Takotsubo Cardiomyopathy: Pathophysiology and Assessment

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Japanese word for octopus catcher

Tako-Tsubo Cardiomyopathy

Broken Heart Syndrome

Apical Ballooning
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, dykinesis, or akinesis 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

*Without concurrent conditions; head injury/intracranial bleed/pheochromocytoma/myocarditis/hypertrophic cardiomyopathy
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 Ox 100%
  - MB index 5.8
  - Troponin 0.45

Classic ECG features

*Figure 1. Progression change in the electrocardiogram in patient 3. The initial electrocardiogram on admission showed ST elevation in the V1 to V4 leads. Twelve hours after admission, the ST level in leads II, III, and aVF was elevated and remained so for 2 weeks.*

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

Initial ECG
Follow-up ECG

LV Function & MCE
Low MI Triggered MCE

3D MCE

Base

MID

Apex
3D Velocity Mapping

LV Angiogram

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

During apical ballooning

- BASE
  - REF=59%
- MID
  - REF=49%
- Apex
  - REF=45%
Three months later

Three months later
Etiology ???

- Localized cardiomyopathy
- Microvascular spasm
- Catecholamine-induced myocardial injury
- Emotional distress
- Pulmonary disease
• 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 ischemia1
  - 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

1. Goldstein D. The ECG in stroke: relationship to pathophysiological type and comparison with prior tracings. Stroke. 1979;10(3)253

• 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.
TTE 9/23/12 vs. 1/2013

LVEF 25-30%

GLS -12%

LVEF 51.1%

GLS -18%
73 year old female with acute ischemic stroke of right middle cerebral artery branch.
TTE 8/17/2015

TTE 8/9/2013 vs 3/2016

LVEF 60%
Discussion

Takotsubo Cardiomyopathy in Acute Ischemic Stroke

Sohei Yoshimura, MD, Kazunori Toyoda, MD, Tomoyuki Ohara, MD, Hikaru Nagasawa, MD, Noriko Ohtani, MD, Takahiro Kawashiro, 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 Takottsubo
Total Takot with thrombus
- 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.