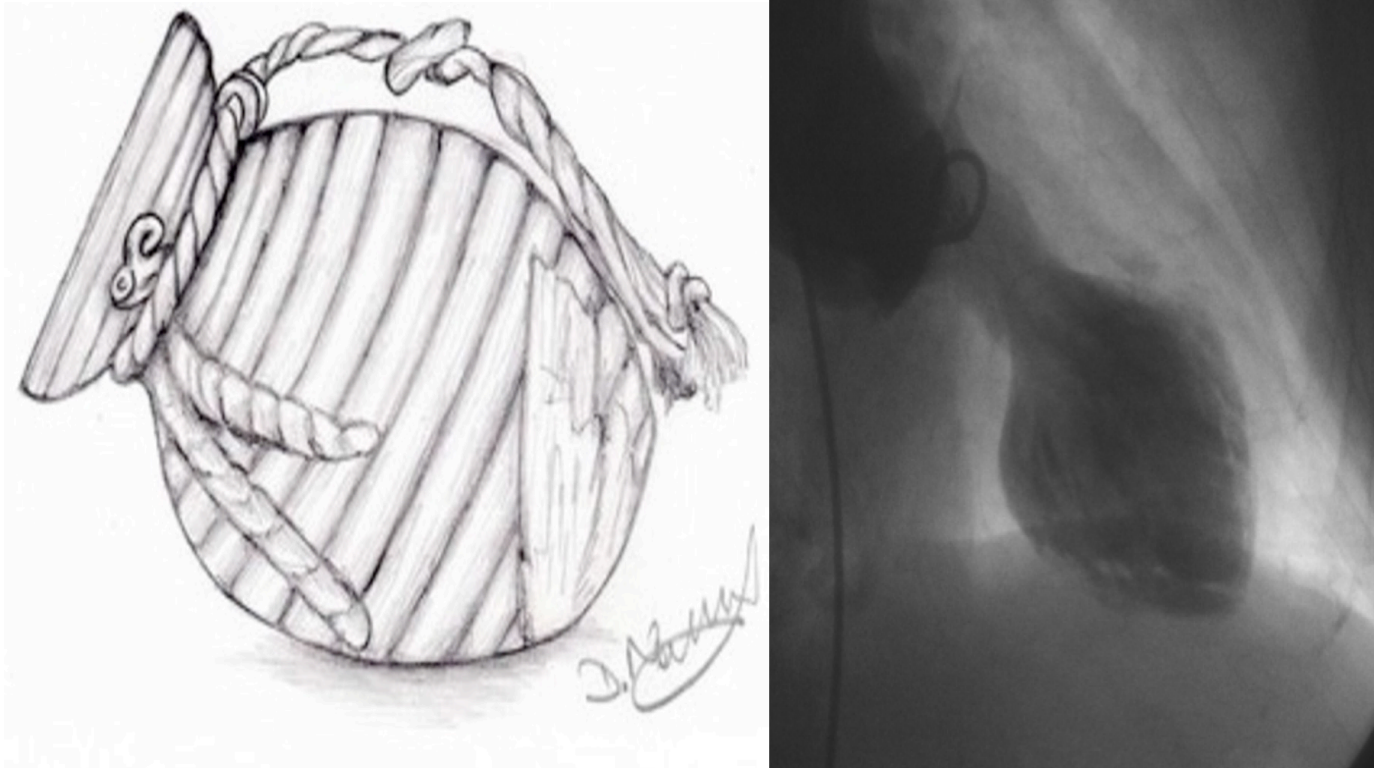


# Don't Go Breaking My Heart: Imaging & Prognosis in Takotsubo's



Peter Liu, M.D., U Ottawa Heart Institute  
*with Advice from Andrew Crean, M.D.*

# Takotsubo: Stress Cardiomyopathy

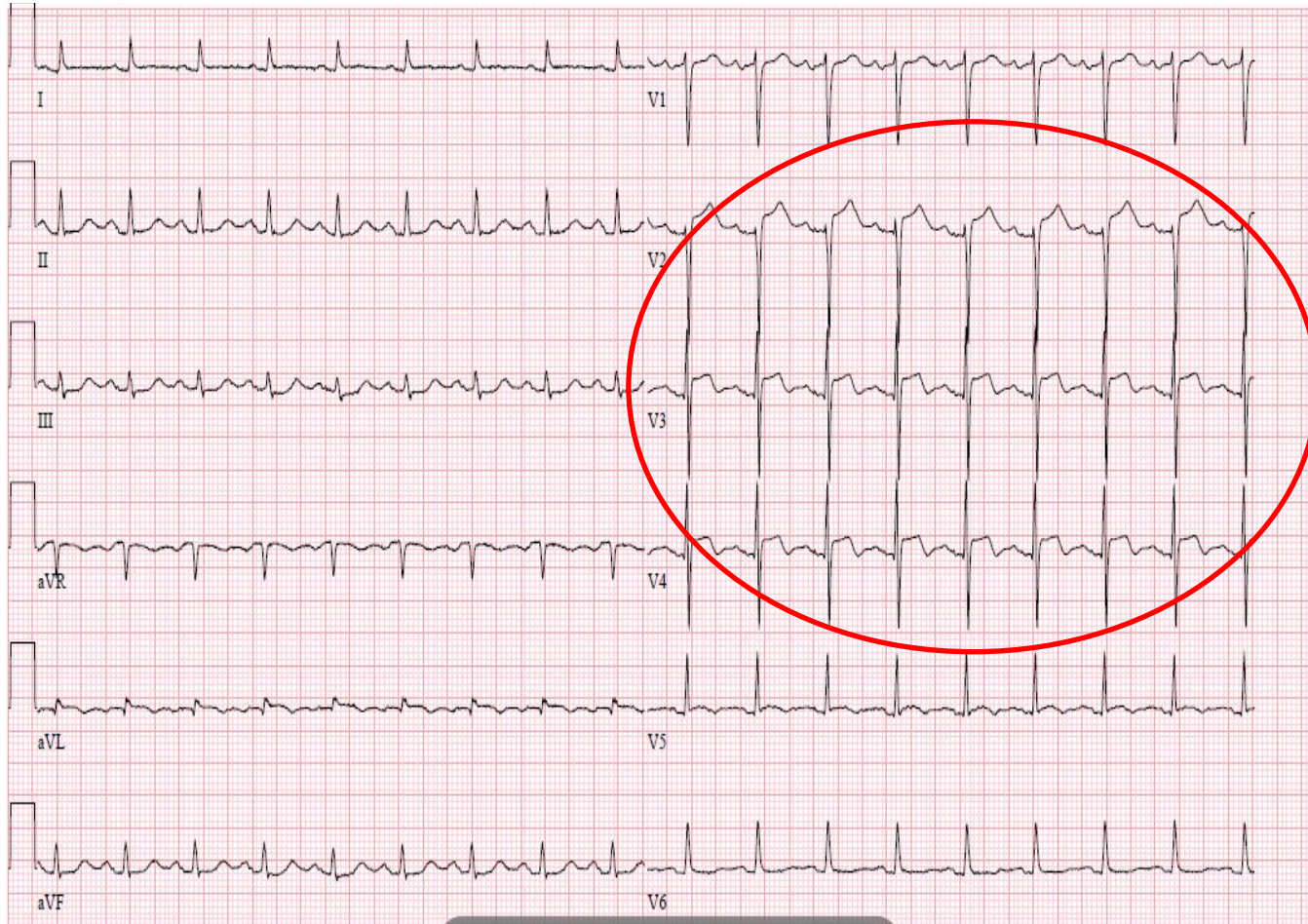


Japanese octopus fishing pot - a 'takotsubo'  
(artwork by Dr David Northridge, Consultant Cardiologist, Edinburgh  
Royal Infirmary).

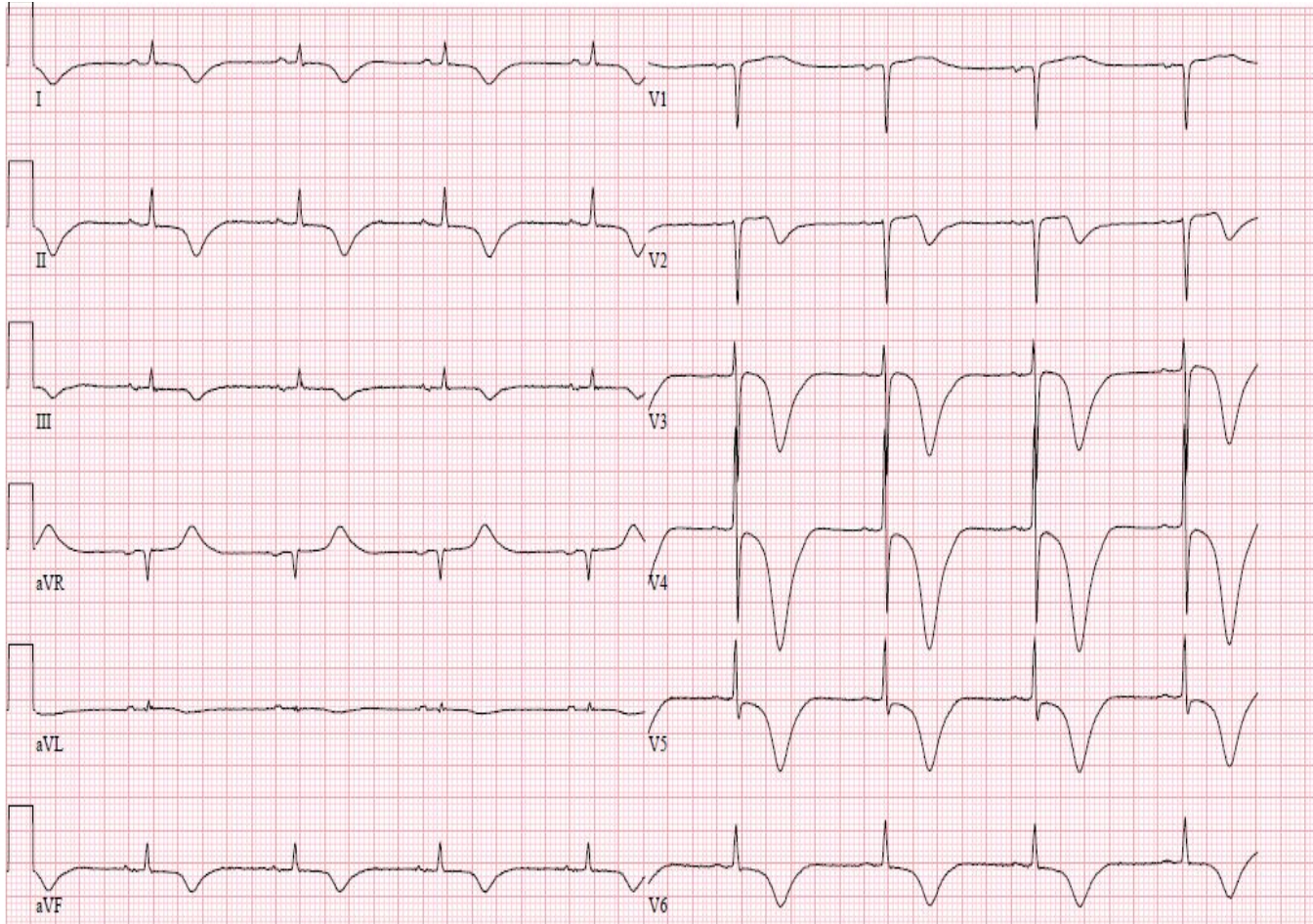
# Case History

- **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

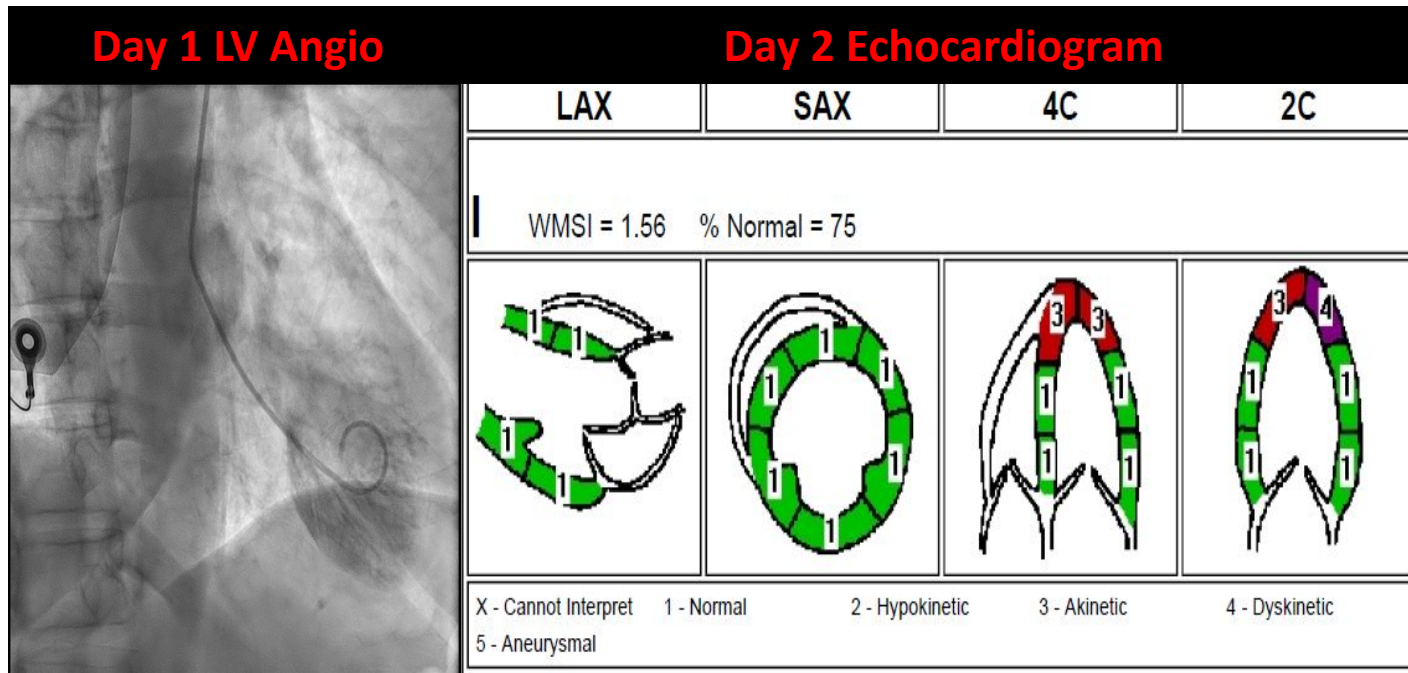
# ECG: Presentation



# ECG: Day 3 post Presentation



# LV Gram & Echo: Stress Takotsubo







### 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



## Positive emotions and Takotsubo syndrome: ‘happy heart’ or ‘Diagoras’ syndrome?

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and Gerasimos Filippatos<sup>1\*</sup>

<sup>1</sup>National and Kapodistrian University of Athens, School of Medicine, Attikon University Hospital, Athens, Greece; <sup>2</sup>School of Medicine, National and Kapodistrian University of Athens, Athens, Greece; and <sup>3</sup>School of Medicine, University of Zurich, Zurich, Switzerland

Received 7 April 2016; revised 25 April 2016; accepted 26 April 2016; online publish-ahead-of-print 1 June 2016

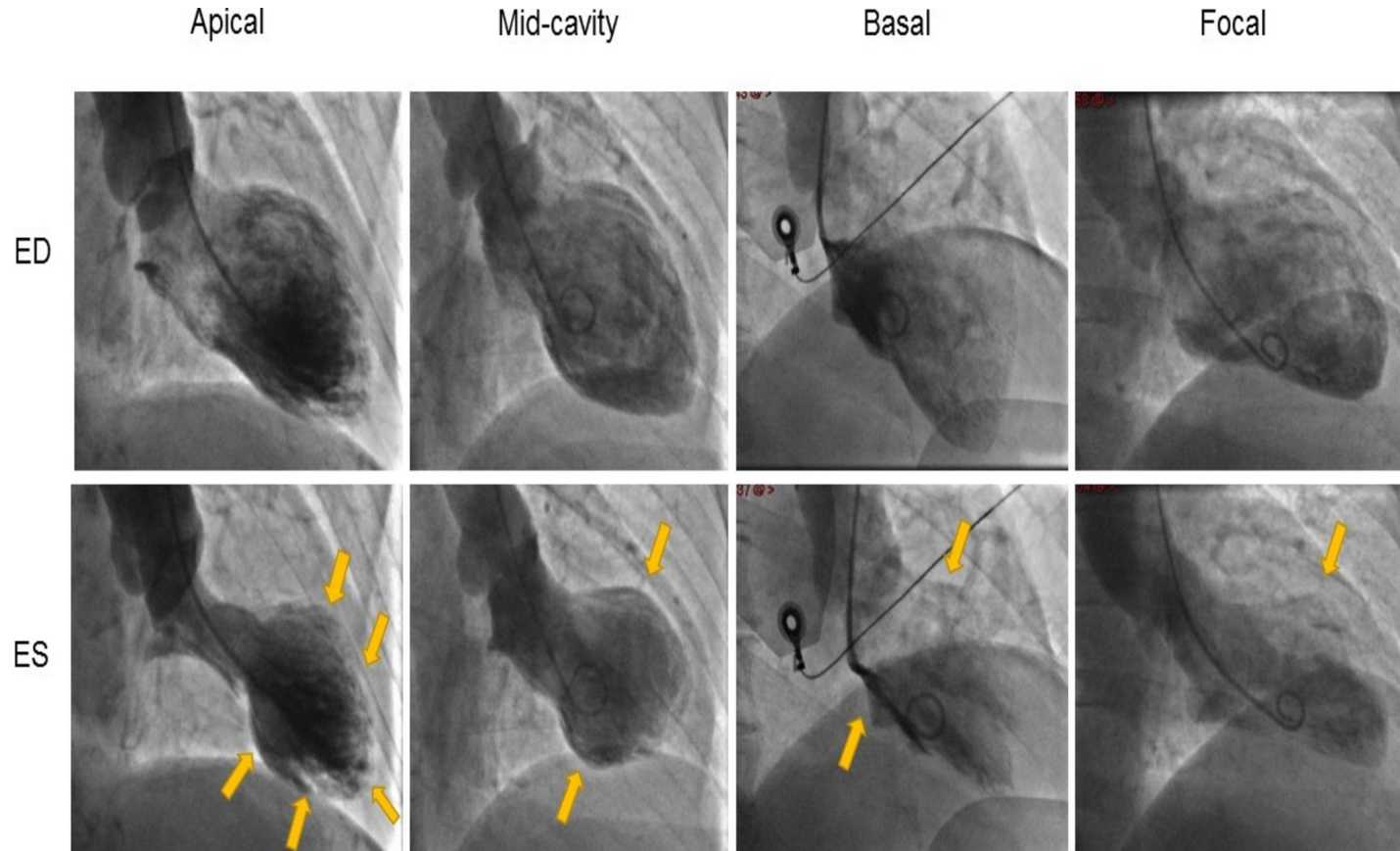


Monument to Diagoras family at the Greek island of Rhodes (a

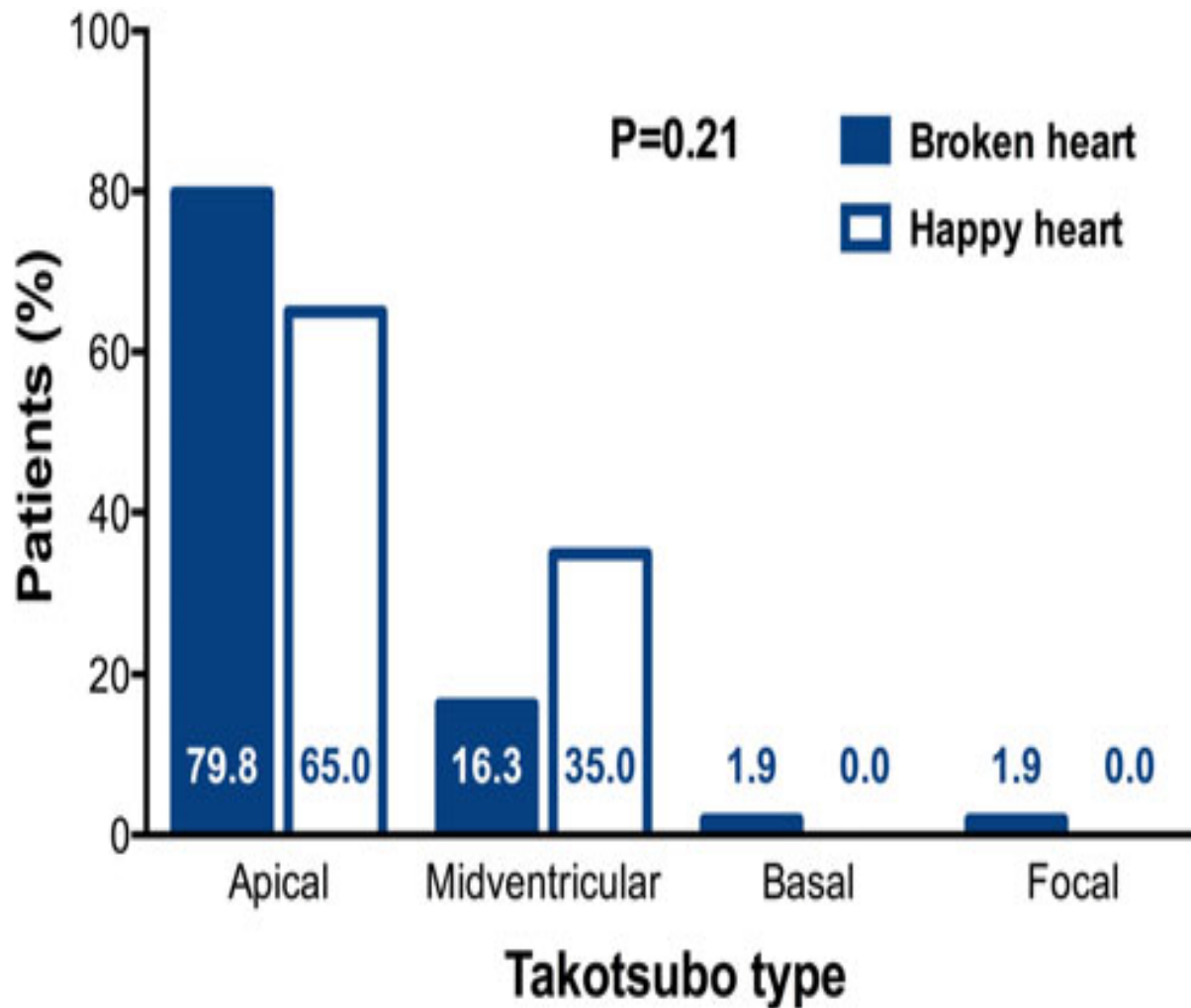


Postal stamp depicting Diagoras carried on the shoulders of his two sons (1937).

# 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 = 1.0) takotsubo syndrome types.

# 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

<b>TABLE 3 InterTAK Diagnostic Score</b>	
<b>Criteria</b>	<b>Points</b>
Female	25
Emotional trigger	24
Physical trigger	13
Absence of ST-segment depression	12
Psychiatric disorders	11
Neurologic disorders	9
QTc prolongation	6
<b>Diagnosis (Cutoff Value [Range 0-100])</b>	
<b>≥50</b>	<b>≤31</b>
Takotsubo (Specificity 95%)	Acute coronary syndrome (Specificity 95%)

Our Case

25

24

-

12

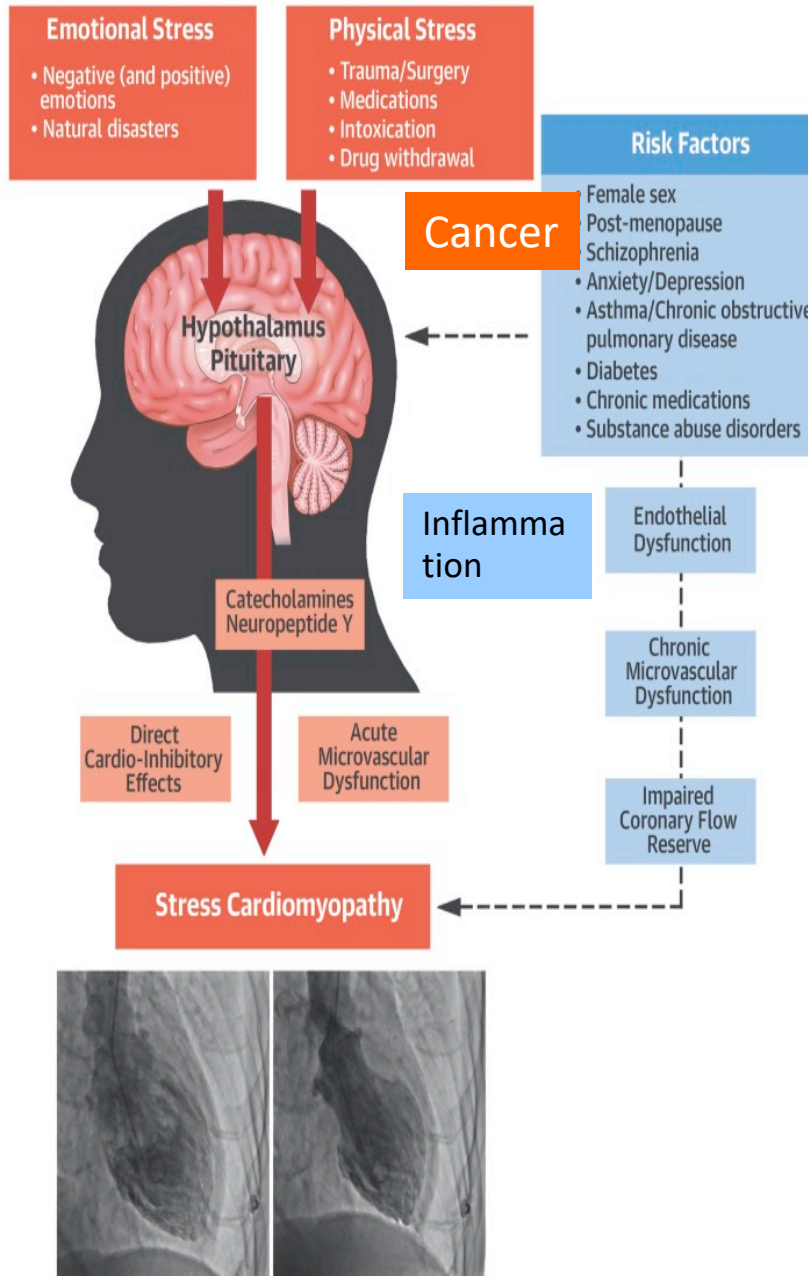
11

-

-






72

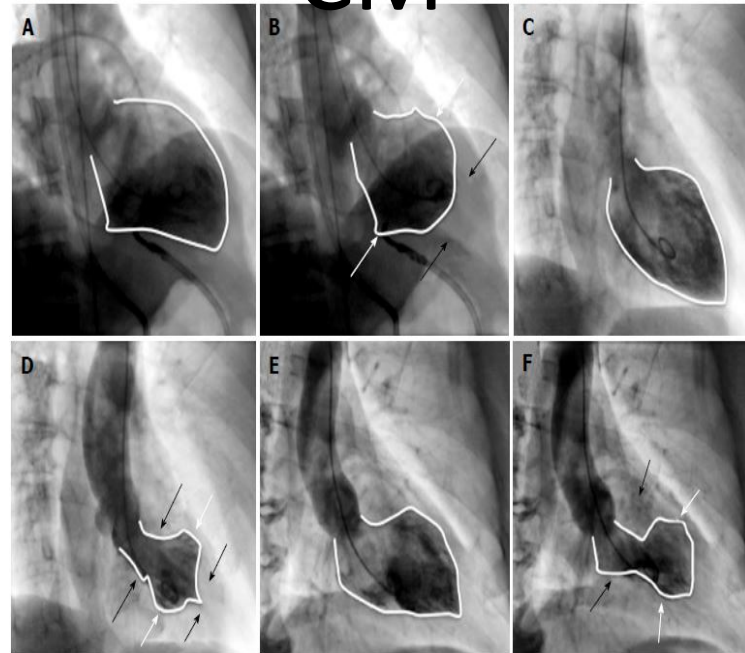
## CENTRAL ILLUSTRATION: Pathophysiology of Stress Cardiomyopathy

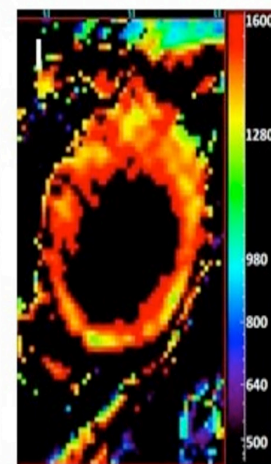
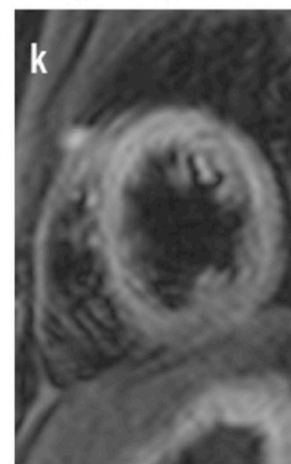
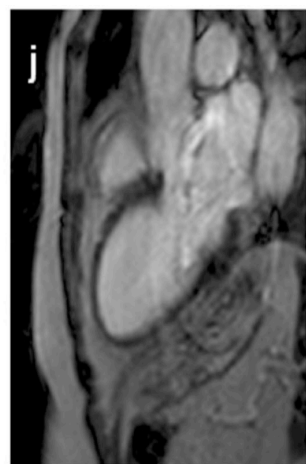
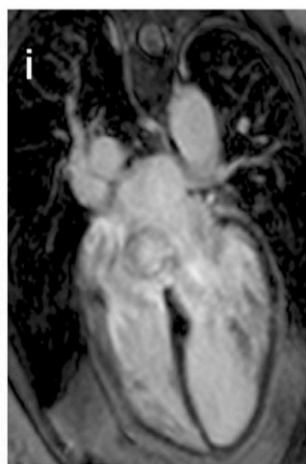
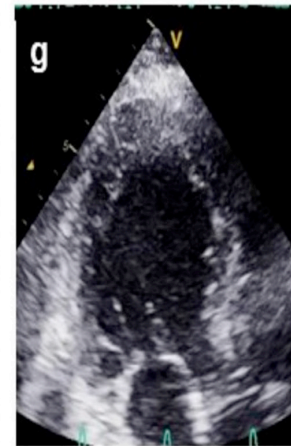
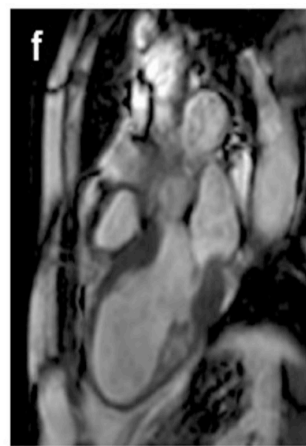
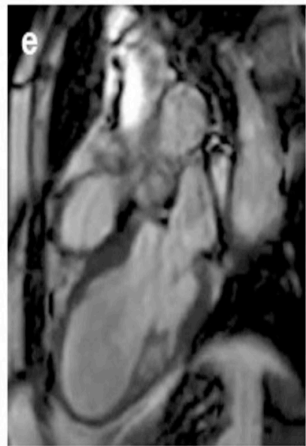
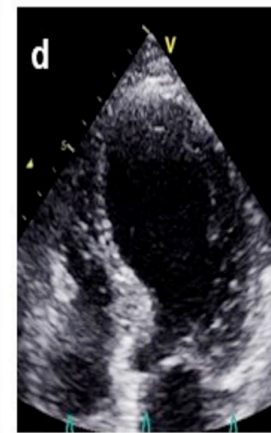


# Anatomic Variations of Takotsubo CM

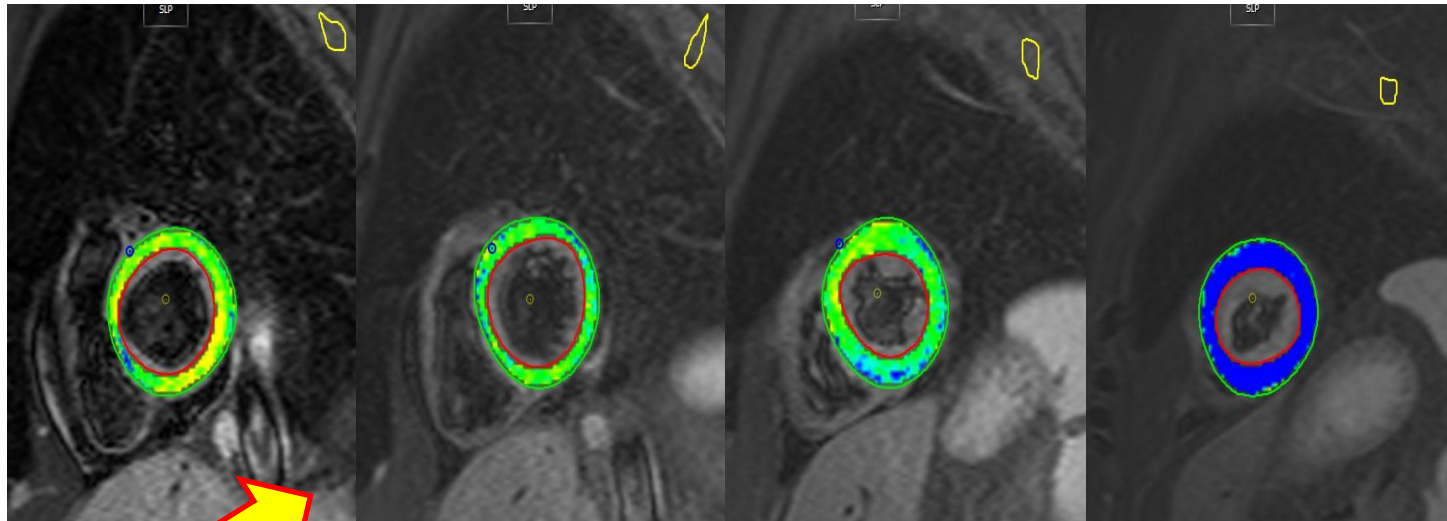
**TABLE 2** Anatomical Variants of Stress Cardiomyopathy

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



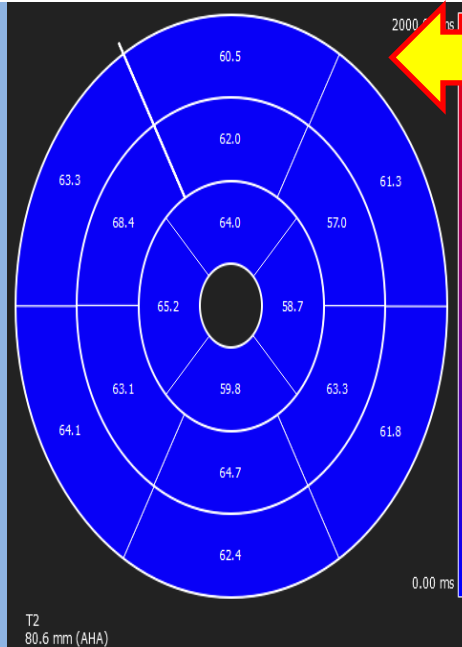


# T2 ratio & T2 mapping



## T2 SPAIR

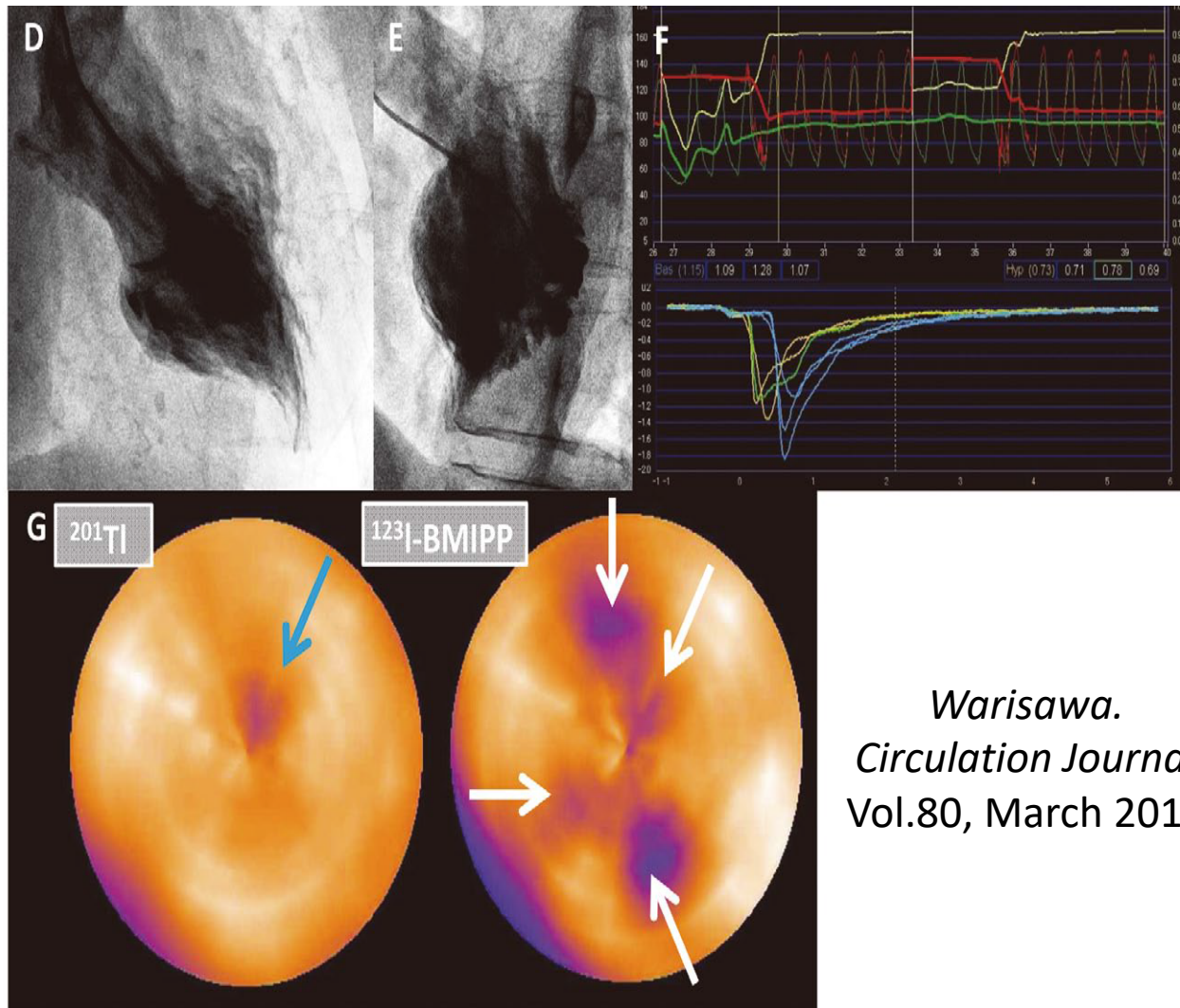
- Observer dependent
- Ratio based
- Assumes uniform signal correction across image



## T2 mapping

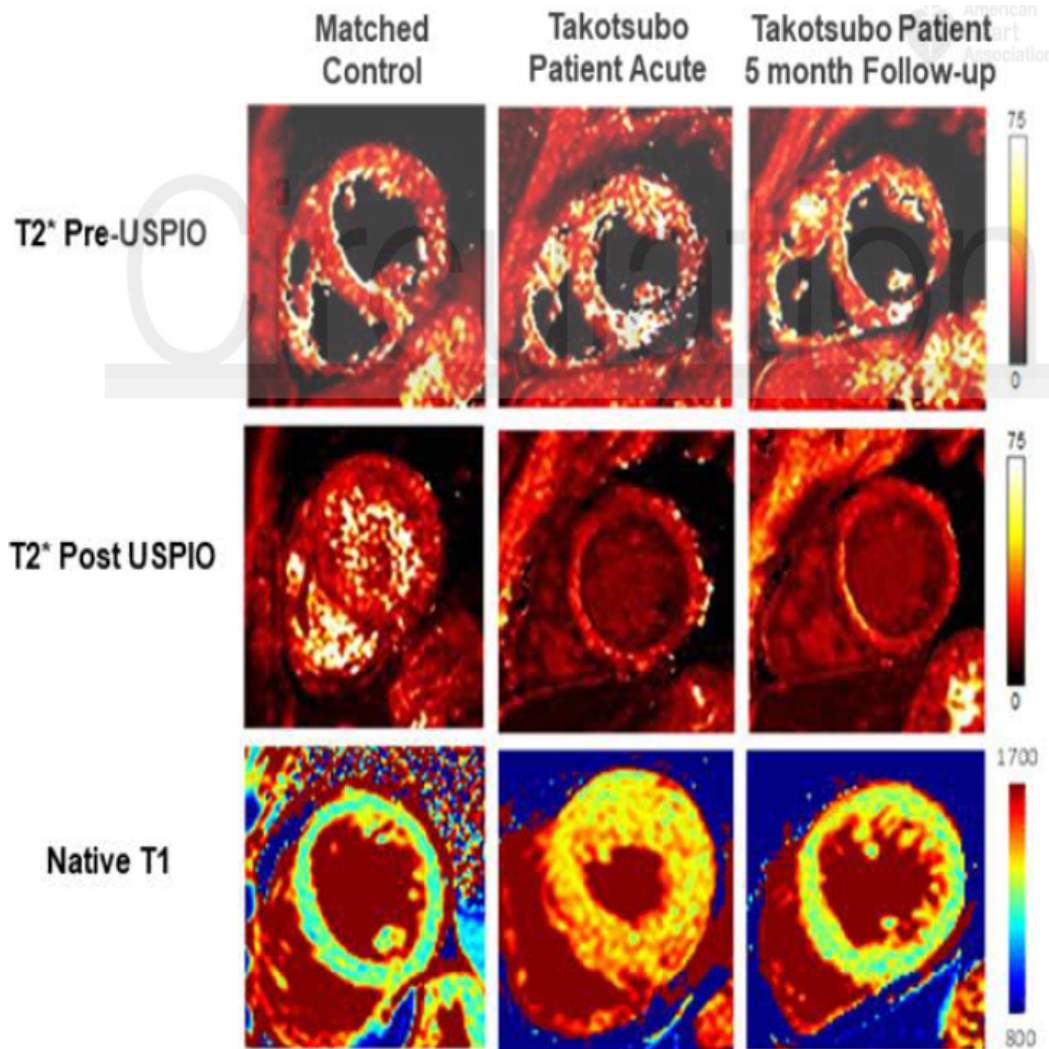
- Observer independent
- Not ratio based
- Quantitative result of LV T2 relaxation time in milliseconds

# Abnormal FA Metabolism: Ischemic Memory & Microvasc Dysf'n



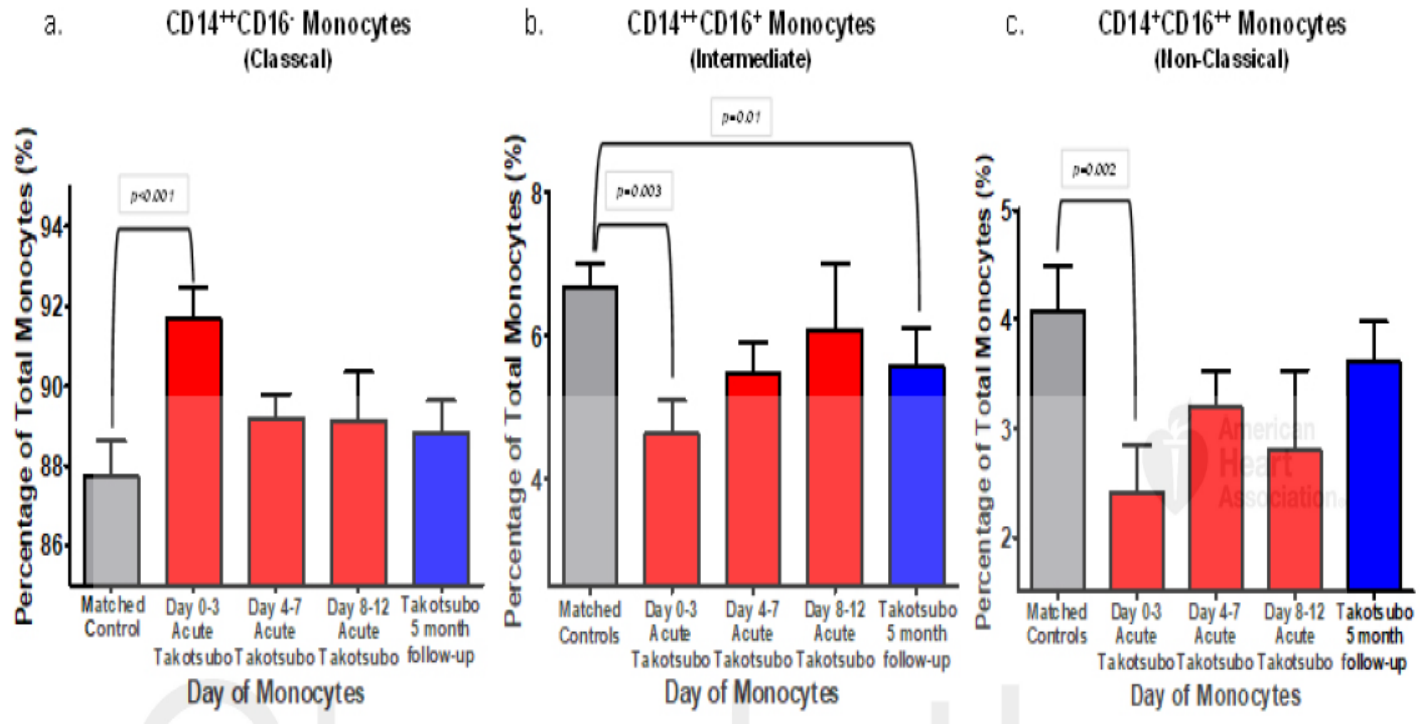
*Warisawa.*  
*Circulation Journal*  
Vol.80, March 2016

# MØ Fe<sub>2</sub>O<sub>3</sub> Uptake in Takotsubo



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

# Monocyte Profiles in Takotsubo Pts



DOES A BROKEN HEART EVERY REALLY MEND?



# LV Dysfunction

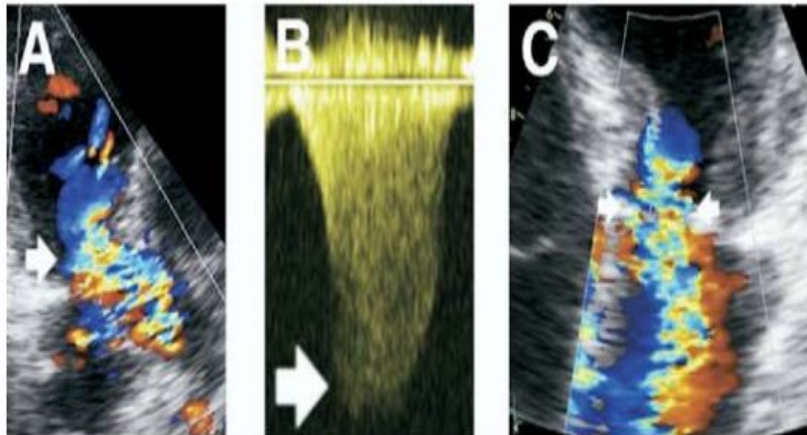
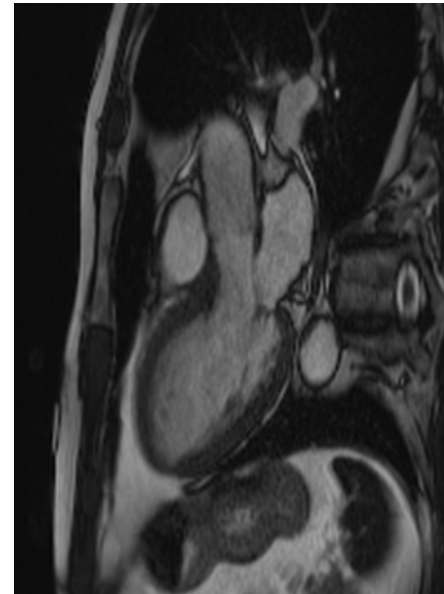
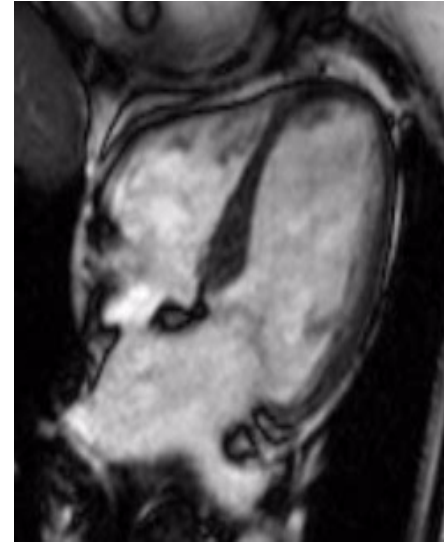
- In the **International Takotsubo Registry**:
  - 9.9% of patients developed cardiogenic shock,
  - 17.3% of patients required invasive or noninvasive ventilation,
  - 8.6% of patients had cardiopulmonary resuscitation.

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

# 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



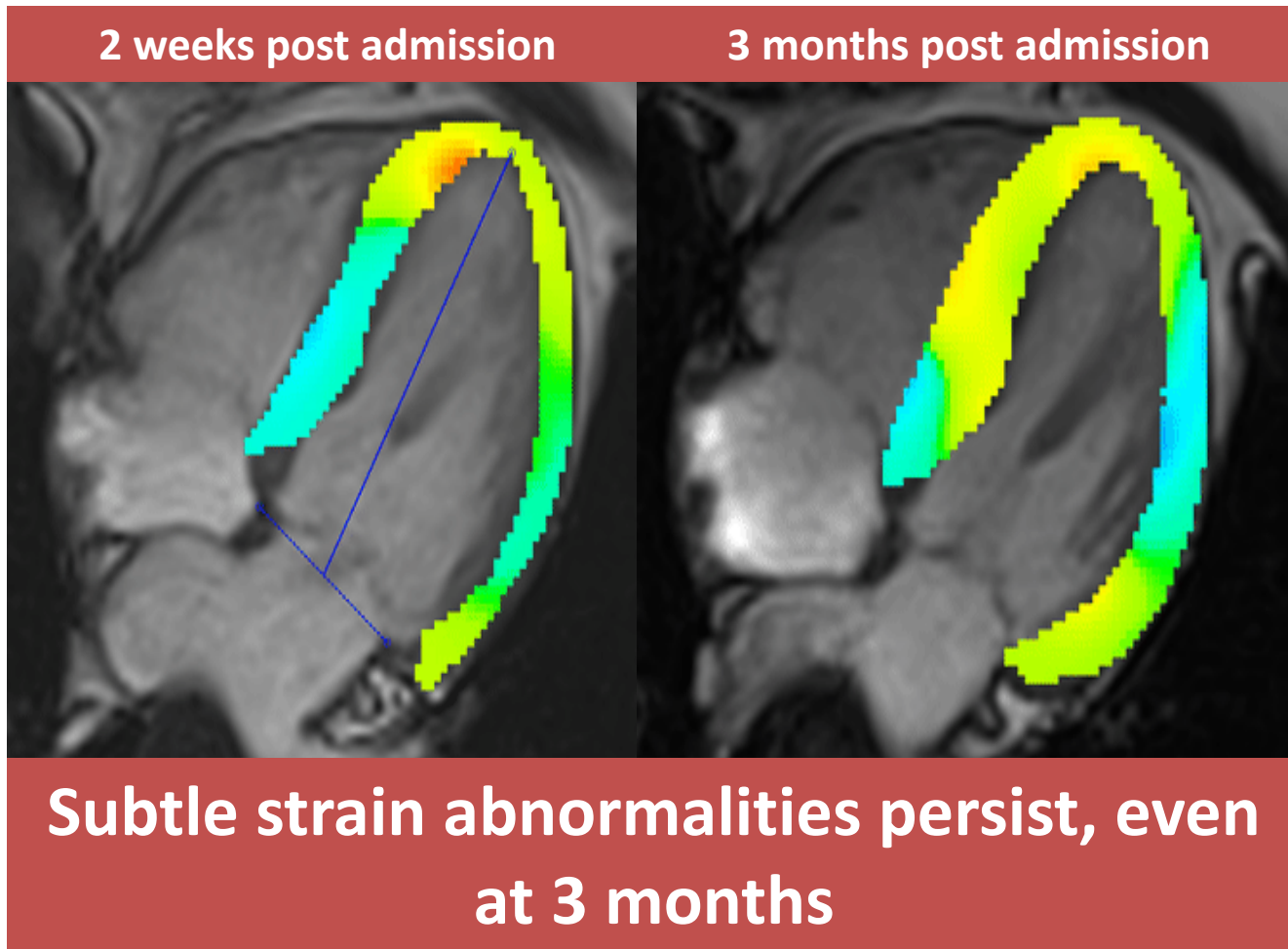
# Arrhythmia

- 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.

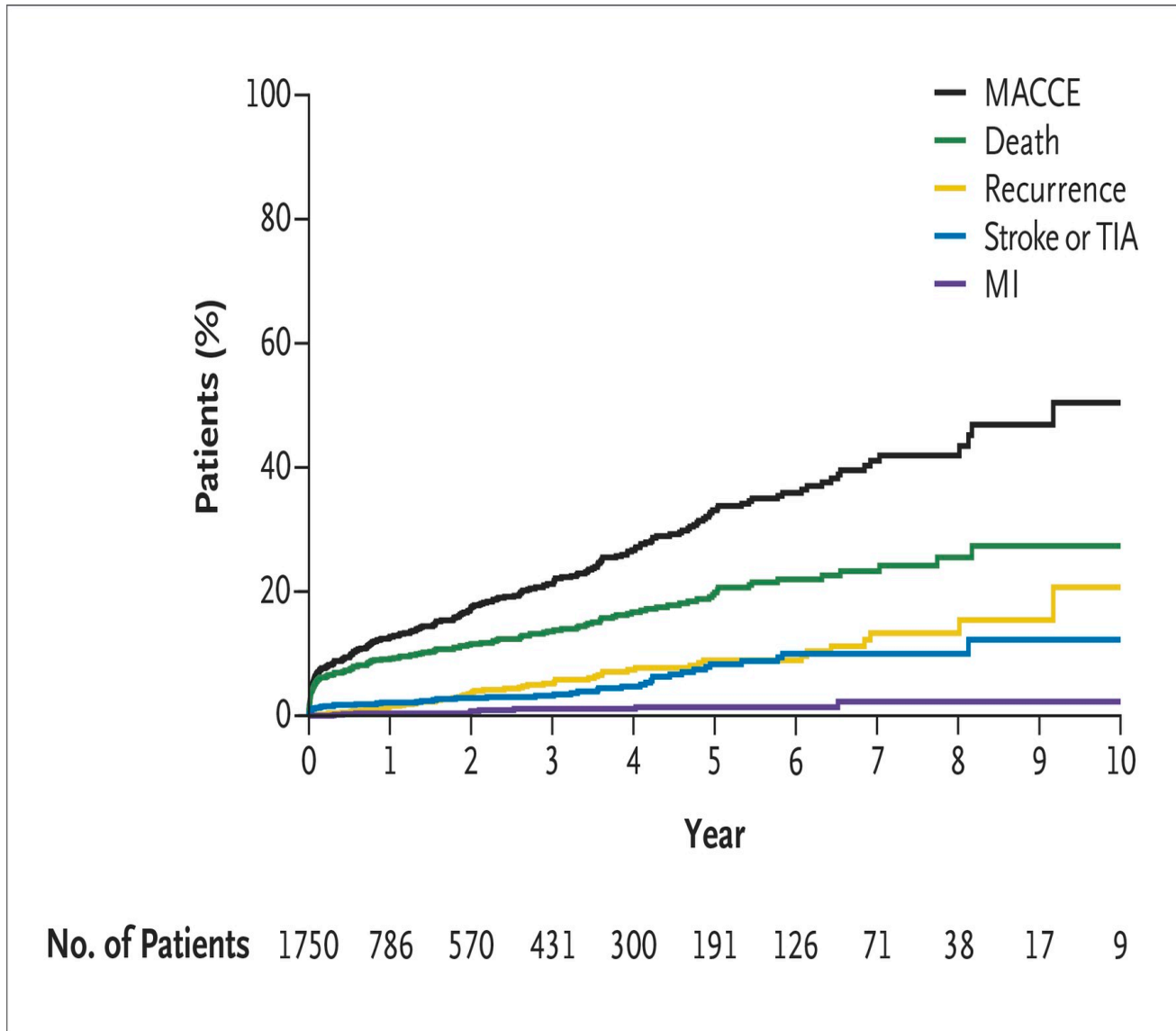
# Thrombo-embolism

- 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'

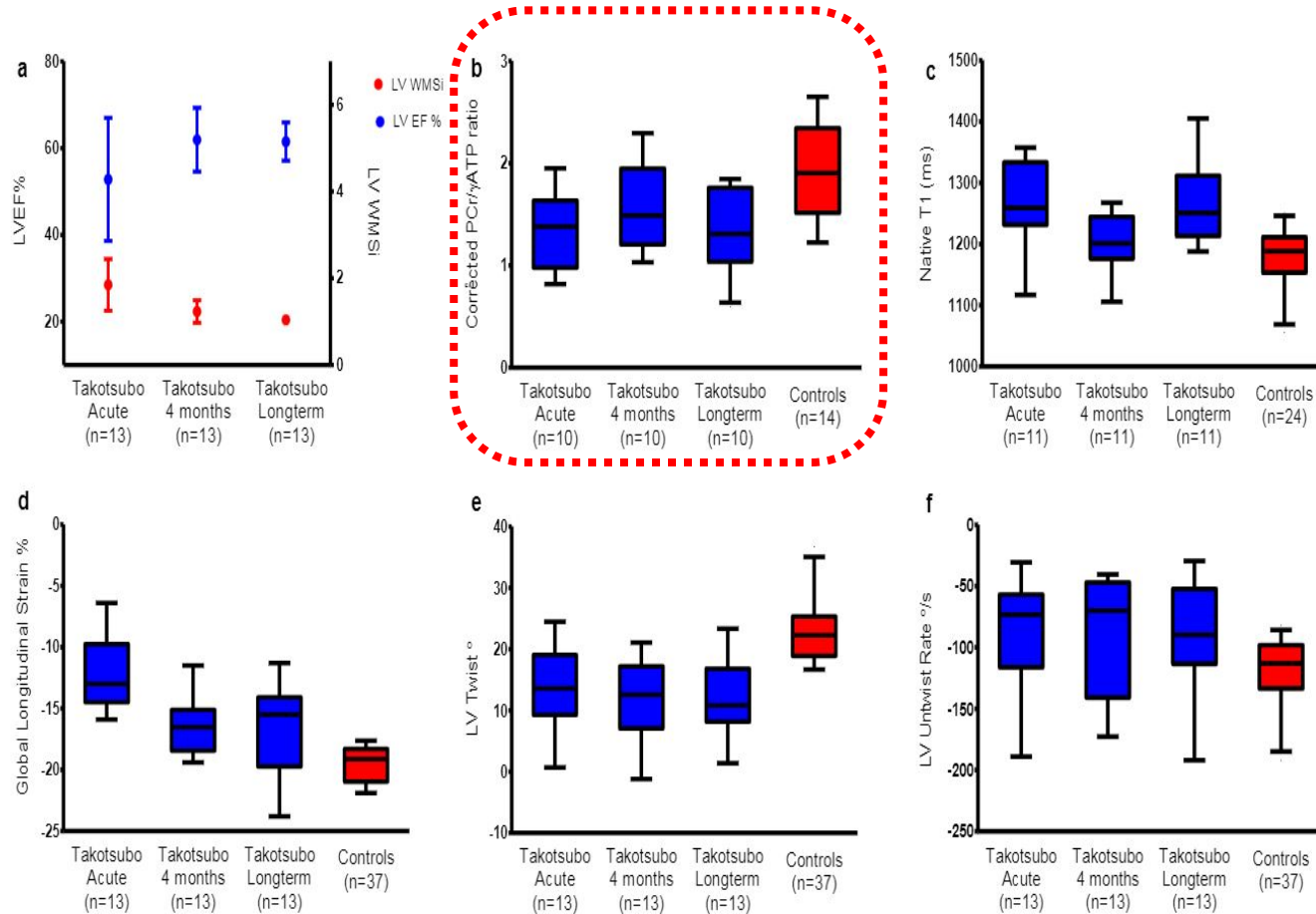


# Not So Benign a Prognosis

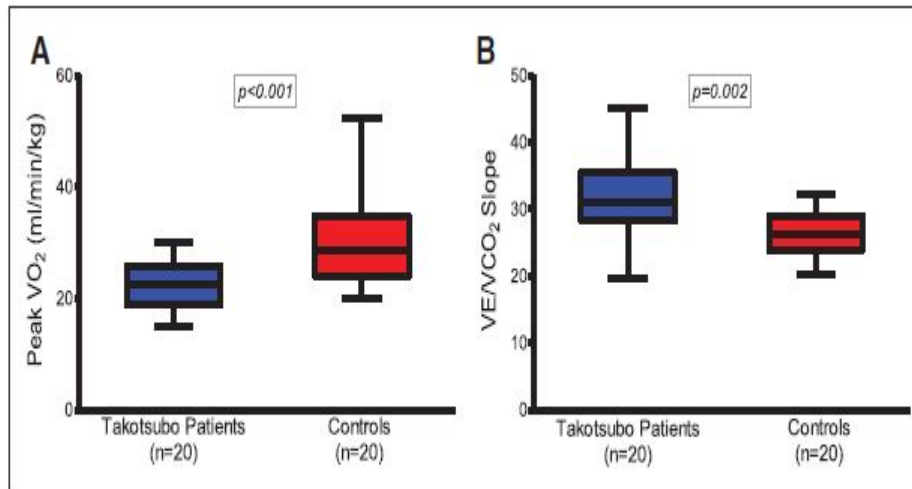


Templin, Hellermann, et al. *N Engl J Med* 2015; 373:929-38

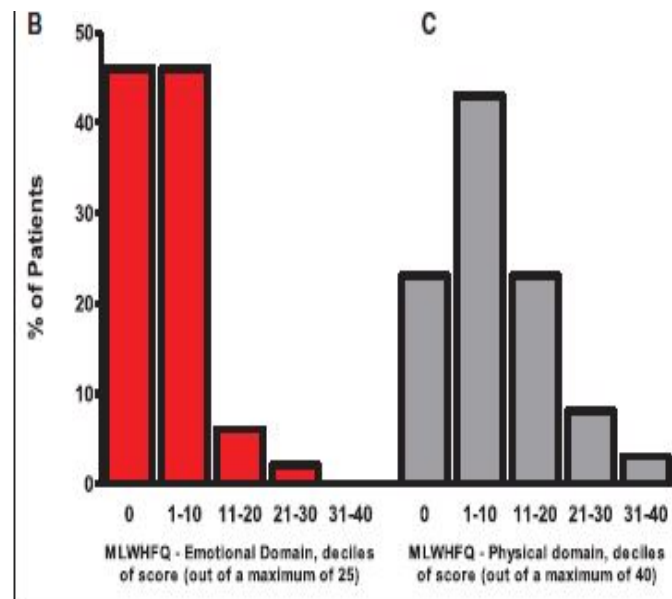
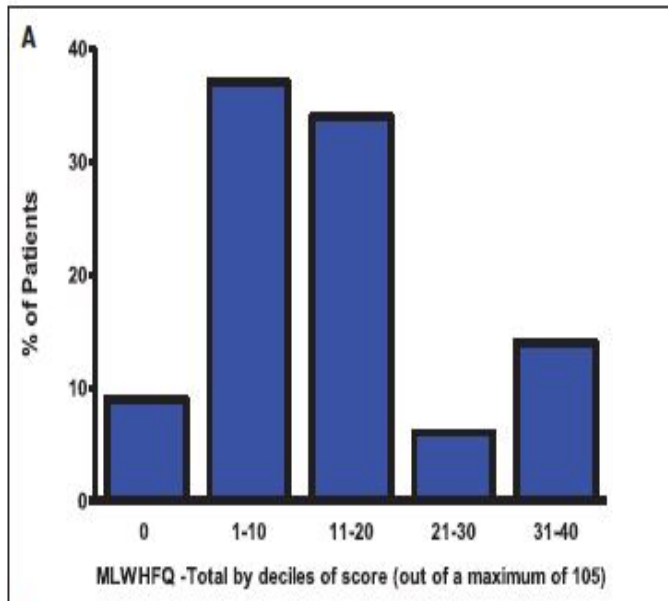
# Long Term Follow Up of Takotsubo



# Functional Capacity & QoL in Takotsubo Patients



**Figure 2.** Cardiopulmonary exercise data in patients with takotsubo cardiomyopathy and matched control subjects. **A**, Peak  $\text{VO}_2$ . **B**,  $\text{VE}/\text{CO}_2$  slope. Data shown as median, 25th, and 75th percentiles and maximum and minimum (whiskers).



# 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



# A Takotsubo moment....

