# Arrhythmias in Acute MI


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# Pathophysiology

# Acute ischemia

- ATP deficiency -> Anaerobic glycolysis -> Acidosis -> Increased extracellular K
- Reduced AP duration
- Reduced resting membrane potential
- Reduced conduction velocity
- Mechanism - Reentry

# Reperfusion

- Intracellular Ca overload -> EAD / DAD
- Mechanism - Triggered activity

# Susceptible groups

- Late presenters
- Incomplete revascularization
- Prior myocardial damage

# Arrhythmias

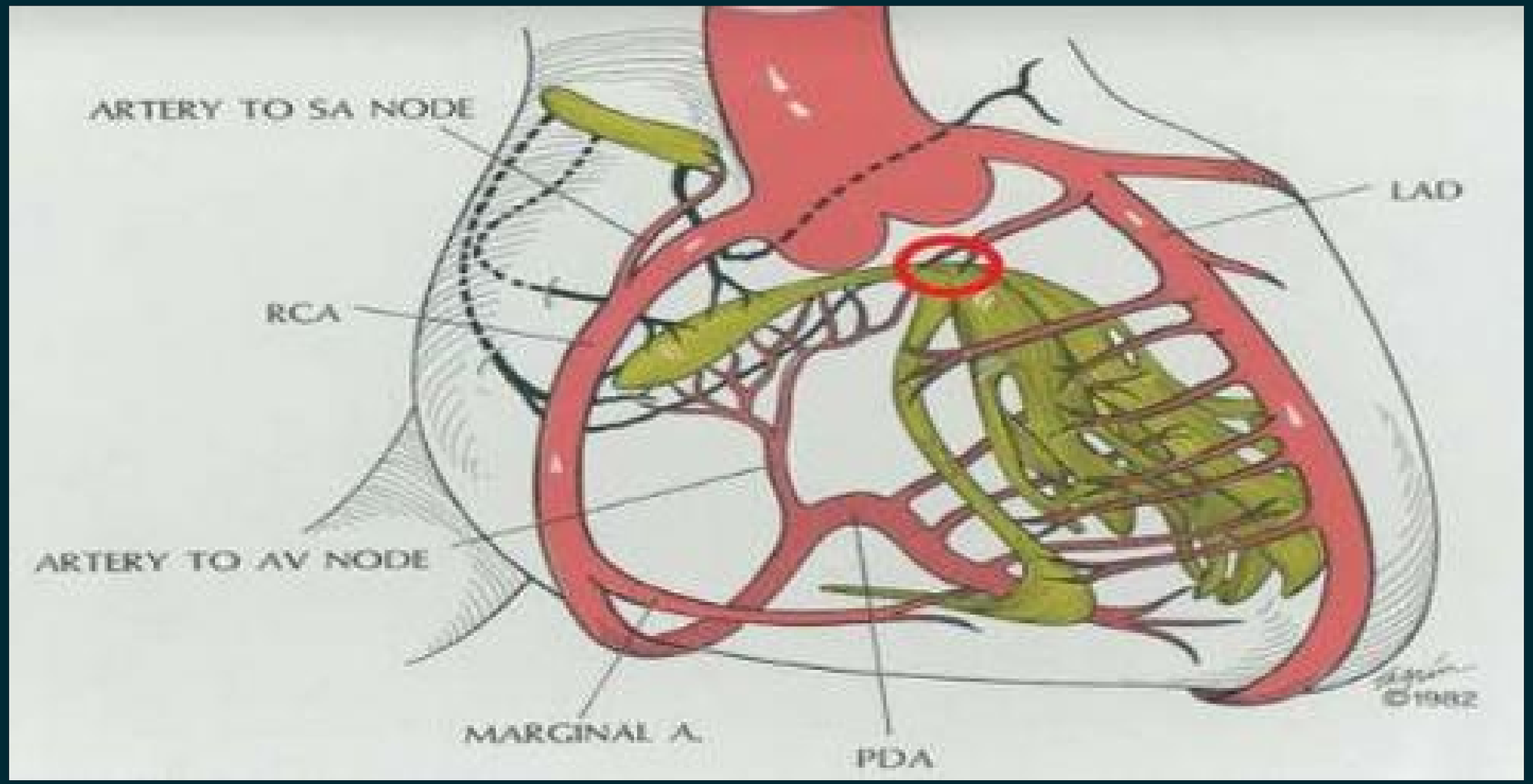
- Prognostic implications - short term and long term
- Acute management
- Long term management

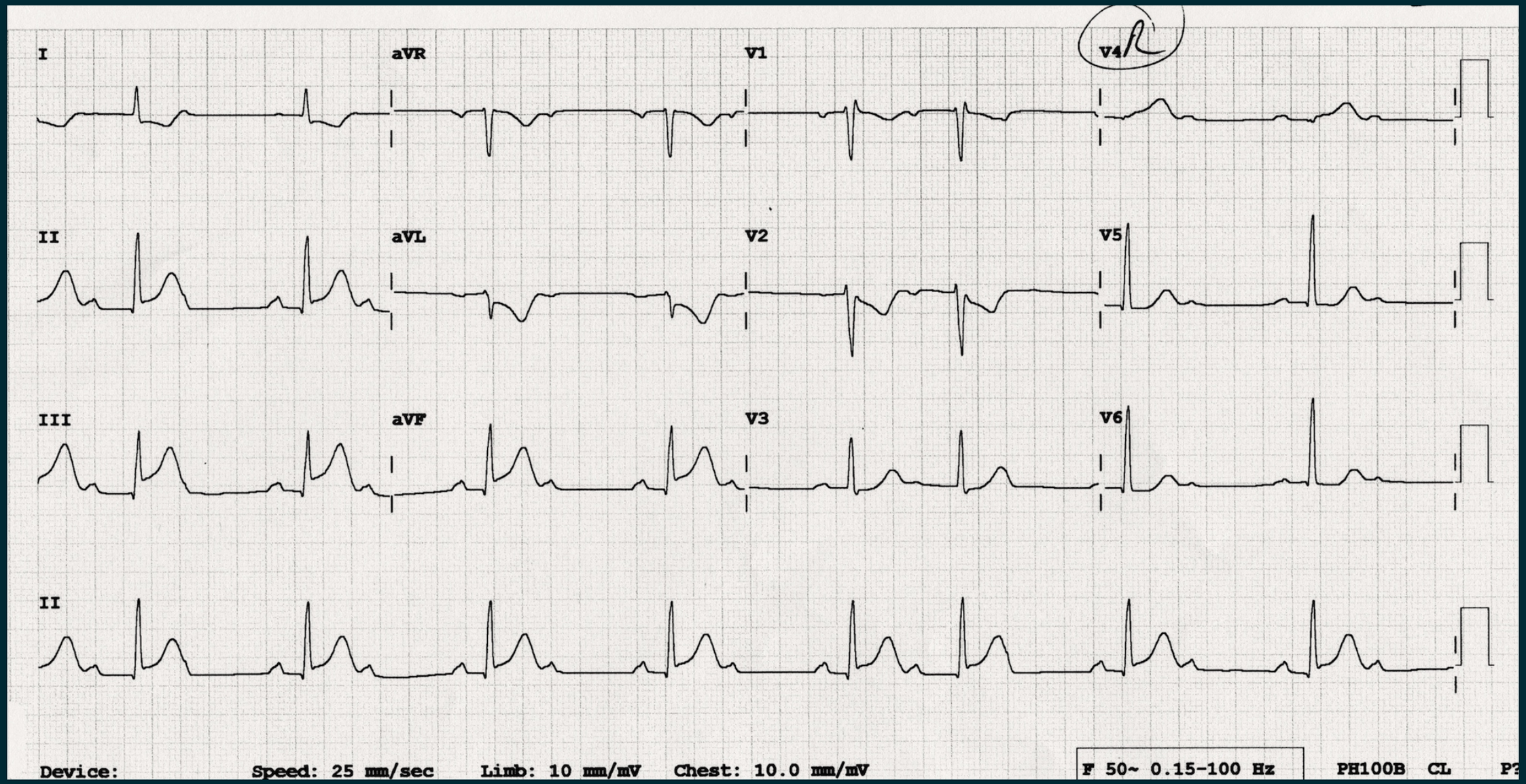
# Complete Heart block

# Mechanisms

- Autonomic imbalance
- Ischemia / necrosis of conduction system
- 2-3 fold higher incidence in IWMI

# Blood supply




I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Device:
Speed: 25 mm/sec
Limb: 10 mm/mV
Chest: 10.0 mm/mV
F 50~ 0.15-100 Hz
PH100B CL

# AV block in IWMI

- Block is above His usually
- Good escape
- Transient block
- Low mortality risk

# AV block in AWMI

- Usually below the node
- Extensive myocardial necrosis
- Multivessel disease
- Usually significant hemodynamic problems

# Prognosis

- Depends on extent of myocardial damage
- Worse in AWMI

# AV block in primary PCI era

- Incidence 3.2%
- Most within 48 hours
- 91% resolved

Uffe Jakob Ortved Gang et al. High-degree atrioventricular block complicating ST-segment elevation myocardial infarction in the era of primary percutaneous coronary intervention. Europace (2012) 14, 1639–1645

# AV block in primary PCI era

- Predictors
  - RCA occlusion
  - Age > 65
  - Female gender
  - HT and DM
- Increased 30 day mortality (HR 3.14)

Uffe Jakob Ortved Gang et al. High-degree atrioventricular block complicating ST-segment elevation myocardial infarction in the era of primary percutaneous coronary intervention. Europace (2012) 14, 1639–1645

# Management

- Reperfusion
- Temporary pacing
  - when AVB with significant bradycardia persists after reperfusion
  - Only as last resort
  - Tamponade in 3/53, lethal in 1 (prev ref)
- Permanent pacing when AVB does not resolve after acute period

# Atrial fibrillation

# Mechanisms

- Atrial ischemia / infarction
- Hypokalemia / Hypoxia
- Pericardial inflammation
- Increased left atrial pressure
- Autonomic imbalance

# Prognosis

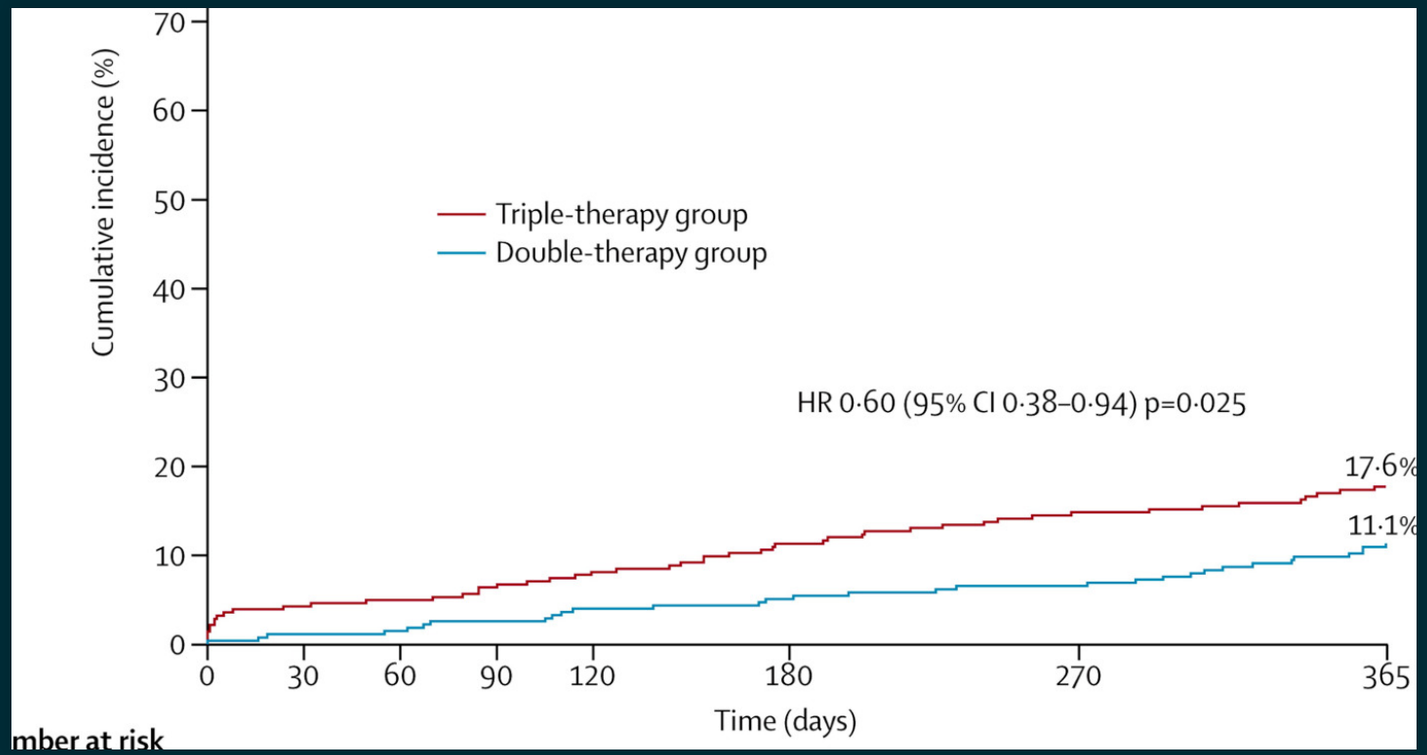
- Excess mortality - in hospital, short term, mid term and long term
- Independent of other clinical factors
- Increased risk of recurrent AF, ischemic stroke

Jabre P et al. Mortality associated with atrial fibrillation in patients with myocardial infarction: a systematic review and meta-analysis. Circulation. 2011 Apr 19;123(15):1587-93

# Management

- Rate control
  - Beta blockers
  - Amiodarone
  - Digoxin
- Rhythm control
  - DCCV
  - Amiodarone
- Anticoagulation depending on CHADS score
  - Triple therapy for short period
  - Clopidogrel + OAC

# AF with need for DAPT




Dewilde WJ … WOEST study investigators. Use of clopidogrel with or without aspirin in patients taking oral aanticoagulant therapy and undergoing percutaneous coronary intervention: an open-label, randomised, controlled trial. Lancet. 2013 Mar 30;381(9872):1107-15

# Sustained Ventricular arrhythmias

# Incidence

- Historically, decrease in incidence
- 6% today

# Management - VT

- Reperfusion if ischemia
- Beta blockers
- K and Mg correction
- Statins ? (1)

He XZ et al. The effect of early and intensive statin therapy on ventricular premature beat or non-sustained ventricular tachycardia in patients with acute coronary syndrome. Cardiol J. 2010;17(4):381-5

# Management - VT

- Cardioversion
- AAD last resort
  - Class I drugs may be harmful (1)
  - Lidocaine does not affect mortality, effective in ischemia (2)
  - Amiodarone
- Catheter ablation - purkinje ectopy


1. The Cardiac Arrhythmia Suppression Trial (CAST) Investigators Preliminary report: effect of encainide and flecainide on mortality in a randomized trial of arrhythmia suppression after myocardial infarction , N Engl J Med, 1989, vol. 321 (pg. 406-12)
2. Wyman et al. Prevention of primary ventricular fibrillation in acute myocardial infarction with prophylactic lidocaine , Am J Cardiol, 2004, vol. 94 (pg. 545-51)

# Amiodarone

- Safest with heart disease
- More mortality compared to lidocaine ? (1)
- No long term benefit (EMIAT / CAMIAT)

Piccini JP et al. Antiarrhythmic drug therapy for sustained ventricular arrhythmias complicating acute myocardial infarction. Crit Care Med. 2011 Jan;39(1):78-83

# Electrical storm

- 3 or more episodes of VT / VF in 24 h
- PVT rather than MMVT - acute ischemia

# Management - Storm

- Cardioversion / defibrillation
- Overdrive pacing
- Complete revascularization
- Electrolyte imbalance
- Beta blockade - drugs / neuraxial modulation
- Sedation
- Amiodarone / Lignocaine
- Ablation
- LVAD

# Long term prognosis

- Sustained VA > 48 h - higher risk of sudden death long term
- Indication for ICD implantation

# Sustained ventricular arrhythmias < 48 h

# Early ventricular arrhythmias (VT / VF < 48 hours)

- AIVR benign
- Primary VF - ICD implantation not indicated
- Primary VF - 3 fold higher risk of mortality at 90 days (1)

Mehta et al, APEX AMI Investigators. Incidence of and outcomes associated with ventricular tachycardia or fibrillation in patients undergoing primary percutaneous coronary intervention. JAMA. 2009 May 6;301(17):1779-89

# Fast MI registry - 5 year analysis of outcomes

European Heart Journal (2014) **35**, 116–122
doi:10.1093/eurheartj/eht453

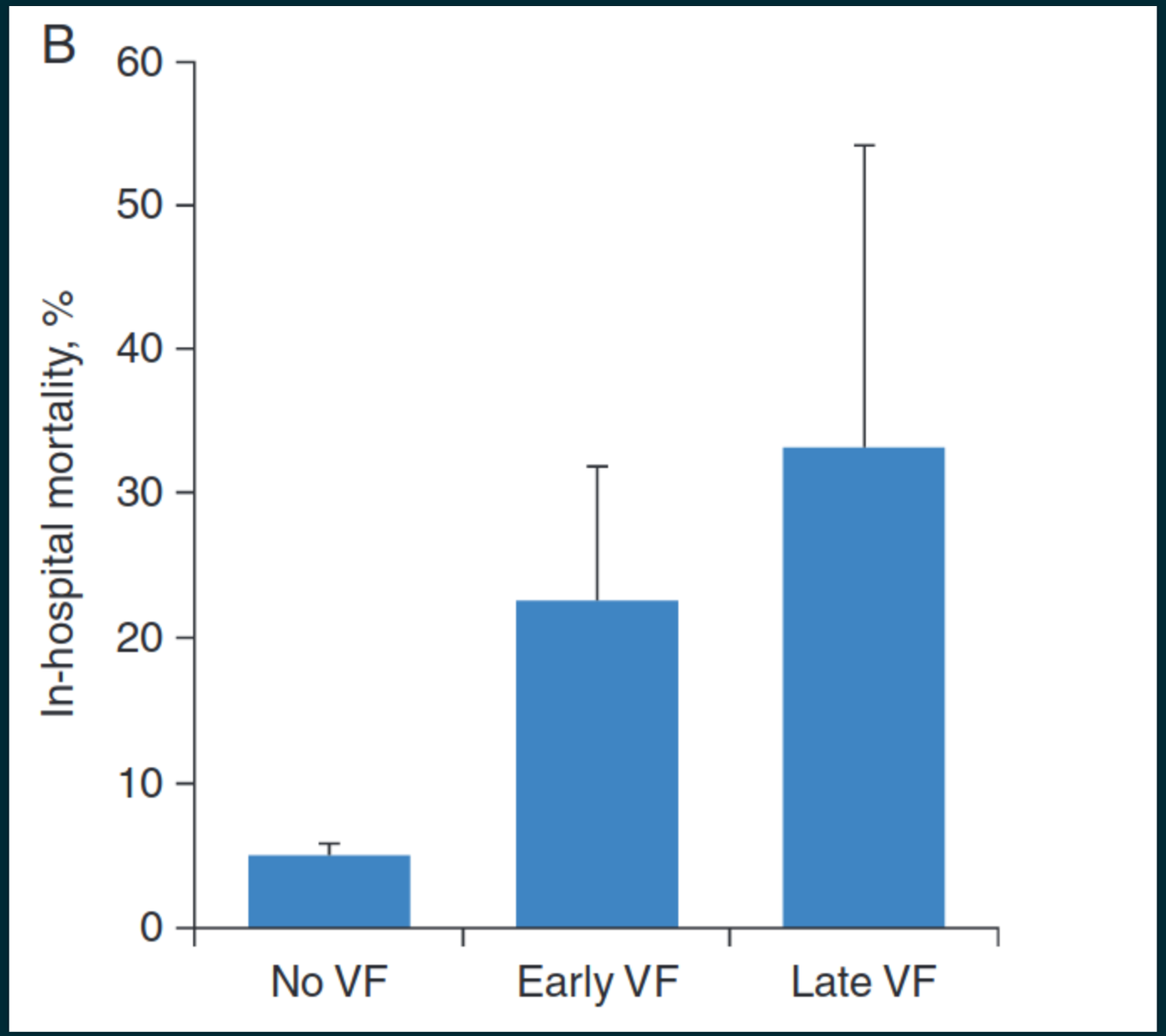
**CLINICAL RESEARCH**
*Arrhythmia/electrophysiology*

# Incidence of sudden cardiac death after ventricular fibrillation complicating acute myocardial infarction: a 5-year cause-of-death analysis of the FAST-MI 2005 registry†

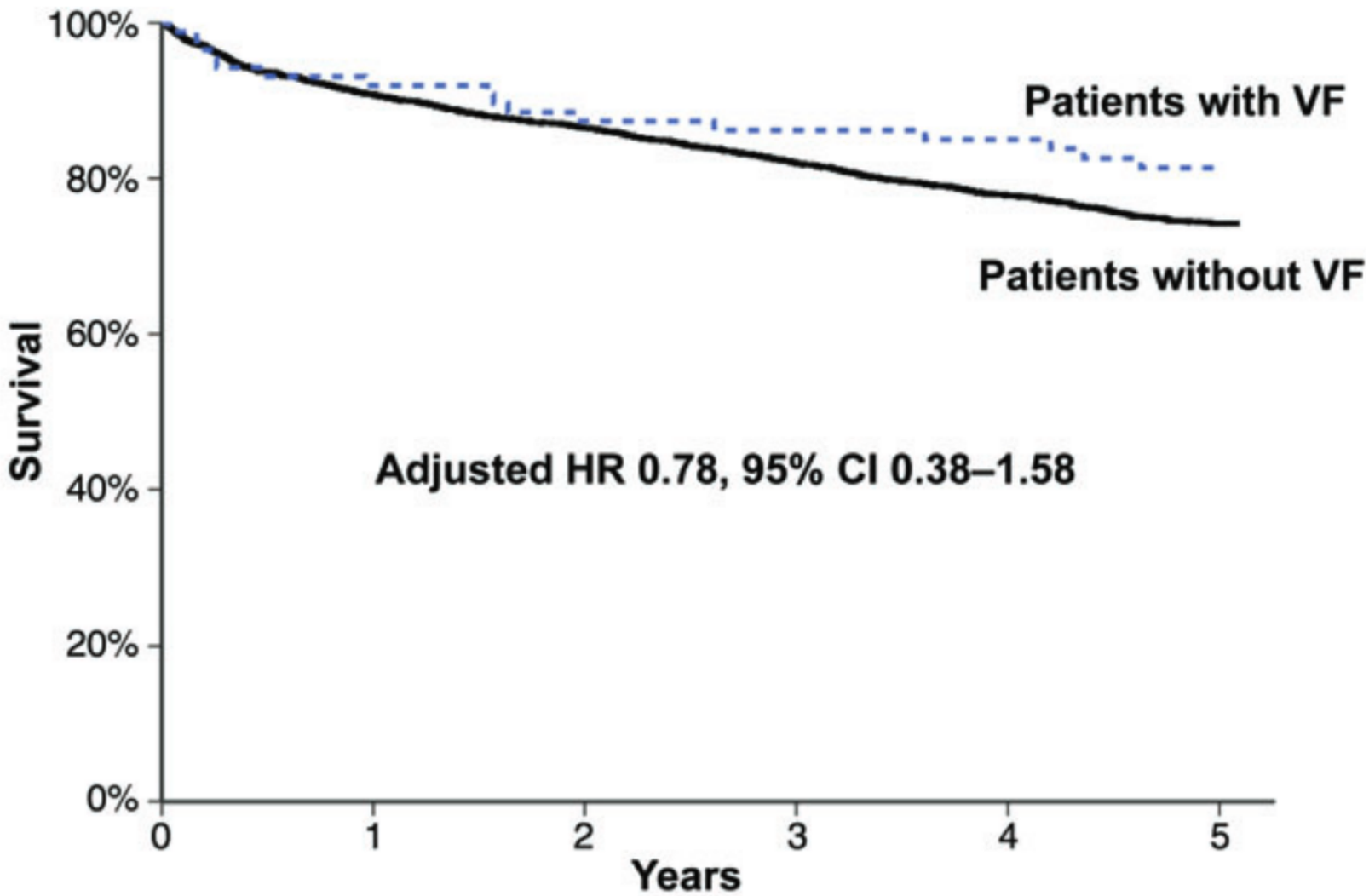
**Wulfran Bougouin[1,2,3], Eloi Marijon[1,2,3], Etienne Puymirat[1,2,3], Pascal Defaye[4], David S. Celermajer[5], Jean-Yves Le Heuzey[1,2], Serge Boveda[6], Salem Kacet[7], Philippe Mabo[8,9], Claude Barnay[10], Antoine Da Costa[11], Jean-Claude Deharo[12], Jean-Claude Daubert[8,9], Jean Ferrières[13], Tabassome Simon[14,15], and Nicolas Danchin[1,2,3]*, on behalf of FAST-MI Registry Investigators**

[1]Cardiology Department, European Georges Pompidou Hospital, 20, rue Leblanc, 75015 Paris, France; [2]Paris Descartes University, Paris, France; [3]Paris Cardiovascular Research Center–INSERM U970 (PARCC), Paris, France; [4]Cardiology Department, Grenoble University Hospital, Grenoble, France; [5]Sydney Medical School, Sydney, Australia; [6]Clinique Pasteur, Toulouse, France; [7]Cardiology Department, Lille University Hospital, Lille, France; [8]Cardiology Department, Rennes University Hospital; [9]Rennes 1 University, Rennes, France; [10]General Hospital, Aix en Provence, France; [11]Cardiology Department, Saint-Etienne University Hospital, Saint-Etienne, France; [12]Cardiology Department, Timone University Hospital, Marseille, France; [13]Cardiology Department, Rangueil University Hospital, Toulouse, France; [14]Clinical Research Unit, Saint-Antoine Hospital, AP-HP; and [15]University of Pierre et Marie Curie, Paris, France

# Higher early mortality



# Long term outcome not affected




| Number at risk | Discharge | 1 year | 2 years | 3 years | 4 years | 5 years |
|---|---|---|---|---|---|---|
| Patients with VF | 87 | 80 | 76 | 74 | 71 | 55 |
| Patients without VF | 3376 | 3053 | 2873 | 2705 | 2526 | 1787 |

# Appropriate use criteria

| | Indication | Appropriate Use Score (1–9) | | |
|---|---|---|---|---|
| | **Total Revascularization Completed After Cardiac Arrest** | | | |
| | | | **LVEF** | |
| | | **≥50%** | **36% to 49%** | **≤35%** |
| 1. | • Single episode VF or polymorphic VT during acute (<48 h) MI | **R (2)** | **R (3)** | **M (4)** |
| 2. | • Recurrent VF or polymorphic VT during acute (<48 h) MI | **R (3)** | **R (3)** | **M (5)** |
| 3. | • VF or polymorphic VT during acute (<48 h) MI<br>• NSVT 4 days post-MI<br>• Inducible VT/VF at EPS ≥4 days after revascularization | **M (5)** | **A (7)** | **A (8)** |
| | **No Revascularization Indicated (i.e., No Significant CAD)** | | | |
| | | | **LVEF** | |
| | | **≥50%** | **36% to 49%** | **≤35%** |
| 4. | • Single episode VF or polymorphic VT during acute (<48 h) MI | **R (2)** | **R (3)** | **M (4)** |
| 5. | • Recurrent VF or polymorphic VT during acute (<48 h) MI | **R (2)** | **R (3)** | **M (5)** |
| | **Obstructive CAD With Coronary Anatomy Not Amenable to Revascularization** | | | |
| | | | **LVEF** | |
| | | **≥50%** | **36% to 49%** | **≤35%** |
| 6. | • VF or polymorphic VT during acute (<48 h) MI<br>• No EPS done | **M (5)** | **M (5)** | **A (7)** |

A = Appropriate; CAD = coronary artery disease; EPS = electrophysiological study; LVEF = left ventricular ejection fraction; M = May Be Appropriate; MI = myocardial infarction; NSVT = nonsustained ventricular tachycardia; R = Rarely Appropriate; VF = ventricular fibrillation; VT = ventricular tachycardia.

ACCF / AHA / HRS Appropriate use criteria 2013

# Summary

- Arrhythmias often associated with poor short and long term outcomes in AMI
- Need prompt and aggressive treatment
- Reperfusion is key
- Beta blockers for tachyarrhythmias