Don’t Go Breaking My Heart: Imaging & Prognosis in Takotsubo’s

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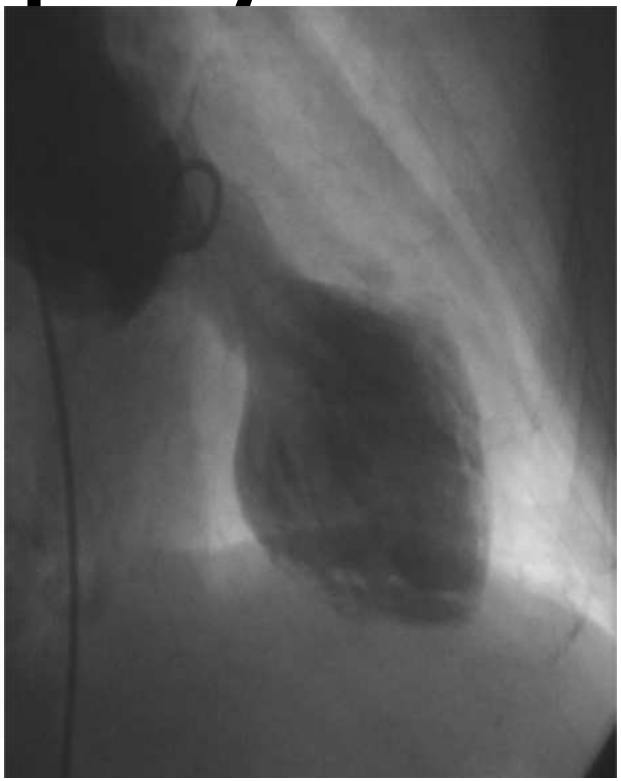
with Advice from Andrew Crean, M.D.

Takotsubo: Stress Cardiomyopathy



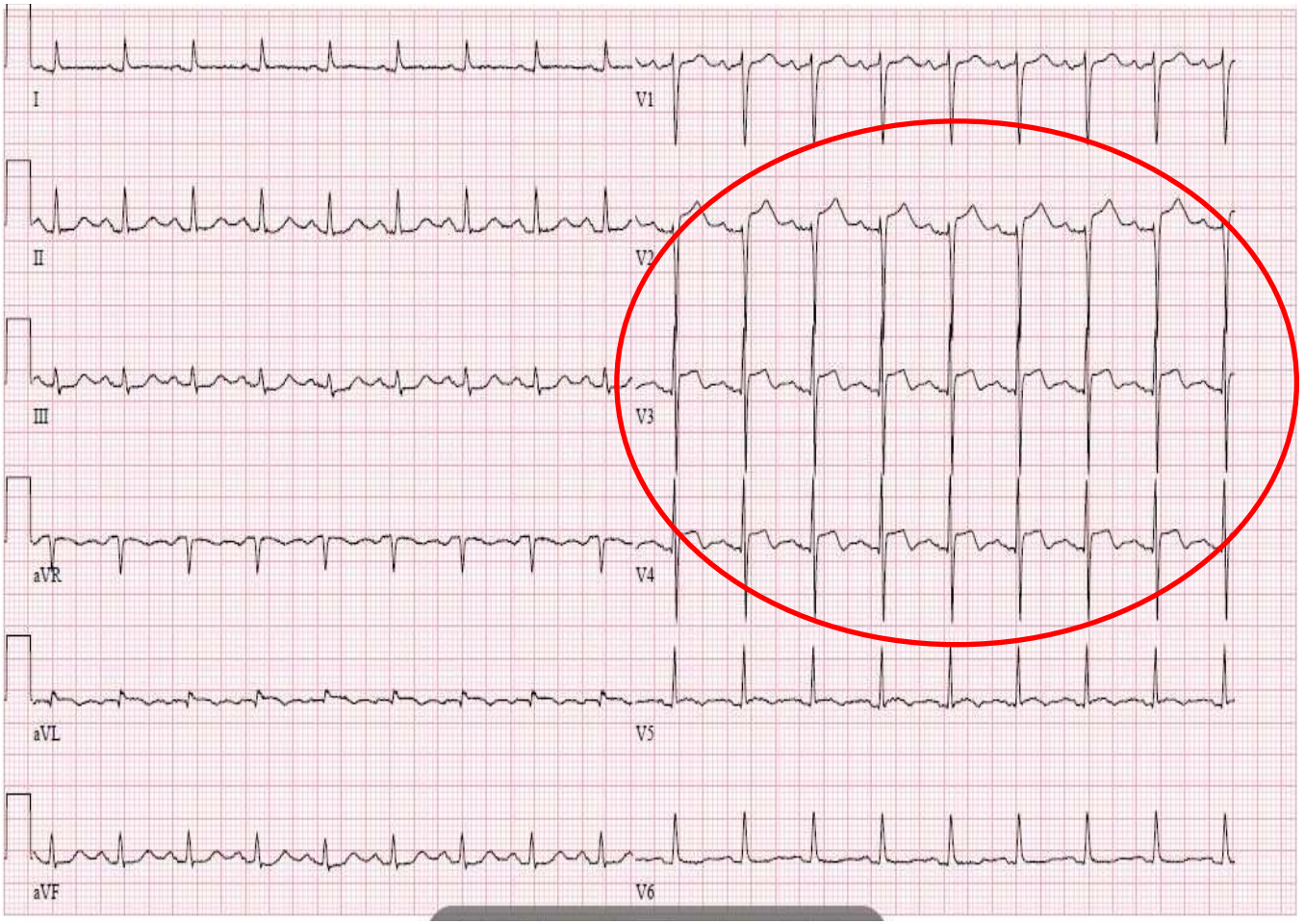
Japanese octopus fishing pot - a ‘takotsubo’

(artwork by Dr David Northridge, Consultant Cardiologist, Edinburgh Royal Infirmary).

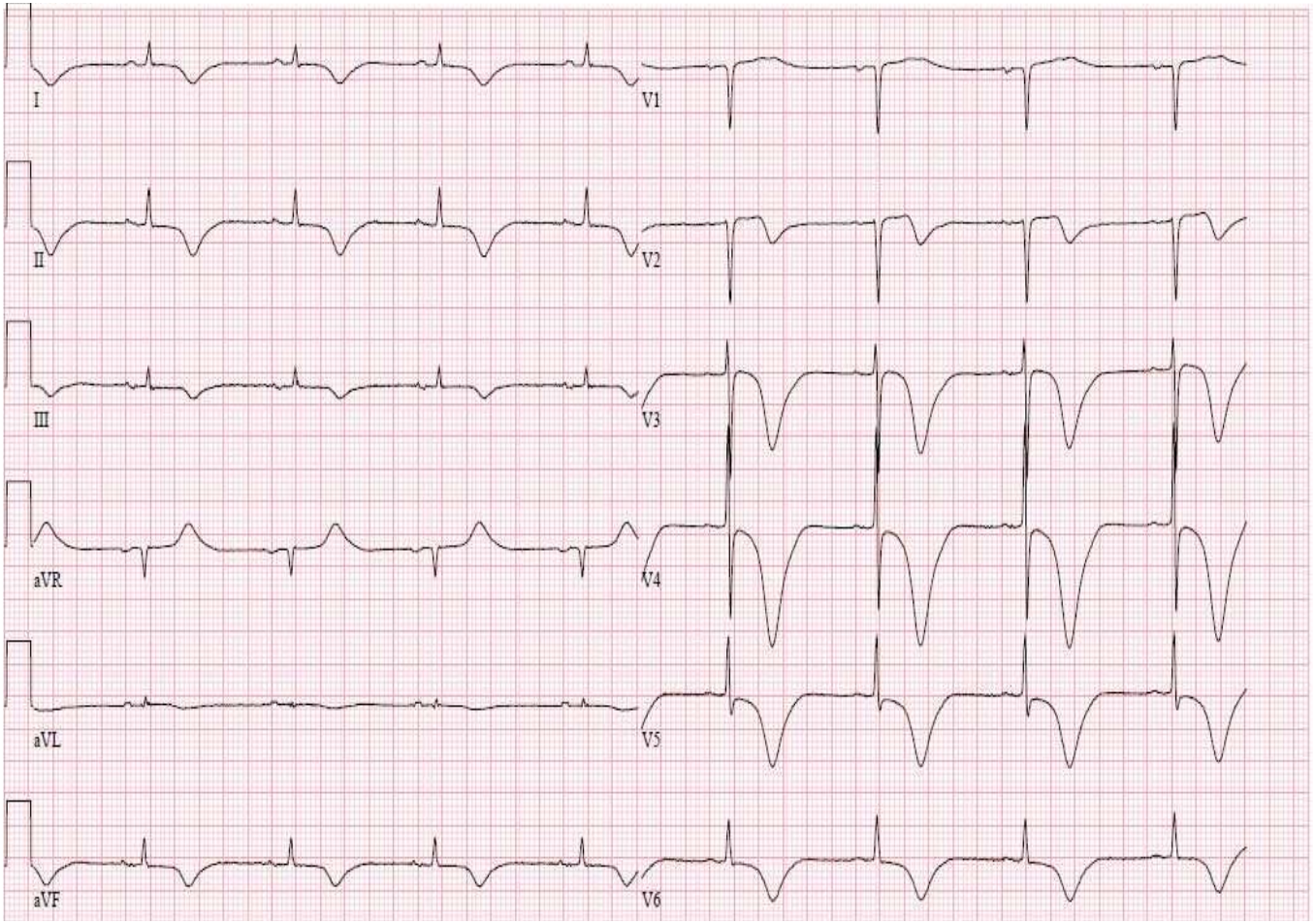
Case History

- **69 yo female, presented with 6 hr of L shoulder and arm pain**
  - Long standing hypertension, panic disorder
  - ECG showed ST elevation in leads V2-V5
  - hsTn = 490 ng/L (Nml < 50 ng/L)
  - NTproBNP = 4,300 ng/L (pg/ml)
  - Echo showed hypokinesis of lateral and inferior walls
- **Coronary Angiogram = Minor lesions only**
- **Additional history**
  - Brother died 3 days ago – Pt is now

ECG: Presentation

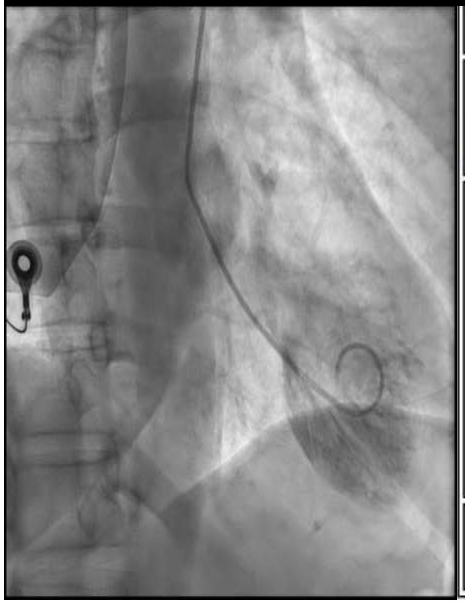


ECG: Day 3 post Presentation

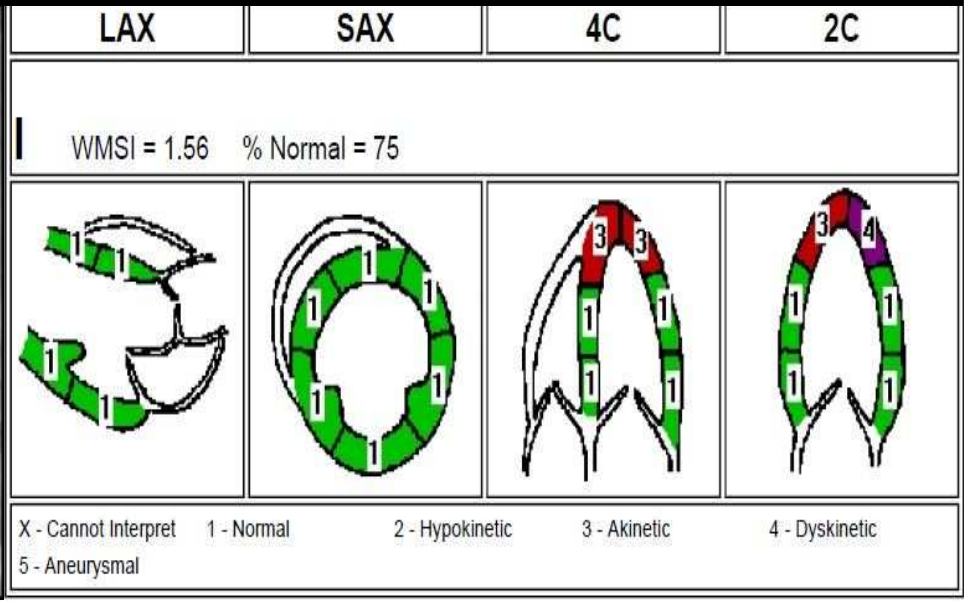


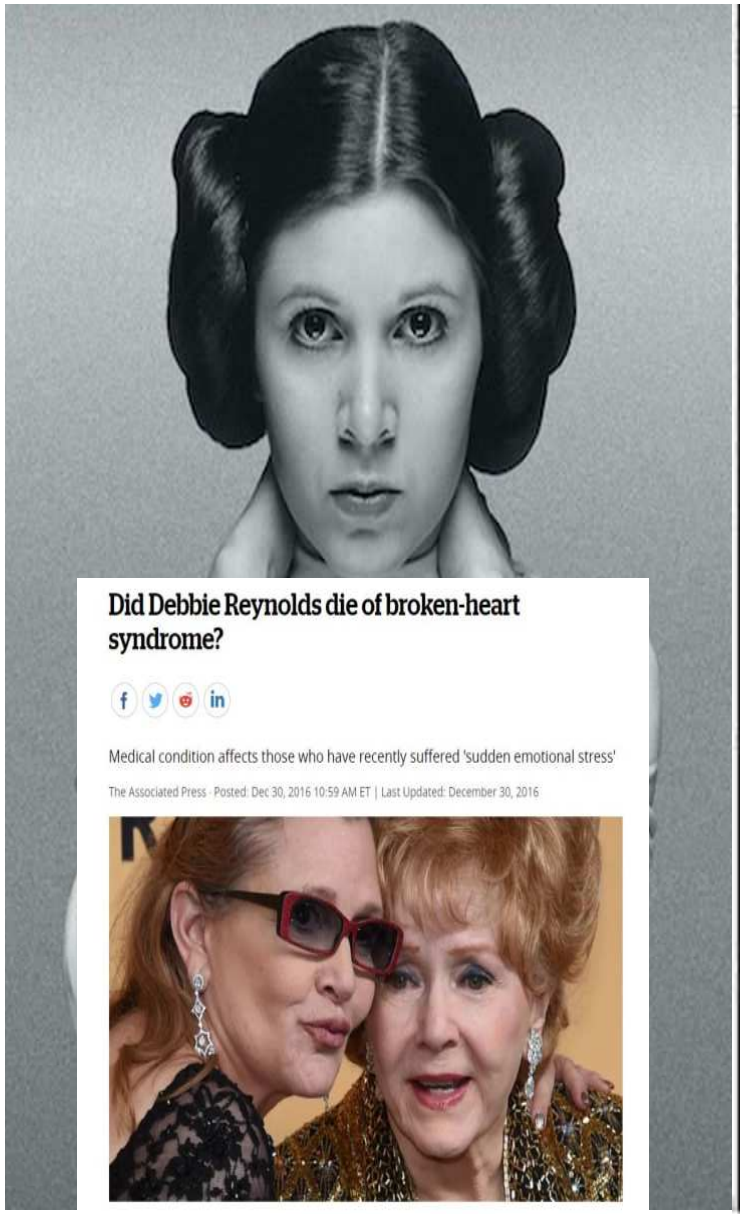
LV Gram & Echo: Stress Takotsubo

Day 1 LV Angio



Day 2 Echocardiogram





Did Debbie Reynolds die of broken-heart syndrome?

Medical condition affects those who have recently suffered 'sudden emotional stress'

The Associated Press · Posted: Dec 30, 2016 10:59 AM ET | Last Updated: December 30, 2016

European Heart Journal (2016) **37**, 2821–2822
doi:10.1093/eurheartj/ehw197

VIEWPOINT

Positive emotions and Takotsubo syndrome: 'happy heart' or 'Diagoras' syndrome?

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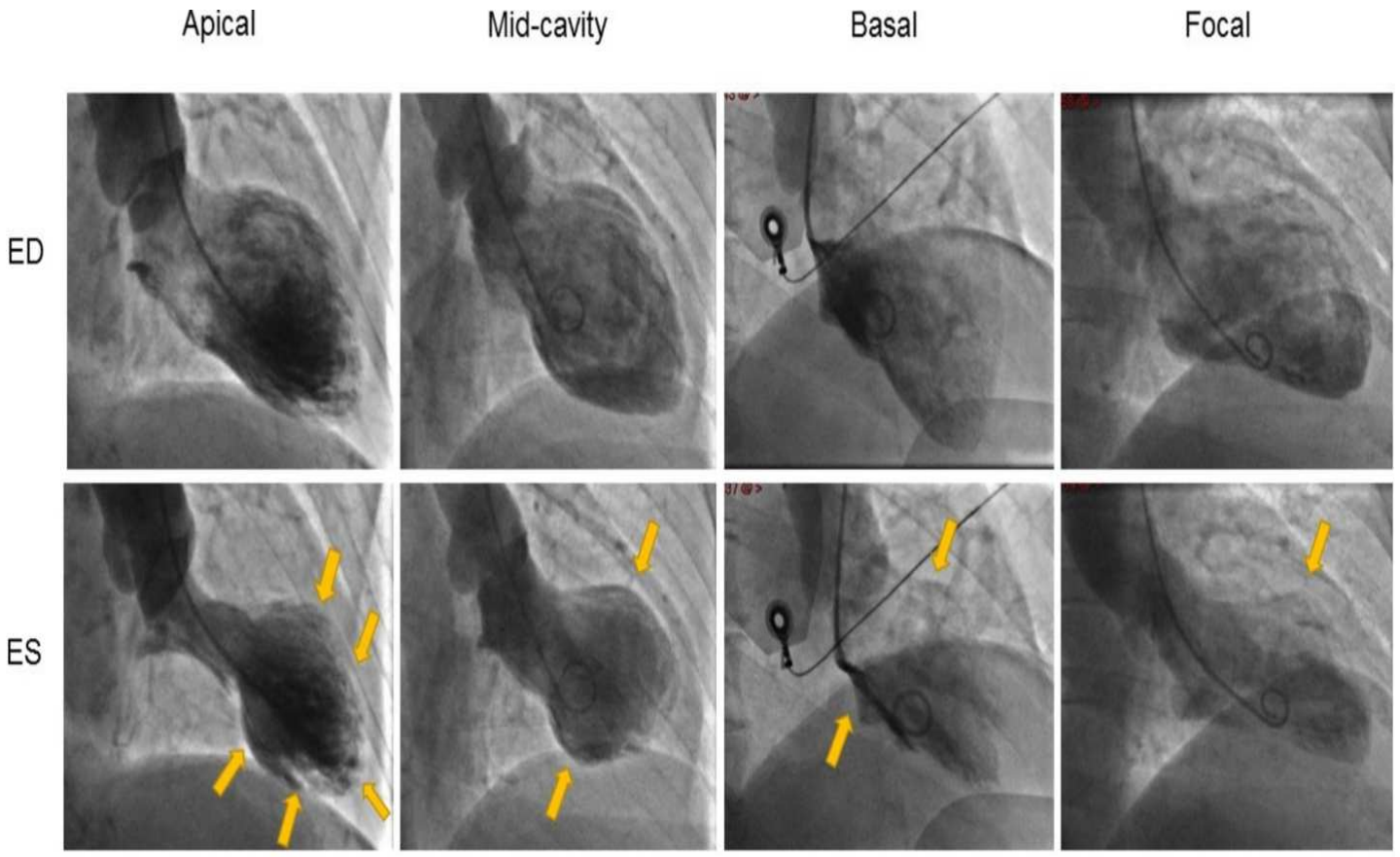
Monument to Diagoras family at the Greek island of Rhodes (a

Postal stamp depicting Diagoras carried on the shoulders of his two sons (1937).

Ballooning Patterns in Takotsubo



Dawson DK. Heart 2018; 104:96-102.

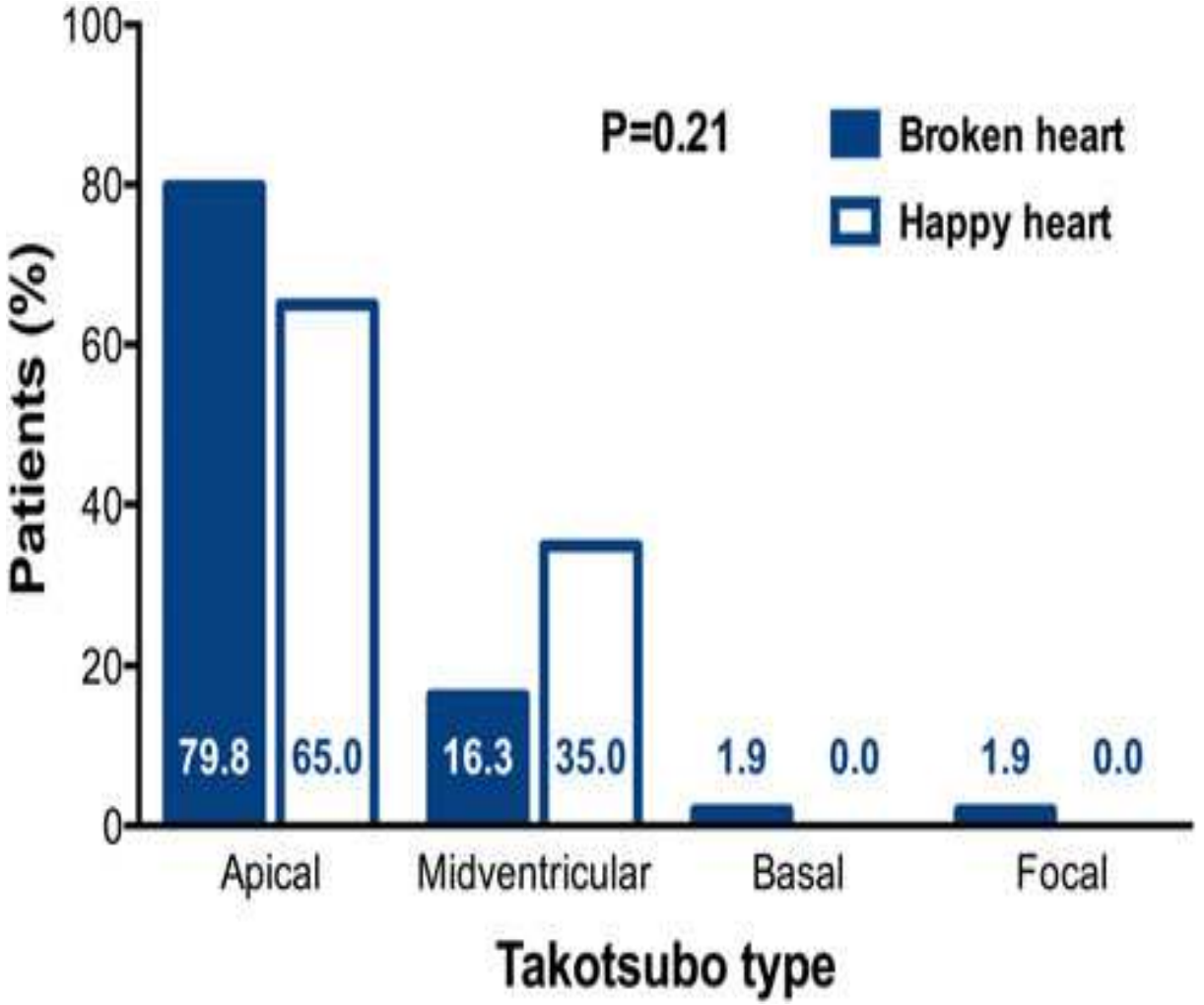


Figure 1 Overall distribution of takotsubo types in 'happy heart syndrome' vs. 'broken heart syndrome' (P=0.21). Post hoc P-values for comparison within takotsubo types showed a significantly higher prevalence of the midventricular takotsubo syndrome type in patients with 'happy heart' vs. 'broken heart' (P = 0.030), while no significant differences were seen in apical (P = 0.15), basal (P = 1.0), or focal (P =

Inter-TAK. European Heart Journal (2016) 37, 2823–2829

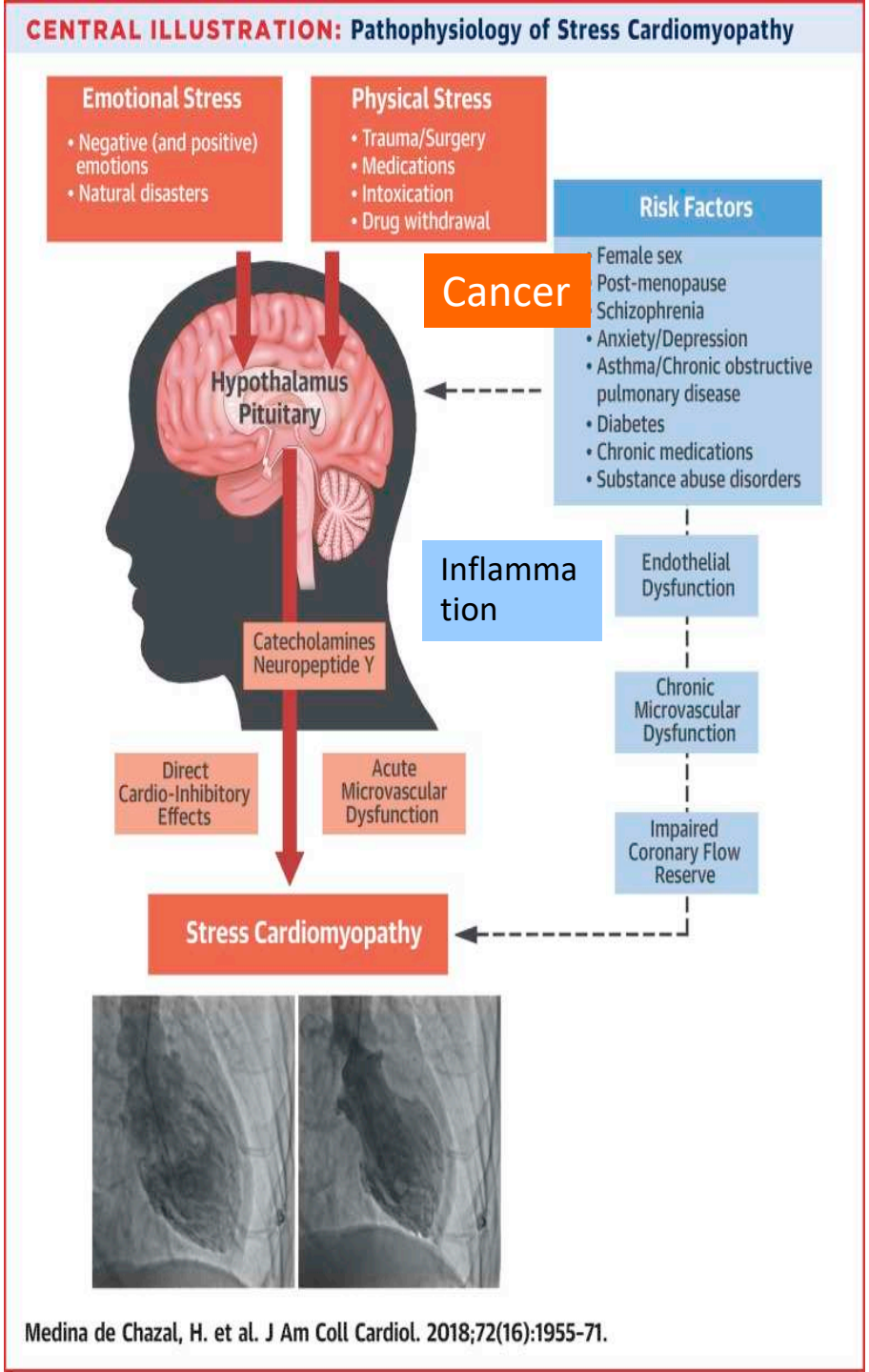
European Heart Failure Association Diagnostic Criteria

- 1. **Transient regional wall motion abnormalities** of left ventricular or right ventricular myocardium, which are frequently, but not always, preceded by a stressful trigger (emotional or physical).
- 2. The regional wall motion abnormalities **usually extend beyond a single epicardial vascular distribution,** and often result in circumferential dysfunction of the ventricular segments involved.
- 3. The **absence of culprit atherosclerotic coronary artery disease** including acute plaque rupture, thrombus formation, and coronary dissection or other pathologic conditions to explain the pattern of temporary left ventricular dysfunction observed (eg, hypertrophic cardiomyopathy, viral myocarditis).
- 4. **New and reversible electrocardiography abnormalities** (ST-segment elevation, ST depression, left bundle branch block, T-wave inversion, and/or QTc prolongation during the acute phase (3 months).
- 5. **Significantly elevated serum natriuretic peptide** (B-type natriuretic peptide or N -terminal pro B-type natriuretic peptide) during the acute phase.
- 6. **Positive but relatively small elevation in cardiac troponin** measured with a conventional assay (ie, disparity between the troponin level and the amount of dysfunctional myocardium present).
- 7. **Recovery of ventricular systolic function on cardiac imaging** at follow-up (3–6 months).

InterTAK Diagnostic Criteria

TABLE 3 InterTAK Diagnostic Score

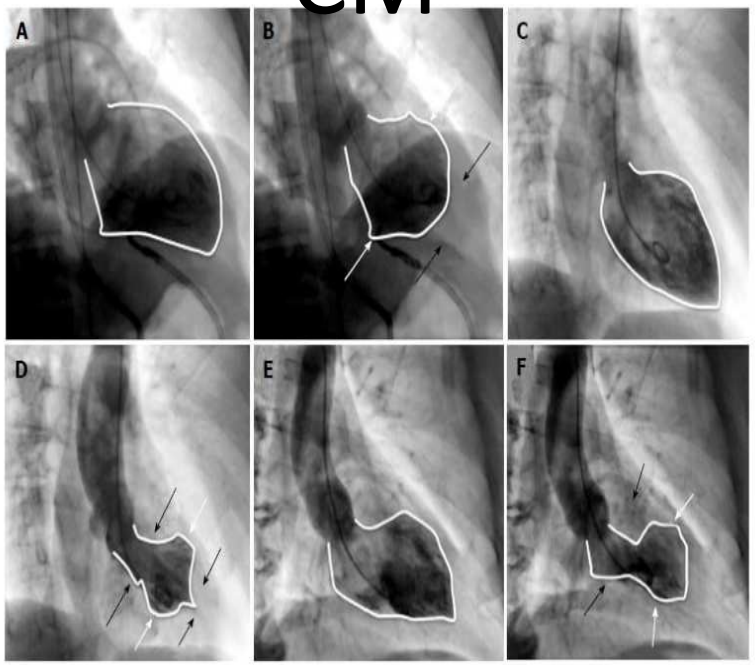
Criteria	Points	Our Case
Female	25	25
Emotional trigger	24	24
Physical trigger	13	-
Absence of ST-segment depression	12	12
Psychiatric disorders	11	11
Neurologic disorders	9	-
QTc prolongation	6	-
Diagnosis (Cutoff Value [Range 0-100])		
≥50	≤31	72
Takotsubo	Acute coronary syndrome	
(Specificity 95%)	(Specificity 95%)	

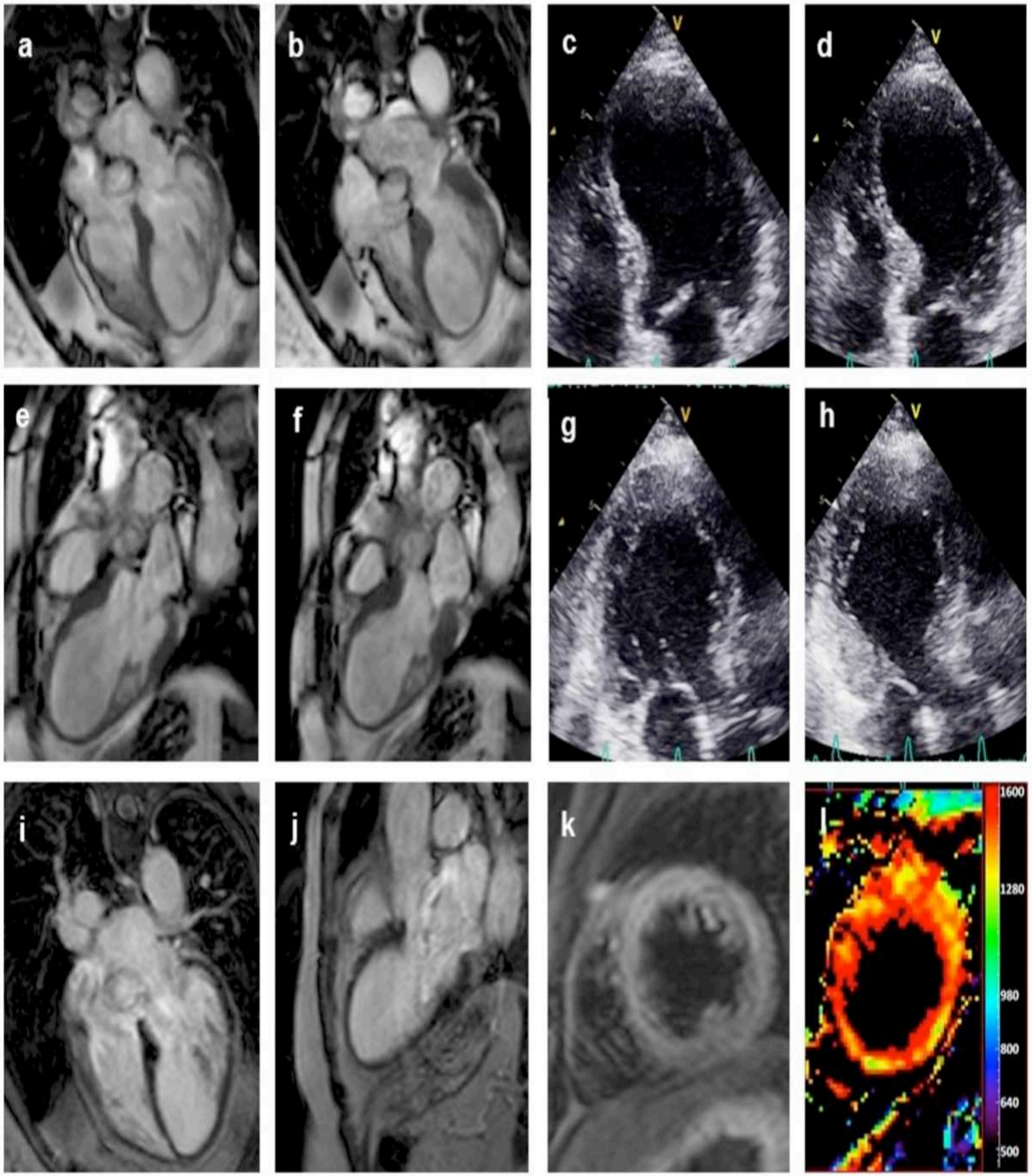

CENTRAL ILLUSTRATION: Pathophysiology of Stress Cardiomyopathy
Emotional Stress
• Negative (and positive) emotions
• Natural disasters
Physical Stress
• Trauma/Surgery
• Medications
• Intoxication
• Drug withdrawal
Risk Factors
• Female sex
• Post-menopause
• Schizophrenia
• Anxiety/Depression
• Asthma/Chronic obstructive pulmonary disease
• Diabetes
• Chronic medications
• Substance abuse disorders
Cancer
Hypothalamus
Pituitary
Inflammation
Endothelial Dysfunction
Chronic Microvascular Dysfunction
Impaired Coronary Flow Reserve
Catecholamines
Neuropeptide Y
Direct Cardio-Inhibitory Effects
Acute Microvascular Dysfunction
Stress Cardiomyopathy
Medina de Chazal, H. et al. J Am Coll Cardiol. 2018;72(16):1955-71.

Anatomic Variations of Takotsubo CM

TABLE 2 Anatomical Variants of Stress Cardiomyopathy

Variant	Prevalence	Considerations
Apical ballooning (typical) 	75%-80%	Can be associated with left ventricular outflow tract obstruction and/or apical thrombus formation Variable prognosis
Midventricular 	10%-20%	Severe left ventricular dysfunction Acute heart failure syndrome is common.
Basal or inverted 	5%	Less severe hemodynamic compromise
Biventricular 	<0.5%	Severe hemodynamic compromise and cardiogenic shock
Focal dysfunction 	Rare	Benign course, more commonly associated with chest pain




a
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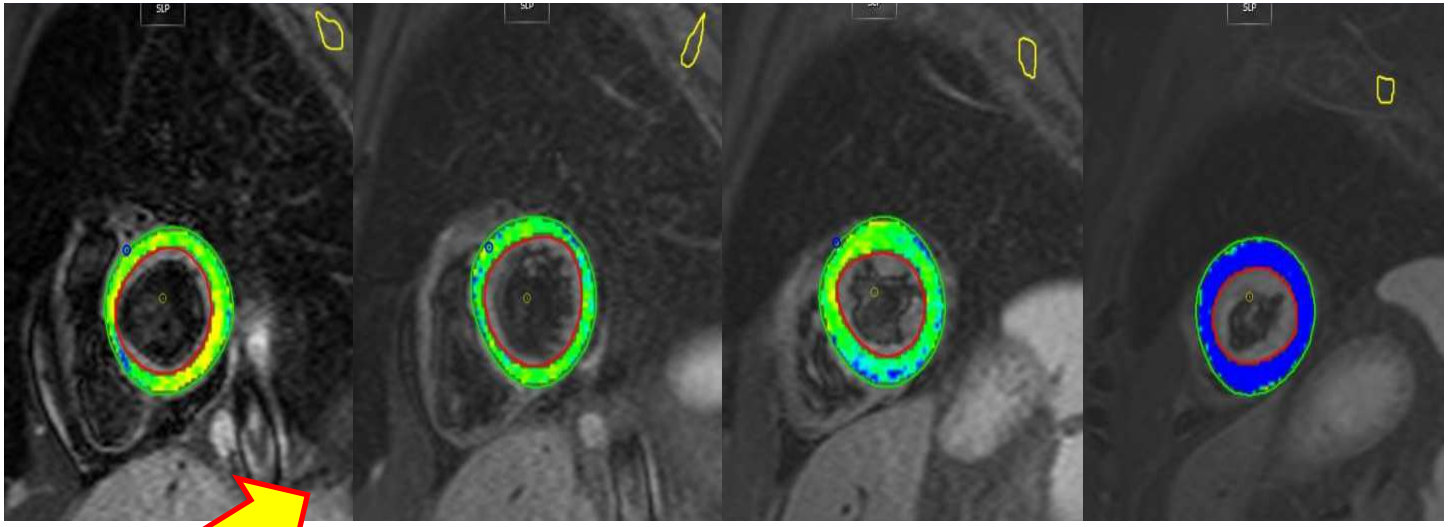
1280
980
800
640
500

T2 ratio & T2 mapping



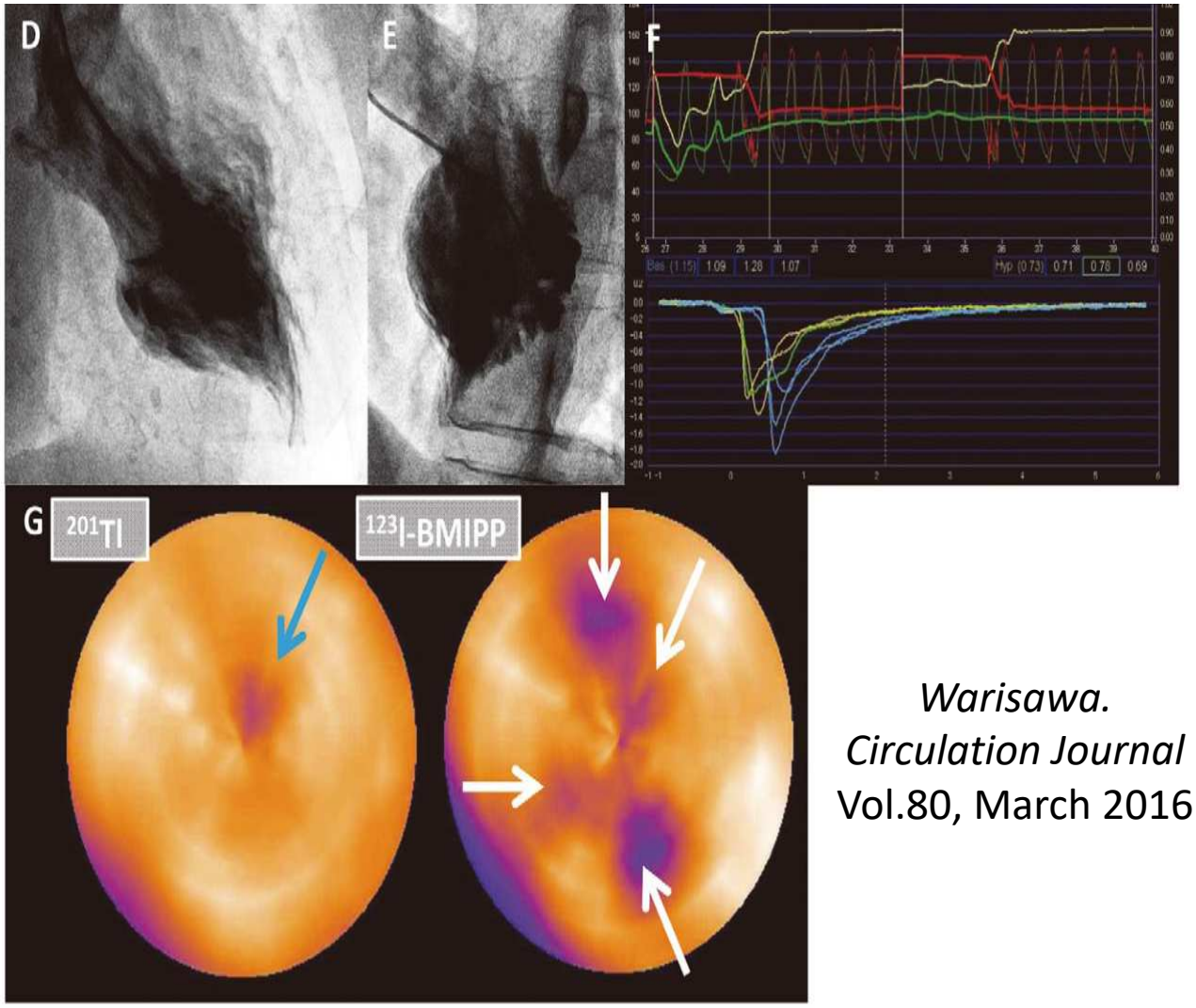
T2 SPAIR

- Observer dependent
- Ratio based
- Assumes uniform signal correction across

T2 mapping

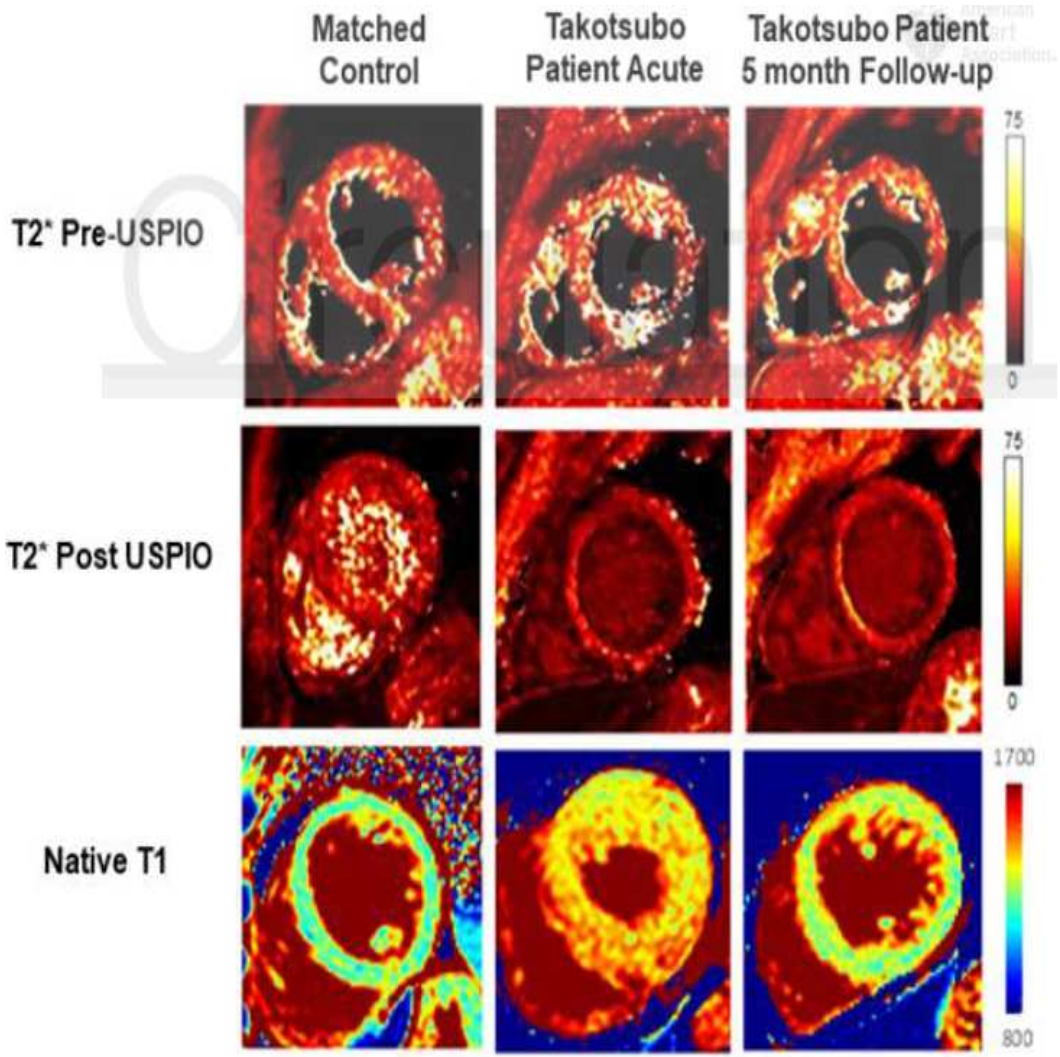
- Observer independent
- Not ratio based
- Quantitative result of LV T2 relaxation time

Abnormal FA Metabolism: Ischemic Memory & Microvasc Dysf'n



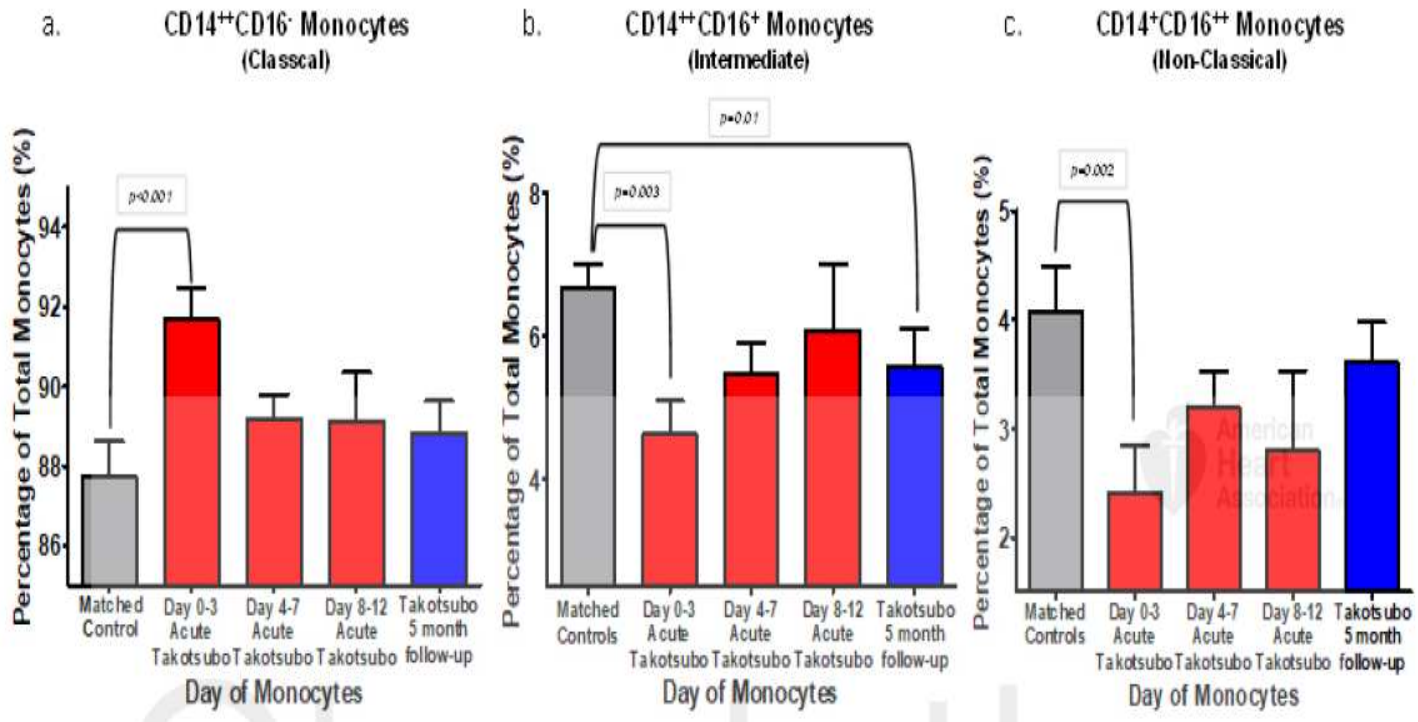
Warisawa.
Circulation Journal
Vol.80, March 2016

MØ Fe_2O_3 Uptake in Takotsubo



Scally C, Dawson DK, et al. Circulation 2019 (in press)

Monocyte Profiles in Takotsubo Pts



Scally C, Dawson DK, et al. Circulation 2019 (in press)


DOES A BROKEN HEART EVERY REALLY MEND?

LV Dysfunction

- In the **International Takotsubo Registry**:
  - 9.9% of patients developed cardiogenic shock,
  - 17.3% of patients required invasive or noninvasive ventilation,
  - 8.6% of patients had cardiopulmonary resuscitation.

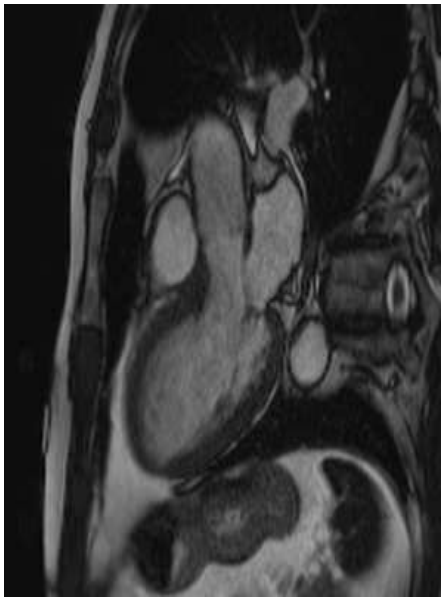
  The incidence of cardiac arrest among hospitalized patients with TCM was approximately 5%.

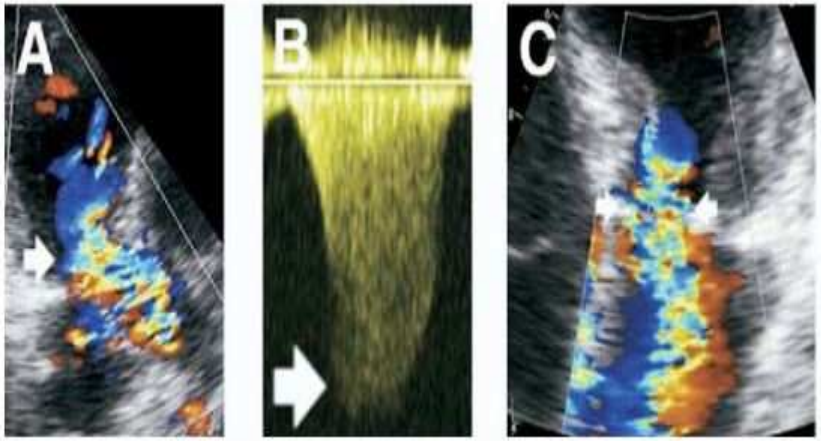
  Independent predictors of acute heart failure include advanced age, low LVEF at presentation, higher admission and peak troponin levels, and a physical stressor

Templin, Hellermann, et al. N Engl J Med 2015; 373:929-38

LVOTO

- It is more common with the apical ballooning pattern and it may be provoked or exacerbated by catecholamine drugs used to treat hypotension.
- In a series of 136 patients with TCM, 13 patients developed dynamic obstruction to LVOT





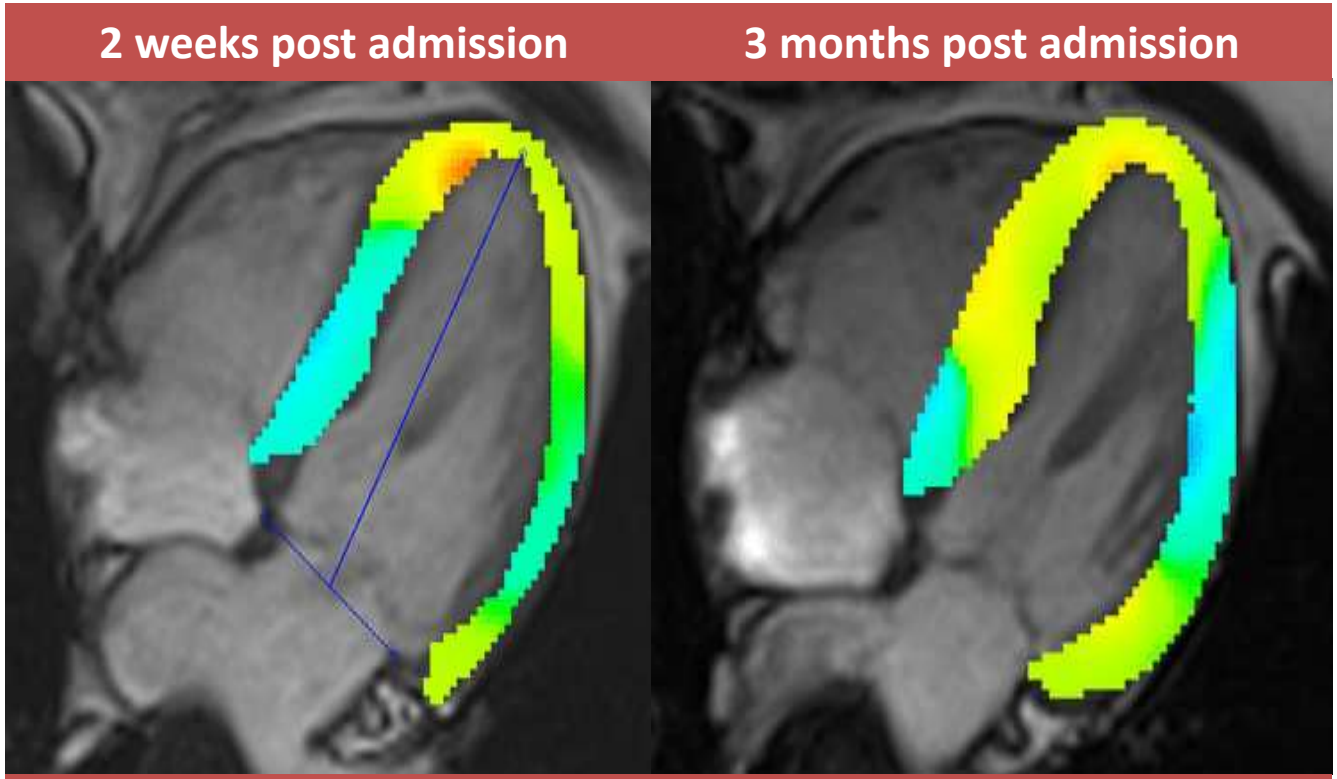
Arrhythmia

- Arrhythmia is common in patients with SIC.
- New atrial fibrillation has been reported in 5% to 15% of cases
- Ventricular arrhythmia occurs in 4% to 10% of patients during the acute phase.
- Potentially lethal arrhythmia, including ventricular fibrillation, torsades de pointes, and ventricular tachycardia in less than 5% of patients.

Thrombo-embolism

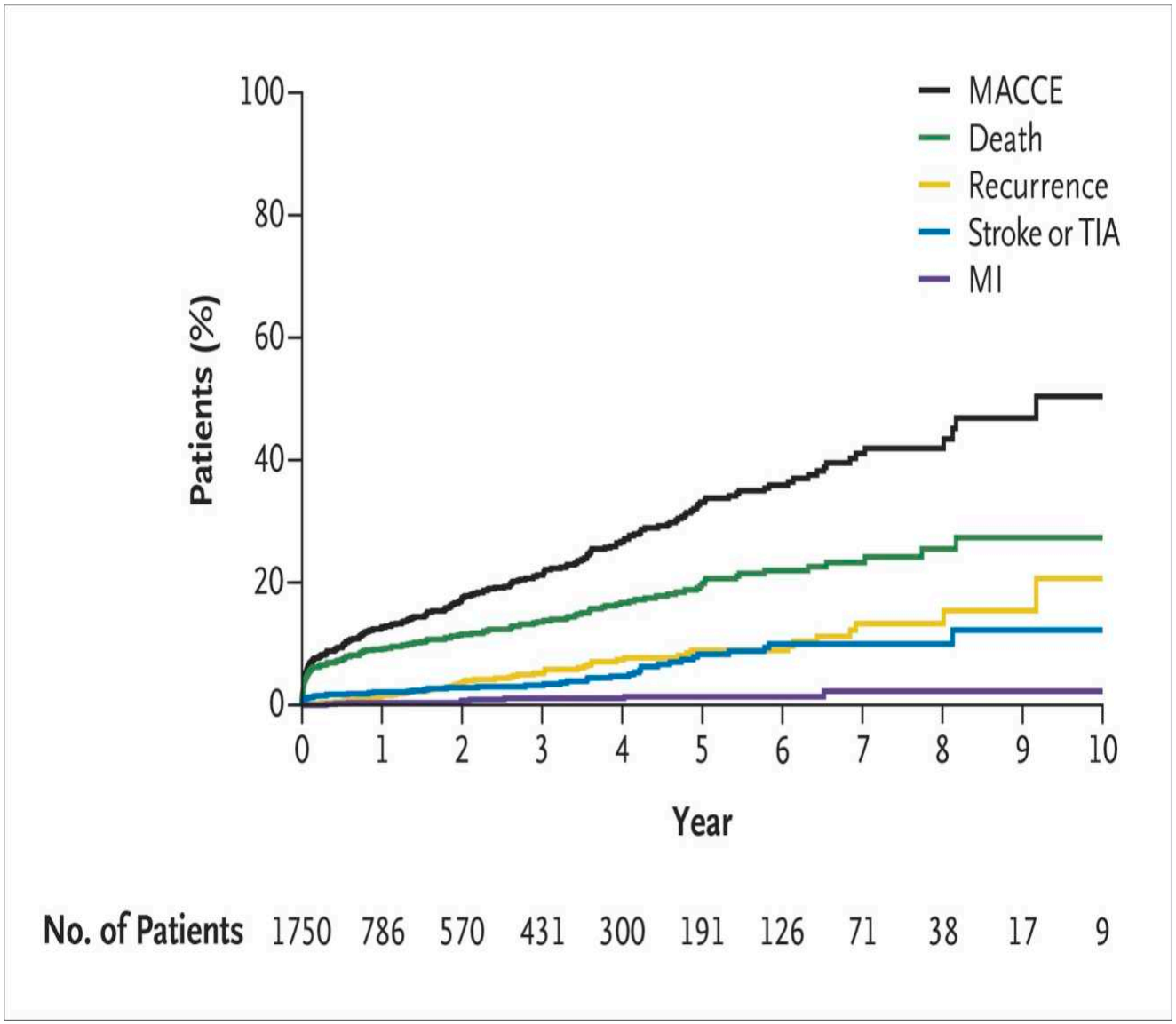
- In 541 patients **German Italian Stress Cardiomyopathy Registry**:
  - 12 patients (2.2%) developed LV thrombi
  - all female
  - presenting with an apical ballooning pattern
  - all treated with oral anticoagulation therapy
  - 2 patients suffered a cerebrovascular accident before treatment initiation.
- A high troponin was an independent predictor of LV thrombi.

Normal echo in ‘recovery’



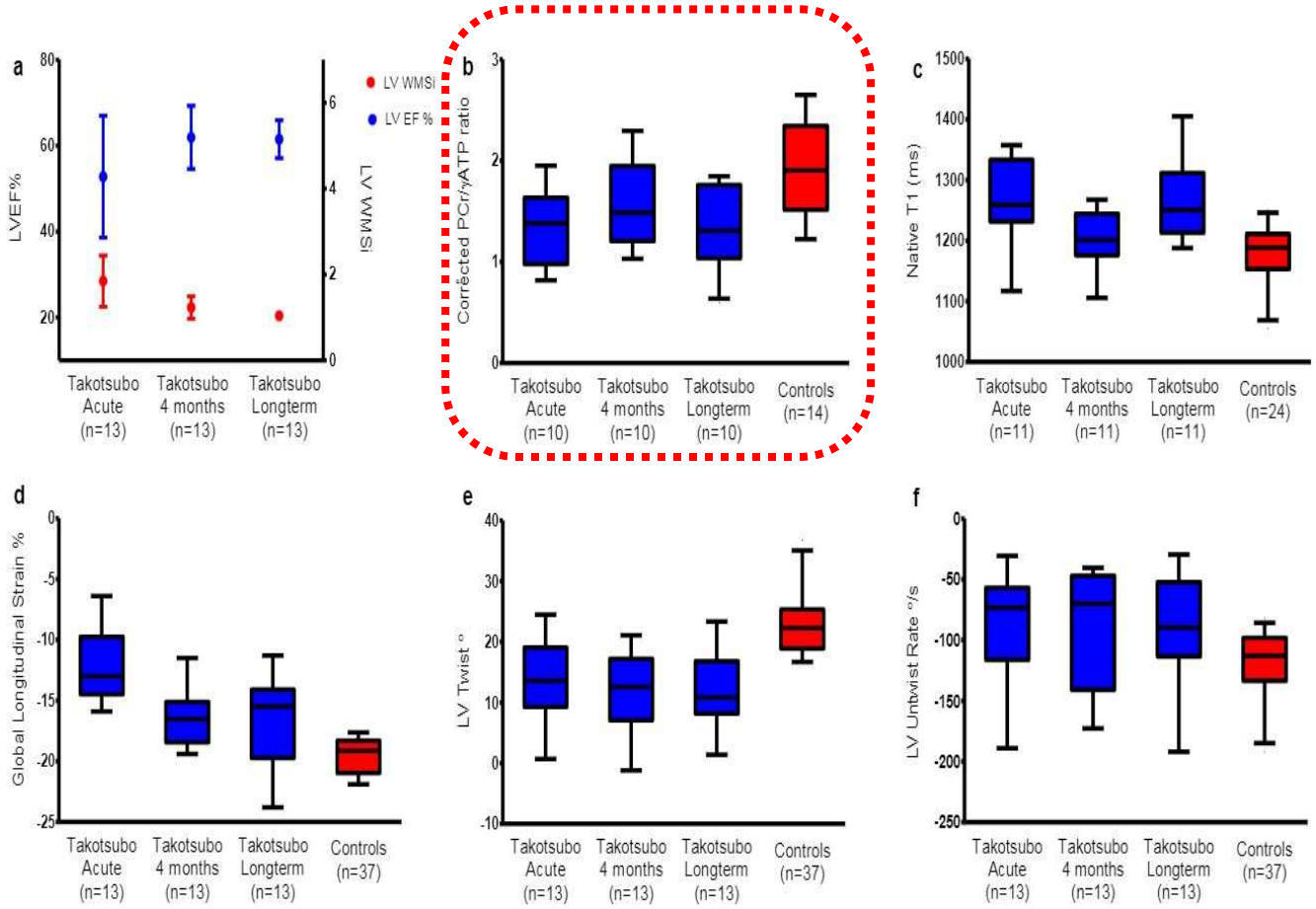
Subtle strain abnormalities persist, even at 3 months

Not So Benign a Prognosis



Templin, Hellermann, et al. N Engl J Med 2015; 373:929-38

Long Term Follow Up of Takotsubo



Scally 2018. DOI: 10.1161/CIRCULATIONAHA.117.031841

Functional Capacity & QoL in Takotsubo Patients

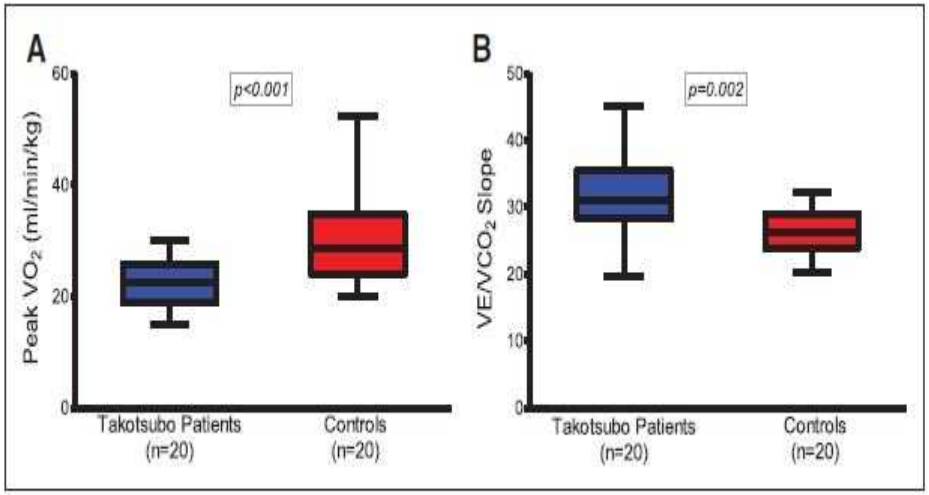
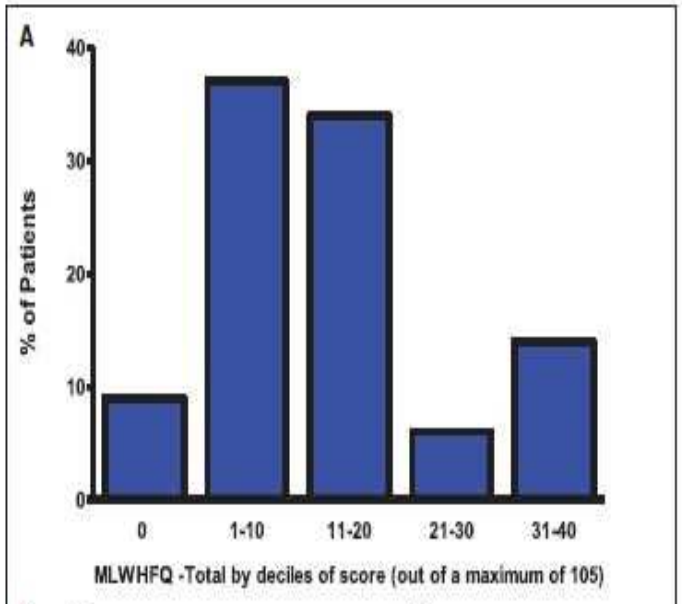
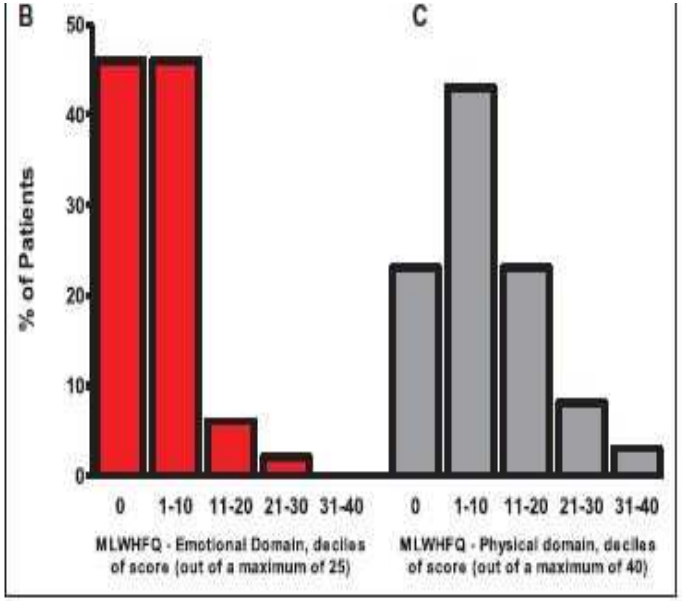


Figure 2. Cardiopulmonary exercise data in patients with takotsubo cardiomyopathy and matched control subjects.
A, Peak Vo_2. **B,** VE/Vco_2 slope. Data shown as median, 25th, and 75th percentiles and maximum and minimum (whiskers).





Scally. Circulation. 2017 Nov 11

Risk of Recurrence

- TCM may recur in 5% to 22% of cases.
- A recent meta-analysis based on 31 cohorts indicated that
  - cumulative incidence of recurrence was approximately 5% at 6 years
  - annual rate of recurrence was approximately 1% to 2%.
- Nearly all cases of recurrence occurred in women.
- The recurrence rate was inversely correlated with ACEi/ARB prescription, but not with beta-blocker prescription.
- The International Takotsubo Registry reported that the rate of recurrence was 1.8% per patient-year, with a span of 25 days up to 9.2 years after the first event

Conclusions

- Takotsubo or stress-induced cardiomyopathy is characterized by “reversible” myocardial injury with distinctive regional wall motion abnormalities of the left ventricle.
- It has a strong predilection for postmenopausal women, but men, young women, and children can all be affected.
- Diagnosis made on clinical criteria


THERE IS ALWAYS HOPE

A Takotsubo moment…..