

ECHO
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Roberto M Lang, MD



Takotsubo Cardiomyopathy: Pathophysiology and Assessment



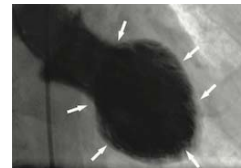
**Tako-Tsubo
Cardiomyopathy**



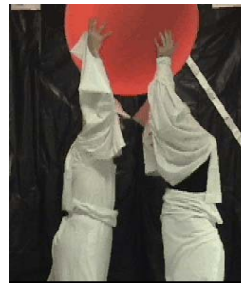
**Broken Heart
Syndrome**



**Apical
Ballooning**



1. Sato H, Tateishi H, Uchida T, et al. Takotsubo type cardiomyopathy due to multivessel spasm. In: Kodama K, Haze, K, Hon M, editors. Clinical aspect of myocardial injury: from ischemia to heart failure. Kagaku Hyoronsha; Tokyo: 1990 pp. 56-64 [in Japanese]



**Japanese word for
octopus catcher**
Circ J 2004; 68: 77-81

***Tako-Tsubo*–Like Transient Left Ventricular Dysfunction**

John P. Girod, DO; Adrian W. Messerli, MD; Frank Zidar, MD;
W.H. Wilson Tang, MD; Sorin J. Brener, MD

Tako-tsubo–like (Japanese word for octopus-catcher, Figure 3) left ventricular dysfunction is an enigmatic cardiomyopathy, characterized by marked apical asynergy in the absence of significant coronary disease. Typically, these patients are elderly women who present with mild to moderate chest pain, have ST-segment elevation in leads V₃ through V₆, and have a modest rise in cardiac markers.

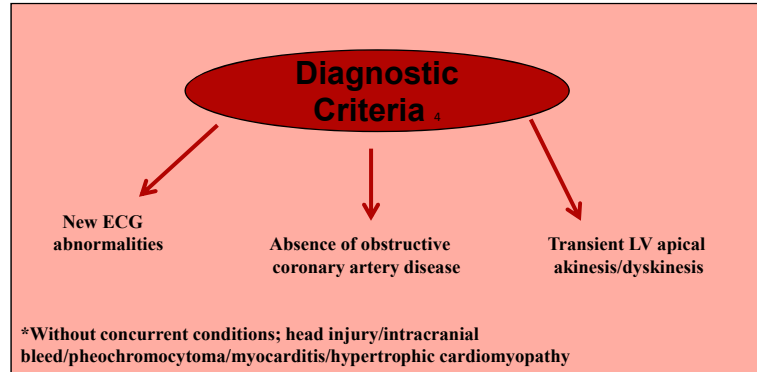
(*Circulation*. 2003;107:e120-e121.)

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Risk Factors

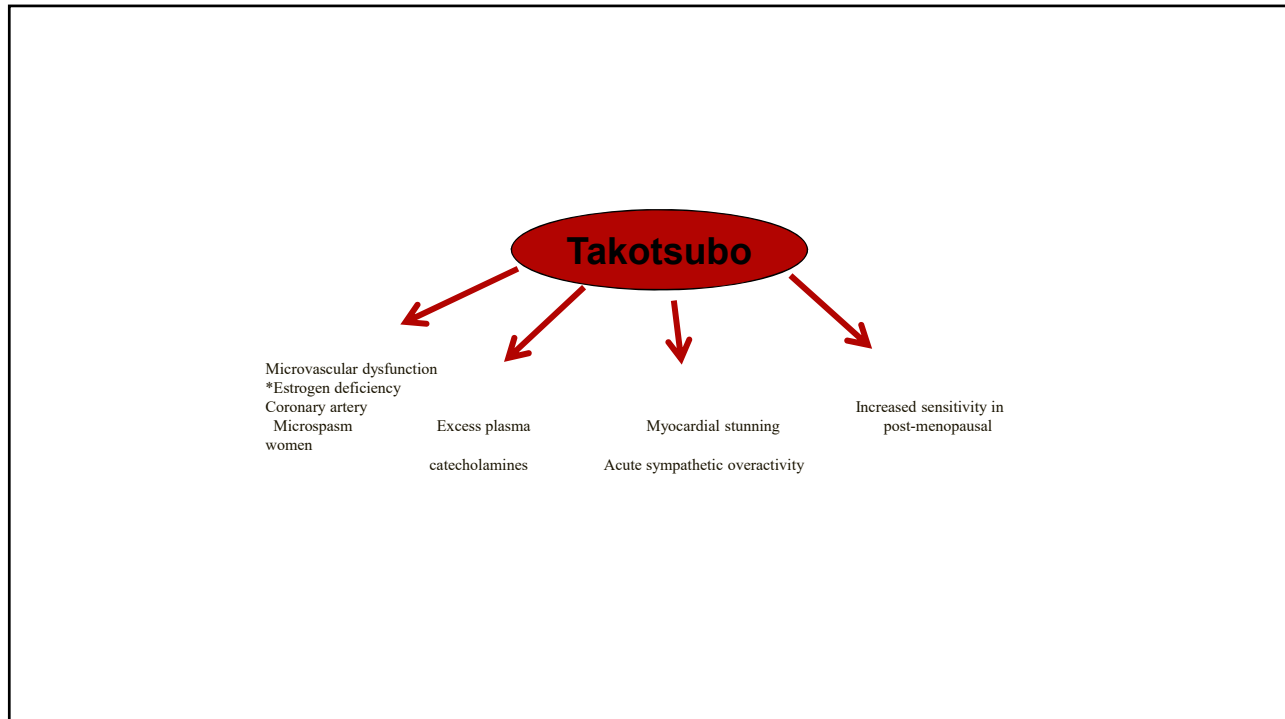
A significant emotional or physical stressor or neurologic injury typically precedes the development of the TCM.⁽⁴⁾ Stressors include the following:

- Learning of a death of a loved one
- Bad financial news
- Legal problems
- Natural disasters
- Motor vehicle collisions
- Exacerbation of a chronic medical illness
- Newly diagnosed, significant medical condition
- Surgery
- Intensive care unit (ICU) stay
- Use of or withdrawal from illicit drugs
- Near drowning episodes



Diagnostic Criteria

- Transient hypokineses, dyskinesia, or akinesia of the LV mid-segments, with or without apical involvement; the regional wall-motion abnormalities extend beyond a single epicardial vascular distribution, and a stressful trigger is often, but not always, present
- Absence of obstructive coronary disease or angiographic evidence of acute plaque rupture
- New ECG abnormalities (either ST-segment elevation and/or T-wave inversion) or modest elevation in the cardiac troponin level
- Absence of pheochromocytoma or myocarditis (5)



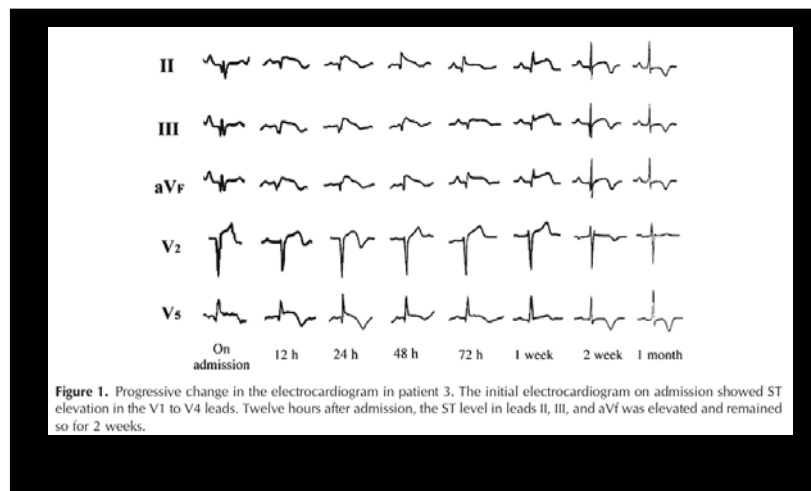
Patient History

- 70 yo AAF admitted with chest pain with a small enzyme leak
- No significant PMH
- Similar complaints at an outside hospital 2 days PTA

Patient History

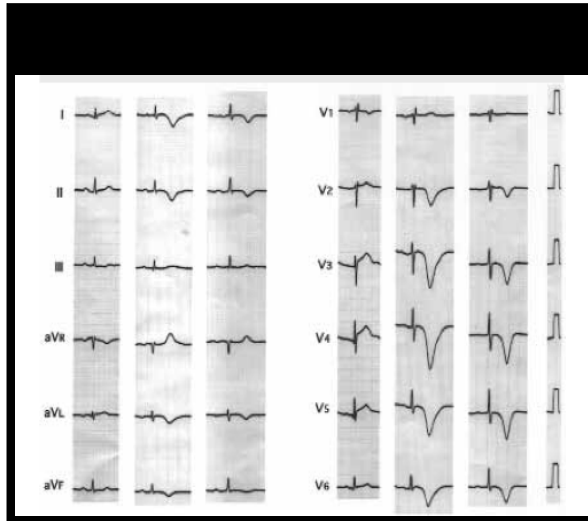
- At the time of admission:
 - BP 95/59, P 69, RR 16, P O₂ 100%
 - MB index 5.8
 - Troponin 0.45

Classic ECG features



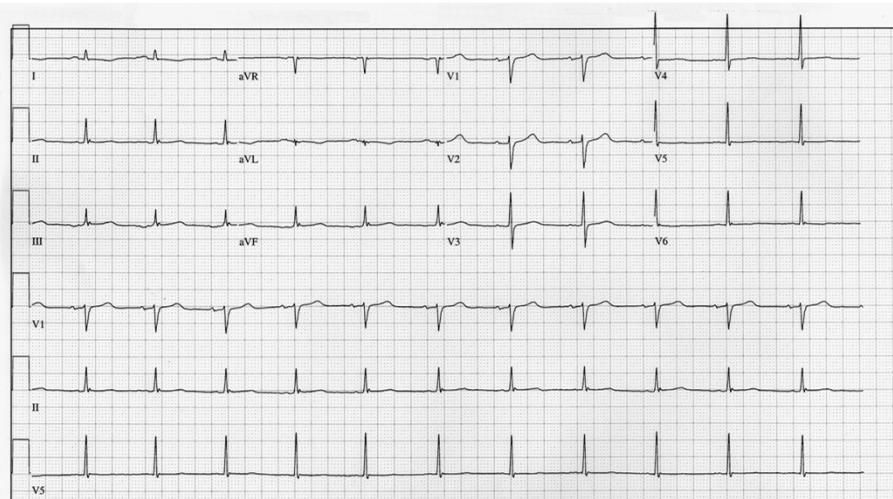
(Circulation. 2003;107:e120-e121.)
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Classic ECG features

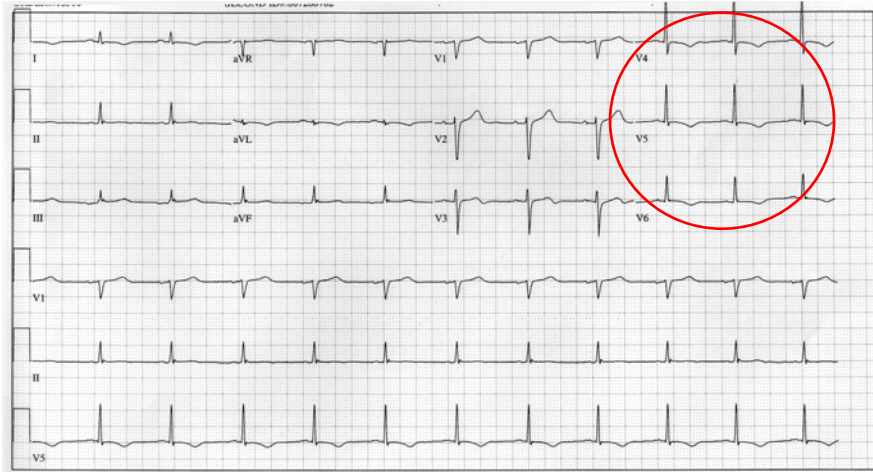


American Heart Journal
Volume 143, Number 3

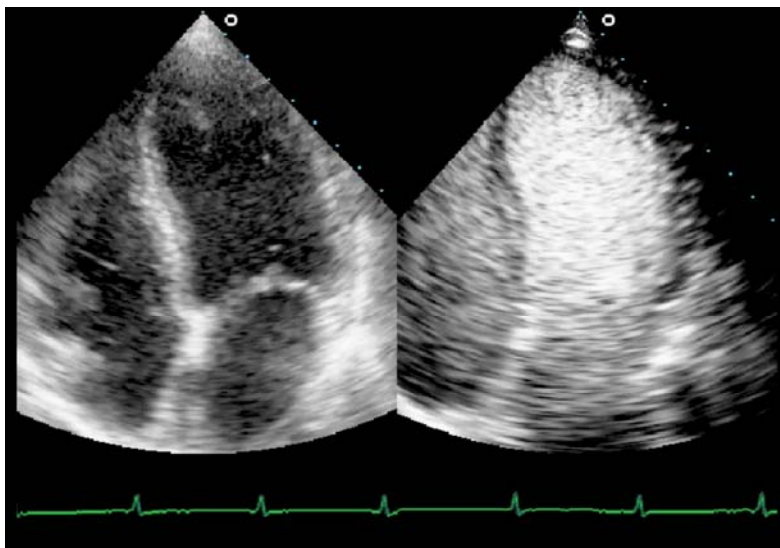
Initial ECG



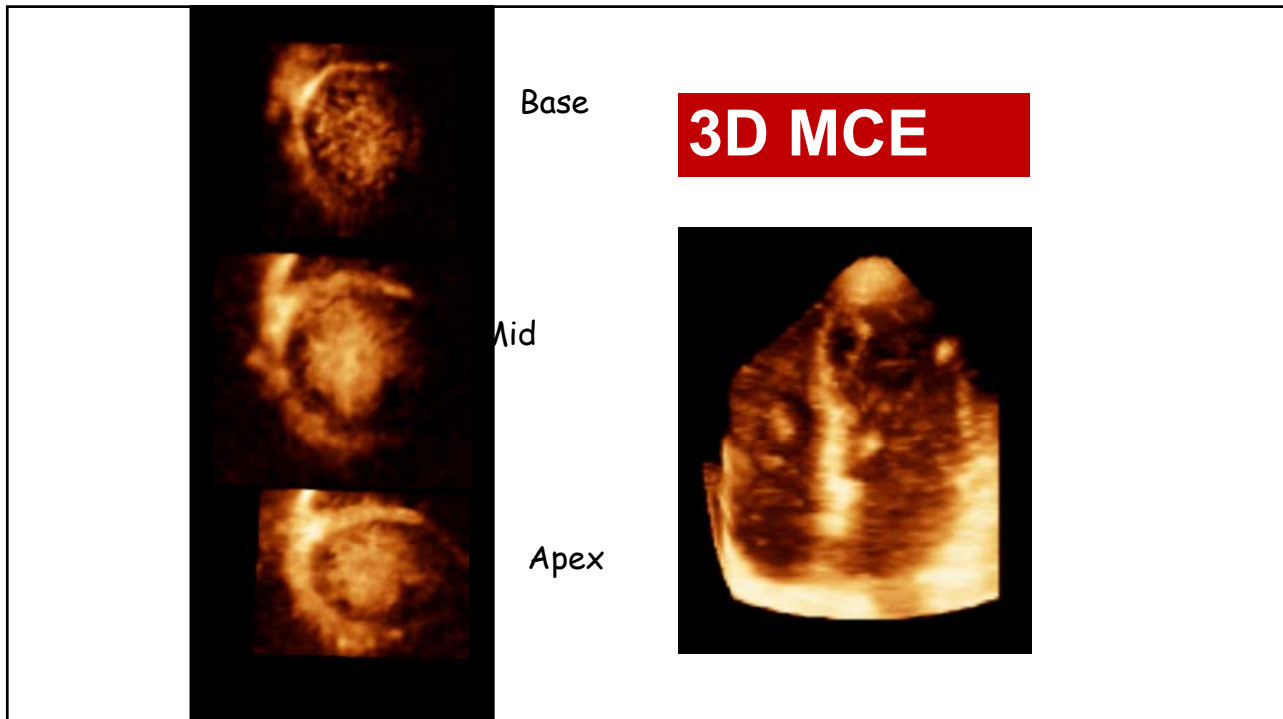
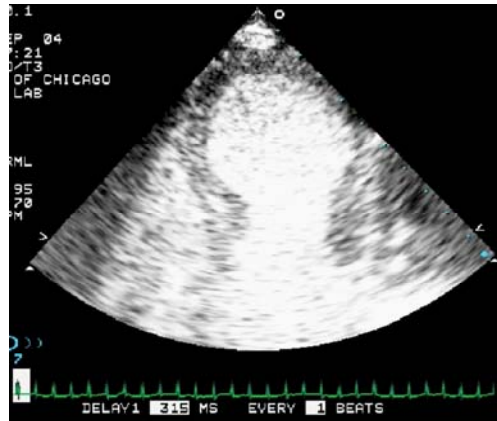
Follow-up ECG



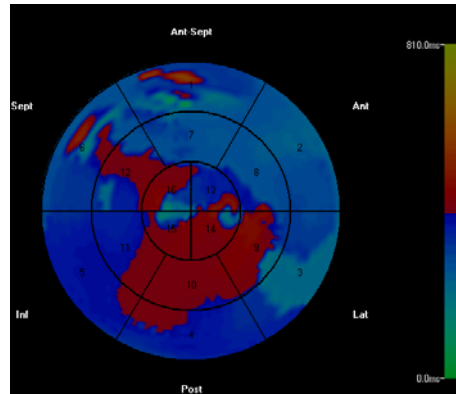
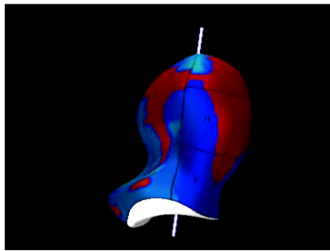
LV Function & MCE



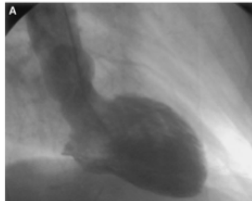
Low MI Triggered MCE



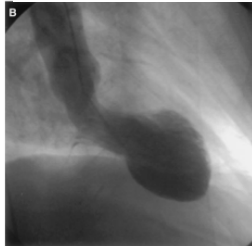
3D Velocity Mapping



LV Angiogram

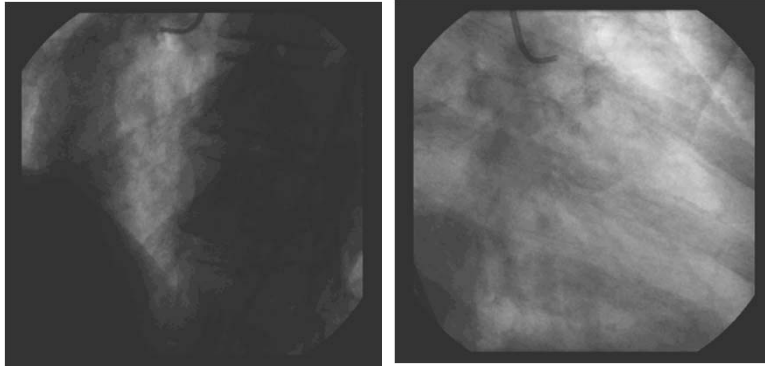


(Circulation. 2003;107:e120-e121.)
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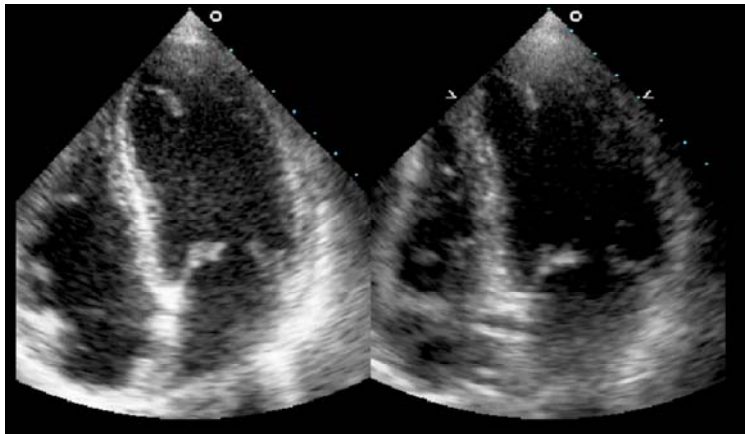


LVEDP - 25 mmHG - EF 25-30%- MR 2+

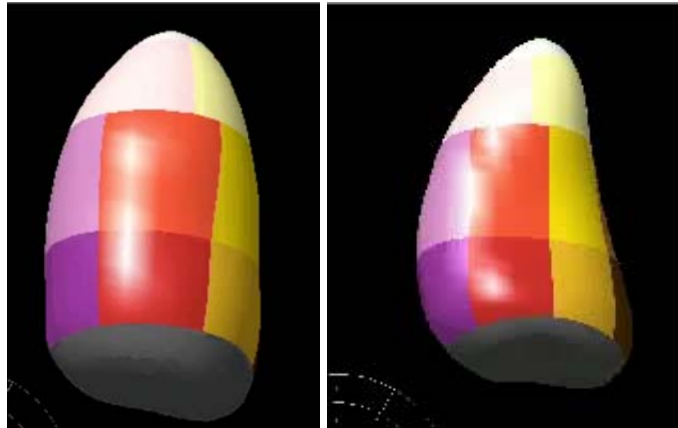
Coronary Angiography



Three weeks later

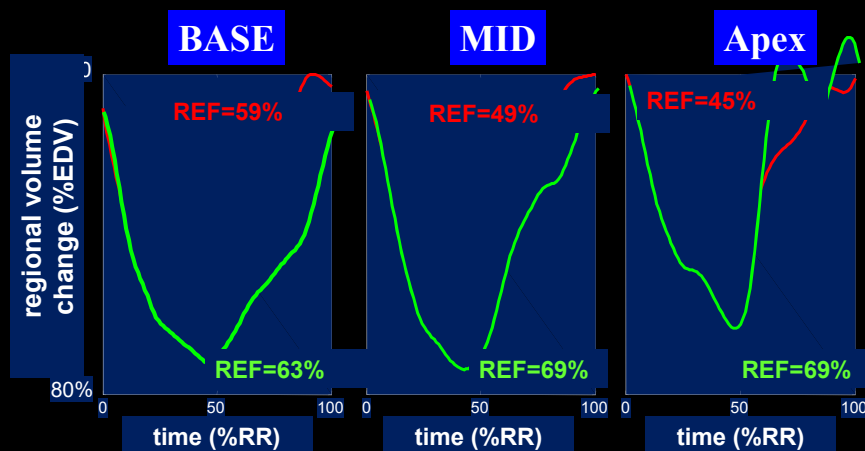


Three weeks later

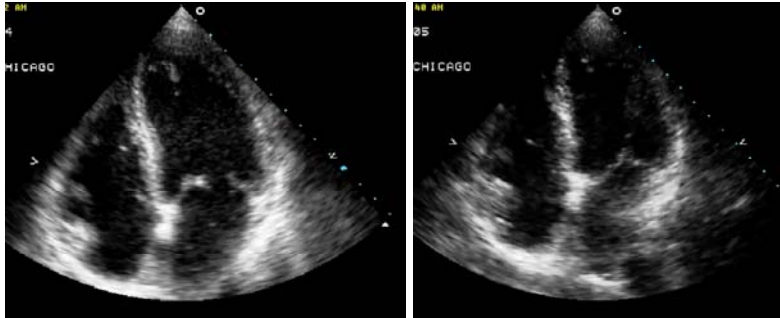


Regional EF

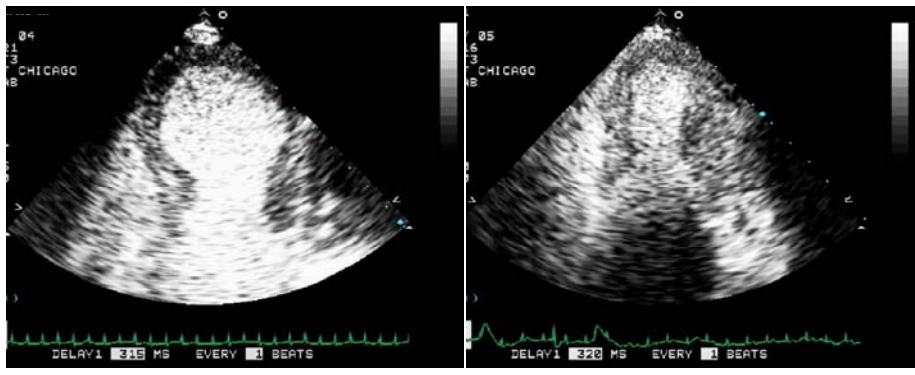
- During apical ballooning
- Three week follow-up

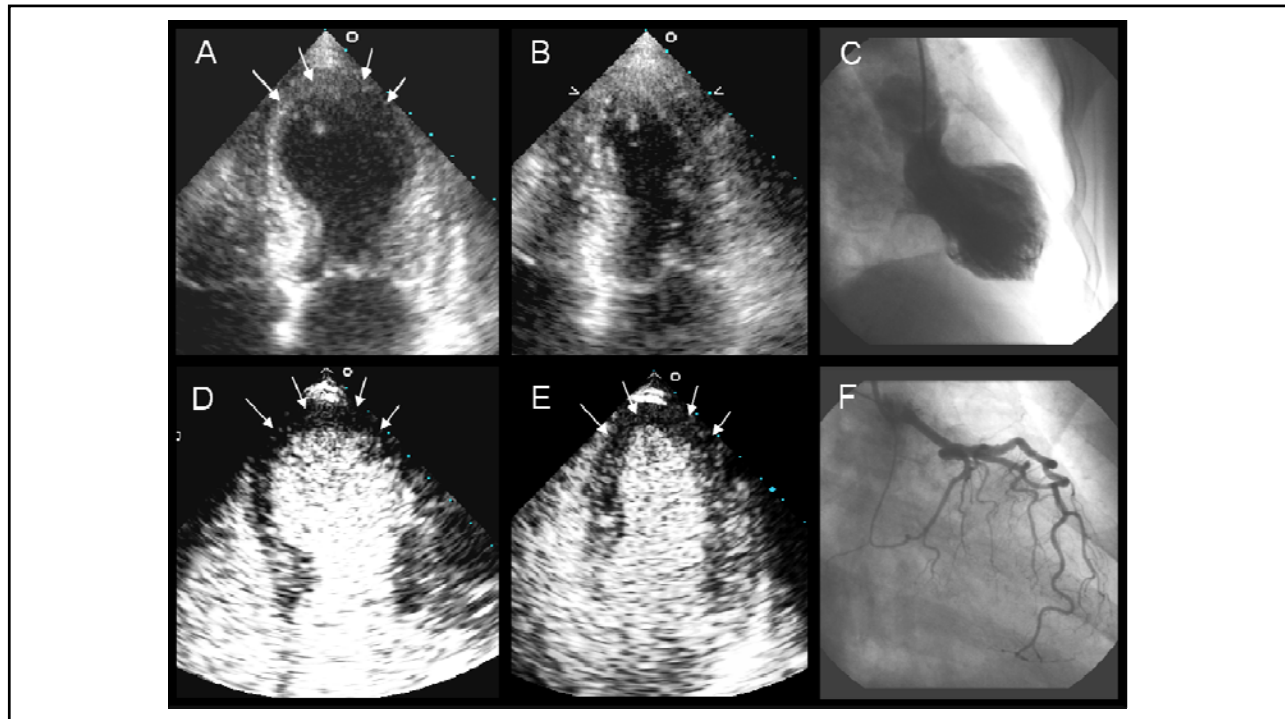


Three months later



Three months later



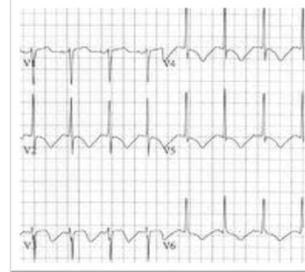


Etiology ???

- Localized cardiomyopathy
- Microvascular spasm
- Catecholamine-induced myocardial injury
 - Emotional distress
 - Pulmonary disease

Background

- ECG changes are seen in 92% of patients with acute stroke¹
 - QT prolongation is the most common stroke-related ECG change
 - 71% SAH, 64% intra-parenchymal hemorrhage, 38% ischemic stroke²
 - T wave abnormalities found in 15% of patients with acute stroke in absence of electrolyte abnormalities and myocardial ischemia³
 - Nonspecific ST segment changes seen in 22%, more common in ischemic stroke than hemorrhagic²
- Cerebral T waves
 - A.K.A. *hyperacute T waves*
 - Cerebral T waves (giant inverted T waves) first described in patients with subarachnoid hemorrhage, have subsequently been reported in ischemic stroke, transient ischemic attacks, and nonvascular cerebral lesions
 - Have been seen in up to 50% of patients with intracranial hemorrhage



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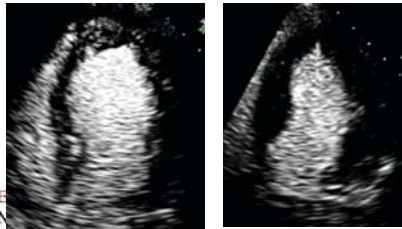
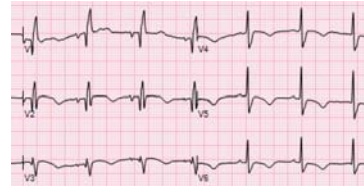
1. Goldstein D. The ECG in stroke: relationship to pathophysiological type and comparison with prior tracings. *Stroke*. 1979;10(3):253
2. Kchechinashvili G, Asplund K. ECG changes in patients with acute stroke: A Systematic review. *Cerebrovasc Dis*. 2002;14(2):67-76)
3. Lavy. The effect of acute stroke on cardiac functions as observed in an invasive stroke unit. *Stroke*. 1974;5(6):775

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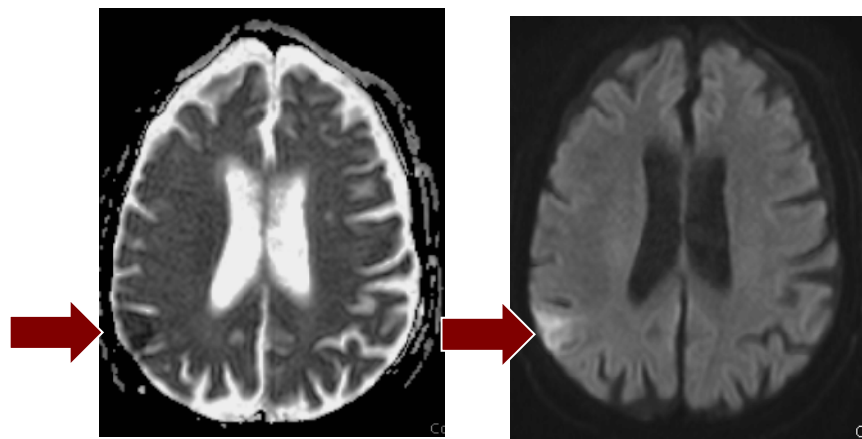
Background

- Transient, symmetric and deep inverted ECG T-waves in the setting of stroke, commonly referred to as cerebral T-waves, are an uncommon occurrence.
- Our study aimed to test the hypothesis that cerebral T-waves are associated with transient cardiac dysfunction.

**82 year old male
with acute
ischemic stroke of
right parietal lobe,
likely due to
embolic occlusion
of an MCA branch.**

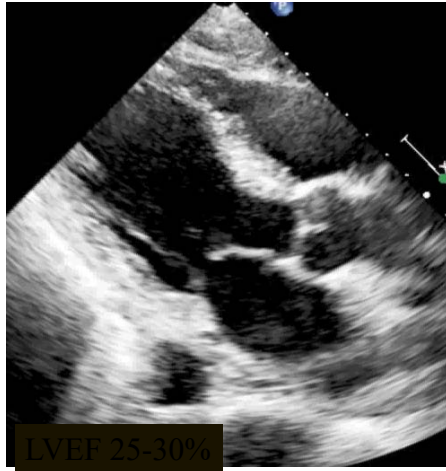


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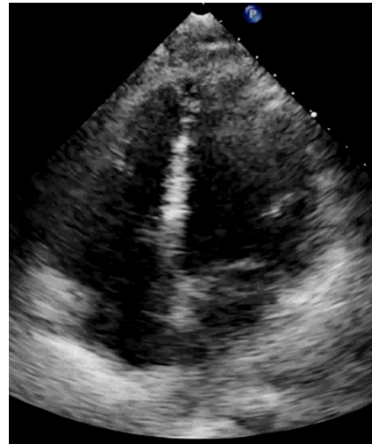
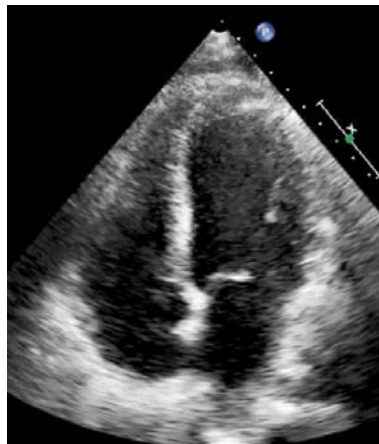


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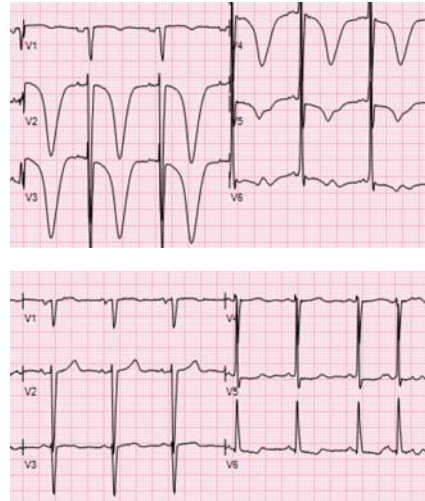
TTE 9/23/12 vs. 1/2013



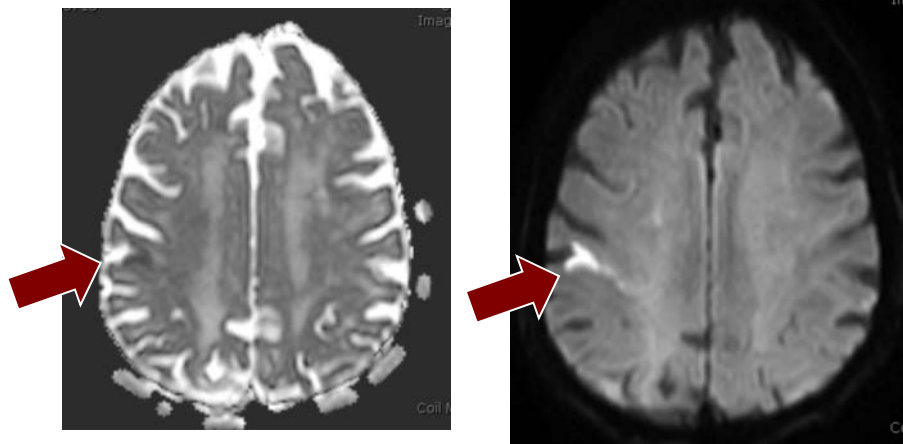
TTE 9/23/12 vs 1/2013



73 year old female with acute ischemic stroke of right middle cerebral artery branch.

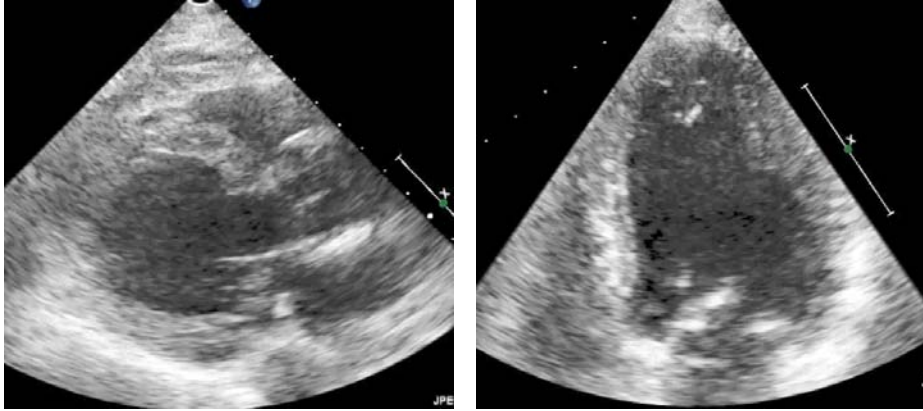


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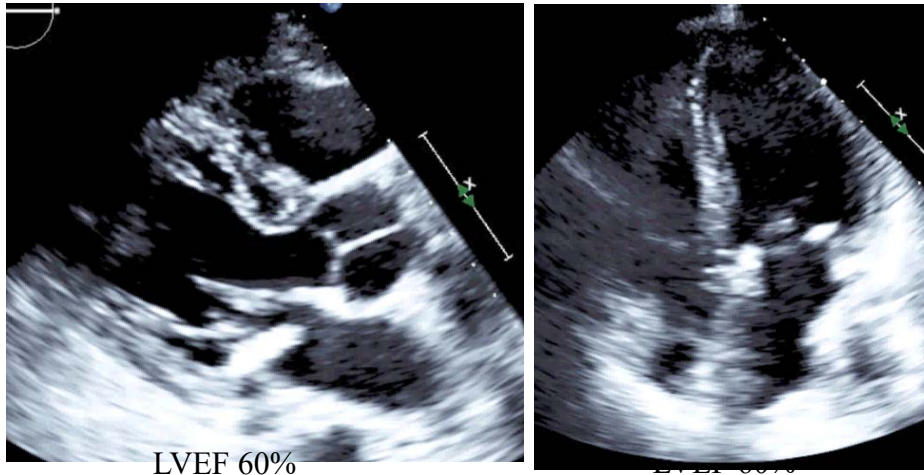


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TTE 8/17/2015



TTE 8/9/2013 vs 3/2016



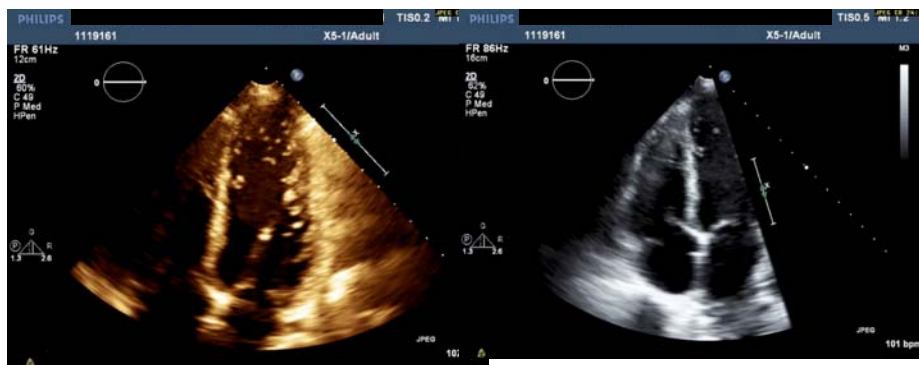
Discussion

Takotsubo Cardiomyopathy in Acute Ischemic Stroke

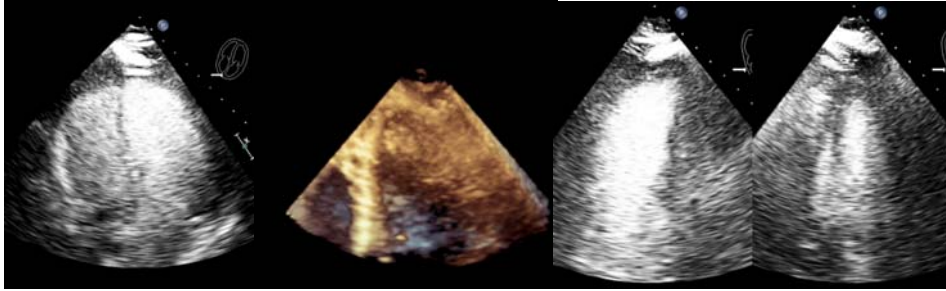
Sohei Yoshimura, MD, Kazunori Toyoda, MD, Tomoyuki Ohara, MD, Hikaru Nagasawa, MD, Noriko Ohtani, MD, Takahiro Kuwashiro, MD, Hiroaki Naritomi, MD, and Kazuo Minematsu, MD

- **Recent study with similar findings**
- 569 consecutive patients admitted with acute ischemic stroke
 - Hemorrhagic stroke not included since Takotsubo has been demonstrated in this already
- 7 patients had Takotsubo cardiomyopathy
 - **All 7 had negative giant T waves (cerebral T waves)**

RV and LV Takotsubo



Total Takot with thrombus



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- Takotsubo is a reversible cardiomyopathy that has become increasingly recognized in recent years.
- Takotsubo cardiomyopathy should be considered as part of the differential diagnosis in patients with acute coronary syndrome and severe left ventricular dysfunction.
- Elevated levels of catecholamines are thought to cause left ventricular dysfunction through the process of signaling trafficking, microvascular dysfunction and oxidative stress.
- The majority of patients are women and estrogen appears to play a significant role, although exact mechanisms are still unknown.
- The role of pharmacological treatment including β -blockers, ACE inhibitors and levosimendan is controversial and management remains largely supportive.
- Mortality rates are generally low with very long term complications.

