Congresso Nazionale IRC

2019

11 · 12 OTTOBRE

Centro Congressi **Veronafiere**

# La morte cardiaca aritmica e la morte coronarica

**Niccolò GRIECO**
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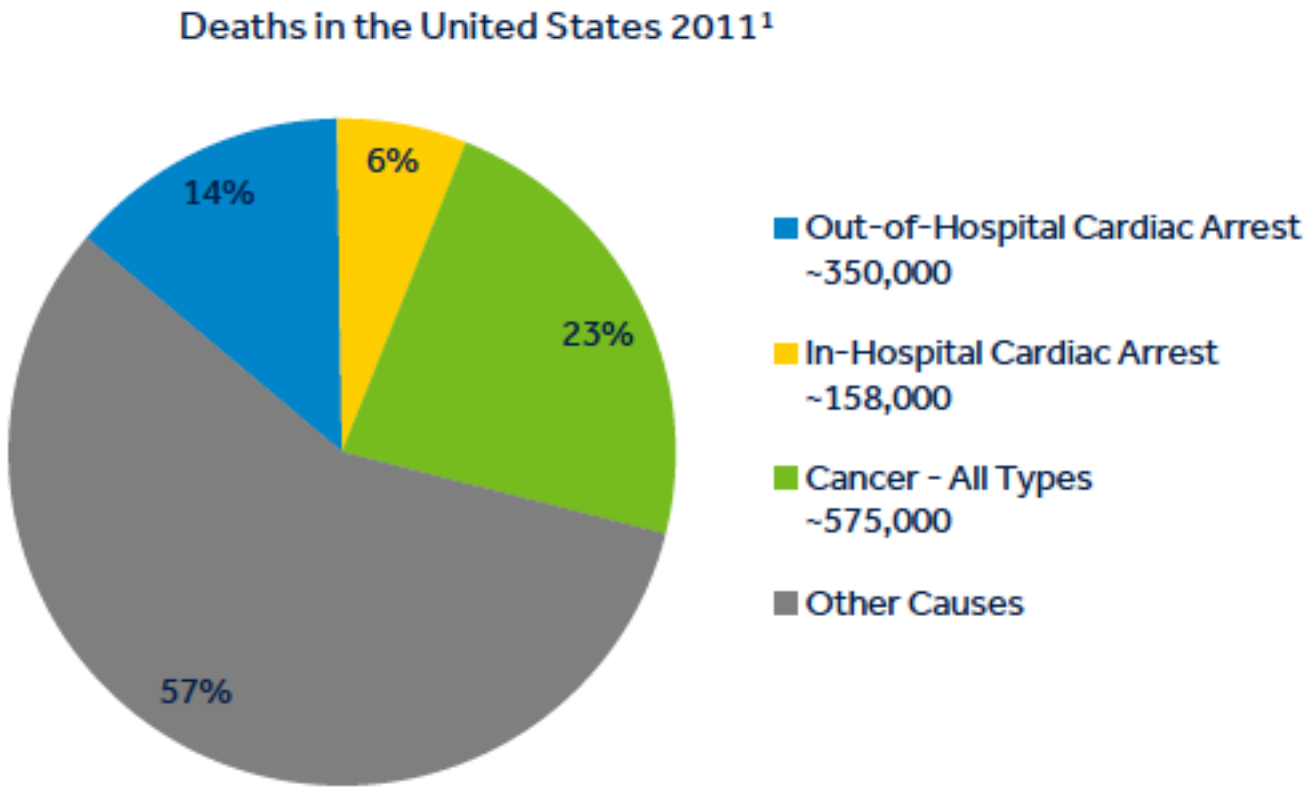
IRC | Italian Resuscitation Council

# SCA IS RESPONSIBLE FOR 1 OUT OF 5 DEATHS IN THE US[1]




1. CDC Death Statistics 2011: 2011 http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_06.pdf
2. AHA Statistical Update, Go et al, Circulation 2013;129:e28–e292

## *Sabato 11 Ottobre 2014*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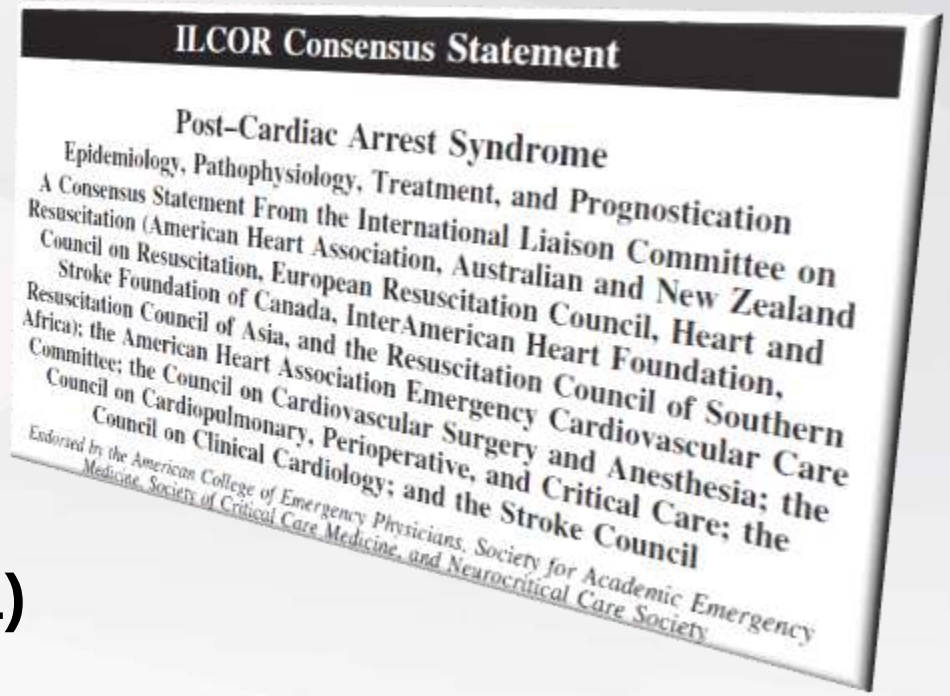
*Niguarda Hospital*
*Intensive Cardiac Care Unit & Prehospital Emergency Care*
*IRC Board Member- ANMCO Fellow*
*Milan, Italy*

# LA RCP E' UN PUNTO D'INCONTRO DI DIVERSE PROFESSIONALITA': IL LAVORO DI EQUIPE

**Chi sottoporre a coronarografia d'urgenza?**
**Coronarografia durante e/o dopo RCP**

IRC Italian Resuscitation Council


ILCOR Consensus Statement

Post–Cardiac Arrest Syndrome

Epidemiology, Pathophysiology, Treatment, and Prognostication

A Consensus Statement From the International Liaison Committee on Resuscitation (American Heart Association, Australian and New Zealand Council on Resuscitation, European Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Asia, and the Resuscitation Council of Southern Africa); the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiovascular Surgery and Anesthesia; the Council on Cardiopulmonary, Perioperative, and Critical Care; the Council on Clinical Cardiology; and the Stroke Council

Endorsed by the American College of Emergency Physicians, Society for Academic Emergency Medicine, Society of Critical Care Medicine, and Neurocritical Care Society


# Post Cardiac Arrest Myocardial Dysfunction: (1)

## Management of ACS

***CAD is present in the majority of out-of-hospital cardiac arrest patients, and acute myocardial infarction is the most common cause of sudden cardiac death. One autopsy study reported coronary artery thrombi in 74 of 100 subjects who died of ischemic heart disease within 6 hours of symptom onset and plaque fissuring in 21 of 26 subjects in the absence of thrombus***. A more recent review reported acute changes in coronary plaque morphology in 40% to 86% of cardiac arrest survivors and in 15% to 64% of autopsy studies. The feasibility and success of early coronary angiography and subsequent percutaneous coronary intervention (PCI) after out-of-hospital cardiac arrest are well described […]

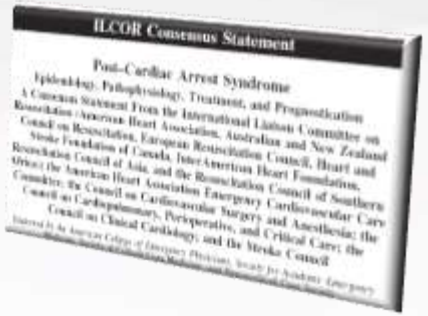
In several of these studies, PCI was combined with therapeutic hypothermia

*In this study, 21 (78%) of 27 hypothermia-treated 6-month survivors had a good neurological outcome (CPC of 1 or 2) compared with only 6 (50%) of 12 non–hypothermiatreated 6-month survivors.*

***Circ. 23 Oct 2008***


# Post Cardiac Arrest Myocardial Dysfunction: (2)

Studies with broader inclusion criteria (not limited to ST-elevation myocardial infarction) have also shown promising results. In 1 such study […] revealed CAD in 97%; of these, 80% had total occlusion of a major coronary artery. Nearly half of these patients underwent reperfusion interventions, with the majority by PCI and a minority by coronary artery bypass graft. Among patients admitted after ROSC, the overall in-hospital mortality rate decreased from 72% before the introduction of a comprehensive post– cardiac arrest care plan (which included this intensive coronary reperfusion strategy and therapeutic hypothermia) to 44% (*P0.001), and 90% of survivors were* neurologically normal. […]


ILCOR Consensus Statement

Post–Cardiac Arrest Syndrome

In summary, patients resuscitated from cardiac arrest who have electrocardiographic criteria for STEMI should undergo immediate coronary angiography, with subsequent PCI if indicated. Furthermore, given the high incidence of ACS in patients with out-of-hospital cardiac arrest and limitations of electrocardiography-based diagnosis, it is appropriate to consider immediate coronary angiography in all post– cardiac arrest patients in whom ACS is suspected.
Standard guidelines for management of ACS and CAD should be followed.

# Coorte STEMI: conclusioni


**Tabella 1.** Studi sulla coronarografia nell'arresto cardiaco condotti su pazienti con sopraslivellamento del tratto ST all'ECG dopo ripristino di circolazione spontanea.

| | Tipo di studio | N. pazienti | TV/FV | CGF | PTCA | PTCA efficace[a] (TIMI 2-3) | Sopravvivenza |
|---|---|---|---|---|---|---|---|
| Bendz et al.[20], 2004 | R | 40 | 36/40 (90%) | 40/40 (100%) | 40/40 (100%) | 38/40 (95%) | 29/40 (73%)[b]<br>29/40 (73%)[c] |
| Garot et al.[21], 2007 | R | 186 | 186/186 (100%) | 186/186 (100%) | 186/186 (100%) | 161/186 (87%) | 103/186 (55%)[b]<br>100/186 (54%)[c] |
| Gorjup et al.[22], 2007 * | R | 135 | 112/135 (83%) | 117/135 (87%) | 109/135 (81%) | 102/135 (76%) | 93/135 (69%)[b]<br>67/135 (50%)[c] |
| Hosmane et al.[23], 2009** | R | 98 | NN | 98/98 (100%) | 64/98 (65%) | 62/98 (63%) | 63/98 (64%)[b]<br>60/98 (61%)[c] |
| Lettieri et al.[24], 2009 | R | 99 | 90/99 (91%) | 99/99 (100%) | 99/99 (100%) | 80/99 (80%) | 77/99 (78%)[b]<br>74/99 (75%)[c] |

CGF, coronarografia; NN, non noto; PTCA, angioplastica coronarica percutanea; R, retrospettivo; TV/FV, tachicardia/fibrillazione ventricolare.
[a] la definizione di PTCA efficace varia tra i diversi lavori; [b] sopravvivenza alla dimissione; [c] sopravvivenza a 6 mesi.

✓ Tutti gli STEMI hanno indicazione a coro/PTCA in emergenza

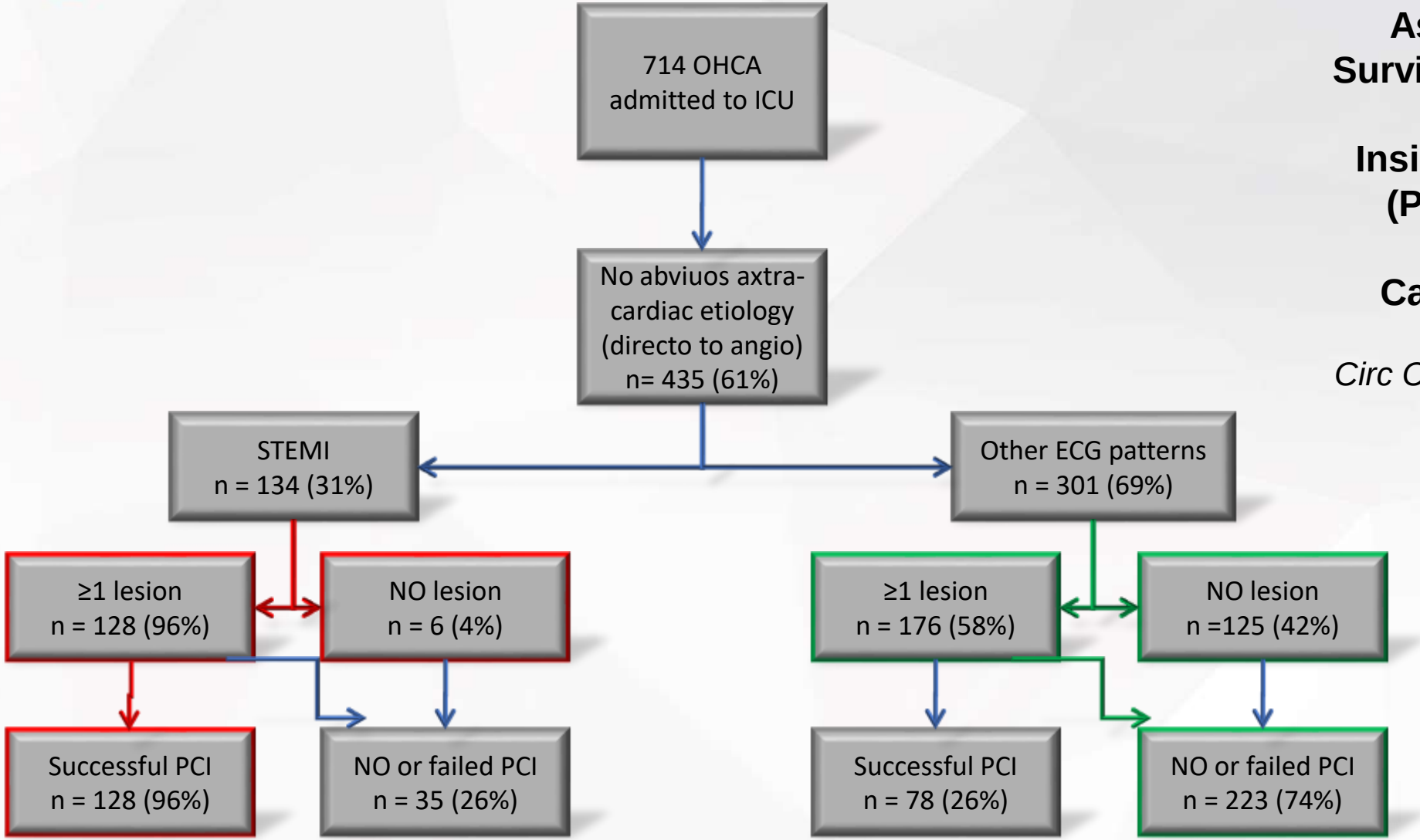
✓ quelli che recuperano precocemente lo stato neurologico hanno sopravvivenza uguale alla popolazione senza ACC *

✓Il vantaggio in termini di mortalità si mantiene anche nei pazienti in stato comatoso, sia immediato che a 6 mesi. **

# Immediate Percutaneous Coronary Intervention Is Associated With Better Survival After Out-of-Hospital Cardiac Arrest Insights From the PROCAT (Parisian Region Out of Hospital Cardiac Arrest) Registry

*Florence Dumas, et al*

*Circ Cardiovasc Interv. 2010;3:200-207.*





Italian Resuscitation Council

# Popolazione e pattern ECG


**Table 1. Characteristics of Patients With OHCA According to ECG Patterns**

| | Overall (n=435) | ST-Segment Elevation (n=134) | Other ECG Pattern (n=301) | P* |
|---|---|---|---|---|
| Male sex | 359 (83) | 113 (84) | 246 (81) | 0.55 |
| Age, y† | | | | 0.92 |
| ≤59 | 216 (50) | 67 (50) | 149 (50) | |
| >59 | 219 (50) | 67 (50) | 152 (50) | |
| Risk factors | | | | |
| Hypertension | 168 (42) | 48 (38) | 120 (43) | 0.52 |
| Diabetes mellitus | 71 (18) | 16 (14) | 55 (21) | 0.10 |
| Dyslipidemia | 118 (31) | 38 (33) | 80 (29) | 0.55 |
| Smoking | 179 (53) | 60 (58) | 119 (51) | 0.21 |
| Location of cardiac arrest | | | | 0.87 |
| Outside | 166 (38) | 52 (39) | 114 (38) | |
| Home | 170 (39) | 50 (37) | 120 (40) | |
| Other | 99 (23) | 32 (24) | 67 (22) | |
| Time from collapse to BLS, min† | | | | 0.008 |
| <5 | 204 (49) | 76 (59) | 128 (45) | |
| ≥5 | 210 (51) | 53 (41) | 157 (55) | |
| Time from BLS to ROSC, min† | | | | 0.06 |
| ≤15 | 223 (53) | 78 (60) | 145 (49) | |
| >15 | 201 (47) | 53 (40) | 148 (51) | |
| Initial arrest rhythm | | | | 0.28 |
| VT/VF | 294 (68) | 96 (72) | 198 (66) | |
| PEA/asystole | 138 (32) | 38 (28) | 100 (34) | |
| Lactate blood, mmol/L‡ | | | | 0.80 |
| ≤2 | 101 (23) | 33 (25) | 68 (23) | |
| 2 to 4.9 | 104 (24) | 28 (21) | 76 (25) | |
| 4.9 to 7 | 96 (22) | 30 (22) | 66 (22) | |
| >7 | 134 (31) | 43 (32) | 91 (30) | |
| Troponine, μg/L‡ | | | | <0.001 |
| <2.3 | 159 (41) | 27 (23) | 132 (49) | |
| 2.3 to 11.8 | 105 (27) | 31 (26) | 74 (27) | |
| >11.8 | 124 (32) | 60 (51) | 64 (24) | |
| Therapeutic hypothermia | 370 (86) | 108 (82) | 262 (88) | 0.09 |

Data are presented as n (%), taking into account missing data. VT indicates ventricular tachycardia; VF, ventricular fibrillation; and PEA, pulseless electrical activity.

*P values for comparison between ST-segment elevation group and other ECG patterns group obtained from a $\chi^2$ test.

†Age, time from collapse to BLS, and time from BLS to ROSC were classified according to their respective medians.

‡Lactate blood and troponine were classified according to interquartiles.

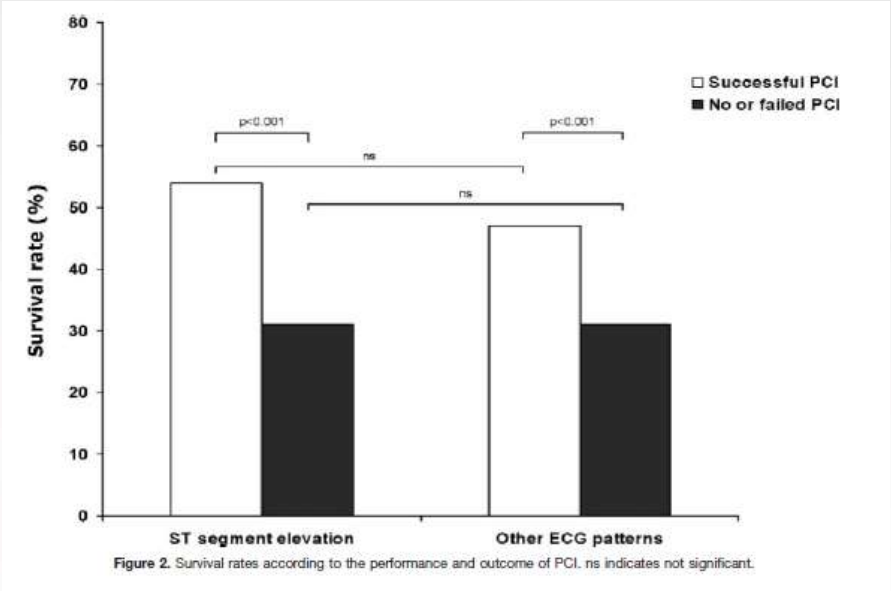



**Figure 2.** Survival rates according to the performance and outcome of PCI. ns indicates not significant.

✓ **l'ECG post ACC ha un VPP 96% ma un VPN 42% non può quindi essere utilizzato per il rule-out**

*Circ Cardiovasc Interv. 2010;3:200-207.*


Resuscitation 85 (2014) 1533–1540

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Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Clinical paper

# Cardiac catheterization is associated with superior outcomes for survivors of out of hospital cardiac arrest: Review and meta-analysis☆

Anthony C. Camuglia[a,b,c,*], Varinder K. Randhawa[d], Shahar Lavi[d], Darren L. Walters[c,e]

| Study or Subgroup | Acute angiography Events | Total | No acute Angiography Events | Total | Weight | Odds Ratio M-H, Random, 95% CI |
|---|---|---|---|---|---|---|
| Bro-Jeppesen 2012 | 126 | 198 | 79 | 162 | 13.1% | 1.84 [1.20, 2.81] |
| Grasner 2011 | 80 | 154 | 57 | 430 | 13.1% | 7.07 [4.64, 10.78] |
| Hollenbeck 2013 | 74 | 122 | 65 | 147 | 12.5% | 1.94 [1.19, 3.17] |
| Mooney 2011 | 61 | 101 | 12 | 39 | 9.8% | 3.43 [1.56, 7.55] |
| Nanjayya 2012 | 14 | 35 | 11 | 35 | 8.1% | 1.45 [0.54, 3.89] |
| Nielsen 2009 | 278 | 479 | 169 | 507 | 14.4% | 2.77 [2.14, 3.58] |
| Reynolds 2009 | 33 | 63 | 19 | 33 | 9.2% | 0.81 [0.35, 1.89] |
| Strote 2012 | 48 | 61 | 138 | 179 | 10.5% | 1.10 [0.54, 2.22] |
| Tomte 2011 | 75 | 145 | 9 | 29 | 9.2% | 2.38 [1.02, 5.58] |
| **Total (95% CI)** | | **1358** | | **1561** | **100.0%** | **2.20 [1.46, 3.32]** |
| Total events | 789 | | 559 | | | |

Heterogeneity: $Tau^2 = 0.29$; $Chi^2 = 40.71$, df = 8 ($P < 0.00001$); $I^2 = 80\%$
Test for overall effect: $Z = 3.75$ ($P = 0.0002$)

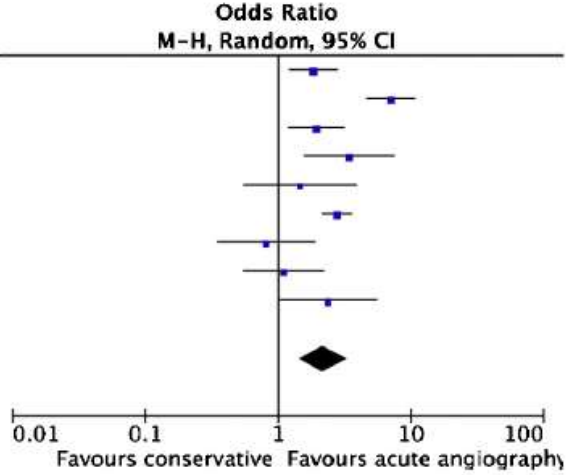
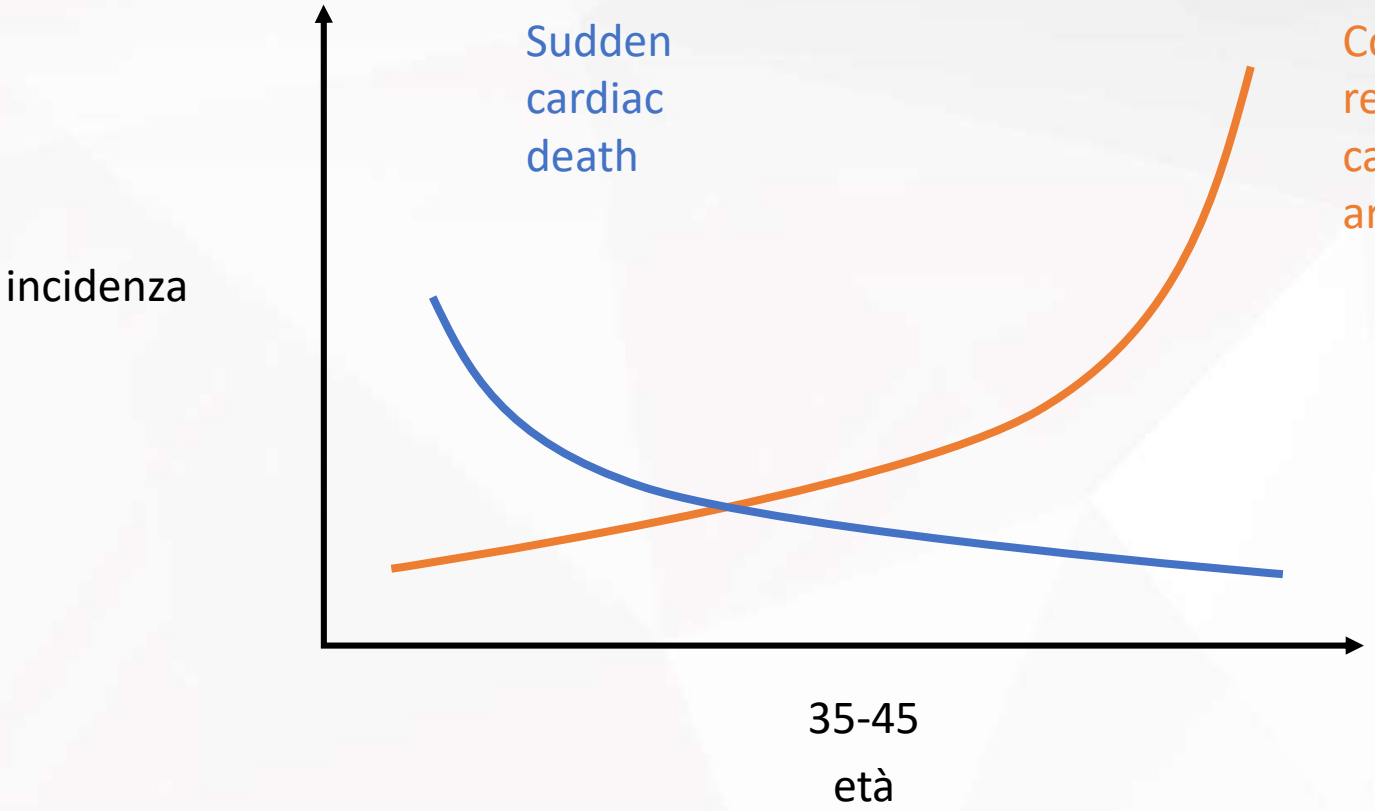



**Fig. 3.** Weighted hazard effects model of the relationship between acute coronary angiography and good neurological outcome after OHCA.


LIBERTY
IN GOD WE TRUST
1997


Sudden cardiac death
Coronary releted cardiac arrest
incidenza
35-45
età

# SCA Signs and Myocardial Infarction Symptoms

## SCA Signs

- Sudden collapse and loss of consciousness
- Cessation of normal breathing
- Loss of pulse and blood pressure

## MI Symptoms

- Uncomfortable pressure, fullness, squeezing, or pain in the center of the chest lasting more than a few minutes
- Pain spreading to the shoulders, neck, or arms
- Chest discomfort with lightheadedness, fainting, sweating, nausea, or shortness of breath
- Atypical chest pain, stomach, or abdominal pain
- Nausea or dizziness
- Shortness of breath and difficulty breathing
- Unexplained anxiety, weakness, or fatigue
- Palpitations, cold sweat, or paleness

www.americanheart.org

# SCA and Myocardial Infarction **autopsy** findings

## SCA findings

- Usually normal macroscopic and microscopic postmortem examination
- Possible scattered inflammation, fatty infiltration without fibrosis…uncertain significance finding 47-51%
- genetics or molecular autopsy is required

## MI findings

- Macroscopic signs on heart muscle, hemorragia or necrosis
- Plaque rupture in coronary arteries
- Frequent other vascular districts are involved (carotid artery, periferical artery disease, etc)
- Pulmonary edema
- Papillay muscle, mitral valve or chordae tendineae rupture
- sings of cardiomyophathies (myocarditis, amyloidosis, hypertrofic, etc

# SCA Is Not a Heart Attack!

## SCA

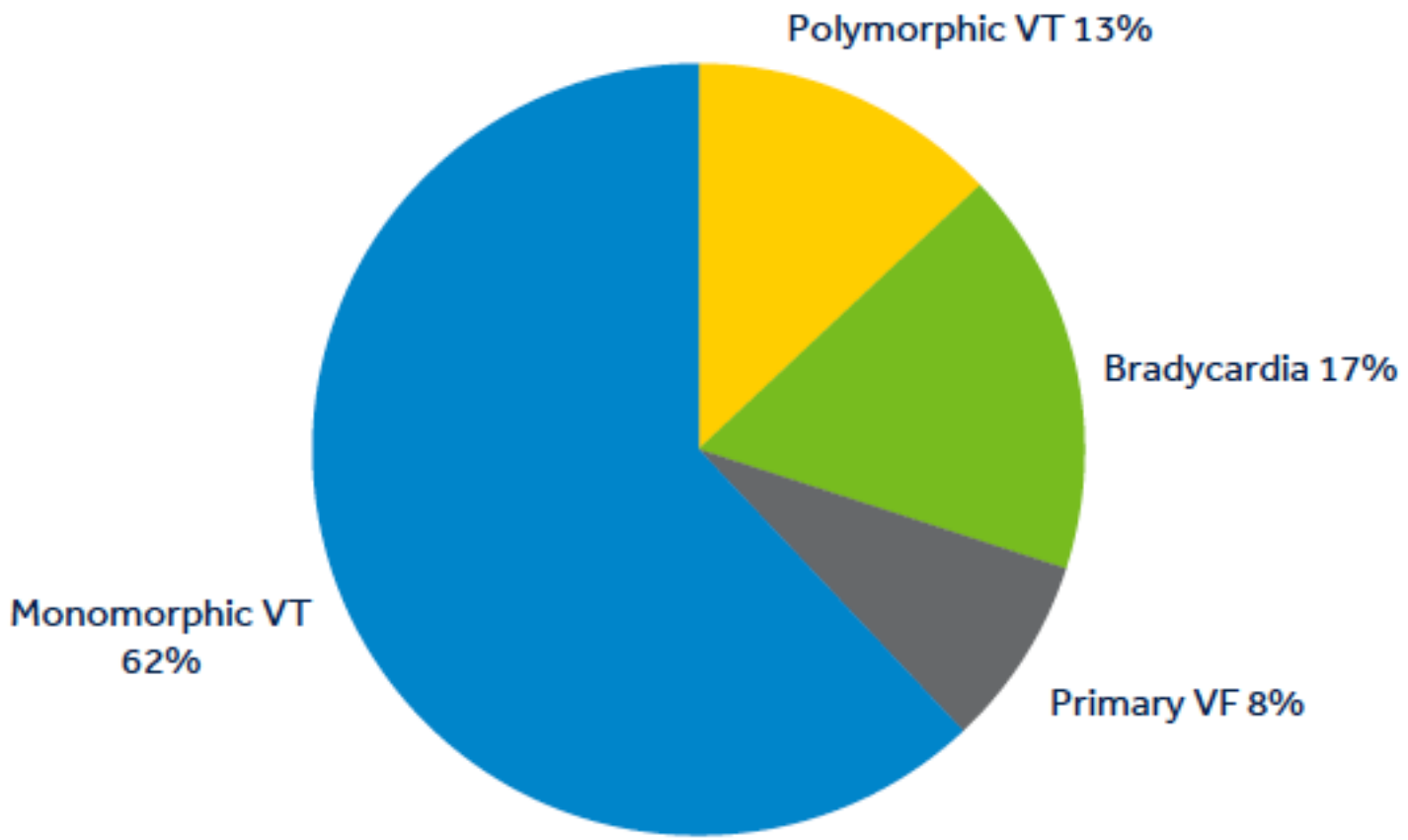
- Electrical problem in the heart
- The heart stops beating abruptly and without warning
- If heart is not electrically shocked within minutes, death occurs

## Heart Attack

- Plumbing problem in the heart
- Blockage in blood vessel prevents blood flow to heart
- Lack of blood causes damage to the heart muscle and scar tissue

**NOTE**: SCA can occur during a heart attack because the heart muscle is irritated by the sudden blockage of an artery. SCA can also be caused by previous heart damage or an inherited (genetic) heart condition.

# UNDERLYING ARRHYTHMIAS OF SCA

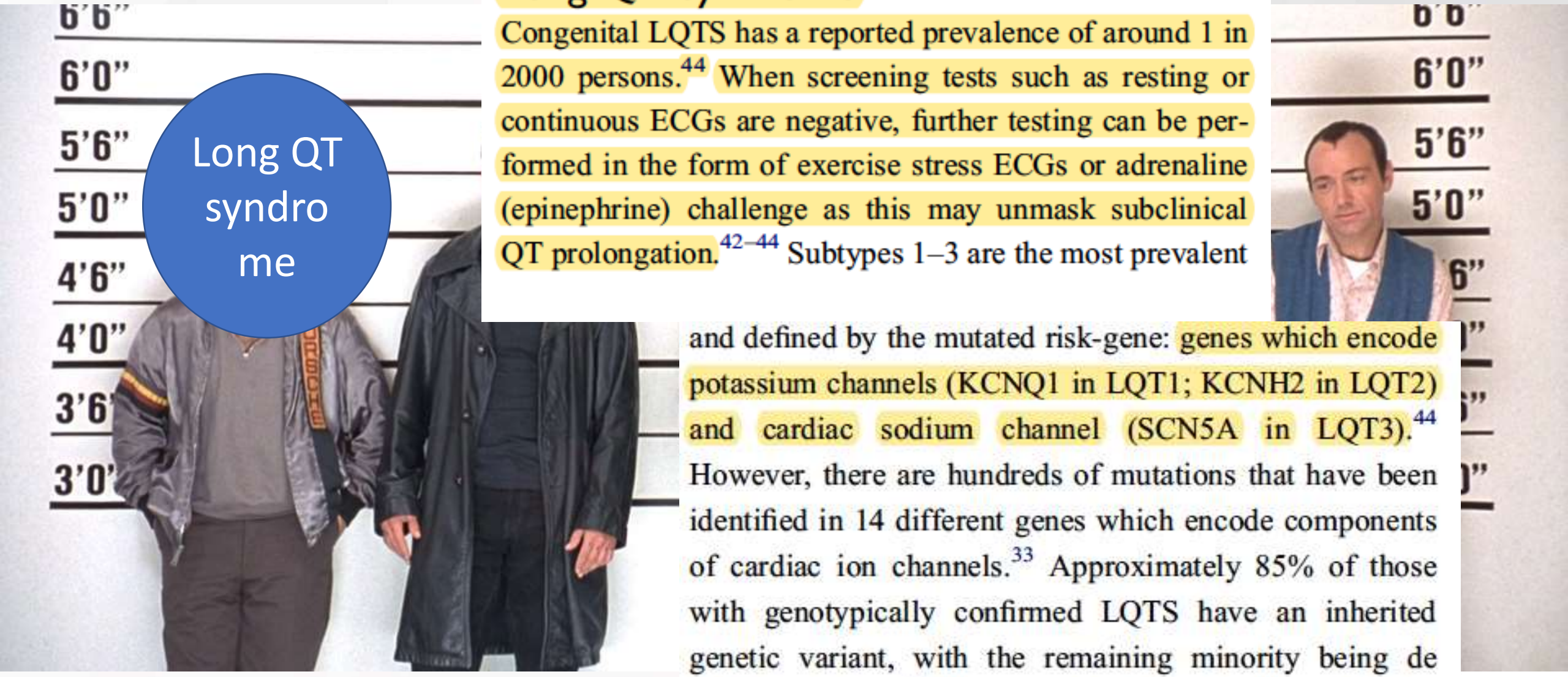


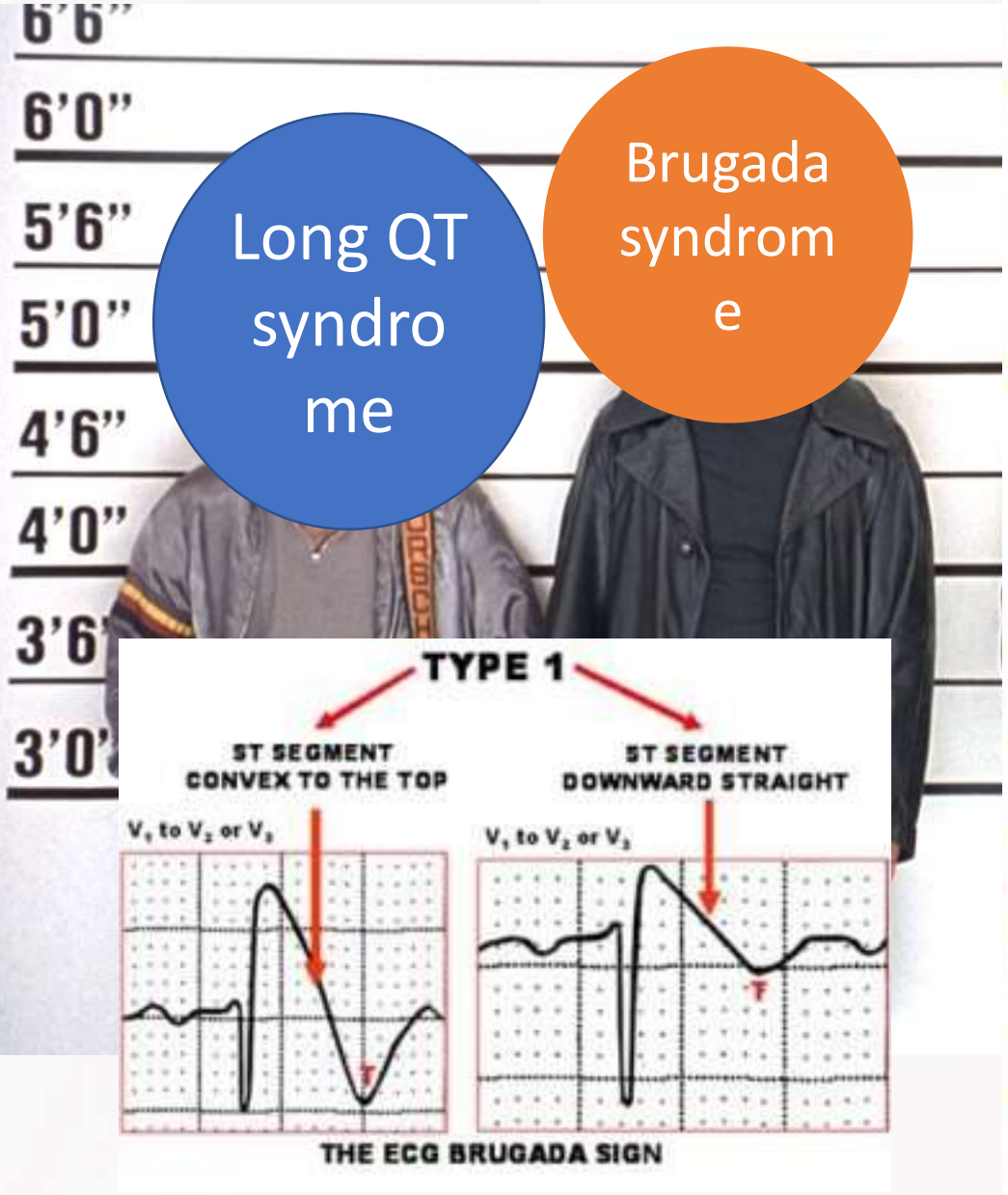

Bayés de Luna A, et al. *Am Heart J.* 1989;117:151-159.

# But who are «The usual Suspects»?

# Long QT syndrome

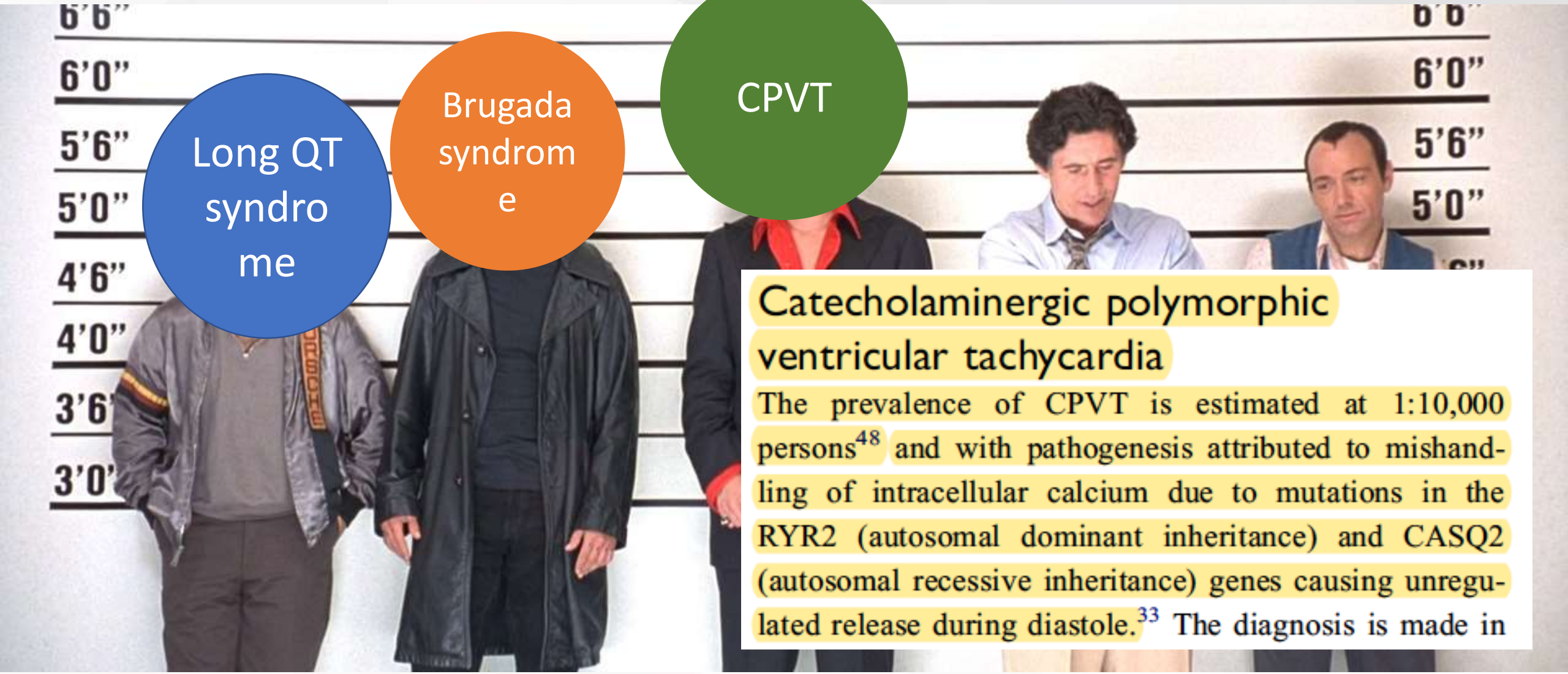
Congenital LQTS has a reported prevalence of around 1 in 2000 persons.[44] When screening tests such as resting or continuous ECGs are negative, further testing can be performed in the form of exercise stress ECGs or adrenaline (epinephrine) challenge as this may unmask subclinical QT prolongation.[42–44] Subtypes 1–3 are the most prevalent and defined by the mutated risk-gene: genes which encode potassium channels (KCNQ1 in LQT1; KCNH2 in LQT2) and cardiac sodium channel (SCN5A in LQT3).[44] However, there are hundreds of mutations that have been identified in 14 different genes which encode components of cardiac ion channels.[33] Approximately 85% of those with genotypically confirmed LQTS have an inherited genetic variant, with the remaining minority being de novo mutations.[44] The major LQTS genes have a high





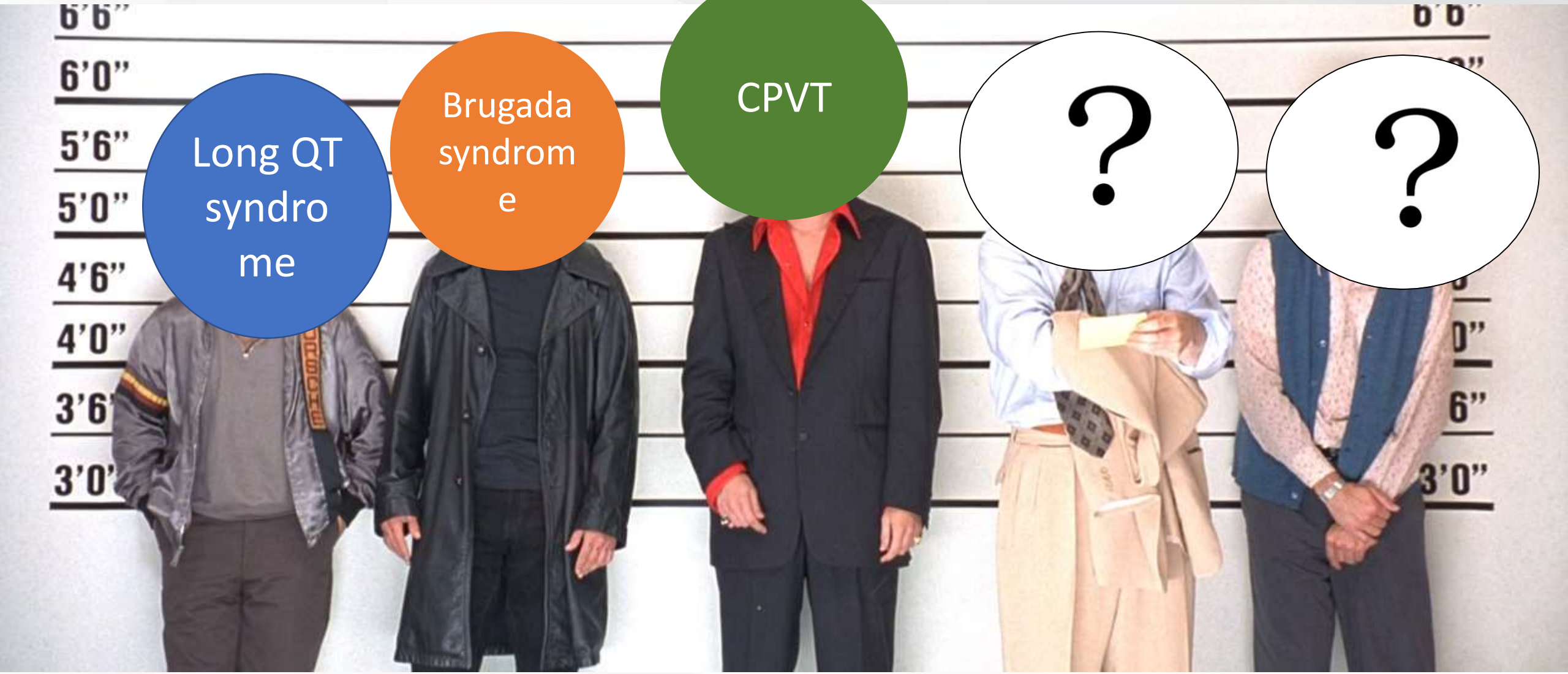

## Brugada syndrome

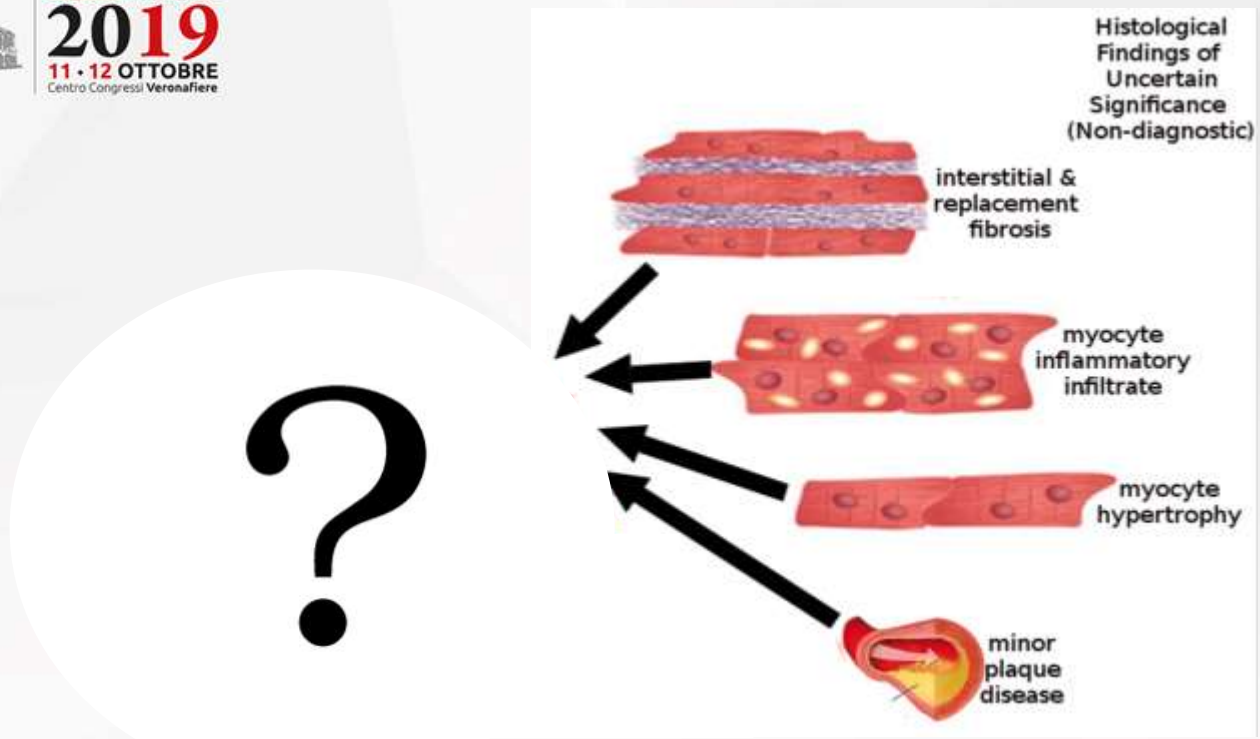
A recent meta-analysis reported a worldwide prevalence of BrS of around 0.5 per 1000 persons.[45] The highest prevalence was seen in Southeast Asia with a Type 1 Brugada pattern on ECG in up to 1.8 in 1000 persons, and being 9 times more common in Asians than Caucasians.[45] The diagnostic criteria for BrS has been revised several times since its original description and was most recently revisited in the 2015 J-wave syndromes expert consensus conference report. The consensus agrees that the diagnosis of BrS is made if a Type 1 pattern is found in more than one of the right precordial leads either spontaneously or if induced by pharmacological provocation, must also be in the presence of one of the following: documented VF or polymorphic VT, syncope of probable arrhythmic cause, a family history of SCD at <45 years old with negative autopsy, coved-type ECGs in family members or nocturnal agonal respiration.[46] The sensitivity of the ECG diagnosis




## Catecholaminergic polymorphic ventricular tachycardia

The prevalence of CPVT is estimated at 1:10,000 persons[48] and with pathogenesis attributed to mishandling of intracellular calcium due to mutations in the RYR2 (autosomal dominant inheritance) and CASQ2 (autosomal recessive inheritance) genes causing unregulated release during diastole.[33] The diagnosis is made in


Long QT syndrome
Brugada syndrome
CPVT
?
?

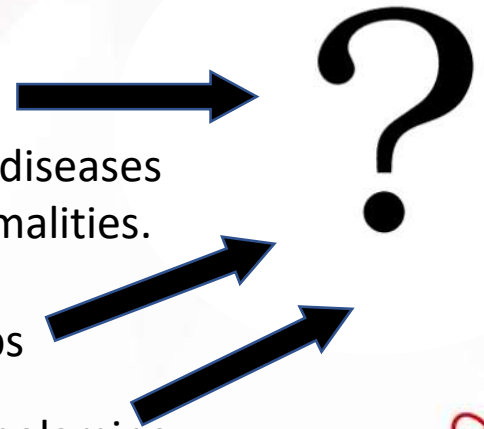



**Up to 50% of autopsy**

Other Structural Heart Disease: dilated cardiomyopathies, hypertrophic cardiomyopathy, arrhythmogenic right ventricular dysplasia, infiltrative diseases (sarcoidosis, amyloidosis), valvular heart disease, and congenital abnormalities.

Epidemiological gaps

«findings not found» at autopsy: vasospastic angina, WPW, acute catecholamine damage in Tako Tsubo



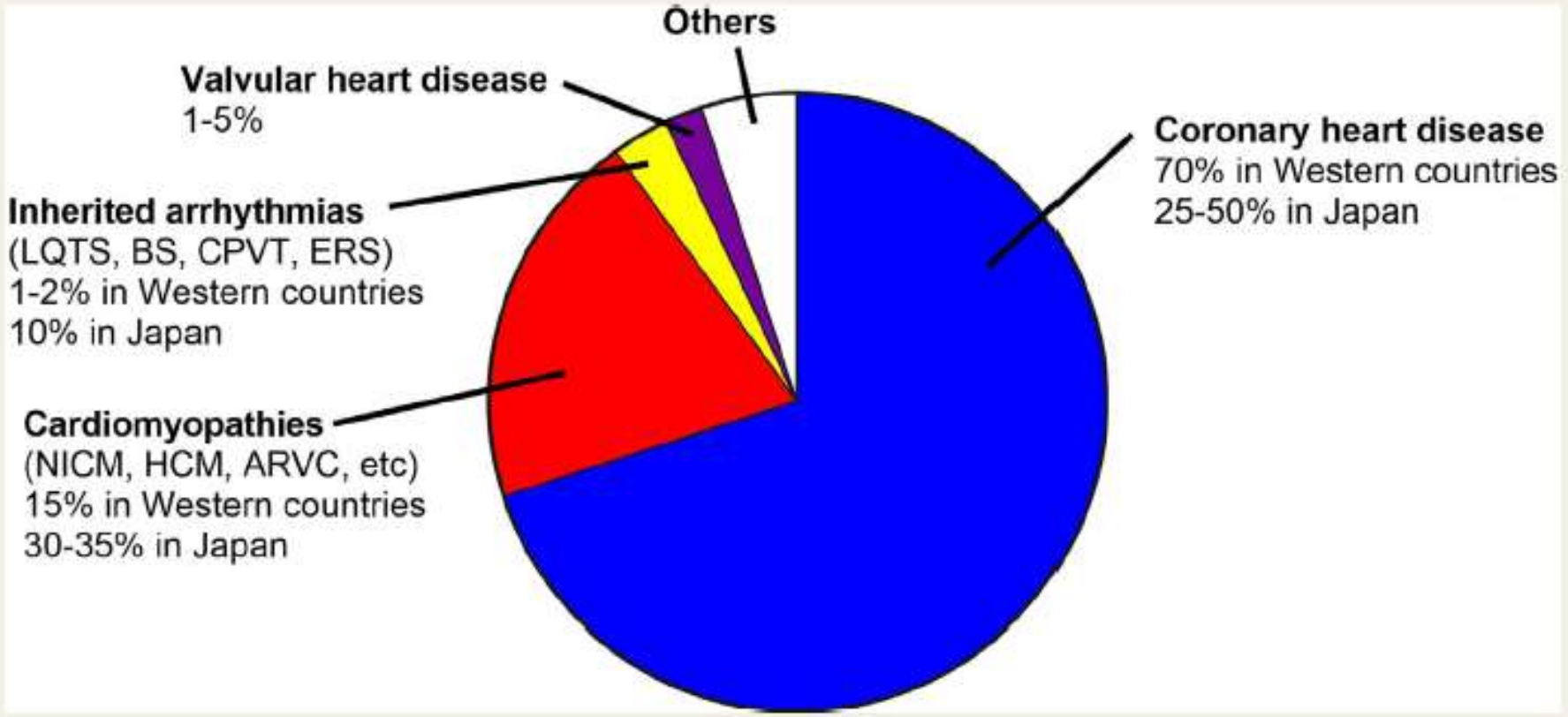


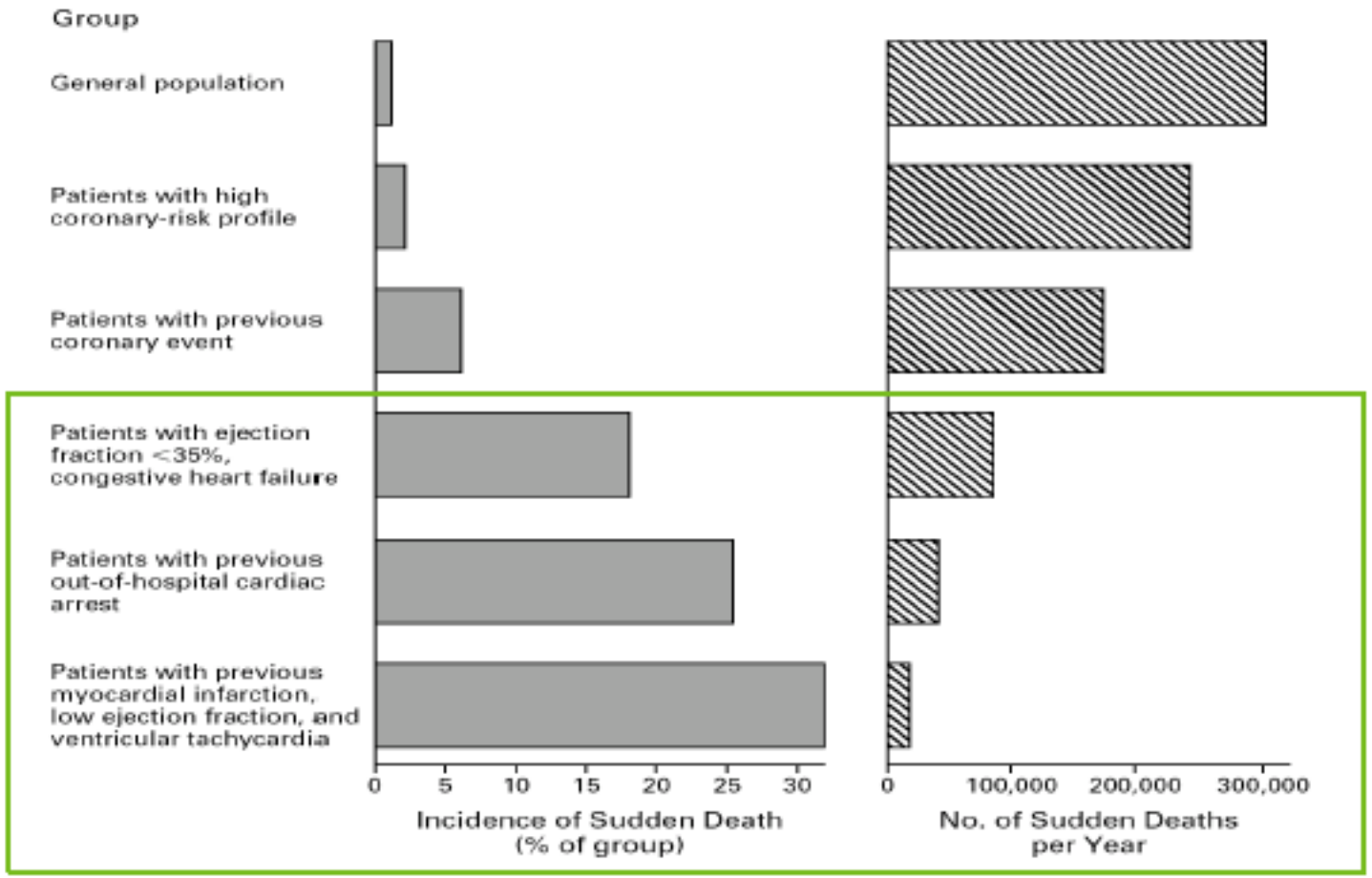

Figure 3 Causes of Sudden Cardiac Disease.

# SCA LINKED TO REDUCED EF, HF AND MI

| Clinical Factor | Risk Description |
|---|---|
| Low Left Ventricular Ejection Fraction (LVEF) | LVEF ≤ 30%[1] |
| Heart Failure (HF) | 50% die of SCA in 2.5 years[2] |
| Prior Myocardial Infarction (MI) and HF | SCA = 4x general population[3] |
| Prior Ventricular Tachycardia (VT), Ventricular Fibrillation (VF) or SCA | 3 years after prior event, SCA = 18%[4] |

1. de Vreede-Swagemakers JJ, et al. *J Am Coll Cardiol.* 1997;30:1500-1505.
2. Sweeney MO. *PACE.* 2001;24:871-888.
3 Adabag AS, et al. *JAMA.* 2008;300:2022-2029.
4 Pratt CM. *Circulation.* 1998;98(suppl 1):1494-1495.

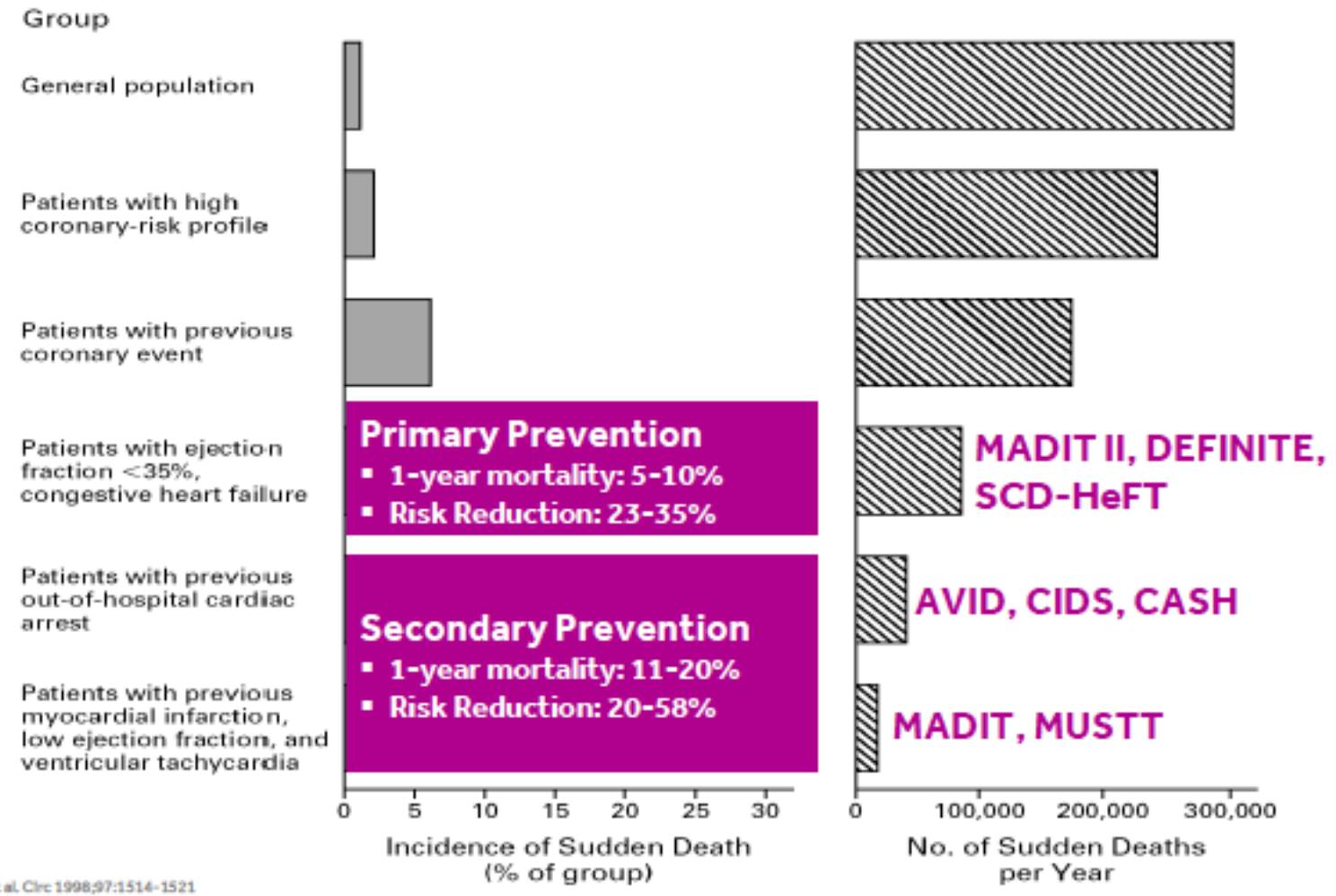
# WHERE DO YOU BEGIN WITH PREVENTING SCA?
## HIGH RISK PATIENTS: LOW EF, PRIOR MI, AND VT/VF




Myerburg, et al. Circ 1998;97:1514-1521

# ICDS HAVE A PROVEN MORTALITY BENEFIT FOR HIGH RISK PATIENTS

## CURRENT ICD EVIDENCE BASE




Myerburg, et al. Circ 1998;97:1514-1521

# ICD UNDERUTILIZATION IS PRONOUNCED IN CERTAIN POPULATIONS

- **African-Americans twice as likely to die** as a result of SCA compared to Caucasians[1]
- In the US **Hispanics** make up 17%[2] of the population but only 5.2% of current ICD implants[2,3]
- **Less than 10% of elderly patients** who survive a heart attack receive an ICD[4]
- **Women** with ischemic cardiomyopathy are **65% less likely to receive an ICD** compared with men[5] despite a nearly identical survival benefit compared to men[6]


1. Kyndaron Reinier et al. Circulation. 2015;132:580-587
2. http://www.census.gov/quickfacts/table/HSG010215/00/accessible
3. Kremers MS, Hammill SC, Berul CI, et al.. Heart Rhythm. 2013 Apr;10(4):e59-65
4. Poloniecy SD, Miller AL, Chen AY, et al.. JAMA. 2015;313(24):2433-2440. doi:10.1001/jama.2015.6409
5. A.J. Geurt, A. Davis, T. Hong, M.C. Burke, B.P. Knight.. Am J Med. 119 (2006), pp. 167.e17–167.e21
6. Zeitler et al. JACC: Heart failure, Feb. 2015

# What Can **You** Do to Prevent SCA?

## Prior to SCA Event

- **Pre-identify** patients at high risk for SCA
- Come to more IRC and similar classes! **Learn** "how to" CPR and more.
- **Refer** patients to EP for evaluation, appropriate medical management therapy, and potential ICD or CRT-D
- **Learn** from your patients by **listening** to what they say and what they don't say

## During SCA Event

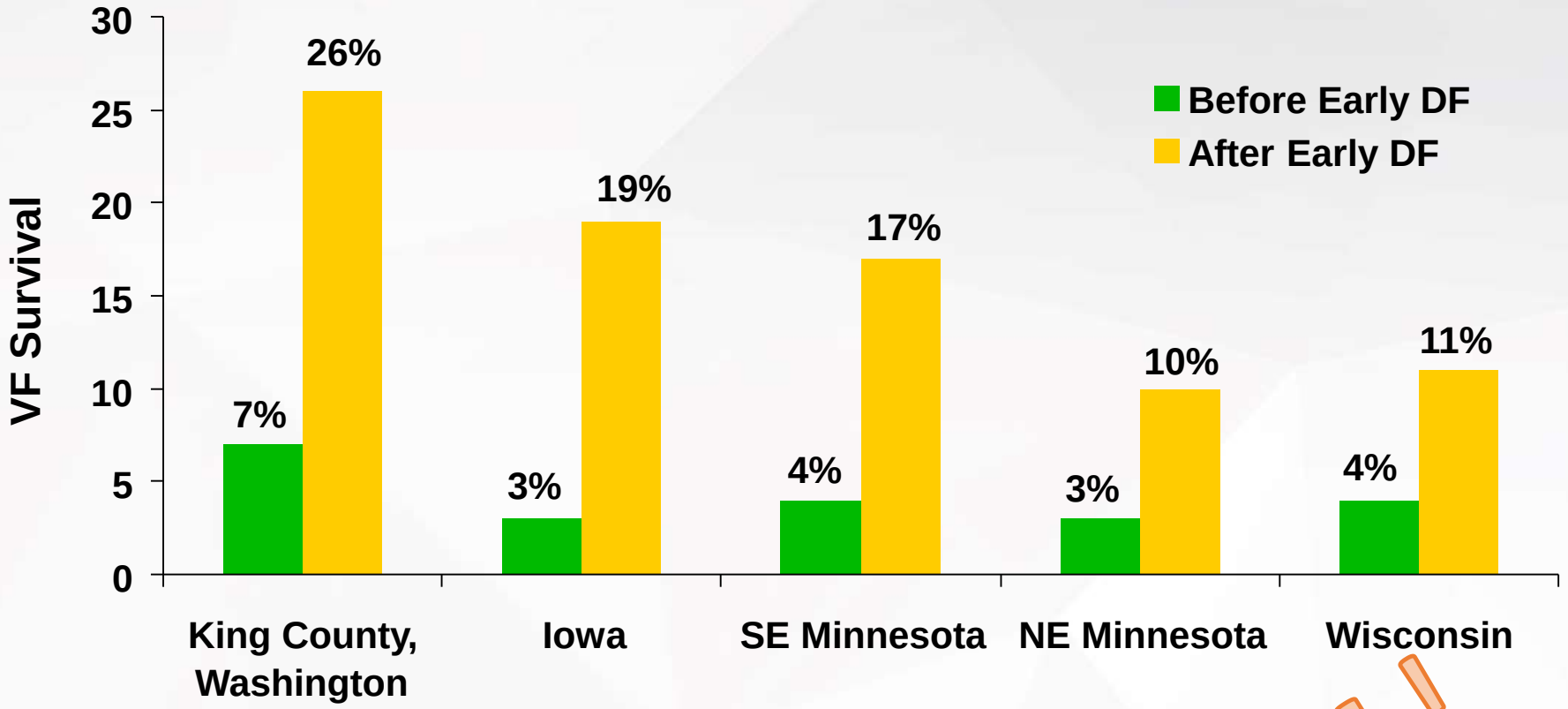
- Effective community **AED** programs (out of hospital events)
- Effective in hospital procedures (in hospital events)

## SCA Survivors

- **Refer** patients to EP for evaluation, appropriate medical management therapy, and potential ICD or CRT-D
- **Explore** family aggregate risk & other reversible effects

Identify – Assess – Protect

# Community Survival Rates before and after Early Defibrillation Programs




1994 !

Ornato JP. Baltimore, MD: Williams & Wilkins; 1994:450-462.

# My personal conclusions:

- **First of all…never stop exploring!** Both in aborted SCA or in SCA victims is useful to investigate the causes of sudden death with an autopsy and or molecular/genetic autopsy to «save» any family members
- We should fill the lack of epidemiological data using large registries and databases
- Arrhythmic death and coronary death are two sides of the coin: the first more linked to genetic factors, the second is closely linked to cardiovascular risck factors
- As we always say: **if you are in doubt…Call the expert!** we have specialists in «genetic-determined» arrhythmias that can be decisive in saving life of your patient or his family members. Remember that some arrhythmias are «group diseses»
- **An extra coronarography is never too much!**

*«…è male minore l'agitarsi nel dubbio che il riposare nell'errore» Alessandro Manzoni*

# EMS & CPR ARE NOT ENOUGH
## CURRENT SCA SURVIVABILITY STATISTICS

| | |
|---|---|
| Current SCA Survival | ▪ National out-of hospital survival-to-discharge of SCA is estimated at ~5%[1]<br>▪ National in-hospital survival-to-discharge of SCA is estimated at 24%[1] |
| CPR Training | ▪ Less than 3% of the US population receives CPR training annually[2] |
| CPR/AED Usage | ▪ More than 80% of SCAs occur at home/non-public settings[1]<br>▪ Less than 50% of out-of-hospital SCA is witnessed[1] |

*Even in the best EMS/AED programs, SCA survival is rare **due to lack** of witnesses and difficulty of reaching victims within 6-8 MINUTES.*

1. Daya, M., R. Schmicker, S. May, and L. Morrison. 2015. "Current burden of cardiac arrest in the US: Report from the Resuscitation Outcomes Consortium."

2. Anderson et al., 2014. "Cardiopulmonary resuscitation training rates in the United States". *JAMA Internal Medicine* 174(2):194-201.

Heart Rhythm Society

# Sudden Cardiac Death Primary Prevention Protocols

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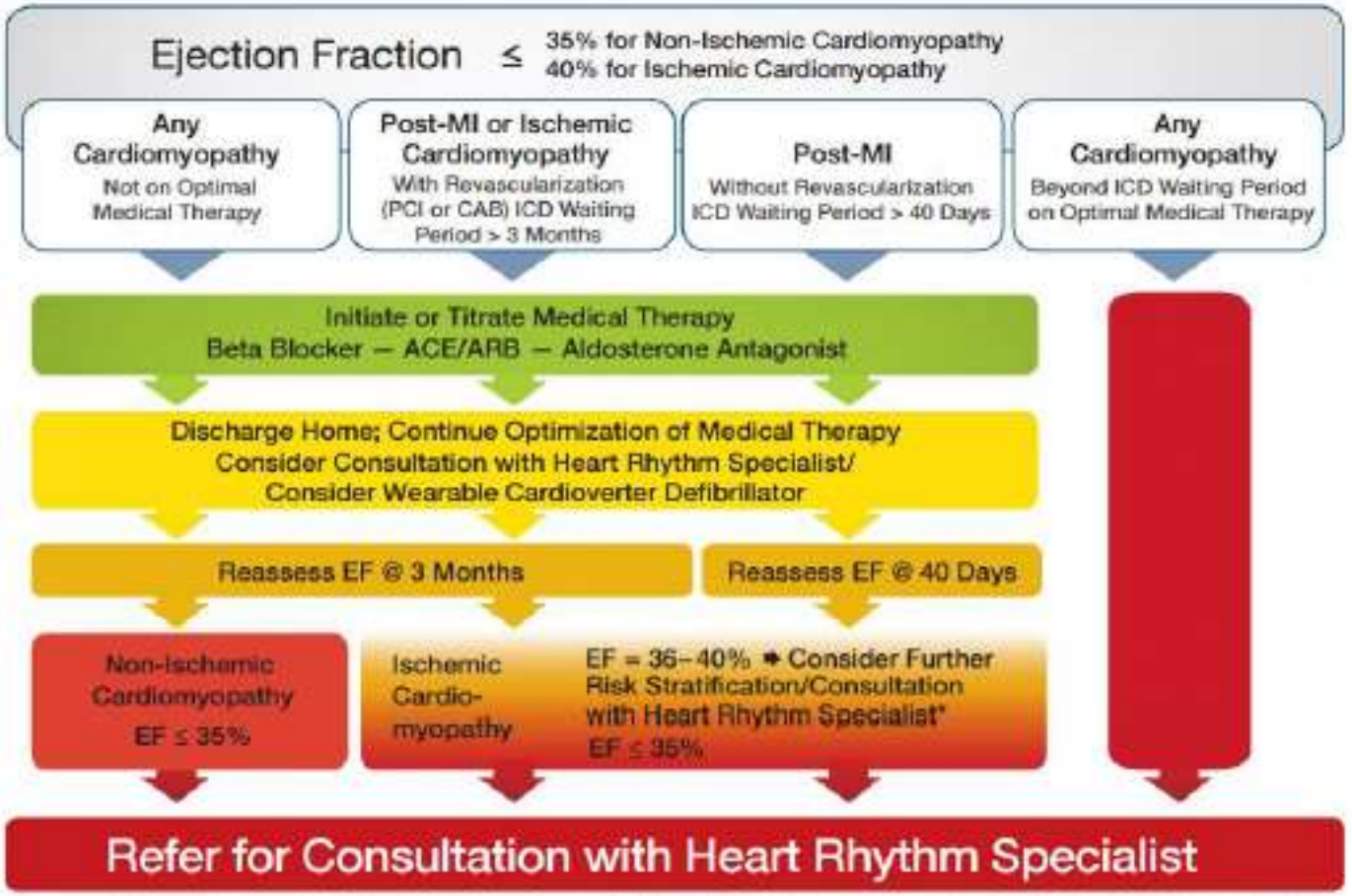


* Buxton AE, Lee KL, Fisher JD, Josephson ME, Prystowsky EN, Hafley G. A randomized study of the prevention of sudden death in patients with coronary artery disease. Multicenter Unsustained Tachycardia Trial Investigators. N Engl J Med. December 16, 1999;341(25):1882-1890.

# Sudden Cardiac Arrest

## What Can You Do?