

Velletri 2030

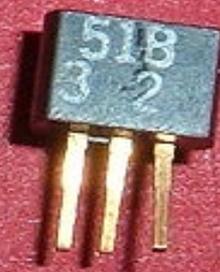
**Innovazione tecnologica
in cardiologia e cardiochirurgia
da Barnard ad oggi**

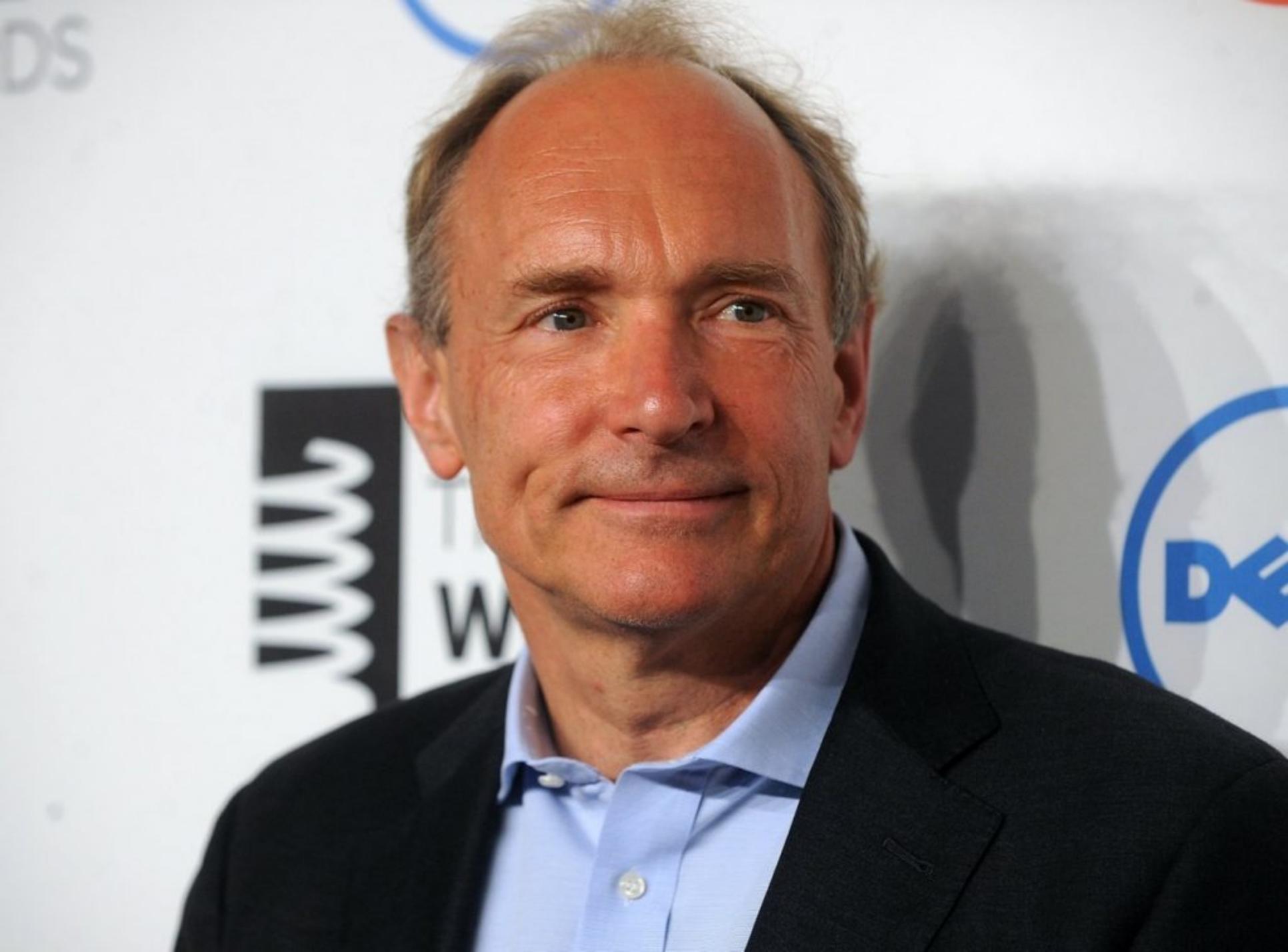
Velletri, 22 Giugno 2020

**Natale Di Belardino M.D.
Ph.D.**

**Direttore UOC Cardiologia-UTIC
Anzio-Nettuno**







When the human heart is stopped by any accident, the new self-starter is used as is shown in this picture. Here the needle is being inserted by one of its inventors, C. Henry Hyman. At right is the generator



PHYSICIAN INVENTS SELF-STARTER for Dead Man's Heart



An insulated wire passes through the hollow center of this needle to complete the circuit

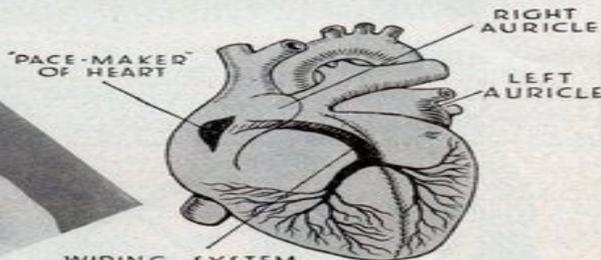
WHAT can be done when the heart

ceases to beat? Under all sorts of different conditions, a doctor often is confronted with this urgent question.

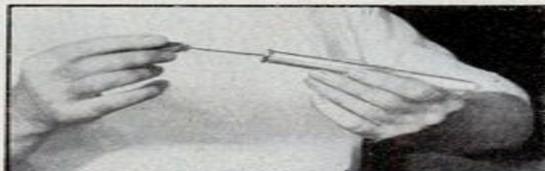
The ambulance physician faces it with the victim of heart stroke, drowning, or accident. The surgeon faces it when the pulse of an etherized patient suddenly stops. The family physician faces it when a baby is still born or when a mother's heart stops during childbirth.

Until recently the only answer was the injection of a powerful stimulant into the heart itself, with the result that, not infrequently, the heart failed to respond.

A new answer has just been furnished by the invention of Dr. Albert S. Hyman, heart specialist of the Beth David Hospital of New York, and by C. Henry Hyman, electrical research engineer.



WIRING SYSTEM CONVEYING THE ELECTRIC IMPULSES FROM PACE-MAKER TO THE HEART MUSCLES.



Each needle is kept in a sterilized test tube. Diagram of heart shows position of pacemaker

This life-saving device can be compared with the self-starter of a car. When the car's engine stalls, the starter motor turns it over until the cylinders are again firing. In the same way, when the heart stops

under any of the conditions named above, the needle of the "Hyman Otor," as it is called, gives the four-cylinder heart engine a rhythmical electrical stimulation. This starts the heart beat and maintains it until the heart's own "electric generator" resumes operation.

This comparison is not far-fetched, for the equivalent of an electrical generator exists in the wall of the right upper chamber (or auricle) of the heart, and a system of "wires" conveys the electrical impulses to the heart muscle. This "ignition system" is called the "pace-maker" of the heart.

The essential feature of the Hyman invention is a hollow steel needle, through which a carefully insulated wire runs to the open point. Both the needle itself and its central wire are connected to the terminals of a light, spring-driven generator, provided with a current-interrupting device. This mechanism can be adjusted to give electrical impulses with the frequency of the heart-beat from infancy to old age.

When the physician faces a case of heart stoppage, he inserts the needle between the first and second ribs into the right auricle of the heart, and starts the generator at the required frequency. The rhythmical current then "cranks" the heart engine by stimulating the "pace-maker" to act in step with the generator, until its normal action is resumed. Usually this occurs quickly.

Medical authorities predict a wide usefulness for the "Hyman Otor."

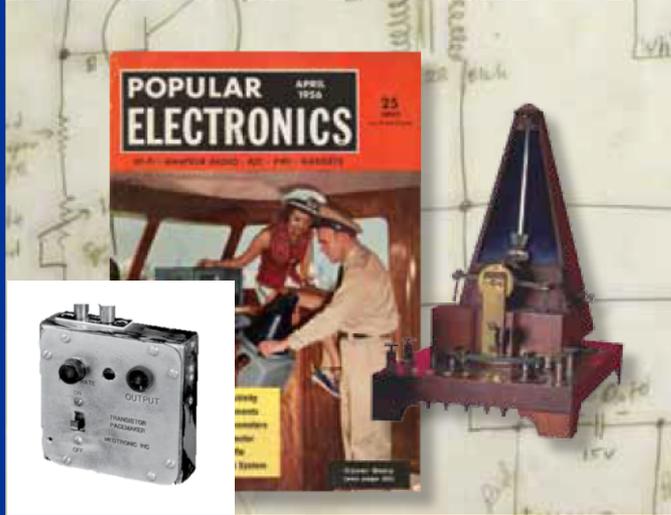


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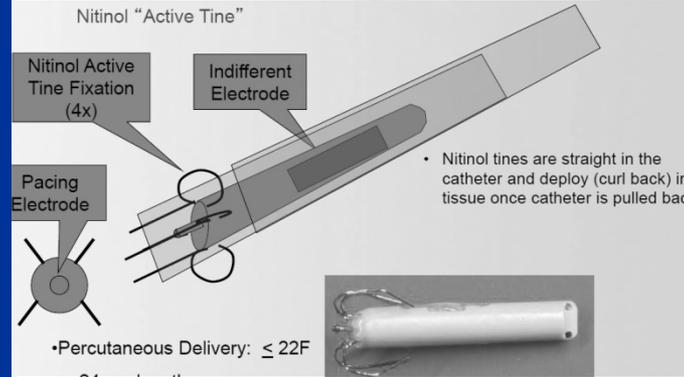
per gli Ospedali

Pacing Innovation

1959



2013



micropacemaker

ACTUAL SIZE

A patient in Linz, Austria, was the first to receive what is now the world's smallest pacemaker. At less than 1 inch long Medtronic's Micra TPS pacemaker is inserted through a small incision in the thigh (so there's no chest scarring) and threaded through veins to the patient's chest, where it's attached to the heart wall. Without wires connecting the pacemaker to the heart, the risk of infection and other complications is greatly reduced. — A.H.

Historical perspective



5800

First External Pacemaker

1958



5858

Pediatric Asynchronous Pulse Generator

1970



Activitrax

Rate response

1986



MicroMinix

Radically smaller size

1990



Thera™

1st Micro-processor-based, Mode switching

1995



EnPulse

Full automaticity

2004



EnRhythmMRI™

1st MRI-Conditional

2011



Micra™

Transcatheter Pacing System

2015

1960

Chardack - Greatbatch

First Implantable Pacemaker



1979

Byrel



1989

Synergist

Dual chamber rate response



1991

Elite



1998

Kappa™

Rate response via activity & minute ventilation



2006

Adapta™

MVP™, Full automaticity



2013

Advisa MRI™

2nd MRI-Conditional



New opportunities to:

REDEFINE THE PATIENT EXPERIENCE

- Potential to increase pacemaker patient satisfaction
- No chest scar, bump, and no visible or physical reminder
- Minimally-invasive procedure
- Potential for fewer post-implant activity restrictions



Miniaturized

93% smaller than other modern-day pacemakers¹, Micra™ is the **world's smallest pacemaker**², yet it offers a complete set of features.



¹ Williams, Eric, Whiting, Jon; Micra Transcatheter Pacing System Size Comparison, November 2014, Medtronic Data on File.

² Nippoldt, Doug, Whiting, Jon; Micra Transcatheter Pacing System Device Volume Characterization Comparison, November 2014, Medtronic Data on File.

Micra™ CardiocAPSULE¹

Size

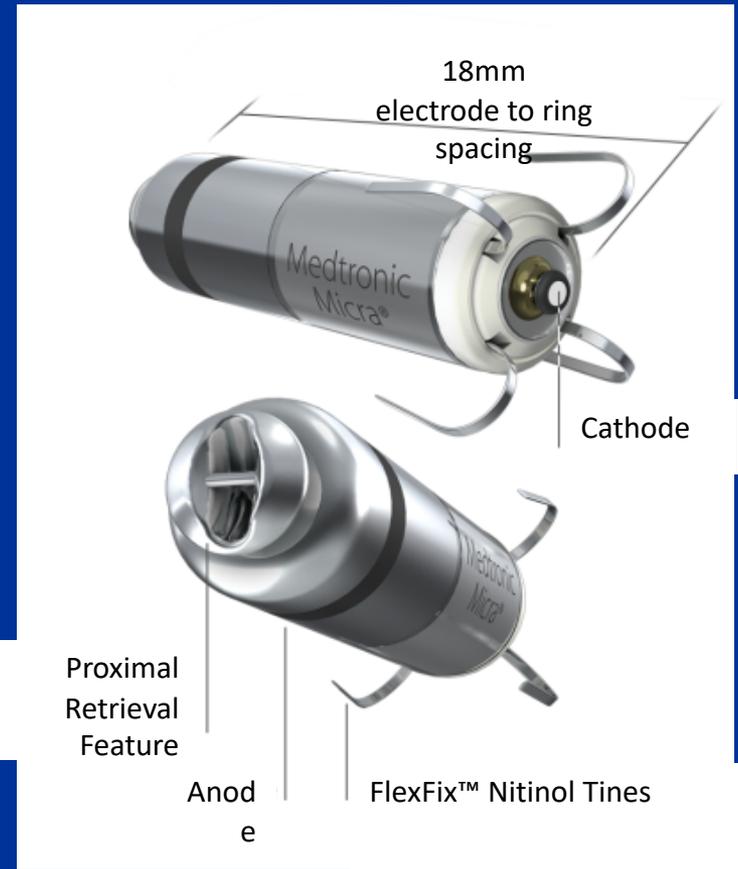
- Volume: 0.8 cc
- Mass: 1.75 g
- Length: 25.9 mm
- Width: 20 Fr

Battery

- 12 year estimated average longevity²

Capabilities

- Pacing Mode: VVIR
- Bipolar sensing
- MRI SureScan™, allowing 1.5 T or 3 T full body MRI scans
- Capture Management™
- Rate Response
- Diagnostics: battery status, threshold, impedance, % paced
- Device can be manually deactivated and automatically deactivates at EOS



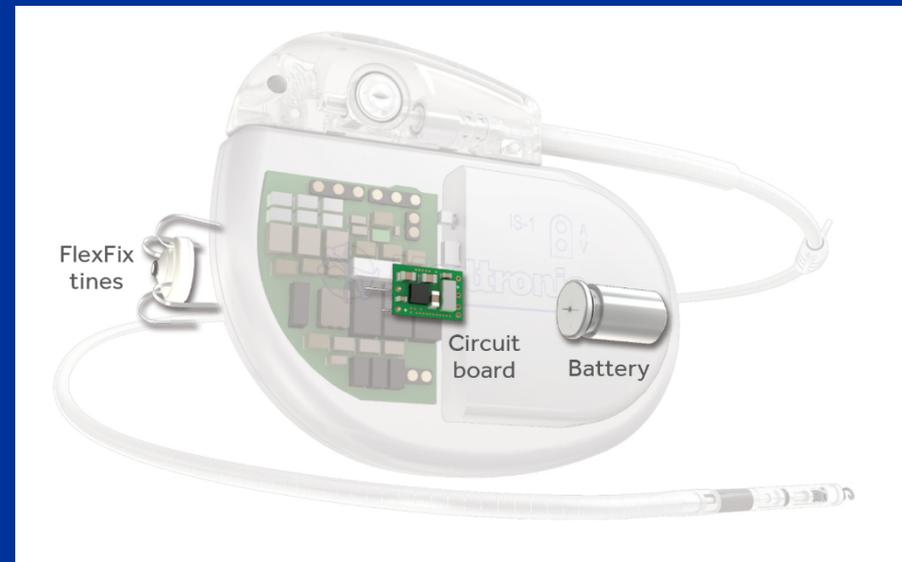
¹ Medtronic Micra MC1VR01 Clinician Manual, November 2014

² Reynolds D, Duray GZ, Omar R, et al. A Leadless Intracardiac Transcatheter Pacing System. N Eng J Med. Published online November 9, 2015

Complete feature set

Micra™ is the only TPS to offer a complete feature set^{1,2}

- 12+ year estimated average battery longevity^{3*}
- MRI SureScan™, which allows the patient to be safely scanned using either a 1.5 T or 3 T full body MRI
- Accelerometer based rate response
- CareLink™ 2090 Programmer compatible; no accessories requirement; currently not yet available

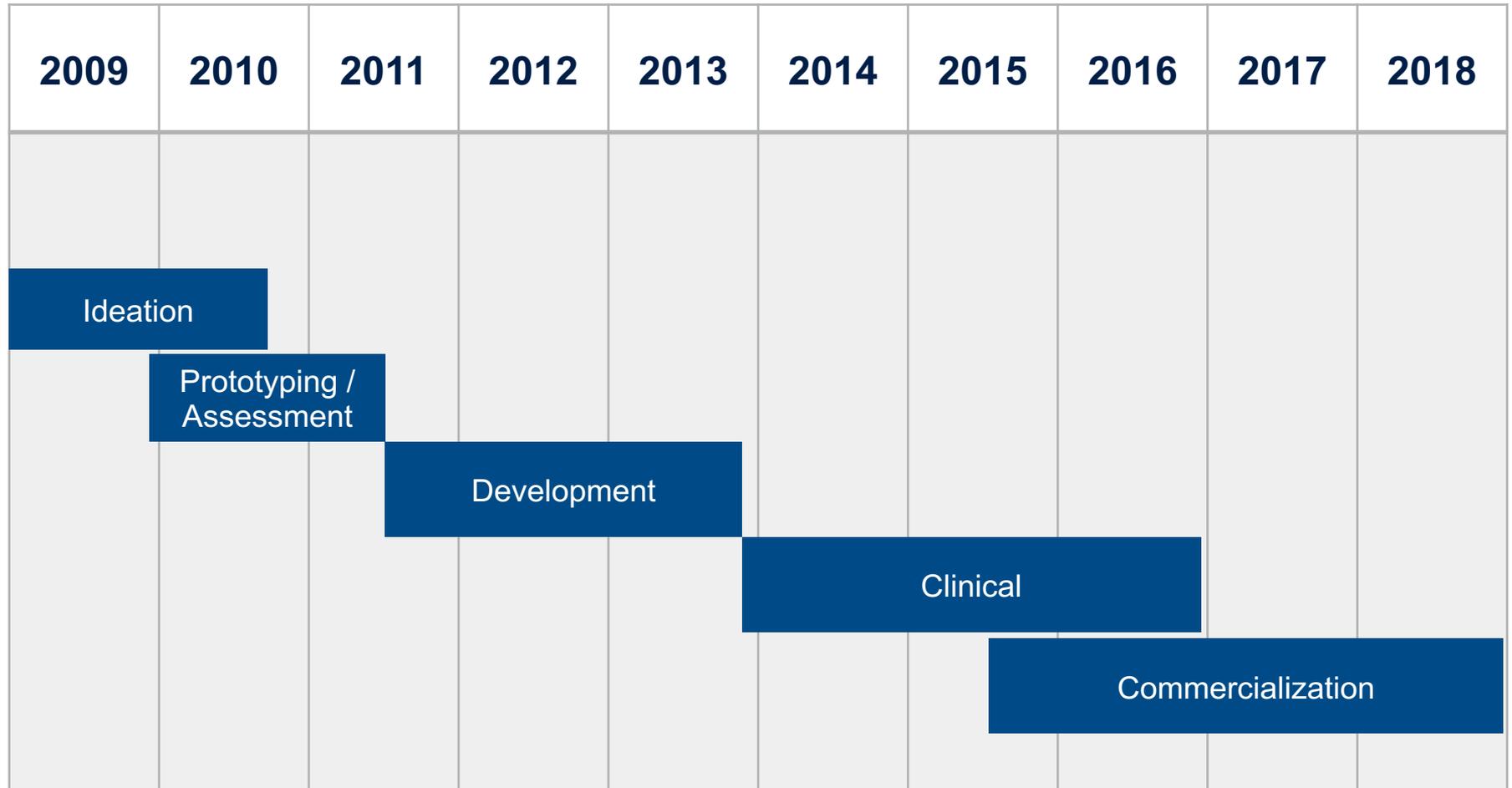


Micra Major Complications¹

	Within 30 days	30 days – 6 Mos	> 6 Mos	Events (Patients, %)
Total	24	6	2	32 (29, 4.0%)
Cardiac Perforation/Effusion	10	1	0	11 (11, 1.5%)
AV Fistula/Pseudoaneurysm	5	0	0	5 (5, 0.7%)
Cardiac Failure	0	4	2	6 (6, 0.8%)
Elevated Thresholds	2	0	0	2 (2, 0.3%)
Pacemaker Syndrome	1	1	0	2 (2, 0.3%)
Acute MI	1	0	0	1 (1, 0.1%)
Deep Vein Thrombosis	1	0	0	1 (1, 0.1%)
Metabolic Acidosis	1	0	0	1 (1, 0.1%)
Presyncope	1	0	0	1 (1, 0.1%)
Pulmonary Embolism	1	0	0	1 (1, 0.1%)
Syncope	1	0	0	1 (1, 0.1%)

¹Ritter P, et al. Long-Term Performance of a Transcatheter Pacing System: 12 month results from the Micra Global Clinical Trial. Presented at: European Society of Cardiology Congress 2016; August 28, 2016; Rome, Italy.

MICRA DESIGN JOURNEY

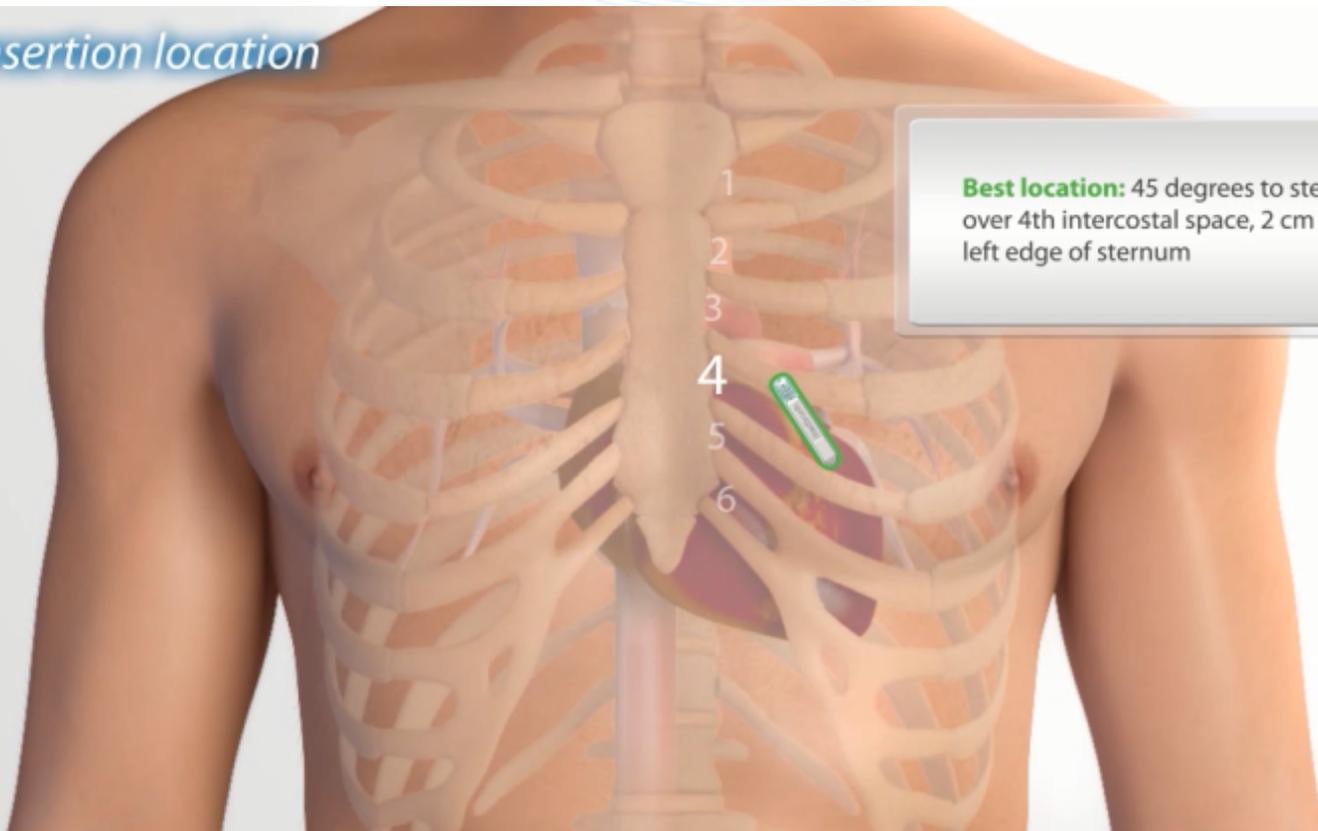


“Everyone here has the sense that right now is one of those moments when we are influencing the future.”

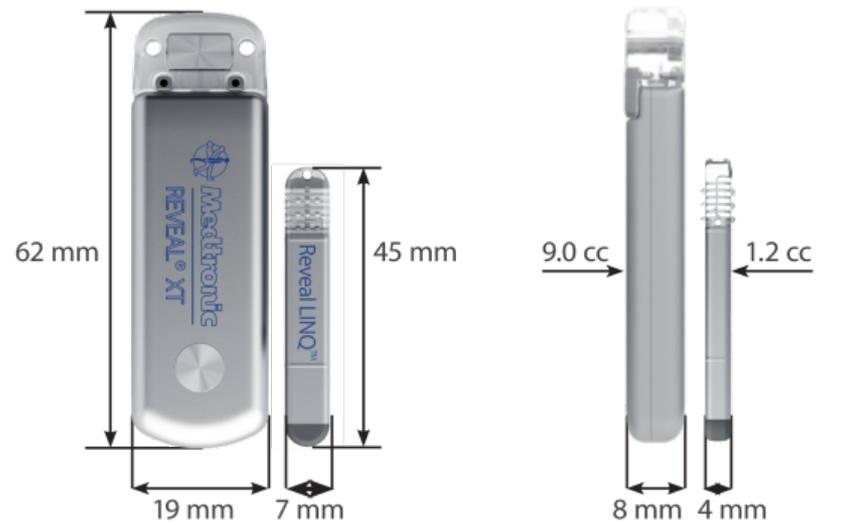
-Steve Jobs

1

Insertion location



Best location: 45 degrees to sternum
over 4th intercostal space, 2 cm from
left edge of sternum



Linear dimensions rounded to the nearest mm

Volume rounded to the nearest tenth of a cc

*Compared to Reveal XT ICM



Proven AF algorithm accurately detects AF in 99.1% of patients*⁵



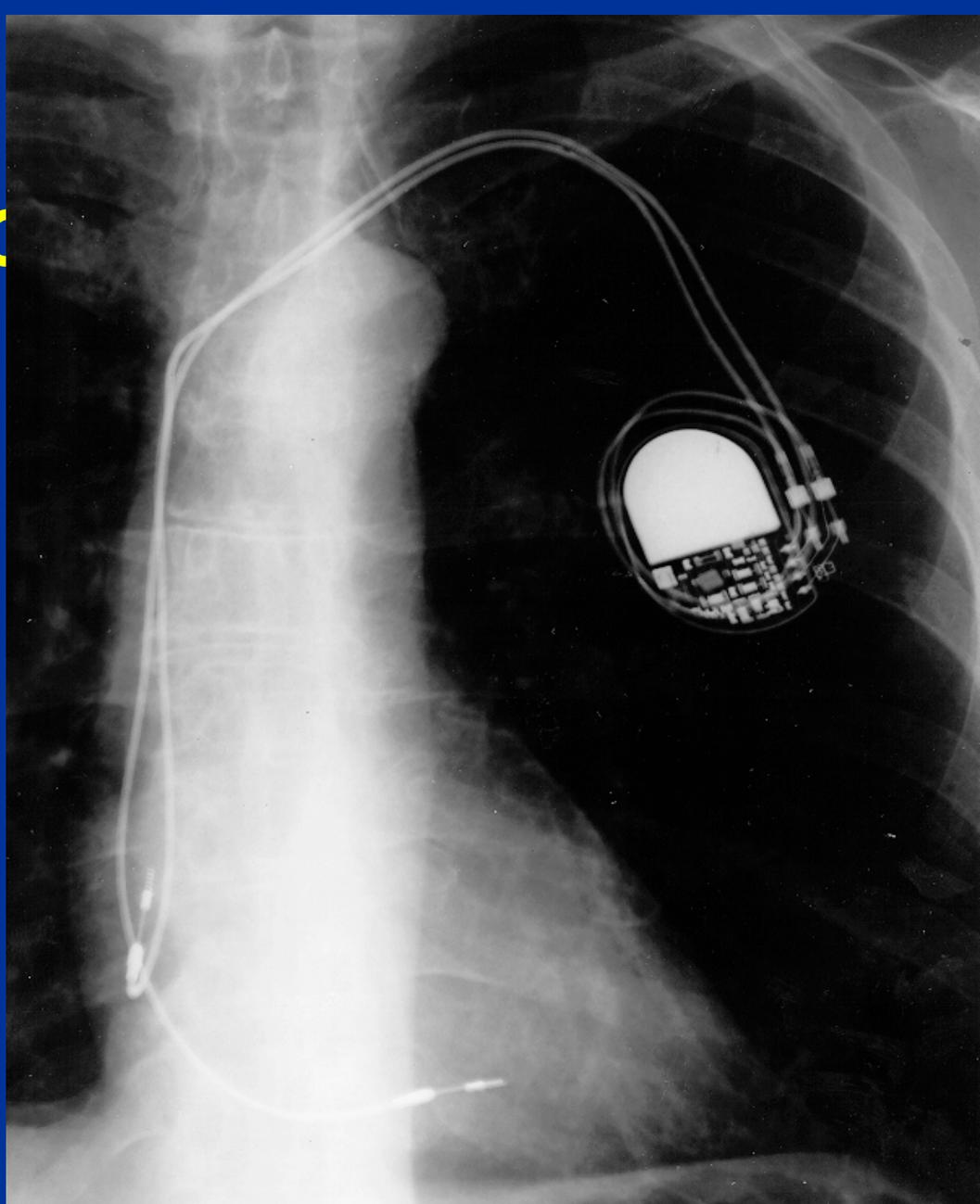
Simplified procedure and redesigned titanium nitride electrode coating support high-fidelity signals



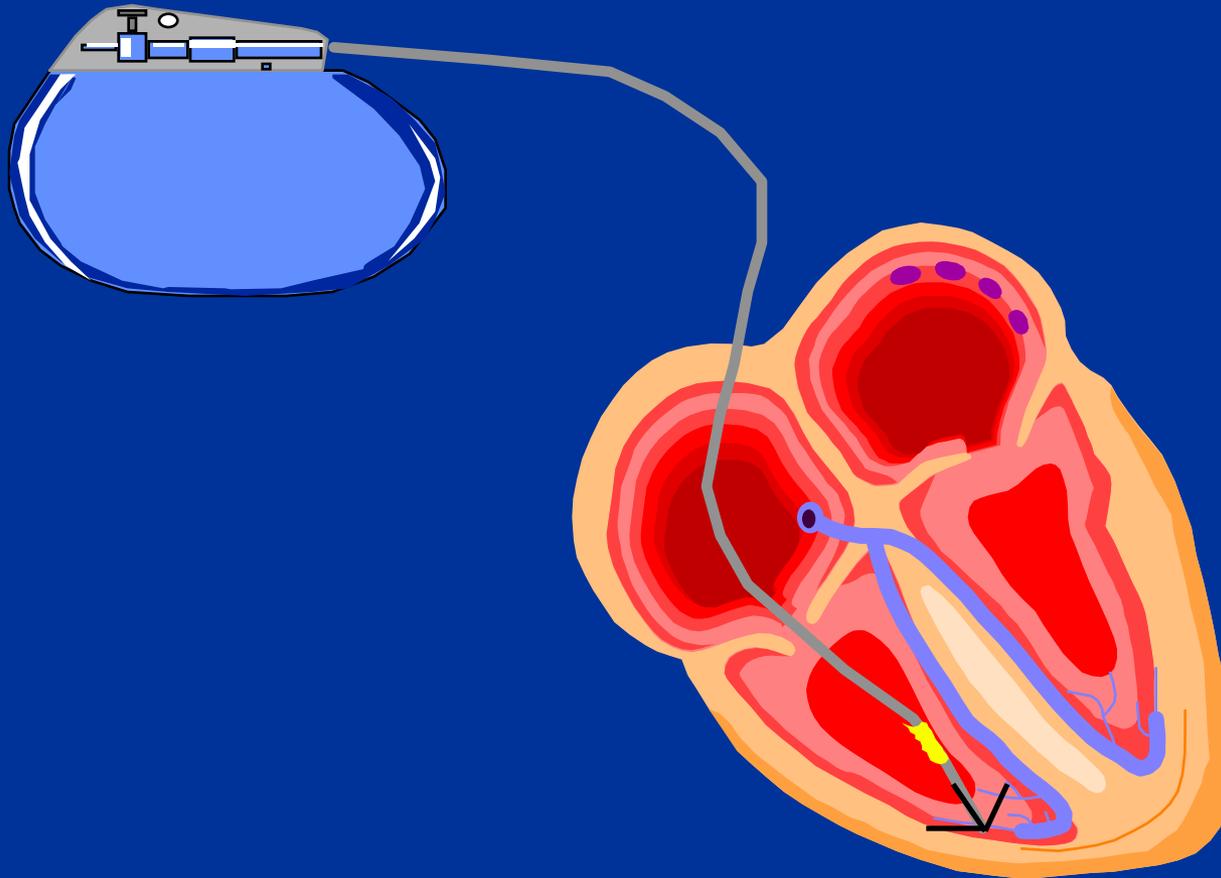
*In patients with known AF

1. Edvardsson N, Frykman V, van Mechelin R, et al. Use of an implantable loop recorder to increase the diagnostic yield in unexplained syncope: results from the PICTURE registry. *Europace*. February 2011;13(2):262-269.
2. Krahn AD, Klein GJ, Yee R, Norris C. Final results from a pilot study with an implantable loop recorder to determine the etiology of syncope in patients with negative noninvasive and invasive testing. *Am J Cardiol*. July 1, 1998;82(1):117-119.
3. Krahn AD, Klein GJ, Yee R, Takle-Newhouse T, Norris C. Use of an extended monitoring strategy in patients with problematic syncope. Reveal Investigators. *Circulation*. January 26, 1999;99(3):406-410.
4. Krahn AD, Klein GJ, Yee R, Hoch JS, Skanes AC. Cost implications of testing strategy in patients with syncope: randomized assessment of syncope trial. *J Am Coll Cardiol*. August 6, 2003;42(3):495-501.
5. Pirerfellner H, Pokushalov E, Sarkar S, et al. P-wave evidence as a method for improving algorithm to detect atrial fibrillation in insertable cardiac monitors. *Heart Rhythm*. Published online June 6, 2014.

Componenti
di un circuito
di
stimolazione
una foto
ai raggi X



Funzioni principali di un sistema di stimolazione



Funzioni Principali di un sistema di stimolazione

STIMOLARE

in modo efficace e costante
in armonia con il ritmo
cardiaco naturale

RISPONDERE
ad un aumento della richiesta
metabolica accrescendo la
frequenza della
depolarizzazione cardiaca
quando il cuore non è in grado di
farlo da solo

RILEVARE

quando il cuore funziona
correttamente così da evitare
una stimolazione inutile



FORNIRE INFORMAZIONI
sul funzionamento del cuore del
paziente e del pacemaker
(DIAGNOSTICA)

...il circuito di stimolazione è un circuito elettrico, dunque...

Le misure elettriche sono l'unico metodo per avere informazioni sul suo corretto funzionamento (posizione cateteri, stimolazione, sensing...)

Si misurano...

- Soglia di stimolazione
- Sensing (ampiezza del segnale spontaneo rilevato)
- Impedenza

Per
programmare



➤ Uscita del PM

➤ Sensibilità del PM

LE MISURE ELETTRICHE

VALORI TIPICI

- Sensing:
 - Ampiezza onda P (endocavitaria): $> 1\text{mV}$
 - Ampiezza onda R (endocavitaria): $> 5\text{ mV}$
- Soglia di stimolazione:
 - Atriale: $< 1\text{ V}$
 - Ventricolare: $< 1\text{ V}$
- Impedenza di stimolazione:
dipende dal tipo di elettrocatetere, tipicamente da 500 Ohm a 1400 Ohm

L'evoluzione dei pacemakers

- 1958 Pm asincroni
- 1962 Pm a sincronizzazione atriale
- 1965 Pm a domanda
- 1980 Pm bicamerali
- 1986 Pm rate responsive monocamerali
- 1988 Pm rate responsive bicamerali

Michel Miroski

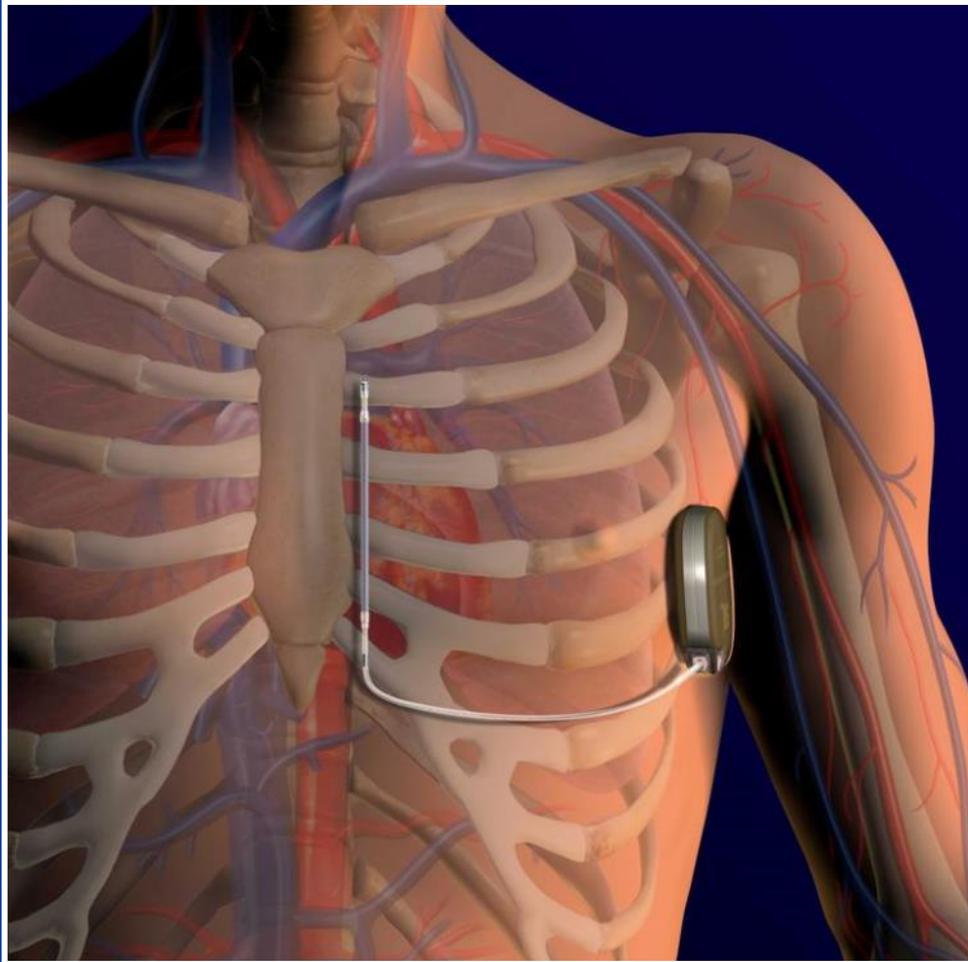


Medtronic InSync® ICD Cardiac Resynchronization System



Il Sistema S-ICD

L'approccio sottocutaneo

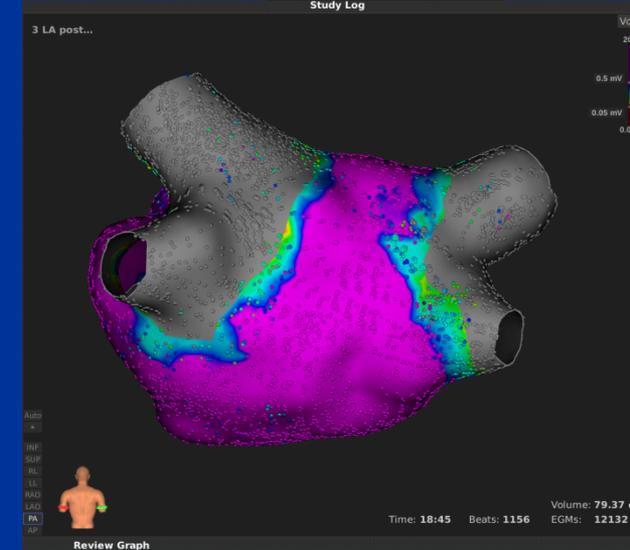
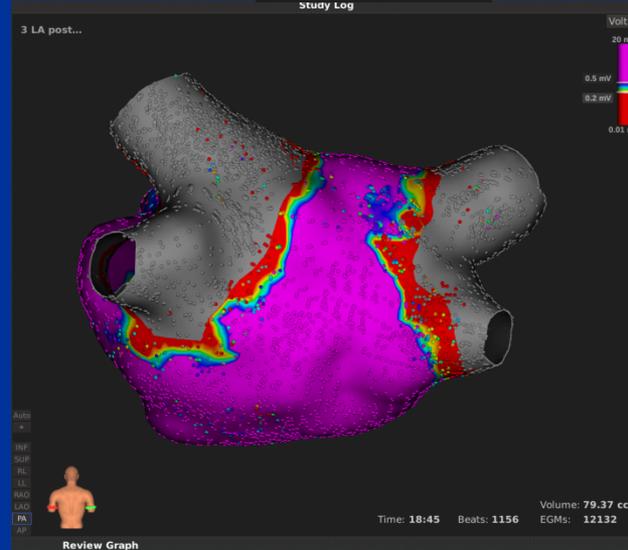
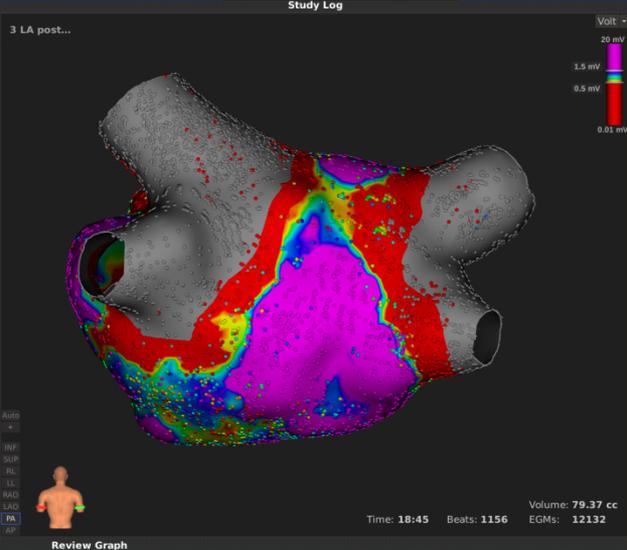
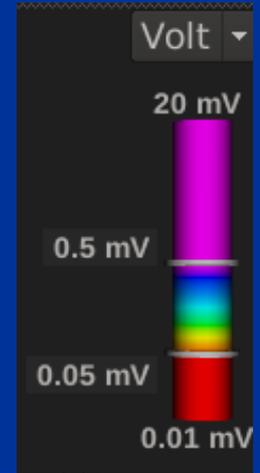
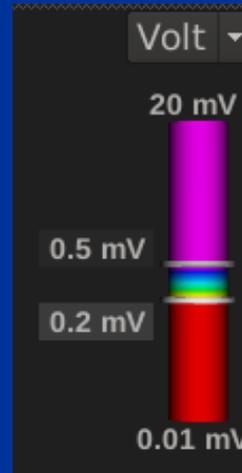
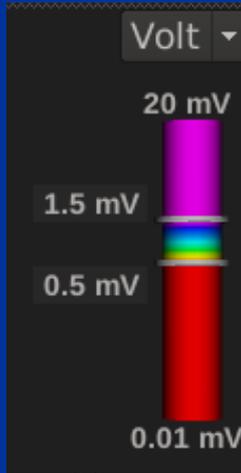


- **Nessun catetere all'interno o sul cuore**
 - Sistema venoso preservato
- **Impianto semplice chirurgicamente**
 - Puri riferimenti anatomici
 - In generale senza bisogno di fluoroscopia
 - Tempo di impianto prevedibile

Protezione senza toccare il cuore

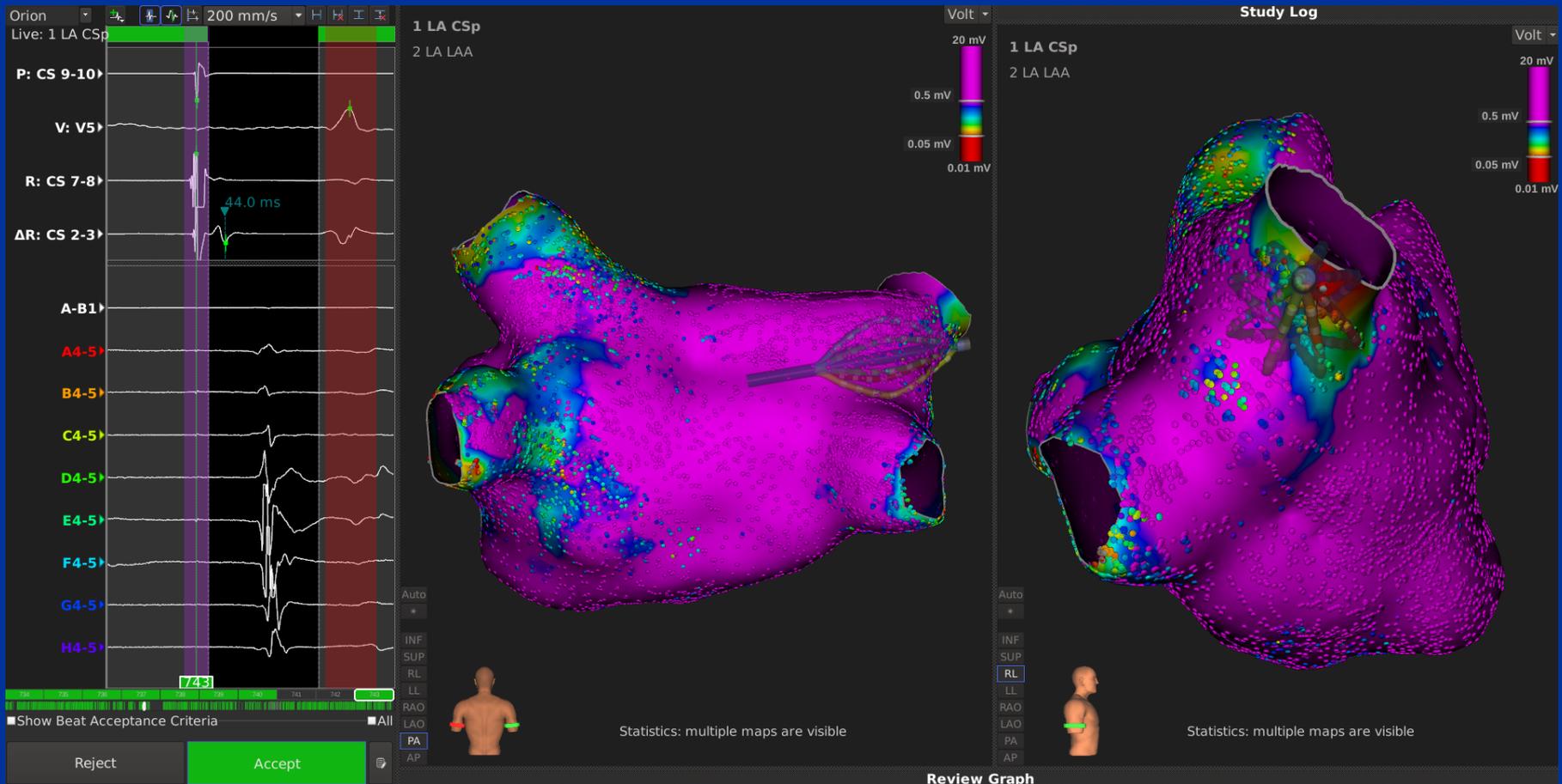
Ultra High density mapping

New Voltage mapping window

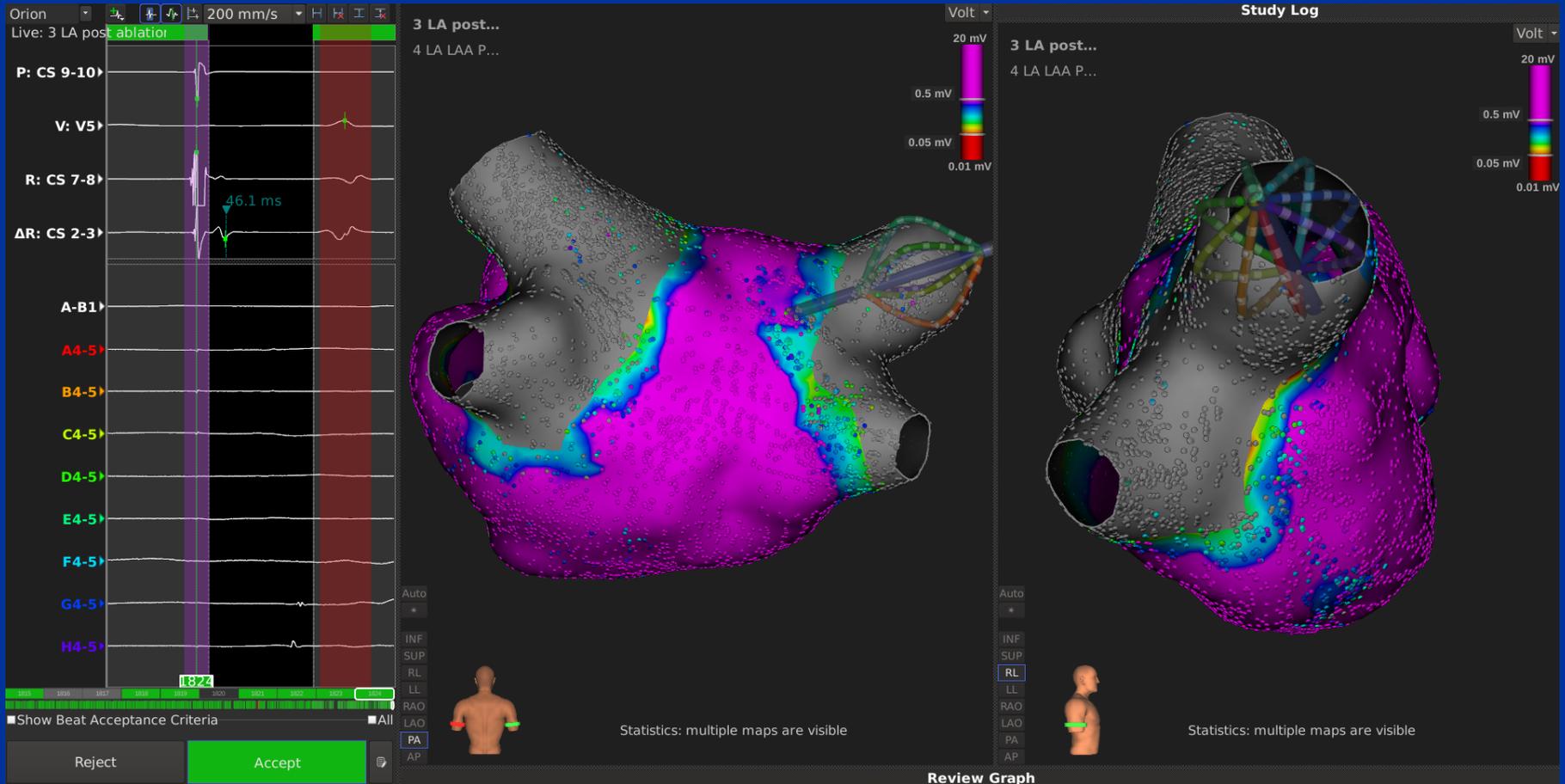


- Case performed by Dr. Vias Markides, Royal Brompton and Harefield NHS Foundation Trust

Pre-ablation RSPV EGM's with IntellaMap Orion

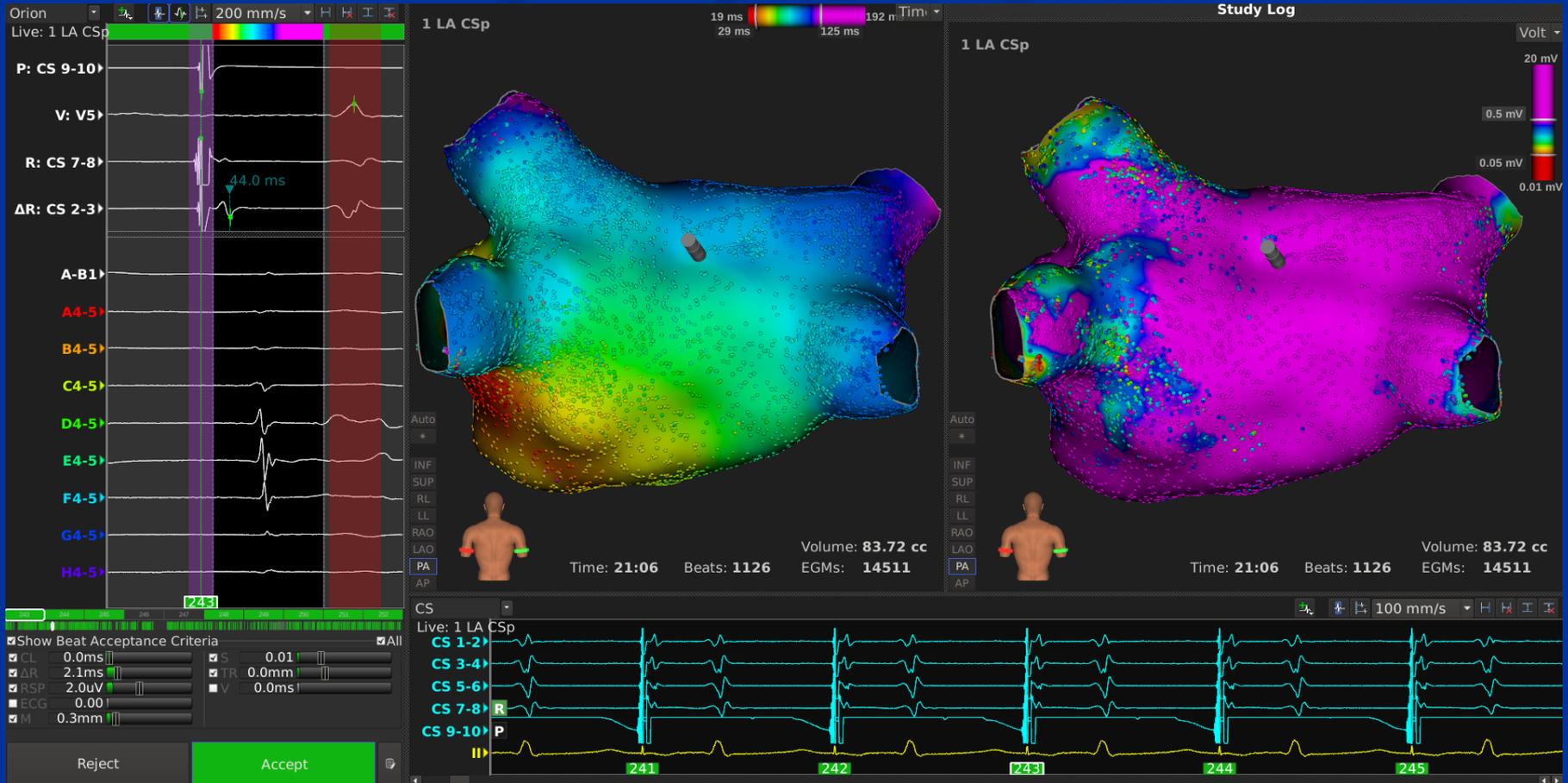


Post-ablation RSPV EGM's with IntellaMap Orion



Pre-ablation Activation and

Voltage Map During CS









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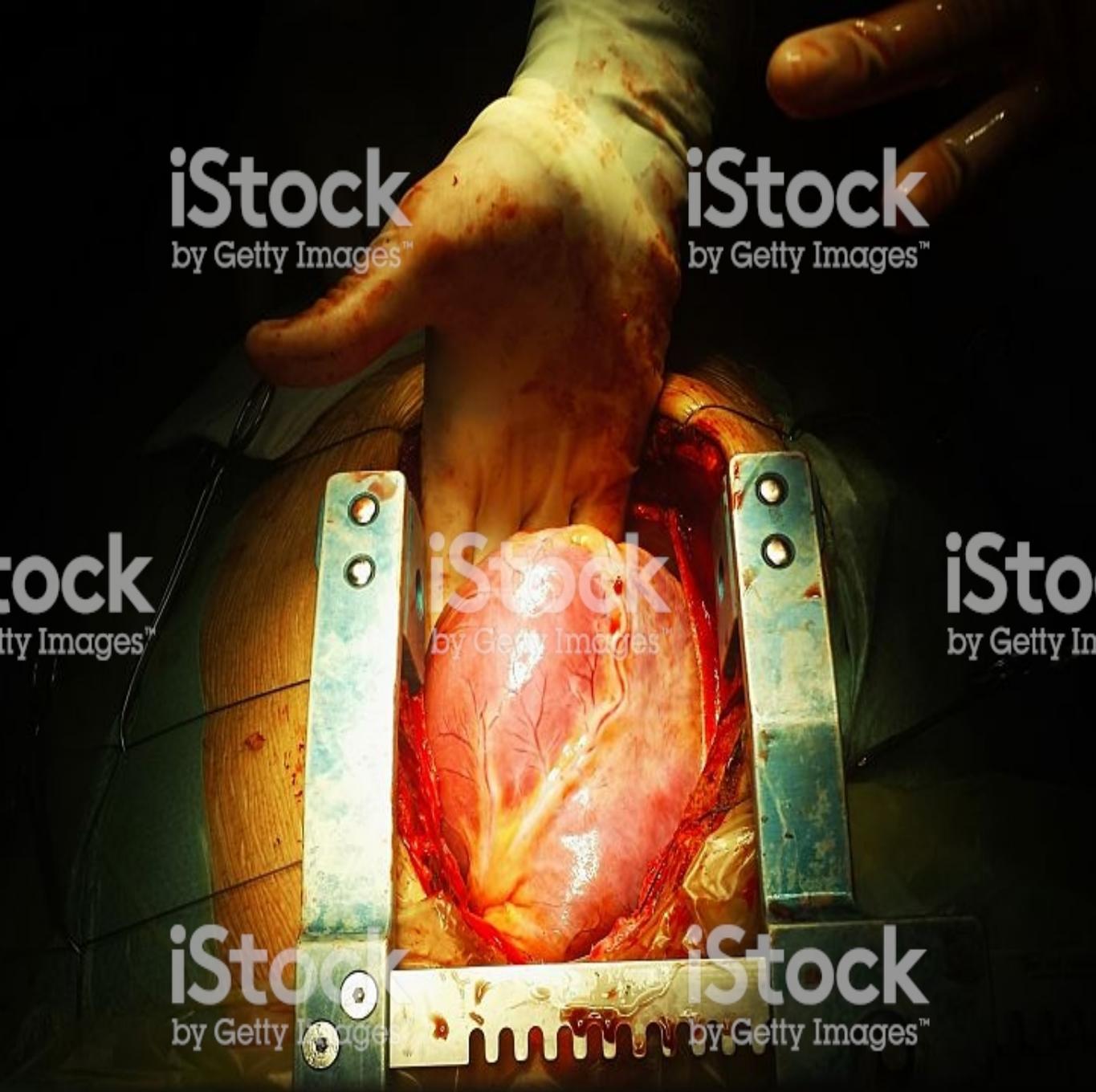
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C.E.C.

Aspetti negativi

SOVRACCARICO IDRICO

- **Priming: 1000 ml**
- **Cardioplegia: 1000 ml**
- **Fluidi e farmaci: 1500 ml**

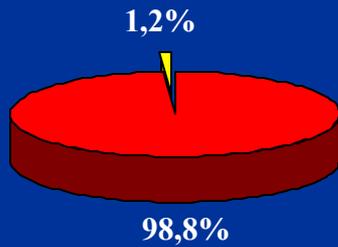
- **Totale: 3500 ml**

Attività cardiocirurgica dal Settembre 2000

Complicanze neurologiche

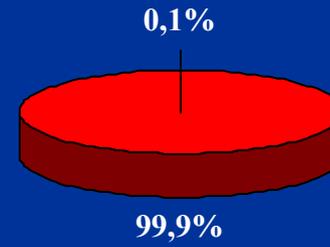
1464 CABG puri

On-Pump
8 di 676 Pz.



■ No-Complicanze ■ Complicanze

Off-Pump
1 di 788 Pz.



■ No-Complicanze ■ Complicanze

Attività cardiocirurgica dal Settembre 2000

Tempi di degenza media

Off-Pump

- Intubazione: 4 h
- Degenza in T.I.: 18 h
- Degenza postoperatoria: 5 gg

On-Pump

- Intubazione: 7,5 h
- Degenza in T.I.: 27 h
- Degenza postoperatoria: 8 gg

Rivascolarizzazione miocardica a cuore battente

Vantaggi

- Significativa riduzione della mortalità e della morbilità

Svantaggi

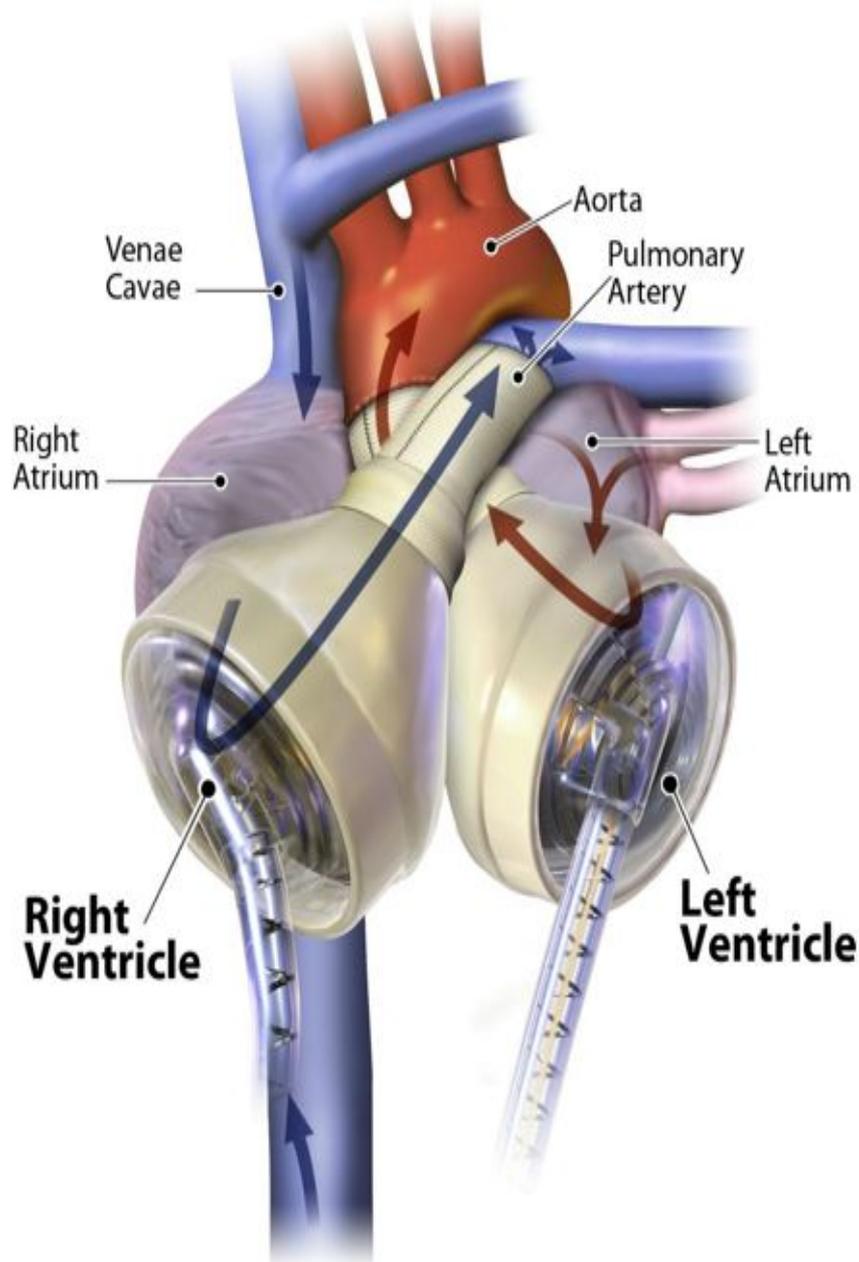
- Curva di apprendimento di maggiore durata
- Maggiore difficoltà tecnica
- Tendenza ad un numero inferiore di anastomosi

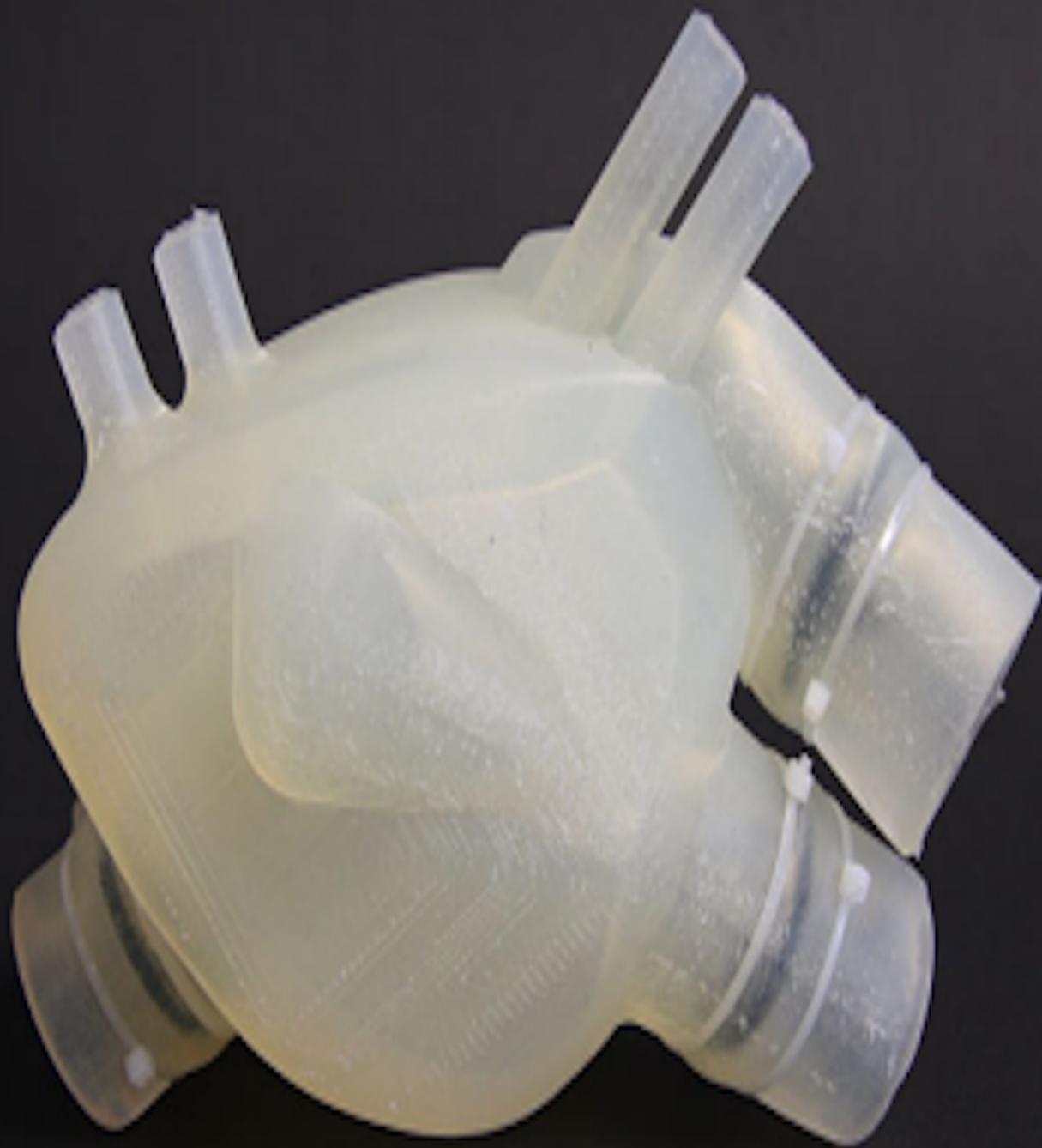
Conclusioni

Gli interventi di Bypass aortocoronarico a cuore battente possono migliorare sensibilmente i risultati chirurgici degli interventi di rivascolarizzazione miocardica se effettuati in un centro che, negli anni, ha introdotto e sviluppato questa tecnica, aggiornando attrezzature e strumentario ed addestrando con gradualità i propri operatori.









ENTITA' DEL PROBLEMA

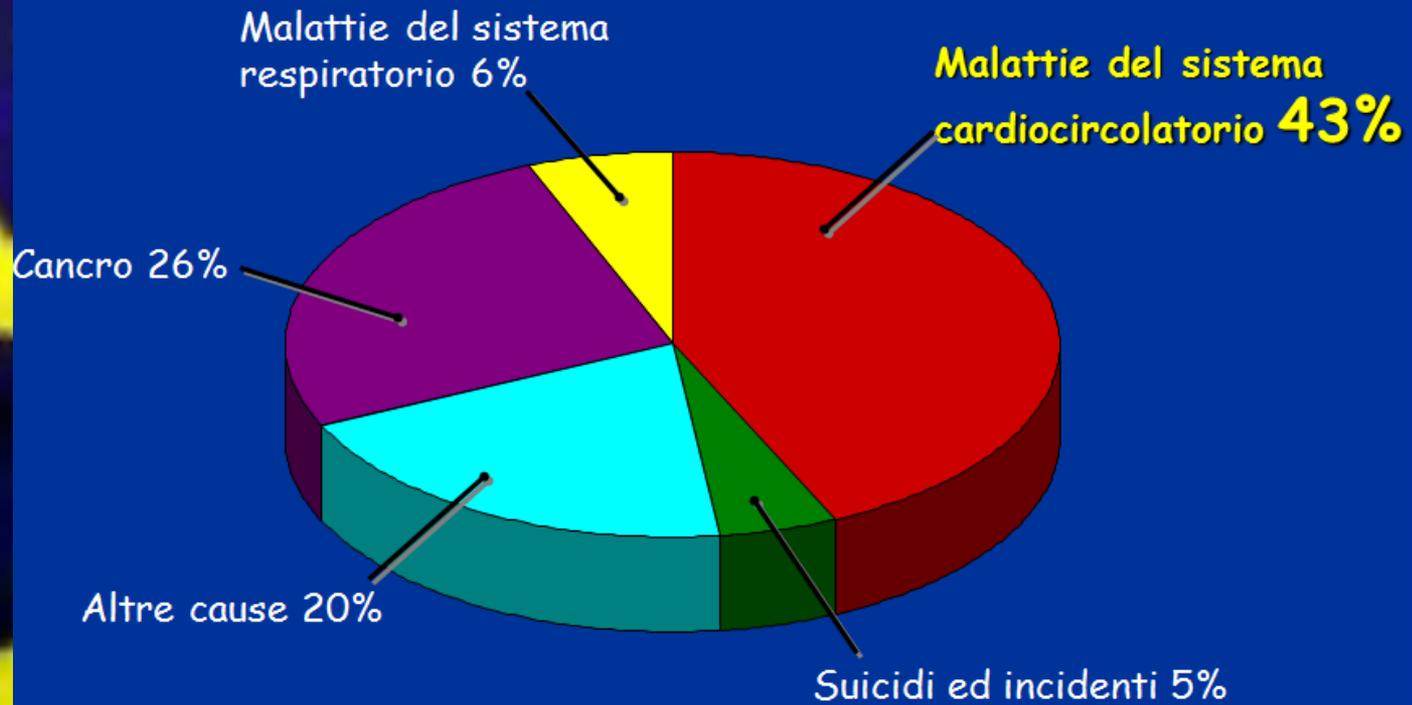
85% delle **MORTI**
70% della **DISABILITA'**

- Malattie CardioVascolari (MCV)
- Diabete
- Obesità
- Malattie Croniche Polmonari
- Alcuni Tumori

MALATTIE CARDIOVASCOLARI

- **Infarto Miocardico**
- **Aneurismi aortici**
- **Angina Pectoris**
- **Ictus**
- **Demenza**
- **Arteriopatie Arti inferiori**
 - **Piede diabetico**
- **Ostruzioni carotidee**
- **Disfunzione erettile**
- **Insufficienza Renale**
- **Etc etc**

Dati di Mortalità: Unione Europea





In Italia le M.C.V. → 250.000 morti/anno (54% Donne)

1 Italiano su 4 è affetto da Malattie Cardio Vascolari

1.000.000 → il N° di persone sopravvissuto ad un Infarto

Frequenza anno di eventi coronarici età 35 → 69 anni

- **Donne 1.7/ 1000 abitanti**
- **Uomini 5.7 /100 abitanti**

Dopo i 65 anni la frequenza di eventi coronarici /anno è maggiore nelle donne rispetto agli uomini



...la morte cardiaca improvvisa...



Stima Numero Casi x Anno

- **Stati Uniti** → **300.000**
- **Europa** → **500.000**
- **Germania** → **80.000**
- **Italia** → **57.000**

...la morte cardiaca improvvisa...



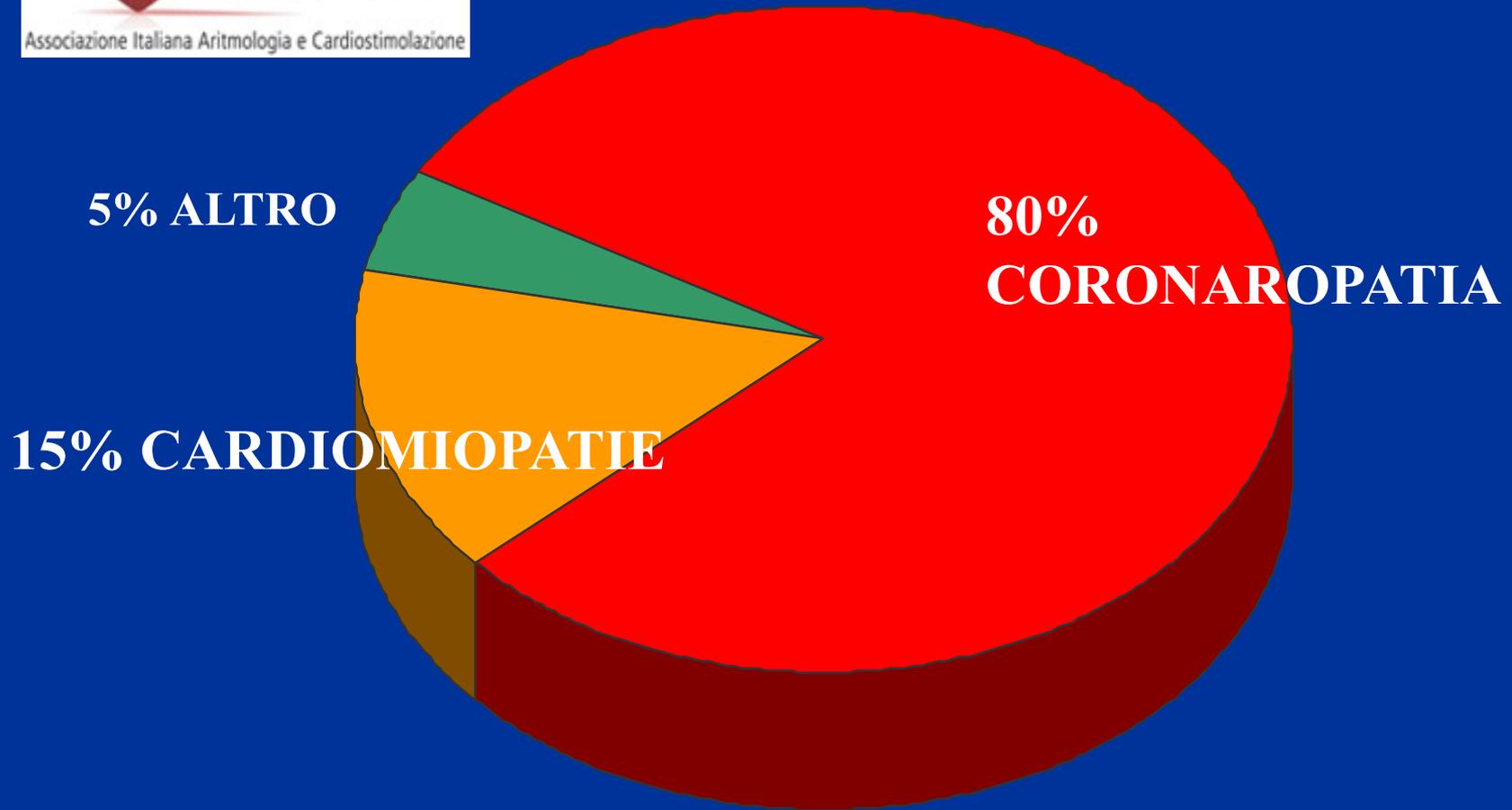
Incidenza per Regione

- ✓ Trentino → 1 caso ogni 9 ore
- ✓ **Lombardia** → **1 caso ogni 57 minuti**
- ✓ Friuli → 1 caso ogni 7 ore
- ✓ Veneto → 1 caso ogni 2 ore
- ✓ **Piemonte** → **1 caso ogni 2 ore**
- ✓ Liguria → 1 caso ogni 5 ore
- ✓ EmiliaRomagna → 1 caso ogni 2 ore e 20
- ✓ Marche → 1 caso ogni 6 ore
- ✓ Toscana → 1 caso ogni 2 ore

...la morte cardiaca improvvisa...



Eziologia



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Stemming the global tsunamis of cardiovascular disease

Sonia S Anand, Salim Yusuf

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Il portale dell'epidemiologia per la sanità pubblica

a cura del Centro Nazionale di Epidemiologia, Sorveglianza e Promozione della Salute

NEI Paesi membri dell'Unione Europea i morti per malattie cardiovascolari sono ogni anno → 2 milioni e rappresentano il 42% del totale dei decessi.

Jennifer L. Baker, Ph.D., Lina W. Olsen, Ph.D., and Thorkild I.A. Sørensen, M.D., Dr.Med.Sci.

LINEE GUIDA

Linee guida nazionali su cardiologia riabilitativa e prevenzione secondaria delle malattie cardiovascolari: sommario esecutivo

a cura del Gruppo di Lavoro dell'Agenzia per i Servizi Sanitari Regionali, dell'Istituto Superiore di Sanità – Piano Nazionale Linee Guida –

Quali sono i Fattori di rischio?

Maggiori

Condizionanti

Predisponenti

Fumo

Ipertensione

- ↑ colesterolo-LDL
- ↓ colesterolo-HDL

● **Diabete**

- Età avanzata

- ↑ trigliceridi

- ↑ LDL Piccole/dense

- **Infiammazione/PCR**

- ↑ lipoproteina(a)

- ↑ omocisteina

- **Fattori protrombotici**

Obesità

- **Obesità addominale**

Sedentarietà

- **Familiarità per MCV**

- **Caratteristiche etniche**

Fattori psico-sociali

**I fattori di rischio,
spiegano” oltre il 90% degli infarti miocardici”**

•“

- L' associazione di più fattori di rischio moltiplica la probabilità di infarto**

Chi presenta tutti i nove fattori di rischio ha una probabilità

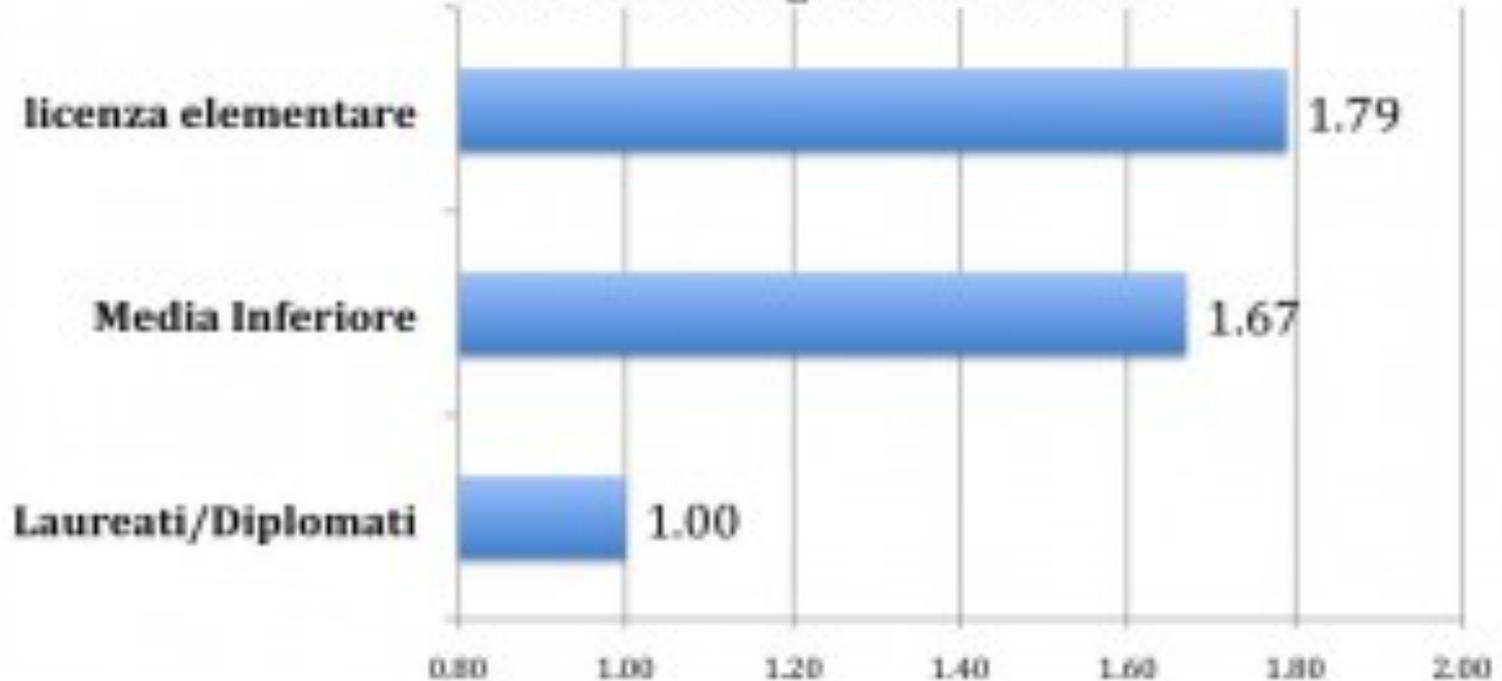
Avere un infarto che è più di 330 volte

superiore a quella di chi non ne ha nessuno

Rischio relativo: Mortalità per Malattia Ischemica di cuore, età 18-74 anni. Firenze 2001-2005.

Figura 1. Rischio Relativo. Mortalità per Malattia ischemica di cuore, Età 18-74 anni. Firenze 2001-2005.

Fonte: Studio Longitudinale Toscano.



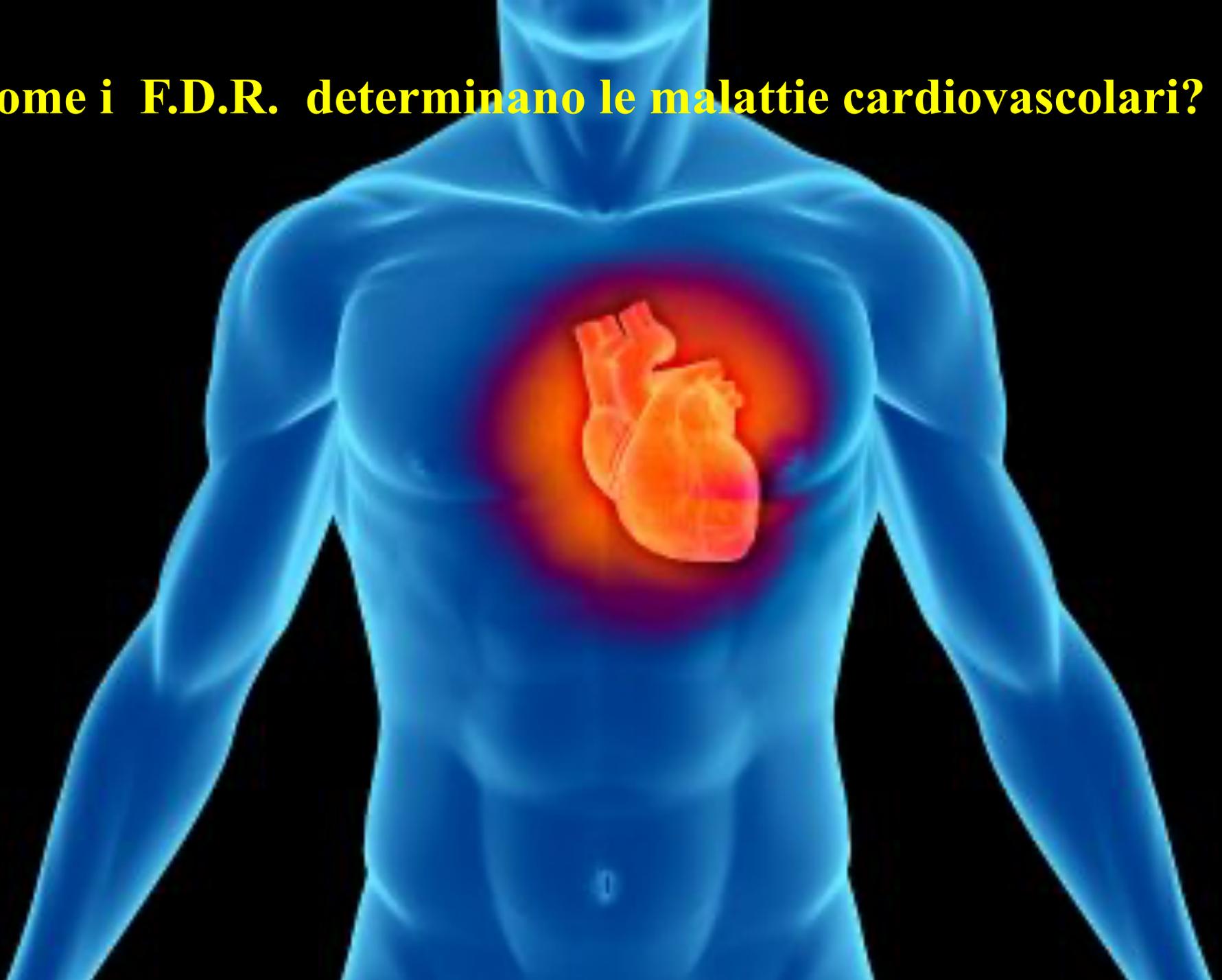
2 Miliardi di Persone sono ad alto rischio di MCV

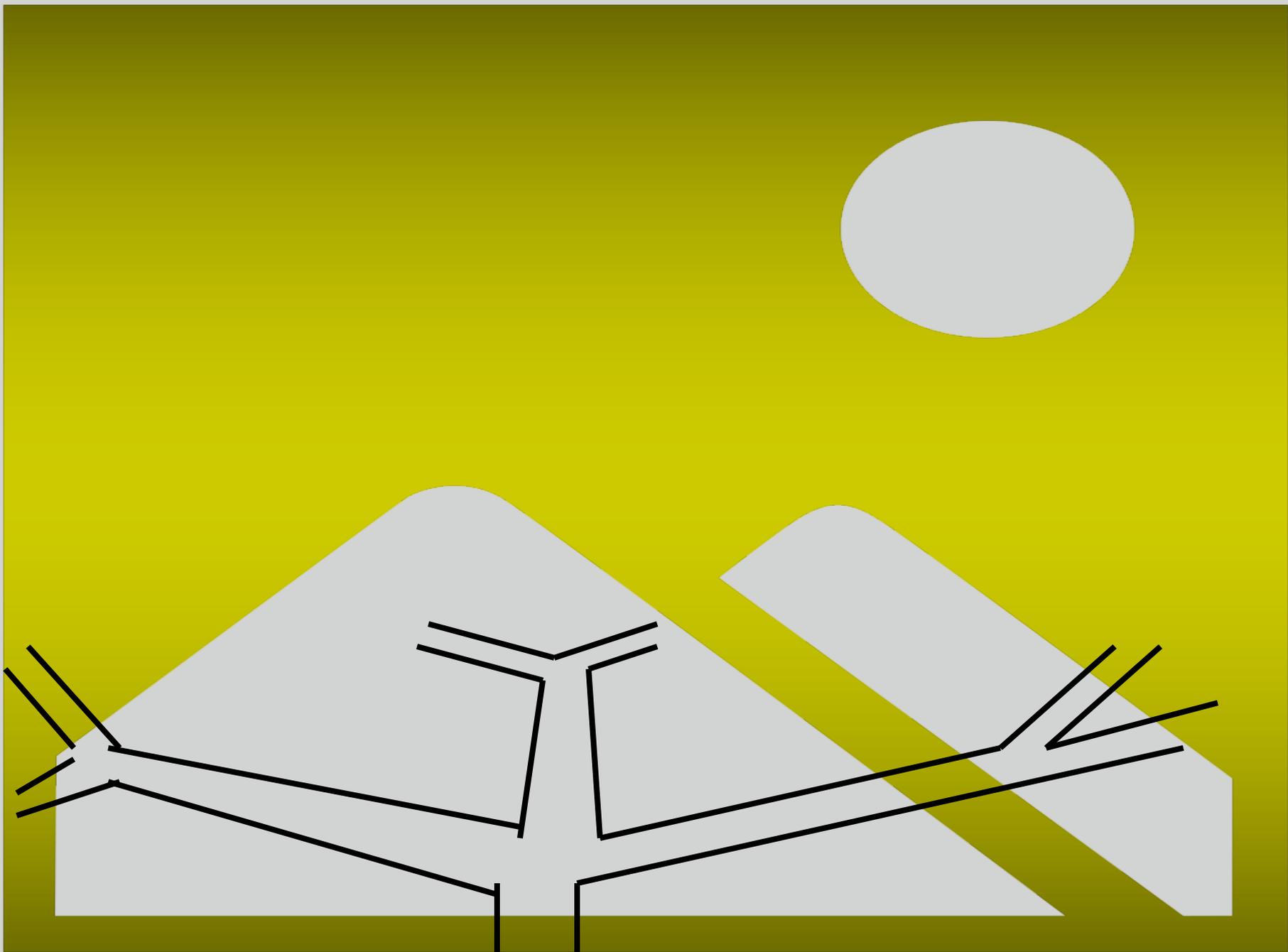
- **1.300.000.000 di FUMATORI**
- **600.000.000 di Ipertesi**
- **220.000.000 Diabetici**

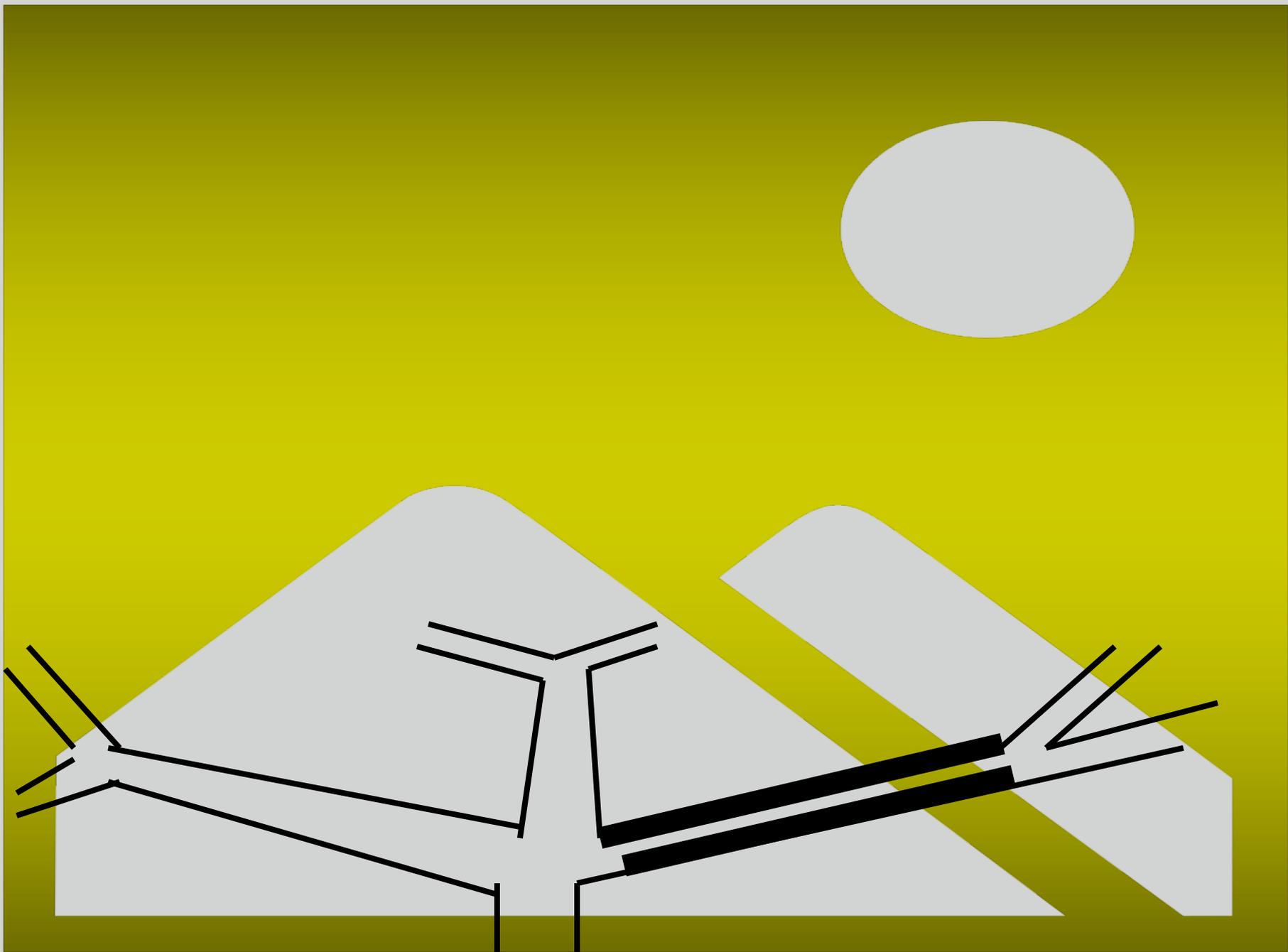
L'incremento di Diabete è molto preoccupante
438 milioni di diabetici previsti nel 2030

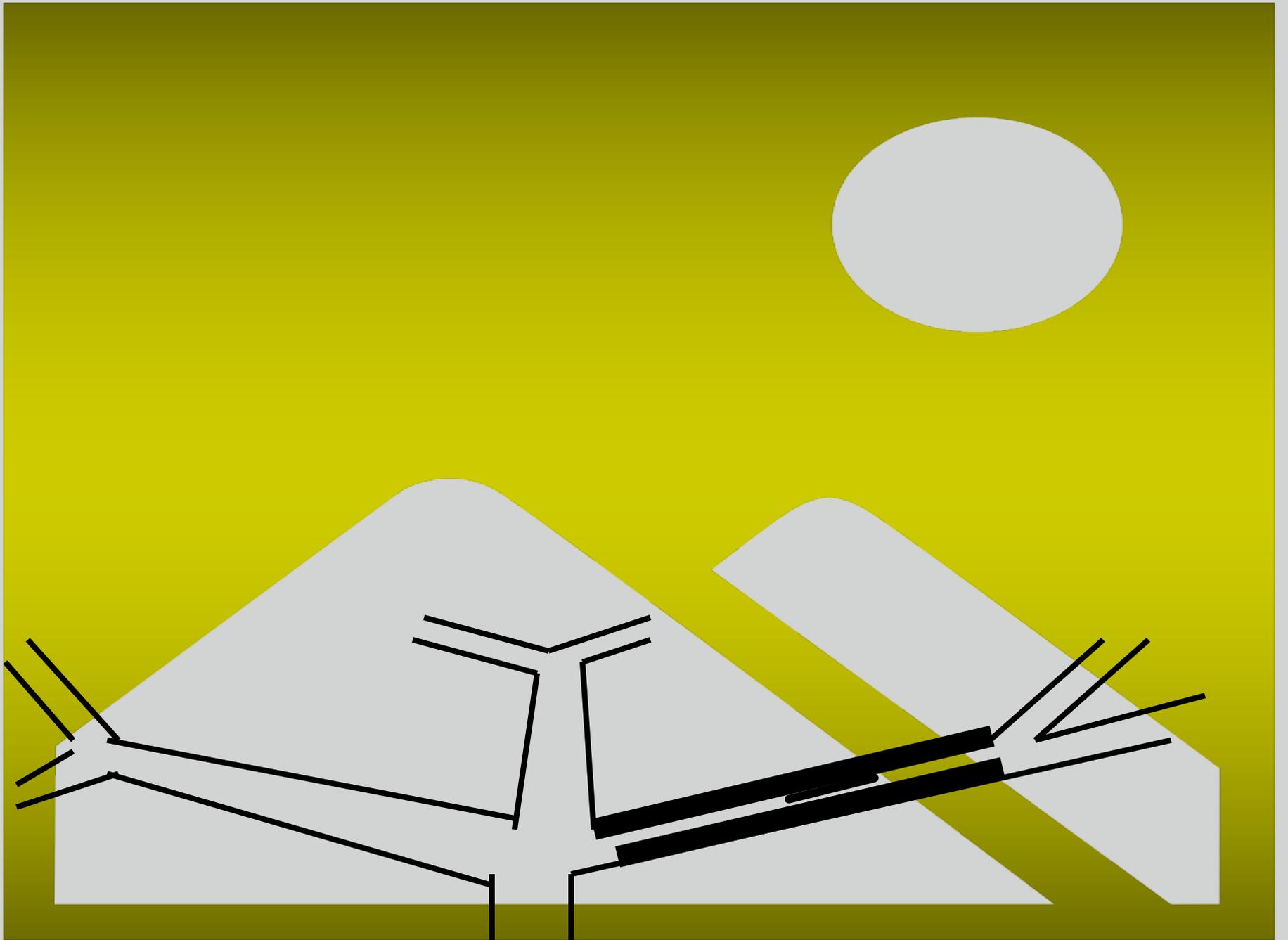
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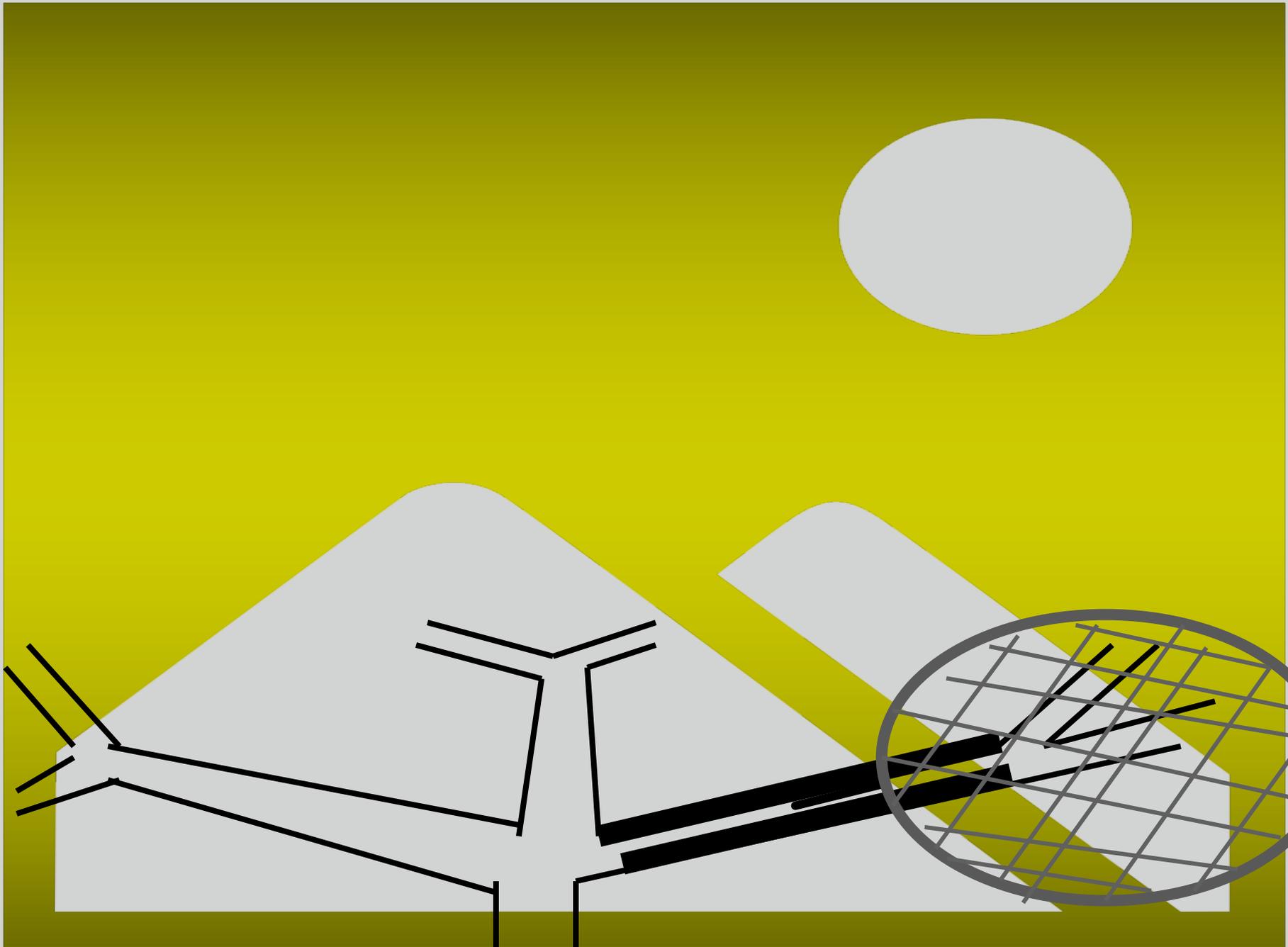
Come i F.D.R. determinano le malattie cardiovascolari?

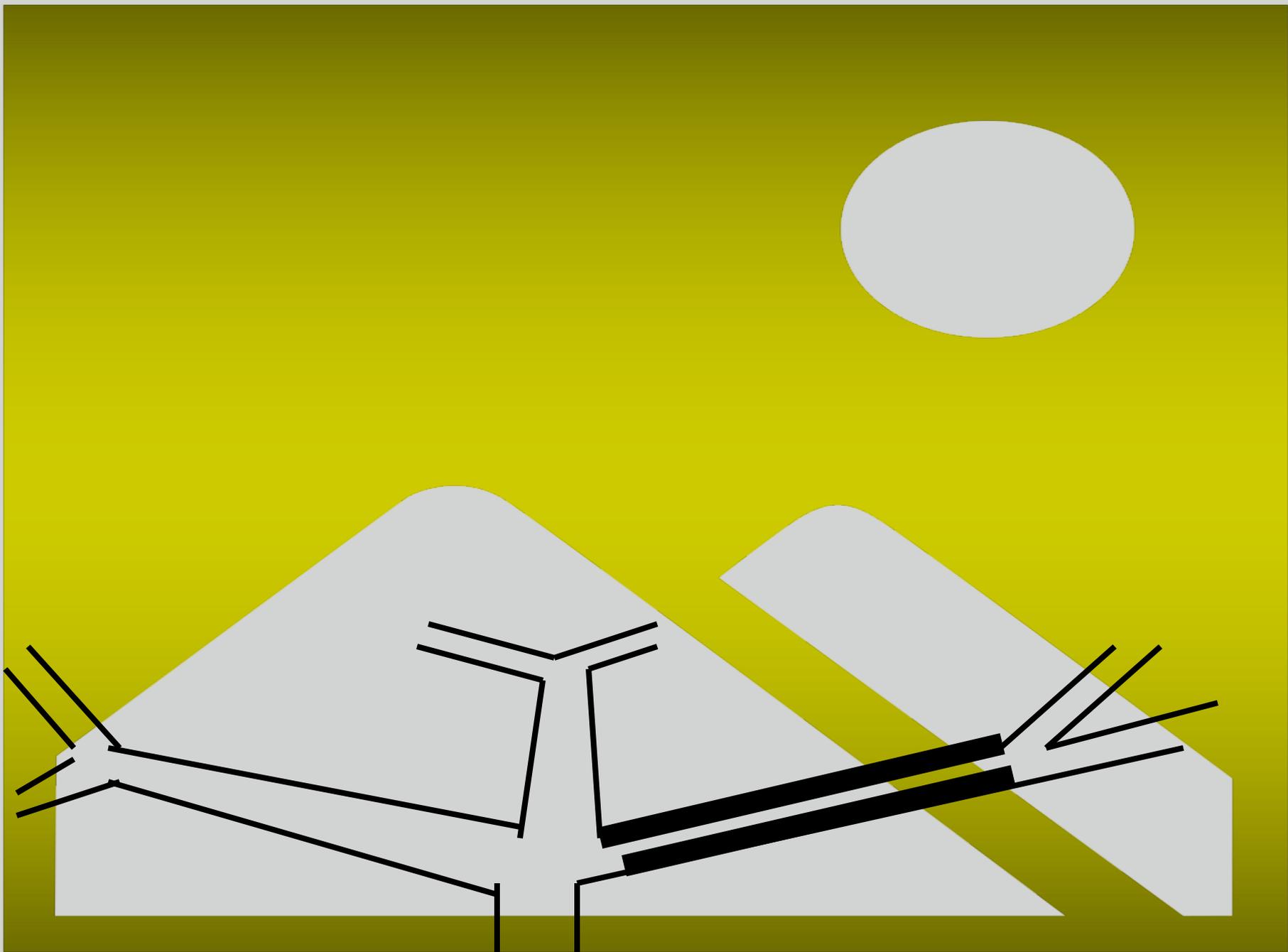


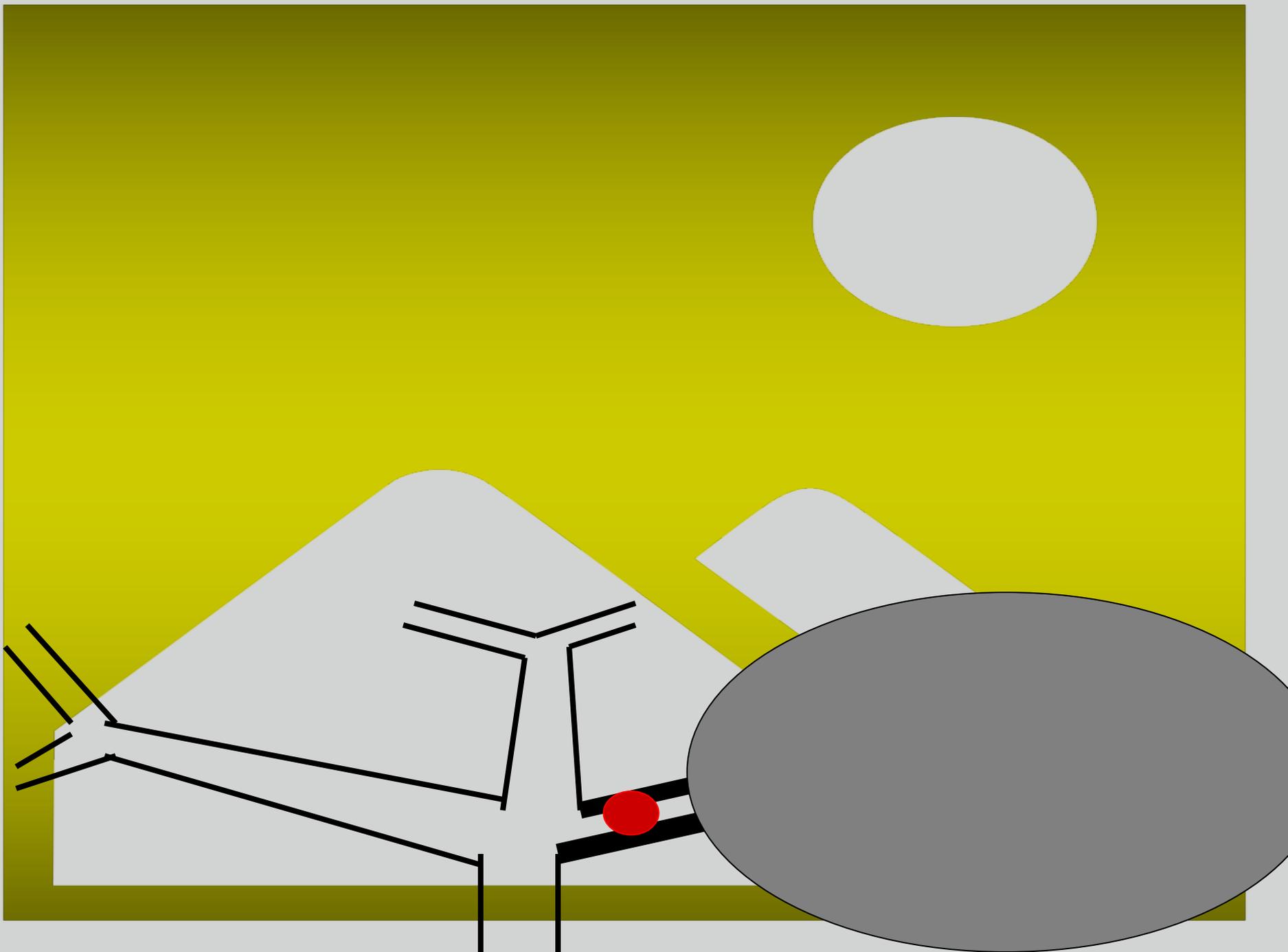






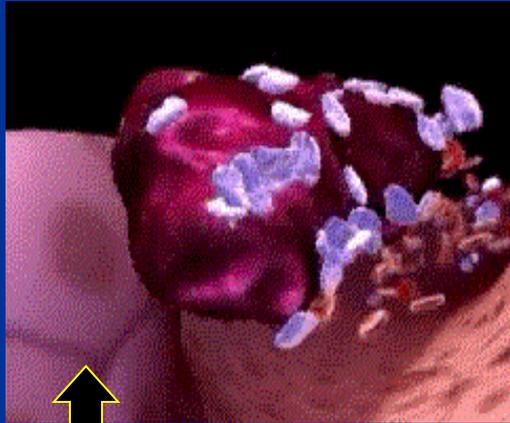




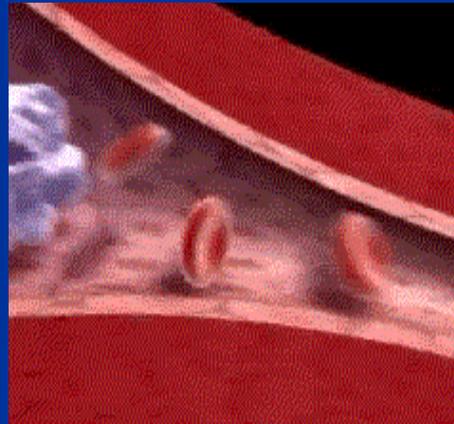


Pathophysiology

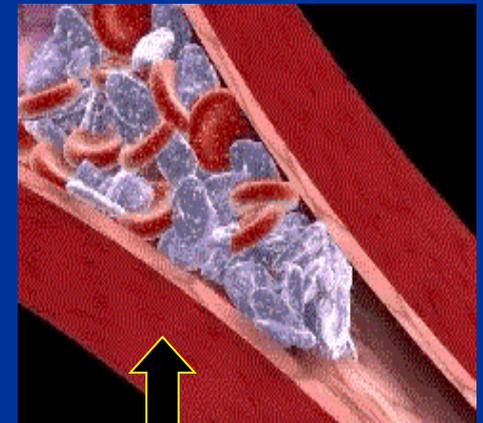
Distal Embolization Mechanical Plugging



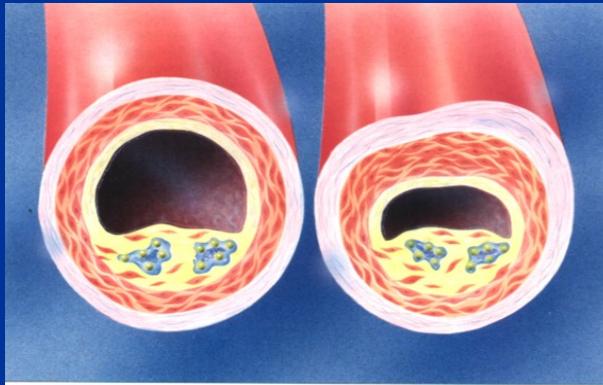
↑ **Thrombus
Plaque Rupture**

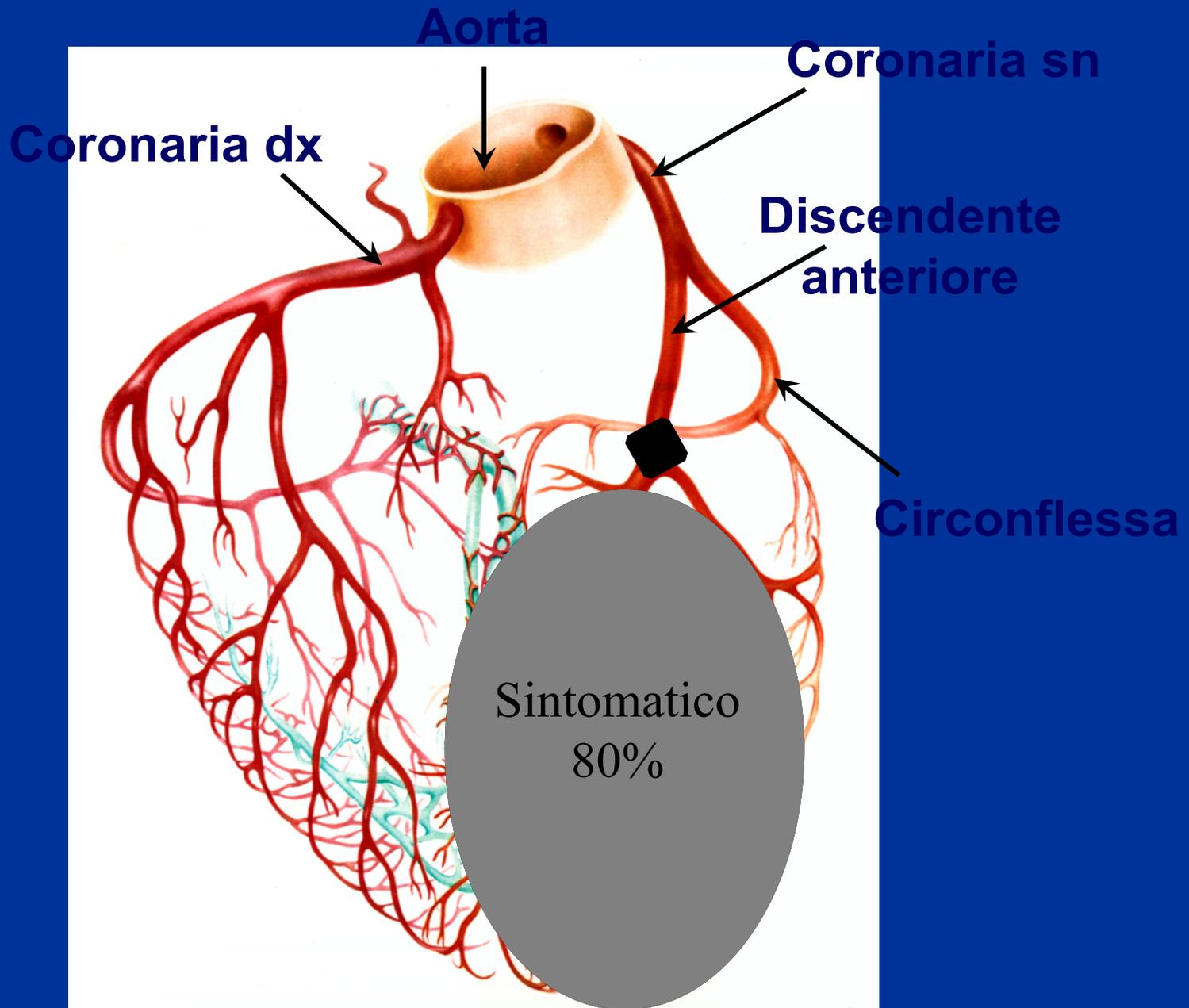


Vasoconstrictive



Vasoconstriction Serotonin Release







Quanto ci costa il SSN
ed in particolare le
Malattie cardiovascolari ?



ITALIA: Voci Bilancio dello Stato Costi /anno



- 1° PENSIONI > 300 Miliardi
- 2° interessi DEBITO PUBBLICO > 120 Miliardi
>2000 Miliardi
- 3° **SISTEMA SANITARIO** **110 Miliardi**

2014



COSTI Malattie C. V.



Europa

192 Miliardi

ITALIA

22 Miliardi

14 MI Costi Sanitari Diretti

4 MI Costi sanitari Indiretti

4 MI Perdita di produttività



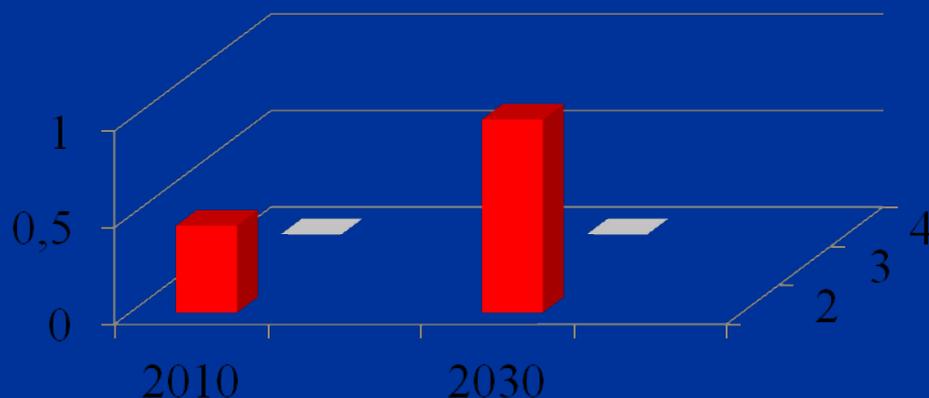
Costi :

Stima American Heart Association AHA

Costi sanitari diretti ed indiretti x MCV

2010 sono stati pari a \$450 bilioni

2030 saranno pari a \$ 1 trilione



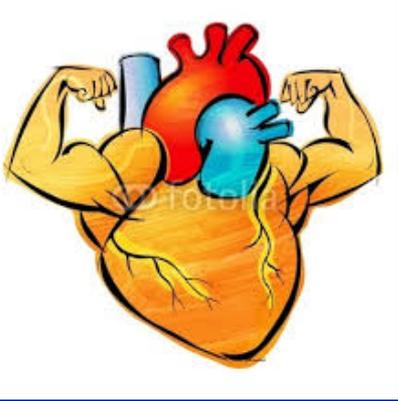
Politiche sanitarie che modifichino lo stile di vita sono efficaci in termini di riduzione di spesa e di eventi evitati

ALTRI EFFETTI ECONOMICI DELLE MALATTIE C.V.

Ogni aumento del 10% di Infarto ed Ictus

Determina

Un rallentamento della crescita dello 0,5 %



La ripresa economica



passa anche per politiche sanitarie che
riducano tali enormi spese migliorando la
salute e l'aspettativa di vita:

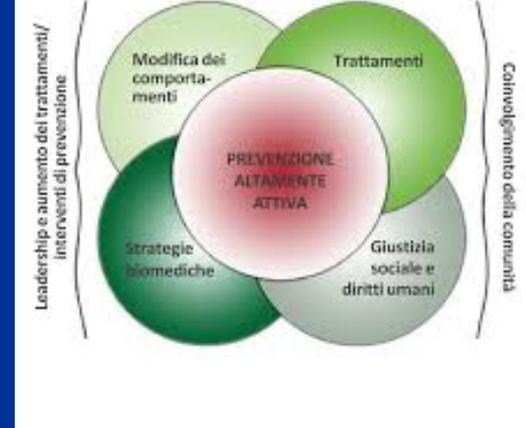
1) Prevenzione

2) diagnosi precoce



Perché Investire in

- PREVENZIONE
- Diagnosi precoce



Questi programmi riducono, in media
le assenze per malattia del 28 %
i costi della salute del 26 %
i costi di risarcimento e le rendite di invalidità del 30 %

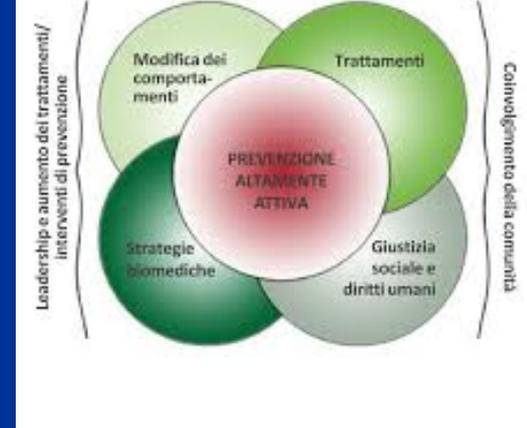
- Esiste una relazione diretta tra il numero di fattori di rischio di un collaboratore e i suoi giorni d' assenza



Perché Investire

in

- **PREVENZIONE**
- **Diagnosi precoce**



I collaboratori con 3 o 4 fattori di rischio CV

si assentano dal lavoro da due a tre volte più di quelli che non hanno fattori di rischio o ne hanno uno solo.

Riducendo di un solo fattore di rischio questo fenomeno diminuisce del 9 %.

I Collaboratori malati producono di meno di quelli sani

PREVENZIONE e Diagnosi precoce

La prevenzione apporta benefici dimostrabili



Ogni anno si manifestano in circa

30'000 infarti cardiaci

16'000 ictus cerebrali

8'000 arresti cardiocircolatori improvvisi

Più di metà di questi eventi sarebbero evitabili .

- **Le attività di prevenzione delle MCV sia nella grande sia nelle media e piccola industria, hanno effetti positivi durevoli.**



Meno disturbi di salute e uno stile di vita sano

- **aumentano il benessere fisico e psichico con incremento della produttività**
- **I processi lavorativi si svolgono con maggior comunicatività ed efficienza**
- **i risultati Produttivi si ottengono più rapidamente e sono di qualità migliore.**

VANTAGGI ECONOMICI DELLA PREVENZIONE

OGNI euro

Investito apporta un Return on Investment di

2,5-13,8 franchi

Fondazione Svizzera Heart@Work sito www.heartatwork.ch

PROGRAMMI DI PREVENZIONE DIAGNOSI PRECOCE

ASSOCIAZIONE
AMICI DELLA COOPERAZIONE
DI MONTEBELLUNA
AAMC

Croce Rossa Italiana

CNI
CITTADINI

**TOUR PEDALATA
DEL CUORE**
I EDIZIONE

**PREVENIRE
PEDALANDO**
Giornata di
prevenzione
dell'infarto

Ospedale Civile di Udine

Croce Rossa Italiana

**ANEURISMA,
MEGLIO PREVENIRE
CHE FARCI
FREGARE!**

MORTA
PERICOLO ROTTURA ANEURISMA

CA PREVA

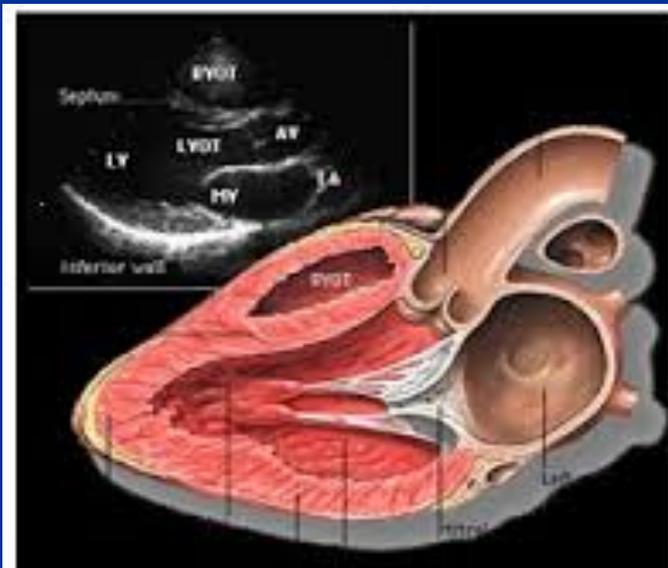


TOUR PEDALATA DEL CUORE

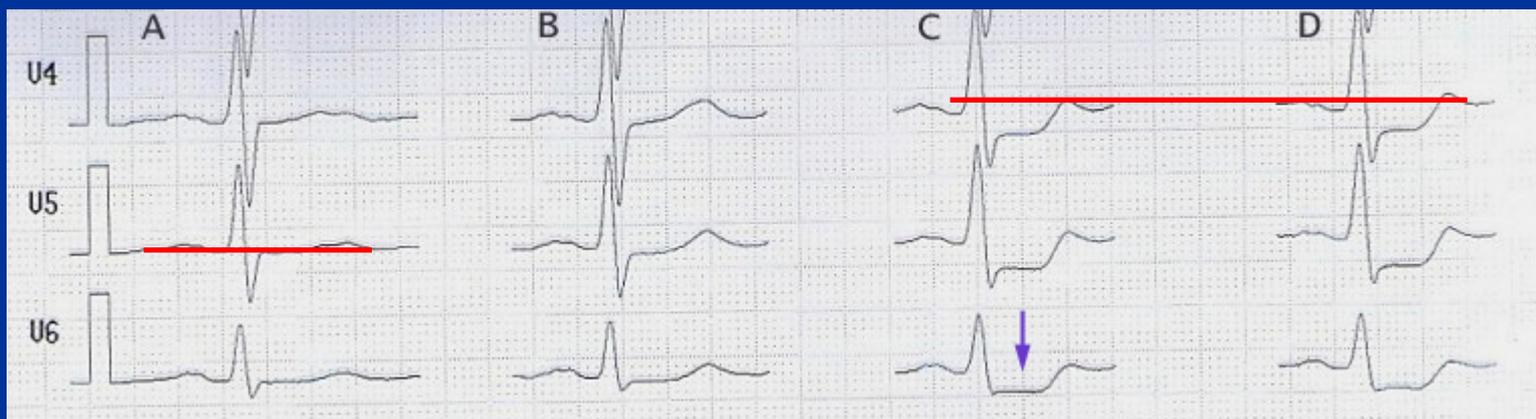
I EDIZIONE



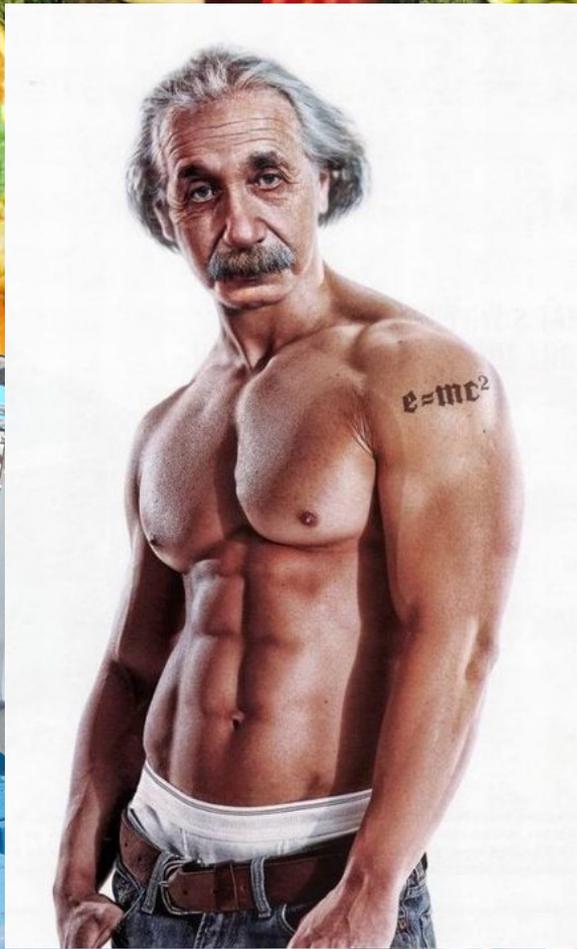
DIAGNOSI PRECOCE



DIAGNOSI PRECOCE



Come dimagrire IN MODO SANO?



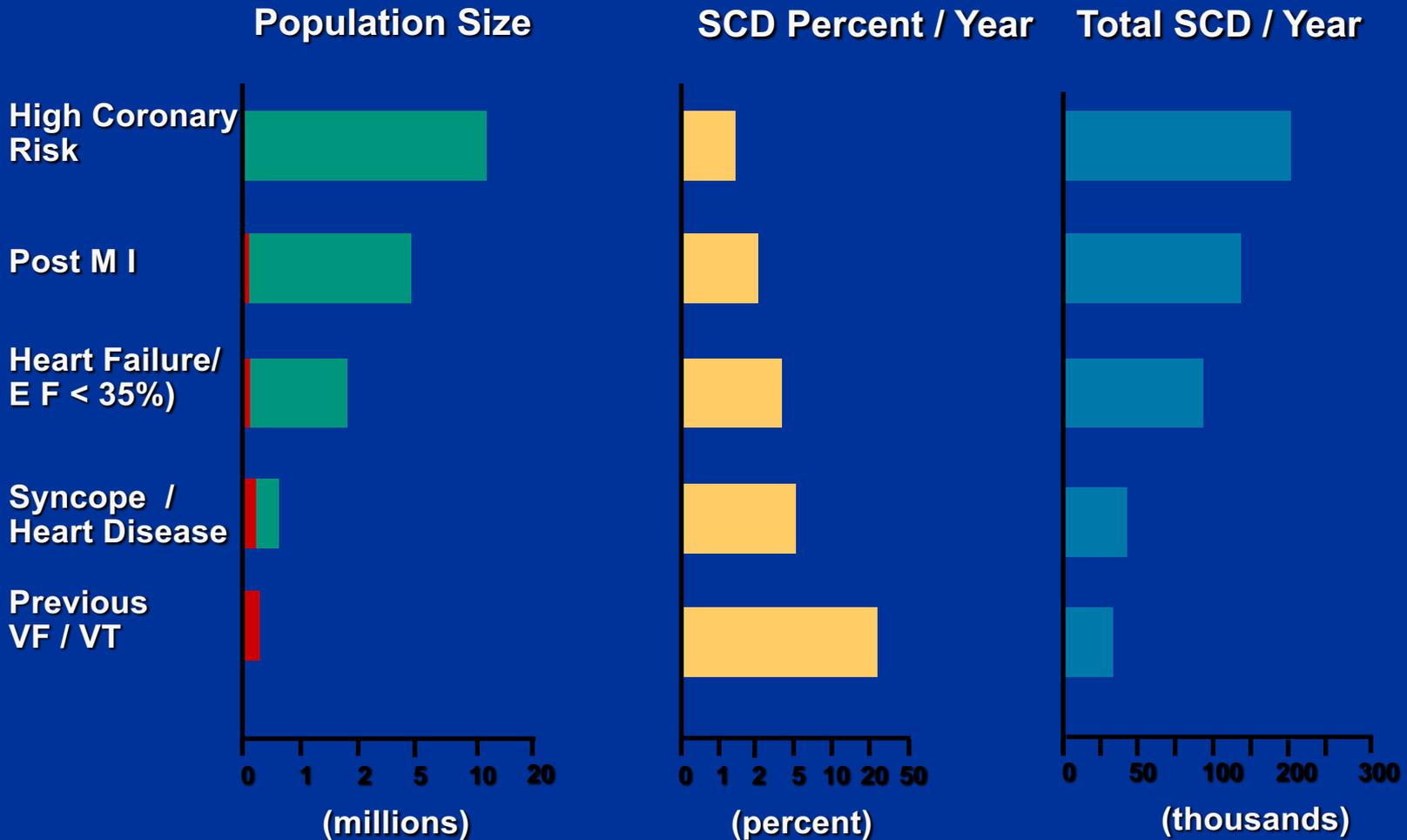
NTARSI CON



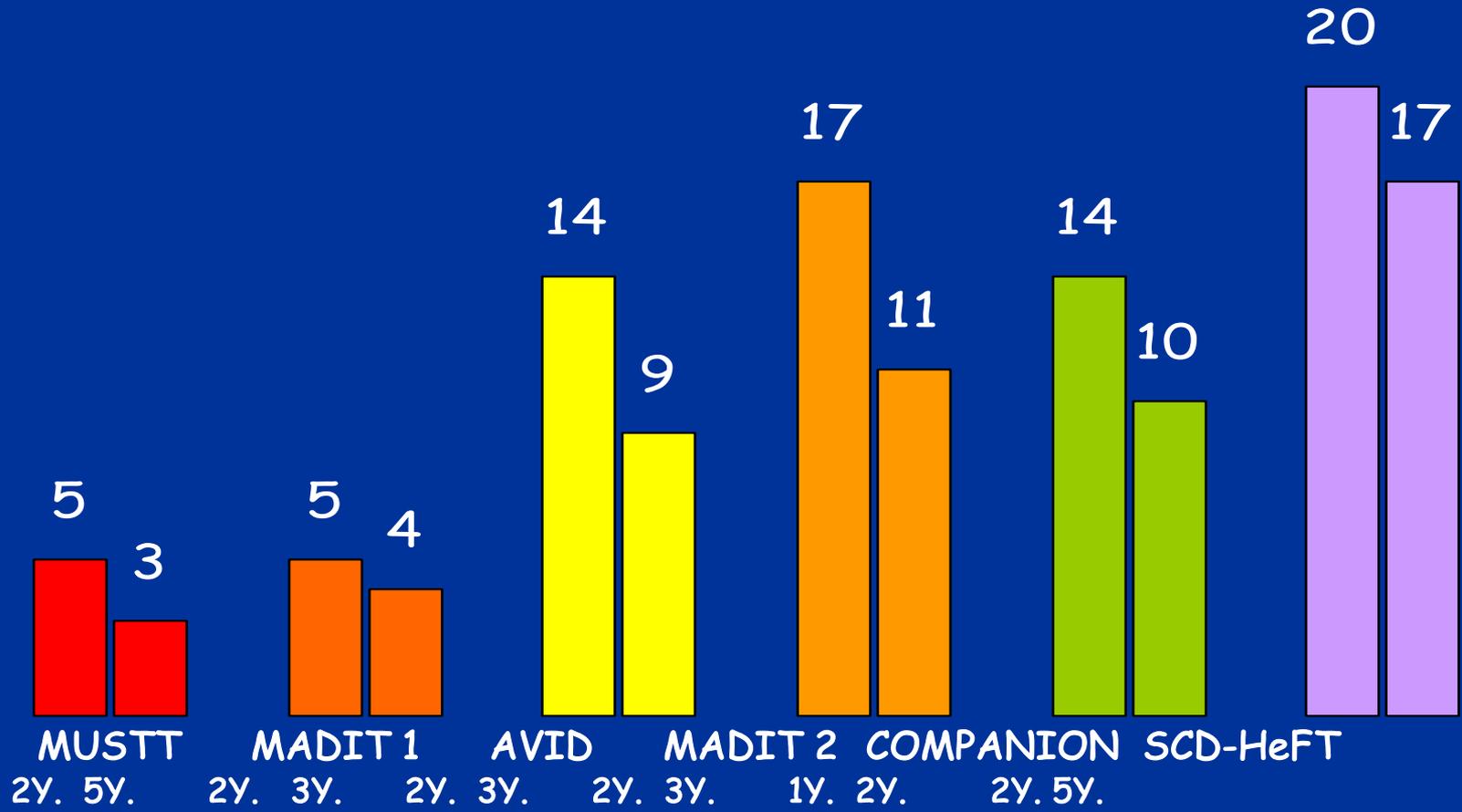
**VIETATO
FUMARE**

Art. 3 L. n. 504 11/11/1975 - D.P.C.M. 14/12/1995 - Art. 51 L. n. 3 16/01/2003 - A.S.R. 16/12/2004

High Risk Groups for SCD



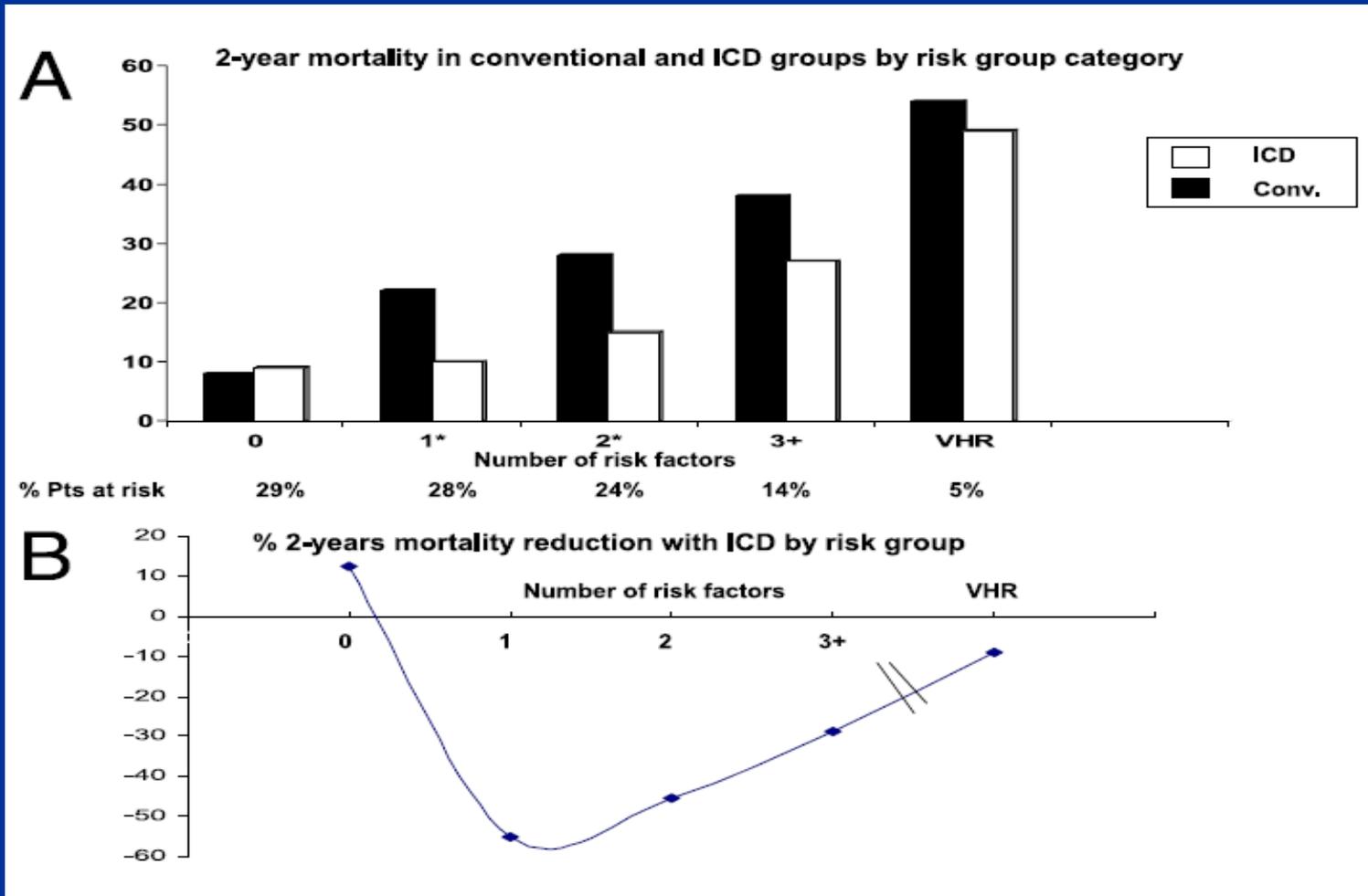
Impact of F-U Time on NNT



Variable	High-Risk Category				Lower-Risk Category				High:Low§	
	Definition	n†	Mortality Rate‡		Definition	n†	Mortality‡		HR	p Value
			Crude, %	Adjusted, %			Crude, %	Adjusted, %		
Atrial fibrillation	Yes	36	39	2.06	No	426	19	0.89	2.39	0.001
BUN, mg/dl	>26	122	29	1.63	≤26	338	18	0.79	2.12	<0.001
NYHA functional class	>II	117	31	1.55	≤II	342	17	0.77	2.02	0.001
Age, yrs	>70	143	27	1.46	≤70	324	18	0.78	1.92	0.002
LBBB	Yes	75	31	1.62	No	361	19	0.87	1.87	0.010
QRS duration, ms	>120	152	27	1.43	≤120	308	18	0.78	1.86	0.003
Creatinine, mg/dl	>1.3	129	27	1.46	≤1.3	333	18	0.81	1.85	0.004
Ejection fraction, %	<20	96	30	1.35	≥20	371	18	0.85	1.58	0.040
Heart rate, beats/min	≥80	120	28	1.30	<80	346	18	0.84%	1.55	0.040
Prior 1-yr hospitalization#	>1	120	27	1.26	≤1	306	17	0.82	1.55	0.051
Body mass index, kg/m ²	<25	135	27	1.26	≥25	331	18	0.83	1.51	0.050
Diabetes mellitus	Yes	176	25	1.20%	No	290	18	0.82	1.48	0.057

Risk Factor	HR	95% Confidence Interval	p Value
NYHA functional class >II	1.87	1.23-2.86	0.004
Atrial fibrillation‡	1.87	1.05-3.22	0.034
QRS >120 ms	1.65	1.08-2.51	0.020
Age >70 yrs	1.57	1.02-2.41	0.042
BUN >26 mg/dl (and <50 mg/dl)	1.56	1.00-2.42	0.048

U-Shaped Curve for ICD Efficacy



The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812

MAY 12, 2005

VOL. 352 NO. 19

Heart-Rate Profile during Exercise as a Predictor of Sudden Death

Xavier Jouven, M.D., Ph.D., Jean-Philippe Empana, M.D., Peter J. Schwartz, M.D., Michel Desnos, M.D.,
Dominique Courbon, M.S.C., and Pierre Ducimetière, Ph.D.

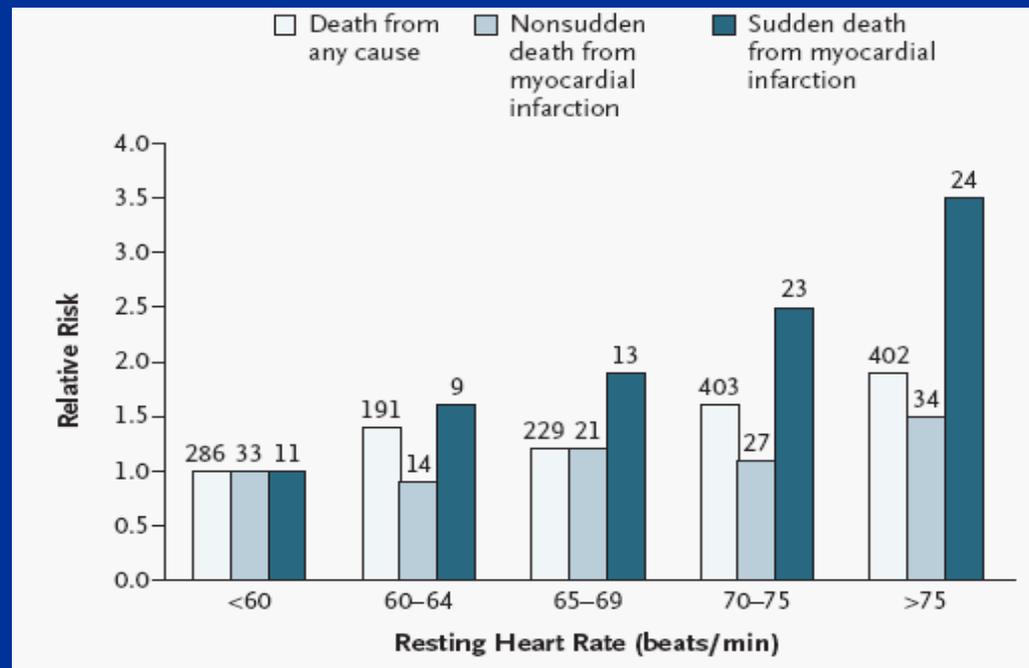


Figure 1. Relative Risks of Death from Any Cause and of Nonsudden and Sudden Death from Myocardial Infarction, According to the Quintile of Resting Heart Rate.

The NEW ENGLAND JOURNAL of MEDICINE

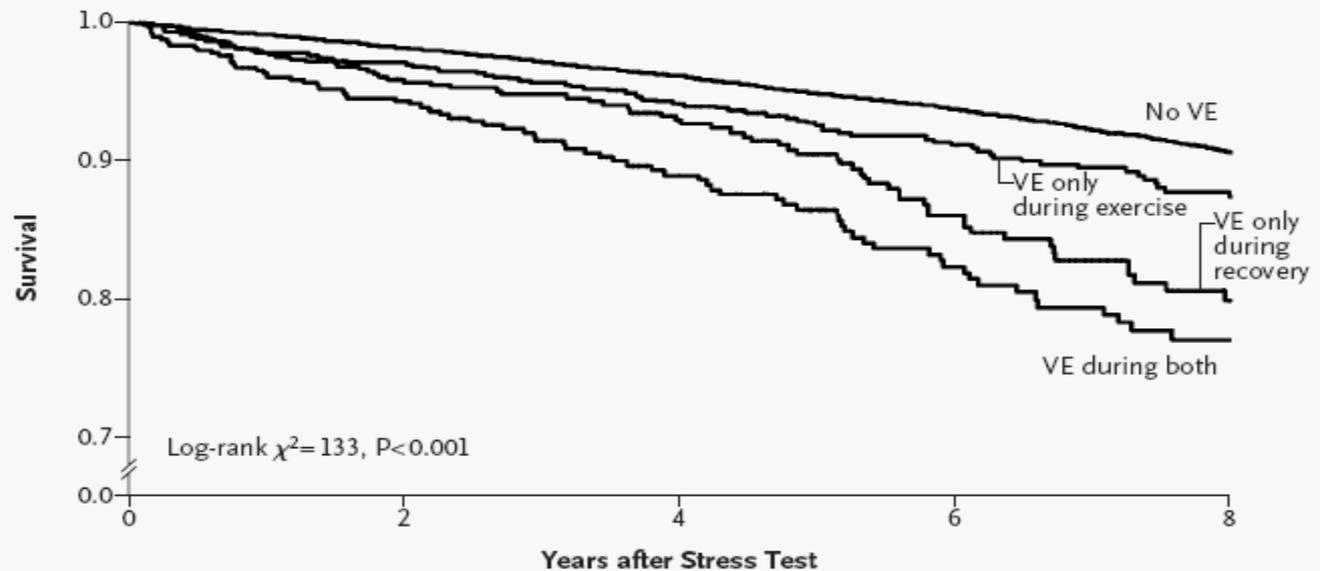
ESTABLISHED IN 1812

FEBRUARY 27, 2003

VOL. 348 NO. 9

Frequent Ventricular Ectopy after Exercise as a Predictor of Death

Joseph P. Frolkis, M.D., Ph.D., Claire E. Pothier, M.S., Eugene H. Blackstone, M.D., and Michael S. Lauer, M.D.



No. at Risk

	0	2	4	6	8
No VE	27,219	26,295	22,900	19,576	16,708
VE only during exercise	945	900	840	687	598
VE only during recovery	589	564	474	425	331
VE during both	491	459	403	329	265

Figure 1 Kaplan–Meier Analysis of the Association of Frequent Ventricular Ectopy (VE) Only during Exercise, Only during Recovery from Exercise, or during Both Exercise and Recovery, with Survival

TVNS

Clinical significance of NSVT

Clinical setting	Significance
Apparently normal heart	
Random finding	No adverse prognostic significance in the absence of occult pathology
During or postexercise	May predict IHD and increased cardiac mortality
Ischemic heart disease	
Acute MI < 24 h	No adverse prognostic significance
Acute MI > 24 h	Adverse prognostic significance
Chronic IHD with LVEF > 40%	Prognostic significance unknown
Chronic IHD with LVEF < 40%	Adverse prognostic significance
DCM	Independent prognostic significance not established, as opposed to LVEF
HOCM	Probable adverse prognostic significance, especially in the young
Primary VF, congenital long-QT, Brugada syndrome, ARVD, repaired congenital abnormalities, valvular disease, hypertension	Prognostic significance unknown

IHD: ischaemic heart disease, MI: myocardial infarction, LVEF: left ventricular ejection fraction, DCM: dilated cardiomyopathy, HOCM: hypertrophic cardiomyopathy, VF: ventricular fibrillation, ARVD: arrhythmogenic right ventricular dysplasia.

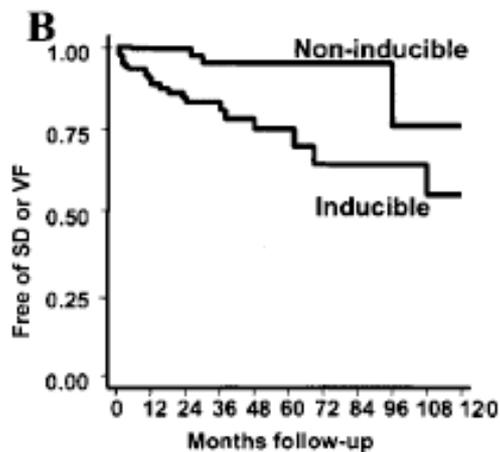
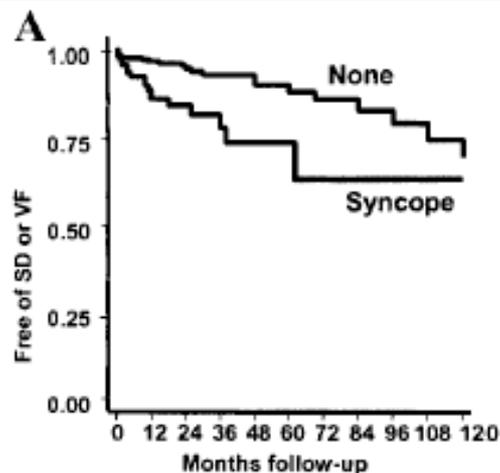


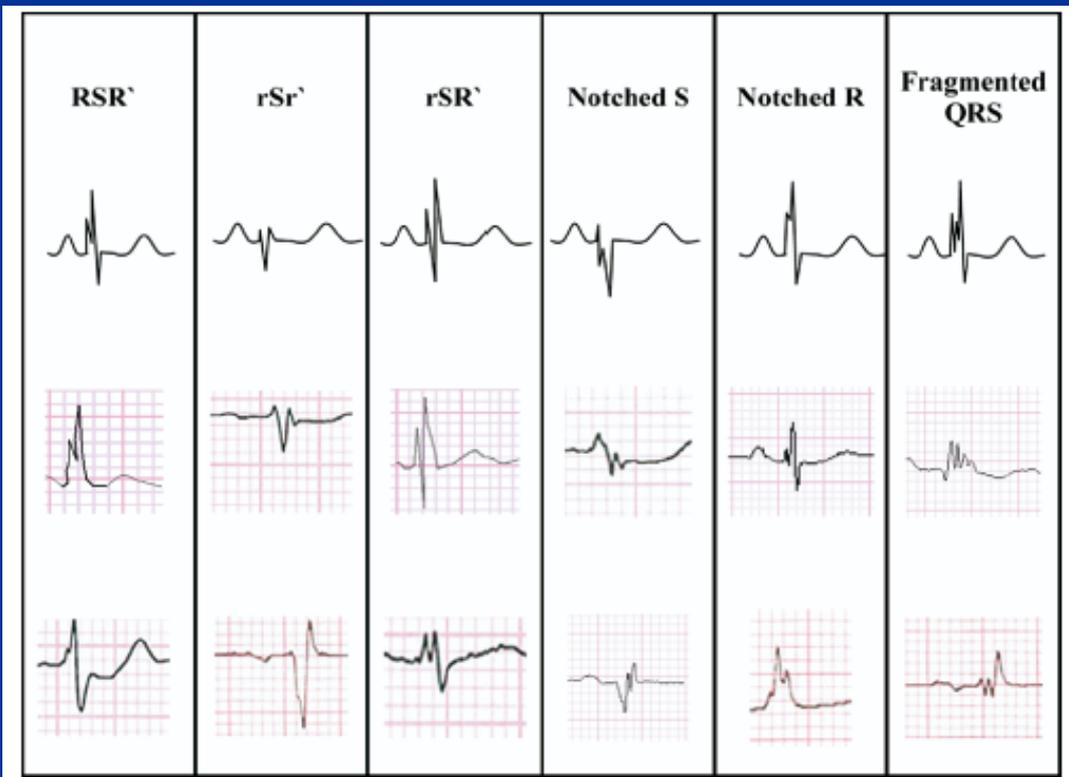
TABLE 3. Logistic Regression Analysis: Probability of Events (Sudden Death or Documented Ventricular Fibrillation) During Follow-Up

	Noninducible, % (CI)	Inducible, % (CI)
Spontaneously abnormal ECG		
Syncope	4.1 (1.4–11.7)	27.2 (17.3–40.0)
No syncope	1.8 (0.6–5.1)	14.0 (8.1–23.0)
ECG abnormal only after antiarrhythmic drug challenge		
Syncope	1.2 (0.2–6.6)	9.7 (2.3–33.1)
No syncope	0.5 (0.1–2.7)	4.5 (1.0–17.1)

Brugada Circulation 2003

Fragmented QRS on a 12-lead ECG: A predictor of mortality and cardiac events in patients with coronary artery disease

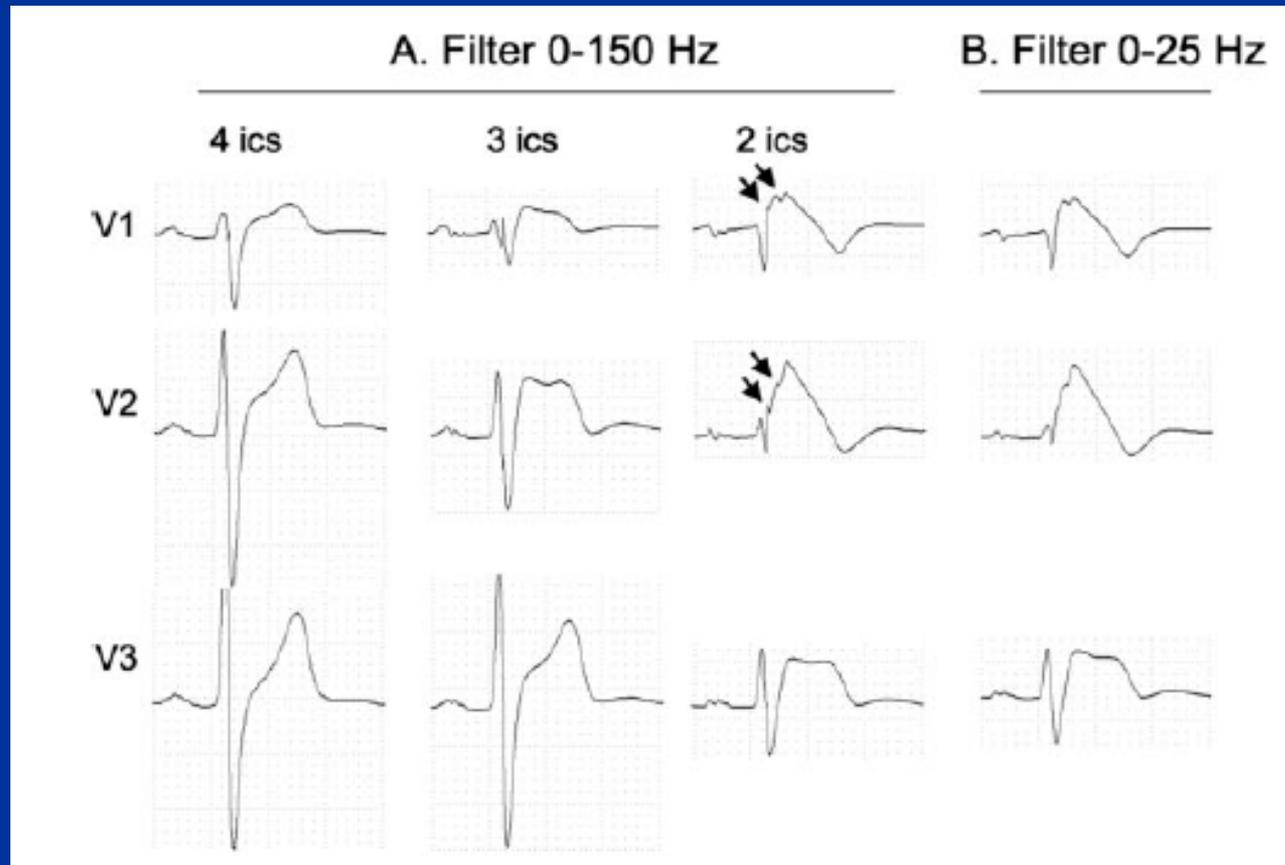
Mithilesh Kumar Das, MD, MRCP, FACC,* Chandan Saha, PhD,[†] Hicham El Masry, MD,*
Jonathan Peng, BS,* Gopi Dandamudi, MD,* Jo Mahenthiran, MD, MRCP, FACC,* Paul McHenry, MD,*
Douglas P. Zipes, MD, FACC*



Different morphologies of fQRS

The fQRS included various RSR' patterns with or without the Q wave *and was defined by the presence of an additional R wave (R' prime), or notching in nadir of the S wave, notching of R wave, or the presence of more than one R prime (fragmentation) in two contiguous leads corresponding to a major coronary artery territory.*

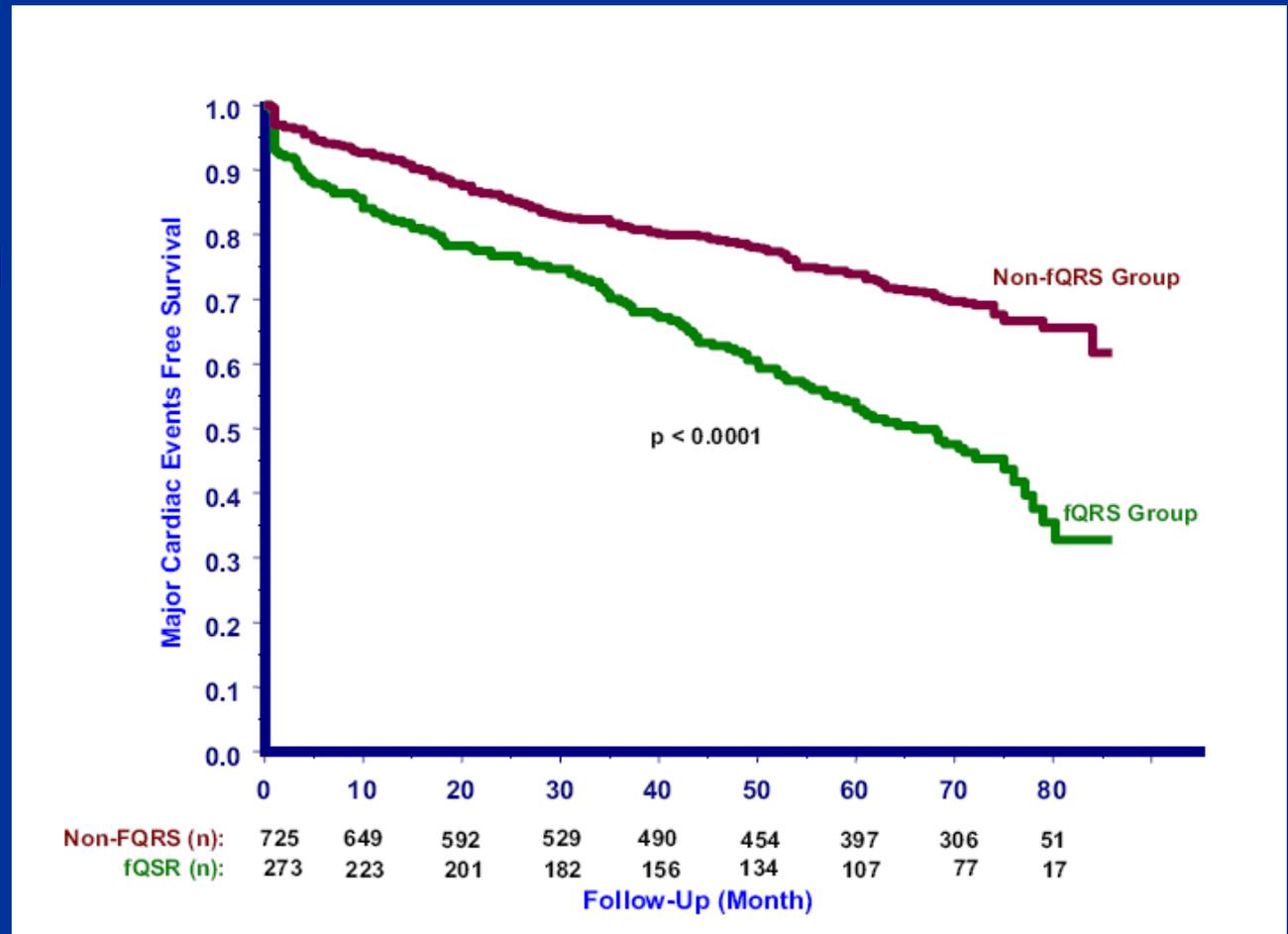
Effects of recording site and filtering on f-QRS.



Fragmented QRS on a 12-lead ECG: A predictor of mortality and cardiac events in patients with coronary artery disease

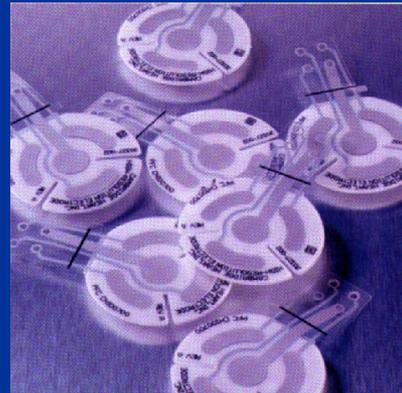
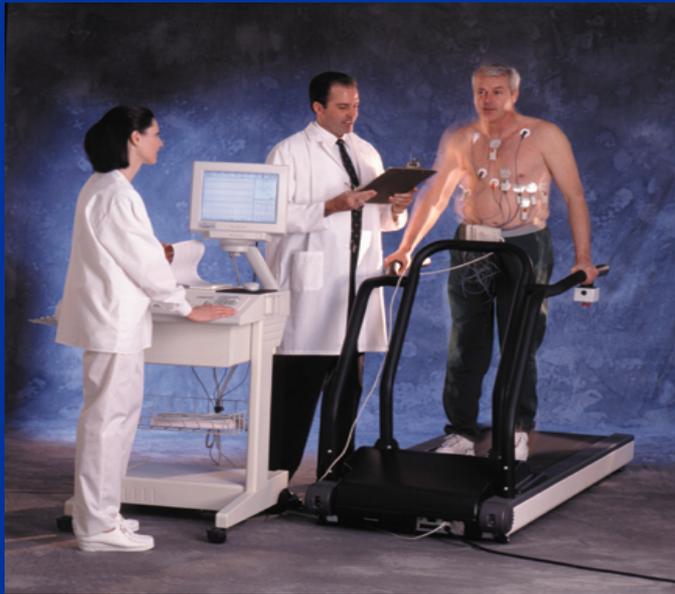
Kaplan-Meier analysis showing major cardiac events in patients with fragmented QRS (fQRS group) and without fragmented QRS (non-fQRS group).

Average follow up was 57 ± 23 months



Measurement of TWA with CH-2000

- 21 elettrodi, 14 standard e 7 speciali.



Adaptive cancellation
reduces noise due to
patient movement

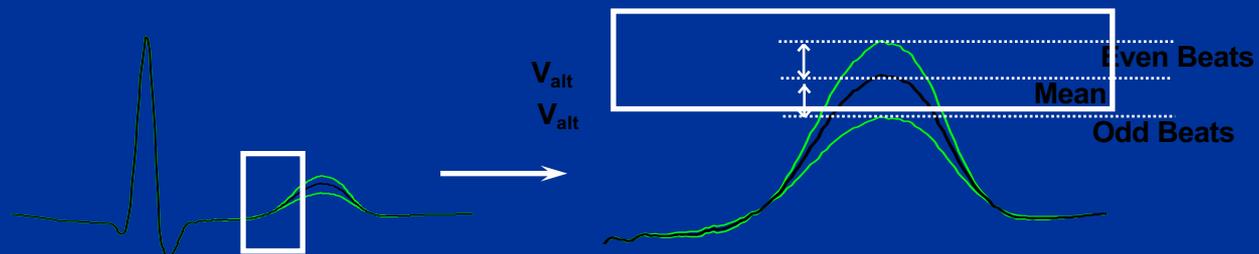
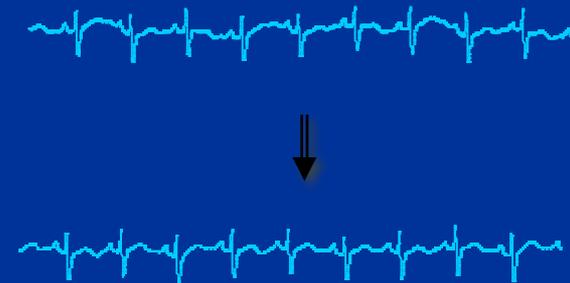


Table 2. Summary Estimates of PPV, NPV, and Univariate RR in 19 Prospective Studies of Microvolt T-Wave Alternans for the Prediction of Cardiac Arrhythmic Events

Summary Estimates	PPV (%) (95% CI)	NPV (%) (95% CI)	RR (95% CI)	Average Follow-Up (months)	No. Studies
All studies	19.3 (17.7 to 21.0)	97.2 (96.5 to 97.9)	3.77 (2.39 to 5.94)	21	19
Subgroups					
CHF	25.5 (22.7 to 28.3)	93.8 (92.3 to 95.4)	2.51 (1.71 to 3.65)	18	12
Ischemic CHF	29.7 (23.5 to 35.8)	91.6 (87.8 to 95.3)	2.42 (1.30 to 4.50)	19	2
Non-ischemic CHF	21.3 (17.8 to 24.7)	95.2 (93.5 to 97.0)	3.67 (1.50 to 8.96)	20	7
Post-MI	6.0 (4.5 to 7.4)	99.4 (98.9 to 99.9)	4.74 (1.11 to 20.19)	18	3

CHF = congestive heart failure; CI = confidence interval; MI = myocardial infarction; other abbreviations as in Table 2.

Elevato Valore Predittivo Negativo (97% al follow-up di 21 mesi)

Basso Valore Predittivo Positivo (19% al follow-up di 21 mesi)

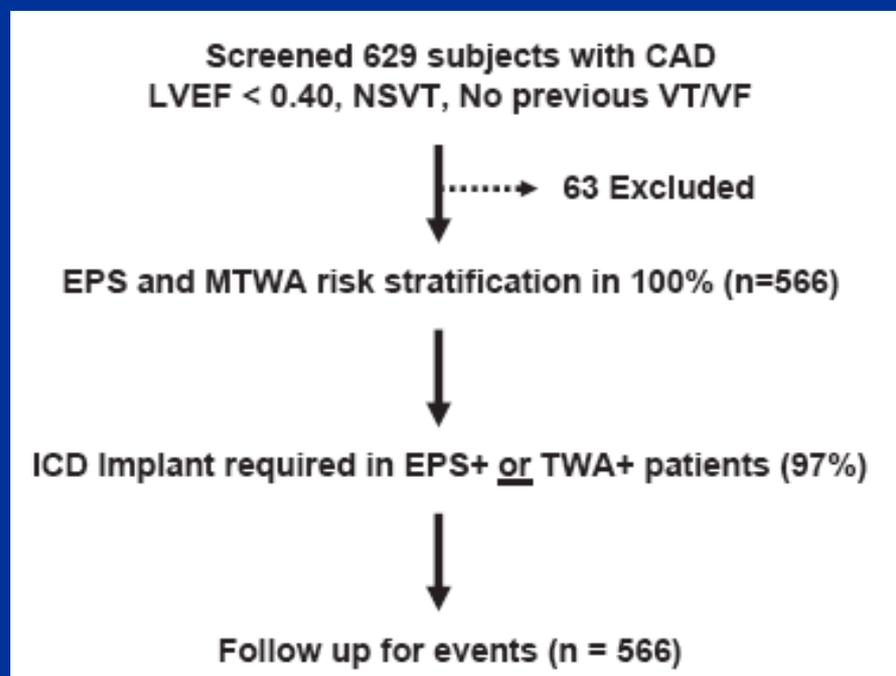
The ABCD (Alternans Before Cardioverter Defibrillator) Trial

(J Am Coll Cardiol 2009;53:471–9)

Strategies Using T-Wave Alternans to Improve Efficiency of Sudden Cardiac Death Prevention

Otto Costantini, MD,* Stefan H. Hohnloser, MD,† Malcolm M. Kirk, MD,‡ Bruce B. Lerman, MD,§ James H. Baker II, MD,|| Barathi Sethuraman, PhD,¶|| Mary M. Dettmer, RN,* David S. Rosenbaum, MD,* for the ABCD Trial Investigators

Cleveland, Ohio; Frankfurt, Germany; Providence, Rhode Island; New York, New York; Nashville, Tennessee; and Sunnyvale, California



Infarct Morphology Identifies Patients With Substrate for Sustained Ventricular Tachycardia

David Bello, MD, David S. Fieno, PHD, Raymond J. Kim, MD, F. Scott Pereles, MD, Rod Passman, MD, FACC, Gina Song, BA, Alan H. Kadish, MD, FACC, Jeffrey J. Goldberger, MD, FACC

Chicago, Illinois

- 48 pazienti con CAD ed indicazione a SEF
- ceMRI entro 32 ± 6 giorni dal SEF
- “infarct surface area” e “infarct mass” hanno identificato, meglio della FE, i pazienti con substrato aritmico (TV monomorfa)

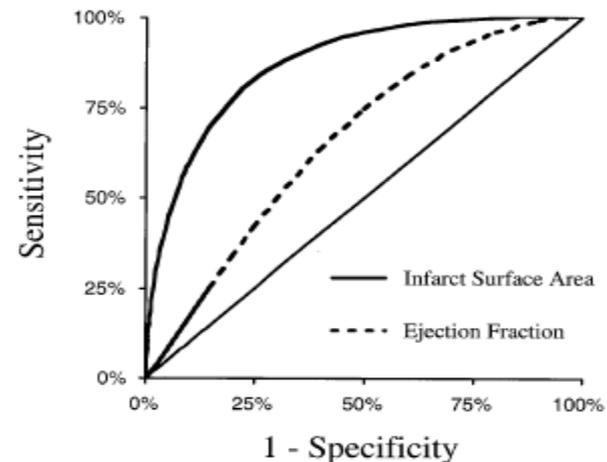


Figure 2. The receiver-operating characteristic curves for infarct surface area and ejection fraction as predictors of inducibility of monomorphic ventricular tachycardia.

Cardiovascular Magnetic Resonance, Fibrosis, and Prognosis in Dilated Cardiomyopathy

Ravi G. Assomull, MRCP,*† Sanjay K. Prasad, MD, MRCP,*† Jonathan Lyne, MRCP,*
Gillian Smith, MSc,* Elizabeth D. Burman, MSc,* Mohammed Khan, MSc, MPH,‡
Mary N. Sheppard, MD, FRCPATH,§ Philip A. Poole-Wilson, MD, FRCP,†
Dudley J. Pennell, MD, FRCP, FESC, FACC*†

101 DCM pts with the presence or absence of midwall fibrosis followed up prospectively for 658 ± 355 days for events

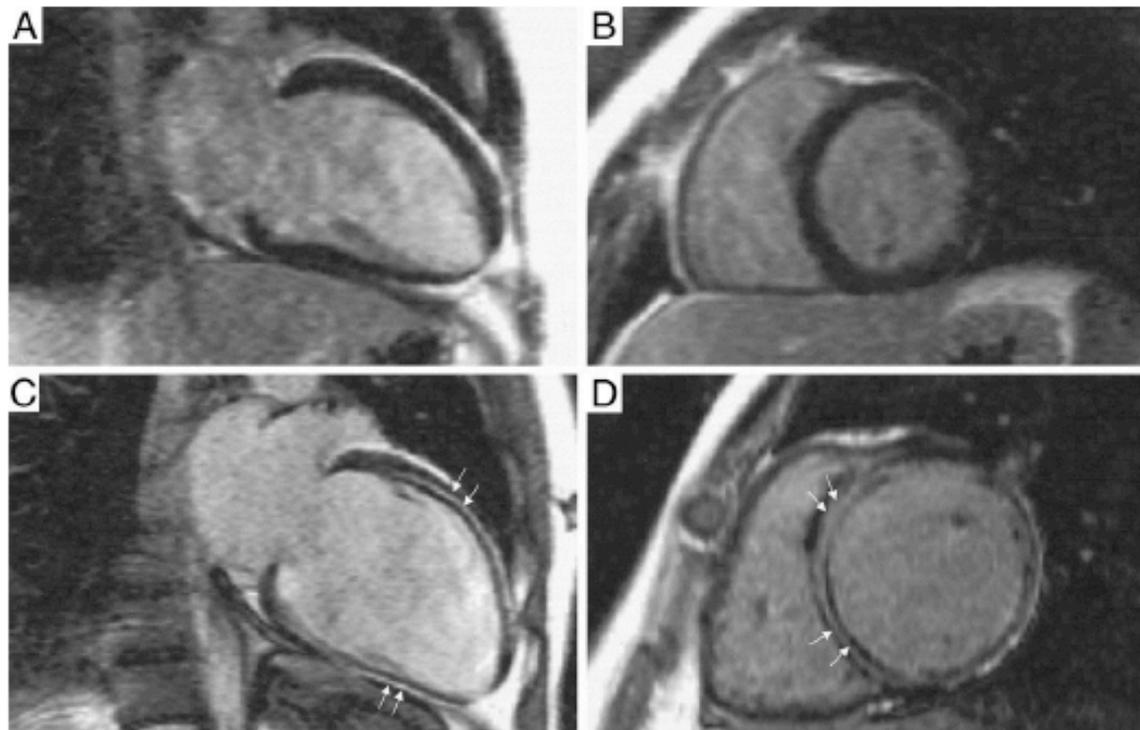
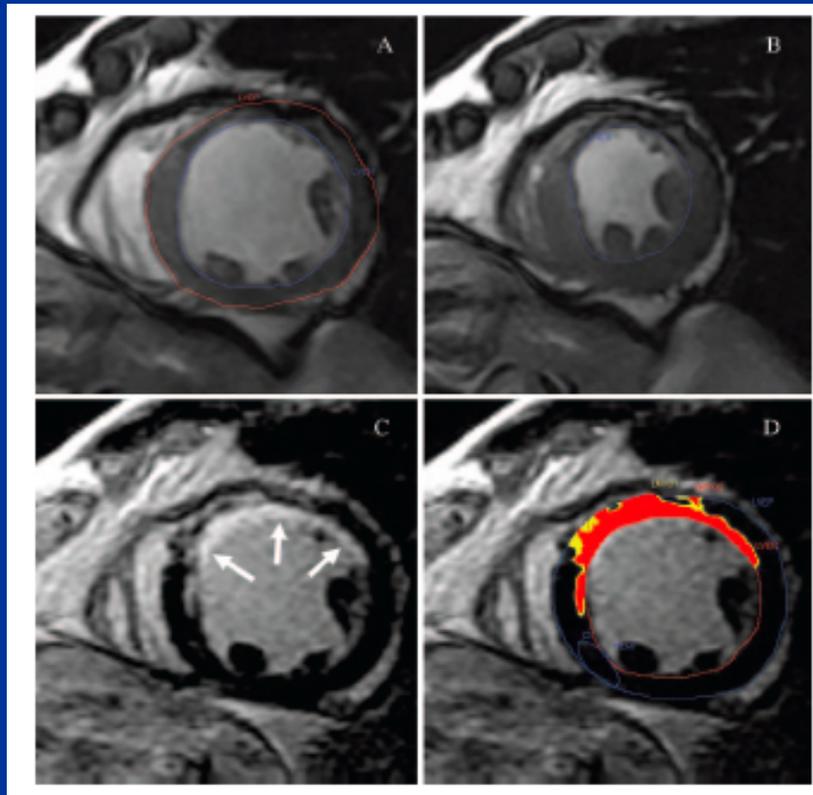


Figure 1. Late gadolinium enhancement patterns in dilated cardiomyopathy in vertical long axis (A and C) and short axis (B and D). A patient without late enhancement is shown in A and B, and a patient with marked midwall enhancement is shown in C and D. The enhancement pattern (arrows) is distinct from that associated with coronary artery disease because of endocardial sparing and noncoronary territory distribution.

Characterization of the Peri-Infarct Zone by Contrast-Enhanced Cardiac Magnetic Resonance Imaging Is a Powerful Predictor of Post-Myocardial Infarction Mortality

Andrew T. Yan, MD; Adolphe J. Shayne, MD; Kenneth A. Brown, MD; Sandeep N. Gupta, PhD; Carmen W. Chan, MBBS; Tuan M. Luu, BSc; Marcelo F. Di Carli, MD; H. Glenn Reynolds, MSc; William G. Stevenson, MD; Raymond Y. Kwong, MD, MPH



CONCLUSIONI

Lo studio della fibrosi ventricolare con cardio-RMN LGE è probabilmente il più importante progresso degli ultimi anni nella valutazione del rischio di MI.

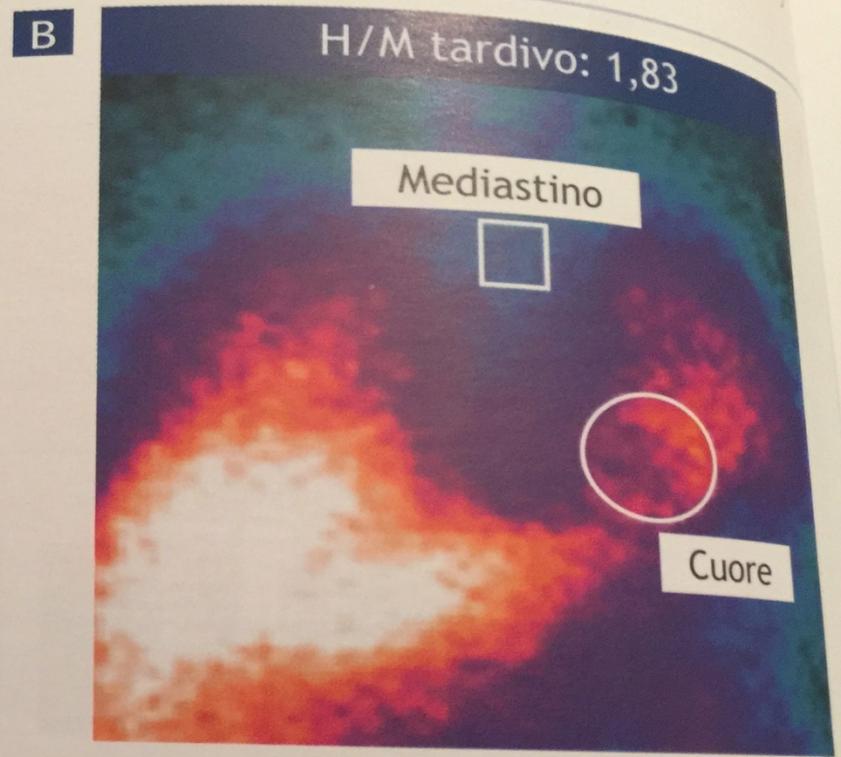
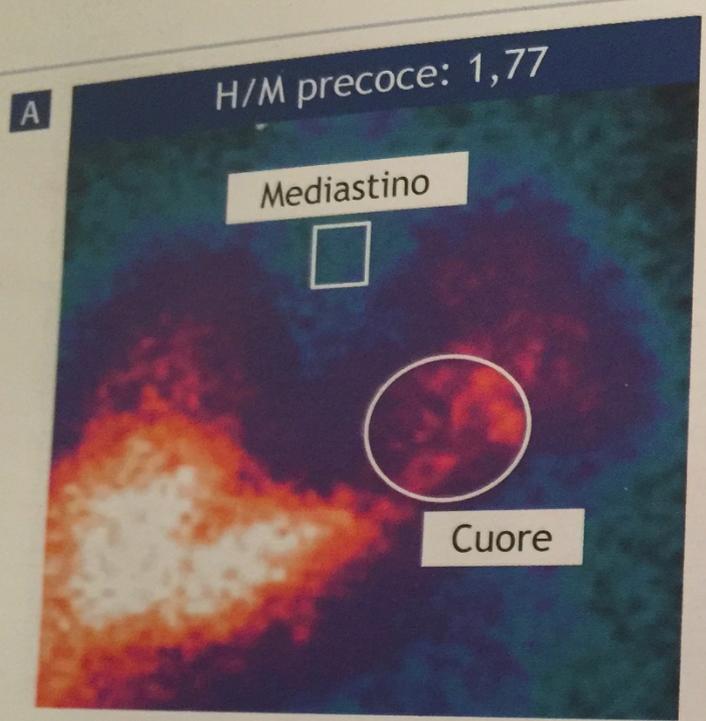
Nei pz con EF severamente depressa, l'assenza di fibrosi ventricolare nella CMPD ischemica o la scarsa estensione della fibrosi, in particolare nella zona periinfartuale, identificano un sottogruppo di pz con rischio di MI relativamente basso nei quali l'impianto di ICD in prevenzione primaria potrebbe essere attentamente riconsiderata.

CONCLUSIONI

Nei pz con EF solo moderatamente depressa , la presenza di fibrosi, in particolare in cuori di pz diabetici senza chiari segni di necrosi infartuale, identificano un sottogruppo di pz a rischio relativamente alto di MI nei quali l' indicazione all' impianto di ICD in prevenzione primaria potrebbe essere presa in considerazione.

all'impianto di ICD que
di morte aritmica improvvisa.

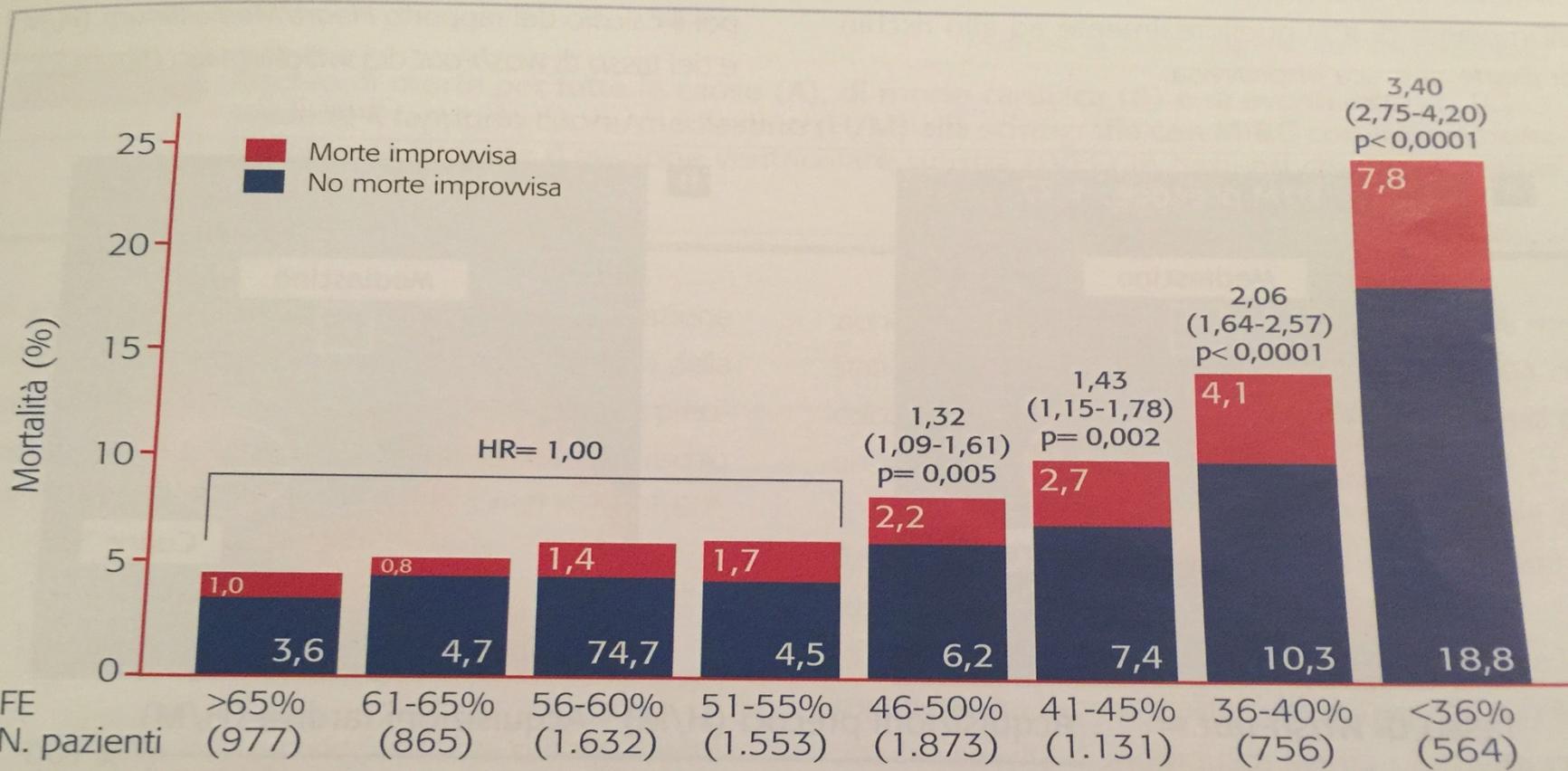
farmaco (figura 2)



Tasso di wash-out =
$$\frac{\text{Acquisizioni precoci (H/M)} - \text{Acquisizioni tardive (H/M)}}{\text{Acquisizioni precoci (H/M)}} \times 100$$

FIGURA 2

Calcolo del rapporto cuore/mediastino (H/M) durante acquisizione precoce (A) e tardiva (B) mediante scintigrafia con MIBG.



FE= frazione d'eiezione; HR= hazard ratio

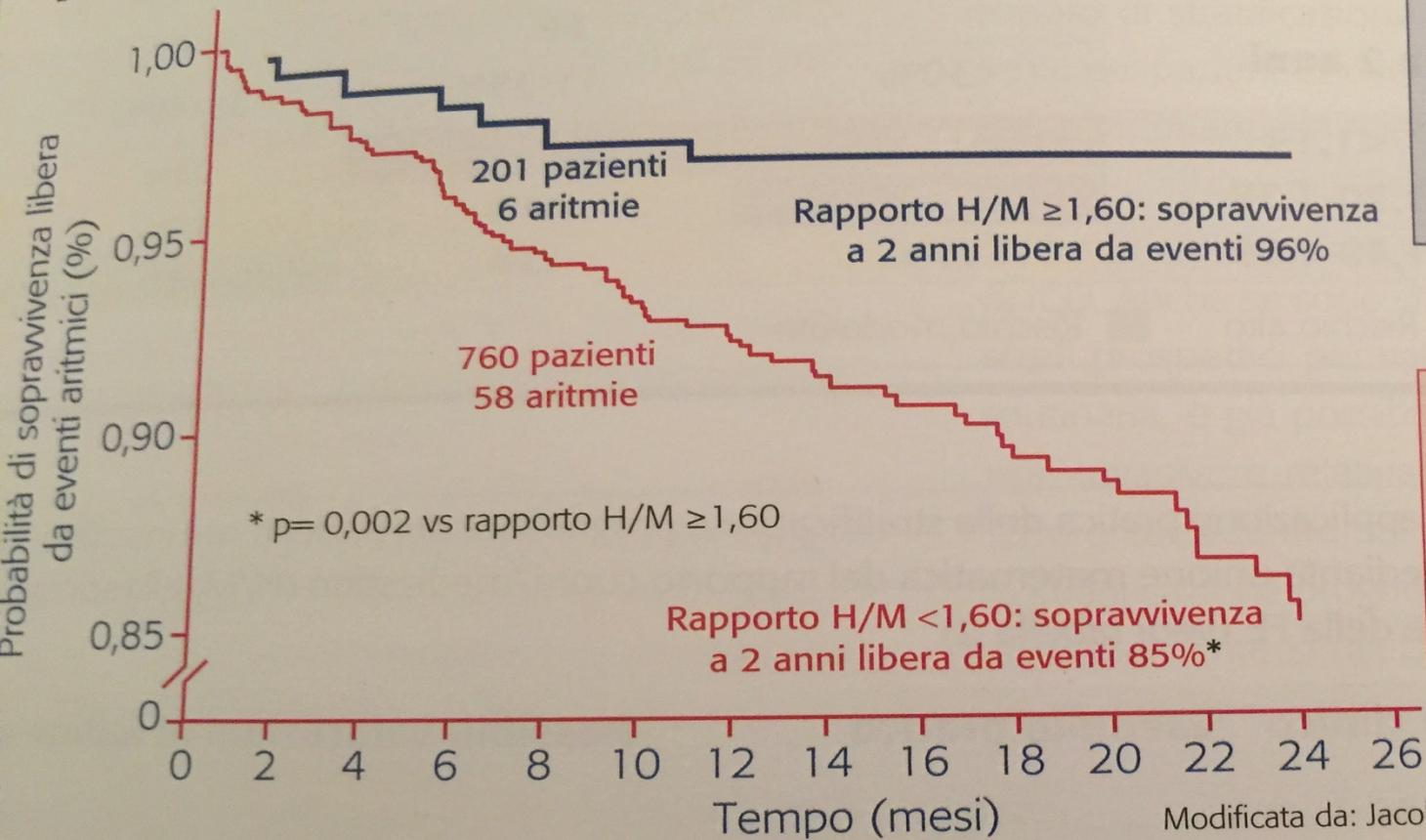
Modificata da: Macchia A et al, *Eur J Heart Fail* 2005

FIGURA 1

Relazione tra rischio di morte per tutte le cause e di morte improvvisa al variare della frazione d'eiezione del ventricolo sinistro in pazienti con insufficienza cardiaca.

Rapporto H/M: stime di Kaplan-Meier della probabilità di sopravvivenza libera da eventi aritmici

L'analisi secondaria ha mostrato che 64 pazienti hanno subito un evento aritmico



Il valore predittivo negativo per la probabile aritmia è 96%, il valore predittivo negativo per l'aritmia certa è 96%

La sopravvivenza a 2 anni libera da eventi aritmici è superiore nei pazienti con rapporto H/M $\geq 1,60$ rispetto a quelli con rapporto H/M $< 1,60$

Modificata da: Jacobson AF et al, *J Am Coll Cardiol* 2011

FIGURA 5

Valore predittivo negativo per aritmia del rapporto cuore/mediastino (H/M) alla scintigrafia con MIBG con acquisizione tardiva in pazienti con insufficienza cardiaca.

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TABELLA 2

Ruolo prognostico del rapporto cuore/mediastino (H/M) alla scintigrafia con MIBG e della FE nei pazienti con insufficienza cardiaca

Rischio di morte a 2 anni		FE		
		<30%	31-35%	36-40%
Rapporto H/M	<1,19	34%	30%	25%
	1,20-1,39	28%	25%	20%
	1,40-1,59	26%	23%	18%

■ Rischio molto alto ■ Rischio alto ■ Rischio moderato

TABELLA 3

Schema di applicazione pratica della stratificazione prognostica dei pazienti con insufficienza cardiaca mediante unione matematica del rapporto cuore/mediastino (H/M) alla scintigrafia con MIBG e della FE (vedi tabella 2)

Rischio di morte a 2 anni	Approccio clinico	Esempio pratico	Possibili valutazioni al follow-up
≥28%	Immediato	Impianto di defibrillatore in caso di LVEF ≤35% anche	Si suggerisce di considerare la ripetizione della scintigrafia con MIBG (AdreView) a

Thank you



Photograph by Robert Clark

Hearts
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