

Risk Stratification Post MI for Patients at Risk for Sudden Death

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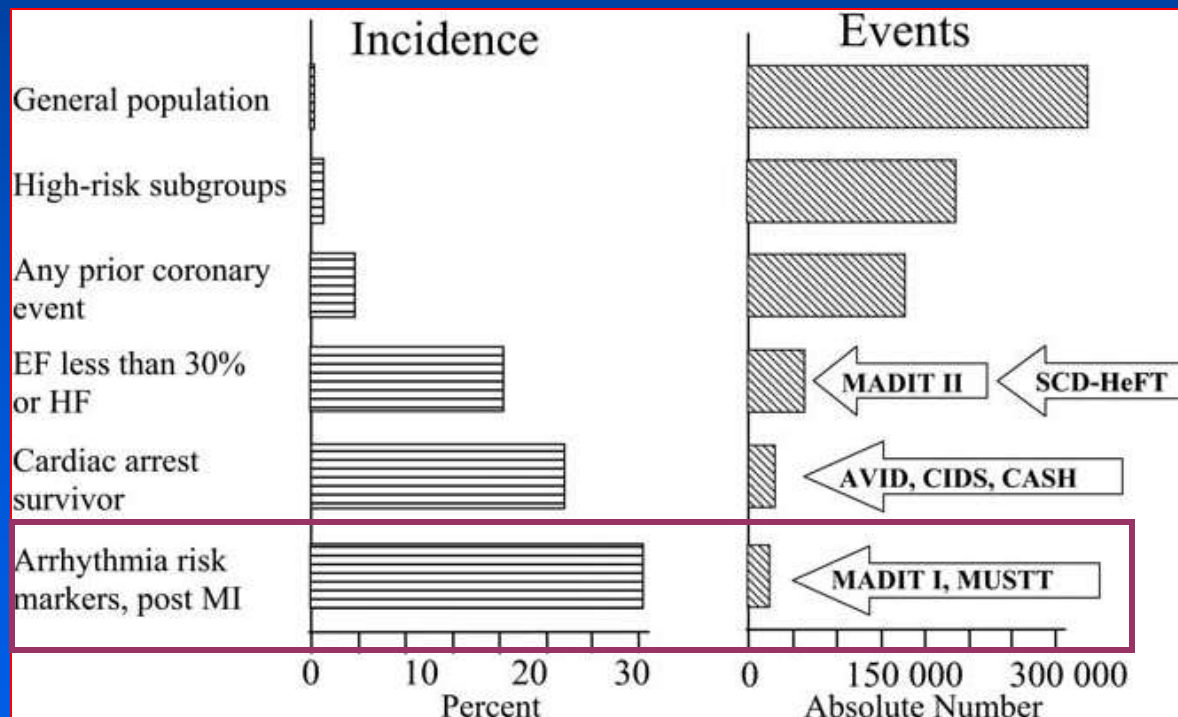
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Epidemiology

- 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 sinus tachycardia
- Holter monitoring with 24-hour, worse
- 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.

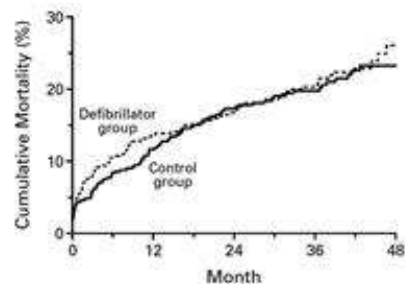
Post MI : risk of SCD

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

Secondary prevention trials

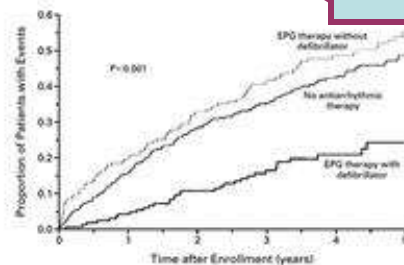
CAD: Cardiomyopathy

CABG-Patch



Defibrillator group	446	384	313	213	61
Control group	454	399	308	199	57

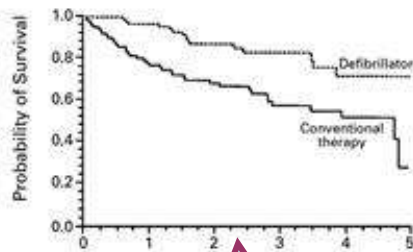
MUSTT



EF \leq 0.40

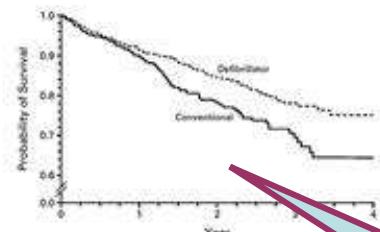
- NSVT within the last 6 months
- \geq 4 days post-MI or revascularization

MADIT

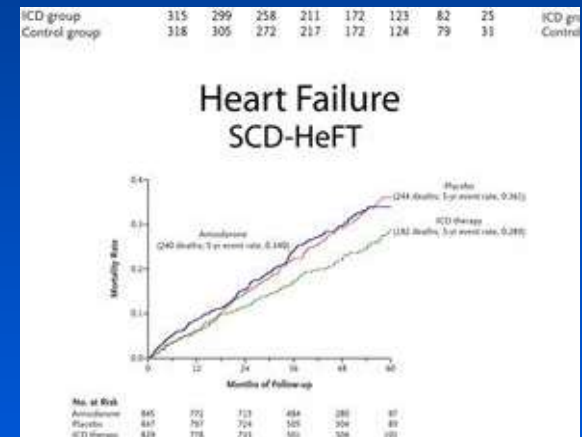


No. of Patients	95	80	5	31	17	3
Defibrillator						

MADIT-II



No. at Risk	142	502 (0.91)	274 (0.84)	110 (0.75)	9
Defibrillator					
Conventional	480	329 (0.80)	170 (0.76)	63 (0.88)	7



LVEF \leq 0.35

- >3 weeks post-MI
- >2 months post-CABG
- >3 months post-PTCA

EF \leq 0.30

- >1 month after MI
- >3 months after revascularization

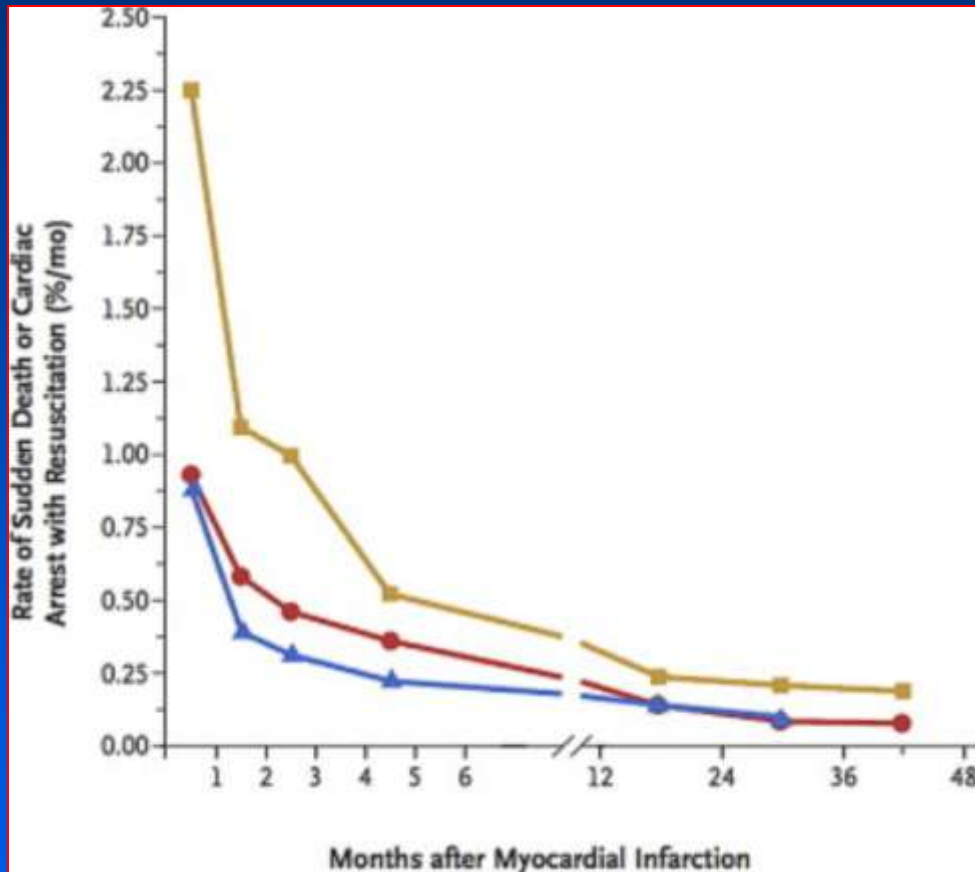
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VALIANT



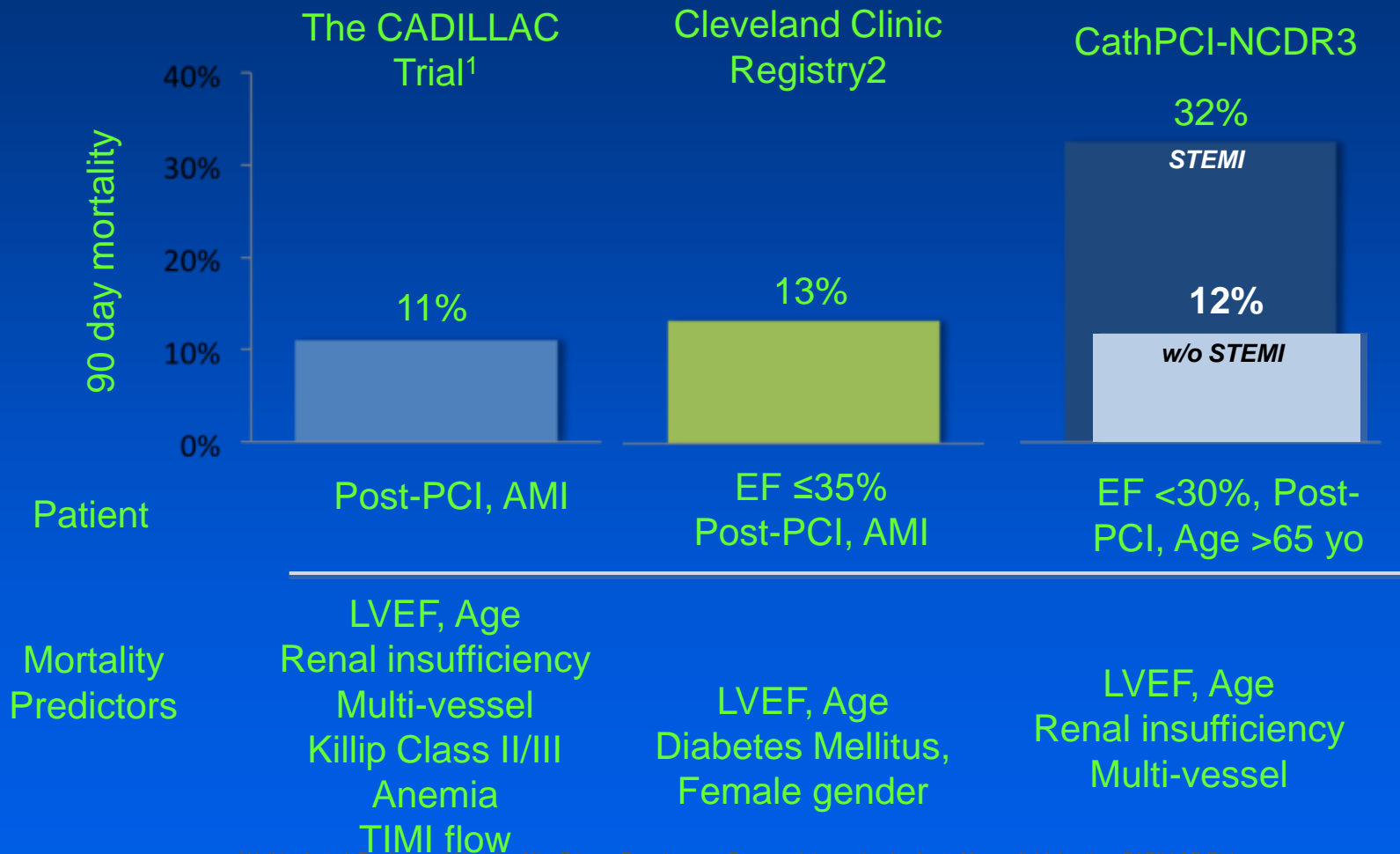
Acute MI
LVEF <30%
Heart failure symptoms

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




¹Halkin, A et al. Prediction of Mortality After Primary Percutaneous Coronary Intervention for Acute Myocardial Infarction: CADILLAC Risk Score. JACC 2005;45:1397-1405.

²Ziahin ET, et al. Early Risk of Mortality after Coronary Artery Revascularization in Patients with Left Ventricular Dysfunction and Potential Role of the Wearable Cardioverter Defibrillator. Circulation: Arrhythmia and Electrophysiology. 2013;6: 117-123

³Weintraub et al. Prediction of Long-Term Mortality After Percutaneous Coronary Intervention in Older Adults: Results From the National Cardiovascular Data Registry. Circulation 2012;125:1601-1610.

The CADILLAC Trial

Risk Factors	Score
Baseline LVEF <40%	4
Renal Insufficiency	3
Killip Class II/III	3
Age >65	2
Final TIMI flow 0-2	2
Three-Vessel Disease	2
Anemia	2



CADILLAC Risk Score	Risk Category
Score ≥ 6	High
Score 3-5	Intermediate
Score 0-2	Low

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

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Post MI, LVEF <40% and HF

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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
-

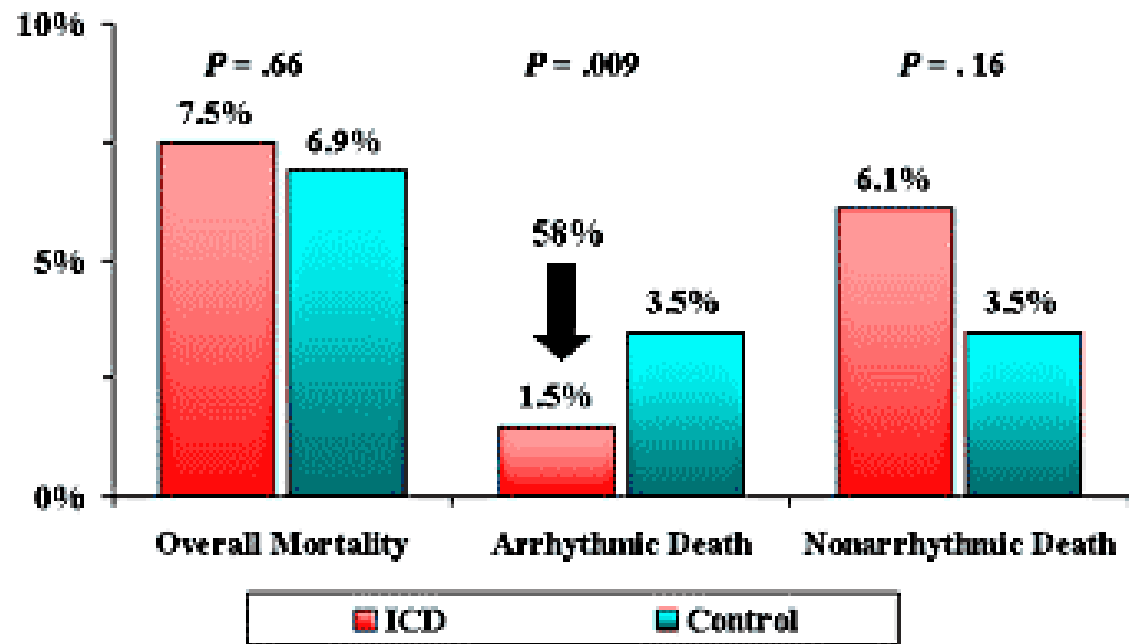
674 patients enrolled,
Average age: 61 years

- 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)

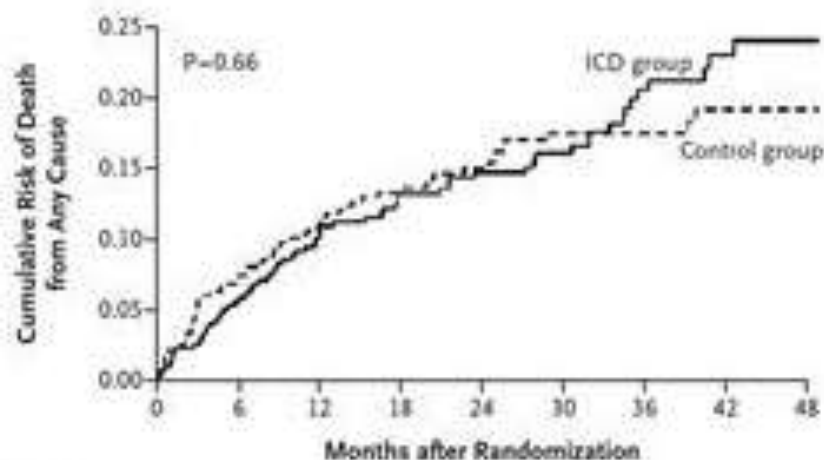


Immediate Risk Stratification Improves Survival Study (IRIS)

<p>MI in the past 5–31 days and either:</p> <ul style="list-style-type: none">• EF \leq40% and initial HR >90 bpm• NSVT >150 bpm	<p>898 enrolled, Average age: 63 years</p> <ul style="list-style-type: none">• 77% male• EF: 0.35 <p>Index MI:</p> <ul style="list-style-type: none">• 64% anterior• 77% STEMI• Reperfusion: 77%• 72% PCI• 16% thrombolysis (+/- PCI) <p>445 received ICDs</p>	<p>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)</p> <ul style="list-style-type: none">• 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)
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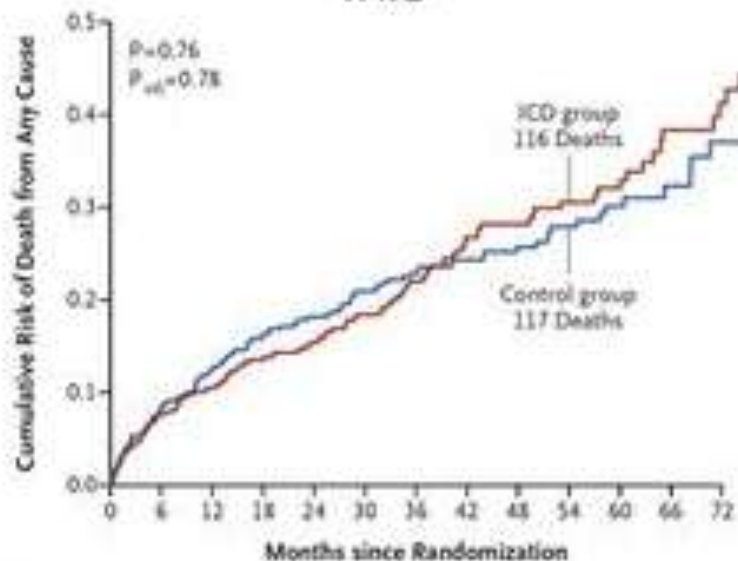
CAD: Acute MI

DINAMIT



at Risk	0	6	12	18	24	30	36	42	48
ICD group	315	299	258	211	172	123	82	25	
Control group	318	305	272	217	172	124	79	31	

IRIS



No. at Risk	0	6	12	18	24	30	36	42	48	54	60	66	72
ICD group	445	390	366	338	303	253	207	163	137	106	78	48	40
Control group	453	410	380	336	307	267	230	187	151	118	79	49	36

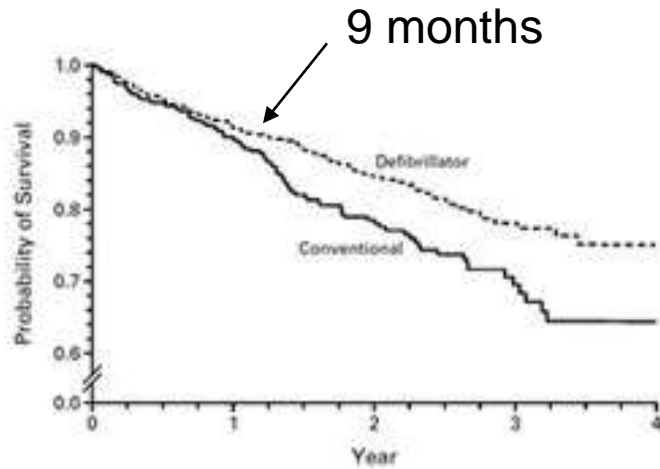
Post MI : risk of SCD

- Within 48 hours
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- > 3 months - revascularization

Acute MI : sudden cardiac death paradox

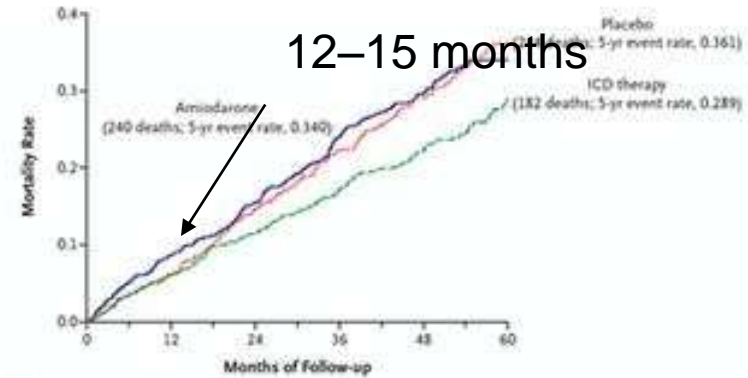
- SCD : 50 - 80% non arrhythmic : LV rupture, acute MI, recurrent MI. By 1 year : 50% arrhythmic deaths.
- Defibrillator shocks can result in injury to the myocardium, and that ventricular function can be further impaired as a consequence of backup ventricular pacing.

MADIT-II



No. at Risk	0	1	2	3	4
Defibrillator	742	503 (0.91)	274 (0.84)	110 (0.78)	9
Conventional	490	329 (0.90)	170 (0.78)	65 (0.69)	3

Heart Failure SCD-HeFT



No. at Risk	0	12	24	36	48	60
Amiodarone	845	772	715	484	280	97
Placebo	847	797	724	505	304	89
ICD therapy	829	778	733	502	304	103

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

Answer

Post MI, LVEF <40% and HF

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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/m^2 (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

Case 2

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.

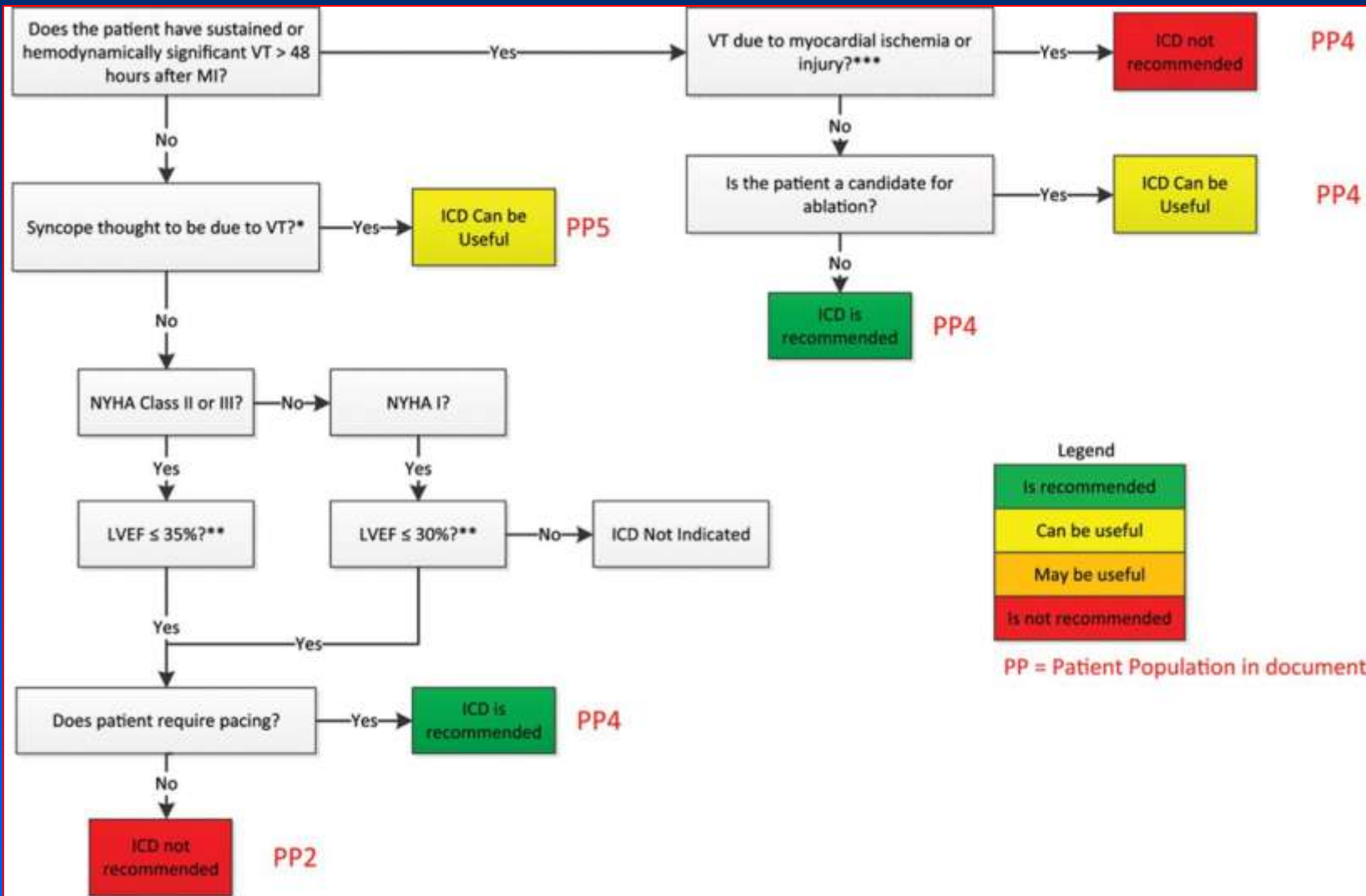
What next, upon recovery

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.

HRS/ACC/AHA Expert Consensus Statement on the Use of ICD Therapy in Patients Who Are Not Included or Not Well Represented in Clinical Trials

- 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

*And no evidence of ischemia.

**And recovery of left ventricular function is uncertain or not expected.

***And can be successfully treated with revascularization.

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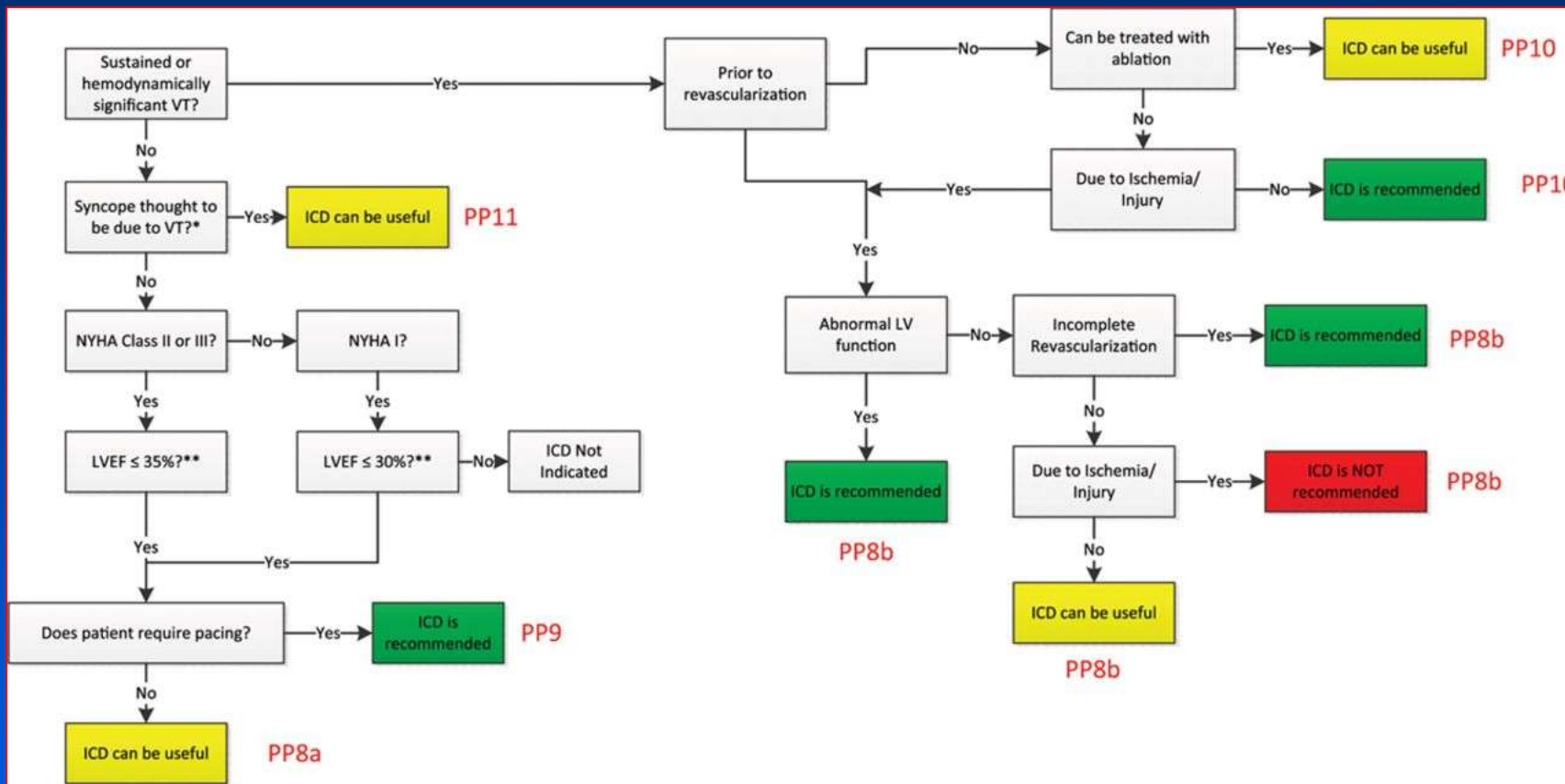
Case 3

- 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.



PP = Patient Population in document

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

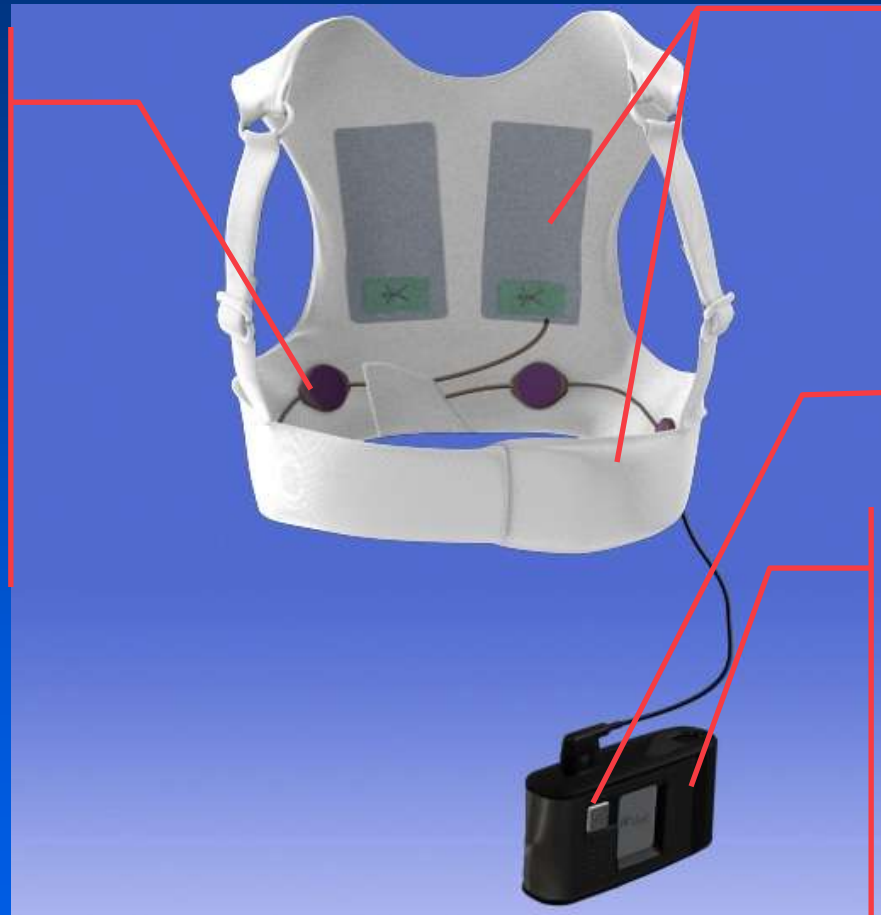
WCD

- Retrospective evaluation of 4958 patients with $EF \leq 0.35$ 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

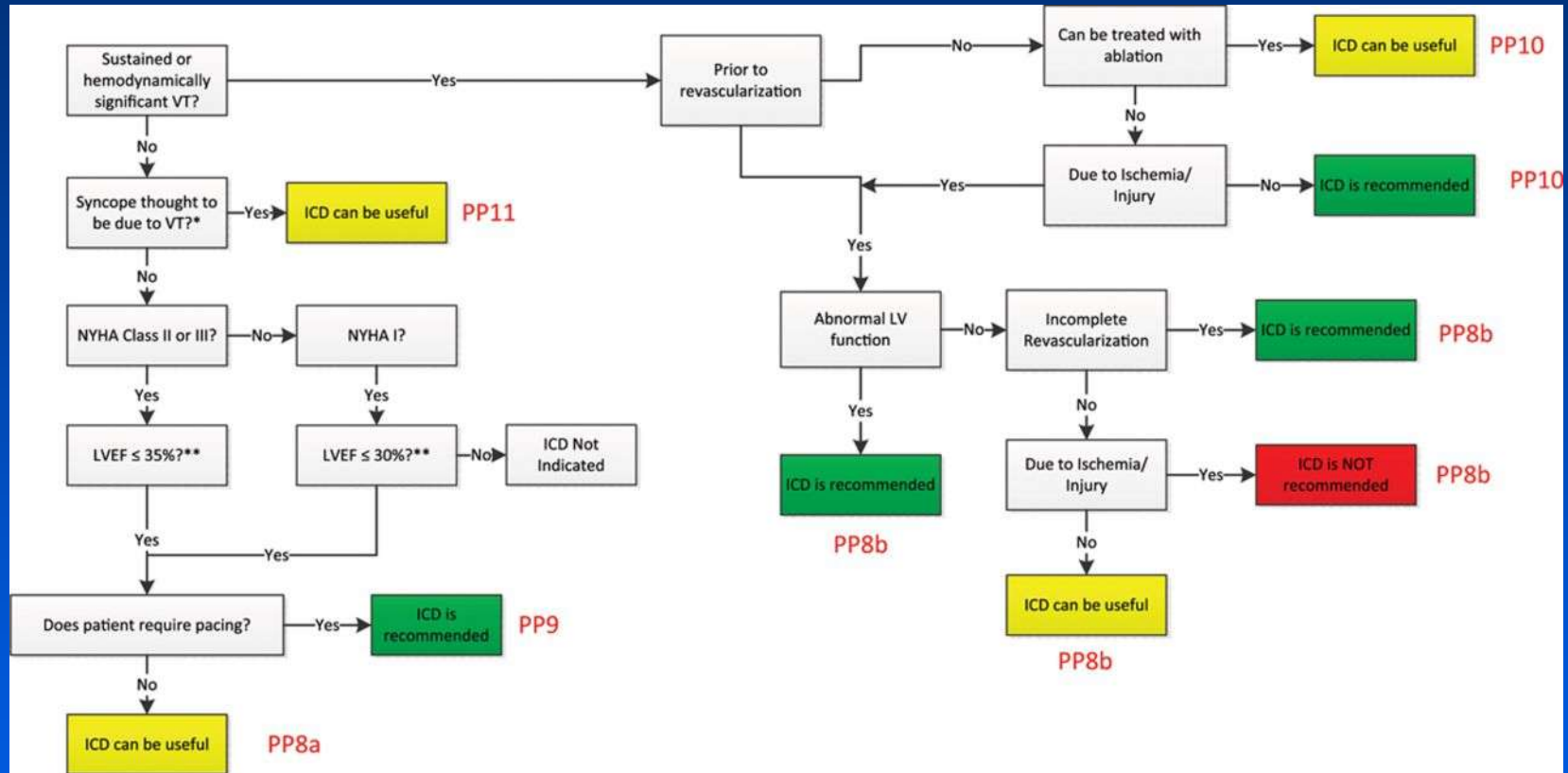
Monitor

- 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.



*And no evidence of ischemia.

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