Risk Stratification Post MI for Patients at Risk for Sudden Death

Dr. Umang Patel
St. Mary’s hospital, Evansville, IN
Epidemiology

- The overall incidence of SCD in the United States is 1 to 2 per 1000 population (0.1% to 0.2%) annually.
Potential risk factors post MI that predict SCD

- LVEF
- Programmed ventricular stimulation MMVT or PMVT with single or double.
- Functional class of heart failure.
- Holter monitor showing PVC > 10 / hour, worse arrhythmias.
- Autonomic dysfunction.
- Renal failure

MMVT: monomorphic ventricular tachycardia
PMVT: polymorphic ventricular tachycardia
Tools to prevent SCD

• Medications: Beta blockers, ACEI/ARB, Aldosterone antagonist
• Implantable Cardioverter Defibrillator
• Wearable Cardioverter defibrillator
ICD - Secondary prevention

- Survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT without reversible causes.
- Spontaneous sustained VT, whether hemodynamically stable or unstable + structural heart disease.
- Positive electrophysiologic study: clinically relevant, hemodynamically significant sustained VT or VF.
ICD - Primary prevention

• Nonischemic DCM or ischemic heart disease at least 40 days post-MI with LVEF of 35% or less and NYHA Class II or III symptoms on chronic GDMT

• 40 days post-MI with LVEF of 30% or less, NYHA Class I symptoms while receiving GDMT.

• Nonsustained VT due to prior MI, LVEF <40%, and inducible sustained VT at electrophysiologic study.
Post MI: risk of SCD

- Within 48 hours
- 48 hours to 40 days
- >40 days to 3 months - revascularization
- > 3 months - revascularization
Secondary prevention trials

**LVEF ≤0.35**
- >3 weeks post-MI
- >2 months post-CABG
- >3 months post-PTCA

**EF ≤0.40**
- NSVT within the last 6 months
- ≥4 days post-MI or revascularization

**EF ≤0.30**
- >1 month after MI
- >3 months after revascularization
Post MI: risk of SCD

- Within 48 hours
- 48 hours to 40 days
- >40 days to 3 months
- > 3 months - revascularization
Post MI: risk of SCD

- Within 48 hours
- 48 hours to 40 days
- >40 days to 3 months
- > 3 months - revascularization
The yellow line indicates LVEF ≤30% (n = 3,852); the red line indicates LVEF 31% to 40% (n = 4,998); and the blue line indicates LVEF >40% (n = 2,406).
Predictors of SCD : Valiant

- LVEF <40%
- Higher HR, atrial fibrillation post-MI, and impaired creatinine clearance.
- Long term: recurrent cardiovascular events, LVEF <40%.
- Changes with time after MI.
Post-PCI: Risk of SCD

The CADILLAC Trial

Cleveland Clinic Registry

CathPCI-NCDR3

90 day mortality

Patient

Mortality Predictors

Post-PCI, AMI

EF ≤35%

EF <30%, Post-PCI, Age >65 yo

11%

13%

32%

12%

STEMI

w/o STEMI

LVEF, Age

Renal insufficiency

Multi-vessel

Killip Class II/III

Anemia

TIMI flow

LVEF, Age

Diabetes Mellitus,

Female gender

LVEF, Age

Renal insufficiency

Multi-vessel


Weintraub et al. Prediction of Long-Term Mortality After Percutaneous Coronary Intervention in Older Adults: Results From the National Cardiovascular Data Registry. Circulation 2012;126:1701-1710.
# The CADILLAC Trial

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline LVEF &lt;40%</td>
<td>4</td>
</tr>
<tr>
<td>Renal Insufficiency</td>
<td>3</td>
</tr>
<tr>
<td>Killip Class II/III</td>
<td>3</td>
</tr>
<tr>
<td>Age &gt;65</td>
<td>2</td>
</tr>
<tr>
<td>Final TIMI flow 0-2</td>
<td>2</td>
</tr>
<tr>
<td>Three-Vessel Disease</td>
<td>2</td>
</tr>
<tr>
<td>Anemia</td>
<td>2</td>
</tr>
</tbody>
</table>

## CADILLAC Risk Score

<table>
<thead>
<tr>
<th>CADILLAC Risk Score</th>
<th>Risk Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score ≥6</td>
<td>High</td>
</tr>
<tr>
<td>Score 3-5</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Score 0-2</td>
<td>Low</td>
</tr>
</tbody>
</table>
Post MI: risk of SCD

- Post-MI patients with heart failure are at 4–6 times greater risk of sudden cardiac death in the first 30 days after MI.
- 83% of SCD occurred after hospital discharge.
- 74% of those resuscitated in the first 30 days were alive at 1 year.
Post MI, LVEF <40% and HF

= 

ICD
Acute Coronary Artery Disease
Defibrillator in Acute Myocardial Infarction Trial (DINAMIT)

18–80 years old
• MI past 6–40 days
• EF <0.35
• Abnormal HRV

674 patients enrolled,
Average age: 61 years
• 76% male
• EF: 0.28
• Index MI:
  • 72% Anterior
  • 72% new Q wave
• Peak CK: 2300 U/L
• Reperfusion: 63%
• 26% PCI
• 27% thrombolysis
• 10% both

332 received ICDs

After mean f/u of 30 months, no difference in mortality between ICD and no ICD groups (HR: 1.08; 95% CI: 0.76–1.55; P=.66)

• ICD group had a significant decrease in risk of death due to arrhythmia (HR: 0.42; 95% CI: 0.22–0.83; P=.009) but a significant increase in risk of nonarrhythmic death. (HR: 1.75; 95% CI: 1.11–2.76; P=.02)
Overall Mortality: ICD (7.5%) vs Control (6.9%)

Arrhythmic Death: ICD (1.5%) vs Control (3.5%)

Nonarrhythmic Death: ICD (6.1%) vs Control (3.5%)

P = .66

P = .009

P = .16
**Immediate Risk Stratification Improves Survival Study (IRIS)**

<table>
<thead>
<tr>
<th>MI in the past 5–31 days and either:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• EF ≤40% and initial HR &gt;90 bpm</td>
</tr>
<tr>
<td>• NSVT &gt;150 bpm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>898 enrolled, Average age: 63 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 77% male</td>
</tr>
<tr>
<td>• EF: 0.35</td>
</tr>
<tr>
<td>Index MI:</td>
</tr>
<tr>
<td>• 64% anterior</td>
</tr>
<tr>
<td>• 77% STEMI</td>
</tr>
<tr>
<td>Reperfusion: 77%</td>
</tr>
<tr>
<td>72% PCI</td>
</tr>
<tr>
<td>16% thrombolysis (+/− PCI)</td>
</tr>
</tbody>
</table>

| 445 received ICDs                   |

<table>
<thead>
<tr>
<th>After mean f/u of 37 months, no difference in mortality between the ICD and no ICD groups (HR: 1.04; 95%CI: 0.81–1.35; P=.78)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ICD group had a significant decrease in sudden cardiac death (HR: 0.55; 95% CI: 0.31–1.00; P=.049) but a significant increase in risk of nonsudden cardiac death (HR: 1.92; 95% CI: 1.29–2.84; P=.001)</td>
</tr>
</tbody>
</table>
Post MI: risk of SCD

• Within 48 hours
• 48 hours to 40 days – **NO ICD**
• >40 days to 3 months
• > 3 months - revascularization
Acute MI: sudden cardiac death paradox

- SCD: 50 - 80% non arrhythmic: LV rupture, acute MI, recurrent MI. By 1 year: 50% arrhythmic deaths.
- Defibrillator shocks can result in injury to the myocardium, and that ventricular function can be further impaired as a consequence of backup ventricular pacing.
Kusumoto F M et al. Circulation. 2014;130:94-125
Answer

Post MI, LVEF <40% and HF

= ICD
Post MI: risk of SCD

- Within 48 hours
- 48 hours to 40 days – NO ICD
- >40 days to 3 months
- > 3 months - revascularization
Post MI: 48 hrs to 40 days

- Sustained VT/VF more than 48 hours after STEMI: non reversible.
- Syncope presumed to be related to VT by clinical assessment.
- NSVT
- Positive EPS
- Who needs pacing and LVEF is not expected to improve.
Case 1

55 years old man with anterior wall MI had LVEF 25%, NYHA class II despite optimal medical therapy at 2 months. He is scheduled for an ICD placement as outpatient.

He is now admitted with hypotension with reduction in GFR from >60 to 23 ml/min/m2 (blamed on aggressive diuresis and ACEI regimen). Troponin is 0.6 ng/ml. He has multiple NSVT episodes. No chest pain. No new EKG changes.
Upon recovery, what next

1. Cardiac catheterization
2. Discharge with wearable defibrillator
3. Proceed with ICD placement
4. Wait for 40 days based on the guidelines.
Definition of MI

Chest pain and

• EKG changes
• Positive enzymes
• Echocardiogram new regional wall motion abnormality
Causes of elevated troponin other than ACS

Cardiac
- HTN
- SVT with CAD
- Cocaine
- HTN
- hypoxia/hypoperfusion
- Ablation
- Vasospasm/Cardioversion
- Myocarditis

Non Cardiac
- Renal failure
- Sepsis
- Stroke
- Pulmonary embolism
ICD would hence be recommended as the patient did not seem to have acute coronary syndrome
55 years old man with anterior wall MI had LVEF 25%, NYHA class II despite optimal medical therapy at 2 months. He is scheduled for an ICD placement as outpatient.

He is now admitted with chest pain and was found to have troponin of 23 ng/ml pre PCI. He goes on to receive a stent to RCA.
What next, upon recovery

1. Repeat echo to evaluate EF
2. Discharge with wearable cardioverter defibrillator
3. Proceed with ICD placement
4. Wait for 40 days based on the guidelines.
ICD implantation in the context of an abnormal troponin that is not due to a myocardial infarction;

ICD implantation within 40 days of a myocardial infarction;

ICD implantation within 90 days of revascularization; and

ICD implantation <9 months from the initial diagnosis of non-ischemic cardiomyopathy
ICD implantation within 40 days of myocardial infarction.

Kusumoto F M et al. Circulation. 2014;130:94-125
Post MI: risk of SCD

- Within 48 hours
- 48 hours to 40 days
- >40 days to 3 months
- > 3 months - revascularization
Case 3

• 55 years old man with history of prior MI collapsed at work. AED successfully rescued him. Subsequent EKG showed acute STEMI involving the anterior wall. He underwent emergent PCI to LAD with placement of a DES. LV angiogram showed LVEF 40% with akinetic apex.
• 4 weeks later EF is still 40%
What next

1. Continue optimal medical therapy
2. Consider wearable defibrillator
3. Consider further risk stratification / ICD placement
ICD implantation within 90 days of revascularization.

*And no evidence of ischemia.
**And recovery of left ventricular function in uncertain or not expected.
Cardiac arrest at presentation of MI - Risk for SCD

Not at risk:

- Arrhythmia occurred within 48 hour of acute MI
- Complete revascularization
- LVEF normalized

ALL OTHERS NEED RISK STRATIFICATION
WCD

- Retrospective evaluation of 4958 patients with EF ≤0.35 after CABG and PCI from two combined databases, 809 patients who were discharged with a WCD were compared to the remaining 4149 patients.
- The WCD was associated with a lower 90-day mortality in patients after CABG (no WCD: 7% vs WCD: 3%) and after PCI (no WCD: 10% vs WCD: 2%).
- For the entire WCD group, 18 appropriate defibrillations occurred in 11 patients (12% of patients discharged with a WCD).
- Inappropriate shocks accounted for 42% of the therapies delivered.
LifeVest System

ECG Electrodes
- Dry & non-adhesive
- 4 electrodes providing 2 channels of monitoring

Self-Gelling Defibrillation Electrodes

Response Buttons

Monitor
- 150 joules biphasic
- Stores ECG, daily use, etc.
Final thoughts

• Avoid placing ICD in 40 days post MI
• An early period in which ICD therapy is ineffective, and a later period in which ICD therapy is effective.
• Can place after 40 days but prior to 90 days as needed.
• Consider wearable cardioverter defibrillator in specific situations.
ICD implantation within 90 days of revascularization.

Kusumoto F M et al. Circulation. 2014;130:94-125

Copyright © American Heart Association, Inc. All rights reserved.