Indication of Wearable Defibrillator (lifevest)

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Case study

48 yo LAM had recent ant MI s/p LAD stenting with Ef of 30%. He was dc home with medical therapy. Two weeks later, he sustained VF arrest at home with a long delay to CPR. the stent was patent on repeat cardiac cath but pt suffered significant anoxic encephalopathy.

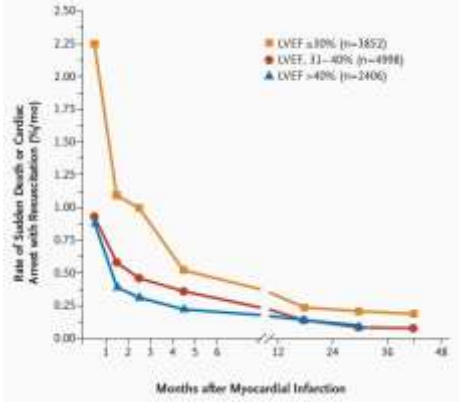
80 yo male with recently dx NIDCM CHF and non sus VT which was not inducible for VT. Send home with lifevest. He received a shock two weeks later for VF and he received ICD at that time.

Patient's Changing Condition
Multiple Considerations To Balance

- **The risk of sudden cardiac death post-MI is the highest in the first 30 days[1,2]**
  - Post-MI patients with heart failure are at 4-6 times greater risk of sudden cardiac death in the first 30 days after MI
- **Patient condition can improve from the benefits of optimized medical therapy[3]**
  - Significant improvements in EF are observed over the initial 8-10 weeks post-MI
  - REFINE Study average relative improvement in EF was 18% at 8-10 weeks

[1] Adabag AS, et al. Sudden Death After Myocardial Infarction. JAMA 2008; 300: 2022-2029.
[2] Solomon SD, et al. Sudden Death in Patients with Myocardial Infarction and Left Ventricular Dysfunction, Heart Failure, or Both. NEJM 2005; 352: 2581-2588.
[3] Exner DV. Non-invasive Risk Stratification Early After a Myocardial Infarction—The Risk Estimation Following Infarction Non-invasive Evaluation (REFINE) Study. J Am Coll Cardiol. 2007; 50: 2275-2284.

VALIANT Trial
High Early Risk of SCA



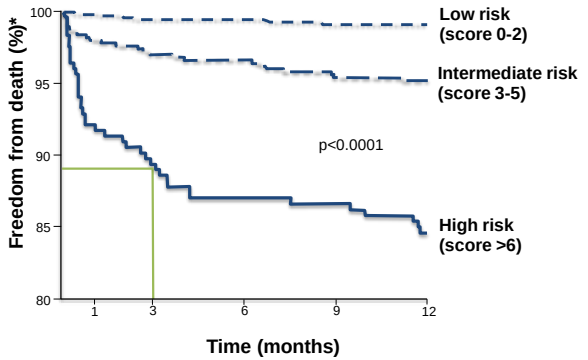
Post-MI patients with heart failure are at 4-6 times greater risk of SCA in the first 30 days post-MI[1]

- **83% of SCA occurred after hospital discharge.**
- **74% of those resuscitated in the first 30 days were alive at 1 year**

[1] Solomon SD, et al. Sudden Death in Patients with Myocardial Infarction and Left Ventricular Dysfunction, Heart Failure, or Both. NEJM 2005; 352: 2581-2588.

The CADILLAC Trial

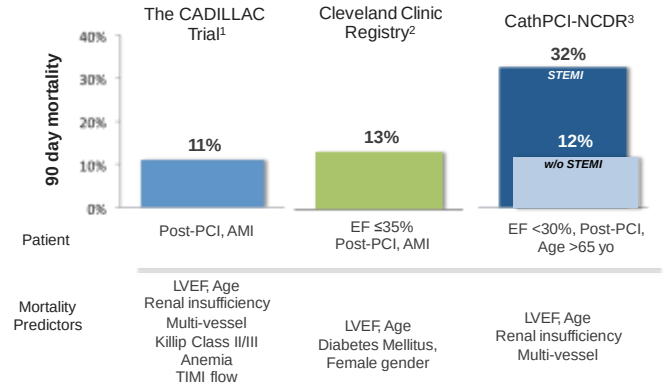
High Early Mortality Post-PCI



** 60% of mortality due to SCD[1]*

[1]Stone, G et al. "Prevention of Sudden Cardiac Arrest Post PTCA in High-Risk Patients." April 2011. Available at http://www.theheart.org/article/1202823.do.

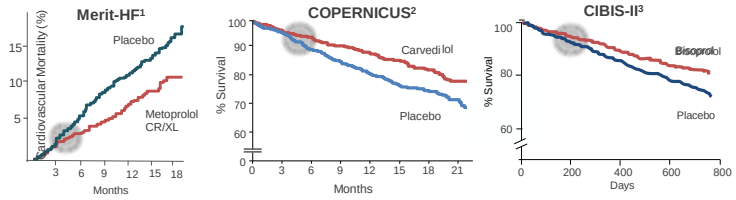
Wealth of Evidence Supports Post-PCI Risk



[1] Halkin, A et al. Prediction of Mortality After Primary Percutaneous Coronary Intervention for Acute Myocardial Infarction: CADILLAC Risk Score. JACC 2005;45:1397-1405.
[2] Zishiri 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: 117-128
[3] Weintraub et al. Prediction of Long-Term Mortality After Percutaneous Coronary Intervention in Older Adults: Results From the National Cardiovascular Data Registry. Circulation 2012;125:1501-1510.

Medical Therapy Optimization Required
Prior To Managing Long-Term Arrhythmic Risk

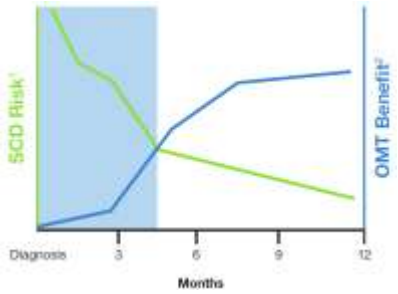
- **Medical optimization and stabilization can take 3 months or more.**
  - Beta blocker doses effective in HF are generally achieved in 8 to 12 weeks and do not impart any mortality benefit until at least 3 months



[1] Merit-HF Study Group. Effect of metoprolol CR/XL in chronic heart failure: Metoprolol CR/XL Randomized Intervention Trial in Congestive Heart Failure (MERIT-HF) *Lancet* 1999;353:2001-7.
[2] Packer M, et al. Effect of Carvedilol on survival in severe chronic heart failure. NEJM 2001;344:1651-8.
[3] CIBIS-II Investigators. The Cardiac Insufficiency Bisoprolol Study II (CIBIS-II). Lancet 1999;353:9-13.

Medical Therapy Optimization
Opportunity for SCD Risk Protection

- **LifeVest provides SCD protection during medical therapy optimization while a patient's risk is changing**



[1] Solomon SD, et al. Sudden Death in Patients with Myocardial Infarction and Left Ventricular Dysfunction, Heart Failure, or Both. NEJM 2005; 352: 2581-2588.
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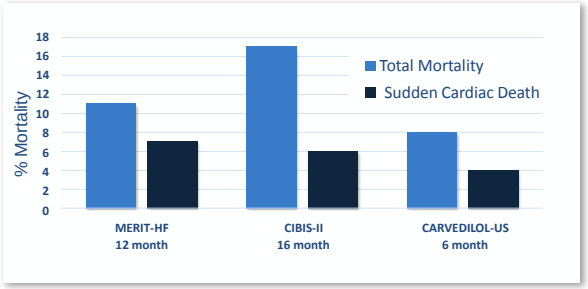
Understanding the Risk
LV Systolic Dysfunction and SCD Risk

- **SCD accounted for ~50% (35-64%) of total mortality**[1,2,3]
  - EF was the single most important risk factor for SCD



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2 CIBIS-II Investigators. The Cardiac Insufficiency Bisoprolol Study II (CIBIS-II). *Lancet* 1999;353:9-13.
3 Packer M, et al. The Effect of Carvedilol on Morbidity and Mortality in patients with Chronic Heart Failure. NEJM 1996; 334(21):1349

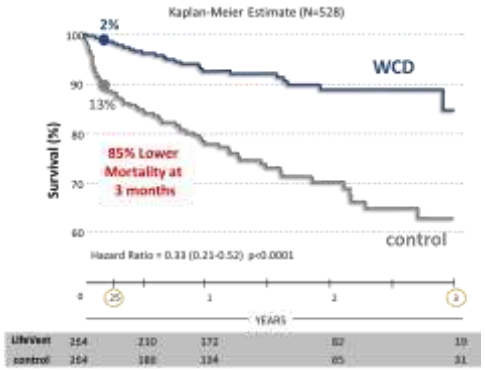
Cleveland Clinic Post-PCI Registry
Conclusions

- **Patients with LVEF ≤35% have higher early compared to late mortality after coronary revascularization**
- **Post-PCI patients with EF ≤35% who were prescribed the WCD had:**
  - 85% lower 90-day total mortality (2%) compared to a matched cohort of patients not prescribed the WCD (13%)
- **WCD use associated with significant reduction in total mortality in patients with EF ≤35% following PCI**
  - 57% lower risk of death ($p<0.0001$) over a mean follow-up of over 3 years in the total post-PCI cohort
  - Following the end of WCD use, a persistent survival benefit was observed out to 3 years

Zishiri 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: 117-128

Cleveland Clinic Post-PCI Registry

LifeVest use associated with improved survival



- **Post-PCI low EF (≤35%) patients prescribed LifeVest had an 85% lower 90-day mortality** (2%) compared to a matched cohort of patients not prescribed LifeVest (13%)
- **WCD use associated with a 57% lower risk of death** (p<0.0001) over a mean follow-up of over 3 years in the total post-PCI cohort

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FDA Indications for Use

- **The LifeVest System is indicated for patients* who are at risk for sudden cardiac arrest and are not candidates for or who refuse an implantable defibrillator.**

*Patients under 18 years of age must have a chest circumference of 26 inches (66 centimeters) or greater, and a weight of 18.75 kilograms (41.3 pounds) or greater.

LifeVest System

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

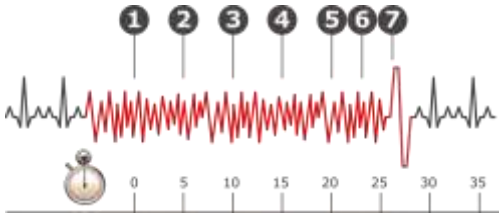
Self-Gelling Defibrillation Electrodes

Response Buttons
- *May be used by patients to delay treatments*

Monitor
- *150 joules biphasic*
- *Stores ECG, activity, heart rate, etc.*

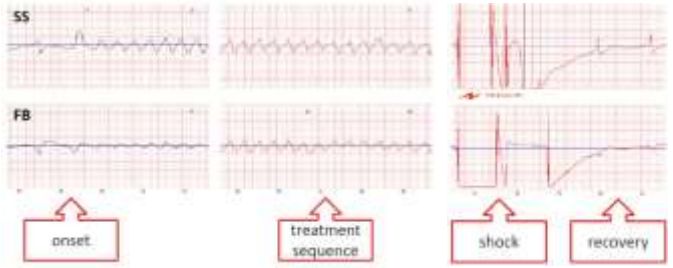
LifeVest Patient Example

Treatment Sequence



1. Arrhythmia detected, activating vibration alert (continues throughout sequence).
2. Siren alerts begin (continues throughout sequence).
3. Siren alerts get louder.
4. Patient audible prompt: “Press response buttons to delay treatment.”
5. Gel release.
6. Bystander audible prompt: “Bystanders, do not interfere.”
7. Treatment shock.

Example Event ECG



WEARIT-II
Study Purpose

- **To provide prospective data on:**
  - **The safety and efficacy of the LifeVest Wearable Cardioverter Defibrillator (WCD) in a real world setting**
    - Characterize the patients prescribed with WCD
    - Assess the risk for sustained ventricular tachyarrhythmic events among at-risk patients during WCD use by disease etiology
    - Identify the rate of ejection fraction improvement and the need for ICD implantation at the end of WCD use
  - **One-year outcomes of patients prescribed the WCD**

WEARIT-II
Registry Design & Follow-Up

WEARIT-II
Study Population

A prospective registry of 2,000 patients prescribed the LifeVest

- Data collection: Aug 2011-May 2015
- Data management: University of Rochester
- Ejection Fraction (median) = 25%

WEARIT-II
Baseline Characteristics

	All Patients N=2000	Ischemic N=805	Non-ischemic N=927	Cong/Inherited N=268
Age, years (median)	62	65	59†	59*
Female	30%	23%	36%†	30%*
EF (median)	25%	30%	25%†	25%*
HF symptoms	52%	48%	52%	63%*
Diabetes	28%	35%	21%†	30%*
Prior ACA	9%	11%	7%†	7%

*p-value < 0.05 ischemic, non-ischemic, congenital/inherited, †p-value < 0.05 ischemic, non-ischemic
Data are reported by patients using a baseline evaluation form.

WEARIT-II
Arrhythmic Events

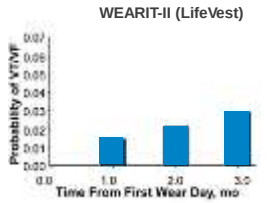
- 1 in 14 patients diagnosed with an arrhythmia requiring intervention while wearing the LifeVest

	Patients (%)	Events (events/pt)	Event Rate Per 100 Pt-Year
Any Sustained VT/VF *	41 (2.1%)	120 (2.9)	22
WCD Therapy for VT/VF	22 (1.1%)	30 (1.36)	5
Non-sustained VT	28 (1.4%)	164 (5.9)	30
Atrial arrhythmias/SVT	72 (3.6%)	561 (7.8)	101
Asystole	6 (0.3%)	9 (1.5)	2

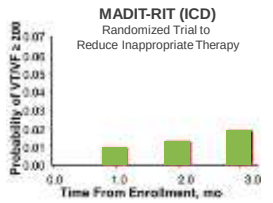
*Treated VT/VF and sustained VT's that spontaneously terminated during the use of the response button or during the extended detection time

WEARIT-II
Treatment Rate

- The treatment rate with the LifeVest was high at 5 events per 100 patient-years.
  - ICD treatment rate in MADIT-RIT[1] was 3 events per 100 patient-years



LifeVest Response Buttons:
Use of WCD response button, by a conscious patient, extends detection time



Device programming:
High heart-rate threshold at ≥200 bpm (Arm B) or Initial 60 sec duration-delay at ≥170 bpm (Arm C)

1. Moss AJ, Schuger C, Beck CA, et al. (2012) Reduction in inappropriate therapy and mortality through ICD programming. N Engl J Med 367(24):2275-83.

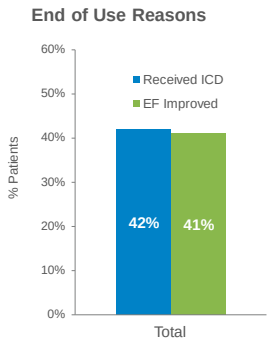
WEARIT-II
Low Occurrence of Inappropriate Therapies

Type	Total N=2000
Inappropriate Treatment, n (%)	10 (0.5%)
Death, n (%) with the WCD	3 (0.2%)*

* LifeVest detected asystole at the time of death in all 3 patients
No death related to unsuccessful termination of VT/VF

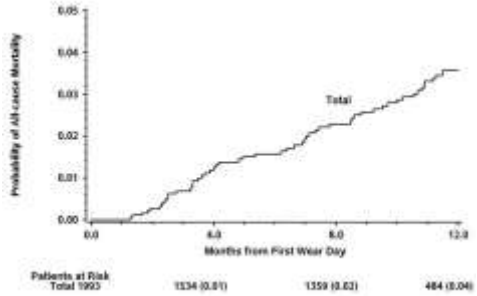
WEARIT-II
Outcomes Following WCD Use

- **At the end of LifeVest Use**
  - 41% of patients demonstrated improved LVEF did not need an ICD
  - 42% of patients had an LVEF that did not improve and received an ICD



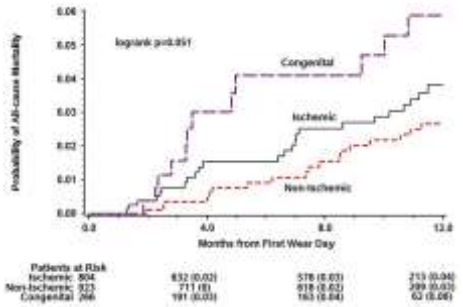
WEARIT-II
One-Year All-Cause Mortality

- One-Year survival following use of the LifeVest across all patients was high at 96%.



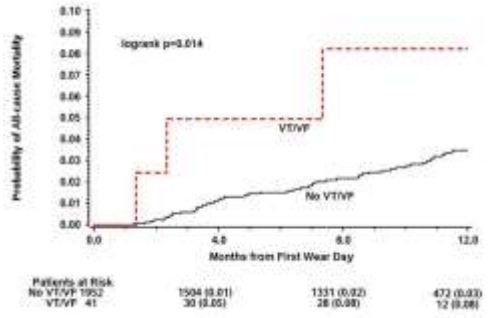
WEARIT-II
All-Cause Mortality by Disease Etiology

- No meaningful difference in one-year survival between patients with ischemic and non-ischemic cardiomyopathy.



WEARIT-II
All-Cause Mortality after VT/VF event

- **One-year survival for patients who experienced VT/VF during use of the LifeVest was high at 92%.**



WEARIT-II
Conclusions

The LifeVest can be used as part of a strategy for managing patients at risk of sudden cardiac death.

- High one-year survival rate
- Risk assessment tool to identify patients at higher risk for SCD who need subsequent ICD implantation
- Very low rate of inappropriate therapies
- Safe, no death related to LifeVest

PREDICTS Study

2400 pts randomized post MI with EF <= 35% for lifevest vs regular care.

Primary outcome SCD occurrence in the first three months post MI.

Study results will be announced in the late breaking trials at ACC this March.

LifeVest

- **Primary prevention (EF≤35% and MI, NICM or other DCM) including:**
  - After recent MI (Coverage during the 40 day ICD waiting period)
  - Before and after CABG or PTCA (Coverage during the 90 day ICD waiting period)
  - Listed for cardiac transplant
  - Recently diagnosed nonischemic cardiomyopathy
    Terminal disease with life expectancy of less than 1 year
- **ICD indications when patient condition delays or prohibits ICD implantation**
- **ICD explantation**