

“La Reconstruction du ventricule gauche ischémique après le STICH TRIAL”

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Amicale des Cardiologues de la Côte d'Azur

“Innovations”?! en Chirurgie Cardiaque

Nice, 8 juin 2010



S.T.I.C.H.

Investigator meeting chapter 3 pp17-18 2002

1. - Med/CABG
2. - CABG/CABG + SVR
3. - Med/CABG/CABG + SVR

Anterior akinetic/dyskinetic SCAR
Coronary anatomy suitable for revasc.

Trial Exclusion Criteria

- Patients with concurrent cardiogenic shock or requiring inotropic or intra-aortic balloon support.
- PCI planned for CAD treatment.
- Acute myocardial infarction within 30 days.
- More than one prior cardiac operation.
 - Combined anterior & inferior akinesia.
 - Both right & Cx territories supplied by diseased arteries not amenable to CABG

2009 N.E.J.M : “CABG with or without S.V.R.”

Arm 2 : 1000 pts	CABG alone : 499	CABG + S.V.R : 501
N.Y.H.A. IV	36 (7%)	21 (4%) 57/1000 : 5.7% !
“Cross Over”	+ S.V.R : 27	No CABG & S.V.R : 47
Follow Up 44 months	? EF non assessed!	?
LV vol. 4 months	212 373/1000 : 1/3 !	169 (ESVI 83 to 67 ml) !

Conclusion : NEJM April 2009 “for I.C.M :

«no significant difference between CABG vs CABG + SVR»

CAUSES OF ISCHEMIC HEART FAILURE ARE NOT UNIFORM

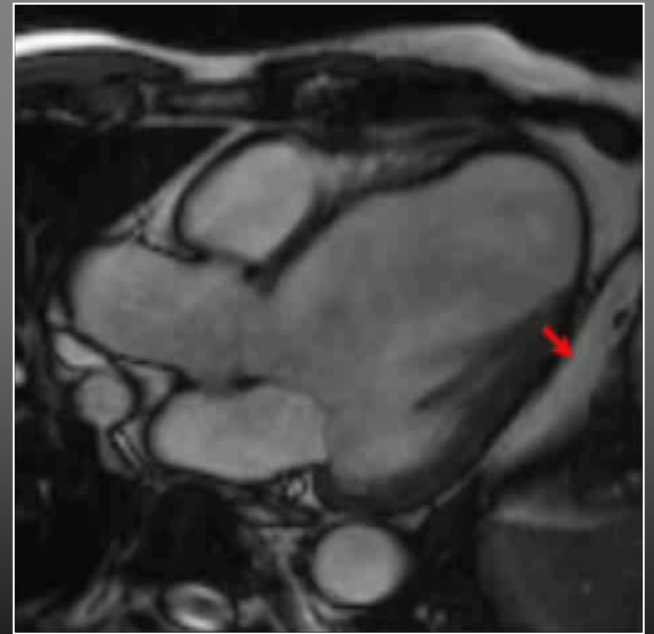
STICH Trial addresses ISCHEMIA more than widely scarred FAILING VENTRICLES, as CABG ALONE may improve wall motion abnormalities, only IF, asynergic stunned myocardium is viable.

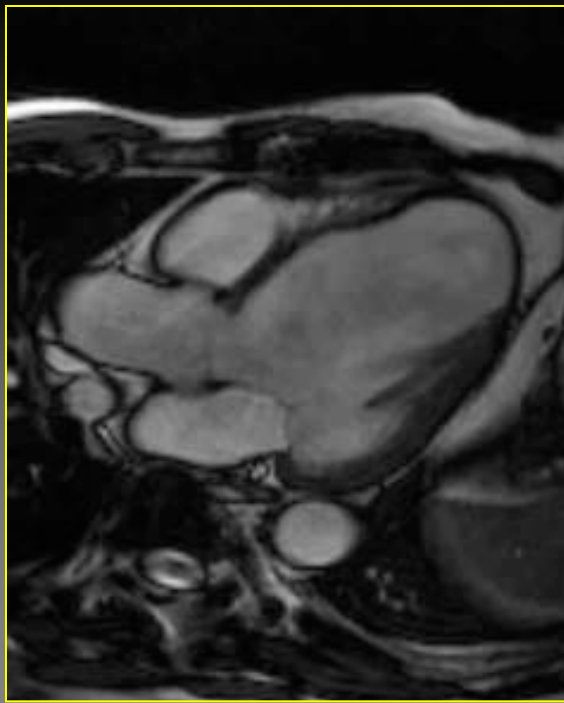
In majority of cases, after M.I, HF is directly linked to the extent of irreversible asynergic LV scar when it involves : 20-25 % of LV area ... Gorlin 1967 or 40-50 % of LV perimeter ... McKay 1986.



LVEF 24 %
EDVI 148 ml/m²
ESVI 112 ml/m²

M.R.I





Why ischemic LV is failing ?

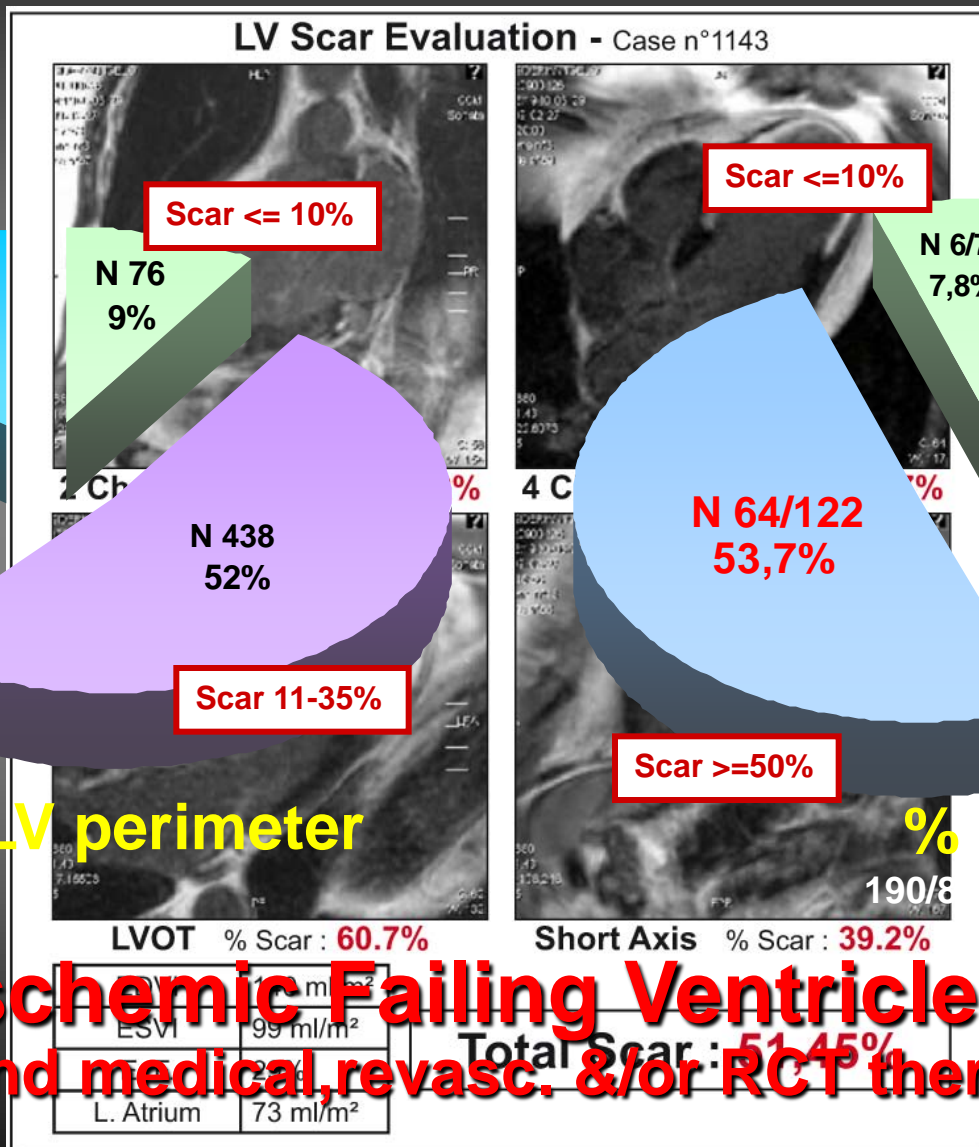
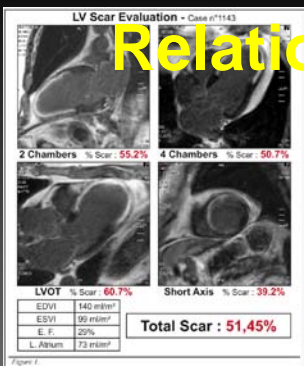
« *The LV remodelling* »

“... it has been possible to **quantify** the degree of heart disease leading to ventricular dilatation : when the myocardium, in an aneurismal area, functions improperly or has been replaced by fibrosis (**asynergy**) in **20 to 25 %** of the surface area of LV, the extent of shortening required of the remaining functioning heart began to **exceed physiological limits...**”

*There are two types of **ASYNERGY** : regional **AKINESIS** (total lack of wall motion), and regional **DYSKINESIS** (paradoxical systolic expansive wall motion)».*

Relationship Infarct Size / advanced Heart Failure*

840 Gadolinium Late Enhancement Maps of scar extensions after MI



Scar >= 50%

N 122
14,5%

N 204
24,5%

Scar 36-49%

Scar <= 10%

N 76
9%

N 438
52%

Scar 11-35%

Scar <=10%

N 6/76
7,8%

N 64/122
53,7%

Scar >=50%

Scar 11-35%

N 51/438
11,6%

Scar 36-49%

N 69/204
33,8%

% of scared LV perimeter

% of AHF

190/840 patients (22%)

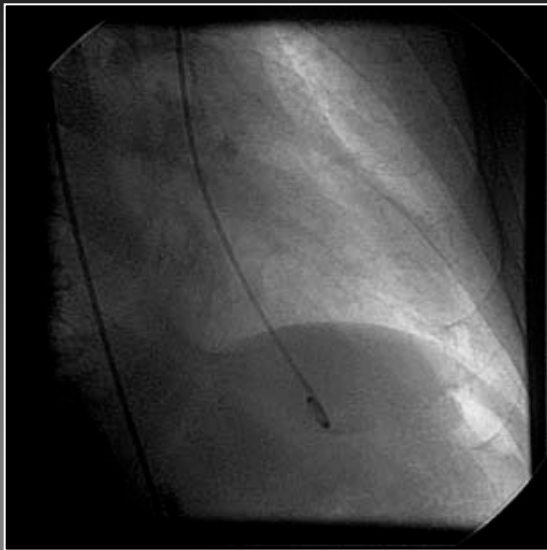
Ischemic Failing Ventricles
beyond medical, revasc. &/or RCT therapies

* Advanced HF = chronic HF III/IV, acute HF, & adv. HF ESC definitions

ASYNERGIC SCAR CAN BE DYSKINETIC (Gorlin 1967)

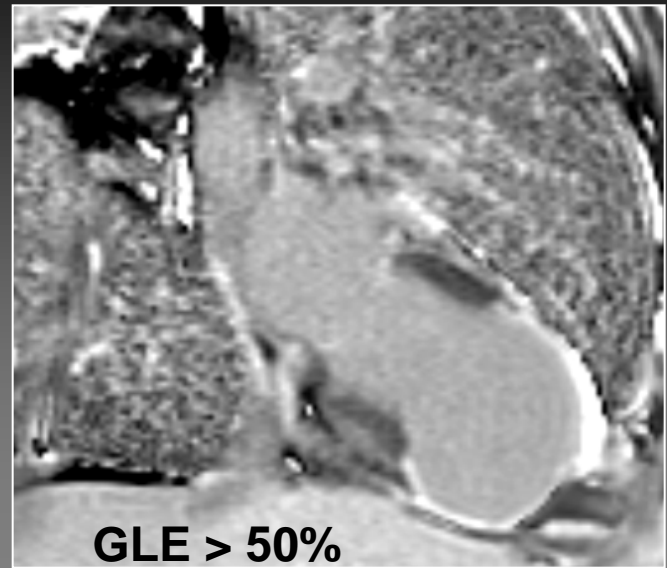
Depends on depth's scar

Dyskinesia



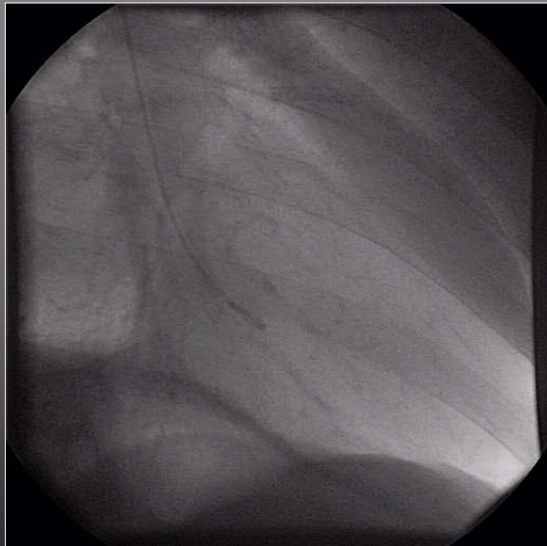
Thrombosed LAD

Transmural
necrosis



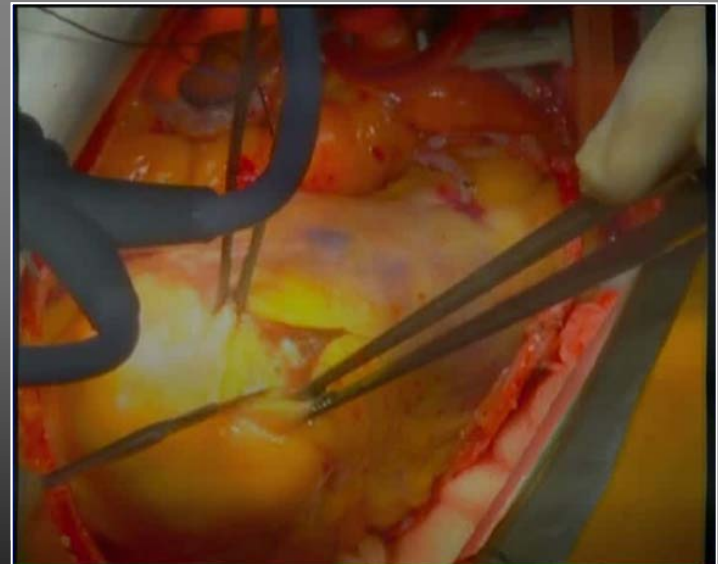
GLE > 50%

Akinesia



Recanalised LAD

Sub endocardial
necrosis



«LV remodeling does not allow viable myocardium to improve LVEF after revascularization»

LV WALL AFTER INFARCT SINCE CORONARY RECANALISATION

INFARCT SIZE (IS) AFTER SUCCESSFUL COR. REPERFUSION

F. Christian & al. *Mayo Clinic (Am J Cardiol)*

1991 : 18 scarred LV/20 pts (IS: 11 to 59 %)

1995 : 14 scarred LV/14 pts (IS: 6 to 58 %)

«After TIMI 3 flow 27% of LV dilatation occurs (15% early, 12% later or progressively).

Bolognese – American H.J 2001;142:684

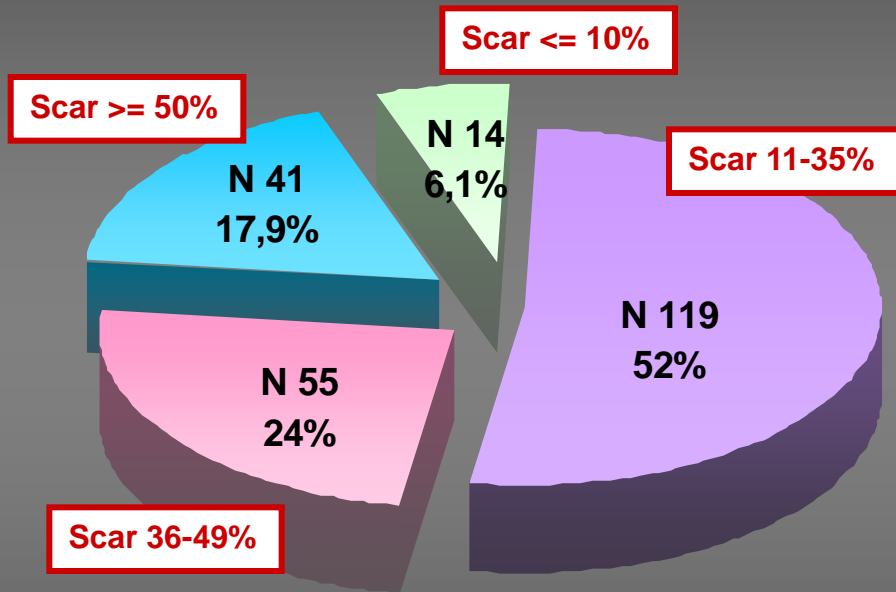
C.T.Monaco 2002-2008 : 1500 MR post MI : 90% GLE+

Recanalisation of culprit artery has changed necrosis size and depth ... BUT : « Once infarcted, LV wall remains ± diseased »

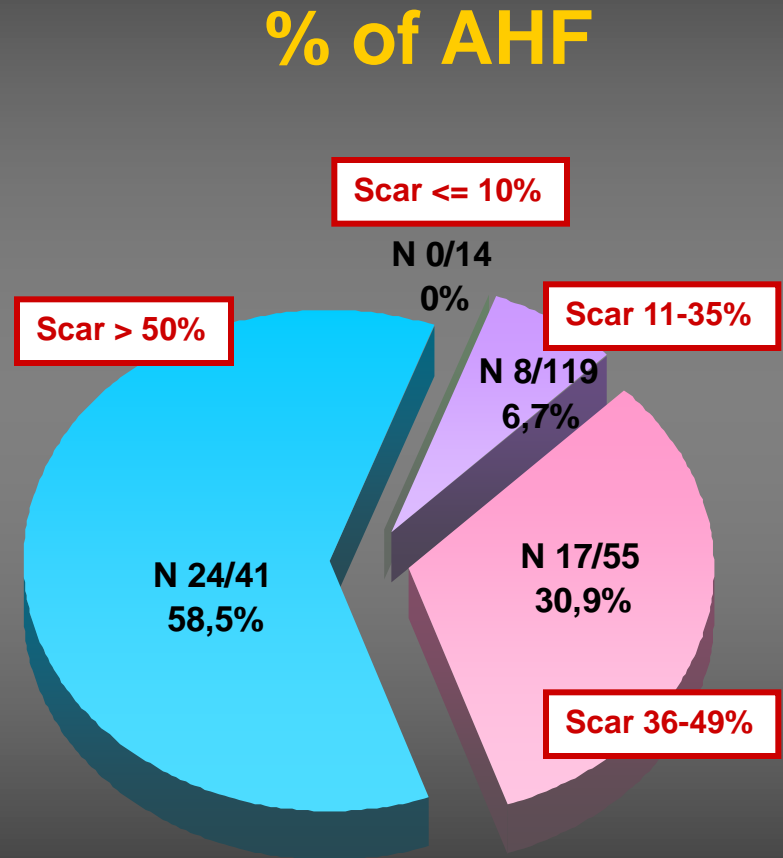
Relationship infarct size / advanced Heart Failure* II

N= 229 patients post MI

With P.C.I for recanalization



% of scarred LV circumference
(mean value GLE map)

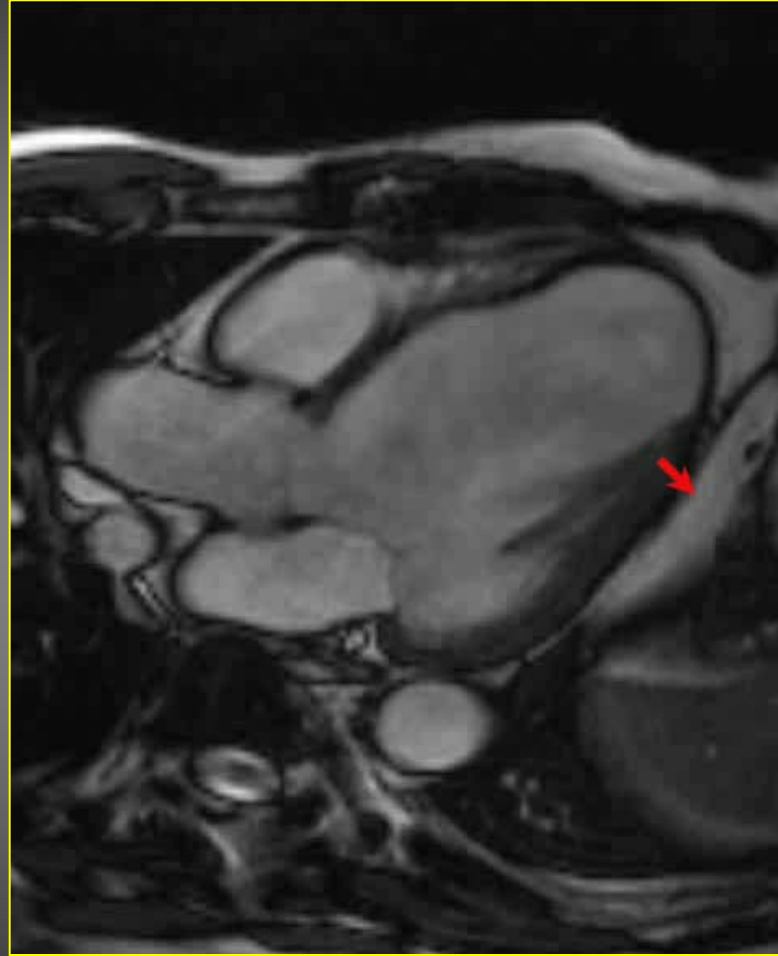


* Advanced HF = chronic HF III/IV, acute HF, & adv. HF ESC definitions

MECANISME DE L'I.C. POST INFARCTUS



«Systolic
eccentric
motion»

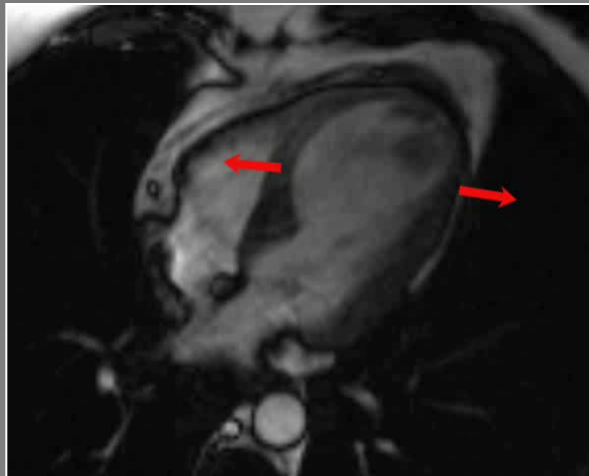


ie « REMODELING »

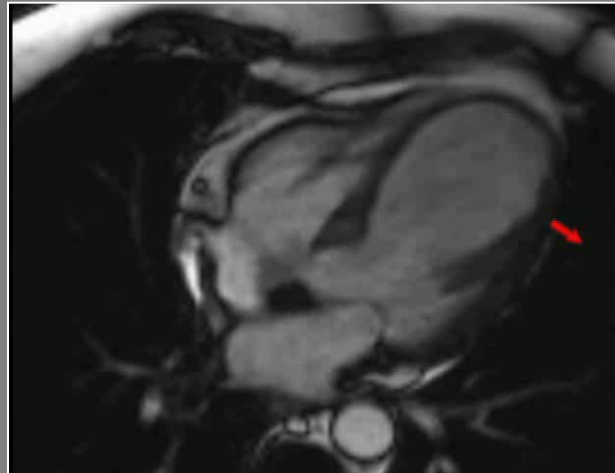
The trigger of ischemic HF is the asynergic scar ...

The MECHANISM is the deleterious SYSTOLIC ECCENTRIC MOTION*

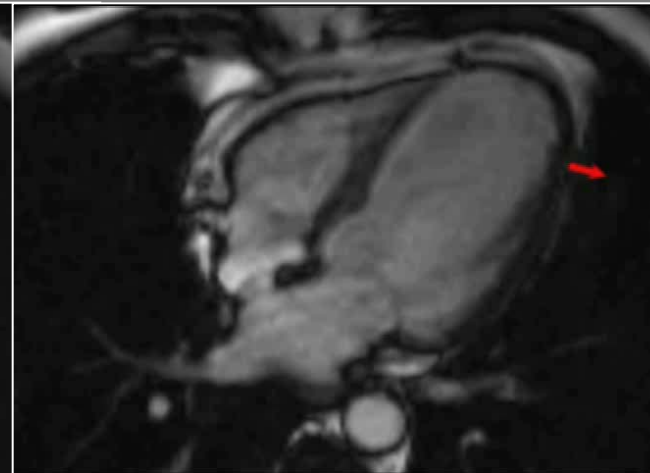
Mr. LEO. 61 y, ant MI August 5 2005 – PCI active stent, severe CHF → IABP



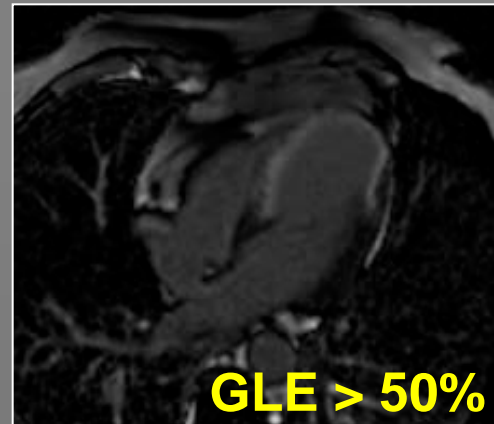
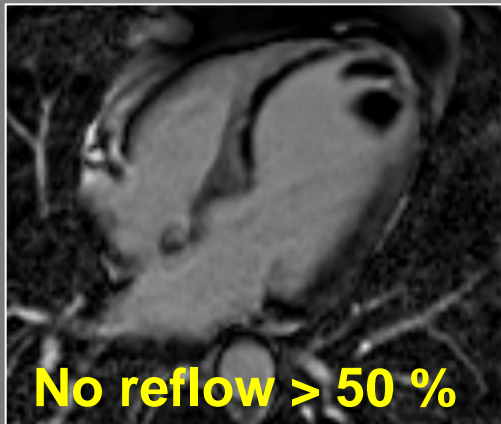
August 2005 (day 12)
ESVI : 47 ml/m²



Nov. 2005
ESVI : 55 ml/m²

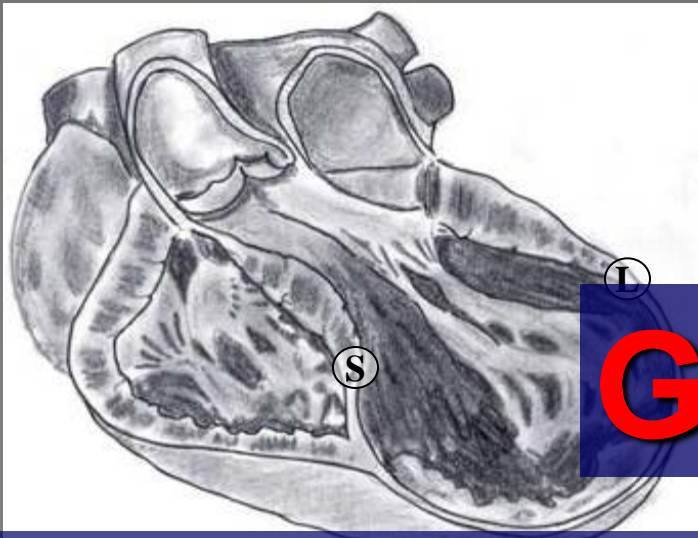


Dec. 2005
ESVI : 67 ml/m²

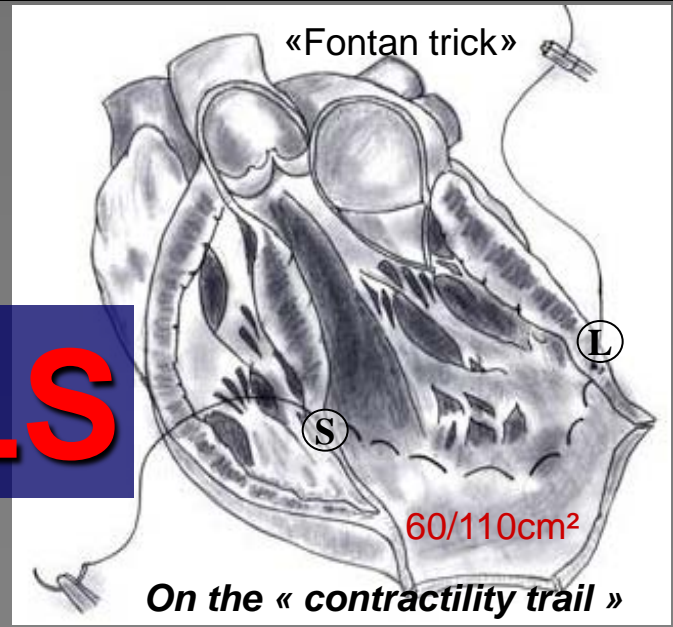


Asynergic Scar # 50% induces always L.V. progressive Dilatation

*** « The extent of shortening required of the remaining functioning heart exceeds its physiological limits ». Gorlin, 1967.**



L.V.R
E.V.P.P

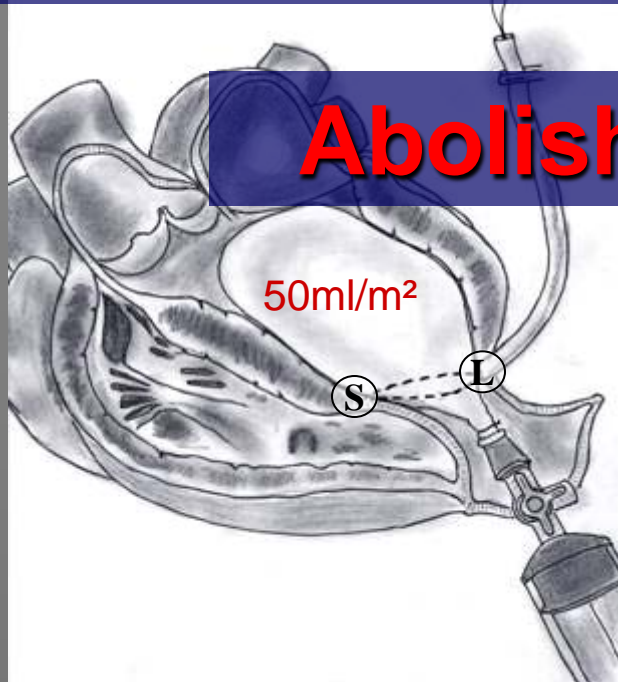


GOALS

S= Septum L=Lateral wall

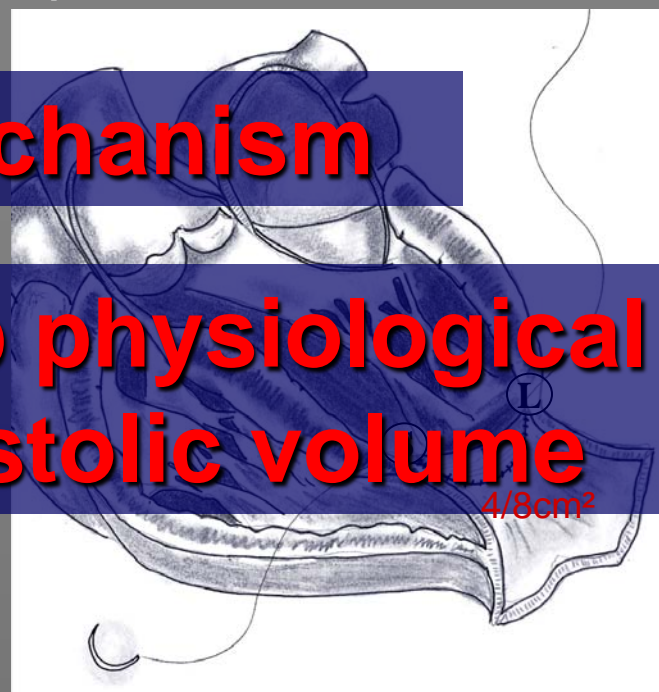
Suppress the cause

B) Endoventricular purse-string suture



Abolish the mechanism

Keep physiological diastolic volume



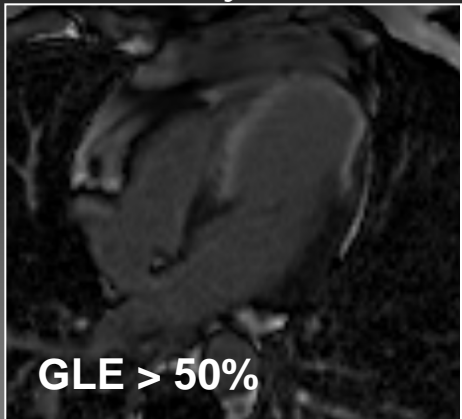
C) Curvature restoration and balloon sizing

D) Endoventricular patch reconstruction

WHY LVR WORKS ?

Mr. LEO... 61 y. Anterior M.I. Aug. 5 2005 PCI & Active Stent. CHF IV +-> I.A.B.P

Dec. 2005

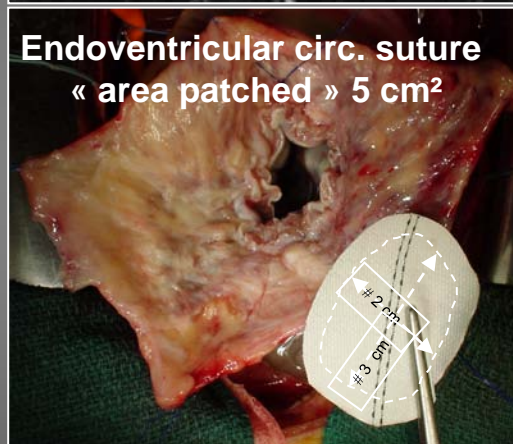
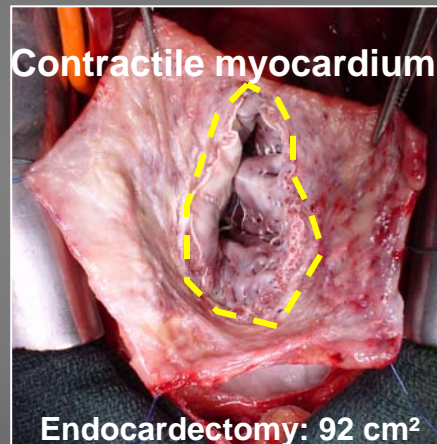
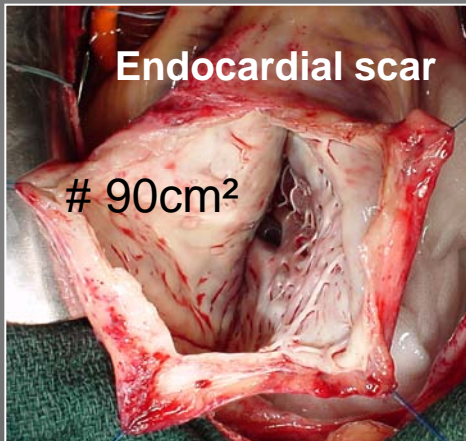


LVEF : 32 %
EDVI : 98 ml/m²
ESVI : 67 ml/m²
caDVI : 44ml

SI : 0.35



Jan. 2006



Jan. 2007



LVEF: 51 %
EDVI : 51 ml/m²
ESVI : 25 ml/m²

SI : 0.50



In severe remodeling L.V.R. (EVCPP) RESTORES :



Preop CHF III +
 LVEF: 22 %
 EDVI: 132 ml/m²
 ESVI : 102 ml/m²
 SV : 31 ml/m²
 CaDVI : 57ml/m²



Postop
 LVEF : 64 %
 EDVI : 78 ml/m²
 ESVI : 28 ml/m²
 SV : 50 ml/m²

«eccentric» (centrifugal) motion ≠ «concentric» (centripetal) contraction

◆ LV wall curvature & contractility

Mean Values	Preop	1mth Postop
n = 101		
*LVEF%	26.4 ± 5.6 ↗	40 ± 8
**LAdVlml/m ²	53 ± 22 ↘	40 ± 14

& IMPROVES :

◆ Systolic function*,

◆ Diastolic function**

... Global cardiac performances

NB in STICH : LAvol & Diastolic function not assessed

S.T.I.C.H. Criteria ...

not fulfilled

Investigator meeting chapter 3 pp17-18.

Trial Inclusion Criteria

Arm 2 : CABG/CABG + SVR

- Limited anterior akinesia
- Coronary anatomy suitable for revascularization

Trial Exclusion Criteria

- Patients with concurrent cardiogenic shock or requiring inotropic or intra-aortic balloon support
- Acute myocardial infarction within 30 days
- Combined anterior & inferior akinesia
- Both right & Cx territories supplied by diseased arteries not amenable to CABG
- Primary valvular heart disease clearly indicating the need for valve repair or replacement + 1 chronic Ao dissec.
- PCI planned for CAD treatment
- More than one prior cardiac operation
- Non-cardiac illness with a life expectancy < three years
- Non-cardiac illness imposing substantial operative mortality
- Waiting list for heart transplantation

12

48

17

15

5

4

6

3

1

3

4

117 IFV* :

106 in Advanced HF (NYHA III/IV VO² max ≤ 15 ml, ESVI > 60

2002-May 2008

11 in Acute HF (8 septal ruptures, 3 ventricular arrhythmias)

(Among 274 LVR)

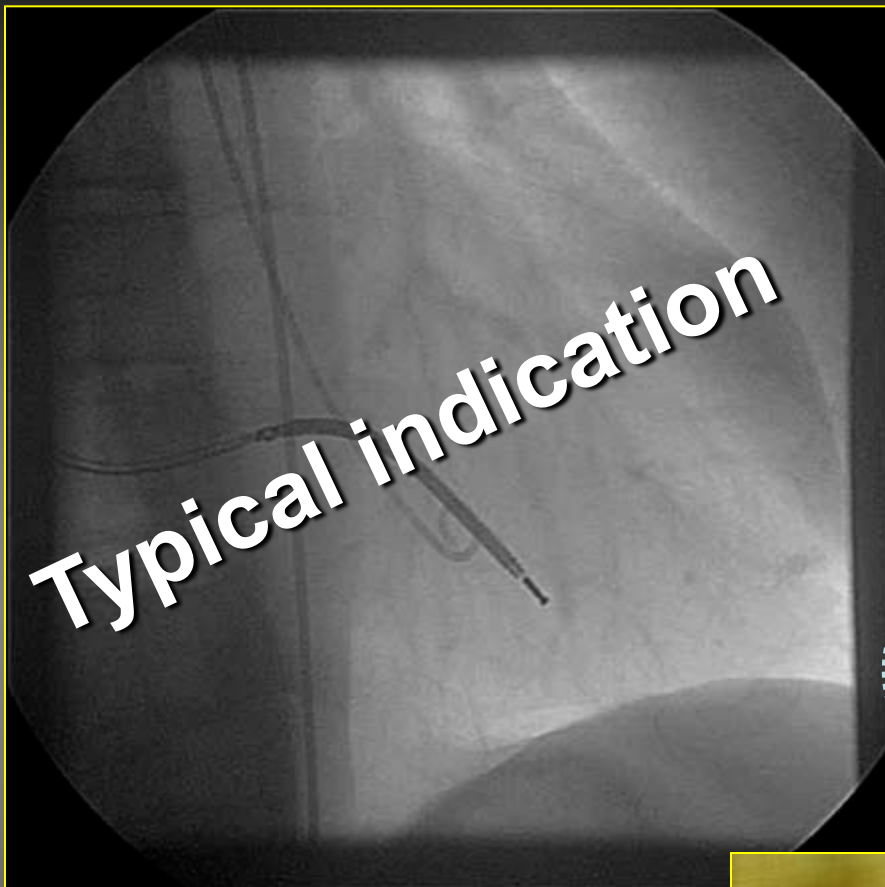
EF 26 %, EDVI 130 ml/m², ESVI 95 ml/m², scar 49% (35-77)

* 58 after PCI at acute phase of MI

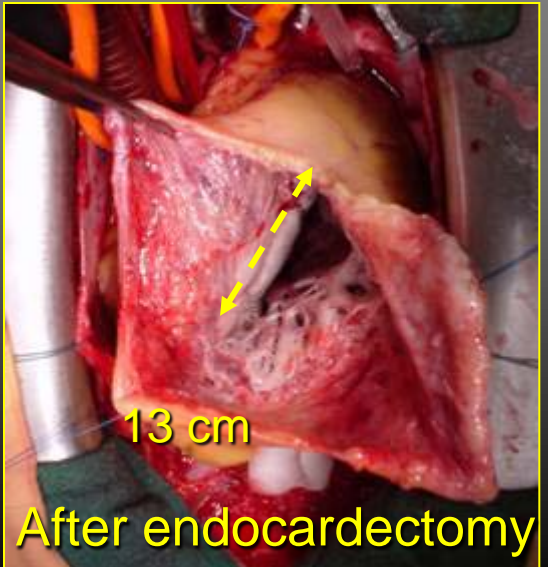
*age > 70 y : 49 pts (42%)

NB in STICH : NYHA Class IV 57pts/1000 !

Mr. LE. 47 y, waiting list H.T + A.I.C.D since 2001



E.S.T



Pre-op Dec 2002 :

EF : 28%

EDVI:144ml (angio)

ESVI: 96 ml (angio)

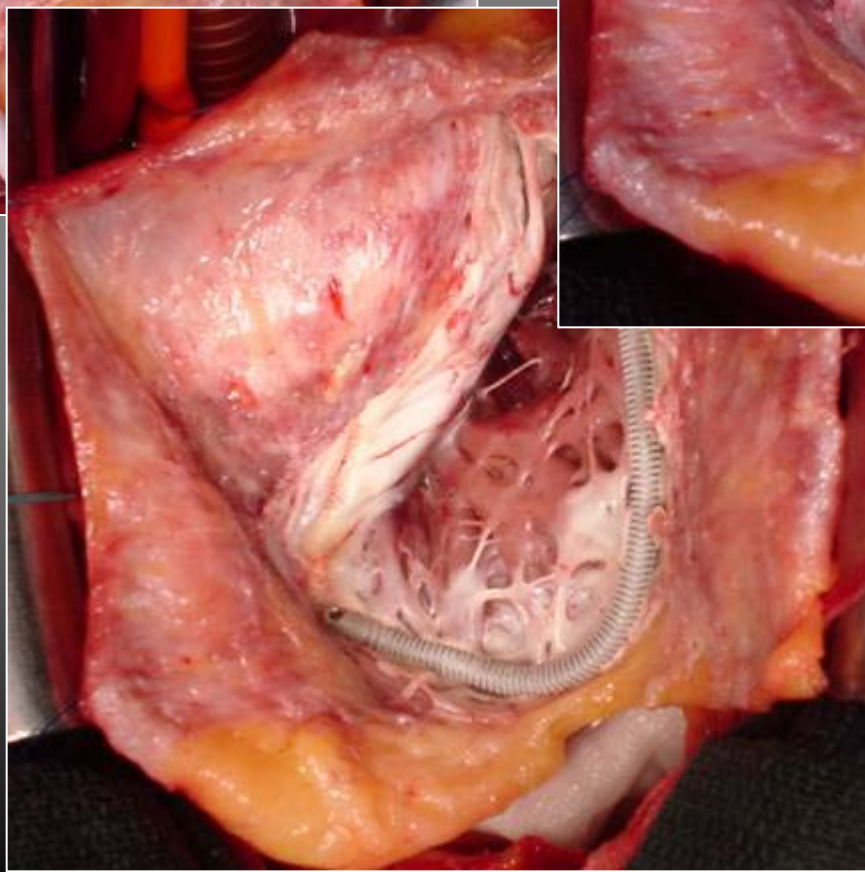
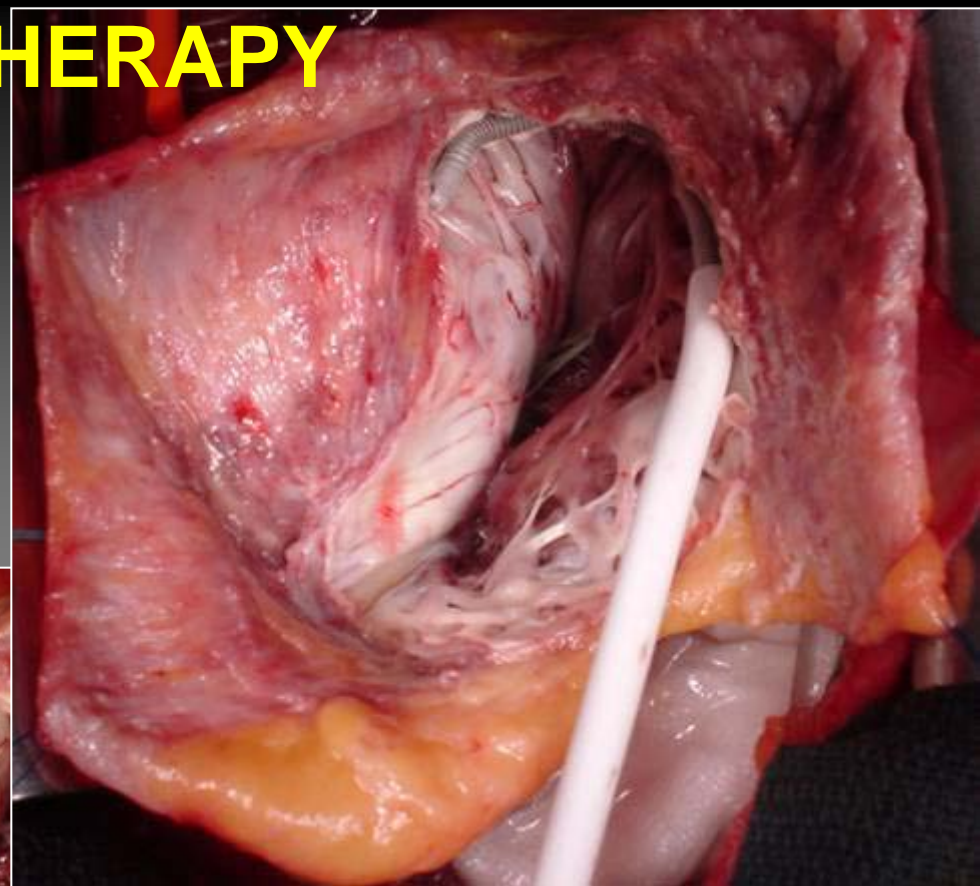
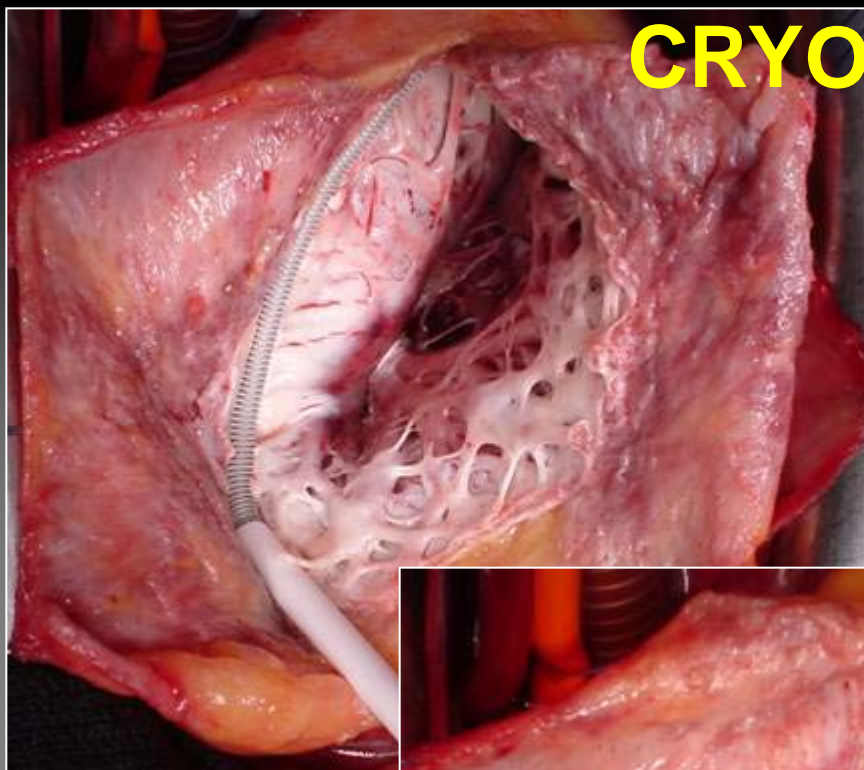
SV : 48 ml/m²

PVS +

SI : 0.32

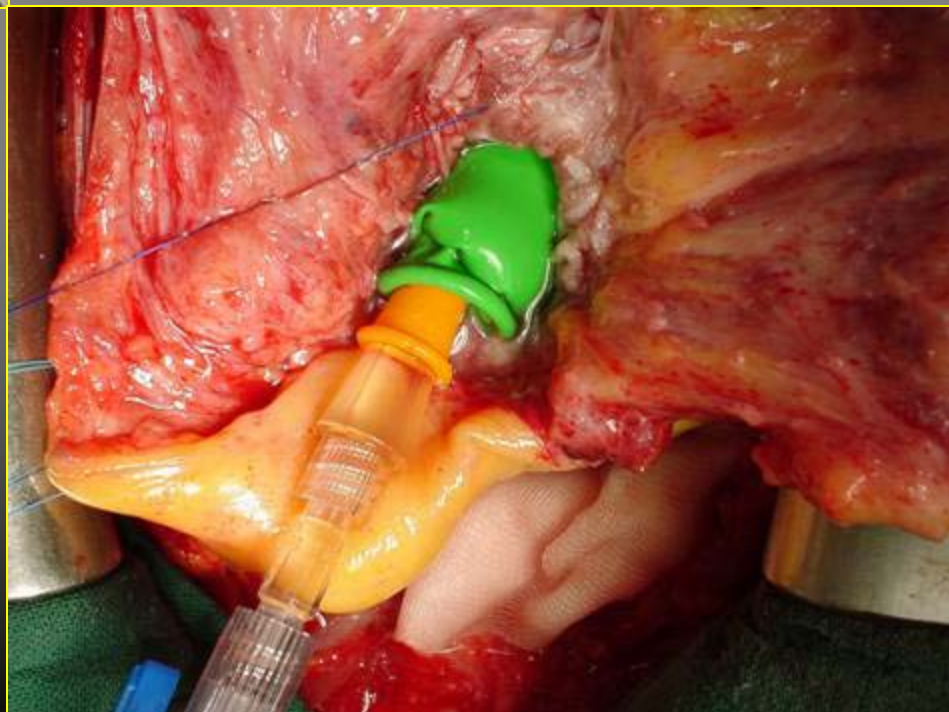
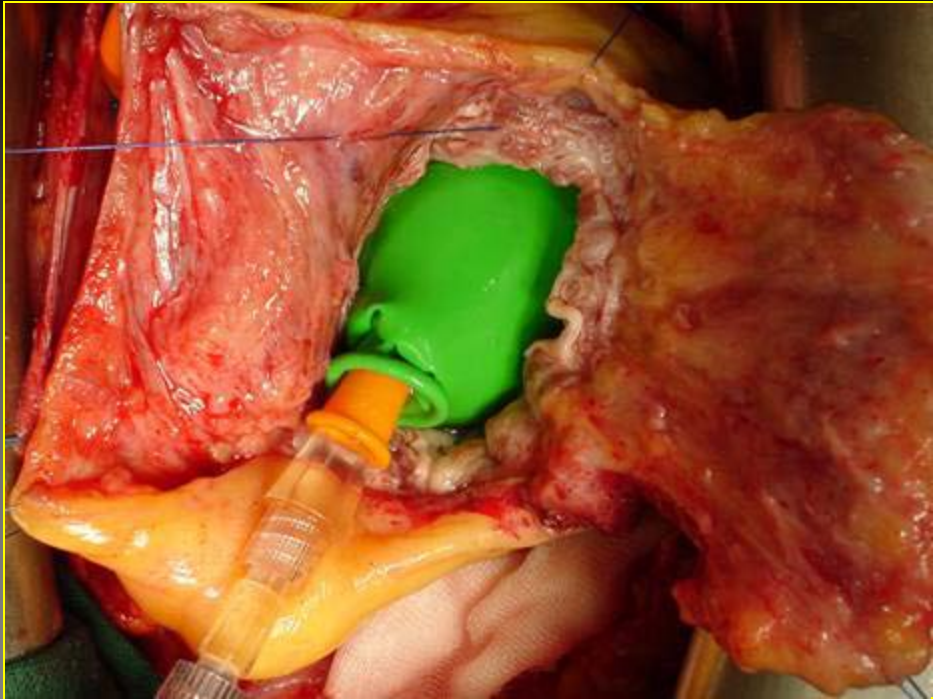
post SI : 0.55

CRYOTHERAPY



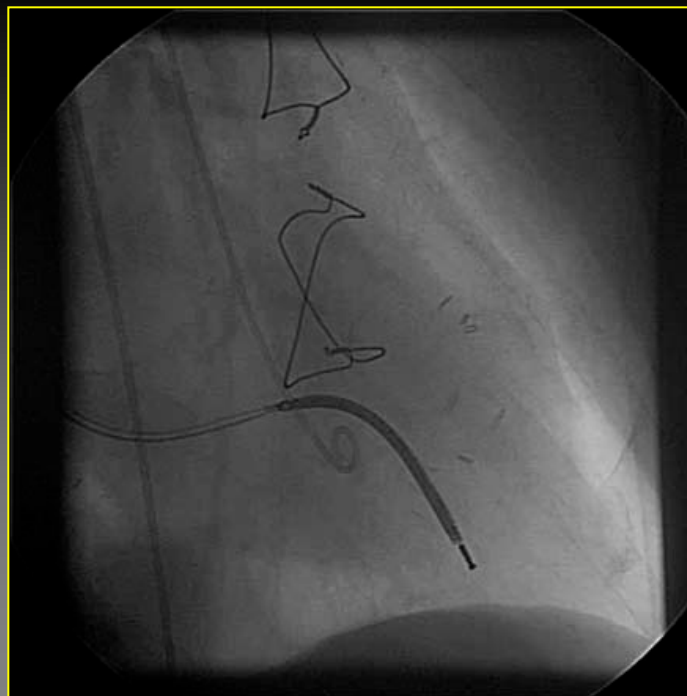
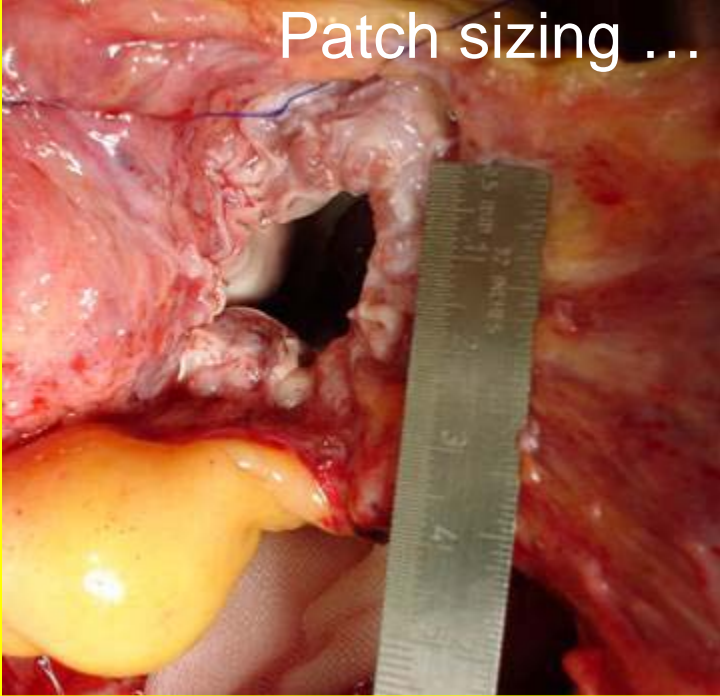
-70° 1-2 mn

Balloon volume sizing



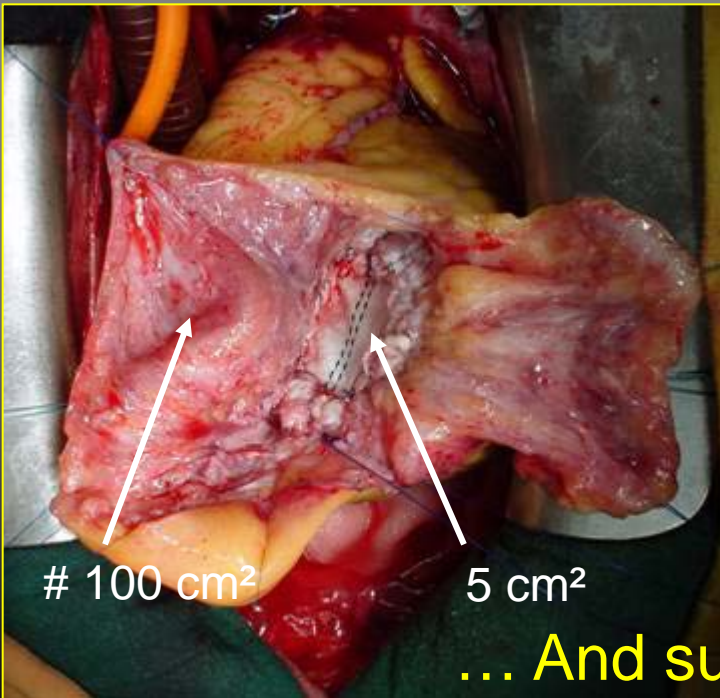
After tightening

Patch sizing ...



Mr. LE.
March 2006
Postop :
EF : 54%
EDVI: 74 ml
ESVI: 34ml
SV : 40 ml/m²
PVS ⊖

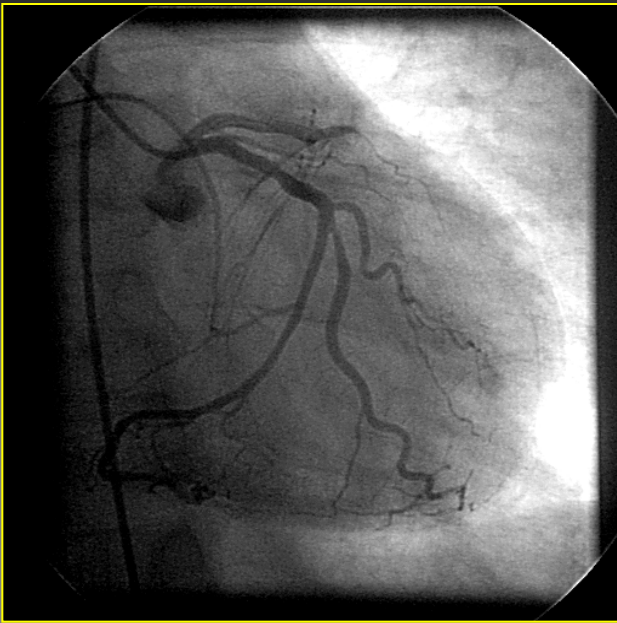
SI : 0.55



July 2008
EF : 55%

SI : 0.45

Mr. LOF. Obs N°1209, 82 years old, Drug resistant CHF IV +



CHF - date MI ?
Pulmonary oedema
at rest

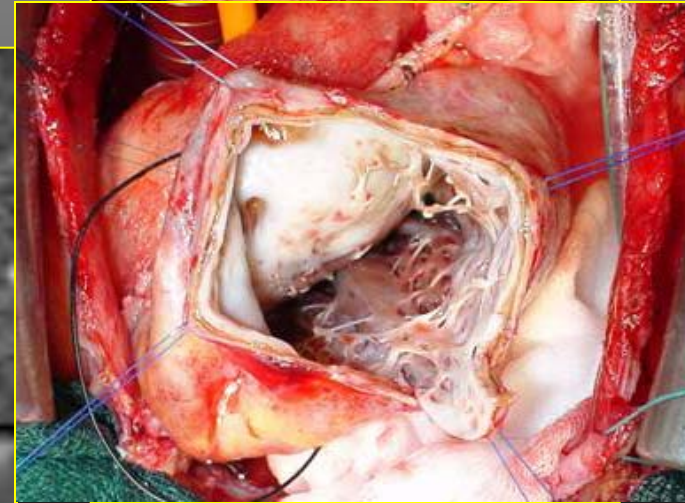
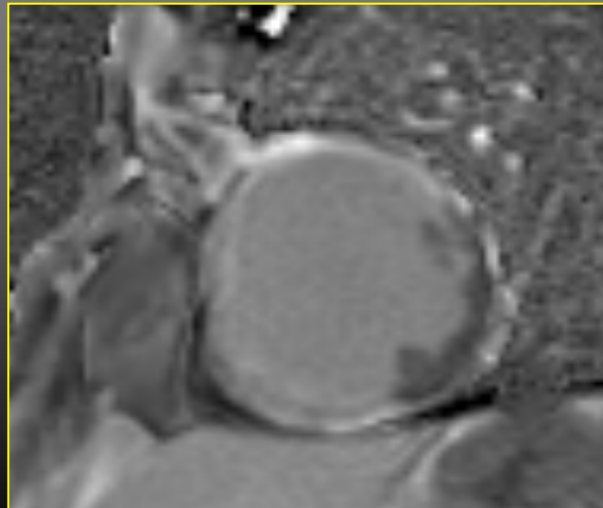
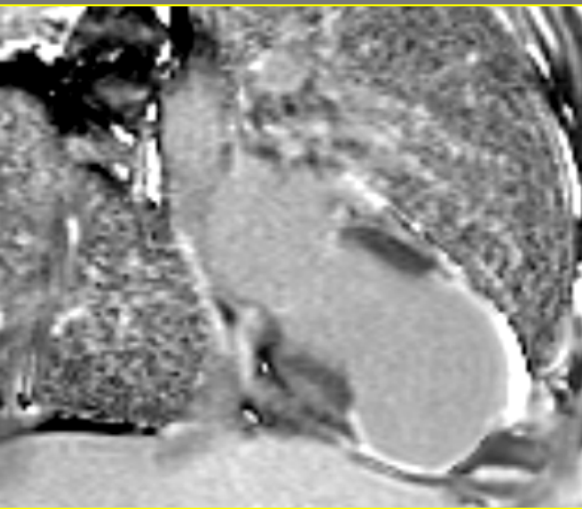
Pre-op :

EDVI : 121 ml/m²

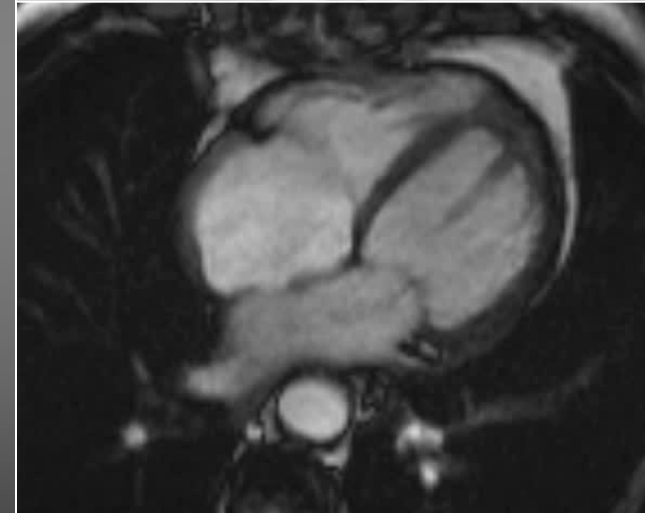
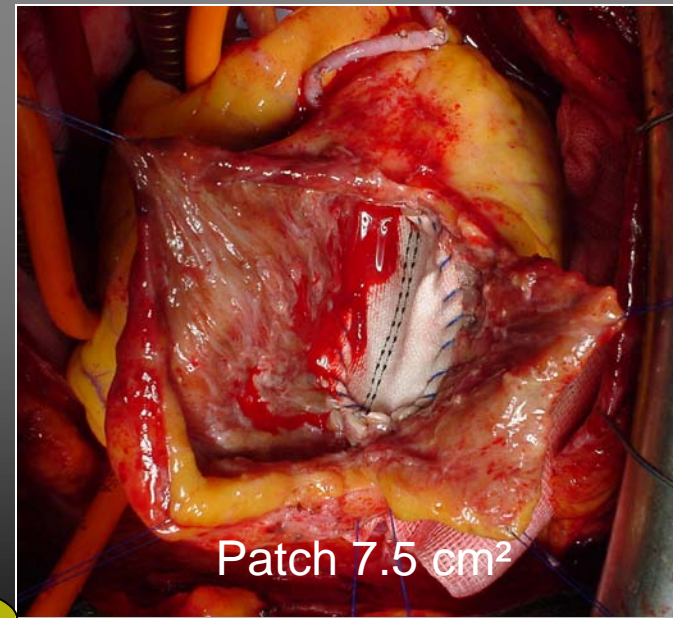
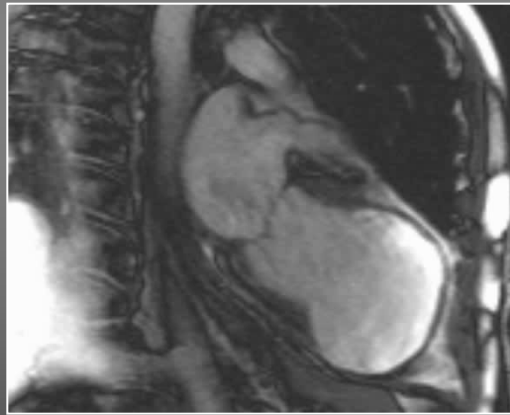
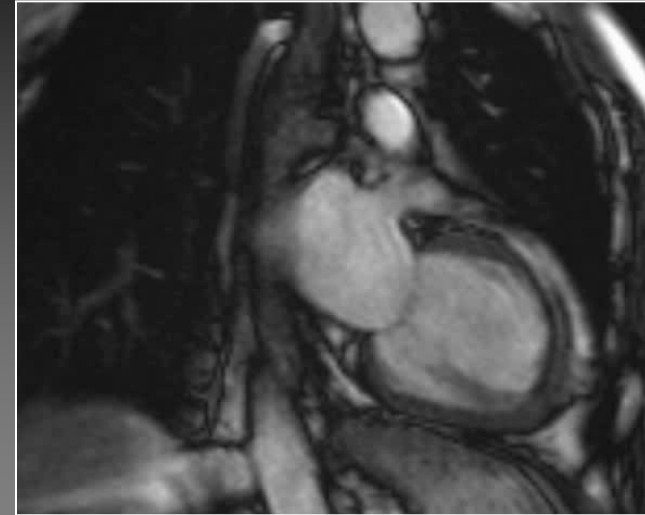
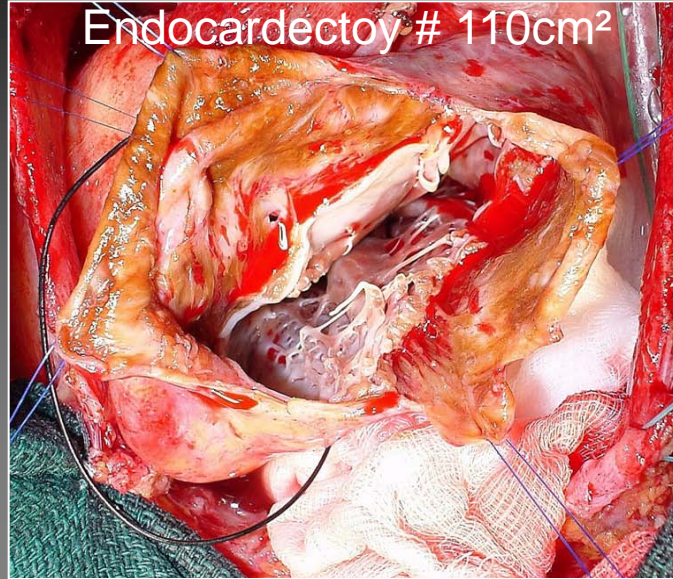
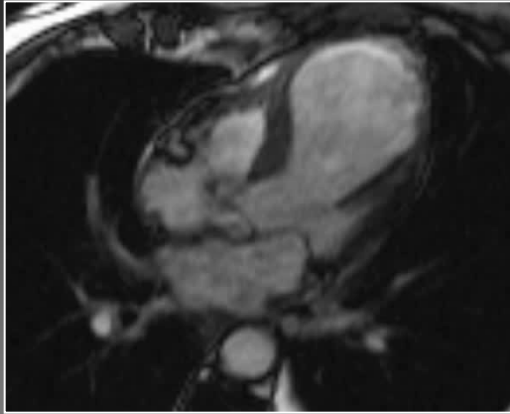
ESVI : 95 ml/m²

LVEF : 22 %

caDVI = 48 ml/m²



Mr. LOF. 82 years Case N°1079

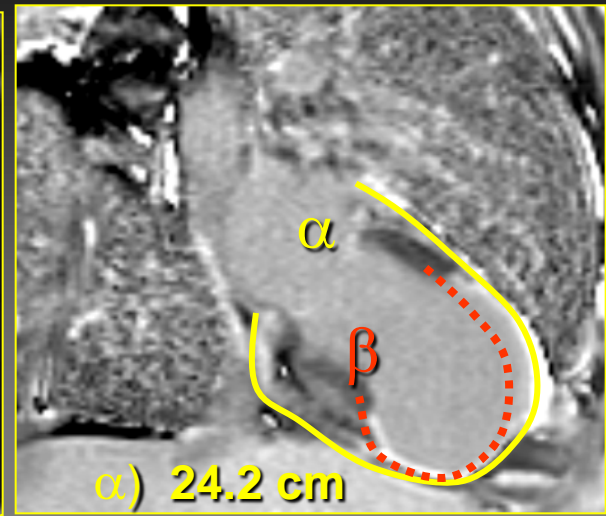


EDVI : 121 ml/m²
ESVI : 95 ml/m²
LVEF : 22 %
SV : 26 ml/m² **SI : 0.42**
LAVI : 50.8 ml/m²

EDVI : 54 ml/m²
ESVI : 25 ml/m²
LVEF : 53 %
SV : 29 ml/m²
LAVI : 41.5 ml/m²

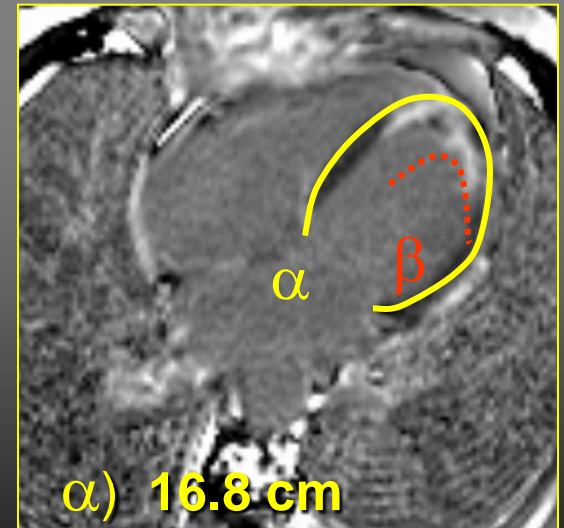
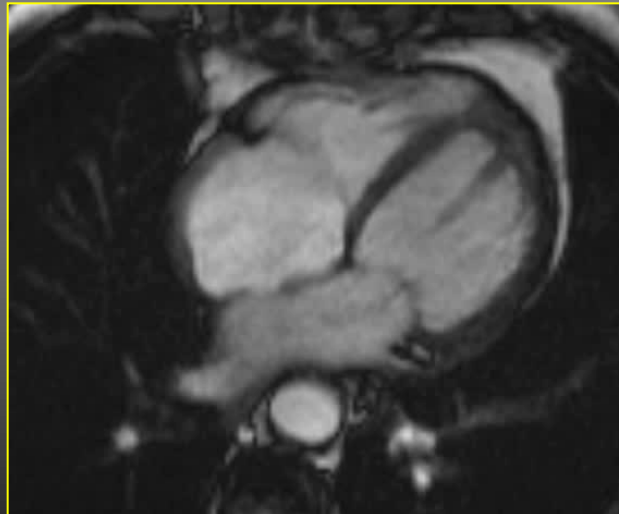
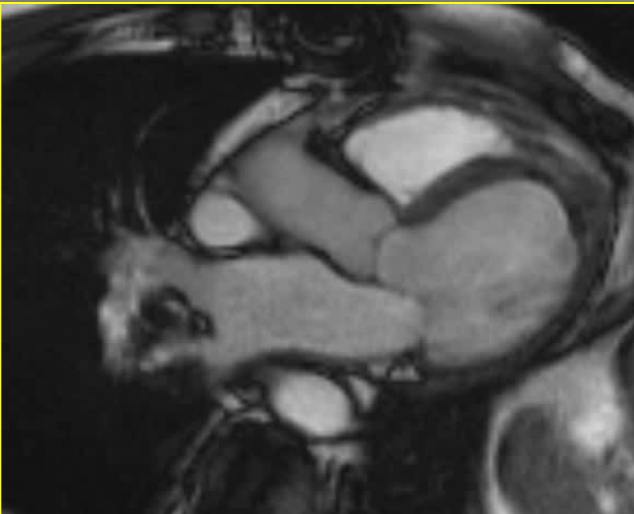
SI : 0.59

Mr. LOF. 82 years Case N°1079



α) 24.2 cm

Pre-op : EDVI : 121 ml/m² ESVI : 95 ml/m² LVEF : 22 % SV : 26 ml/m²
SI : 0.42 β) 16 cm $\beta = 66\% \alpha$
LAVI : 50.8 ml/m²



α) 16.8 cm

Post-op EDVI : 60 ml/m² ESVI : 30 ml/m² LVEF : 50 % SV : 30 ml/m²
SI : 0.59 β) 5.04 cm $\beta < 30\% \alpha$
LAVI : 41.5 ml/m²

Mr. MOR. 60 y (Obs. n° 1113) **A.M.I. Oct 03** **RCA Stenting**

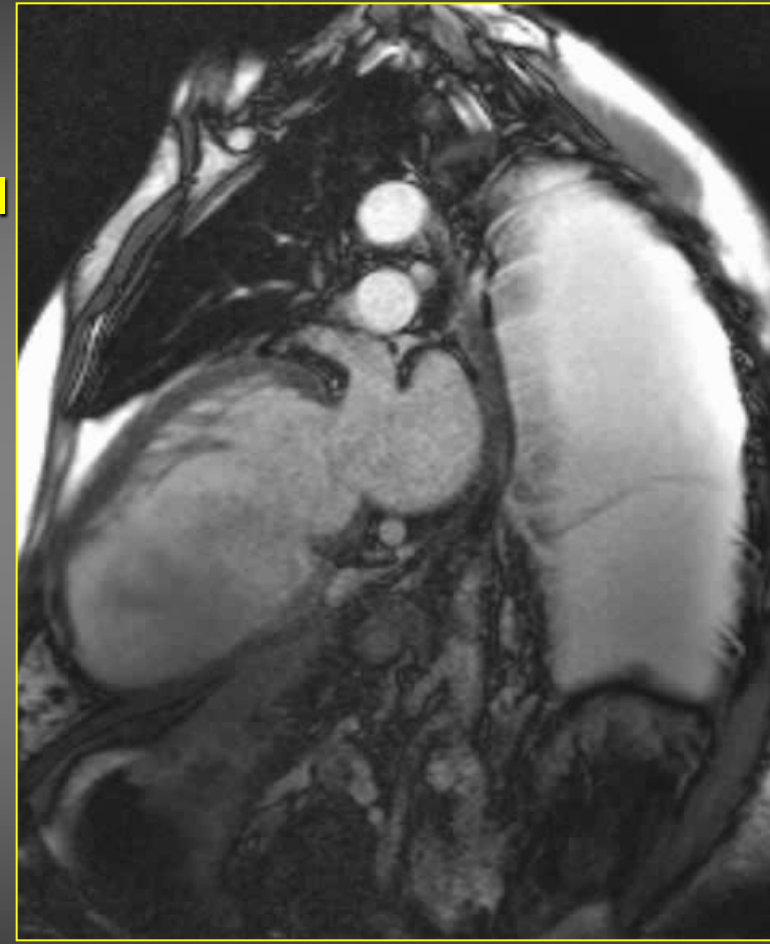
Respiratory insuf. (bronchiectasis) + diabete I.D



**Bi ventricular
Postero septal
aneurysm**



« MRII »

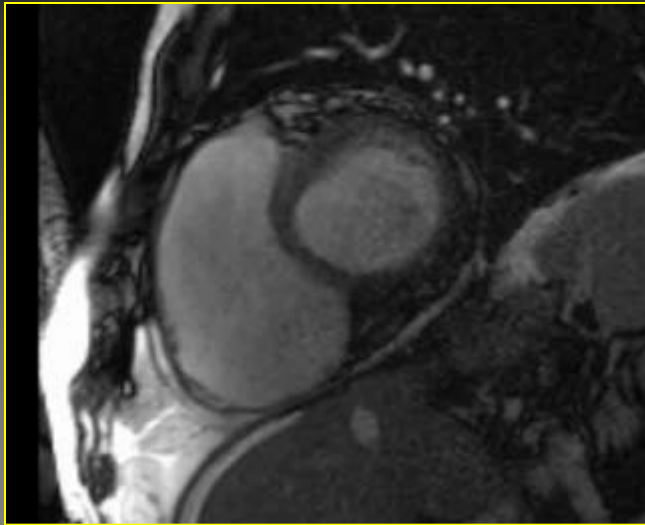


LVEF : 17 % **EDVI : 263 ml/m²** **ESVI : 219 ml/m²** **SI : 0.39**

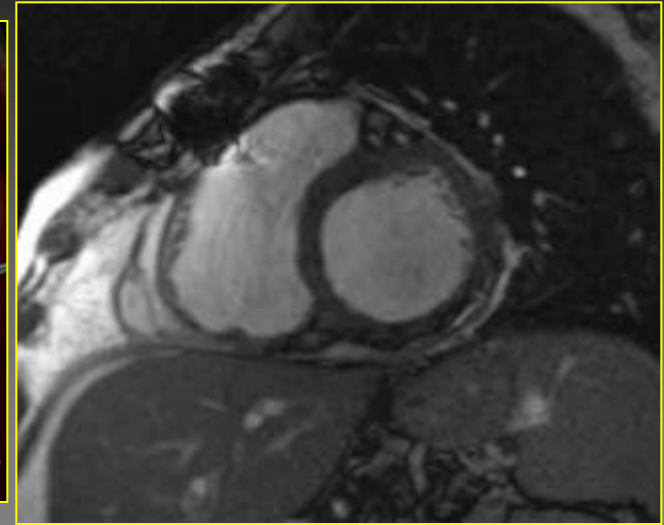
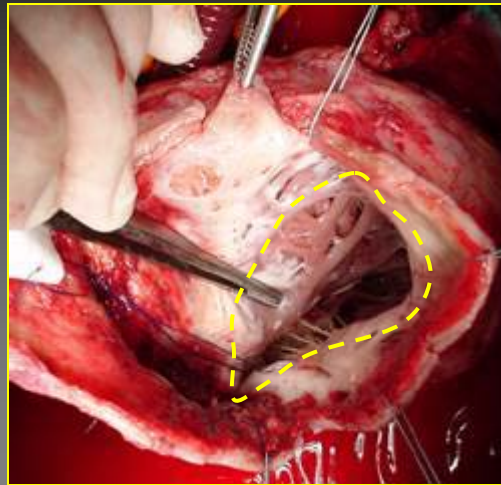
NB : LVEF before RCA recanalization \simeq 35 %. «Myocardial Reperfusion Injury»

Mr. MOR. 60 y (Obs. n° 1113)

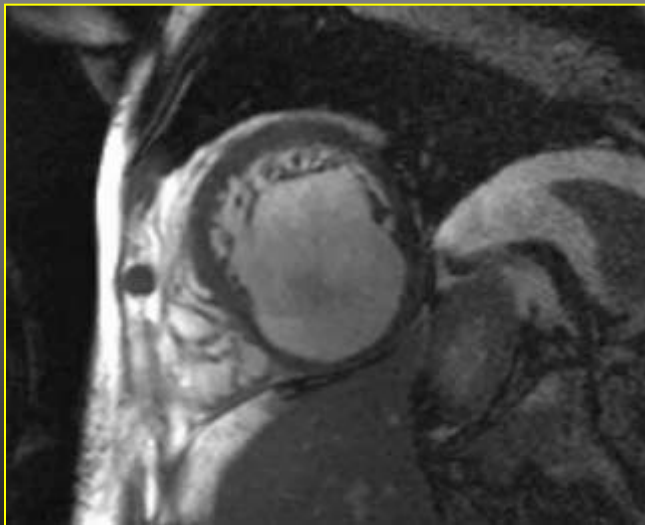
M.R. Induced I



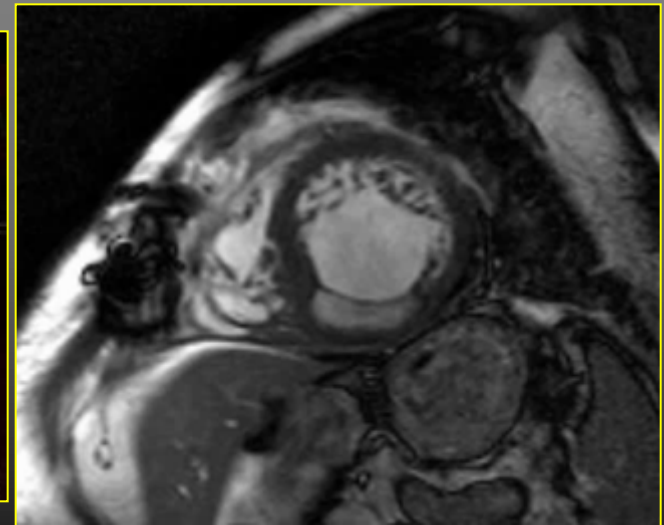
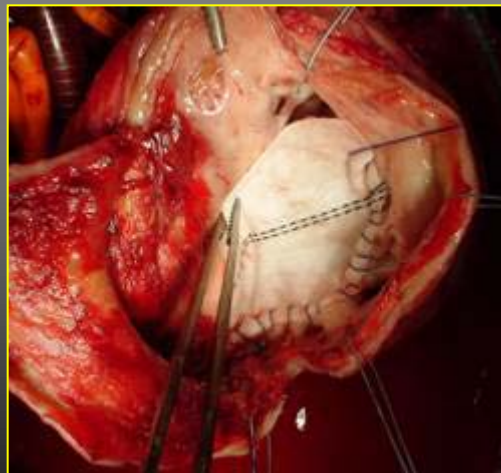
**LVEF : 17 %
EDVI : 263 ml/m²
ESVI : 219 ml/m²**



**LVEF : 30 %
EDVI : 127 ml/m²
ESVI : 89 ml/m²**



Preop 15/03/2004



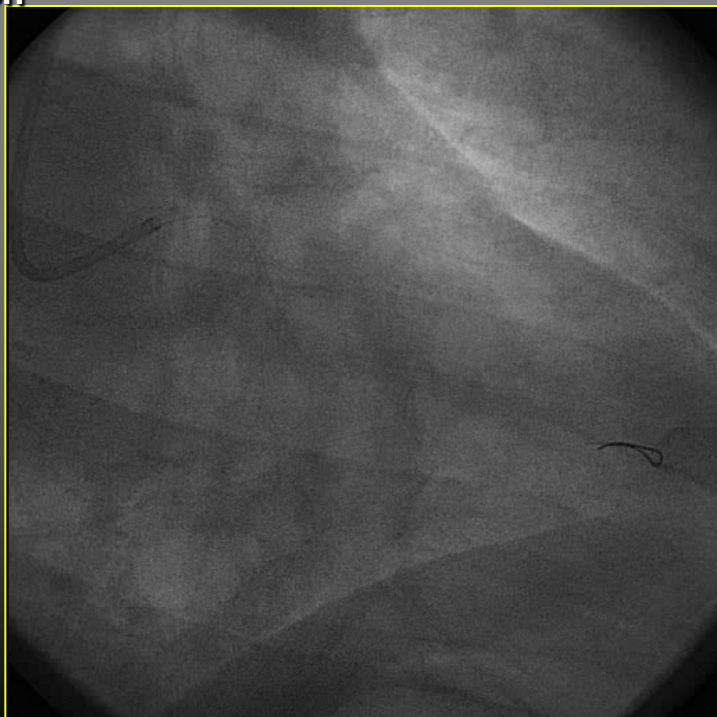
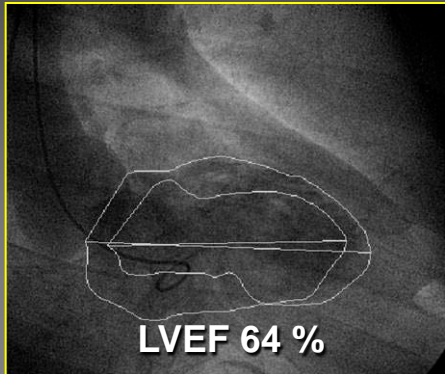
Postop 20/04/04

3. Impairment – (TIMI 3) - extension of MI

Mr. Lab. A.M.I 20/01/06



Coro 27/01/06
Cx occlusion

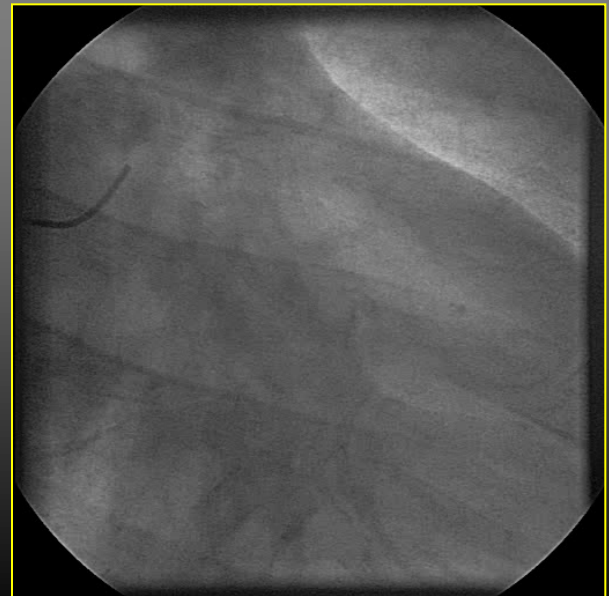


Desob &
Stent Cx

June 06



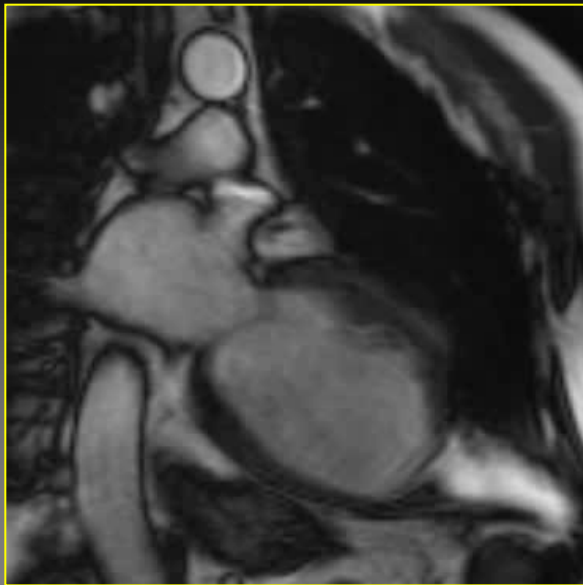
LVEF 38 %



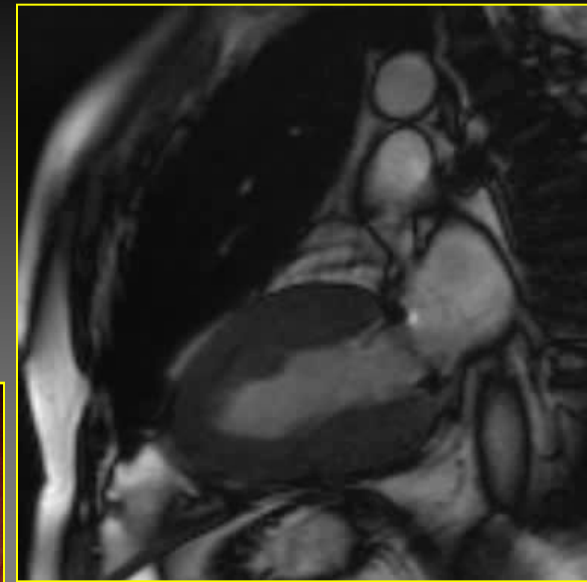
Patent Cx

Mr. Lab. 74 y. A.M.I 20/01/06
postero lateral aneurysm
after Cx recanalization 27/01/06

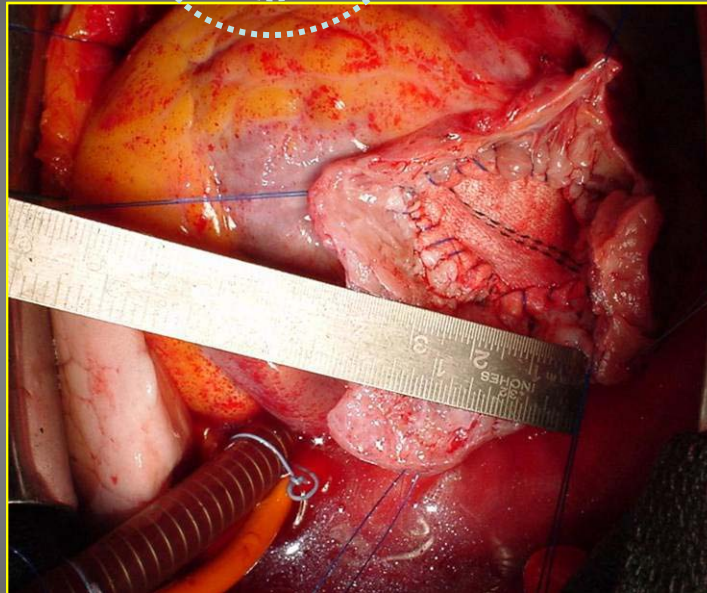
E.S.T



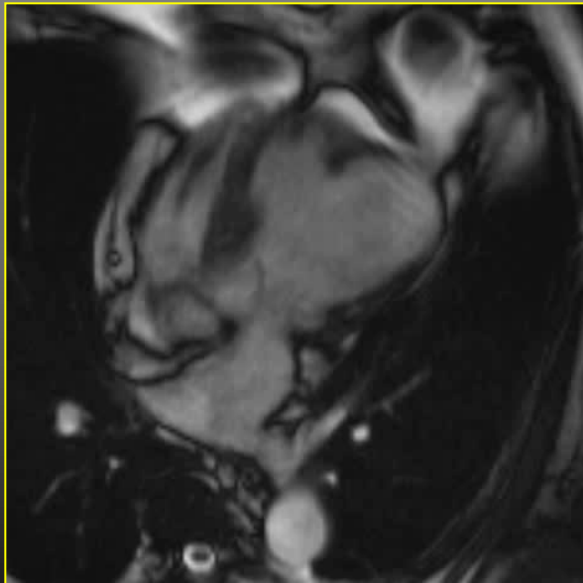
LVEF : 39 %
EDVI : 119 ml/m²
ESVI : 72 ml/m²



LVEF : 50 %
EDVI : 59 ml/m²
ESVI : 25 ml/m²



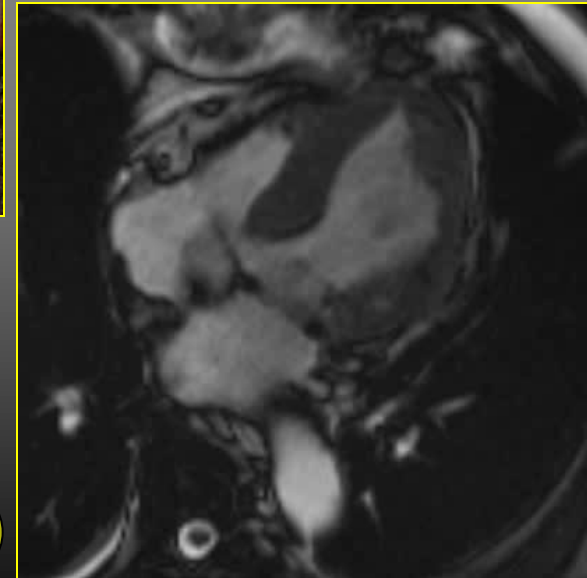
LVR 31/07/06



July 06

SI : 0.74
: 0.54 D

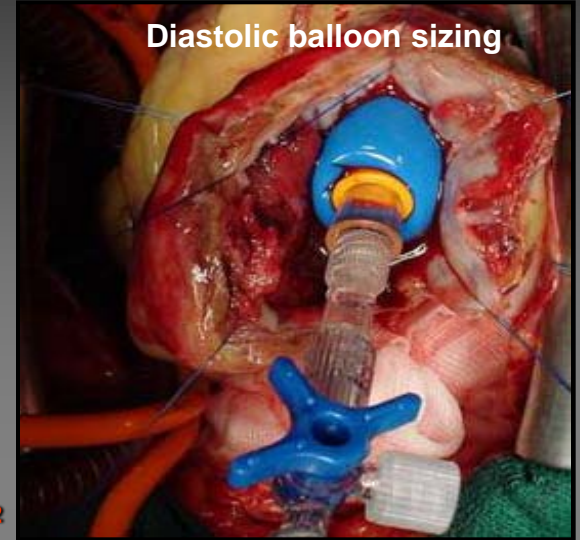
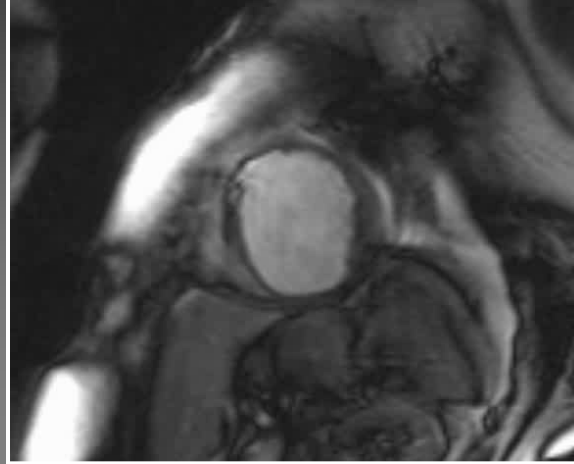
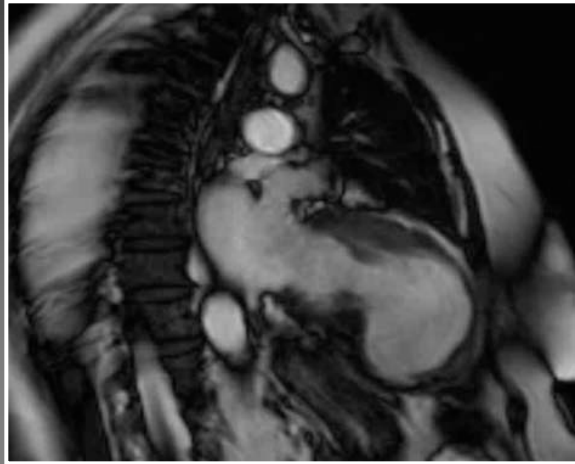
SI : 0.17
: 0.21 D



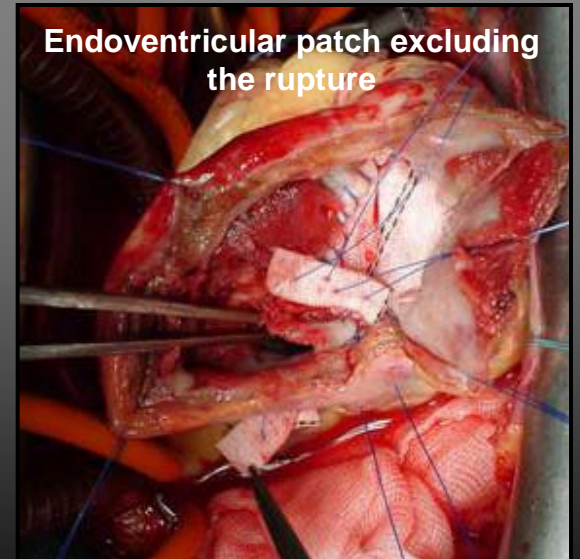
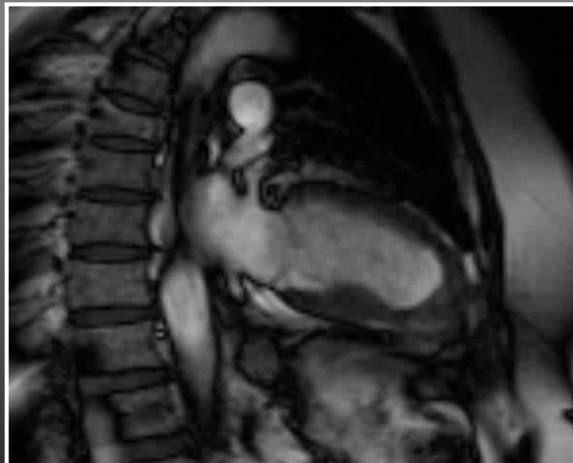
Sept. 06

ANTERO SEPTAL RUPTURE « EXCLUSION »

Mrs.BAR . 76 years ... 03/01/05 Septal rupture 1 month after successfull LAD recanalization



EF: 32 %, EDVI : 122 ml/m, ESVI: 83 ml/m², caDVI: 48 ml/m²



March 06 : EF : 56 %
EDVI: 40 ml/m²

Feb. 05 : EF : 43 %
EDVI: 41 ml/m²

2002 – May 2008 : **117 I.F.V**

LATE RESULTS

EARLY RESULTS

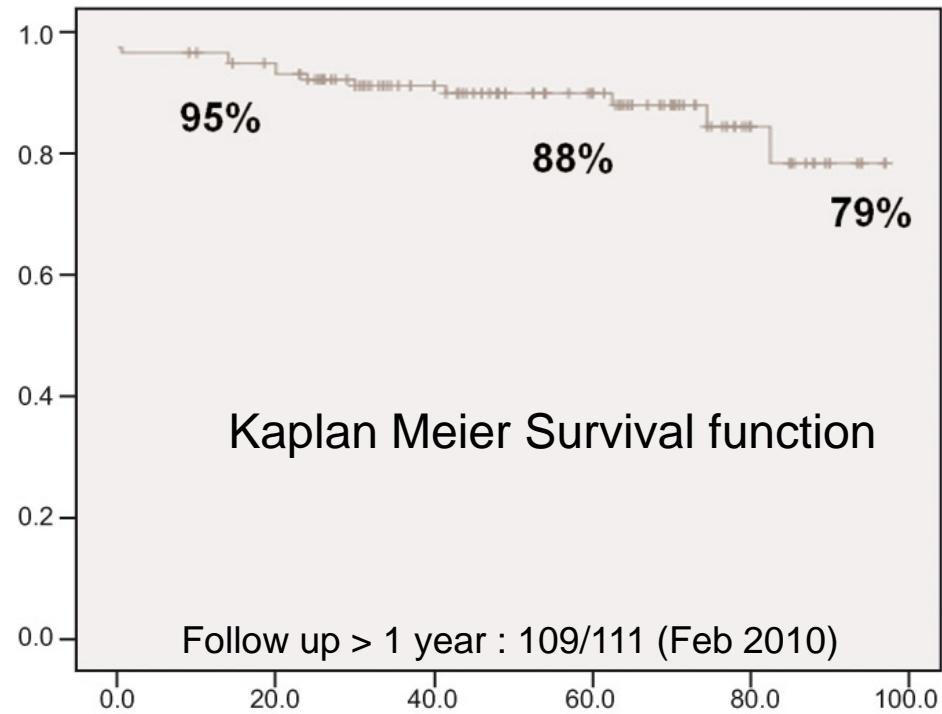
1st month deaths: 4 (3.5%)

SECONDARY RESULTS

Not improved pts : 8 (2 deaths 1st year)

3 CAUSES OF SECONDARY FAILURE
(remodeling recurrence) :

- Diastolic incompliance ... **balloon sizing**
(or to small LV volume)
- «Neglected» mitral insufficiency ... **per op checking**
- Continuum in remodelling ... **the delay**
 - & evolution of coronary disease
 - Questionable indication (bifocal scars)



Months	0	12	24	36	48	60	72	84	96
Subjects at risk	117	111	97	75	58	44	24	13	2

111 survivors over 1 year (95%) with progressive improvement

HEMODYNAMICS RESULTS IN 111 IFV AFTER ONE YEAR

Advanced heart failure n = 101

	Pre-op	> 1 month	> 1year
EF %	26_±4(9-34)	40_±8(21-64)*	44_±11(20-69)**
EDVol(ml/m ²)	130 _± 43(62-342)	84 _± 21(46-170)	85 _± 30(33-217)
ESVol(ml/m ²)	95_±37(45-289)	51_±17(24-118)*	48_±20 (15-128)***
LA Vol(ml/m ²)	53_±22(17-94)	40_±14(13-72)*	(37 _± 2 n=85)

* p<0.001, ** p = 0.44, *** p=0.25

Acute heart failure n = 10

EF %	41(32-50)	52(38-68))	54(38-68)
EDVol (ml/m ²)	79(54-122)	48(28-79)	69(32-105)
ESVol (ml/m ²)	46(31-83)	24(16-49)	33(9-66)
PAP (mmHg)	58.5(38-85)	34.6(30-49)	

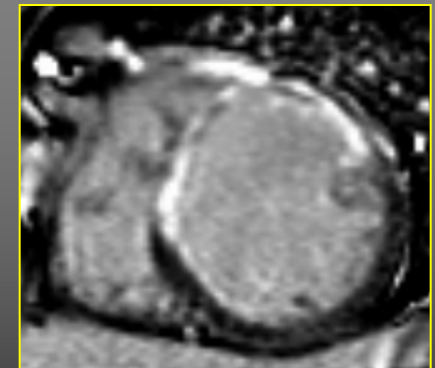
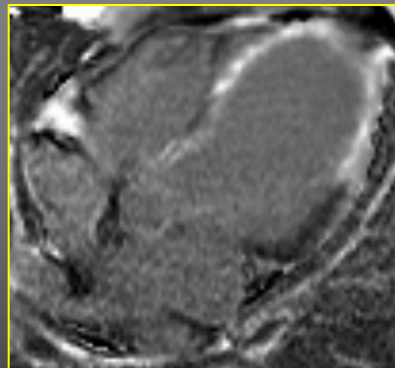
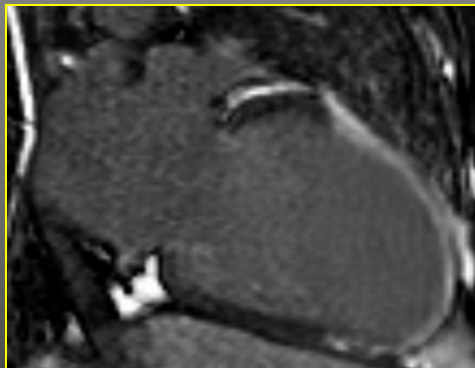
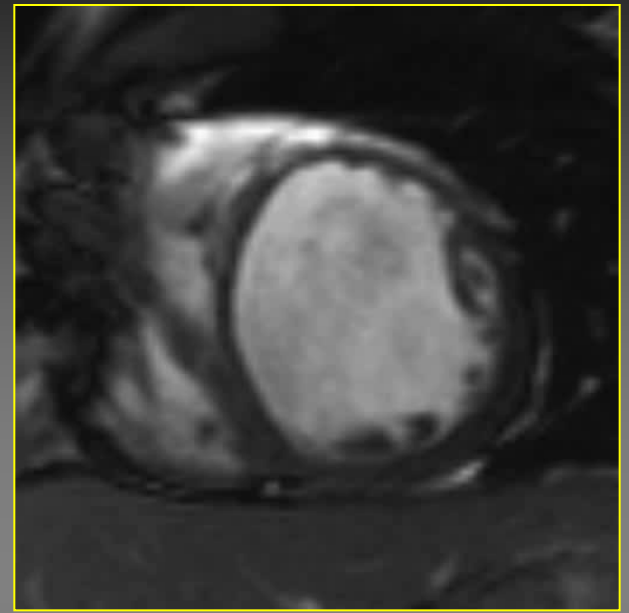
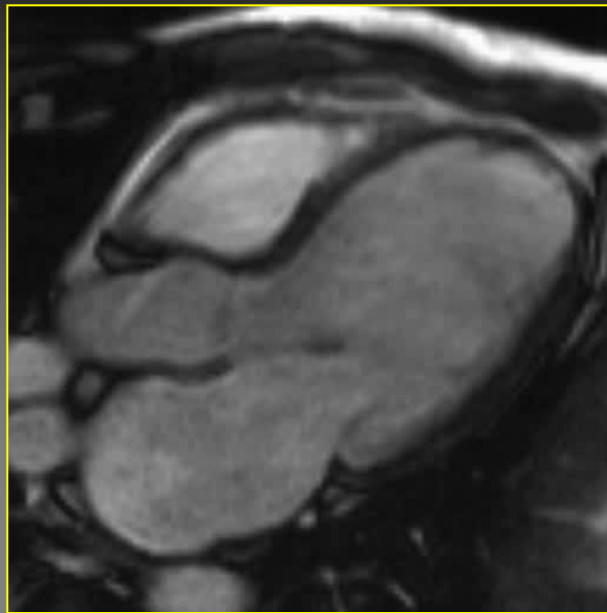
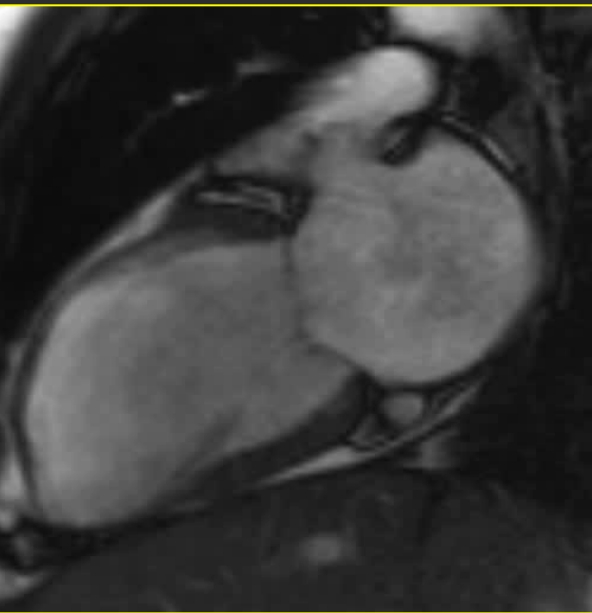
Post MI remodelling is durably reversible by E.V.P.P

NB In STICH : Diastolic function non assessed, EF not evaluated in post op period and ESVI (arm 2 group SVR) decreased from 83 to 67 ml/m² !

DISCUSSION

- Akinésies ?
- Reconstruction VG ou transplantation cardiaque

Mr Her... 46 Y, AMI Dec 2006 PCI + stent LAD. NYHA IV tracheal ste.



Feb 07: LVEF 27%, EDVI : 125, ESVI : 87, DAM 41 mm , IM 2+

Mr Her... 46 Y, AMI Dec 2006 PCI + stent LAD. NYHA IV tracheal ste.

Feb 07:

LVEF 27%,

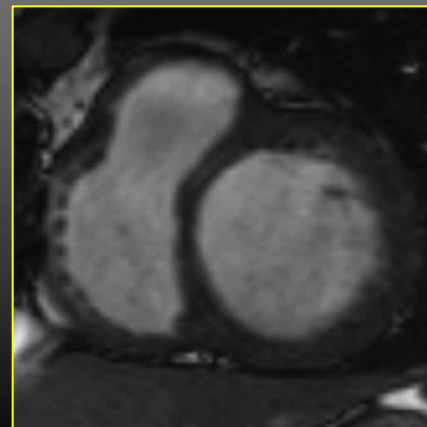
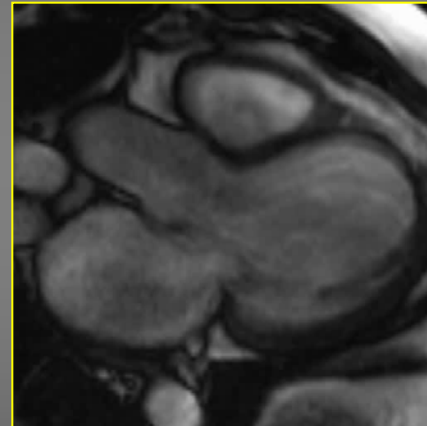
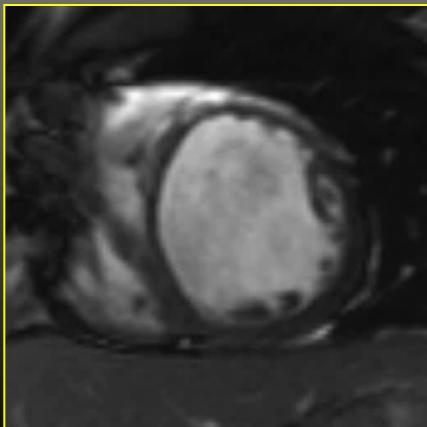
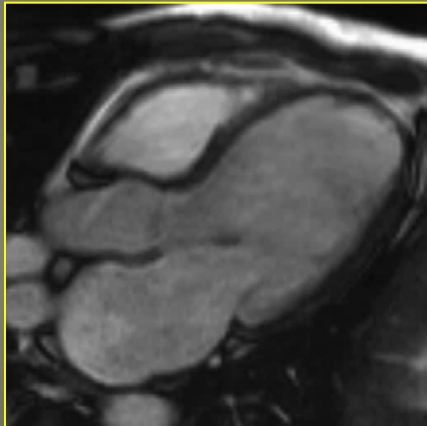
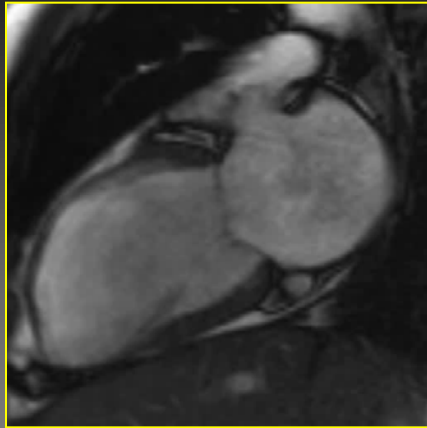
EDVI : 125,

ESVI : 87,

DAM 41 mm ,

IM 2+

LAVI 93ml/m²



June 08 :

LVEF 43%,

EDVI : 87,

ESVI : 52,

DAM 28 mm ,

IM < 1

LAVI 70 ml/m²

**Vie normale
NYHA I 06/10**

FEASIBILITY & GUIDING OF LVR based on G.L.E MAP

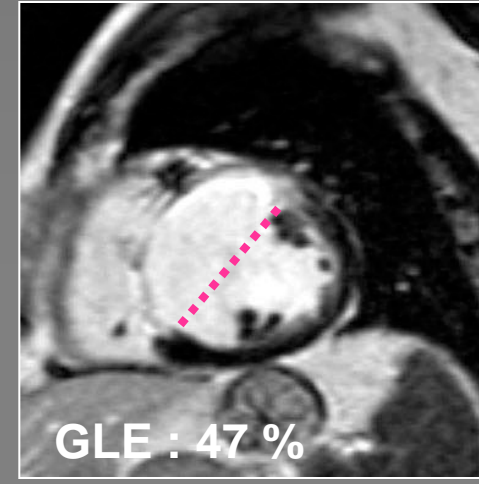
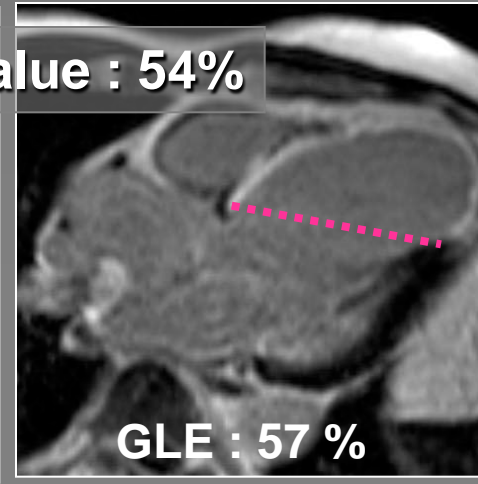
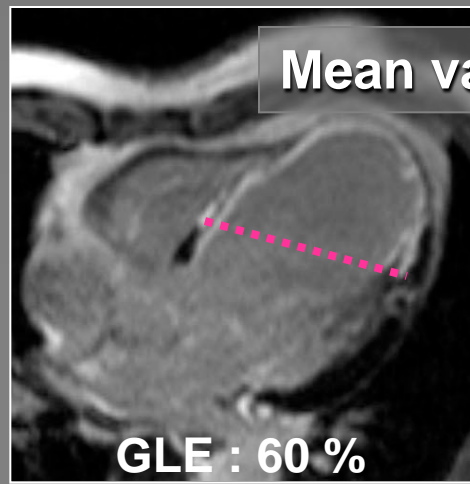
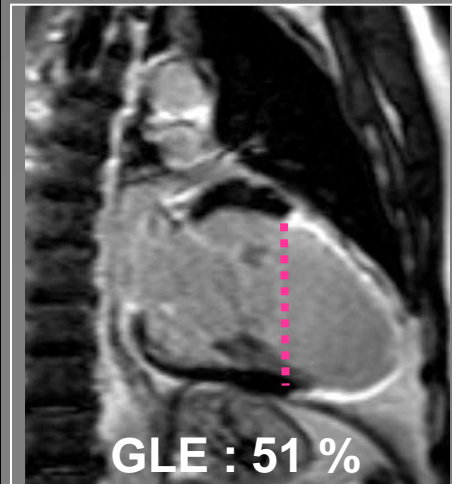
Mr Bau. 57 y – successfull LAD stenting after anterior MI 1998, 2004 CHF III +

2 chambers

4 chambers

LVOT

Short axis



CaDVI : 68 ml/m²

CaDVI = EDVI – (EDVI x 54%)

LVEF 24 %

EDVI 148 ml/m²

ESVI 112 ml/m²

Feasibility : contractile area diastolic volume index (**CaDVI**)

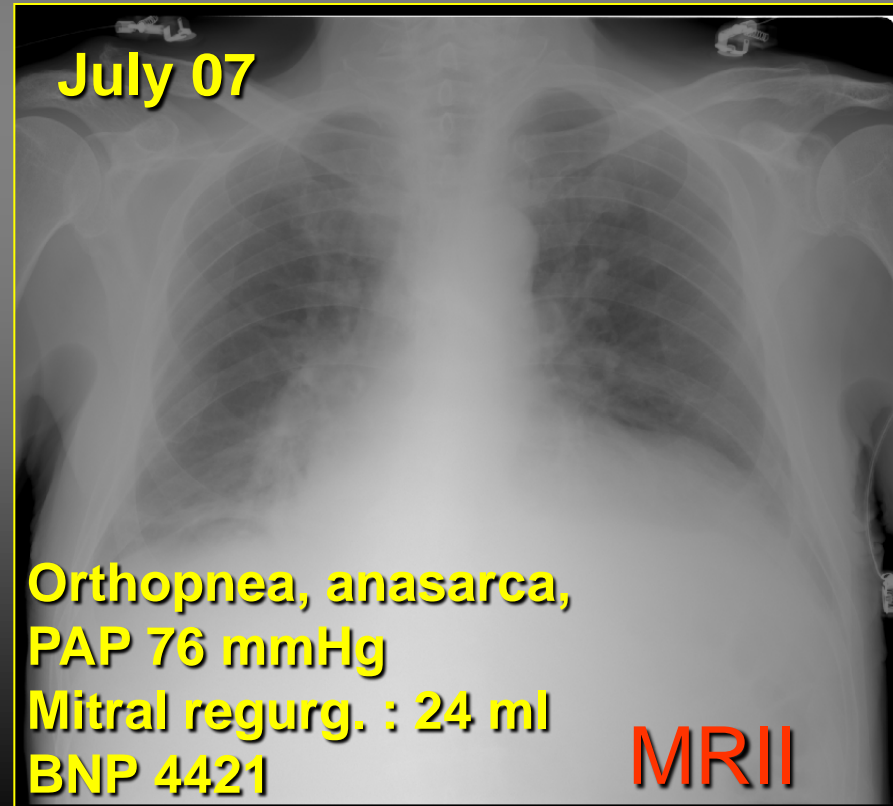
Guiding : the site where the «reorganizer» circular patch has to be set (contractile myocardium) is guided by the G.L.E. Cartography, not by a geometric shaper.

NB in STICH : LV scar type and extension not mentionned or assessed

Mr. NIC. 75 y. A.M.I 04/07, stenting LAD at day 6. Stent thrombosis

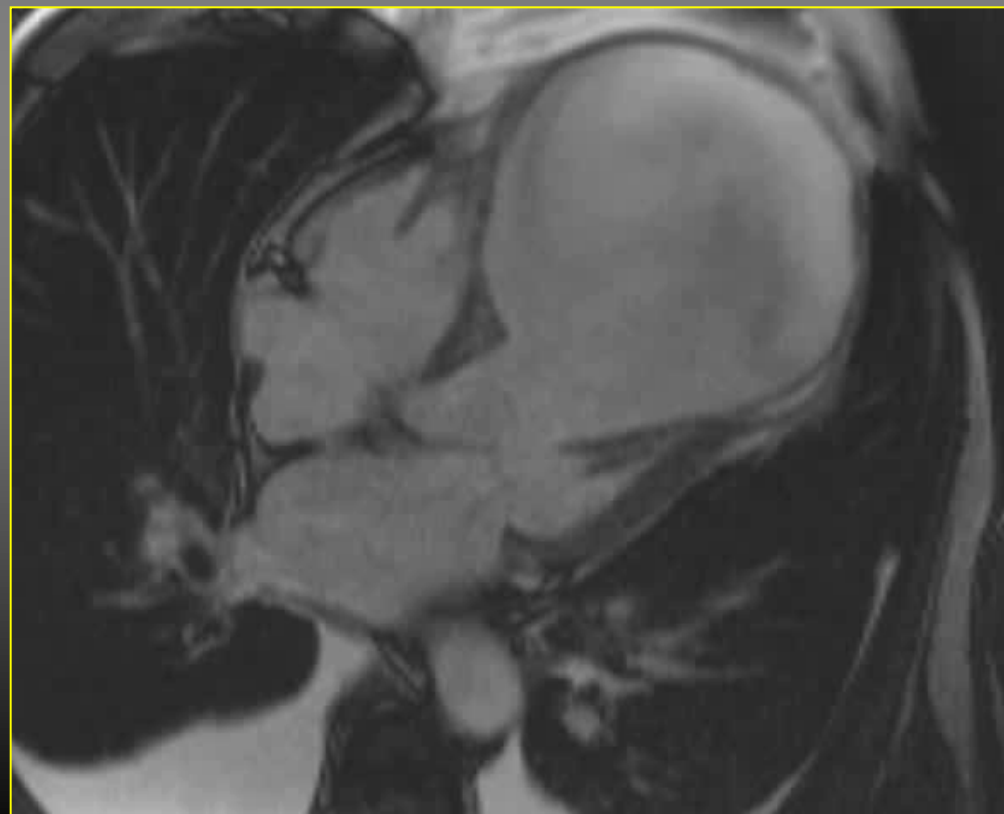


July 07



Orthopnea, anasarca,
PAP 76 mmHg
Mitral regurg. : 24 ml
BNP 4421

MRII

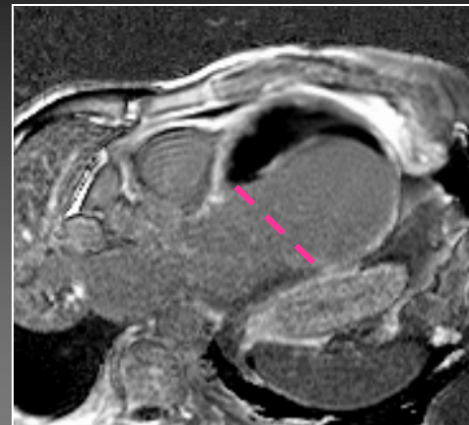


GIANT ASA SCAR : Mr. NIC. 75 y, AMI April 07, stenting LAD day 6, stenting thrombosis

July 07

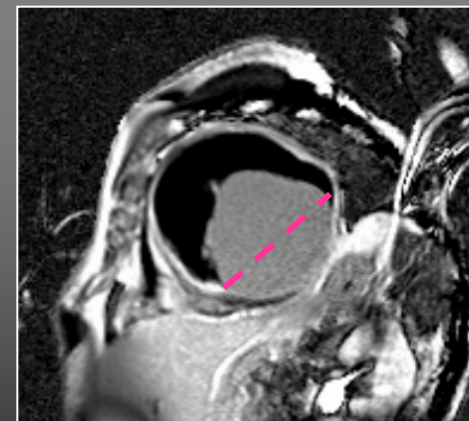
Orthopnea, anasarca,
PAP 76 mmHg
Mitral regurg. : 24 ml
BNP 4421

July 07
Euroscore : >18 (mortality risk > 75 %)



GLE > 75 %

GLE > 75 %

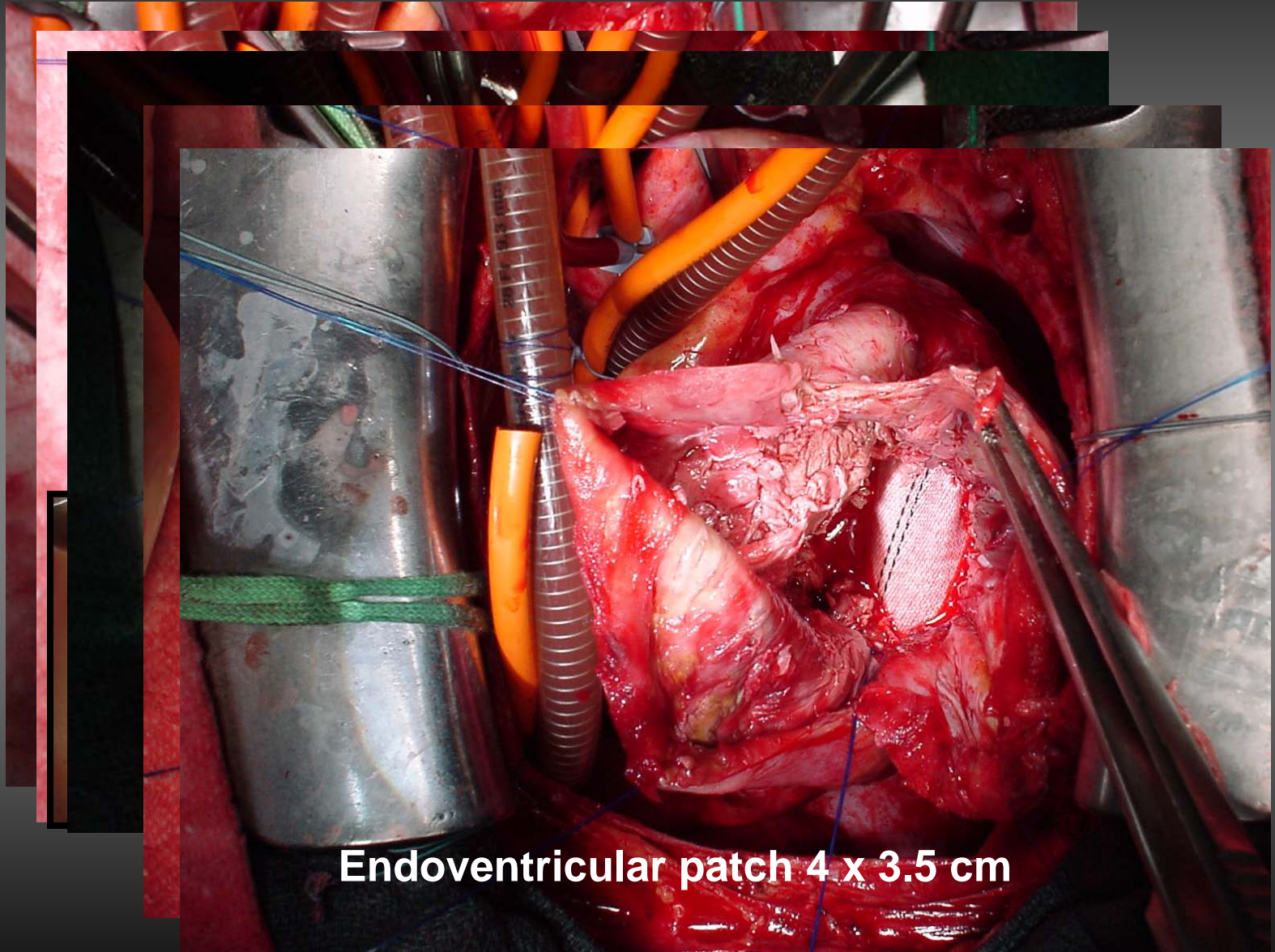


LVEF : 9 %
EDVI : 320 ml/m²
ESVI : 289 ml/m² !
Mitral diam. : 40 mm
CaDVI = 70 ml/m²

E.S.T



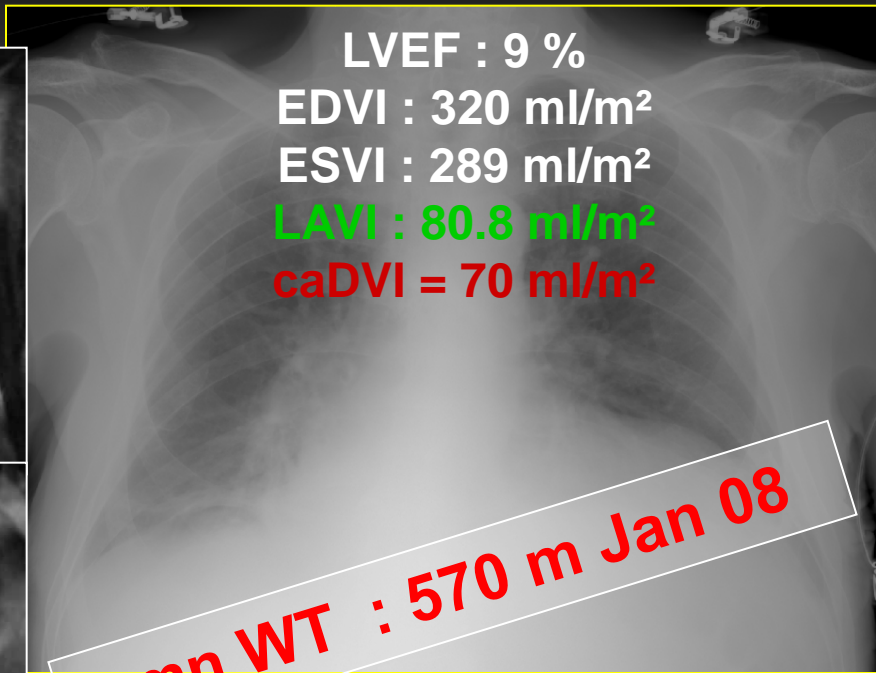
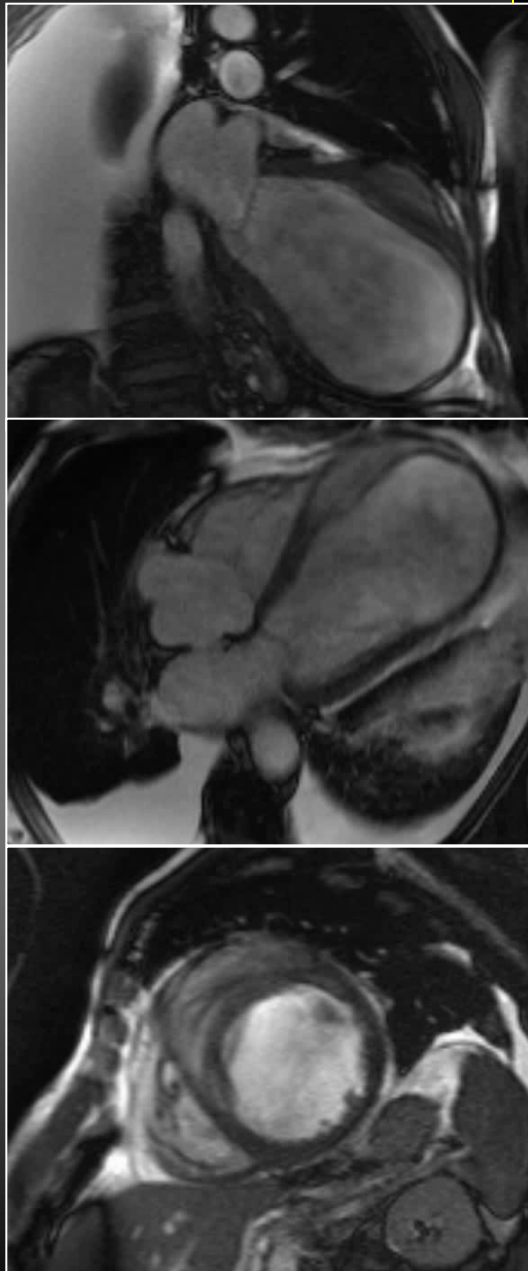
Mr. NIC. 75 y. surgery LVR 12 July 07
After posterior annuloplasty



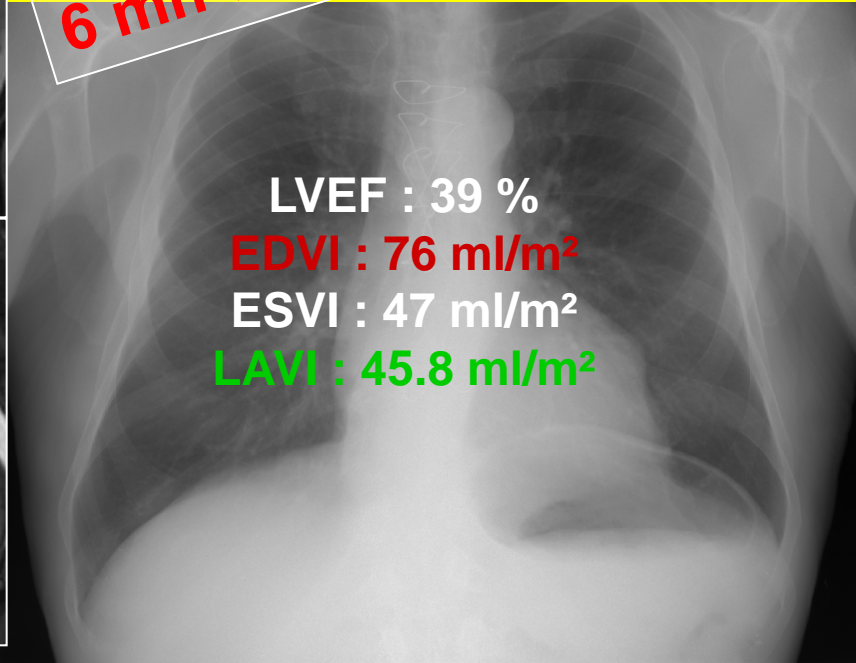
Endoventricular patch 4 x 3.5 cm

Mr. NIC. 75 Y, evolution after 1 month

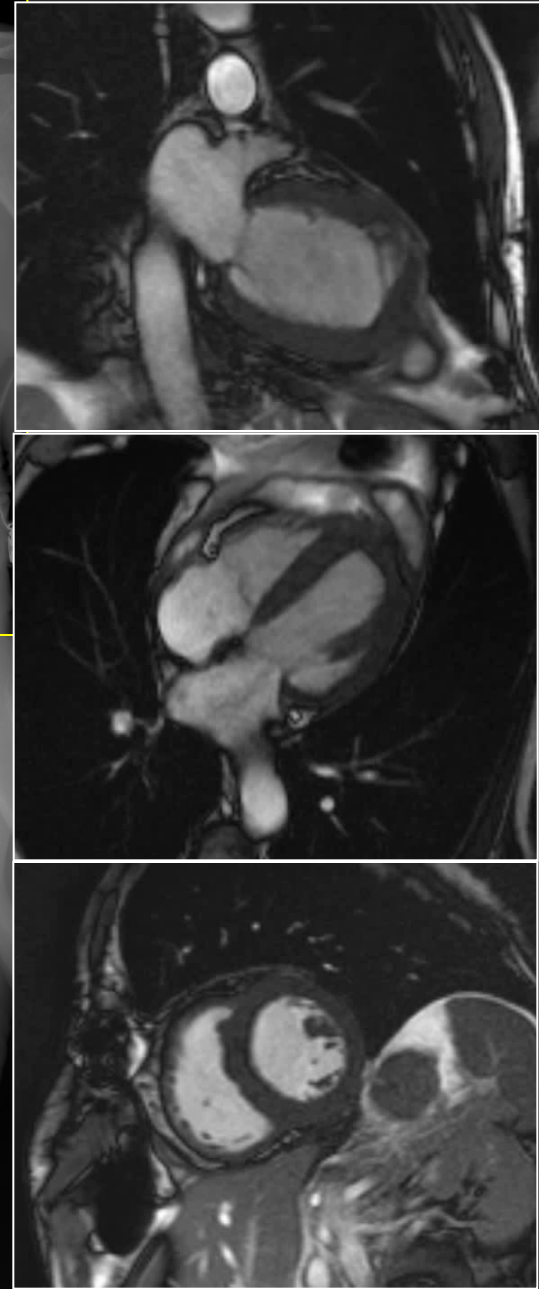
July 07



6 mn WT : 570 m Jan 08



August 07

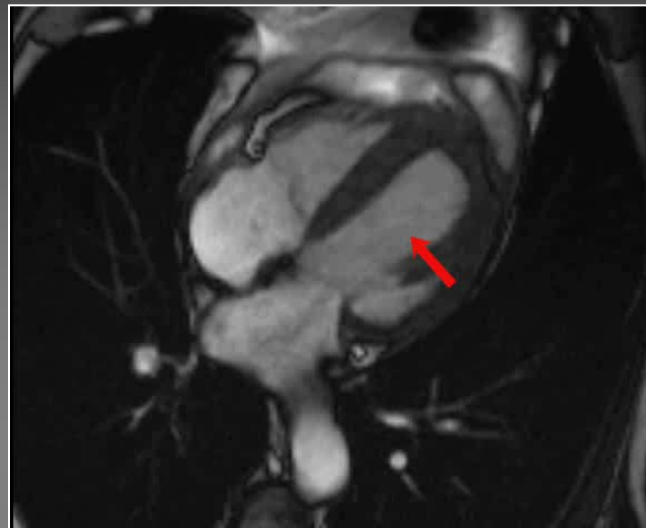


Mr. NIC. 75 y. A.M.I 04/07, stenting LAD at day 6. Stent thrombosis

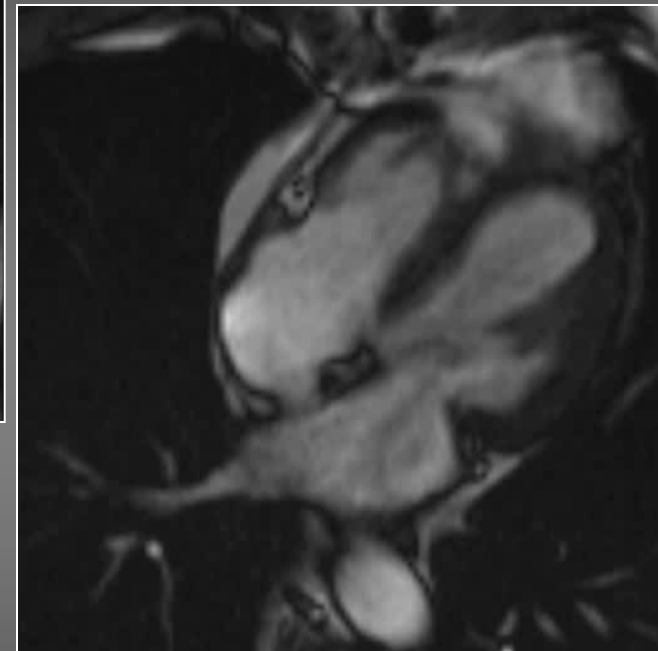
Pre-op 10 July 07



> 1 month



> 1 year (Oct. 08)



LVEF : 9 %
EDVI : 320 ml/m²
ESVI : 289 ml/m²
LAVI : 80.8 ml/m²
"bedridden" in ICU
CaDVI : 70 ml/m²

LVEF : 39 %
EDVI : 76 ml/m²
ESVI : 47 ml/m²
LAVI : 45.8 ml/m²
6 min WT : 570 m

LVEF : 51 %
EDVI : 60 ml/m²
ESVI : 30 ml/m²
LAVI : 31 ml/m²
6 min WT : 650 m
Playing golf !

Influence of Left Ventricular Volume Reduction on Outcome After Coronary Artery Bypass Grafting With or Without Surgical Ventricular Reconstruction

Robert E. Michler, Gerald M. Pohost, Krzysztof Wrobel, Robert O. Bonow, Jan Pirk, Jae K Oh, Carmelo A. Milano, Patricia A. Pellikka, Franckis Eragheais, Thomas A. Holly, Anne G. Hellkamp, Kerry L. Lee, Marisa Di Donato,
on behalf of the STICH Investigators

MICHLER & Co : ACC 2010

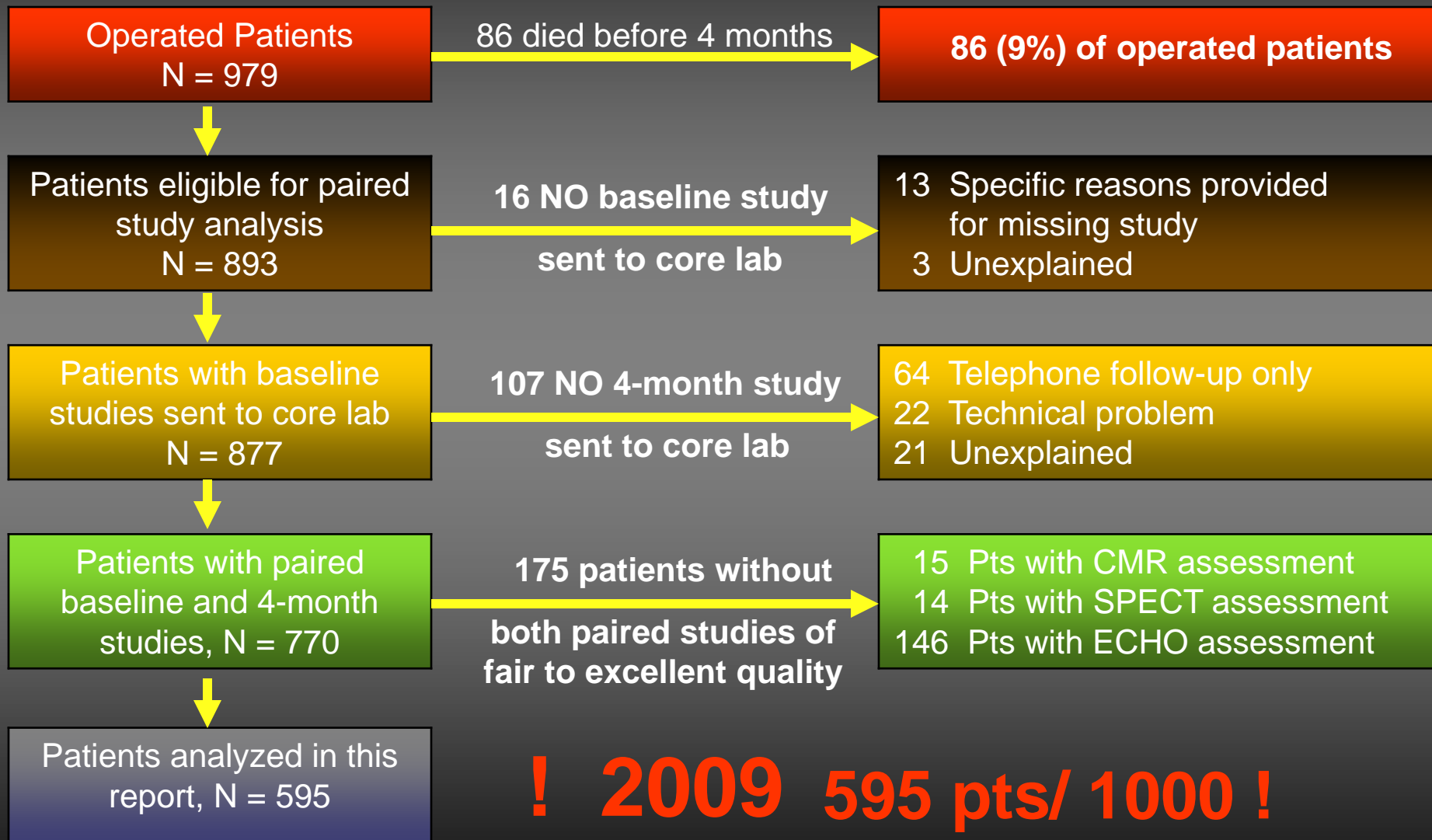
Late-Breaking Clinical Trial Update
American College of Cardiology
March 16, 2010

CABG-eligible patient was also SVR-eligible. SVR eligibility was determined by a clinical decision that sufficient dominant anterior akinesia or dyskinesia was present to justify adding SVR to CABG. Presence or absence of myocardial viability in the dysfunctional anterior-apical segments was not an enrollment criterion.

*Michler
Wrobel*

AK

Paired Left Ventricular Studies Before and After Operation in 979 SVR Hypothesis Patients



Observational cohort defined by ESVI taken from a Randomized population

ESVI Change

Lowest to Highest ESVI	Group 1 <60 ml/m ² (N=160)		Group 2 60-90 ml/m ² (N=200)		Group 3 >90 ml/m ² (N=235)	
Operation	CABG (N=91)	CABG+ SVR (N=69)	CABG (N=111)	CABG+ SVR (N=89)	CABG (N=118)	CABG+S VR (N=117)
% No Reduction	55%	43%	48%	20%	32%	21%
% >30% Reduction	23%	28%	20%	38%	24%	44%
Preop LVEF Median	0.37	0.36	0.28	0.30	0.22	0.21
Postop LVEF Median	0.38	0.40	0.31	0.35	0.25	0.27

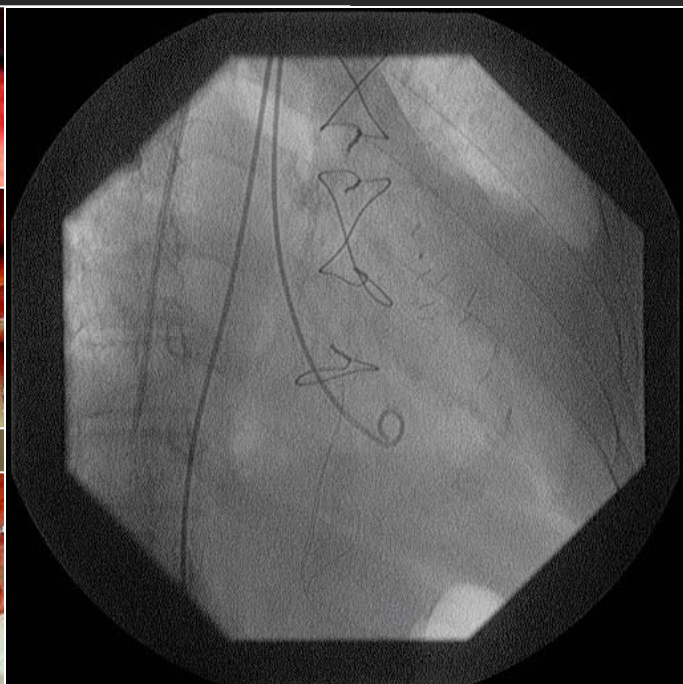
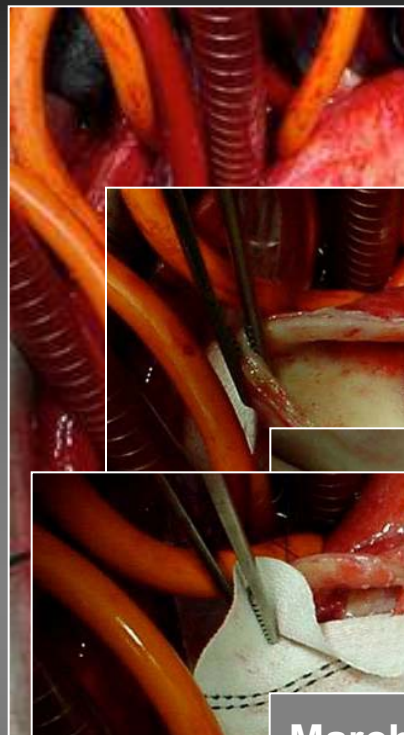
EF %	26_±4(9-34)	40_±8(21-64)*	44_±11(20-69)**
ESVol(ml/m ²)	95_±37(45-289)	51_±17(24-118)*	48_±20(15-128)***

Limitations of Study

- ! ■ **Baseline LV volume and regional function data were not available in every STICH patient.**
- ! ■ **Secondary structural and hemodynamic variables related to LV function, such as sphericity index or mitral regurgitation, were not considered in this analysis.**
- ! ■ **Bias of investigators towards not sending suboptimal postoperative studies cannot be excluded.**

STICH Conclusion for ICM :

«no significant difference between CABG vs CABG + SV reconstruction» ?



Mrs. F. 67 Y, Diabetic ID, LAD Thrombosis
Dec. 2000 Spont V.T., EF 15%, C.H.F.,
PAP 80 mmHG. Sugery Jan. 2002

March 2004 : PAP 44/20/28, ESVI 45,
EDVI 67, EF 39%
Alive in 2010



MRI short axis

In such case,

Could « CABG alone » be a realistic option?

When E.V.P.P is the obvious solution.

S.T.I.C.H conclusion : unfounded as widely scarred failing LV excluded

**Est il logique de traiter
l'insuffisance cardiaque post
IDM sans traiter la cause ?**

(plus d'un quart des survivants après IDM)

**Merci de votre
attention**

1987 Circulation 76, No.1, 44-51 : «Left ventricular end-systolic volume as the major determinant of survival after recovery from myocardial infarction».

“Treatment of infarction should be aimed at limitation of infarct size (I.S) and prevention of ventricular dilatation”.

Harvey D. White

2010

LVR reducing asynergic LV scar, and

reversing remodelling process, ADDRESSES THESE GOALS.

... even if necrosed myocardium remains lost & repaired LV, amputated of this amount, remains with some degree of restriction (stroke volume \approx normal inferior values) ...

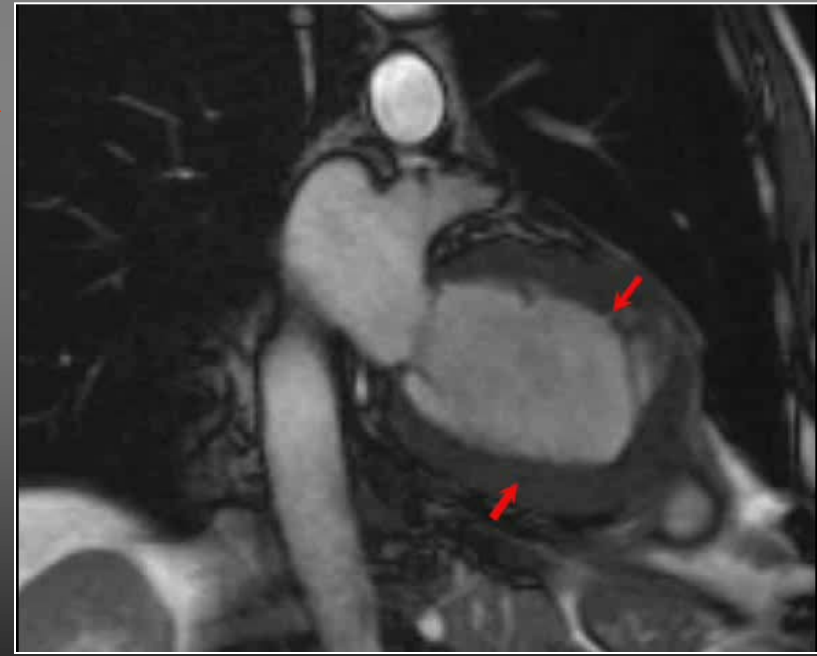
“the future for cell transplant ?”

I.F.V Heart Repair or replacement – Conclusions



Even in end stage situation of IFV,
when remaining viable myocardium
assessed on 4 walls allows to built a
50 ml/m² CAVITY (**caDVI**, *GLE map*)

LVR by **E.V.P.P** is feasible



Pre-op : LVEF : 9 %,ESVI : 289 ml/m²,
LAVI :80.8 ml/m², EDVI : 320 ml, **caDVI: 70ml**

Post-op 1 month : **EDVI : 75 ml**
LVEF : 39 %, ESVI : 47 ml/m², LAVI : 45.8 ml/m²

- Risk \leq 10%, with a durable regression
of remodelling in 90% of survivors.

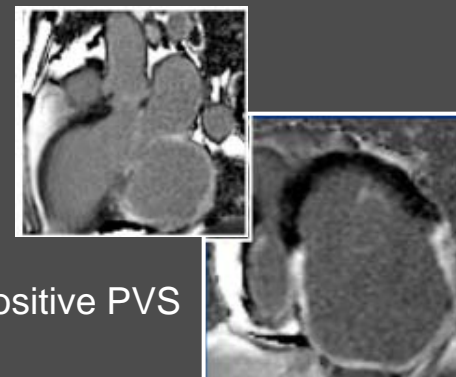
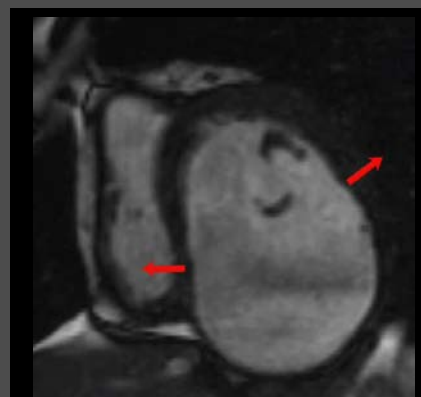
- **These data lead to rerevise
indications of LVR in ICM &
to redefine the place of H.T
in severe I.F.V.**

MR. G. 56 Y, Posterior LV aneurysm

Circulatory arrest after ventricular arrhythmia and pulmonary oedema

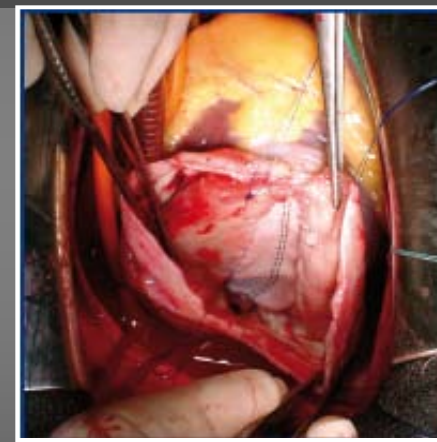
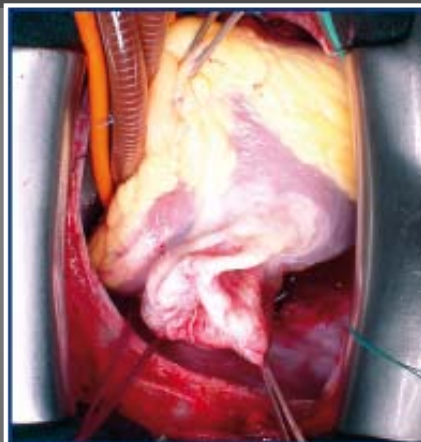
March
2007

LVEF : 20%
EDVI : 170ml/m²
ESVI : 137ml/m²



Positive PVS

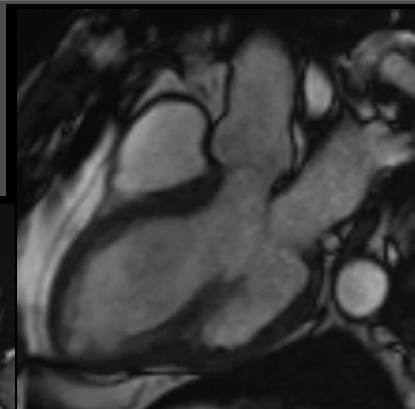
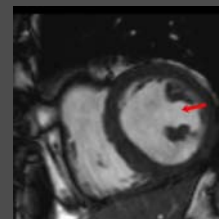
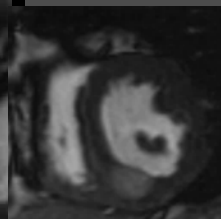
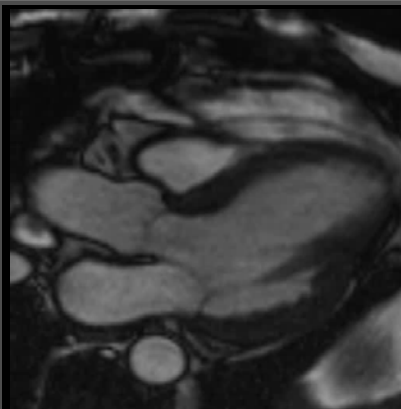
April
2007



May
2007

LVEF : 36%
EDVI : 84 ml/m²
ESVI : 53 ml/m²

LVEF : 48%
EDVI : 93 ml/m²
ESVI : 48 ml/m²
Negative PVS



April
2008

Mitral valve (MV) surgery (51 pts)	Revascularization (107 pts)	Ventricular reconstruction (117 pts)	Cardio-pulmonary bypass time (117pts)
Post. annuloplasty : 31	Only arterial : 105	Endocardectomy : 78	Time : 102 mn \pm 35
Edge to Edge mitral : 18	Only venous graft : 2	+ cryotherapy : 39	Ao. Cross clamp. 74mn \pm 23
MV replacement : 1	Distal anasto. :1.9 \pm 0.8	Patch : 117	1st month death : 4
- after failure E to E : 1		Dacron : 108	Not improved pts : 8
		Pericardium : 9	1st year death : 2
		Septal hinge : 2	

3 CAUSES OF SECONDARY FAILURE (remodeling recurrence) :

- Diastolic incompliance

(or to small LV volume)

... balloon sizing

- «Neglected» mitral insufficiency

... per op checking

- Continuum in remodelling

... the delay

· & evolution of coronary disease

· Questionable indication (*bifocal scars*)

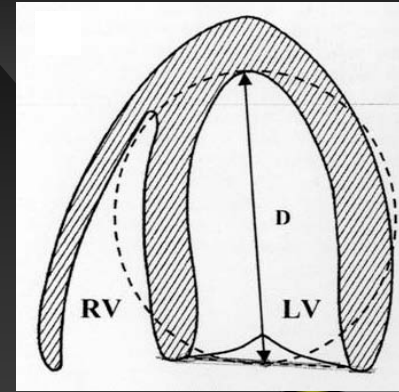
But ... 111 survivors over 1 year (95%) with progressive improvement

* among 274 LVR, 157 “ischemic CHF Stich compatible” 2 deaths (1.5%)

LV AFTER MI IS DILATED (REMODELING) ...

LVEF 24 %
EDVI 148 ml/m²
ESVI 112 ml/m²

SI : 0.34



Vol : $1/6 \pi \times D^3$

SI : 0.25/0.30

Sphericity Index

LVEF 17 %
EDVI 263 ml/m²
ESVI 219 ml/m²

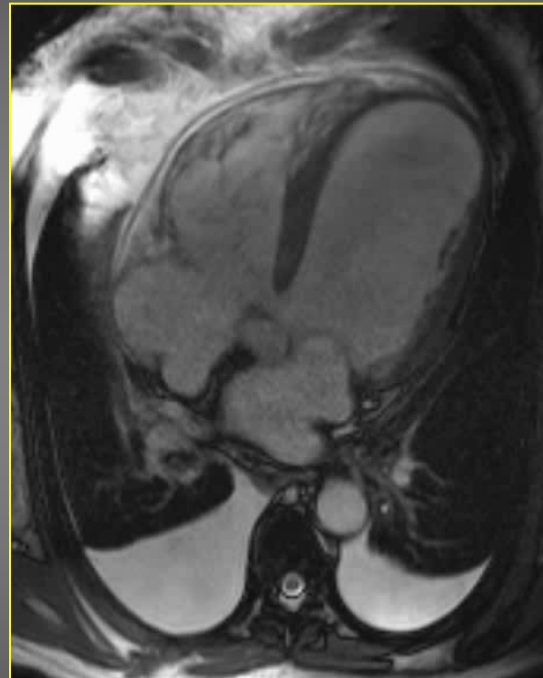
SI : 0.39

Systolic eccentric motion



LVEF 9 %
EDVI 320 ml/m²
ESVI 289 ml/m²

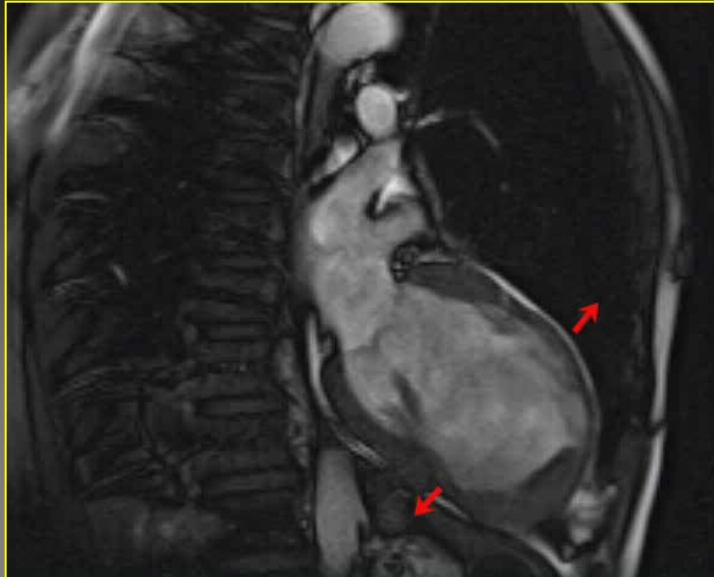
SI : 0.35



GLE : 60 %

Dilated indeed but more like an ellipse than a sphere

... REGRESSION of REMODELLING after LVR...



LV wall after MI

Systolic
Eccentric
(centrifugal)
motion

SI : 0.40

SI : 0.34



after EVCCP

Systolic
Concentric
(centripetal)
motion

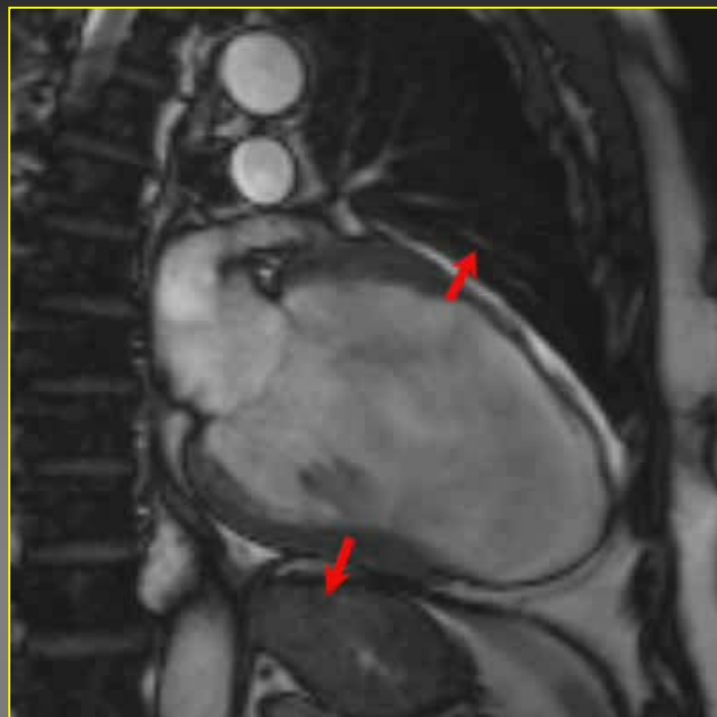
SI : 0.22

SI : 0.51



After EVCCP LV recovers normal curvature & contractility whatever its shape (SI) is

Mr Bau. 57 years – antero apico septal (3/4) scar 1998



Oct. 2004 pre-op

LVEF 24 %

EDVI 148 ml/m²

ESVI 112 ml/m²

SV : 36 ml/m²

caDVI = 68 ml

SI : 0.34



GLE >50 %

Deleterious eccentric motion
akinetic ellipse



Nov. 2004 post-op

LVEF 40 %

EDVI 83 ml/m²

ESVI 50 ml/m²

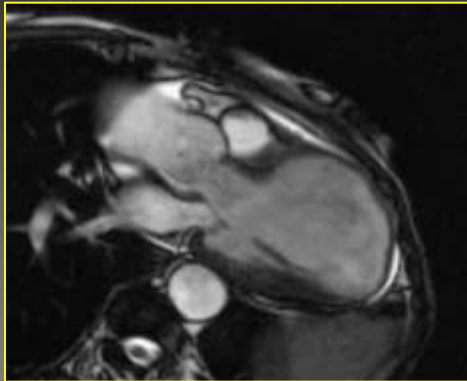
SV : 33 ml/m²

SI : 0.51

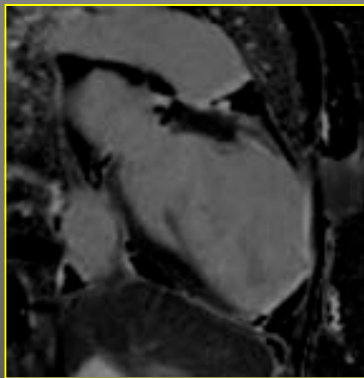
...Curvature restoration
Physiologic Concentric contraction
... contractile sphere

Mrs. CIC. 68 years old – evolving post AMI aneurysm

(27/05/04)



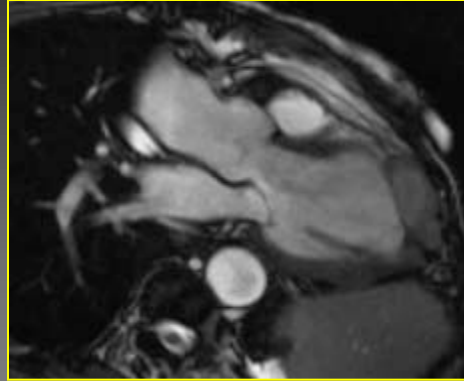
Pre-op
day 27 post AMI



EDVI : 170 ml/m²
ESVI : 140 ml/m²
LVEF : 17 %
SV : 30 ml/m²

SI : 0.42

11/06/04

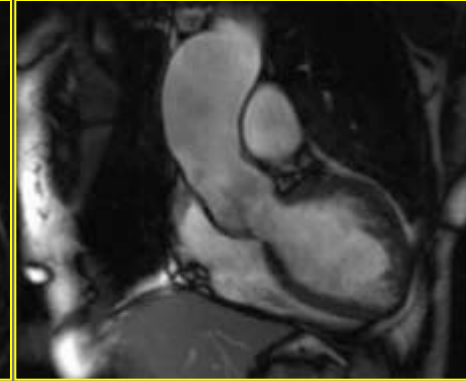


<1 Month

EDVI : 107 ml/m²
ESVI : 71 ml/m²
LVEF : 33 %
SV : 36 ml/m²

SI : 0.63

14/08/05



>1 Year

EDVI : 97 ml/m²
ESVI : 52 ml/m²
LVEF : 46 %
SV : 45 ml/m²

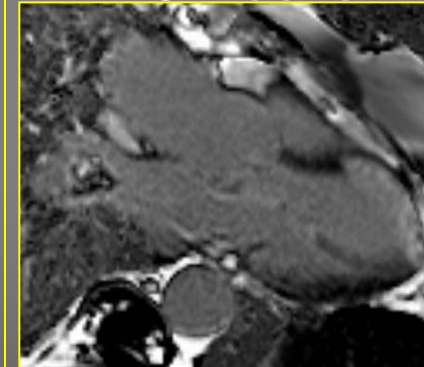
SI : 0.41

Normal life in 2006

06/06/07



>3 Years



EDVI : 86 ml/m²
ESVI : 38 ml/m²
LVEF : 56 %
SV : 48 ml/m²

SI : 0.34

Stop Triatec &
Trinipatch

« **FORM FOLLOWS FUNCTION** »

CAUSES OF ISCHEMIC HEART FAILURE (HF)

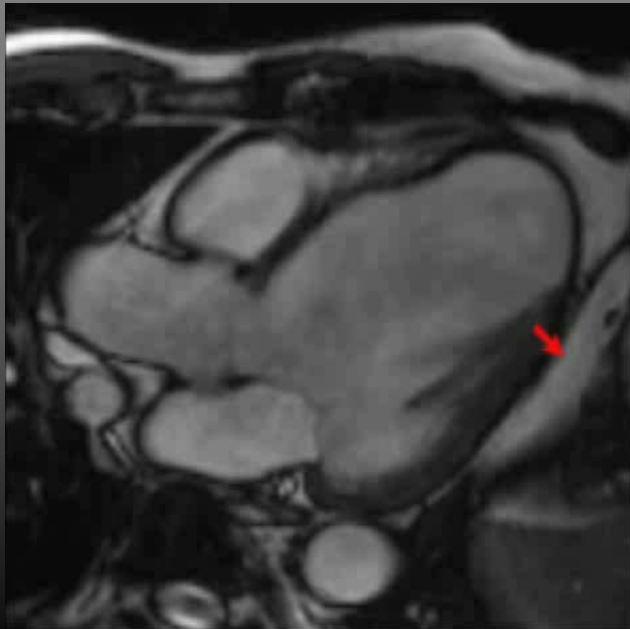
Living but stunned myocardium is an indication for CABG

BUT

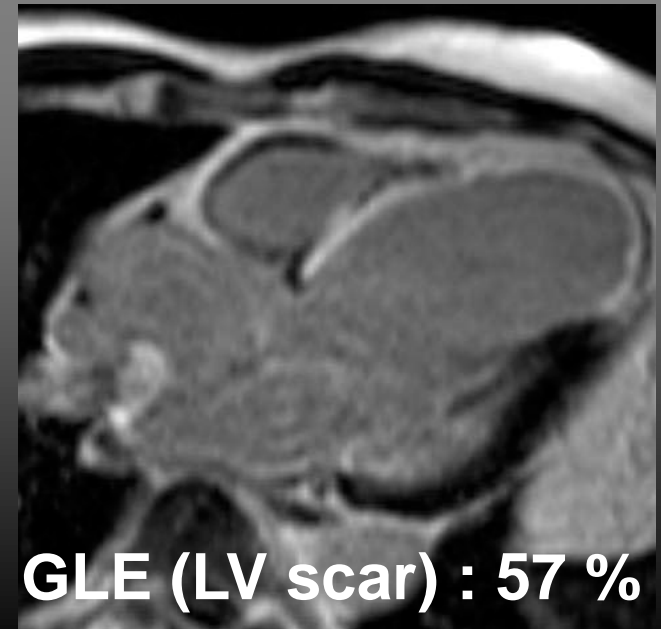
«AFTER MYOCARDIAL INFARCTION the VENTRICULAR DILATATION is directly linked to the EXTENT OF ASYNERGIC SCAR when it involves :

20-25 % LV area is involved ... Gorlin 1967»

or 40-50 % of LV perimeter ... McKay 1986

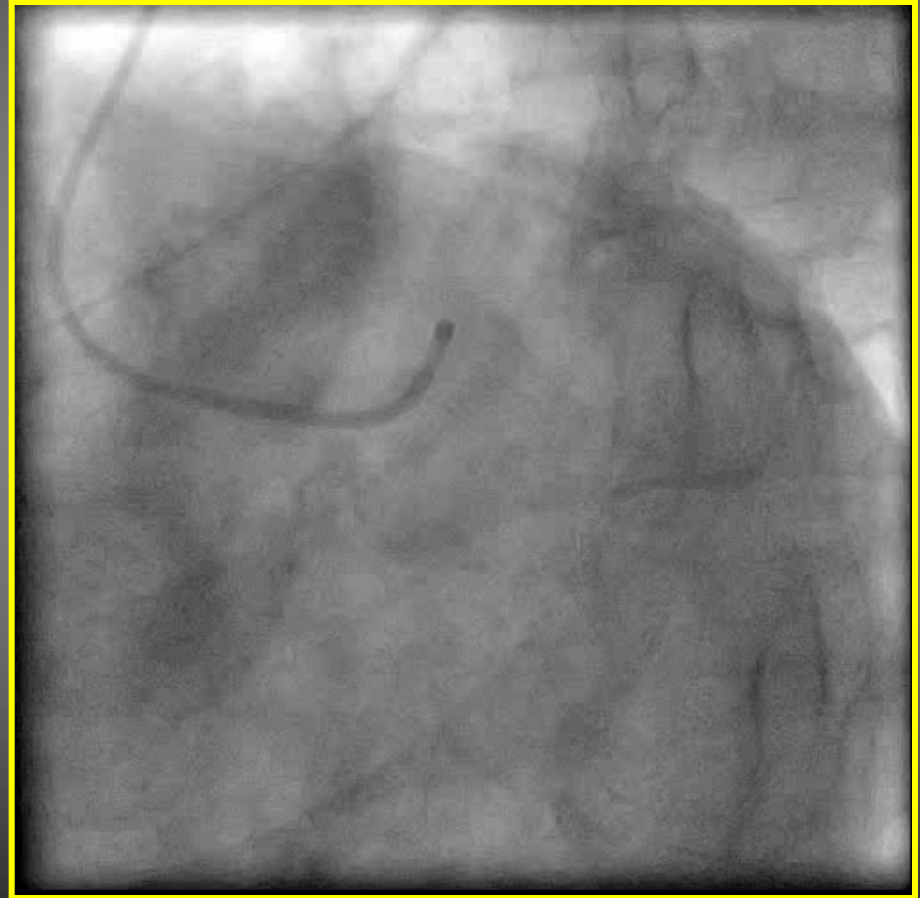
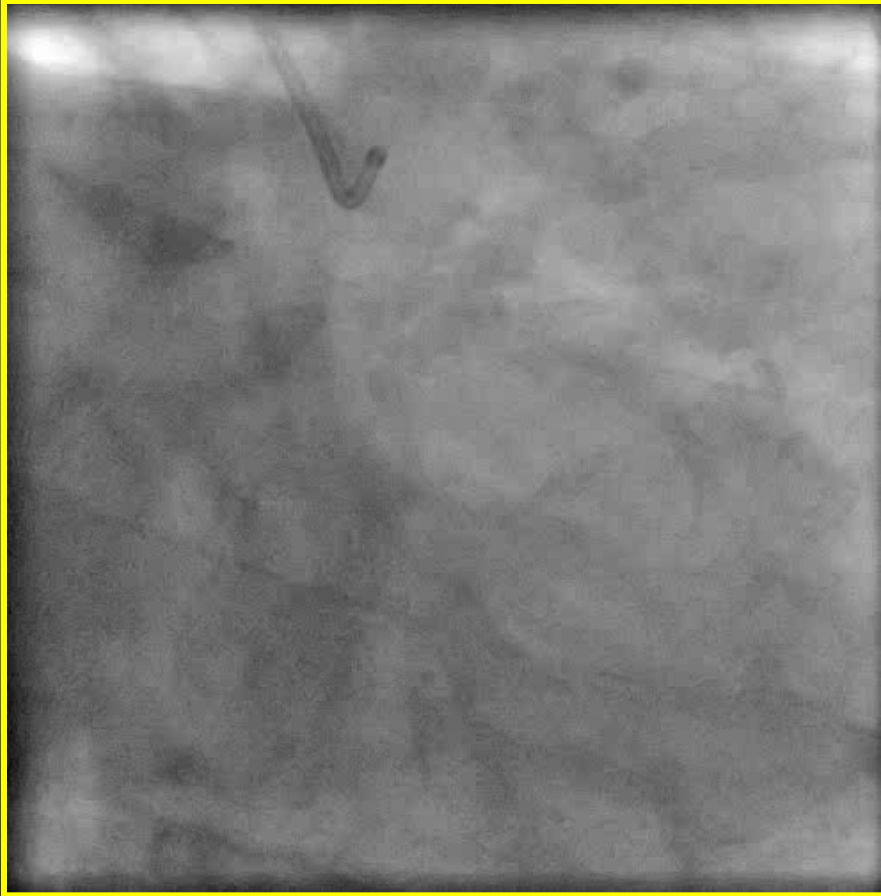


LVEF 24 %
EDVI 148 ml/m²
ESVI 112 ml/m²

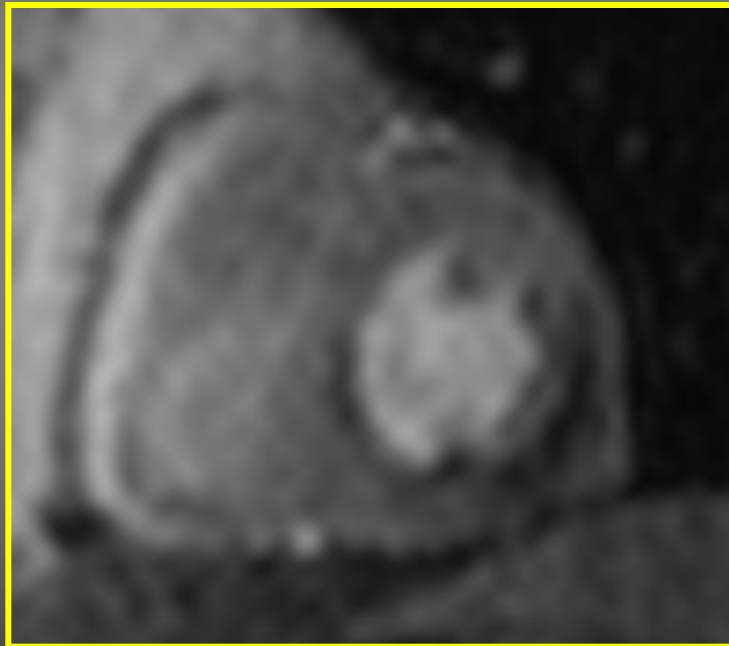


GLE (LV scar) : 57 %

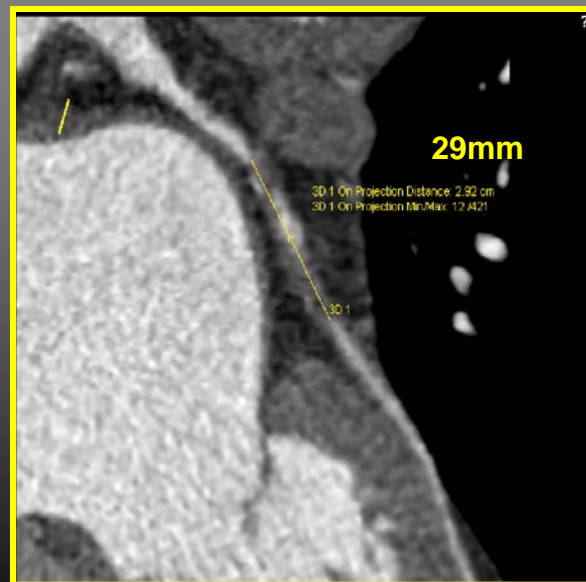
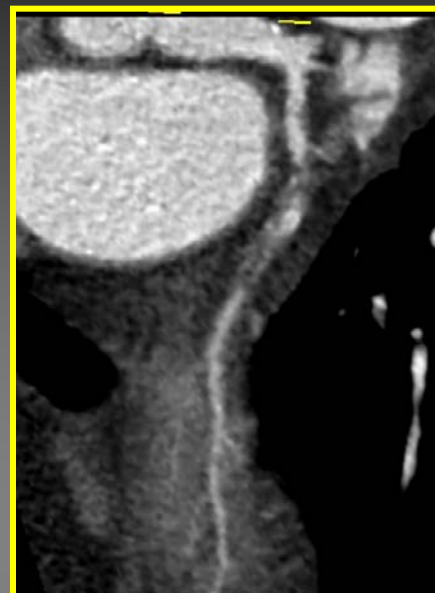
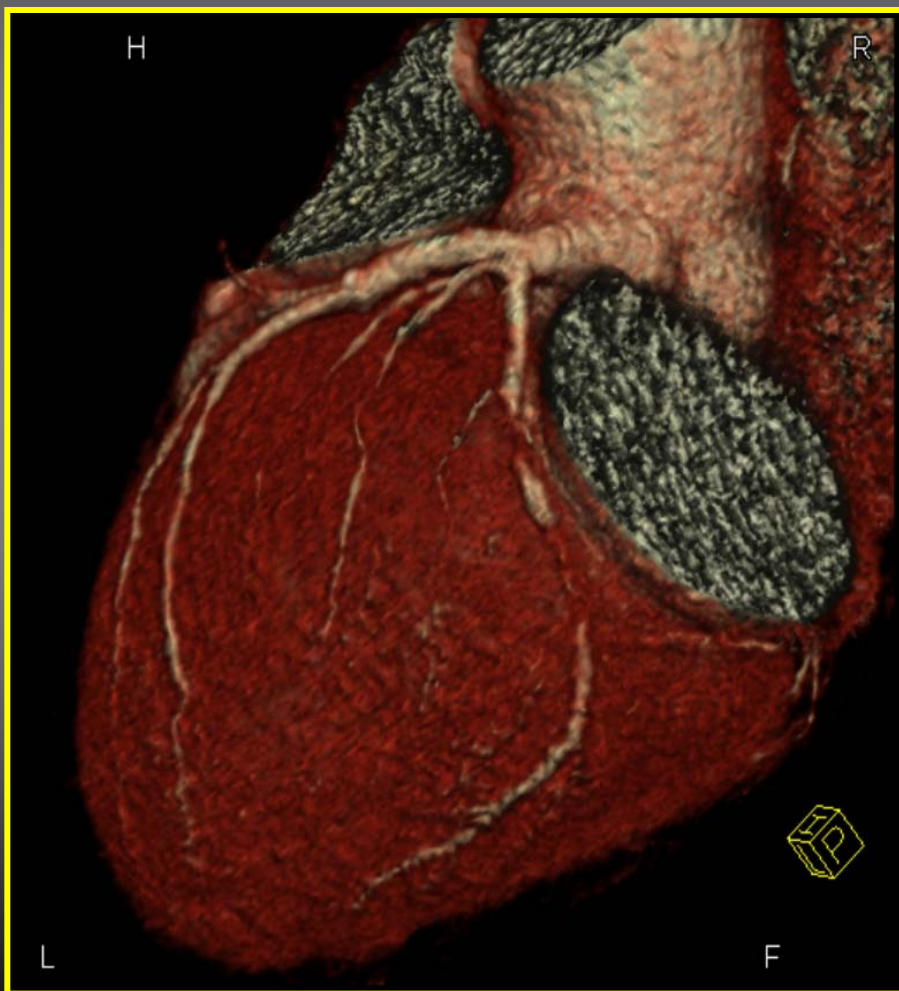
CORO: LCX OCCLUSION



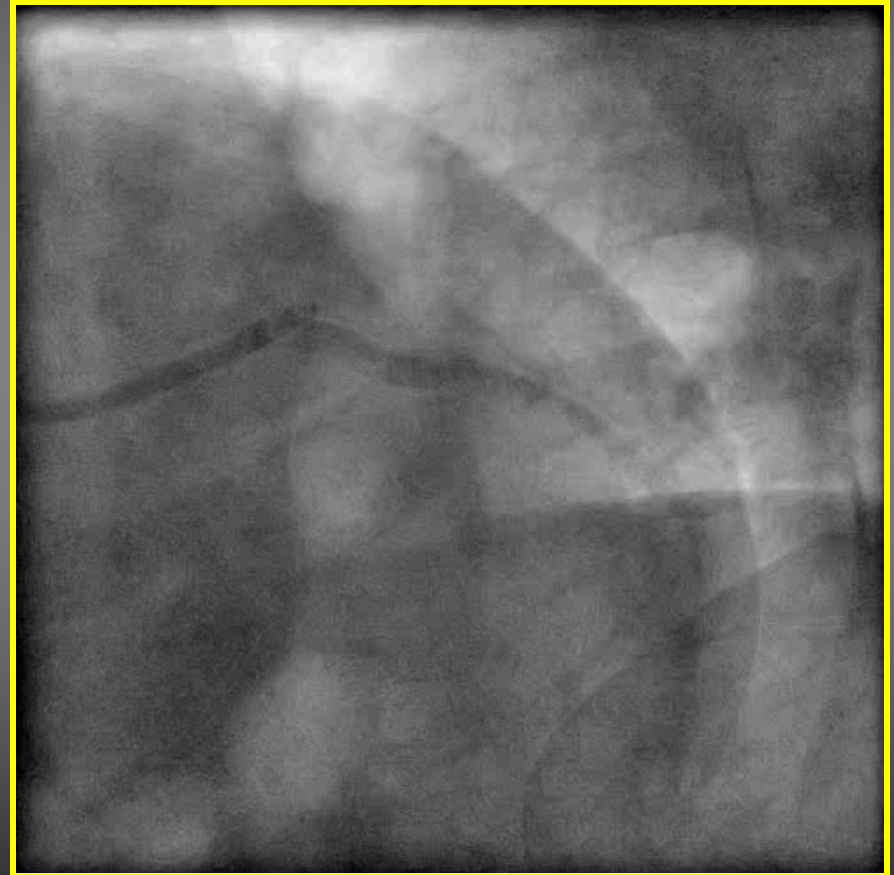
INFERO-LATERAL HYPOPERFUSION MORE IMPORTANT THAN SCAR



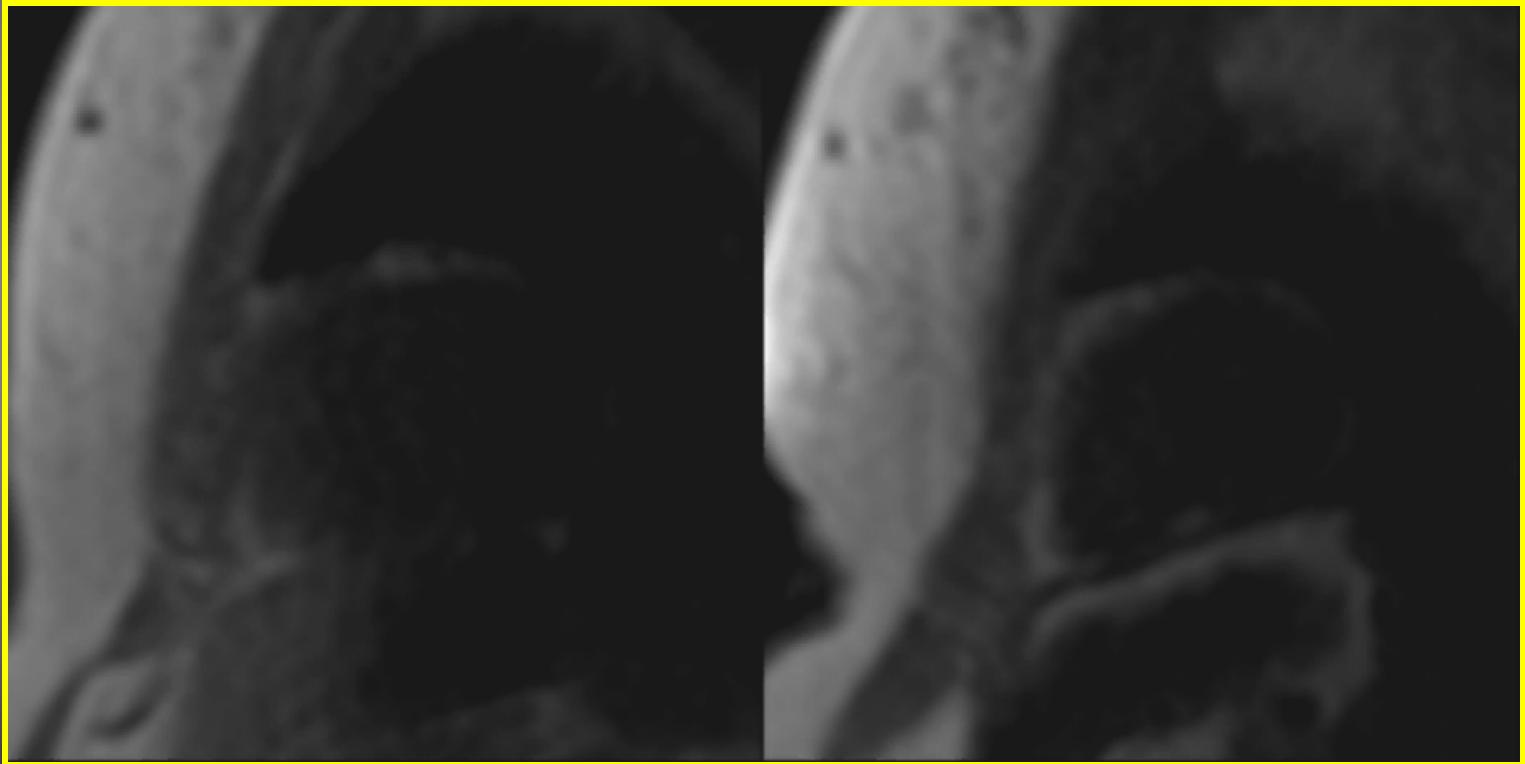
- Distal run-off
- Not calcified plaque of 15 mm
- Not collateral branches



LCX PCI + stenting DES 3,5 x 30mm



Stress control



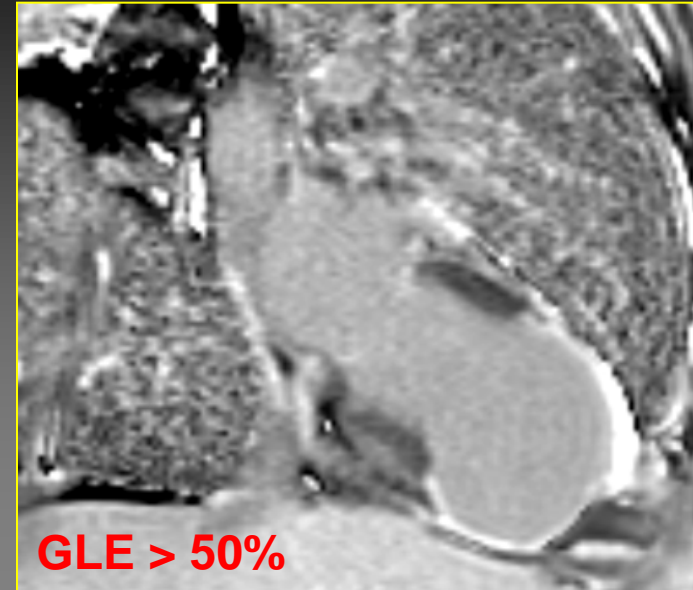
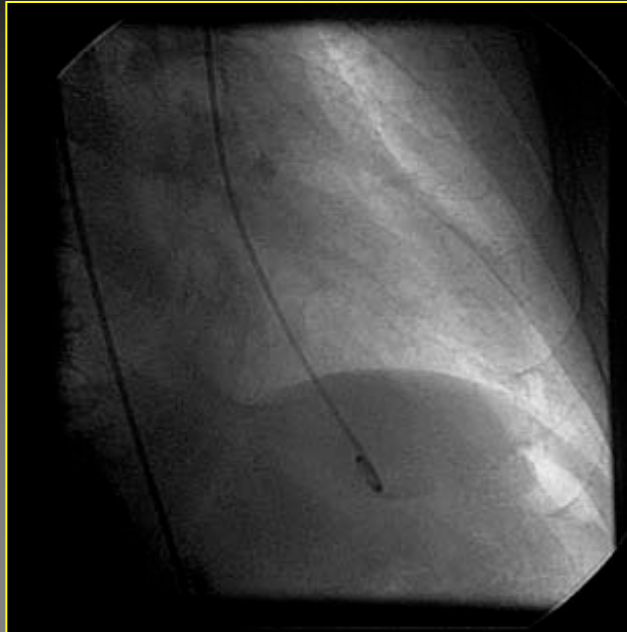
DYSKINESIA vs AKYNESIA ?

= ASYNERGIA

TYPE OF ASYNERGY (dyskinesia, akinesia) depends on depth's scar

Dyskinesia

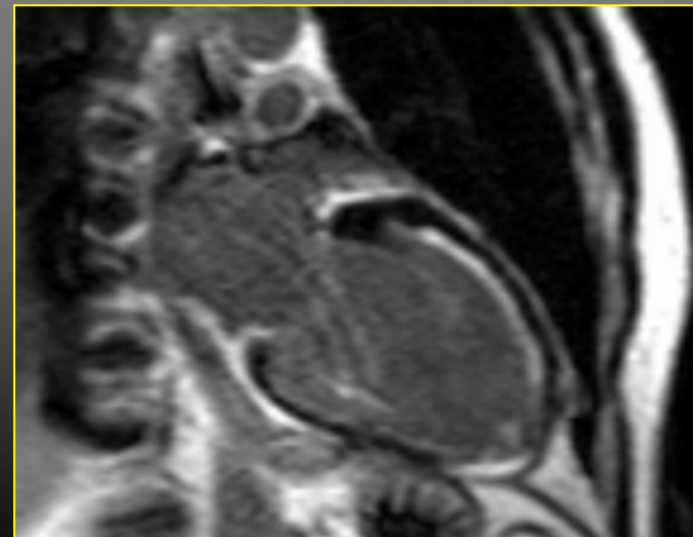
Thrombosed LAD
Transmural necrosis



SI : 0.42

Akinesia

Recanalised LAD
Partially necrosed wall



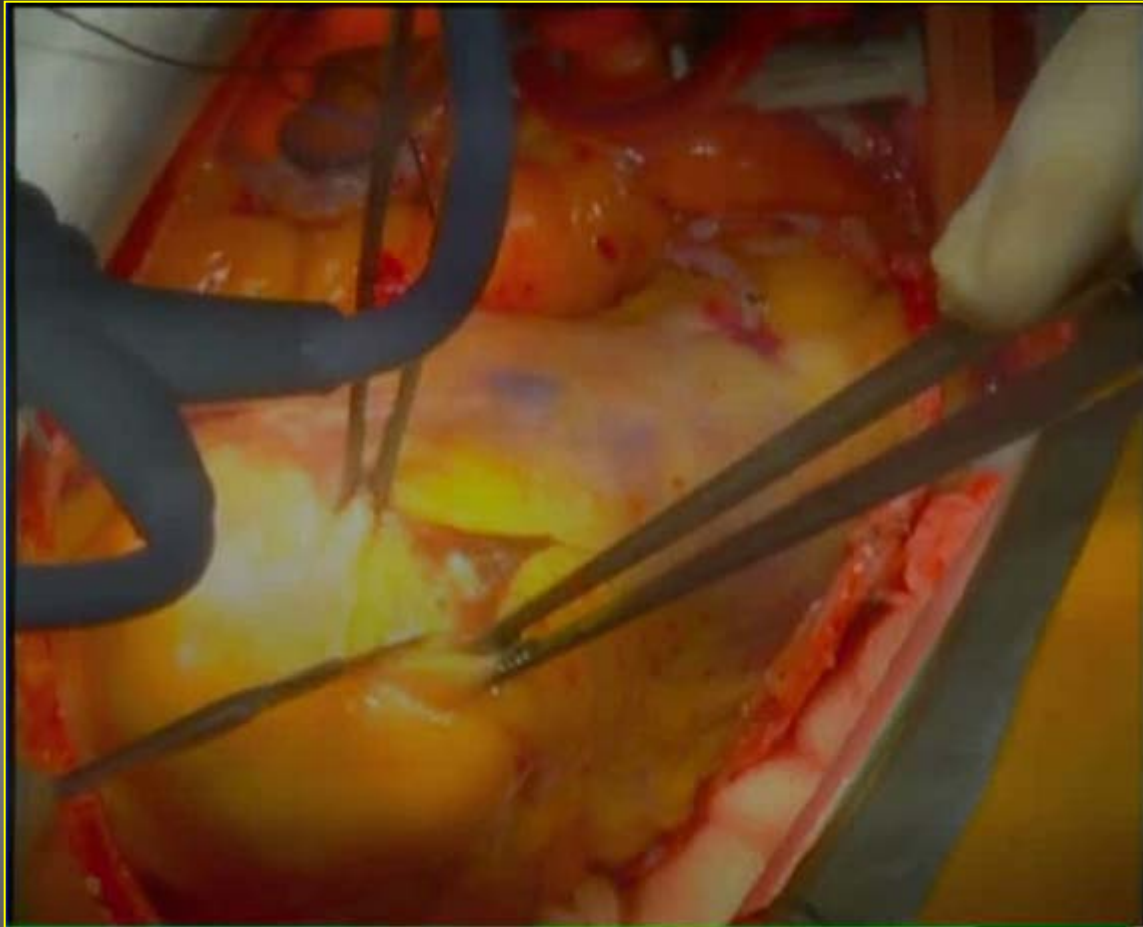
SI : 0.27

Mr U. Obs n°1043

CALCIFIED ASYNERGIA preop

EDVI = 100 ml/m²

ESVI = 73 ml/m²



«LV remodeling does not allow viable myocardium to improve LVEF after revascularization»

J.Bax & al. Circulation 110 (suppl II):11,2004

2002 – May 2008 : **117 I.F.V**

TECHNIQUES

Mitral regurgitation surgery (51 pts)

Post. annuloplasty : 31

Idem + Edge to Edge: 18

MV replacement : 1

- after failure E to E : 1

Revascularization (107 pts)

Only arterial : 105

Only venous graft : 2

Distal anasto. : 1.9±0.8

Ventricular reconstruction (117 pts)

Endocardectomy : 78

+ cryotherapy : 39

Patch : **117**

Dacron : 108

Pericardium : 9

Septal hinge : 2

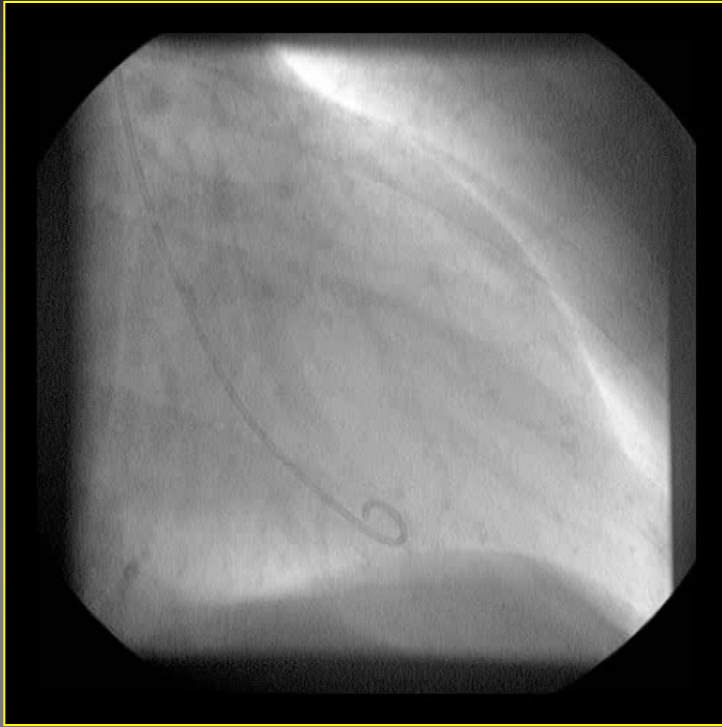
Cardio-pulmonary bypass

Time : 102 mn±35

Ao. Cross clamp. 74mn±23

NB in STICH : ventricular arrhythmias (33%) not mentioned or assessed

End Stage **ISCHEMIC FAILING VENTRICLES** : **RECONSTRUCTION or REPLACEMENT**



Scheduled for LVAD



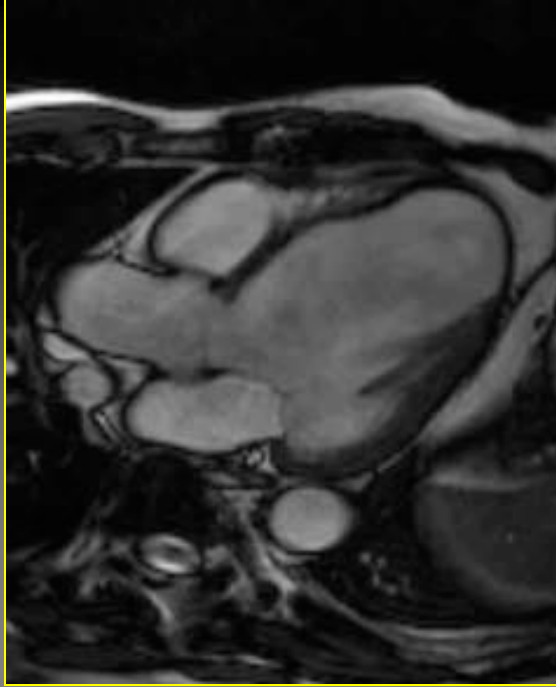
M. 75 years old, LVEF : 9 %, EDVI : 320 ml/m² ,
ESVI : 289 ml/m² !, Mitral diam. : 40 mm

«Hopeless situations» : still exist in spite of coronary recanalization

- CHF IV+ : LVEF <30%, ESVI >60ml,% asynergic wall # 50 %, Pulm. H.T., BNP # 1000

- Recurrent needs for IV Dobutamine and ... IABP

... Beyond medical, or devices, or revascularization therapies



LV WALL AFTER INFARCT



LVEF 24 %
EDVI 148 ml/m²
ESVI 112 ml/m²

« After myocardial infarction the **ventricular dilatation** («remodeling», heart failure) is directly linked with the **infarct size** ».

40-50 % of LV circumference

20-25 % LV area

... McKay **1986**

... Gorlin **1967**

K.Yoshida & Gould : if scar area >23%, mortality rate at 3 years : 43%
(JACC 1993)

« LV REMODELING AFTER MI : A COROLLARY TO INFARCT EXPANSION »

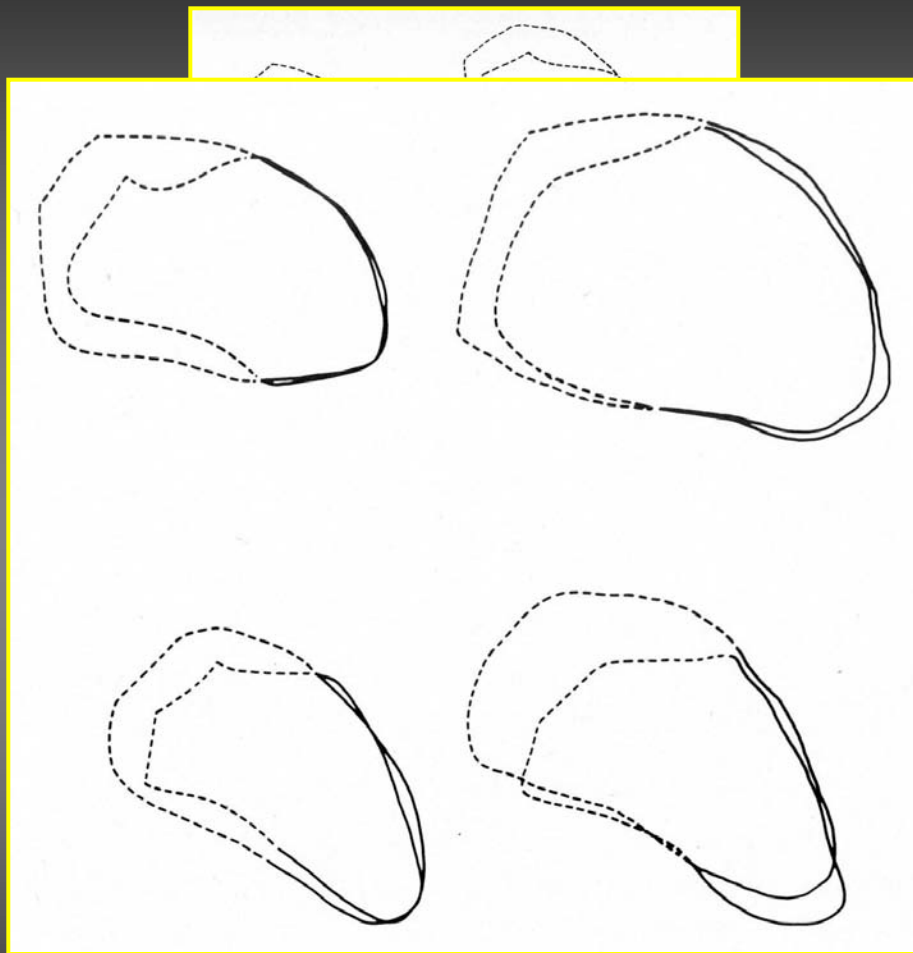
R.G McKay, W. GROSSMAN & all *CIRCULATION* 1986; 74 : 693

Angiographic study of 30 cases after successful thrombolysis < H 10

TABLE 3

Left ventricular endocardial perimeter analysis in patients with greater than 20% increase in left ventricular end-diastolic volume index

Patient	Catheterization 1	Catheterization 2	
	% Akinesis-dyskinesis	% Change infarcted segment	% Change noninfarcted segment
41	+ 4	37 %	+33
46	+38	66 %	+28
50	+11	53 %	+42
41	+20		+25
37	+ 8		+18
30	+10		+10
30	+20		+ 5
40	+26		+ 4



ments and stippled lines indicate noninfarcted areas. In all cases, there has been an increase in chamber volume as well as lengthening of both the infarcted perimeter and noninfarcted perimeter.

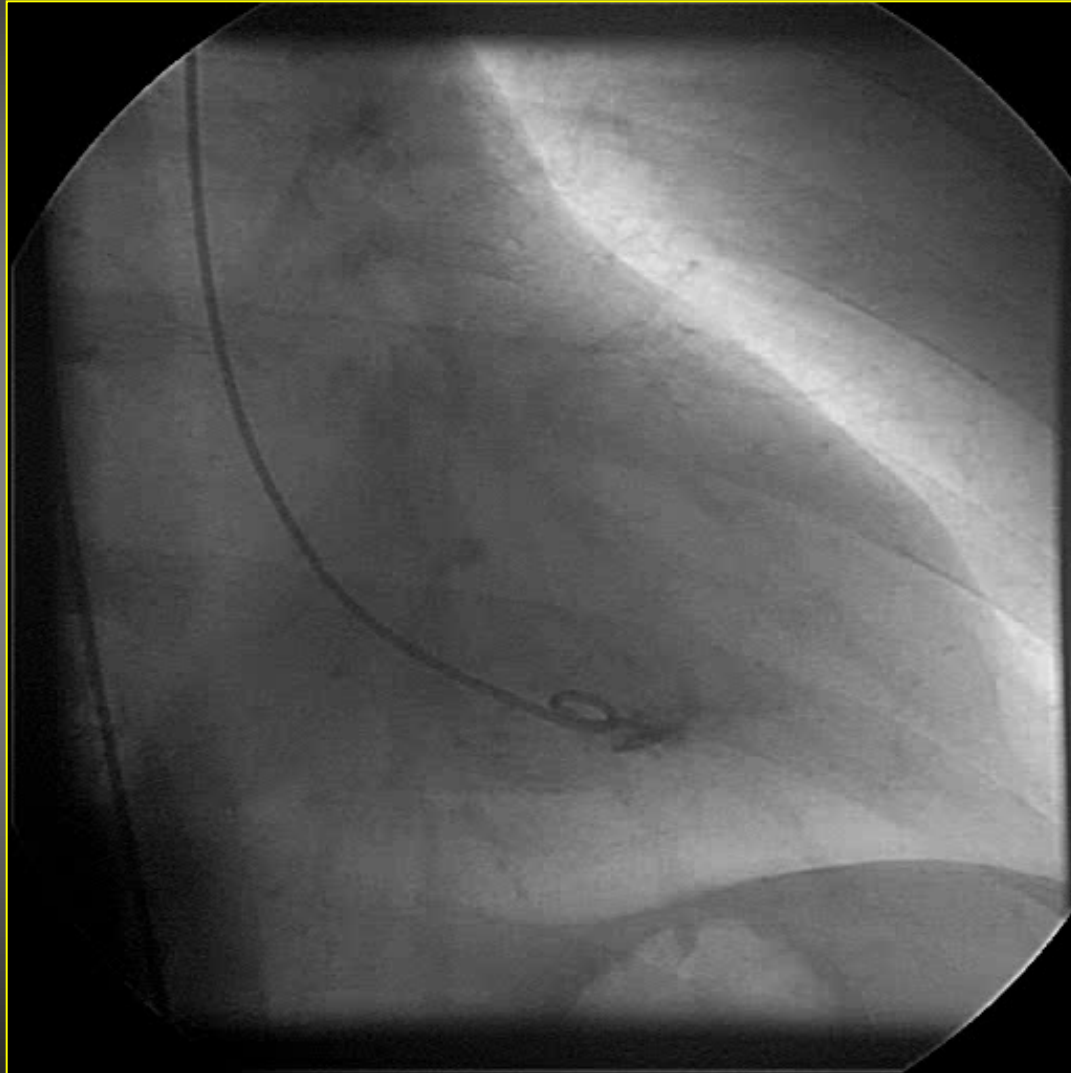
LV perimeter & vol in systole diastole

solid liner indicate akinetic dyskinetic segments

% dysk. akinesis, % change non infarcted segments

«THE MAGNITUDE OF THE REMODELING IS DIRECTLY PROPORTIONAL TO INFARCT SIZE»

CAUSE OF POST MI HEART FAILURE

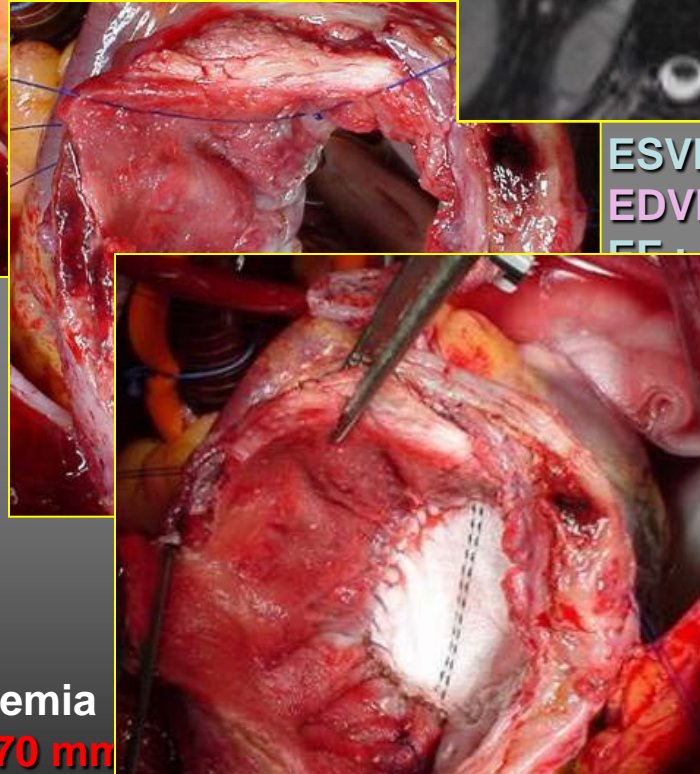
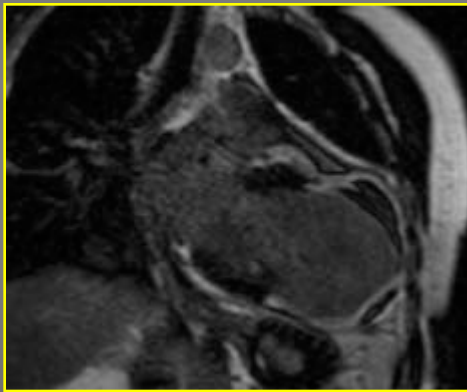
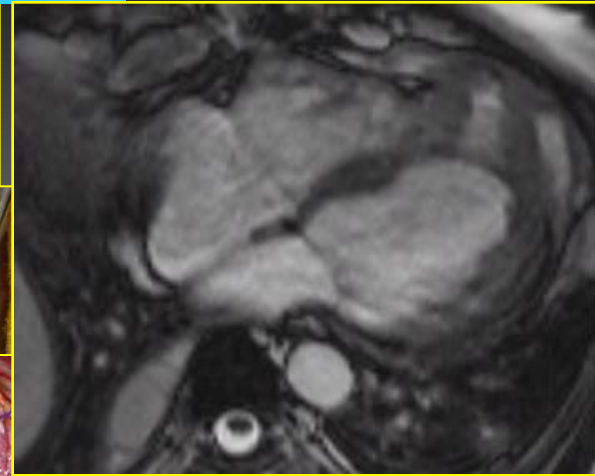
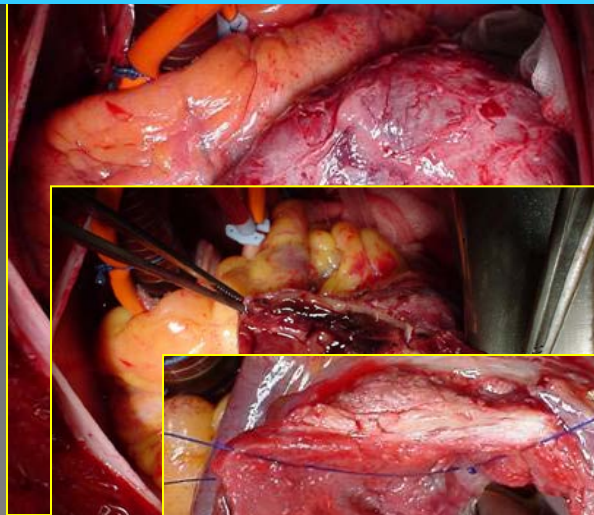


Dilated
contractile
remodeled
area →

←
Asynergic
area

ie « REMODELING »

? STICH Conclusion for ICM: « no significant difference between CABG vs CABG + SV reconstruction » ?



ESVI : 34 ml/m²,
EDVI : 53 ml/m²
EF : 34%,
: 32.7 ml/m²

1 : 0.43

Mr K. 63 years old

Obs N°: 1055

- June 02, M.I
- July 02, C.H.F, LAD thrombosis, no ischemia
- October 02, drug resistant C.H.F, PAP : 70 mm

ESVI :
EF : 17 %

When LVR is the obvious solution.

Could « CABG alone » be a realistic option in such case ?

Thank you for your
attention



CAUSES OF ISCHEMIC HEART FAILURE (HF)

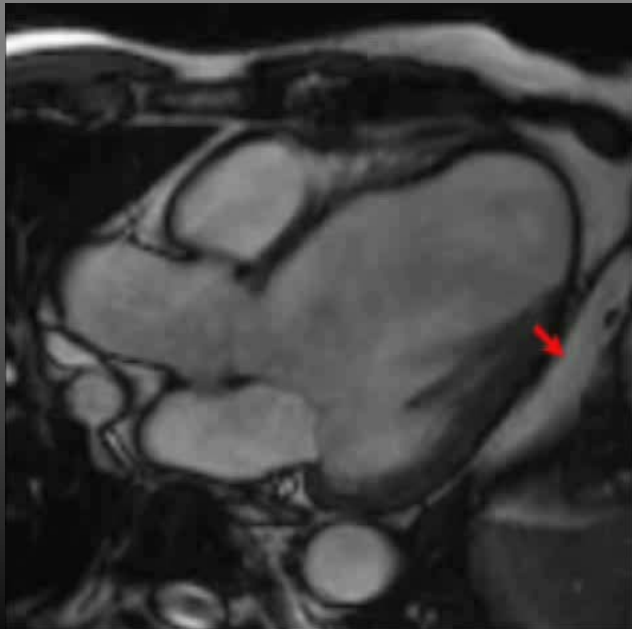
... if some degree of HF is linked with ischemia of living but stunned myocardium, revascularization is indicated

BUT

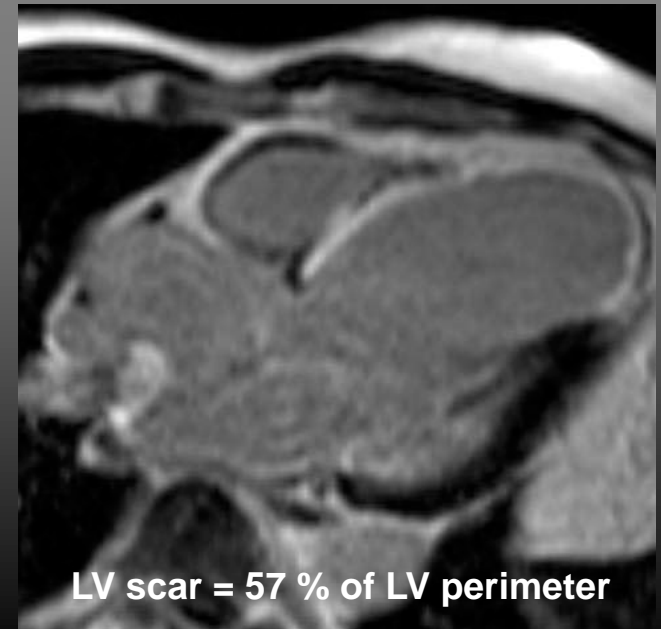
«AFTER MYOCARDIAL INFARCTION the VENTRICULAR DILATATION («remodeling», HF) is directly linked to the ASYNERGIC SCAR when it involves :

20-25 % LV area is involved ... Gorlin 1967»

or 40-50 % of LV perimeter ... McKay 1986



LVEF 24 %
EDVI 148 ml/m²
ESVI 112 ml/m²



LV scar = 57 % of LV perimeter

9
means
nothing

CABG-eligible patient was also SVR-eligible. SVR eligibility was determined by a clinical decision that sufficient dominant anterior akinesia or dyskinesia was present to justify adding SVR to CABG. Presence or absence of myocardial viability in the dysfunctional anterior-apical segments was not an enrollment criterion.

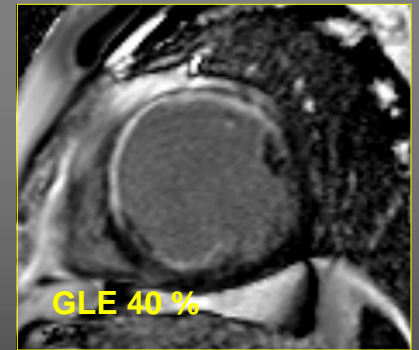
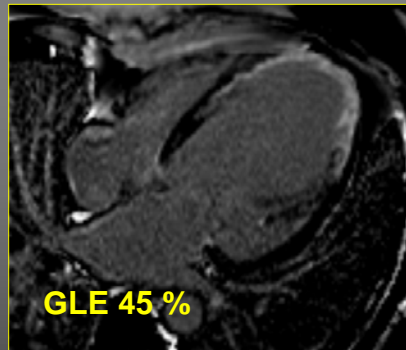
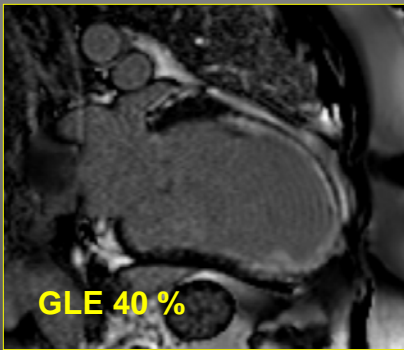
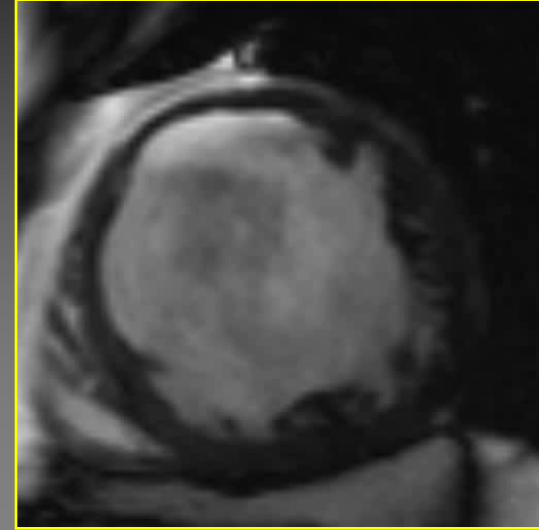
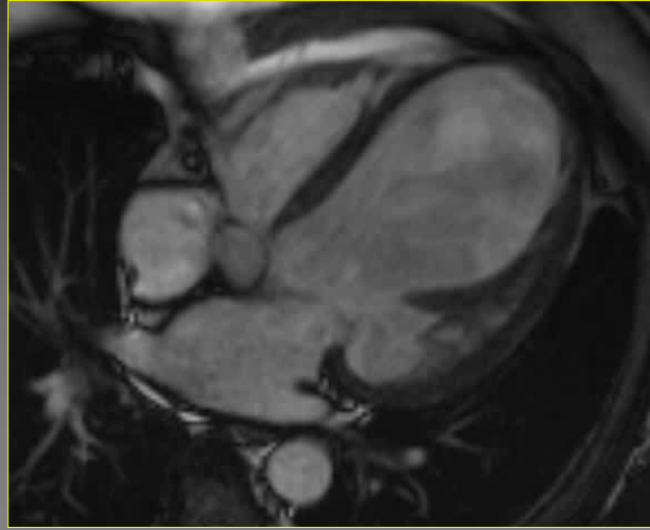
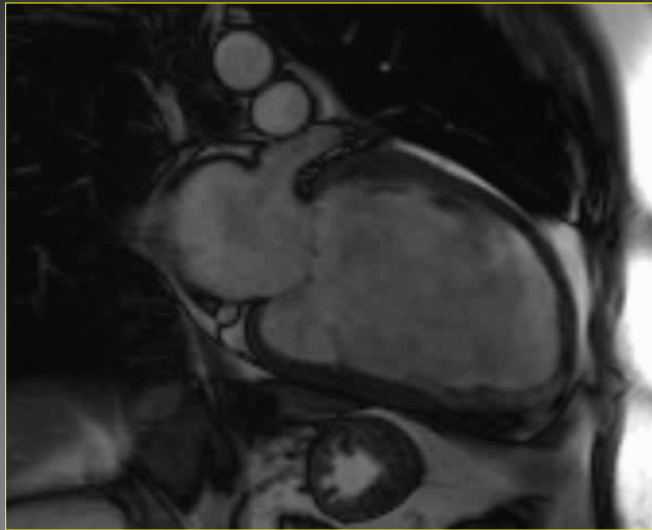
AK!



Thank you for your attention

and You'll be welcome visiting the C.C.M

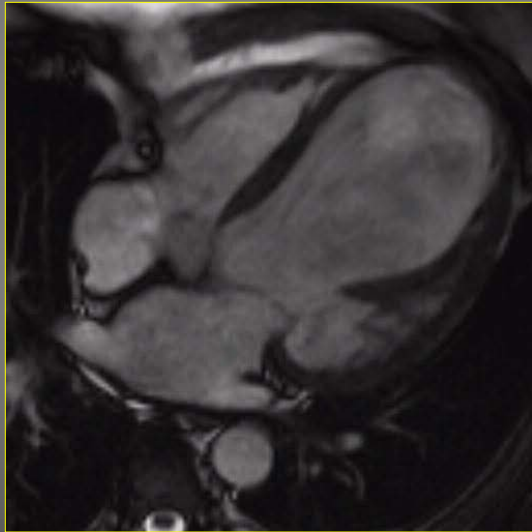
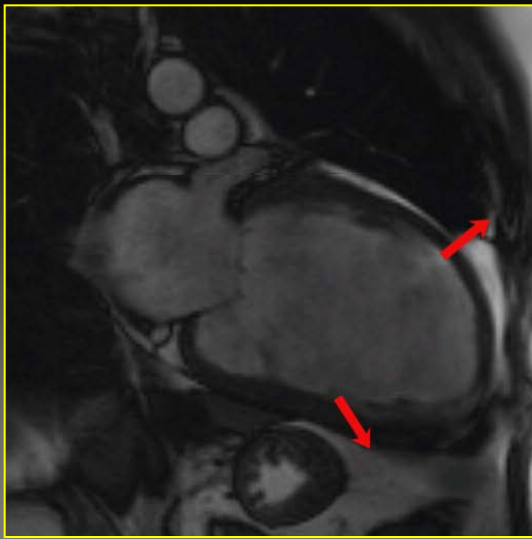
Mr. EL. 57 Y – **large akinesia** post AMI 2008



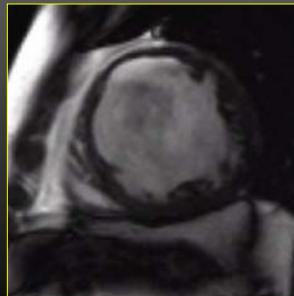
CHF III/IV

LVEF : 30 %
EDVI : 190 ml/m²
ESVI : 140 ml/m²
MAD : 41 mm

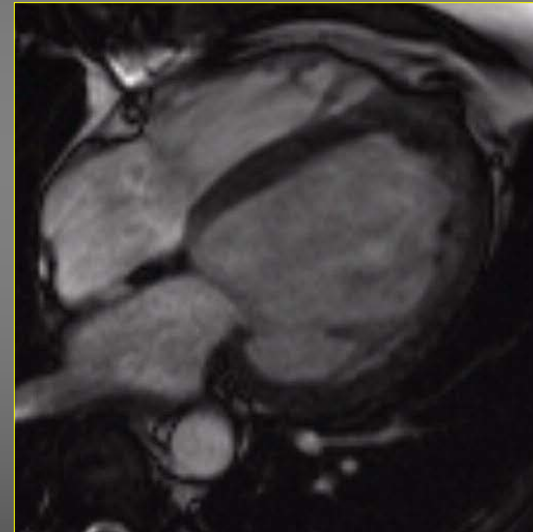
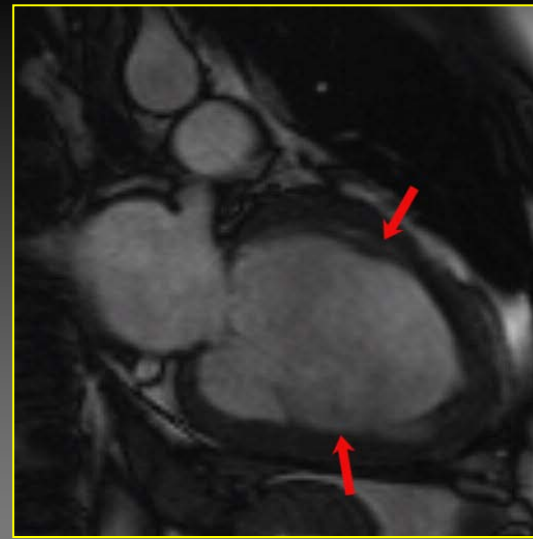
**Mr. EL.
57 Y.
2008**



Pre op values :
LVEF : 30 %
EDVI : 190 ml/m²
ESVI : 140 ml/m²
MAD : 41 mm



2009



Post op values :
LVEF : 47 %
EDVI : 101 ml/m²
ESVI : 53 ml/m²
MAD : 27 mm

