A NEW TREATMENT FOR PATIENTS WITH REFRACTORY ANGINA: THE SHOCK WAVE

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Aim

Treatment for patients with no longer benefit from current revascularization methods inducing Local Angiogenesis at Myocardial Ischemic Areas Using Low Intensity, Non Invasive, Focused Shockwaves

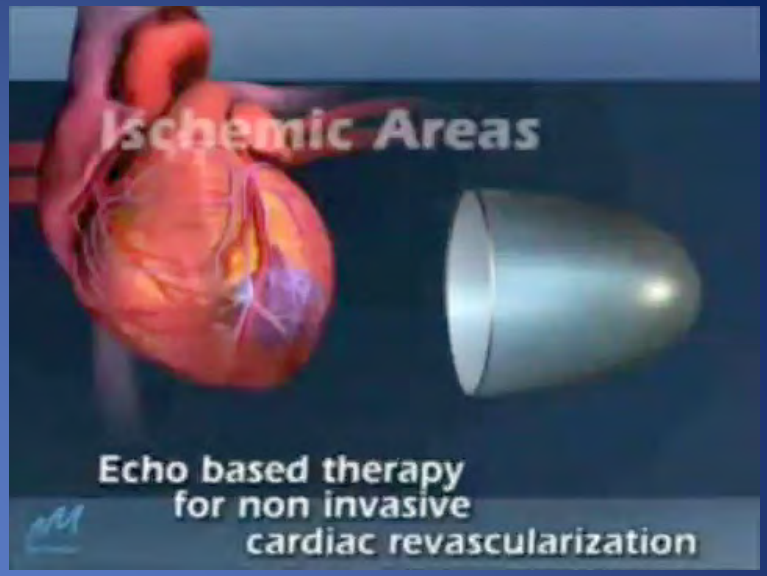
Angioplasty

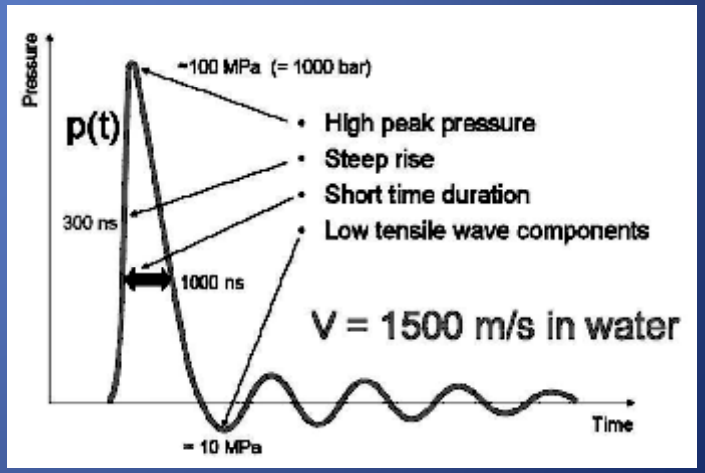
CABG

ESMR

ESMR Therapy
Extracorporeal Shockwave Myocardial Revascularization

- Shockwaves are special acoustics waves that can be targeted and focused non-invasively to a selected area inside the patient body.
- Shock wave therapy have been used in the last decades in Urology (kidney stone lithotripsy) and Orthopedics (plantar facilities) applications.
- In-vitro and animal data show an increase of angiogenic factors and neo-vascularization after treatment of low intensity shock waves (1/10 of the energy of lithotripsy).
- Therapeutic effect is localized, precise (<2 mm precision) and controlled.

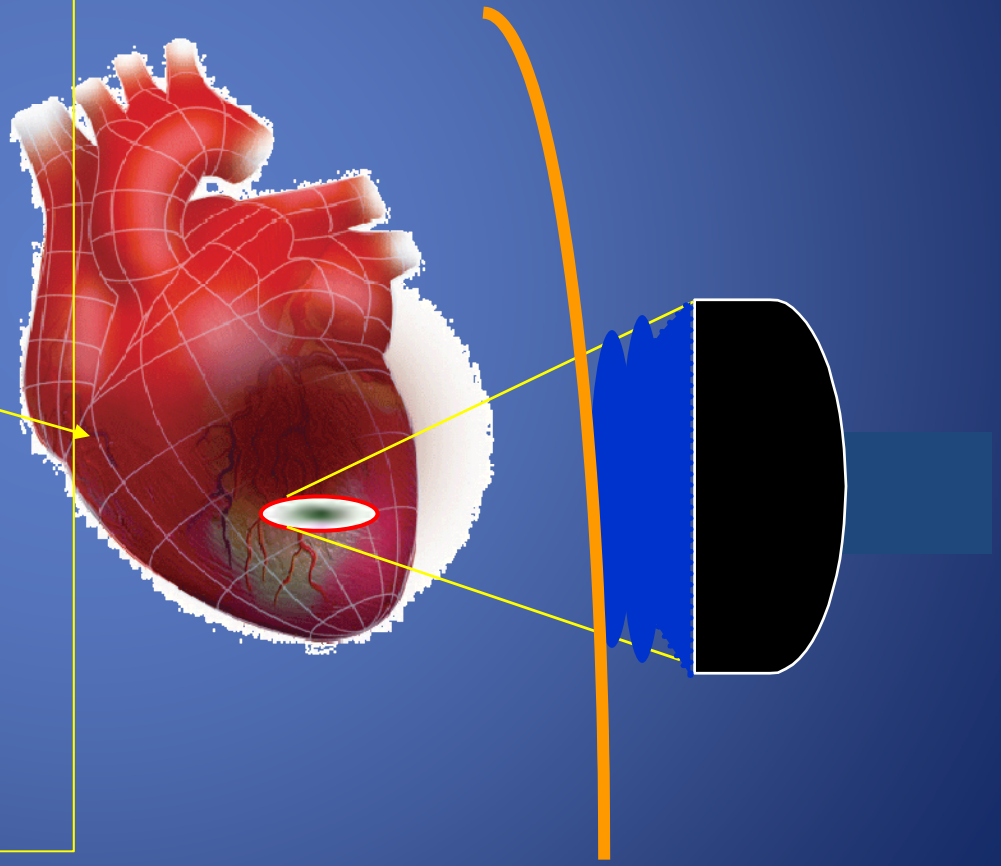




Main Physiological Effects

Short Term
Effect
Local Vasodilatation

Long Term
Effect
Angiogenesis



ESMR Therapy

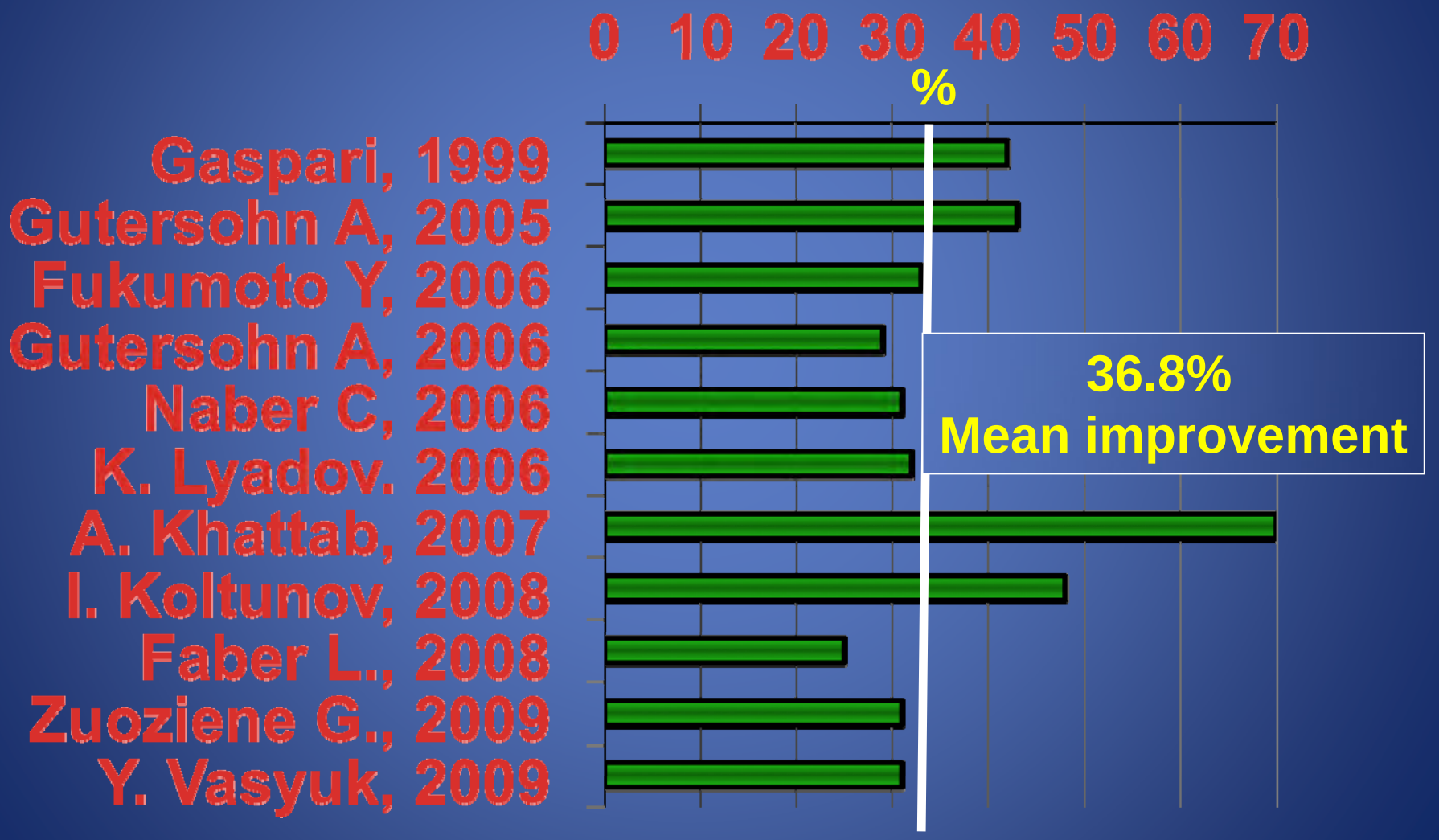
Extracorporeal Shockwave Myocardial Revascularization

- Short treatment time due to large treatment zone (~20 minutes)
- Out-patient settings (no need for hospitalization)
- Echocardiography guided

  (non-invasive revascularization)
- Low intensity shockwaves – 1/10 of lithotripsy)

Reduction in CCS class

11 medical centers, 175 patients:



Dynamics of main indicators with SW treatments

Research	N	Nitrates	QOL	Stress tolerance	EF	Perfusion
Caspari GH, 1999	9		+ (70%)	+ (91%)		+
Gutersohn A, 2005	23					+ (60%)
Fukumoto Y, 2006	9	94%		+ (25%)		+
Schmid J., 2006	8		+ (16%)	+ (17%)		
Gutersohn A, 2006	14			+ (43%)		+ (70%)
Naber C, 2006	25			+(64%)		+
K. Lyadov, 2006	13		+ (33%)	+(60%)	+	
A. Khattab, 2007	10					+(75%)
I. Koltunov, 2008	20			+	+	
Faber L., 2008	16			+ (23%)		+ (63%)
Vainer J., 2008	8	79%				+ (75%)
Zuoziene G., 2009	10	94%			+	
Y. Vasyuk, 2009	26	64%	+	+ (21%)	+	+ (55%)

ESMR Therapy
Extracorporeal Shockwave
Myocardial Revascularization

OUR EXPERIENCE

ESMR Therapy
PROTOCOL (1)

Inclusion criteria

- Reversible ischemia and/or hibernation to SPECT
- CCS Class II-IV
- PCI / CABG not applicable.
- Angina pectoris (dyspnea) > 3 months
- Stable dosage of medication used to treat angina for at least 6 weeks prior to enrollment.

ESMR Therapy
PROTOCOL (2)

Exclusion criteria

- Acute MI < 3 months prior to treatment
- Patient with intraventricular thrombus
- Severe COPD
- Patient has active endocarditis, myocarditis or pericarditis.
- Pregnancy
- Malignancy

Primary and Secondary End-Points
3-6 months post baseline

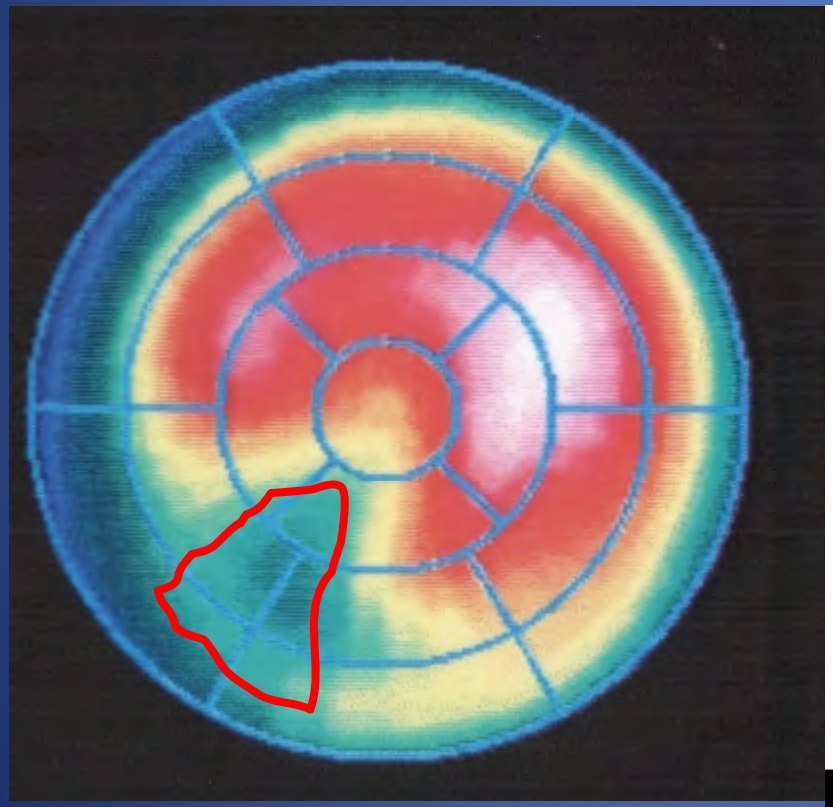
- Primary End-Point:
  - CCS class (3M – 6M)
  - SPECT perfusion (6 M)
- Secondary End-Points:
  - EF ECHO
  - NTG up-take
  - Re ACS/AMI
  - Re-Hospitalization
  - Death

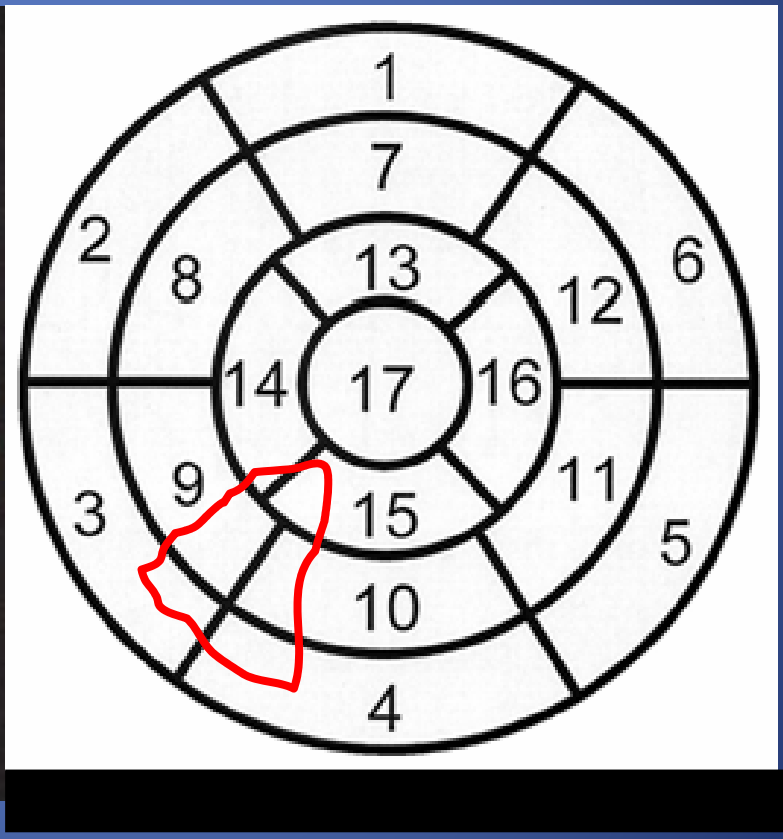
Treatment Protocol

3 treatments per week at 5-10 ischemic zones, 100 shocks per zone, 0.09 mj/mm^2

Locating ROI (Region of Interest)

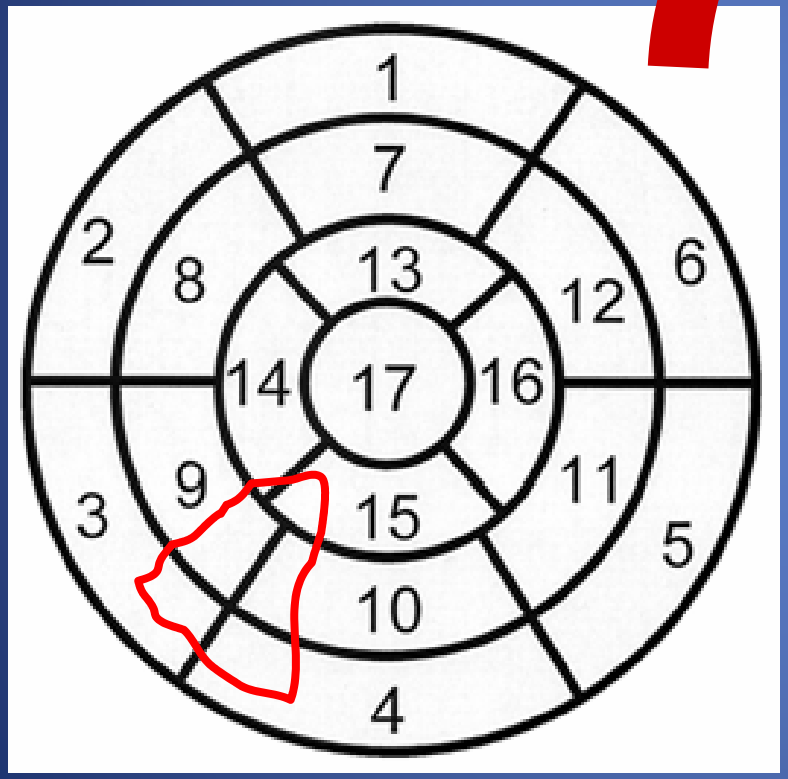
SPECT



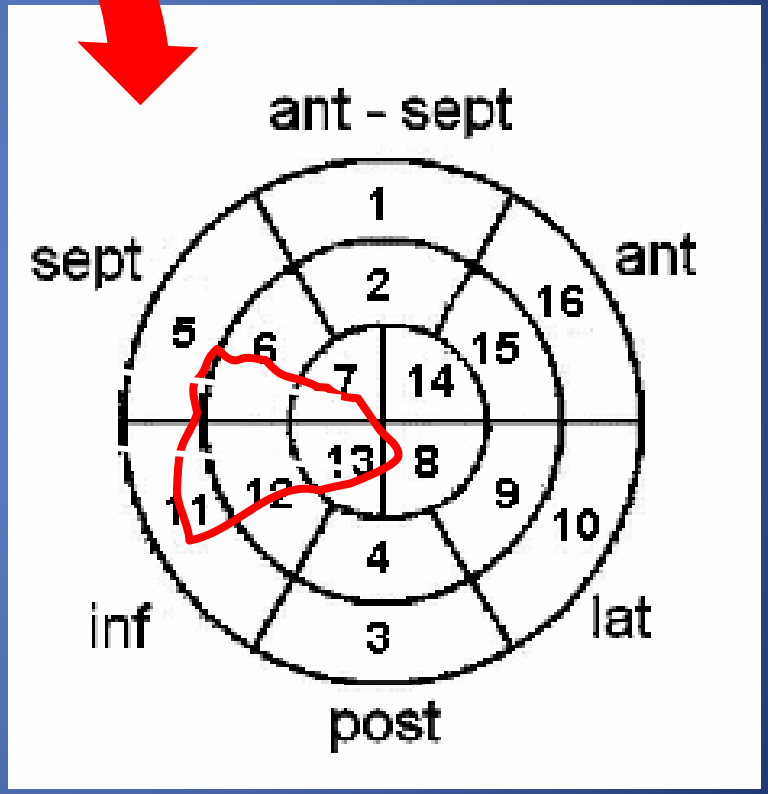


Dividing ROI according to weeks

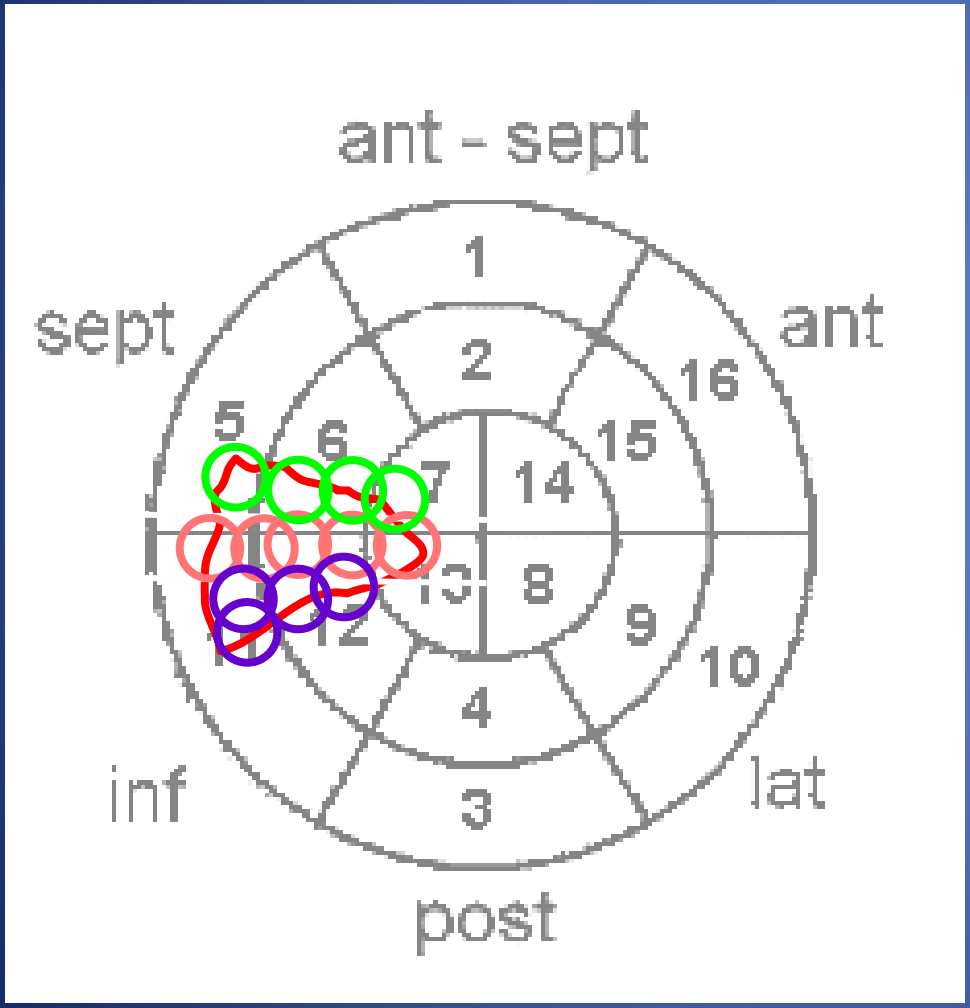
SPECT



ECHO



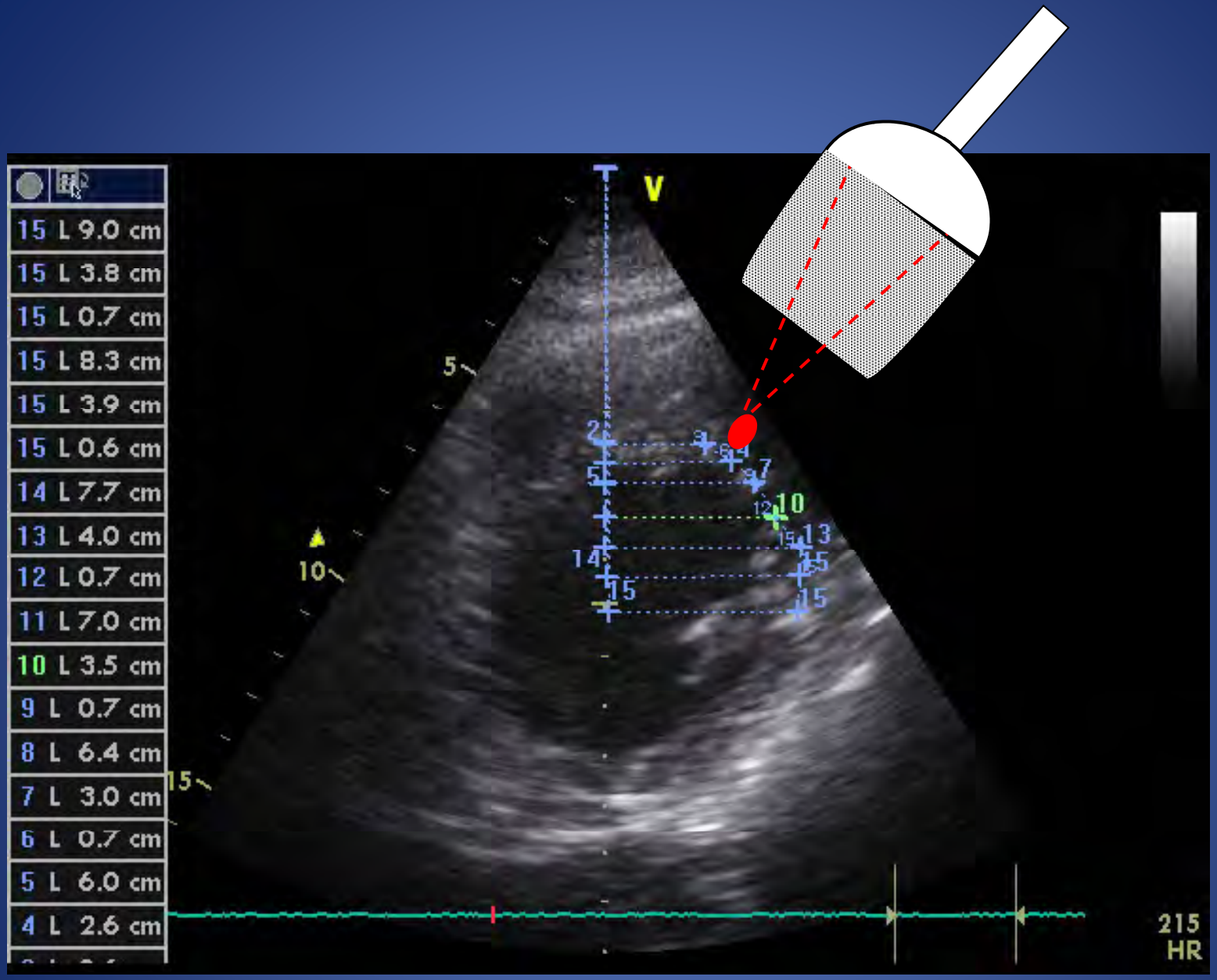
Identifying treatment zones



- Week 1
- Week 5
- Week 9

For 3 days, same area at the same week

- 1 cm^2

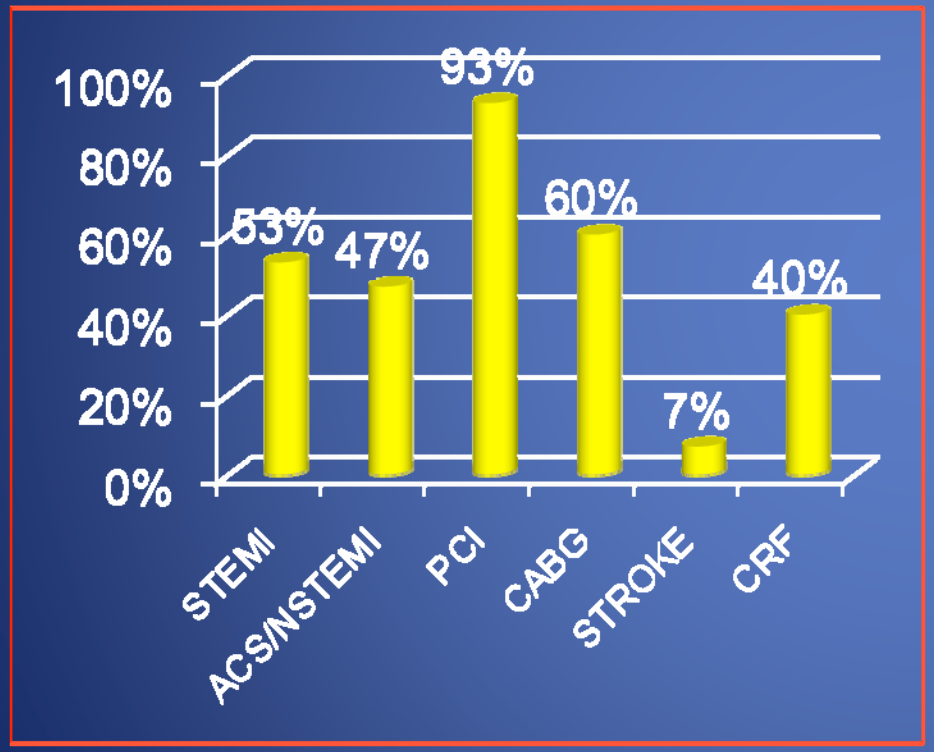

15 L 9.0 cm
15 L 3.8 cm
15 L 0.7 cm
15 L 8.3 cm
15 L 3.9 cm
15 L 0.6 cm
14 L 7.7 cm
13 L 4.0 cm
12 L 0.7 cm
11 L 7.0 cm
10 L 3.5 cm
9 L 0.7 cm
8 L 6.4 cm
7 L 3.0 cm
6 L 0.7 cm
5 L 6.0 cm
4 L 2.6 cm
V
5
10
15
215
HR

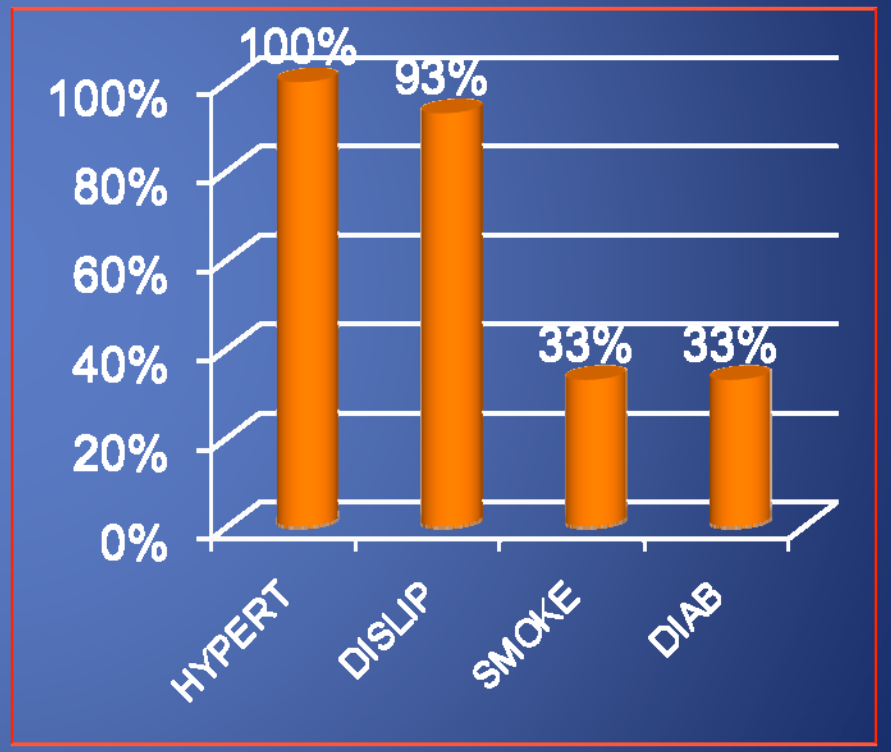
ESMR Therapy
PURPOSE

- Forecast of 20 patients
- Completed to treatment 15 patients
- 4 patients going to treat
- AGE 72 ± 5,6 (58-84)
- 80% M, 20% F

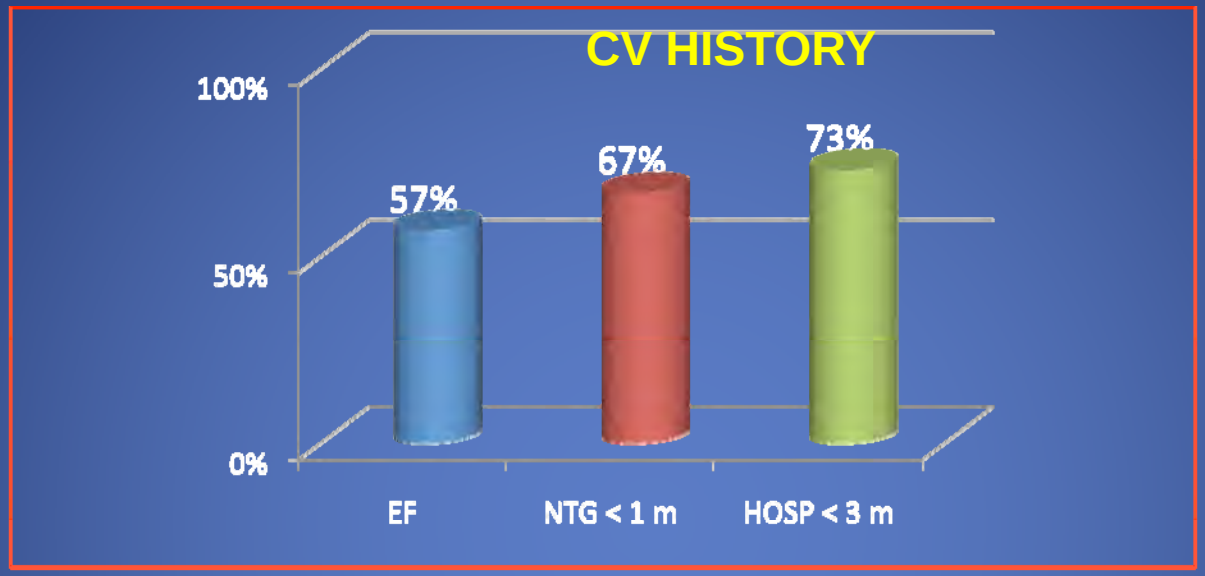
GENERAL POPULATION

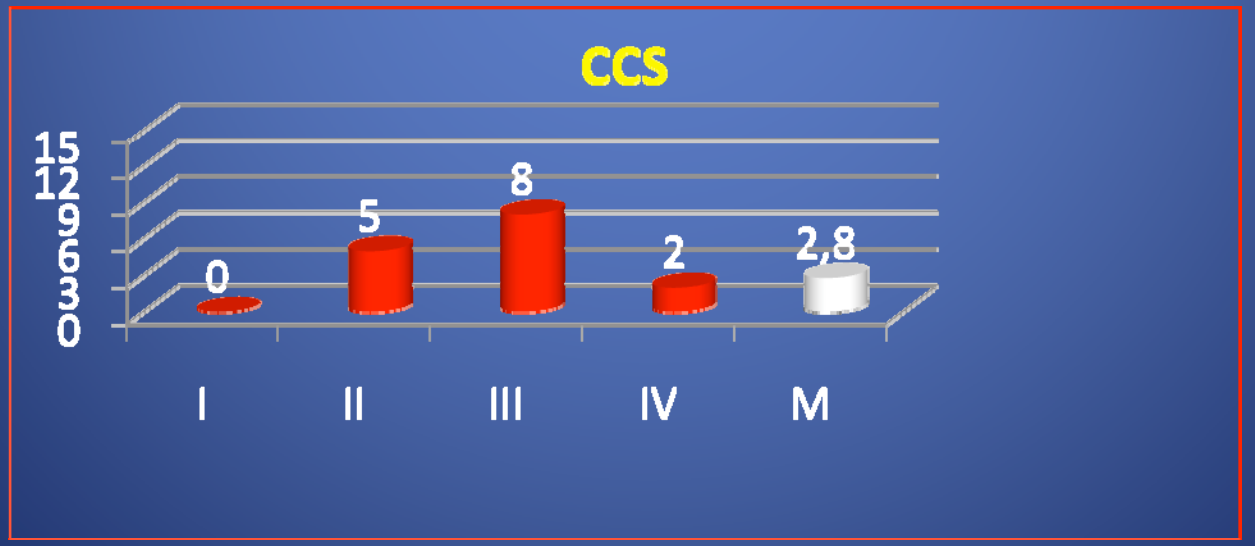
CV HISTORY - CRF



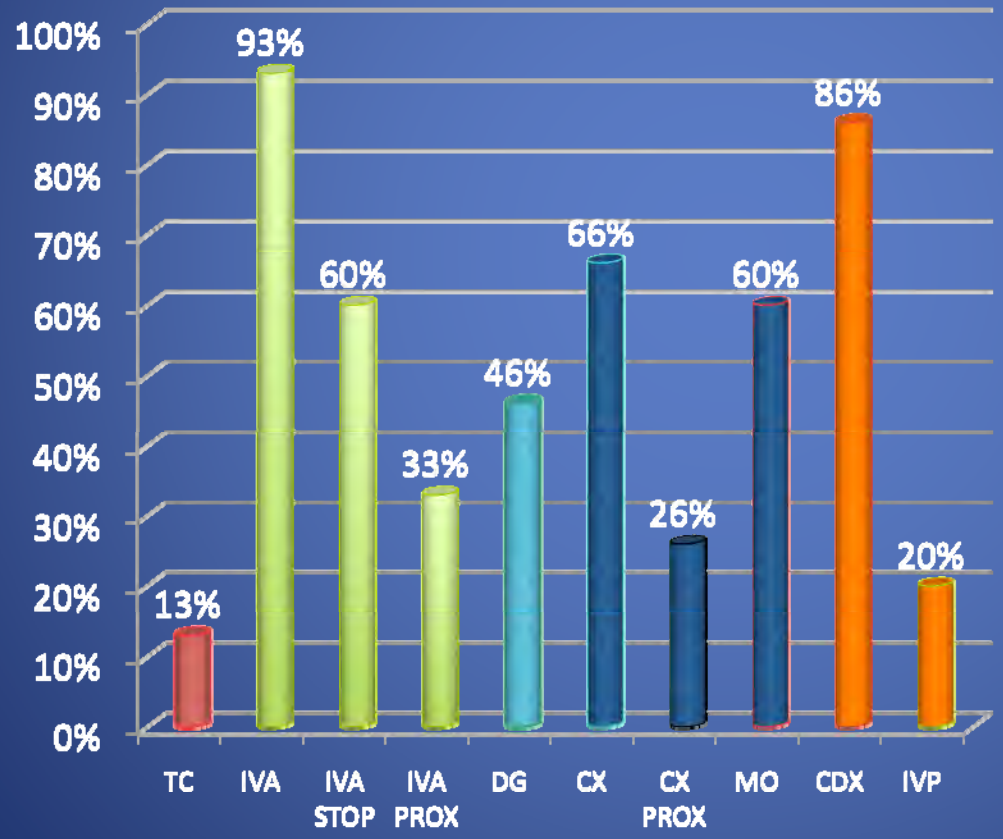


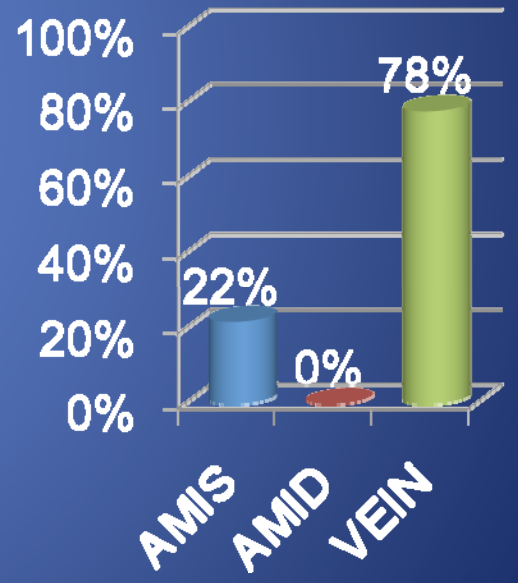
GENERAL POPULATION



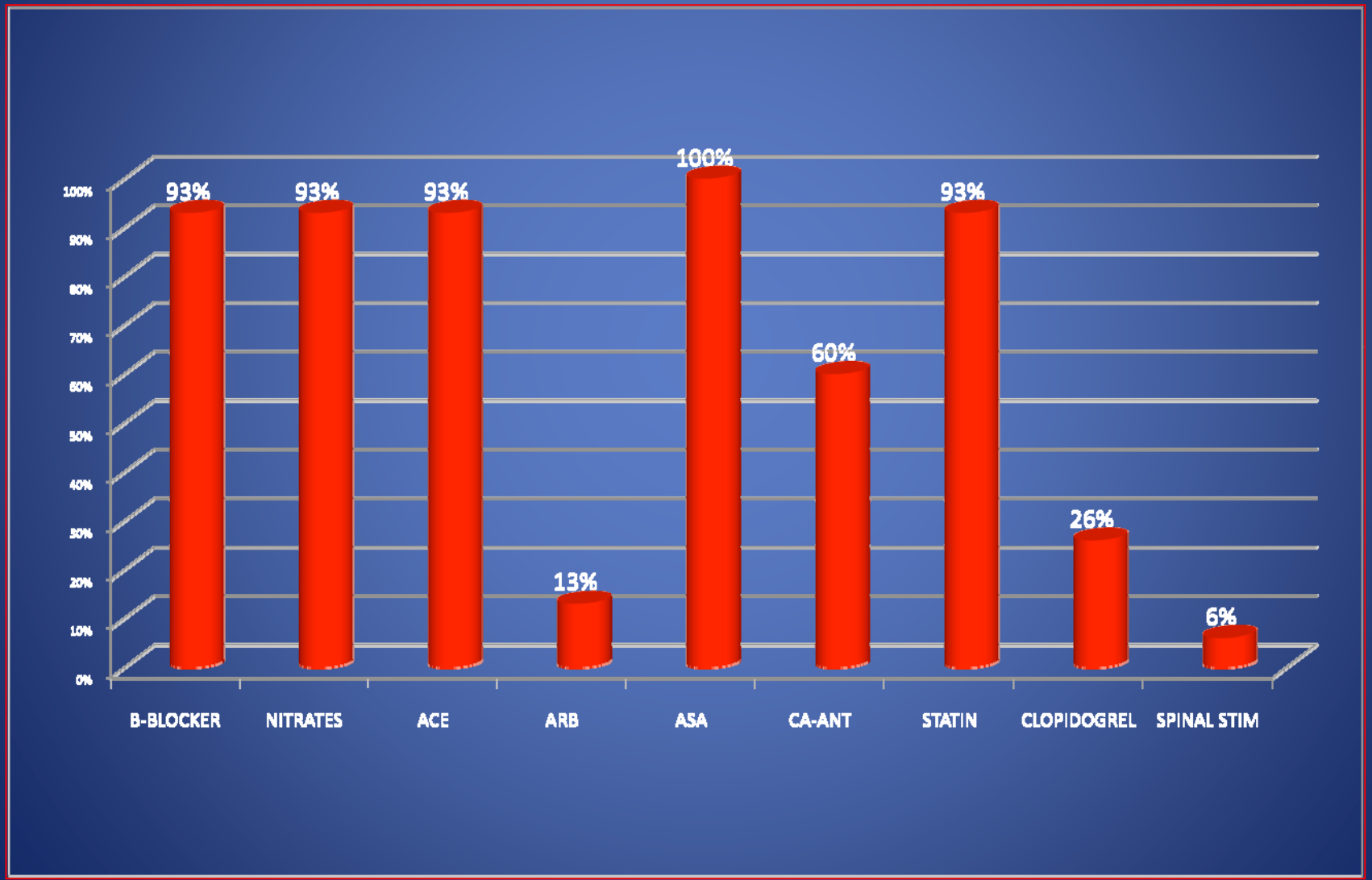


CORONARY ANATOMY





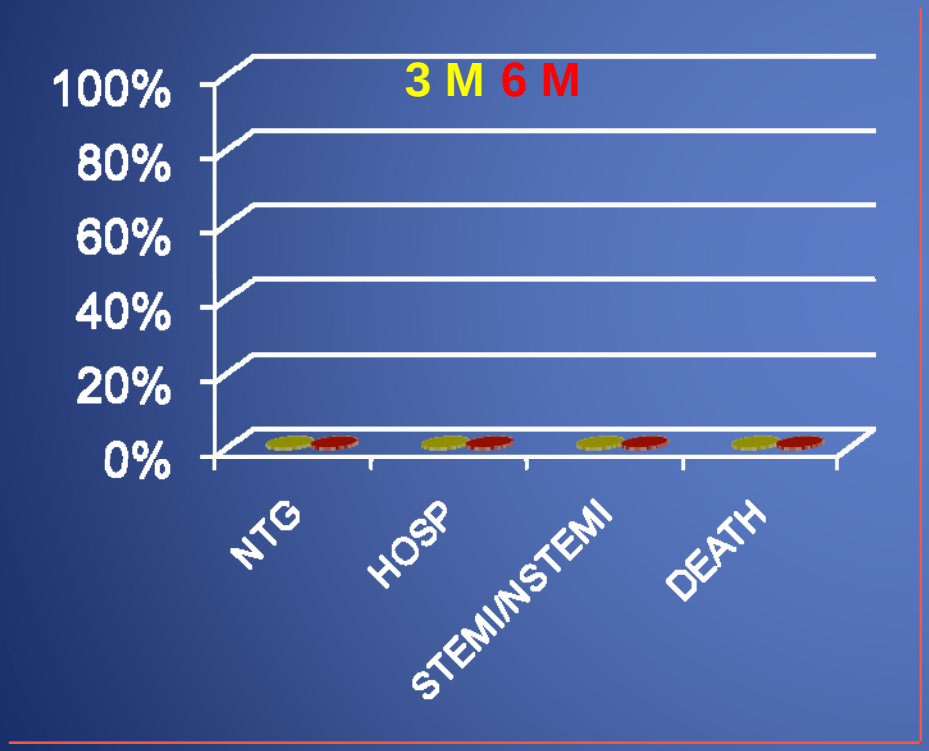
GENERAL POPULATION
THERAPY

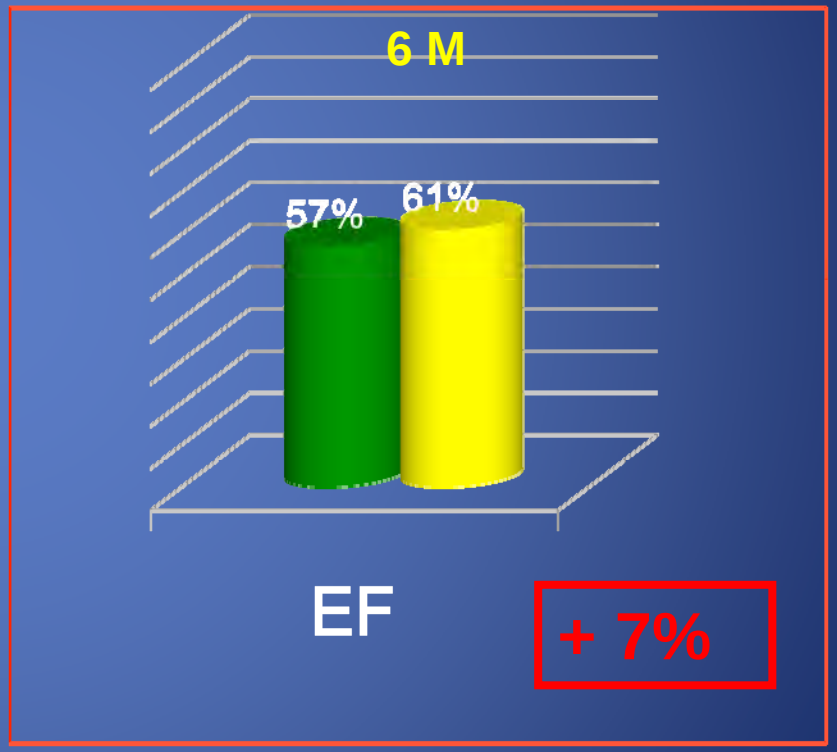


ESMR Therapy
RESULTS

- 15 patients treated
- 11 patients underwent SPECT after the treatment
- 4 patient waiting for to SPECT in april
- 4 patients waiting for to treatment
- No side effects

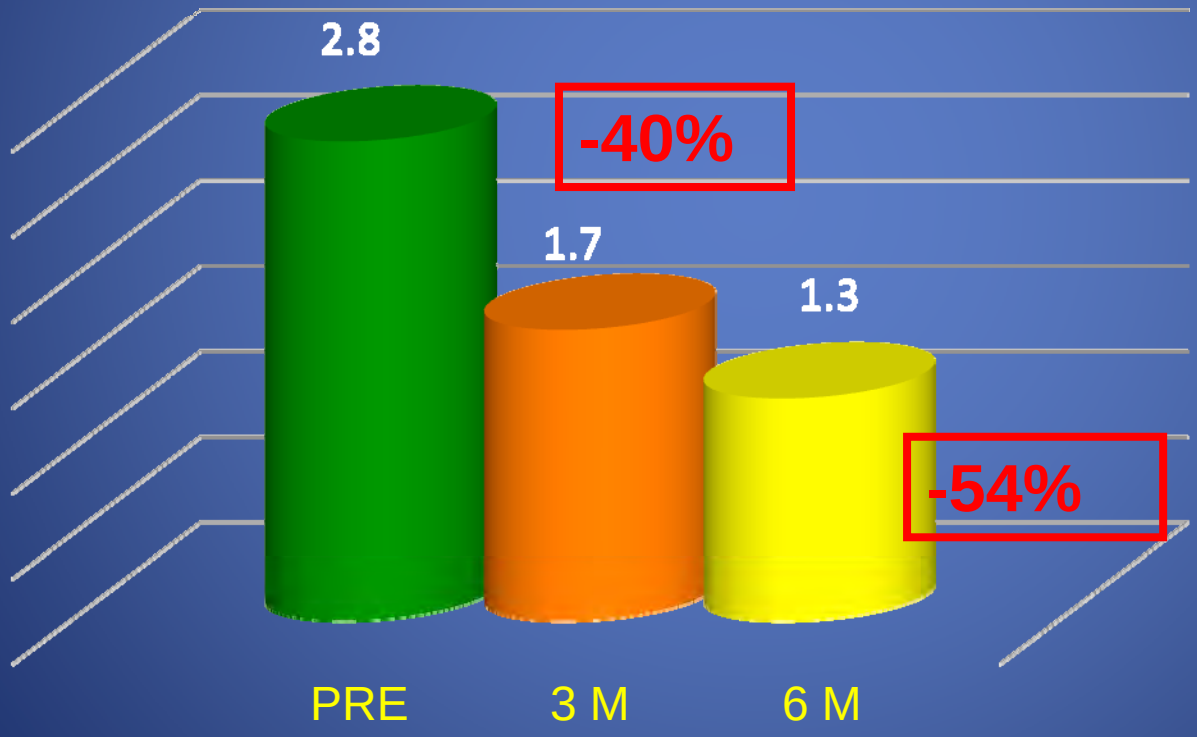
RESULTS
SECONDARY END-POINTS





RESULTS
PRIMARY END-POINTS 3-6 M

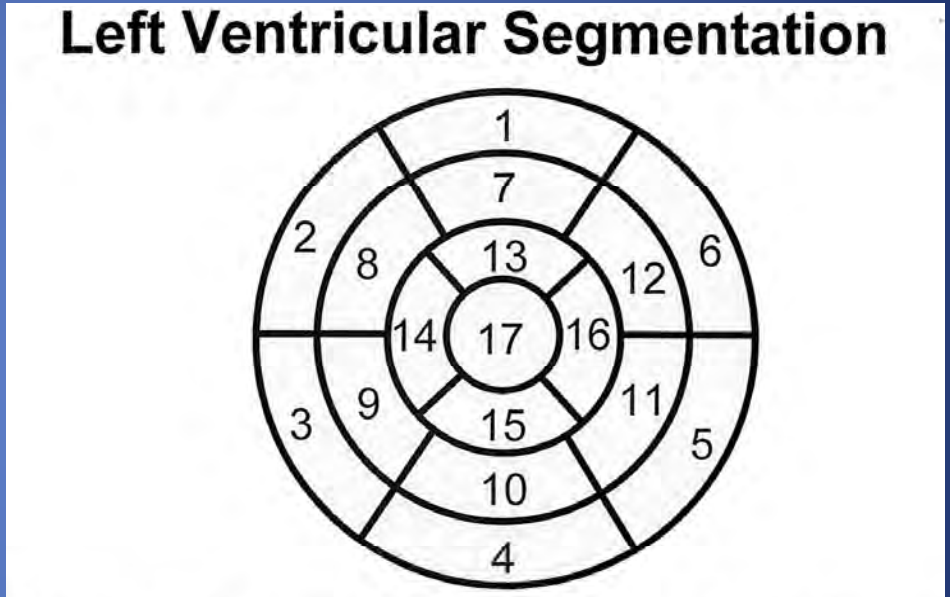
CCS



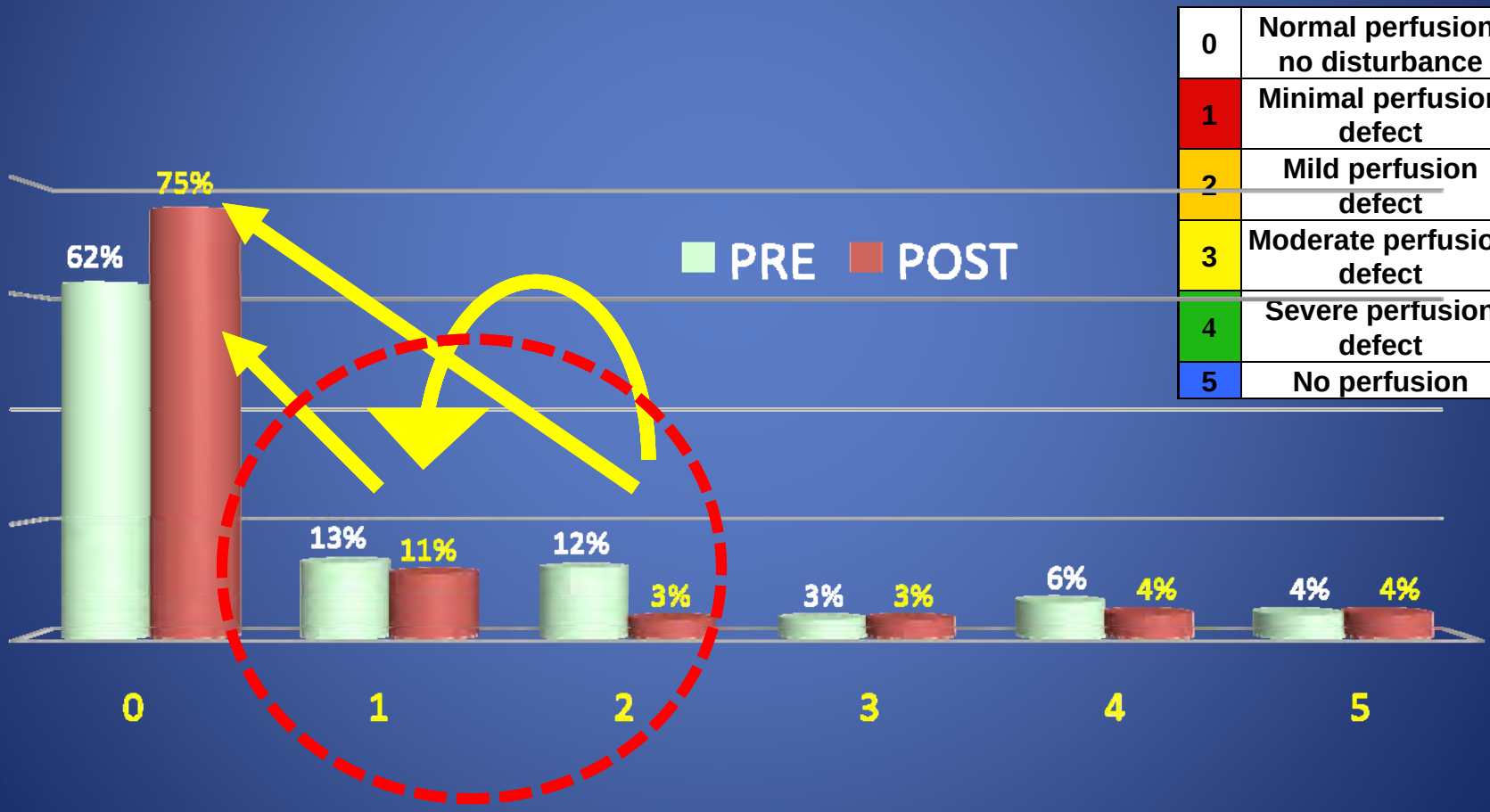
PRIMARY END-POINTS 6 M
TOTAL LV ANALISIS TO SPECT

Analysis method

- SPECT study performed during Rest and Stress pre and post treatment (4 studies for patient)
- 17 segments model
- 0-5 grading for perfusion for each segment at Rest and at Stress
  - Class 0 : normal perfusion
  - Class 5 : no perfusion



RESULTS
PRIMARY END-POINTS 6 M
TOTAL LV ANALISIS TO SPECT - REST



0	Normal perfusion, no disturbance
1	Minimal perfusion defect
2	Mild perfusion defect
3	Moderate perfusion defect
4	Severe perfusion defect
5	No perfusion

RESULTS

PRIMARY END-POINTS 6 M

TOTAL LV ANALISIS TO SPECT - STRESS

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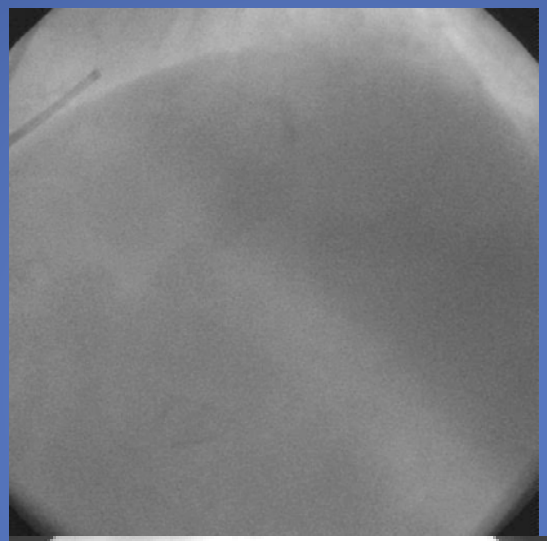

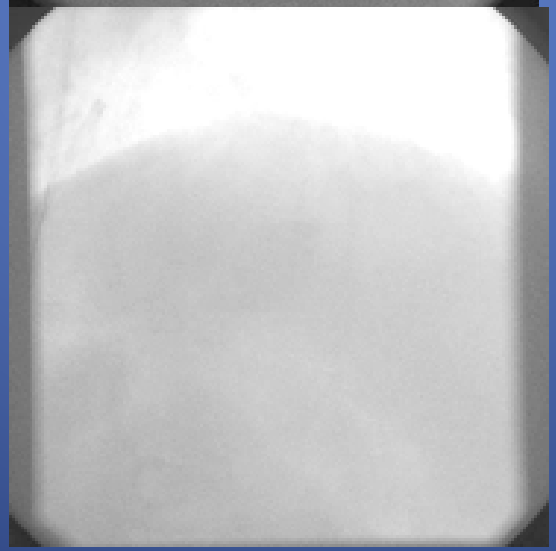

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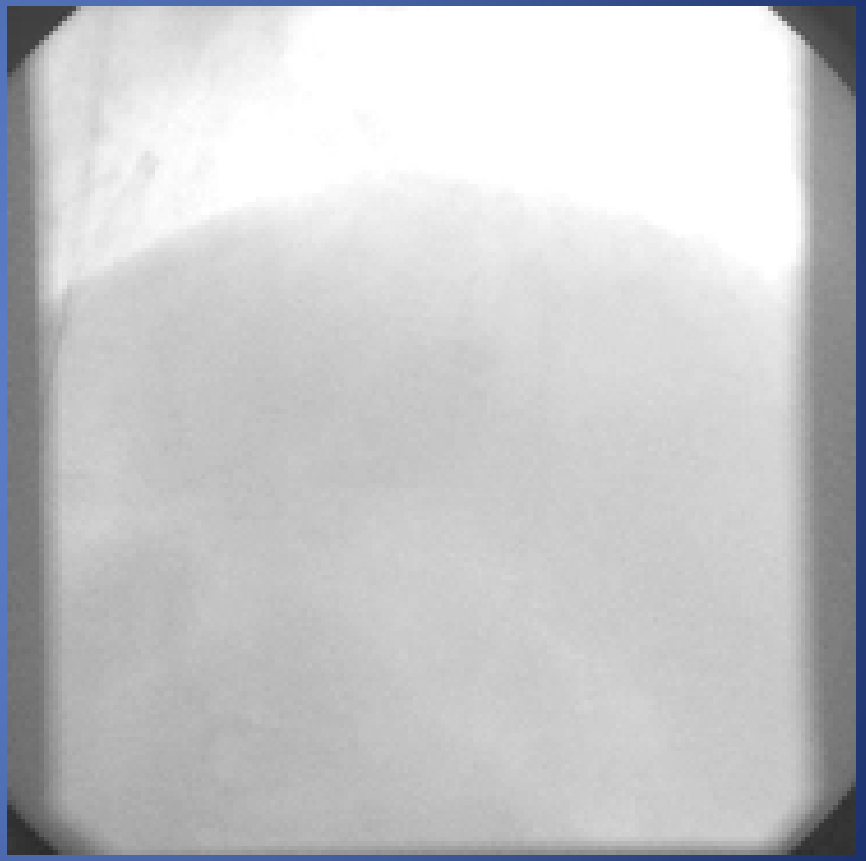
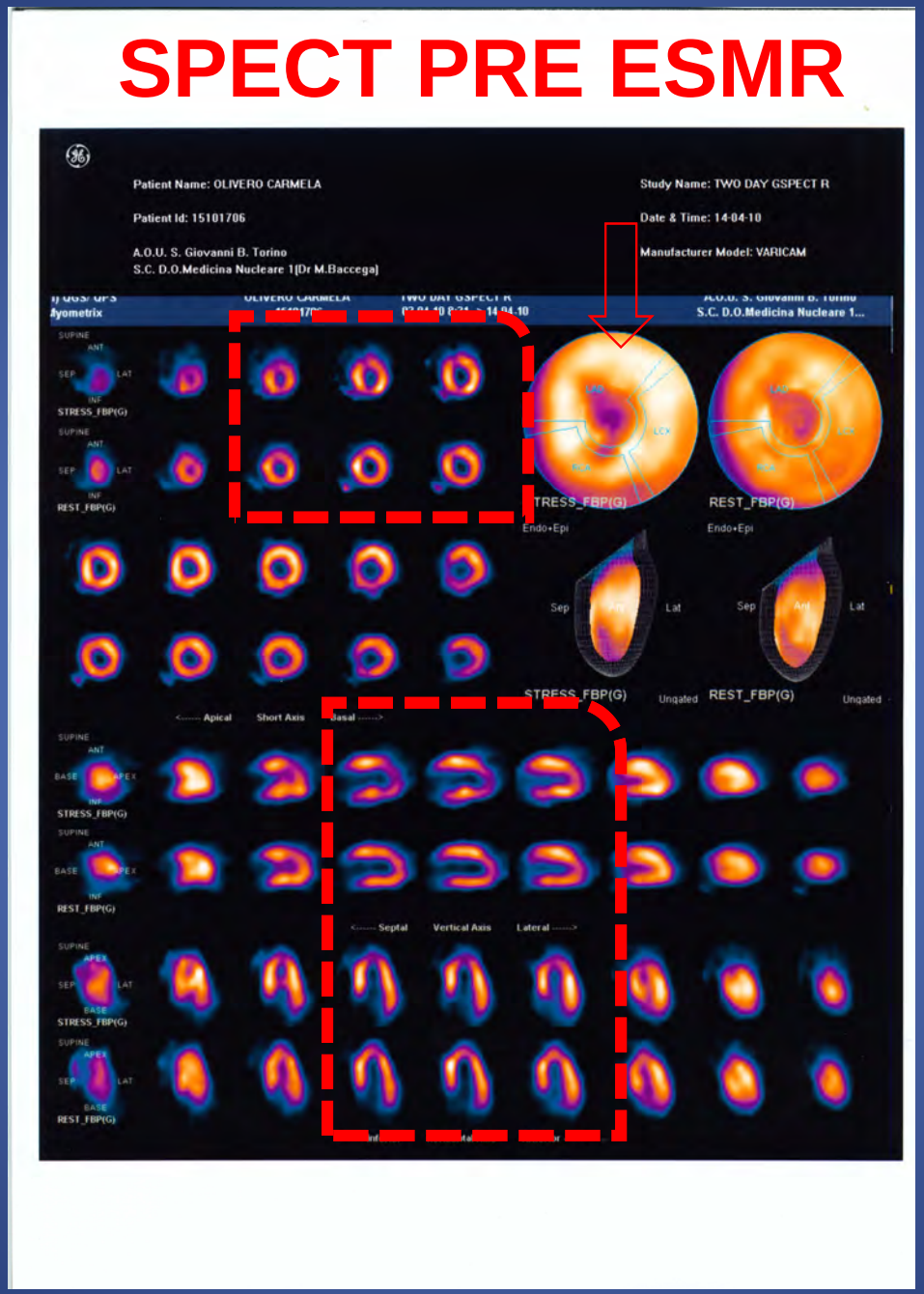
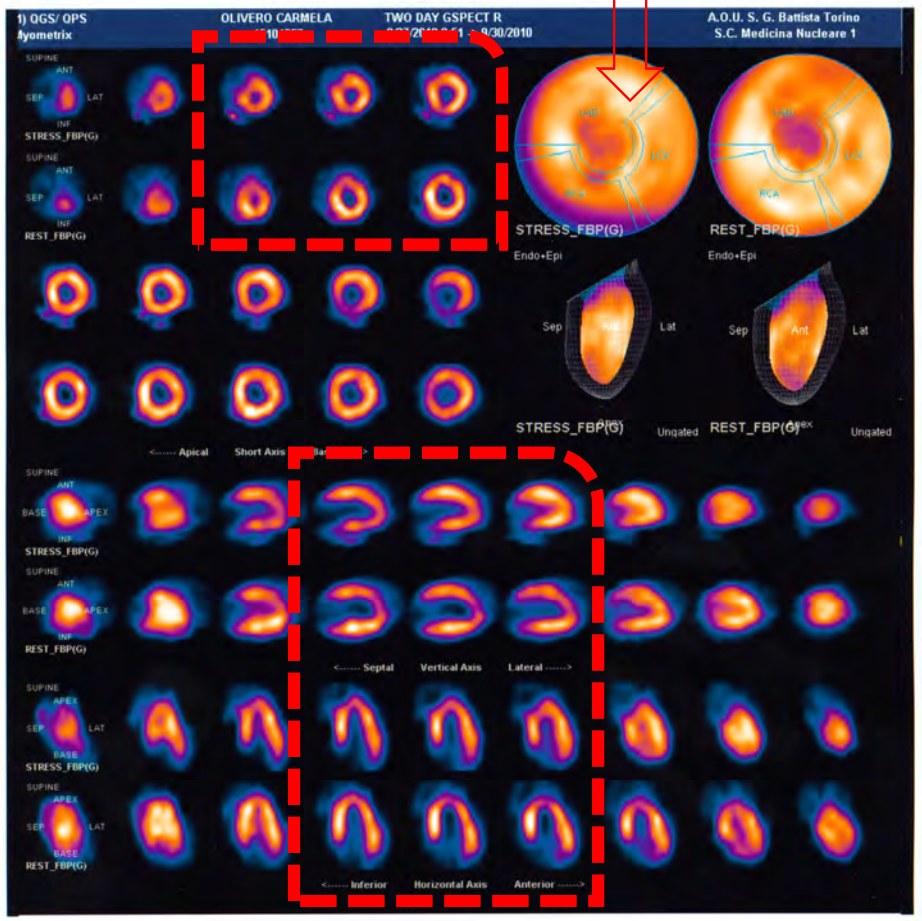


SPECT PRE ESMR



SPECT POST ESMR



RESULTS

- **CCS**

  improvement at three months: **40%**

  improvement at six months: **54%**

- **TOTAL LV ANALISI SPECT REST** :

  Improvement: **17%** normal perfusion (Class 0)

  Reduction: **16%** minimal perfusion (Class 1)

  Reduction: **75%** medial perfusion defect (Class 2)

- **TOTAL LV ANALISIS SPECT STRESS:**

  Improvement: **+ 20%** normal perfusion (Class 0)

  Reduction: **54%** moderate perfusione defect (class 3)

  Reduction: **75 %** severe perfusion defect (Class 4)

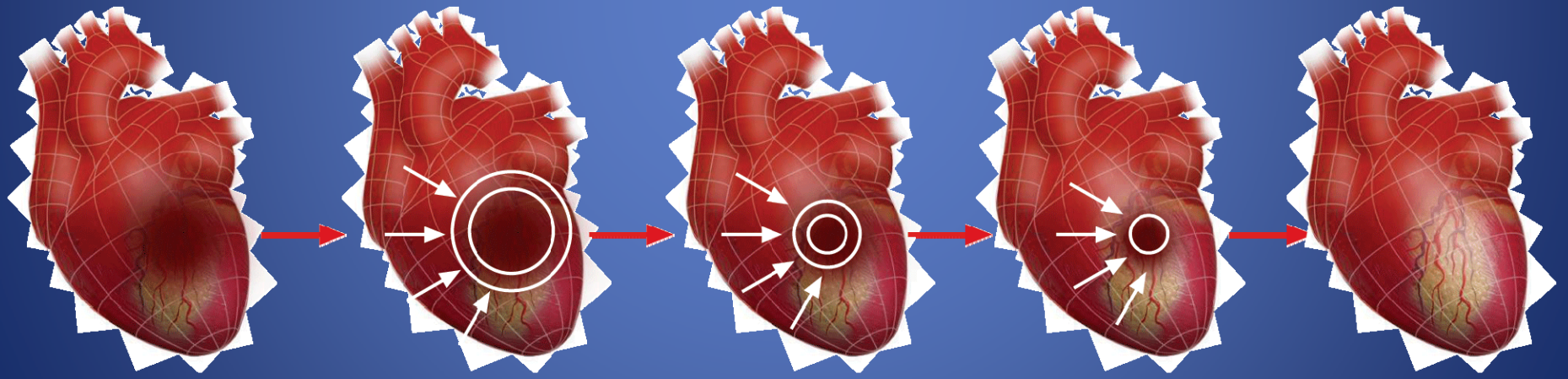
CONCLUSIONS
OUR EXSPERIENCE

- No side effects
- Improvement CCS:
  - 40% 3M; -54% 6M
- Improvement perfusion to SPECT
  - **75%** medial perfusion defect (REST)
  - **54%** moderate perfusione defect (STRESS)
  - **75 %** severe perfusion defect (STRESS)
- No adverse events (3-6 M)
    - IMA-ACS
    - Re-PCI
    - Re- Hospitalization
- wait for new results


Thanks you for attention
Madness is doing the same thing and expect different results
Albert Einstein

Treatment Strategy

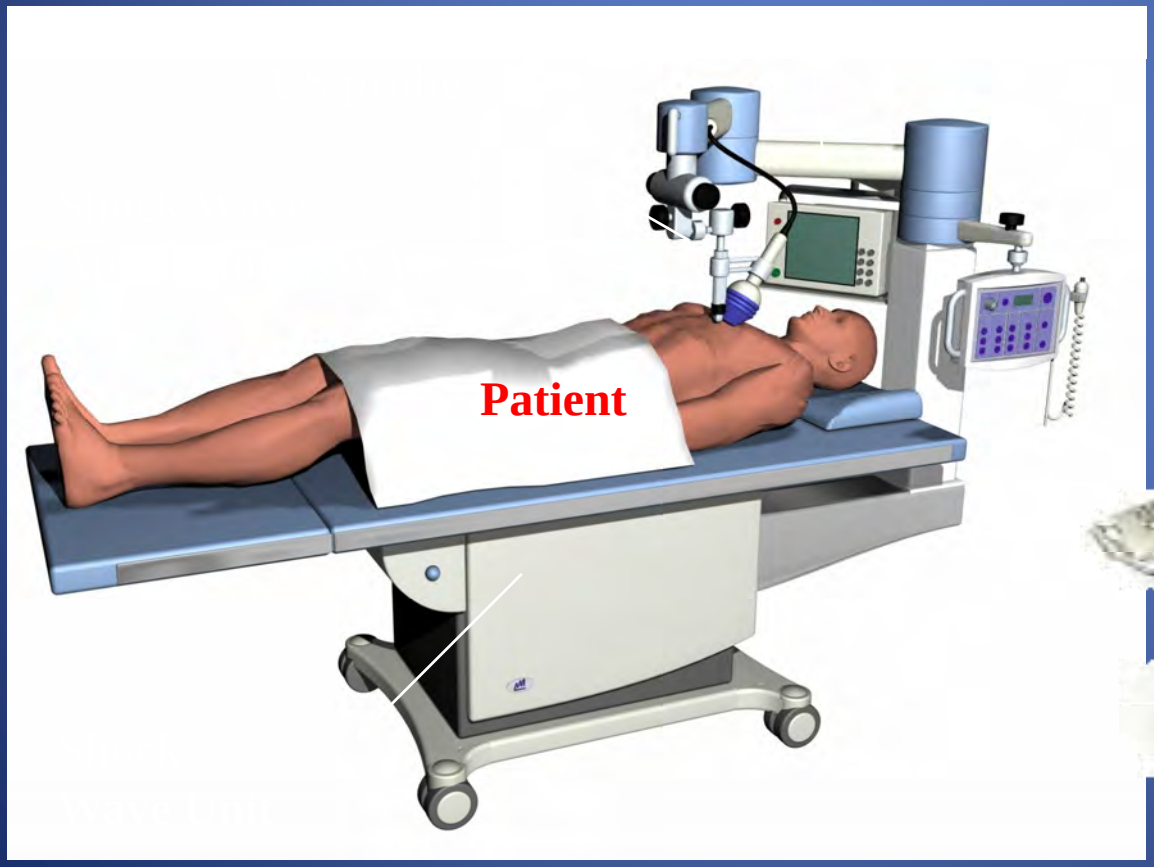
At each treatment session shock waves should be delivered to the border of the ischemic area triggering the viable tissue for angiogenesis



Cardiospec System Components

ECG Monitor

Control Panel



Ultra-Sound (US) system

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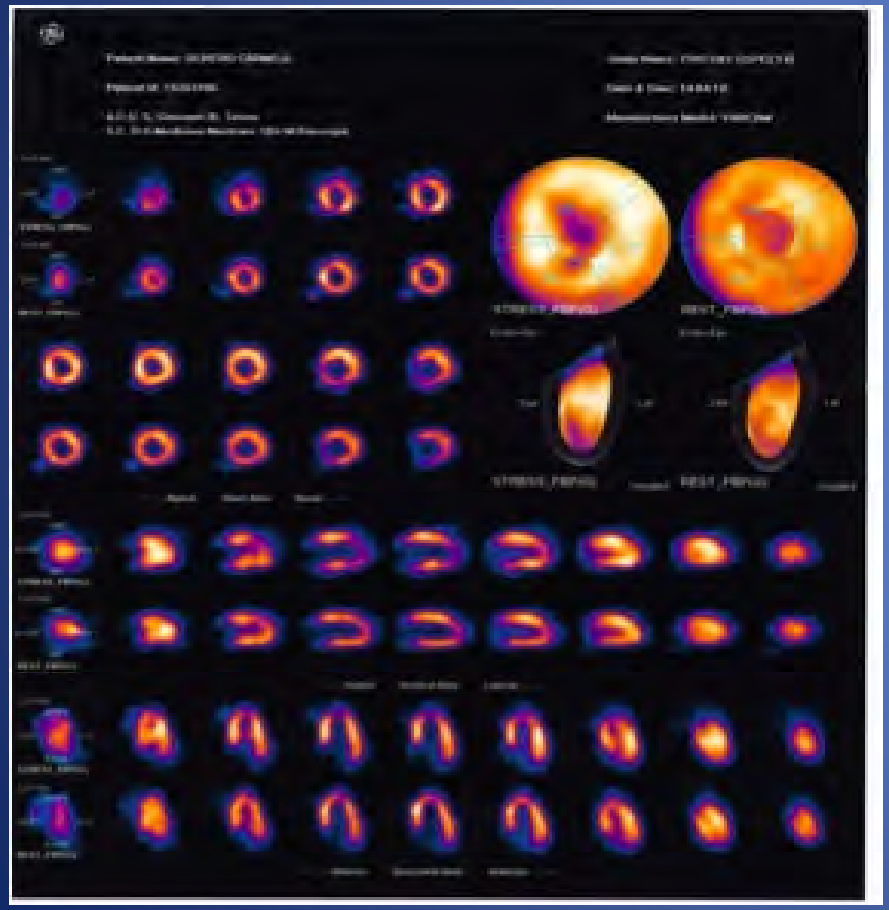
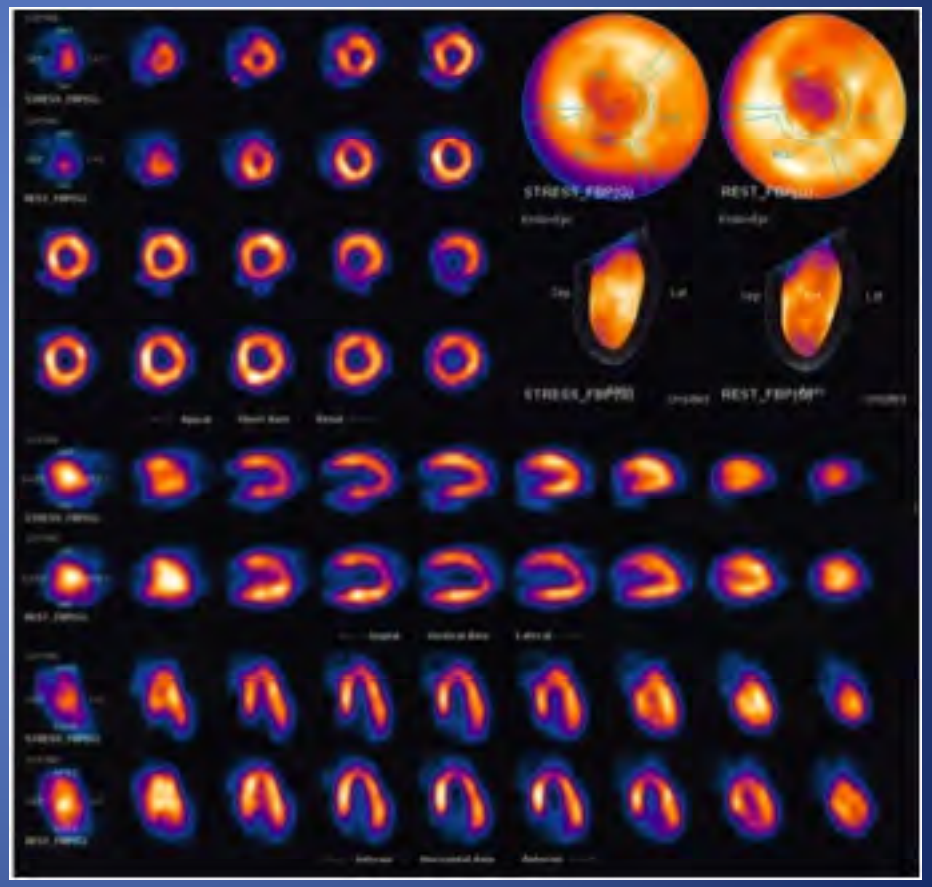
PRE ESMR



POST ESMR



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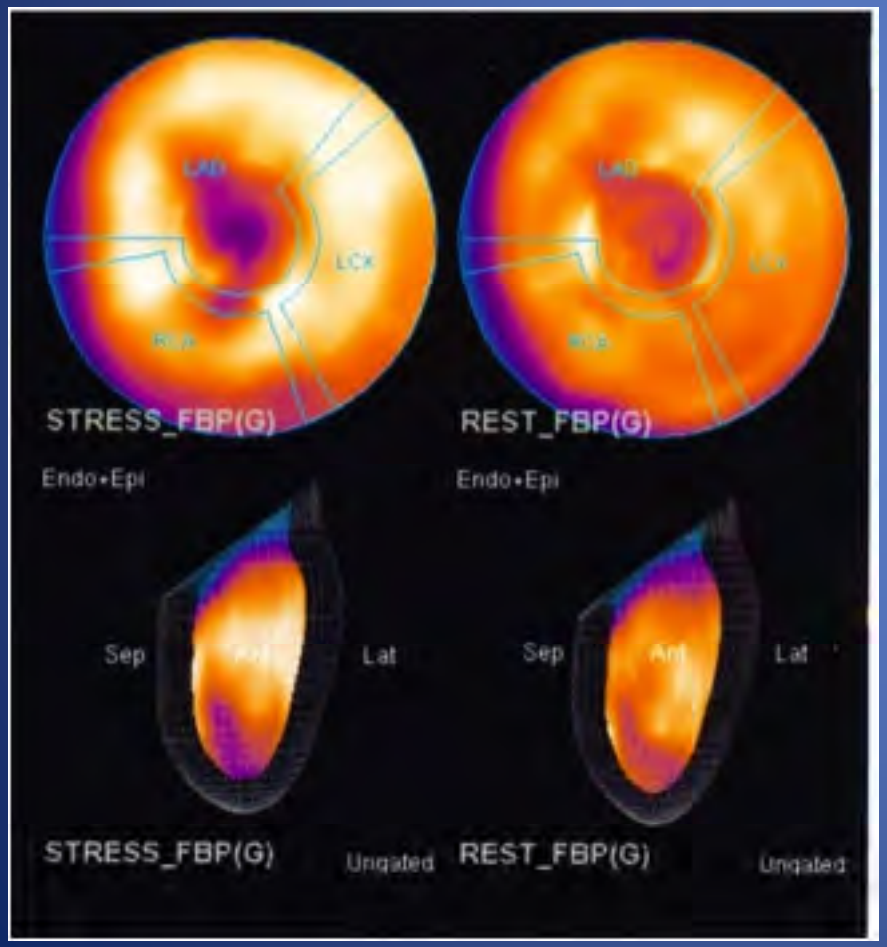
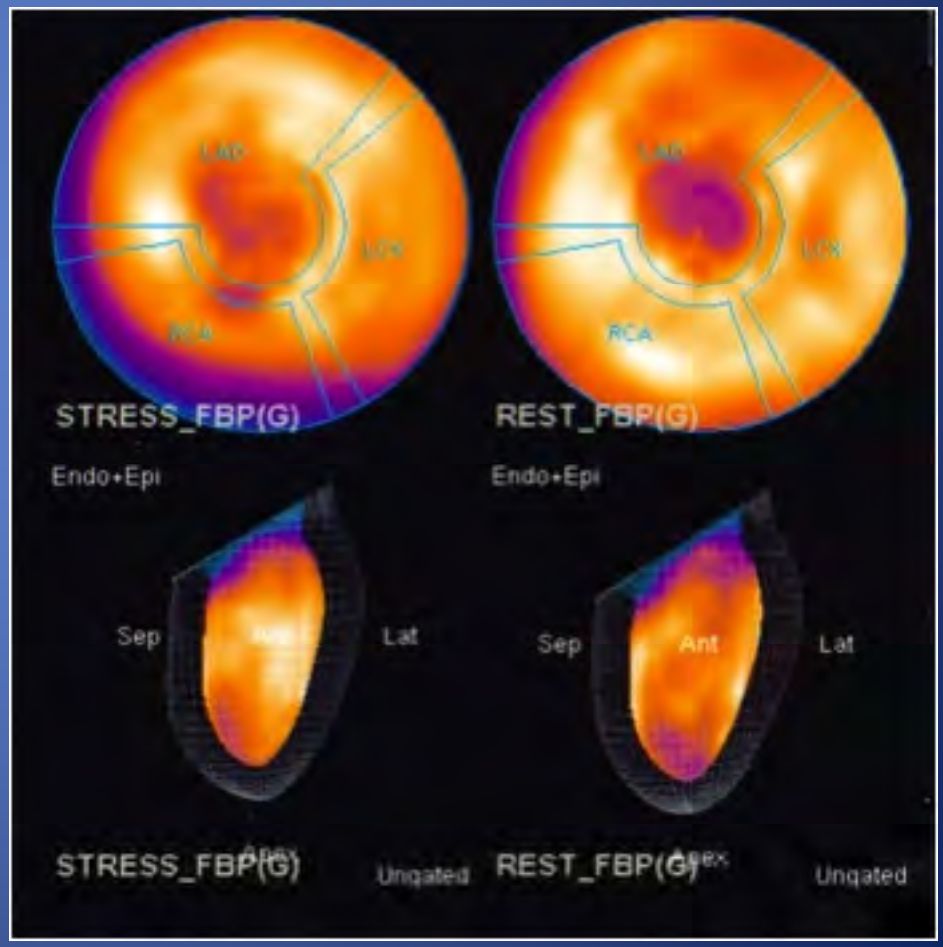
PRE ESMR



POST ESMR



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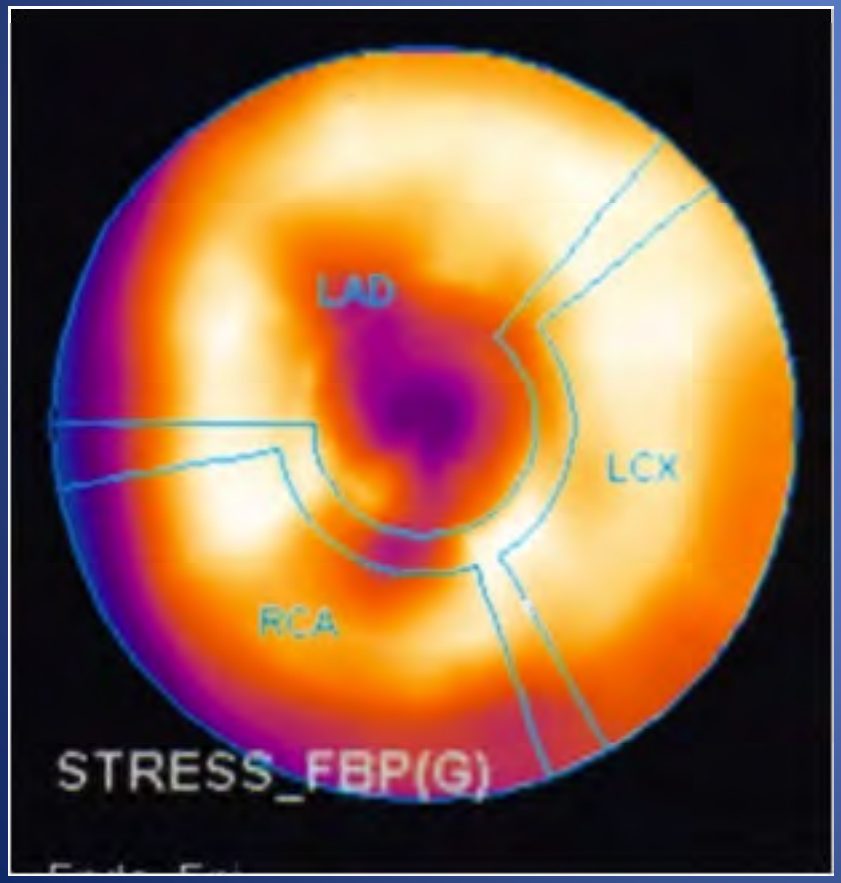
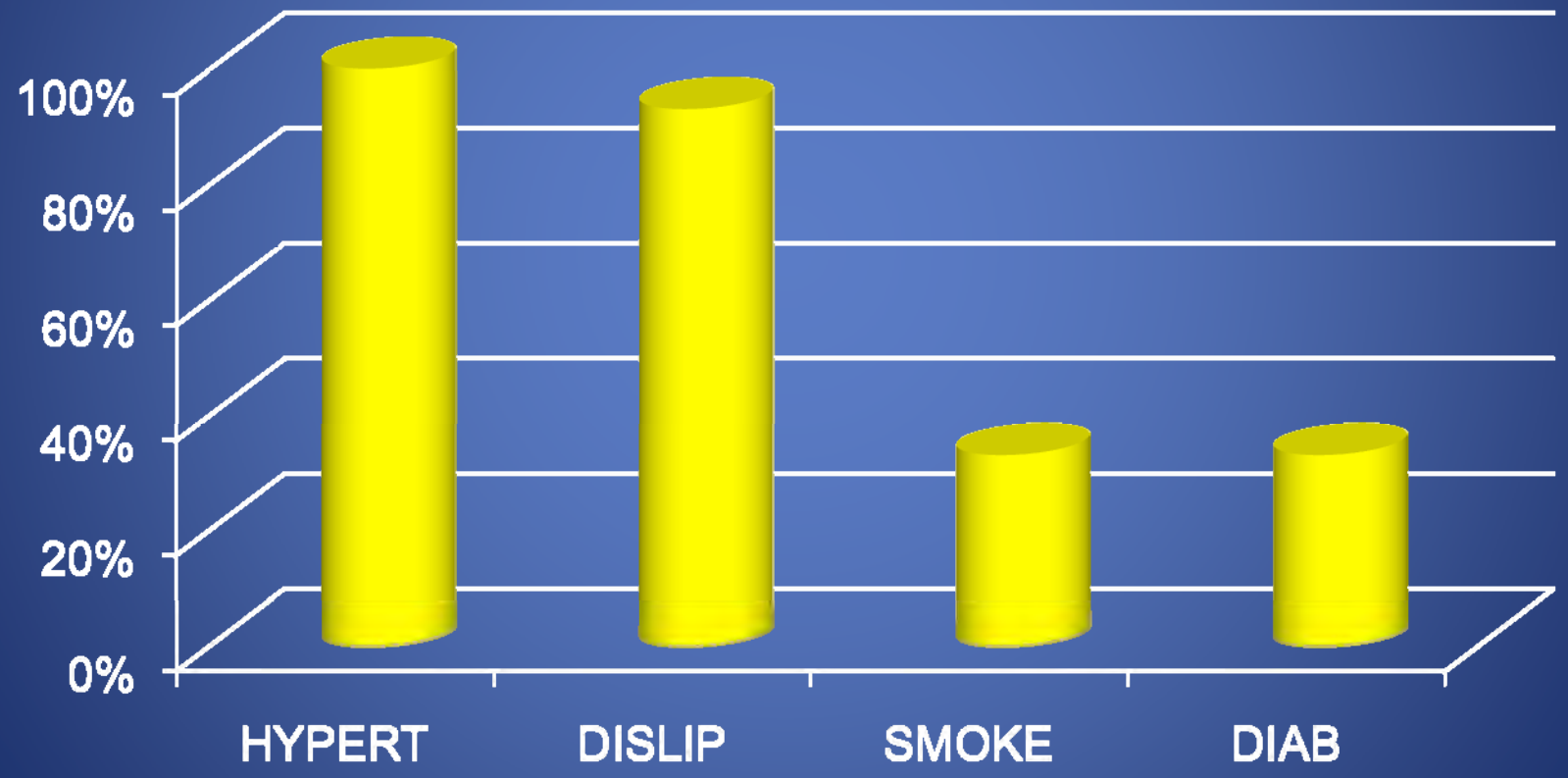
PRE ESMR



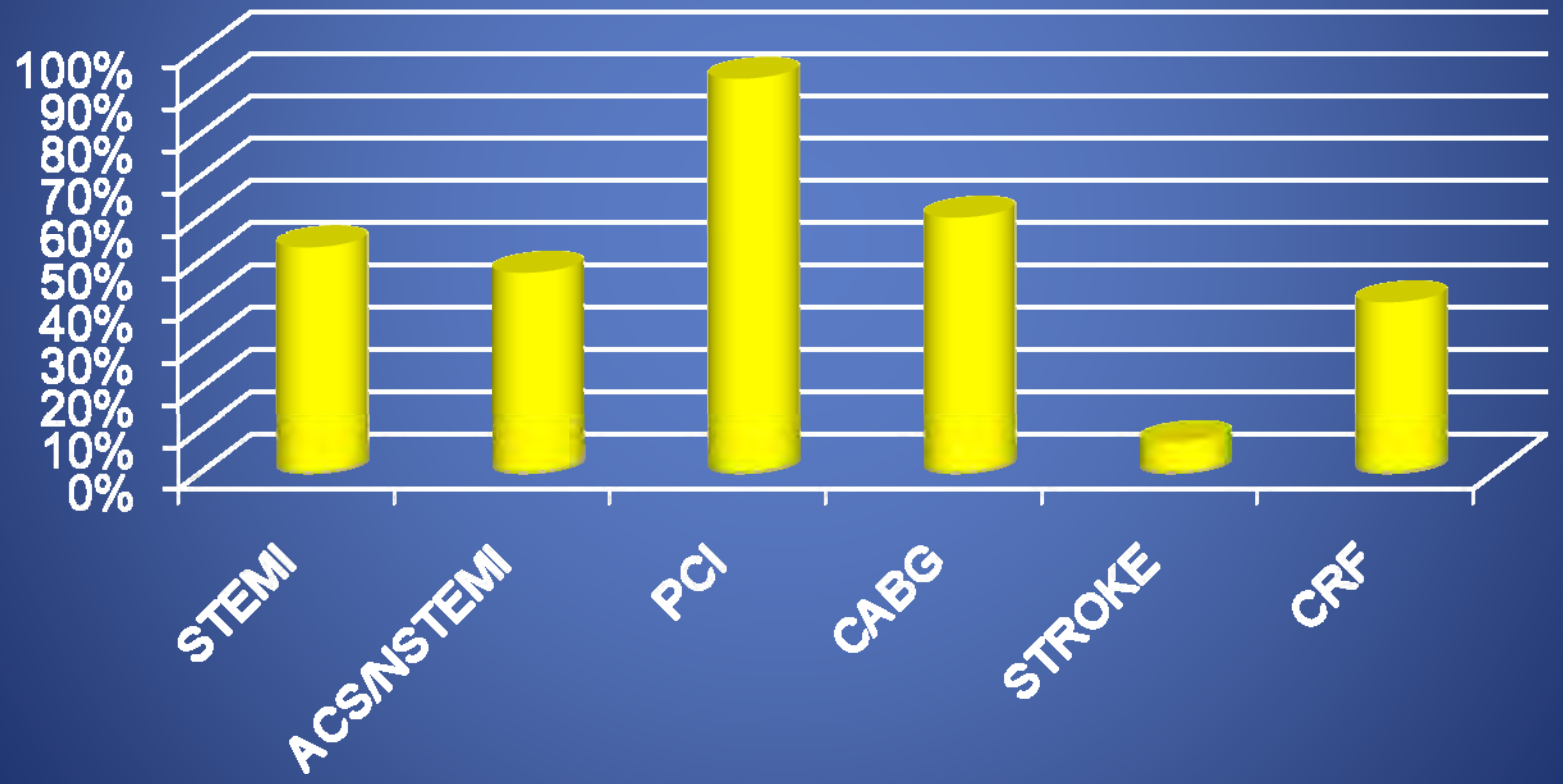
POST ESMR

GENERAL POPULATION

CRF



GENERAL POPULATION
CV HISTORY



ESMR Therapy
Extracorporeal Shockwave Myocardial Revascularization
- Conclusions

- Safe
  - No arrhythmias
  - No cardiac enzyme rise
  - No device related side effects were reported

- Improvement in the following prameters :
  - CCS class score
  - Exercise Tolerance Time
  - Angina threshold at exercise
  - Myocardial perfusion shown by SPECT
  - Local contractility shown by Stress-echo
  - Quality of life shown by SAQ