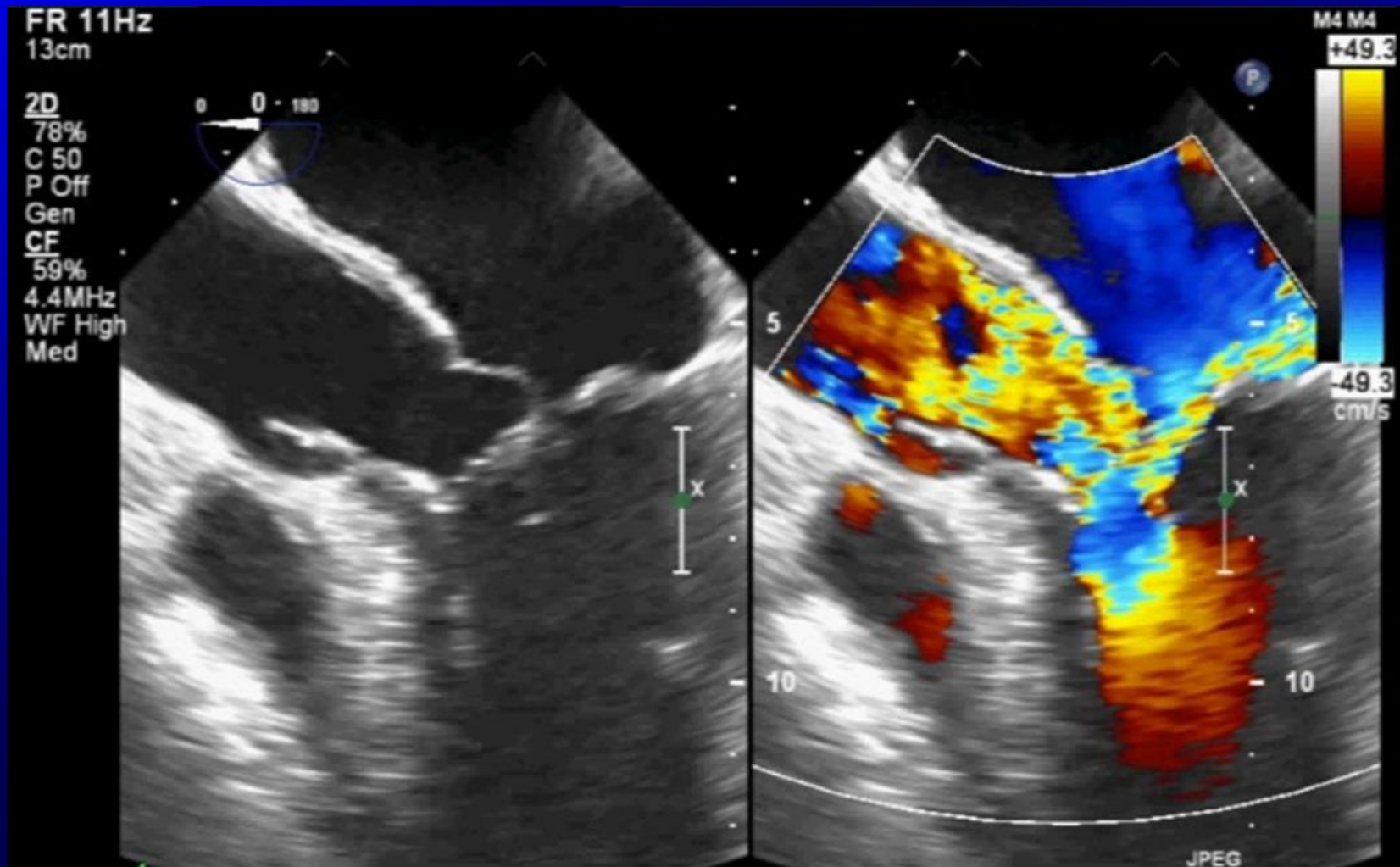


Freezed annular size
and shape in a permanent
diastolic position

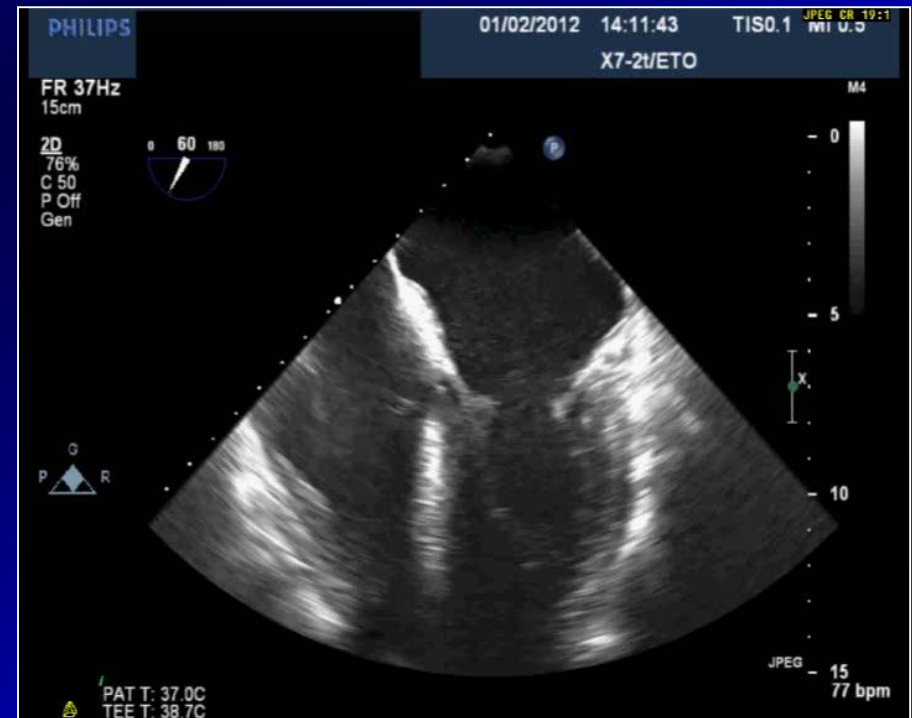


HOCM

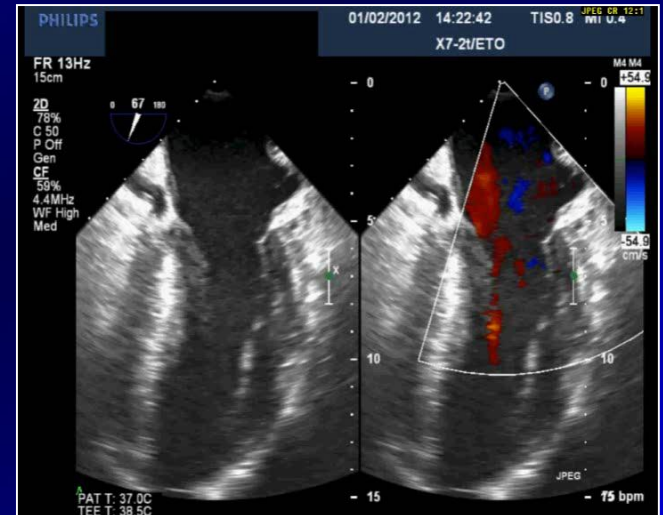
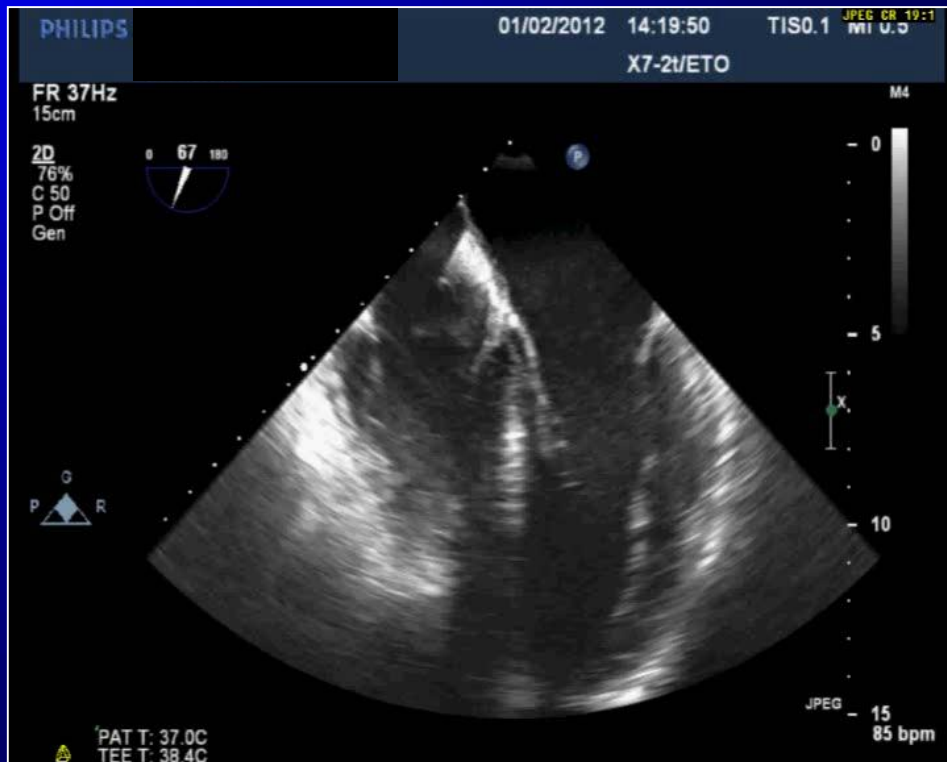
Preoperatively



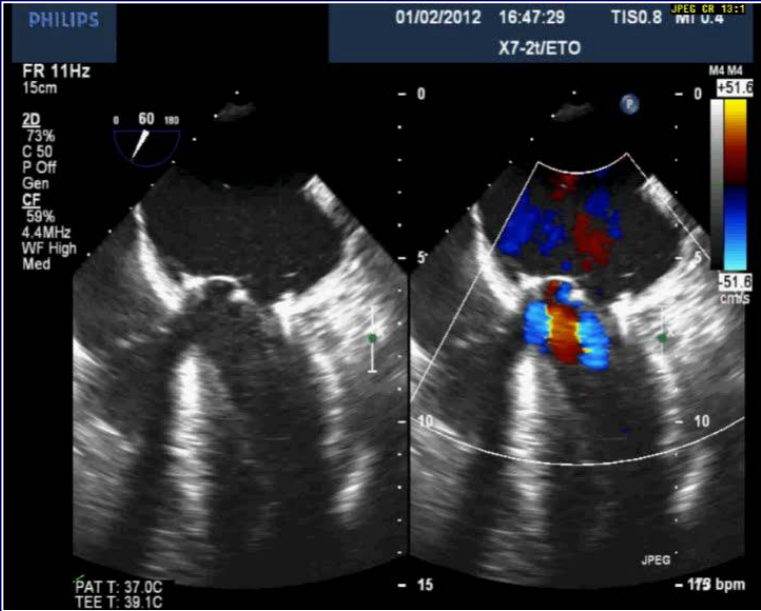
HOCM



FRU...
HOCM

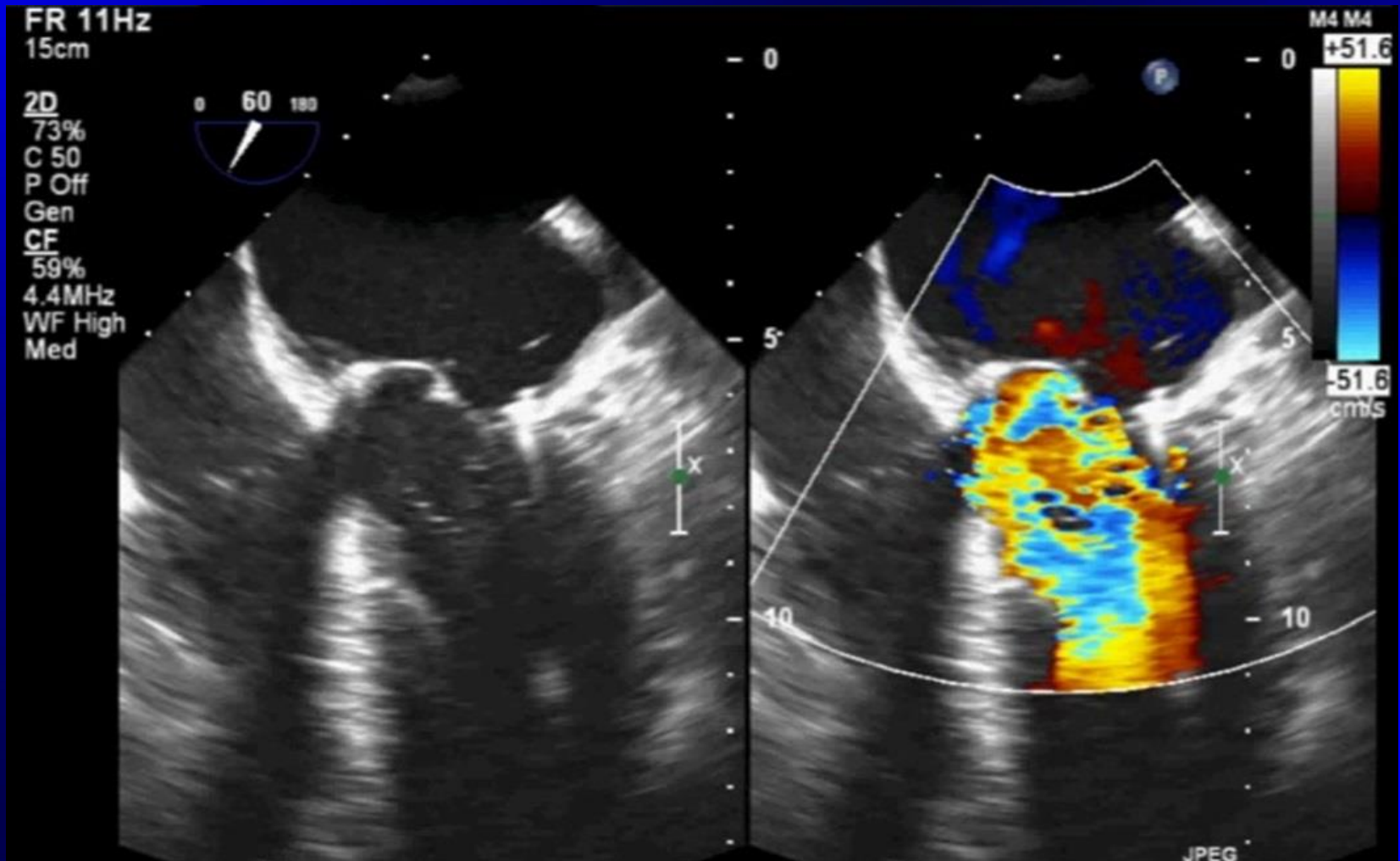


FRU...
HOCM

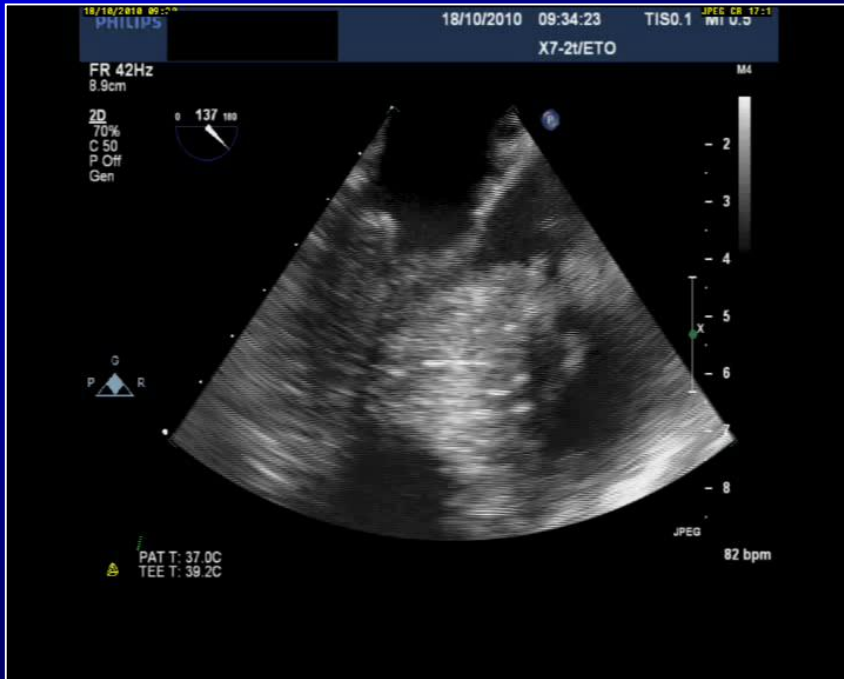


HOCM

Postoperatively



TEE



LVOT

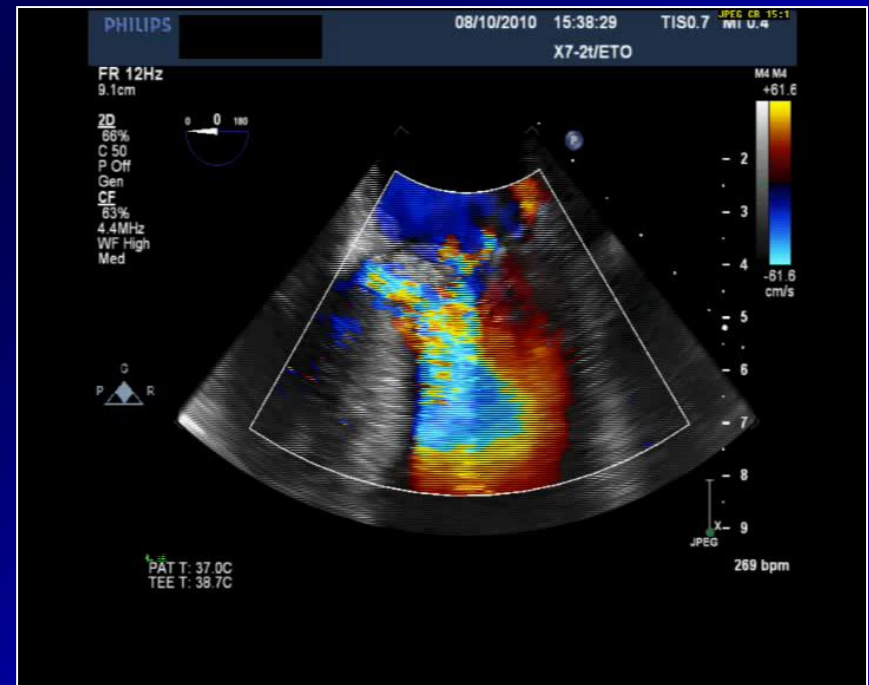
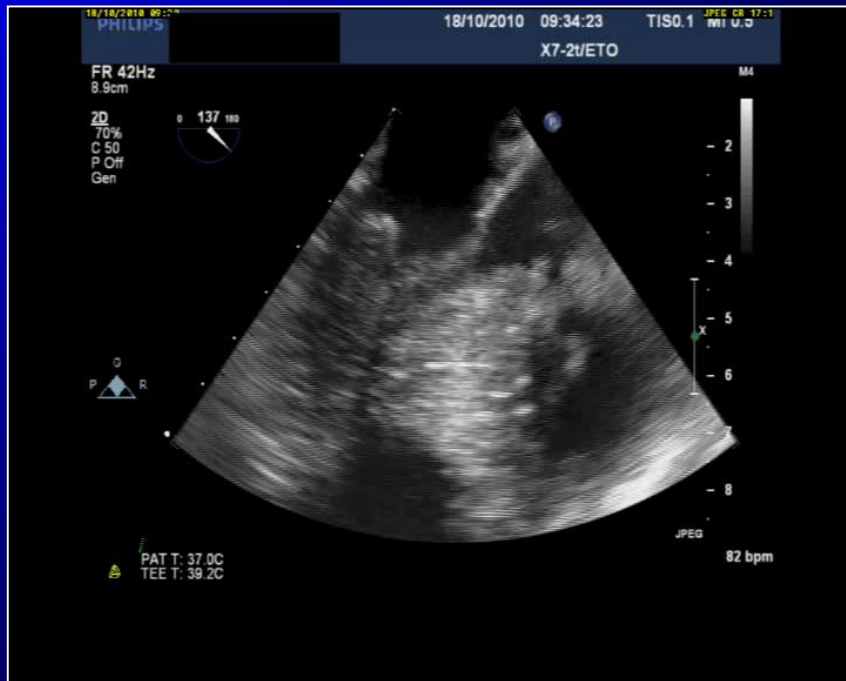


Transgastric view at 90°

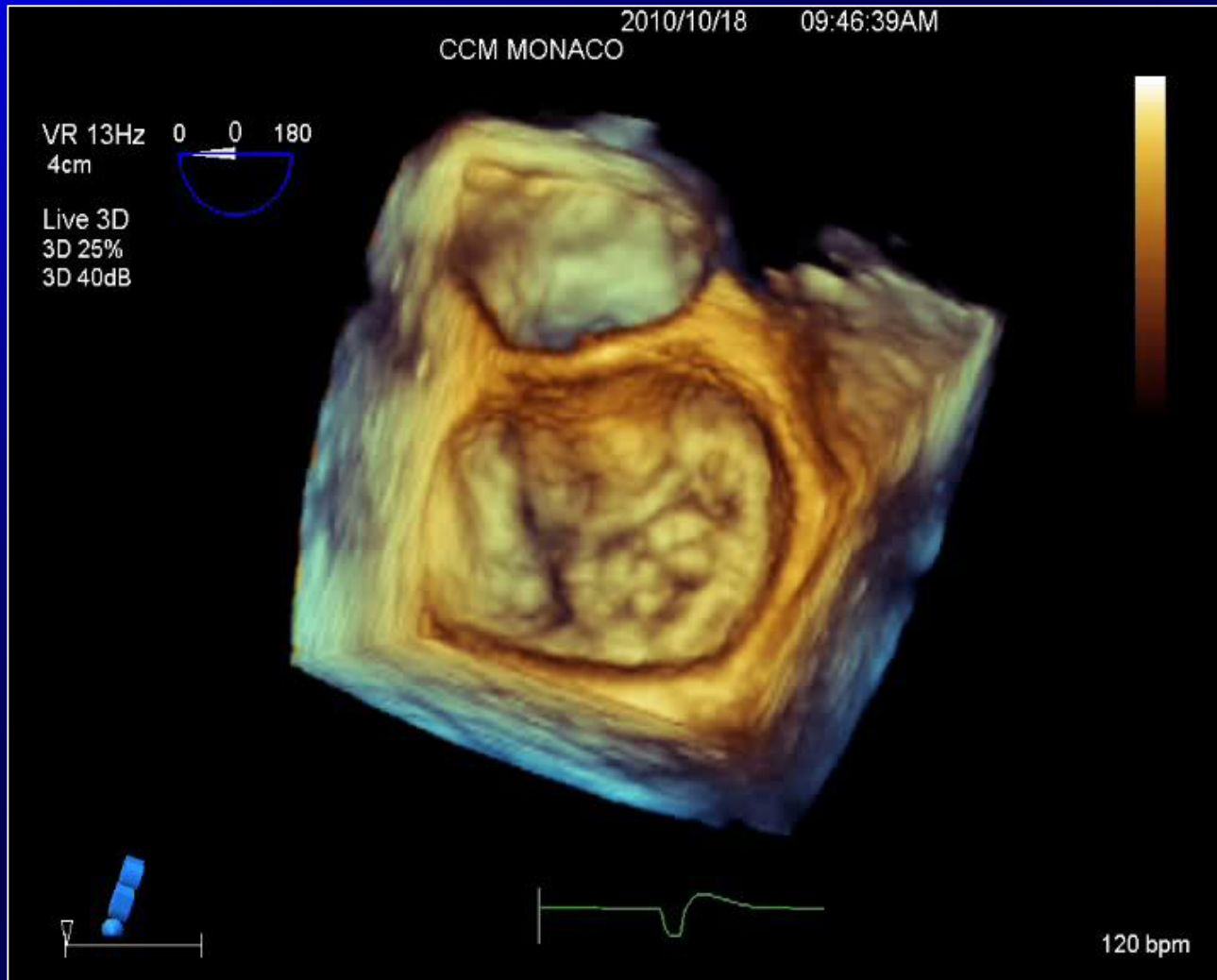
Preop

Case AIT...

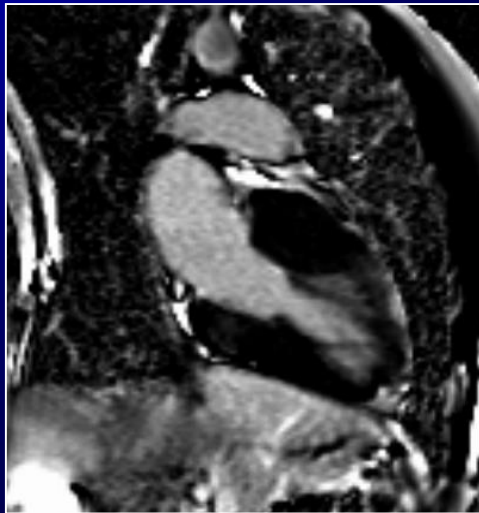
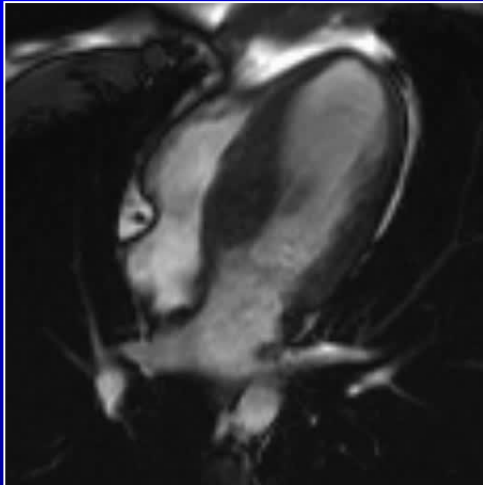
TEE



TEE



MRI



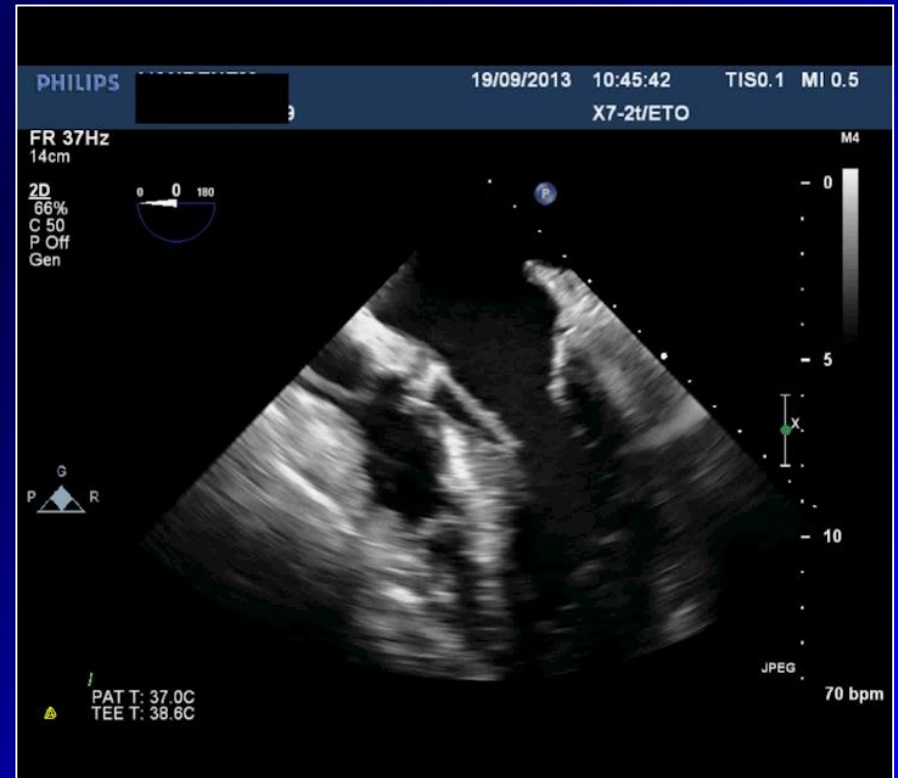
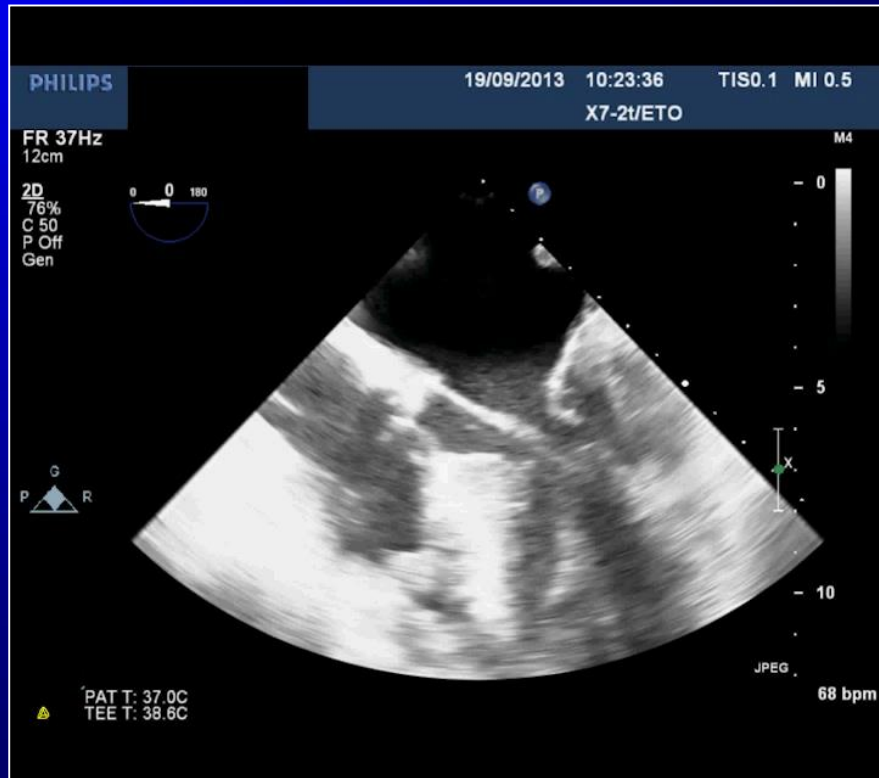
L.V. (Ventricule Gauche)			R.V. (Ventricule Droit)		
E.F.	69 %	56-78	E.F.	N/A %	47-74
Mass	79 g/m²	70-113	Mass	N/A g/m²	16-36
EDVI	46 ml/m²	47-92	EDVI	N/A ml/m²	55-105
ESVI	14 ml/m²	13-33	ESVI	N/A ml/m²	16-48
SV	32 ml/m²	33-62	SV	N/A ml/m²	32-64
CI	2,1 l/m	1.74-4.20	CI	N/A l/m	.

Aorte Thoracique		Normales	Thrombus	
Anneau	15 mm	-	Ventriculaire	N/A mm²
Valsava	27 mm	-	Atrial	N/A mm²
Arche Aortique	N/A mm	-	Epanchement Pericardique	
Aorte Ascendante	23 mm	-	N/A mm	
Aorte Descendante	N/A mm	-		
Oreillette				
Gauche	34	-	ml/m²	Droite N/A -
Mitral Valve				
Mitral Annulus	N/A mm			

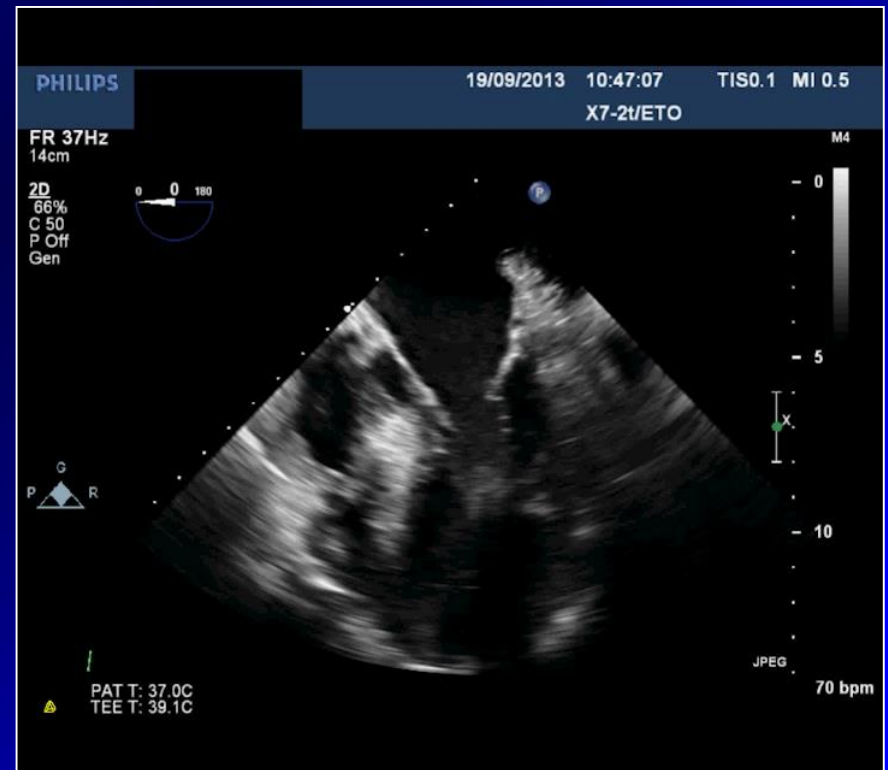
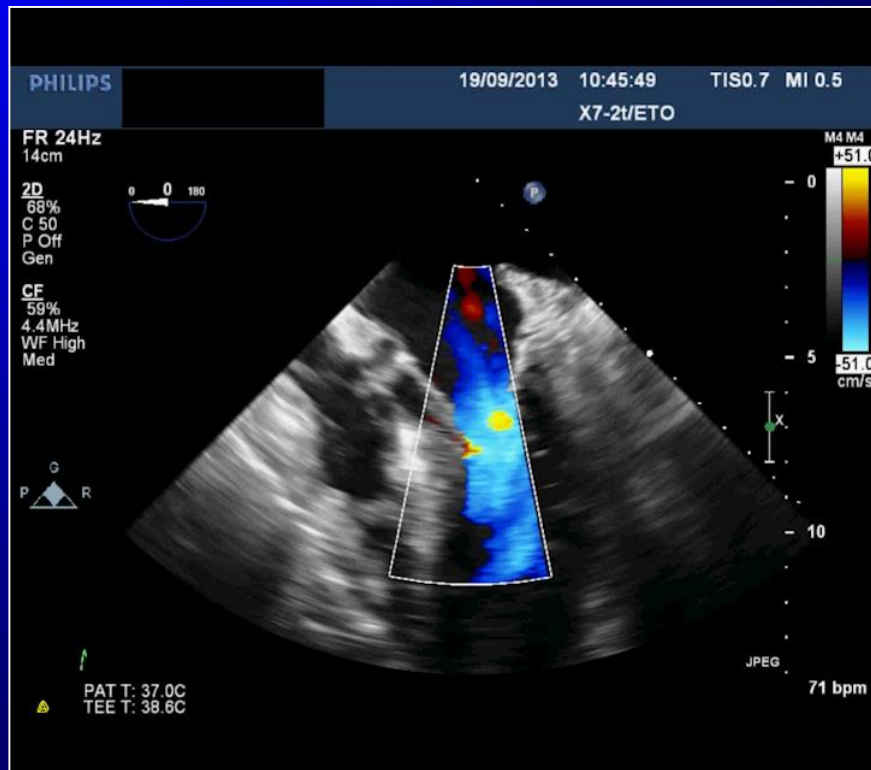
Preop

Case AIT...

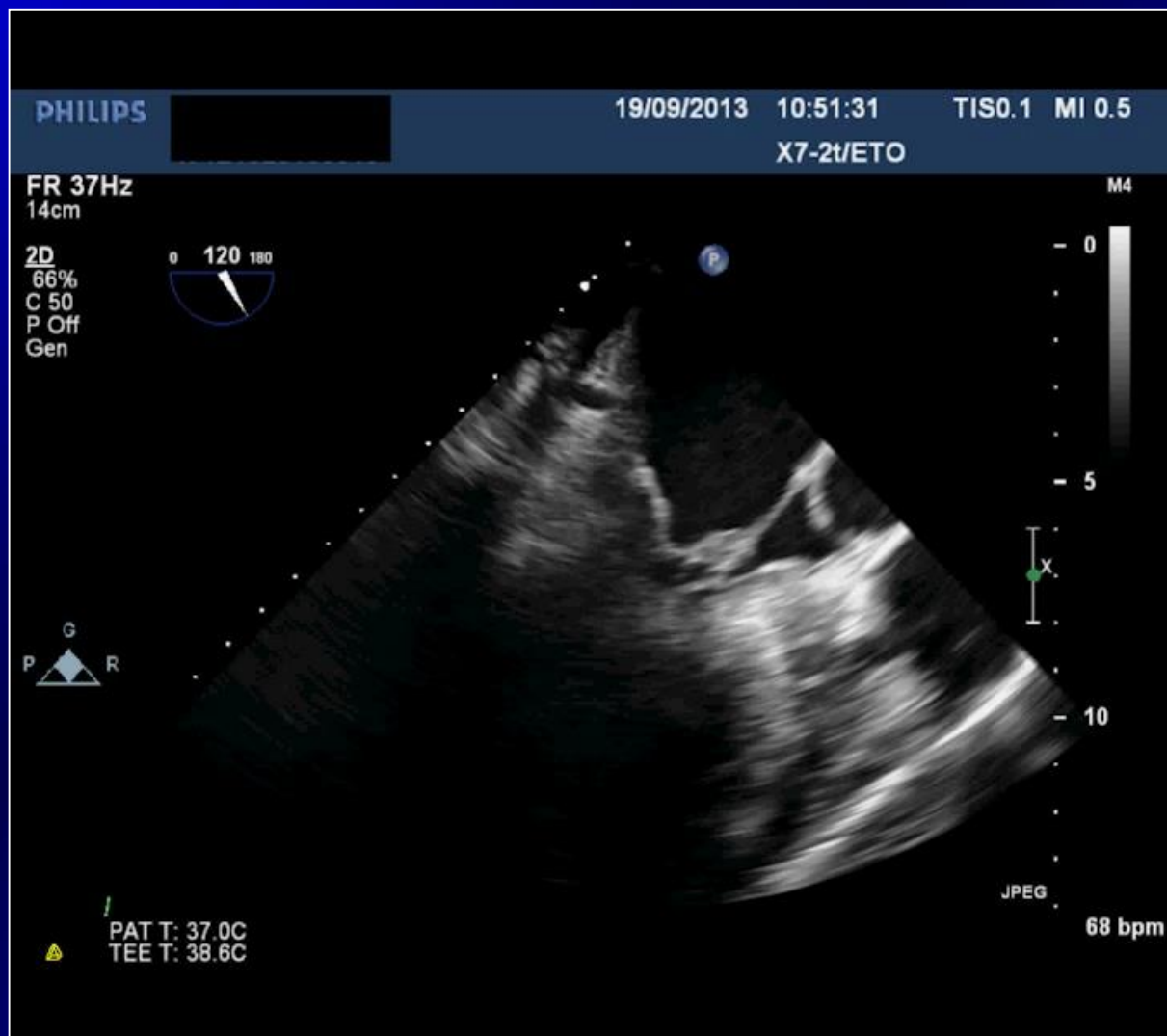
Preop



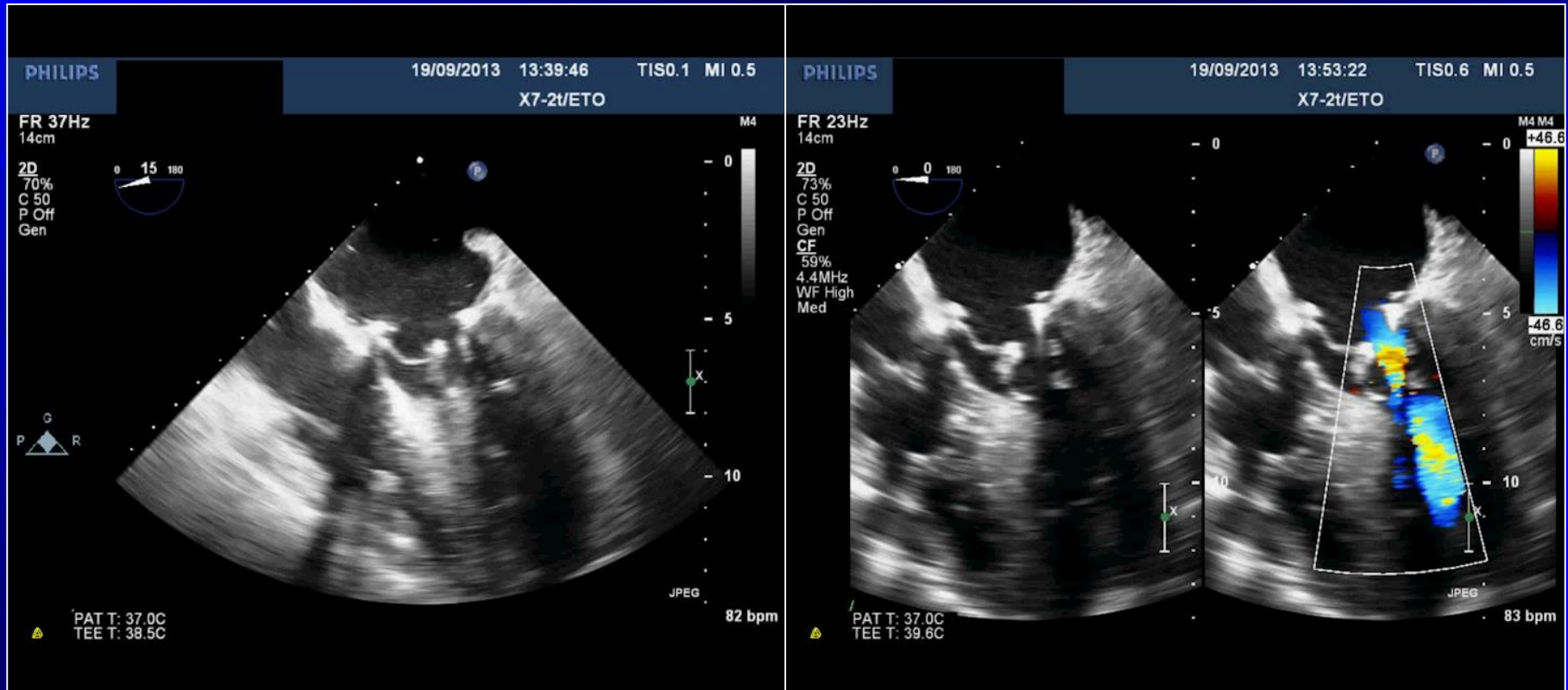
Preop



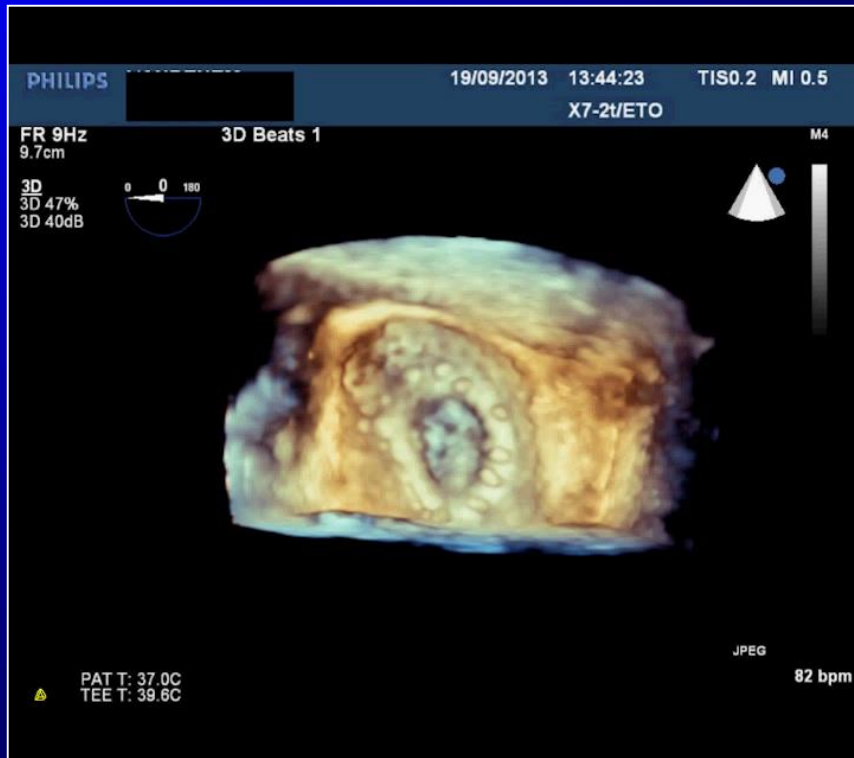
Preop



Postop



Postop



HOCM

Alcohol Septal Ablation (ASA)

Insufficient reduction of the gradient in 10 to 15 % and even up 25% in some specific subgroups has been found with ASA:

- Unfavorable anatomical variability (1st major septal artery)**
- Impossibility to correct the mitral valve component of HOCM**
- Inability to reduce a midventricular or a subvalvular obstruction**

HOCM

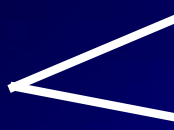
Anatomical modifications of the Mitral Valve:

- Presence of abnormal chordae going from the anterior leaflet to the interventricular septum
- Anteriorly positioned papillary muscles
- Thickening of the leaflets, extensive annular calcifications
- Direct insertion of the papillary muscles on the leaflets

Cleveland Clinic

1997-2007

699 patients with HOCM: 47 ± 11 years old (male 63%)

- Resting LVOT gradient < 30 mmHg  Valsalva
Amyl nitrite
- Resting LVOT gradient < 100 mmHg : Exercise echocardiography
- Resting LVOT gradient > 100 mmHg : no provocative maneuvers

4 GROUPS :

- | | |
|--------------------------------------|--------|
| • Isolated myectomy | = 65 % |
| • Myectomy + MV Repair / Replacement | = 23 % |
| • Myectomy + CABG | = 9 % |
| • Myectomy + MVR + CABG | = 3 % |

Results

Overall mortality : 6%

**Asymptomatic or minimally symptomatic patients
(NYHA class I or II) : 96%**

Results depend on the type of surgery :

- Myectomy
 - Myectomy + MVR
- Events rate 11 %
- Myectomy + CABG → Events rate 19 %
 - Myectomy + CABG + MVR → Events rate 32 %

HOCM

Surgical experience at the Cardiothoracic Center of Monaco:

Categories : III. Mitral - HOCM and SAM

Presentation Type: Oral Presentation

Keywords : HOCM treatment, SAM, mitral valve repair, septum resection, two stages procedure

HYPERTROPHIC OBSTRUCTIVE

Dulguero F.¹, Marcacci C

Cardio-Thoracic Center of

Objectives:

As we believe that treating results and at midterm follow

Methods:

From March 2010 until December 2013, 11 patients with HOCM underwent surgical correction of obstruction. There were 9 males and 2 females. Mean age was 51 years old (range, 32 to 72). All were symptomatic being New York Heart Association (NYHA) class 3 (n=3) or 4 (n=8). All had systolic anterior motion at echocardiogram with severe mitral regurgitation. Maximal intraventricular gradient preoperatively was 73, 5 mmHg (range, 50 to 120). Type of HOCM was septal (n=4); localized at the septum and the anterolateral ventricular wall (n=6), and at the anterior septum (n=1). All patients underwent MRI scan and all except one had myocardial fibrosis. Mean left ventricular volume index in systole was 23, 8 ml/m² (range, 14 to 31), and in diastole 76, 6 ml/m² (range, 46 to 115). Mean left atrial volume index was 73 ml/m² (range, 34 to 115). All patients underwent a double stage procedure: first a septal resection through a) the aortic valve and b) the detached anterior leaflet of the mitral valve. At second, a mitral valve repair by: a) reducing posterior leaflet height and b) increasing anterior leaflet height. Mean crossclamping time was 105 minutes (range, 61 to 252). Mean care unit stay was 72 hours (range, 48 to 96).

Results:

There were no in-hospital or (range, 9 to 18). Three patients

Conclusion:

Our good midterm results suggest that treating the mitral valve also

Methods:

From March 2010 until December 2013, 11 patients with HOCM underwent surgical correction of obstruction. There were 9 males and 2 females. Mean age was 51 years old (range, 32 to 72). All were symptomatic being New York Heart Association (NYHA) class 3 (n=3) or 4 (n=8). All had systolic anterior motion at echocardiogram with severe mitral regurgitation. Maximal intraventricular gradient preoperatively was 73, 5 mmHg (range, 50 to 120). Type of HOCM was septal (n=4); localized at the septum and the anterolateral ventricular wall (n=6), and at the anterior septum (n=1). All patients underwent MRI scan and all except one had myocardial fibrosis. Mean left ventricular volume index in systole was 23, 8 ml/m² (range, 14 to 31), and in diastole 76, 6 ml/m² (range, 46 to 115). Mean left atrial volume index was 73 ml/m² (range, 34 to 115). All patients underwent a double stage procedure: first a septal resection through a) the aortic valve and b) the detached anterior leaflet of the mitral valve. At second, a mitral valve repair by: a) reducing posterior leaflet height and b) increasing anterior leaflet height. Mean crossclamping time was 105 minutes (range, 61 to 252). Mean care unit stay was 72 hours (range, 48 to 96).

ty. We have analysed our immediate

(range, 32 to 72). All were ventricular gradient preoperatively MRI scan and all except one had index was 73 ml/m² (range, 34 to 115). valve repair by: a) reducing posterior

intraventricular gradient was 15 mmHg

even necessary to be studied whether



HOCM

Cardiothoracic Center of Monaco: AATS Sept. 2014 (Istanbul)

Categories : III. Mitral - HOCM and SAM

Presentation Type: Oral Presentation

Keywords : HOCM treatment, SAM, mitral valve repair, septum resection, two stages procedure

HYPERTROPHIC OBSTRUCTIVE CARDIOMYOPATHY (HOCM): SHOULD WE TREAT ONLY THE SEPTUM, ONLY THE MITRAL VALVE OR BOTH?

*Dulguerov F.*¹, Marcacci C.¹, Alexandrescu C.², Dreyfus G.¹

Cardio-Thoracic Center of Monaco Cardiac surgery Monte Carlo-Monaco¹ Cardio-Thoracic Center of Monaco Cardiology Monte Carlo-Monaco²

Objectives:

As we believe that treating the mitral valve abnormalities is a key feature of HOCM, we have systematically corrected both the anterior and posterior leaflet size and geometry. We have analysed our immediate results and at midterm follow up.

Methods:

From March 2010 until December 2013, 11 patients with HOCM underwent surgical correction of obstruction. There were 9 males and 2 females. Mean age was 51 years old (range, 32 to 72). All were symptomatic.

was 73, 5

myocardia

All patient

leaflet he

Results:

There were no in-hospital or late death. All patients were class 1 NYHA at latest follow up. Control echocardiography showed no mitral regurgitation (MR), and mean resting intraventricular gradient was 15 mmHg (range, 9 to 18). Three patients required permanent pace maker implantation prior discharge for atrio-ventricular block.

Results:

There we

(range, 9

Conclusio

Our good

treating th

al regurgitation. Intraventricular gradient preoperatively patients underwent MRI scan and all except one had an left atrial volume index was 73 ml/m² (range, 34 to 115). re. At second, a mitral valve repair by: a) reducing posterior (range, 48 to 96).

MR), and mean rest intraventricular gradient was 15 mmHg

ould be addressed. It is even necessary to be studied whether

Table 5. Stepwise multivariable Cox proportional hazard analysis for the composite endpoint

Variable	Stepwise multivariable	
	Hazard ratio	p-value
Age (10-year increment)	1.49 [1.22-1.82]	0.001
Residual postoperative AF	2.12 [1.37-3.34]	0.001

Chi-square for the final model 25, $p < 0.001$. Obstructive CAD, permanent pacemaker and concomitant cardiac surgeries did not remain significant in stepwise multivariable analysis Because of significant interaction between preoperative and postoperative residual AF, only residual AF was entered in stepwise multivariable model

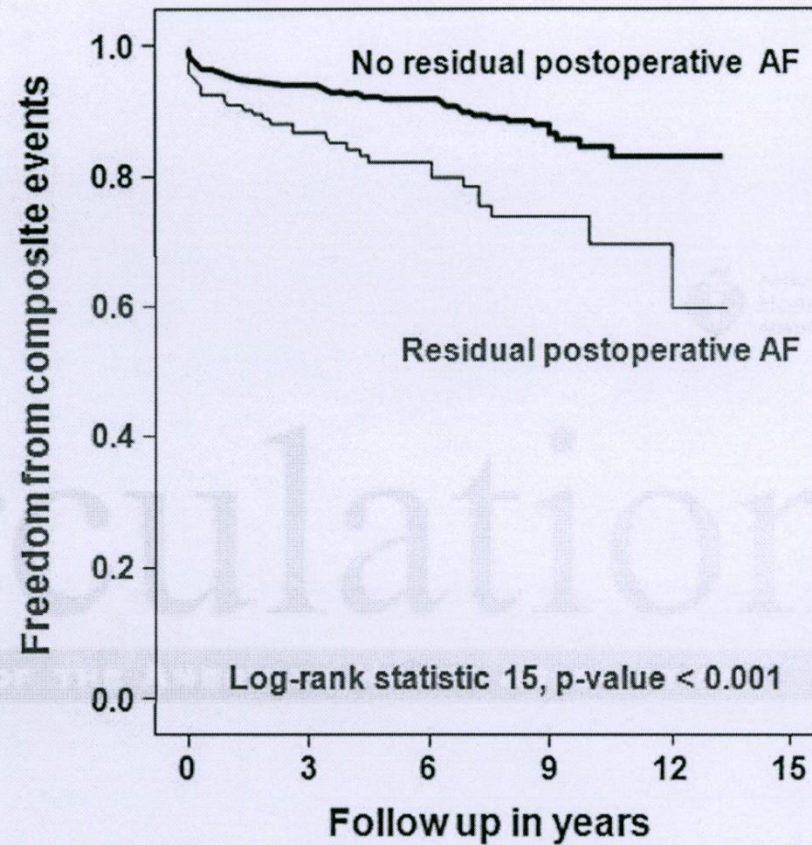
Desai MY et al. *Circulation*. 2013;128:209-216



Numbers at risk
 Age $\leq$ 50 years
 Age > 50 years

355	293	153	59	10	0
344	259	126	46	5	0

Desai MY et al. *Circulation*. 2013;128:209-216



Numbers at risk						
No residual postoperative AF	562	452	219	83	11	0
Residual postoperative AF	137	100	60	22	4	0

Desai MY et al. *Circulation*. 2013;128:209-216

Transapical Approach to Myectomy for Midventricular Obstruction in Hypertrophic Cardiomyopathy

Meghana R. Kunkala, MD, Hartzell V. Schaff, MD, Rick A. Nishimura, MD, Martin D. Abel, MD, Paul Sorajja, MD, Joseph A. Dearani, MD, and Steve R. Ommen, MD

Divisions of Cardiovascular Surgery and Cardiovascular Diseases, and the Department of Anesthesiology, Mayo Clinic, Rochester, Minnesota

Background. Midventricular obstruction in hypertrophic cardiomyopathy (HCM) is less common than subaortic obstruction, and there are few data on outcomes after surgical treatment.

Methods. We reviewed 56 consecutive patients (28 men) with HCM and midventricular obstruction who underwent myectomy between 1990 and 2011. Five patients had prior aortic surgery. Mean age was 42 years. Twenty-five of patients had dyspnea, 12 had chest pain, 12 had syncope (25%), angina (5%), and 12 had a family history of sudden death.

Results. Midventricular obstruction was relieved by means of a transaortic or transapical approach in 32 patients. There were no complications unique to the apical incision, and 5-year survival was similar to expected survival (95% versus 97%).

Intraoperative intraventricular gradients were reduced from 64 ± 32 mm Hg before myectomy to 6 ± 12 mm Hg

postoperatively ($p \leq 0.0001$). Early complications included atrial arrhythmias in 5 patients and reoperation for bleeding in 4 patients. Fifty patients had follow-up beyond 30 days (median, 1.6 years; range, 33 days to 13 years). Survival at 1 and 5 years was 100% and 95%, and average New York Heart Association class improved

Conclusions. A transapical approach allows excellent exposure for midventricular myectomy and relief of intraventricular gradients and related symptoms. There were no complications unique to the apical incision, and 5-year survival was similar to expected survival (95% versus 97%).

(Ann Thorac Surg 2013;96:564-70)

© 2013 by The Society of Thoracic Surgeons



HOCM

Conclusion

- Personal series: **50 patients**
- **No deaths**
- 5 pace makers prior discharge for AV block
- 3 iatrogenic ventricular septal defects
- Diseappearance of:**
 - SAM phenomenon
 - LVOT gradients
 - Mitral Regurgitation

HOCM

Conclusion

- **HOCM** is rather a **mitral disease**
- The septal myomectomy is unpredictable:
 - Risk of AV block
 - Risk of iatrogenic ventricular septal defect
- The mitral repair is **reliable and reproducible**:
Stable results for a period up to **10 years**