



Imagen Cardiovascular en Investigación Traslacional

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CNIC. Translational Research for Cardiovascular Diseases

**Human
disease**

Objectives

**Animal
disease**

**Prevention
Early diagnosis
Prognosis
Treatment**

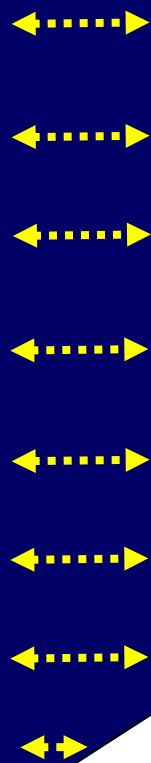


CNIC. Translational Research for Cardiovascular Diseases

**Human
disease**

**Research
tool**

**Animal
disease**



History

Symptoms

Clinical signs

Functional tests

Imaging

Electrophysiology

Blood

Histology



CNIC CV Imaging for Translational Research

Humans



Animals



Ultrasounds:

CV 3D



MRI:

3 Tesla



PET-MRI PET-CT

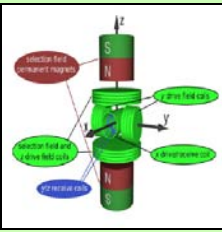
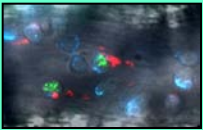
PET-MRI, PET-CT, 256TC



CNIC CV Imaging for Translational Research

Humans	Ultrasounds:	MRI:	PET-MRI PET-CT
Animals	CV 3D	3 Tesla	PET-MRI, PET-CT, 256TC
Small Animals	30-50 Hz Ultrasounds	7 Tesla MPI	Nano PET-CT. PET-MRI inserted Optical imaging

CNIC CV Imaging for Translational Research

Humans	Ultrasounds:	MRI:	PET-MRI PET-CT
Animals   	CV 3D 	3 Tesla 	PET-MRI, PET-CT, 256TC  
Small Animals	30-50 Hz Ultrasounds	7 Tesla MPI	Nano PET-CT. PET-MRI inserted Optical imaging
 		 	 
Cells	Microscopes:		
	In-vivo confocal, Microdissection, Microinjection, Time-lapse z-sectioning, Basal membrane, Cell mobility, Time-lapse (long term),		
	  		

Ischemic Heart Disease. Clinical research at CNIC

Primary prevention
and early detection

AMI treatment

Secondary prevention

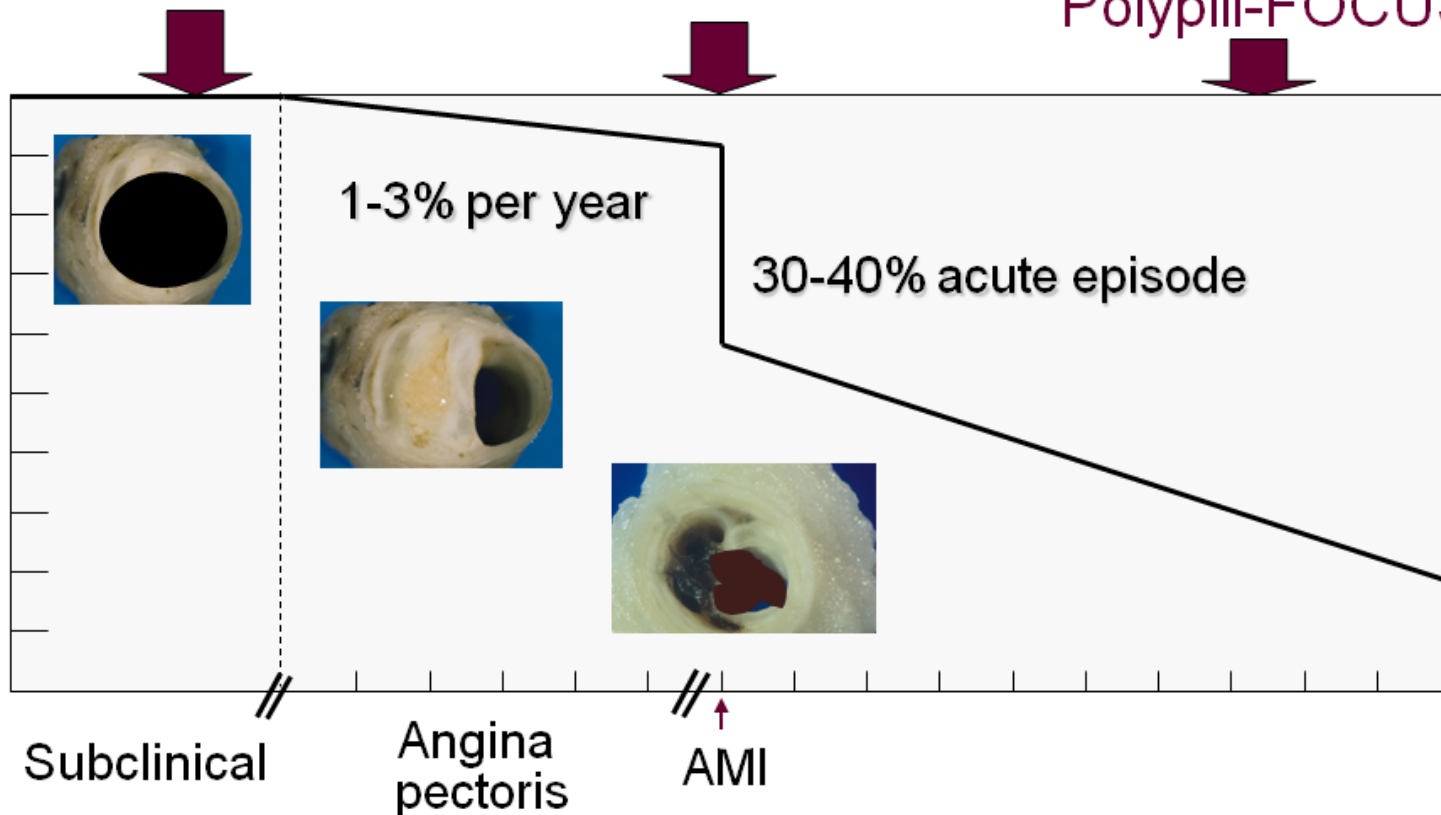
Basic research

AWHS (imaging, omics)

PESA (advanced image)

METOCARD-CNIC

VIRGO-IMJOVEN
Polypill-FOCUS



Current CV Risk Factors prediction power

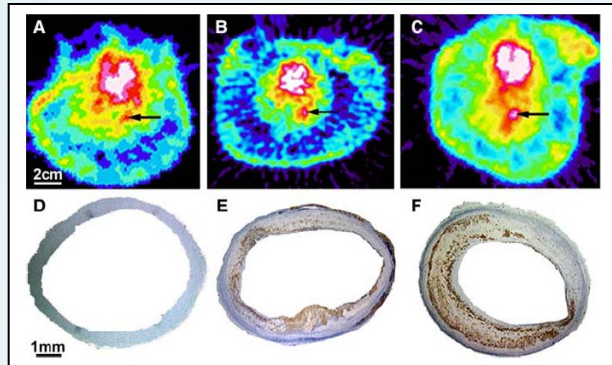
- **Framingham formula** Age, Cholesterol, Blood Pressure, Smoking status
 - Highest risk rate prediction: **30 % at 10 years**
- **European SCORE:**
 - Highest risk rate prediction: **15 % at 10 years**

Previous Risk Factors in 122.458 patients with CAD

	Age, y									
	≤45		46-55		56-65		66-75		>75	
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Total NO. of Risk Factors										
No. with complete data	1569	10 251	4453	20 996	8524	24 817	11 807	21 411	6885	7485
No. of risk factors										
0	9.4	11.4	10.7	13.3	12.0	18.4	15.8	24.6	23.3	35.5
1	41.9	48.0	35.5	44.4	34.5	41.8	36.4	41.5	41.7	40.7
2	30.8	29.8	35.1	30.1	34.7	29.2	34.6	26.0	28.1	19.3
3	15.2	9.9	16.3	10.8	16.7	9.5	12.4	7.4	6.7	4.2
4	2.7	0.9	2.5	1.3	2.0	1.1	0.8	0.6	0.2	0.2

Khot et al. JAMA 2003; 290:898-904

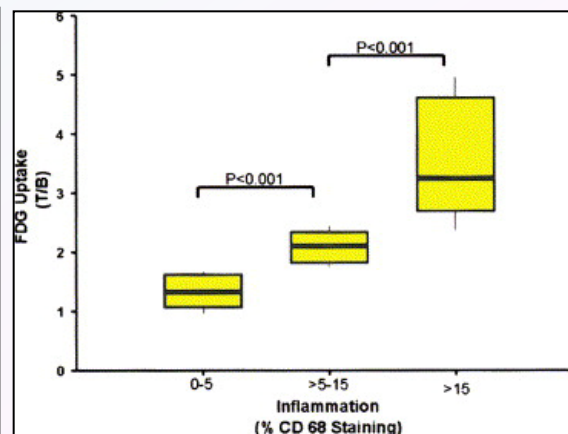
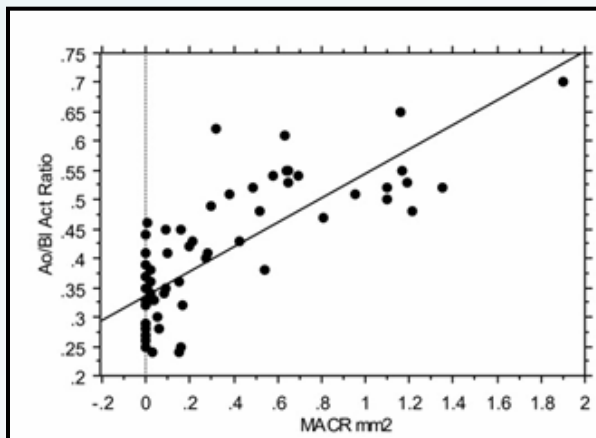
Inflammatory progression / regression: PET/MRI (18FDG) – Macrophages.



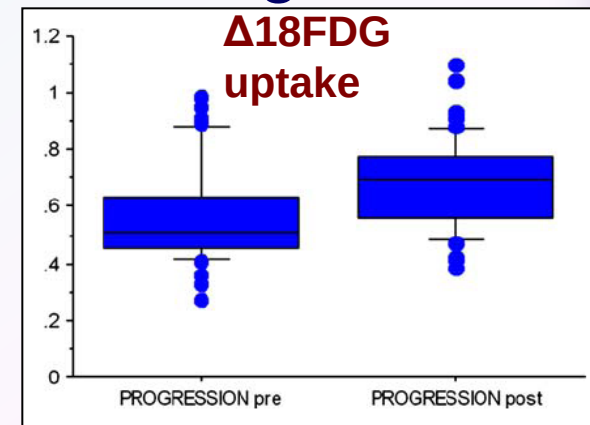
Rabbit

18FDG uptake
Macrophages

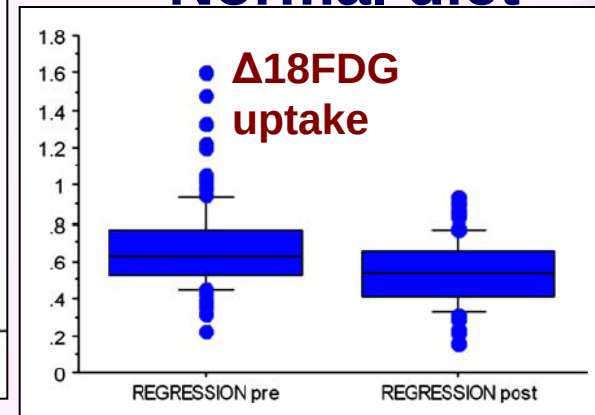
Human



Atherogenic diet



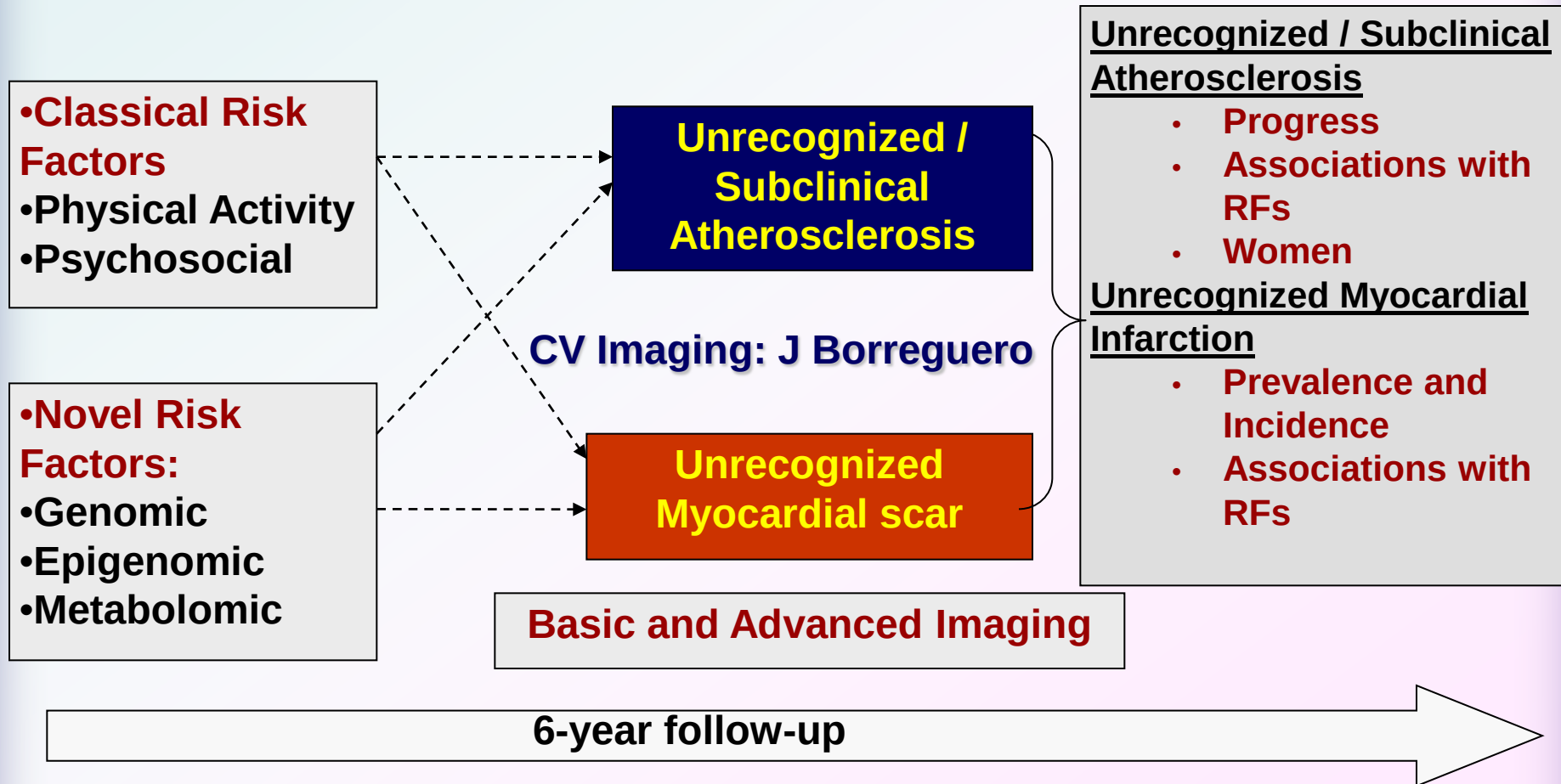
Normal diet



Worthley SG, Fuster V, Badimon JJ,. Int J Cardiovasc Imaging. 2009;25:251-7
Zhang. Fuster V and Badimon JJ. BMC Nucl Med. 2006;25;6:3
Tawakol A et al. J Am Coll Cardiol. 2006;48:1818-24.
Fayad ZA, Fuster V, et al. Lancet. 2011;378:1547-59.

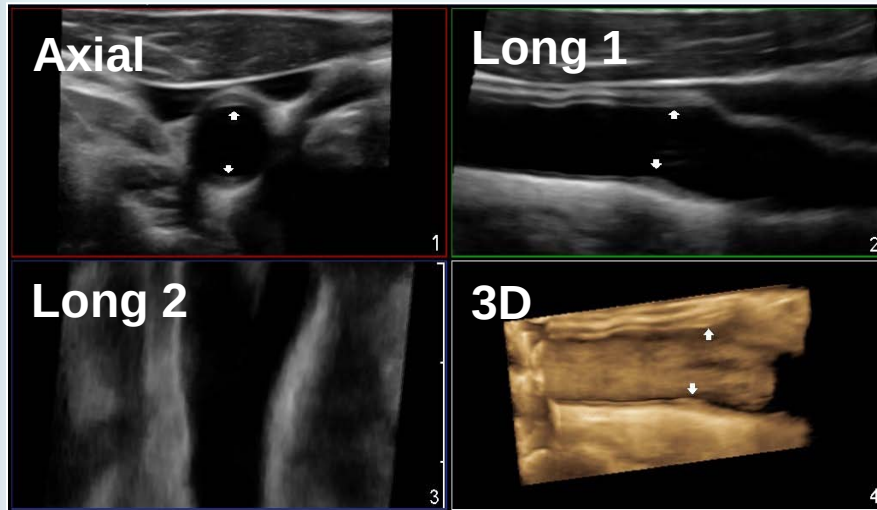
Progression of Early Subclinical Atherosclerosis.

PESA: 4,500 employees: men (65%), women (35%) (40-54 years old)
AWHS: 4,500 employees (most men)

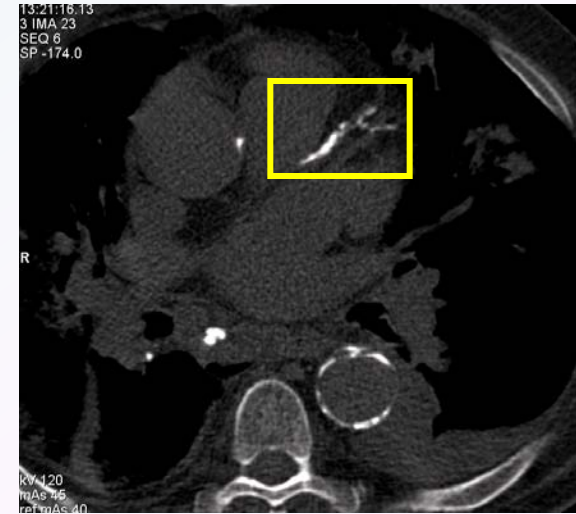


PESA. CNIC 2. Basic and Advanced Imaging.

3D ultrasound. Atheroma



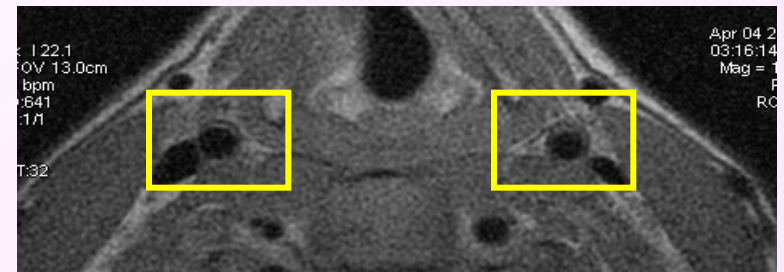
CT Coronary calcium Score



18-FDG PET. Inflammation

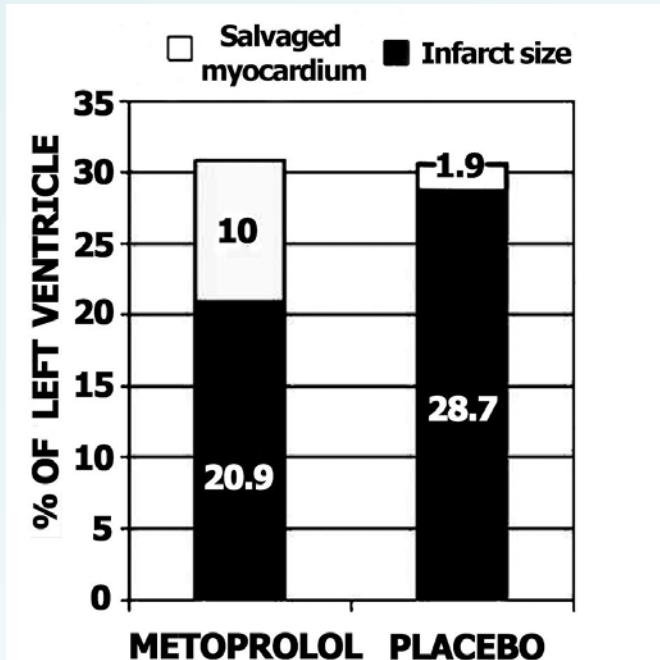


MRI. Composition

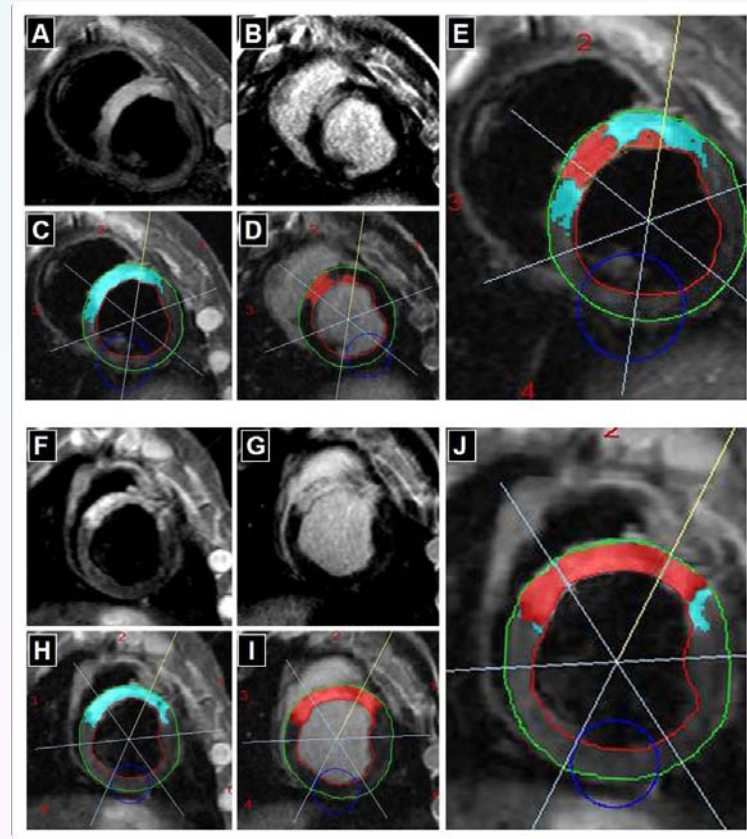


METOCARD:

Metoprolol in Acute Myocardial Infarction



PI: B Ibañez, V Fuster
CV Imaging: J Borreguero

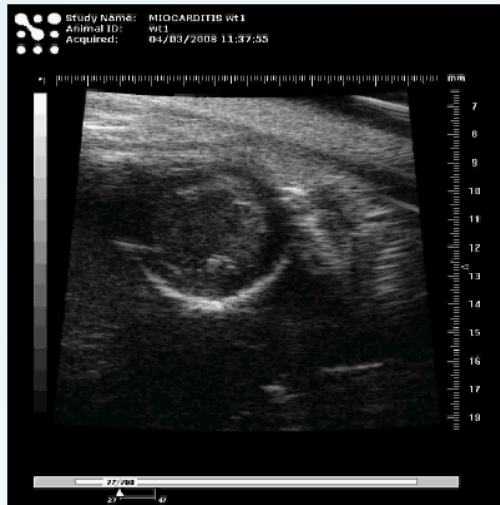


Edema Necrosis Risk area

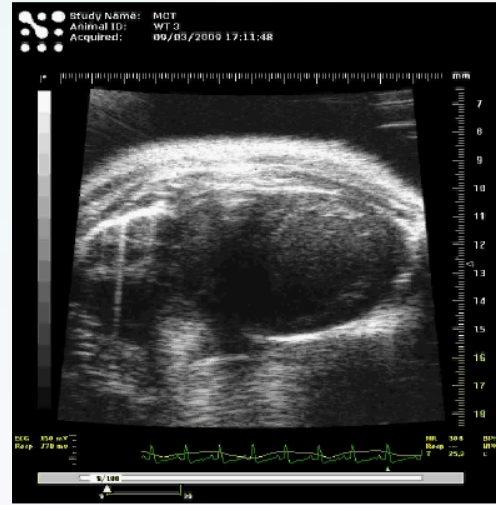
B Ibanez, V Fuster, J Sanz, JJ Badimon et al Circulation. 2007;115:2909
Eitelet. al. JACC. 2010;55:2470. (Leipzig, Germany)
Ibáñez B, Fuster V, Macaya C, J-Borreguero J Rev Esp Cardiol. 2011;64:28-33

CNIC translational research: Heart Failure: CD69 limits inflammation

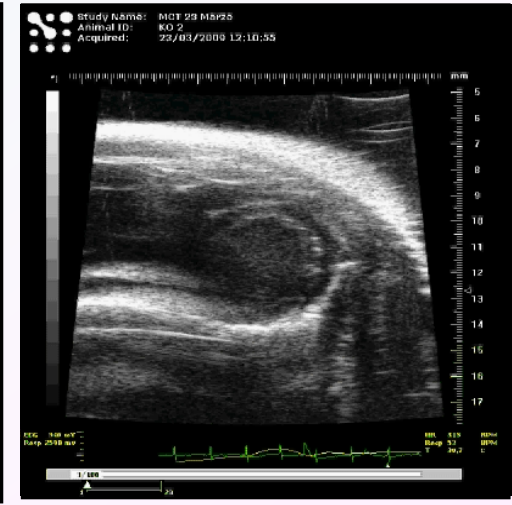
Control CD69^{-/-}



Immunized CD69^{+/+}



Immunized CD69^{-/-}



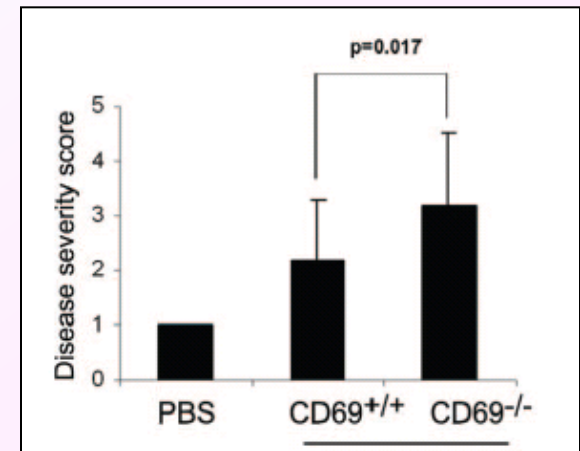
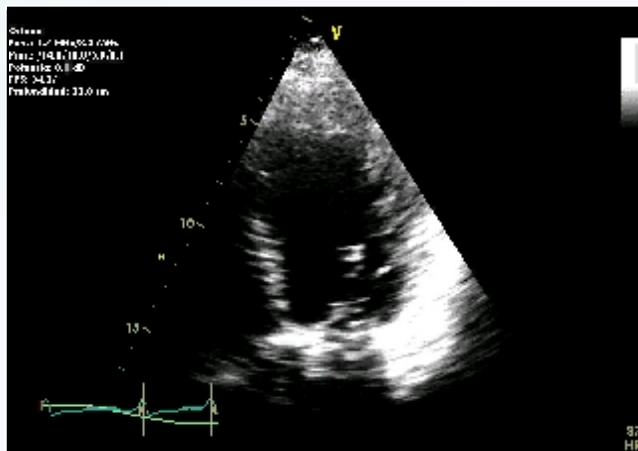
Mice Model

Ejection Fraction: 70%

51%

44%

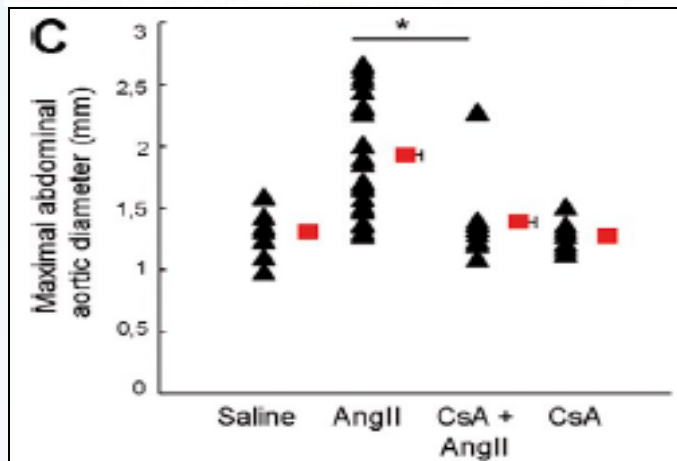
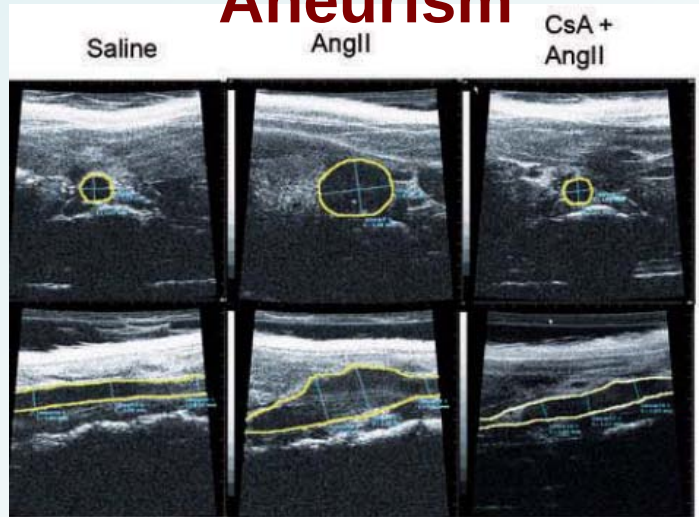
Human



CNIC translational research.

Angiotensin II induction of vascular remodeling.

Aneurism

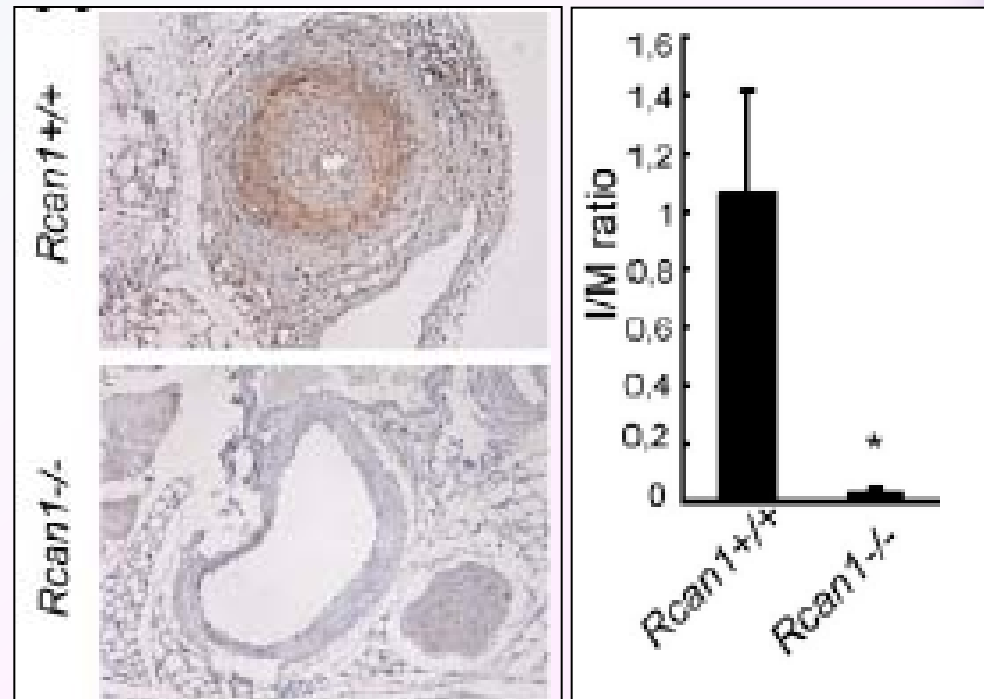


Calcineurin inhibition:

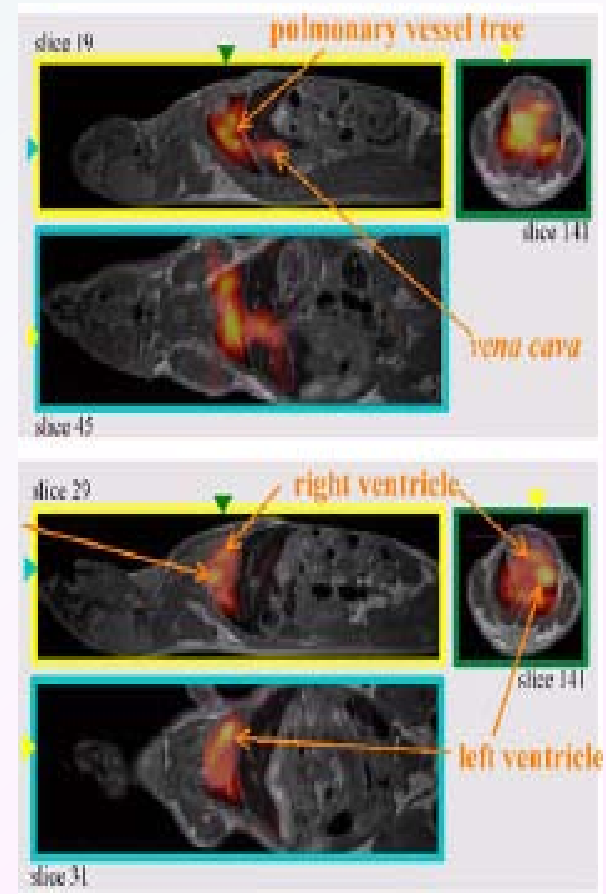
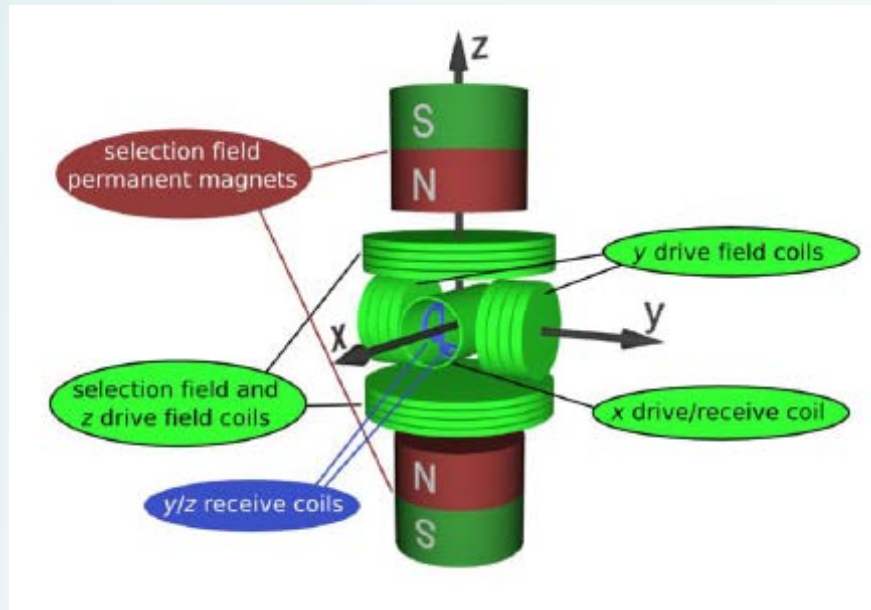
Ciclosporin A

Lentoviral delivery of peptides

Restenosis



CNIC projects for Magnetic Particle Imaging



Cardiovascular Imaging. Translational research.

- **Specific molecular targets for translational research**
 - **¹⁸F FDG PET**
 - **Other PET radiotracers: Gallium, Carbon, Fluor,...**
 - **Molecular MRI: USPIO, Gadolinium.**
 - **Gd based MRI tissues characterization**
 - **Future use of spectral CT for tissues characterization**
- **Invasive imaging:**
 - **Rx Catheterization lab, OCT, IVUS and multimodality imaging**
- **Therapeutic imaging:**
 - **Microbubbles Ultrasound delivery of DNA, RNA**
- **Anatomical and functional assessment of the heart and vessels:**
 - **MRI**
 - **Ultrasounds.**

Other CNIC traslational research:

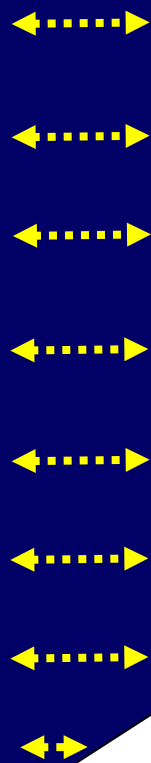
- **Models for researching diseases:**
 - Myocardial ischemia-reperfusion.
 - Notch signaling
 - Aortic valve degeneration and stenosis
 - Heart failure and Cardiomyopathies
 - Cardiovascular Aging and Progeria
 - Tissue regeneration: Mice, Zebra fish.
- **Researching in imaging technology:**
 - MPI
 - PET-MRI inserted
 - Spectral CT
 - PET molecular imaging
 - MRI molecular imaging
 - 3D ultrasonography

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