Differentiation of Takotsubo Cardiomyopathy from ST Elevation Myocardial Infarction in Patients Activated for Fast-Track Coronary Angiography

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Objective: *To compare clinical and electrocardiographic (ECG) features between Takotsubo cardiomyopathy (TC) and ST-elevation myocardial infarction (STEMI).*
Material and Method: *We retrospectively reviewed clinical, electrocardiographic, and laboratory features of 20 consecutive TC patients and 155 consecutive STEMI patients who were activated for fast-track coronary angiography and were ultimately diagnosed with either TC or STEMI and compared these data between the two groups.*
Results: *Patients with TC were older (p = 0.001), more often female (p = 0.001), had more often been triggered by intense emotional or physical stress (p = 0.001) or illness (p = 0.001), and had a lower rate of smoking (p = 0.005) than STEMI patients. Compared with patients who presented with anterior wall STEMI, those with TC less commonly had Q waves (30.0% vs. 62.9%, p = 0.007) and reciprocal change (0.0% vs. 37.1%, p = 0.001), and had a lower rate of ST-segment elevation in lead V1 (5.0% vs. 59.8%, p = 0.001). ST-segment depression was also more common in TC in lead aVR (20.0% vs. 2.1%, p = 0.008). Previously proposed ECG criteria had low sensitivity, but high specificity in our patients. Our proposed point scoring model includes the use of both clinical and ECG findings. According to our proposed model, a score ≥4 had 90% sensitivity and 98% specificity in differentiating TC from acute anterior STEMI (AUC = 0.976, p<0.001).*
Conclusion: *In patients activated for fast-track coronary angiography because of acute coronary ST-segment elevation syndrome, a number of clinical and ECG features differ between TC patients and patients with true STEMI. Our proposed point scoring model that uses clinical and ECG findings demonstrated improved diagnostic accuracy in differentiating TC from acute anterior STEMI.*

Keywords: *Clinical and electrocardiographic findings, ST elevation myocardial infarction, Takotsubo cardiomyopathy*

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Takotsubo cardiomyopathy (TC; apical ballooning syndrome or stress-induced cardiomyopathy) is associated with acute reversible apical and/or middle segment left ventricular (LV) dysfunction without significant coronary stenosis. This syndrome was first described in 2001 in Japanese patients who presented with LV dysfunction that resulted in their hearts resembling octopus traps (takotsubo, in Japanese)[1-5]. TC has electrocardiographic features similar to ST-elevation myocardial infarction (STEMI), which makes it difficult to differentiate one from the other, especially in acute settings[6-8]. Because treatment and prevention are very different between these two conditions, previous studies have explored and compared clinical and electrocardiographic (ECG) findings of TC and STEMI. STEMI is life threatening and has a poor prognosis if correct treatment is not promptly administered. Regarding clinical characteristics, patients with TC are reportedly more often older menopausal women and have fewer coronary heart disease (CHD) risk factors than those with STEMI. Additionally, TC is often precipitated by physical stress, such as surgery, sepsis, and/or acute psychological problems[4-6]. Previous studies have compared ECG features between TC and STEMI of the anterior wall (anterior STEMI) and have proposed diagnostic criteria[9-11]. However, clinical and ECG findings alone

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do not clearly differentiate these disorders. Moreover, increased concentrations of cardiac biomarkers, such as creatine kinase-MB (CKMB) and troponin T can be found in both TC and STEMI patients. Coronary angiography shows culprit lesions or significant coronary stenosis in patients with STEMI, whereas patients with TC have normal coronary arteries.

As such, we set forth to compare the clinical, ECG, and laboratory characteristics between patients with TC and those with STEMI with the aim of identifying factors that may help to differentiate TC from STEMI.

Material and Method

Patients

This study was approved by the Siriraj Institutional Review Board (SIRB) and complied with the provisions set forth in the Declaration of Helsinki and all of its subsequent amendments. We retrospectively reviewed the medical data of consecutive patients who had been activated for emergent coronary angiography for suspected STEMI at Siriraj Hospital between January 2008 and December 2010. We included patients who were at least 18 years old, had clinical and ECG features compatible with STEMI, had undergone coronary angiography for the first time, and whose cardiac function had been assessed by echocardiography, cardiac magnetic resonance imaging, or ventriculography. We excluded patients who had received thrombolytic agents, had been diagnosed with pheochromocytoma, myocarditis, or intracranial hemorrhage, had a history of previous coronary angiography, or who had poor quality cardiac imaging. We then classified patients into either the STEMI or TC groups.

STEMI group

To diagnose STEMI, we used the third universal definition of myocardial infarction, as follows[12]: 1) detection of rise and/or fall in cardiac biomarker values with at least one of the following: symptom of ischemia, new left bundle branch block, development of pathological Q wave, imaging evidence of new loss of viable myocardium or new regional wall abnormality, or identification of intracoronary thrombus by angiography or autopsy, 2) ST-segment elevation: new ST elevation at the J point in two contiguous leads with the following cut-off points: greater than 0.1 mV in all leads other than leads V2 and V3 where the following cut-off points apply: greater than 0.2 mV in men older than 40 years, greater than 0.25 mV in men younger than 40 years, or greater than 0.15 mV in women. Initially, 299 patients were diagnosed with STEMI; however, we subsequently excluded 144 patients because the diagnosis of STEMI was not definite or they met the criteria for exclusion. This left 155 patients, 97 of whom had anterior wall STEMI and 58 who had inferior wall STEMI.

TC group

To diagnose TC, we used the Mayo Clinic criteria[1,13], which included transient left ventricular apical akinesis or dyskinesis in the absence of significant obstructive coronary disease. Patients must also have had new ECG abnormalities in the absence of recent head trauma, intracranial bleeding, pheochromocytoma, obstructive coronary artery disease, myocarditis, or hypertrophic cardiomyopathy. Because there were very few TC patients during the 3-year study period, we added data of consecutive TC patients until July 2013. An initial diagnosis of TC was made in 22 patients; however, we excluded two patients because the diagnosis of TC was not defined. Thus, 20 patients were definitively diagnosed with TC.

Data collection

Clinical data, including baseline characteristics, presenting symptoms, ECG, and laboratory findings, were collected and compared between the two groups.

Statistical analysis

To compare variables between TC and STEMI, we used Student's t-test for continuous variables with normal distribution and Mann-Whitney U test for continuous variables with non-normal distribution. For categorical variables, we used Chi-squared test or Fisher's exact test. Qualitative data were presented as frequencies and percentages and quantitative data as mean ± standard deviation for normal distribution and median (minimum-maximum) for non-normal distribution. Differences were considered statistically significant at p-value of less than 0.05. The best cut-off value for the statistical significance of variables was determined by Receiver Operating Characteristic (ROC) curve analysis and assessing validity by Area Under Curve (AUC). All data analysis was performed using SPSS version 22.

Results

Patient demographic and clinical data

Relevant baseline and clinical characteristics are listed in Table 1. Patients with TC were significantly

Table 1. Baseline characteristics of patients in the Takotsubo cardiomyopathy (TC) group and the acute ST elevation myocardial infarction (STEMI) group

	TC (n = 20)	STEMI (n = 155)	*p*-value
Female	18 (90.0)	43 (27.7)	0.001
Age (years)	73±10	60±13	0.001
Comorbidities			
Diabetes	6 (30.0)	70 (45.2)	0.198
Hypertension	13 (65.0)	83 (53.5)	0.333
Dyslipidemia	8 (40.0)	135 (87.1)	0.001
Ischemic stroke	5 (25.0)	4 (2.6)	0.001
Chronic kidney disease	1 (5.0)	16 (10.3)	0.697
Smoking	2 (11.8)	67 (47.2)	0.005
Presenting symptoms			
Angina	4 (20.0)	131 (84.5)	0.001
Dyspnea	0 (0.0)	5 (3.2)	1.000
PND/orthopnea	5 (25.0)	28 (18.1)	0.542
Syncope	2 (10.0)	7 (4.5)	0.274
Cardiac arrest	1 (5.0)	9 (5.8)	1.000
Non-cardiac surgery	8 (40.0)	2 (1.3)	0.001
Illness	12 (60.0)	5 (3.2)	0.001
Lab findings			
Hematocrit (%)	34±6	41±6	0.001
White cell count (x1,000/uL)	10.0 (5.0-38.9)	11.6 (4.1-30.6)	0.818
Serum cholesterol (mg/dL)	140±56	190±49	0.003
Serum triglyceride (mg/dL)	102±36	121±54	0.276
Serum HDL (mg/dL)	37±14	43±12	0.143
Serum LDL (mg/dL)	77.1 (40-192)	123.6 (13-290)	0.001
Creatinine (mg/dL)	0.8 (0.2-1.6)	1.0 (0.5-9.1)	0.001
Peak CKMB (ng/mL)	18.8 (1.2-35.5)	119.0 (2.8-500.0)	0.001
Peak troponin T (ng/mL)	0.51 (0.02-1.74)	1.27 (0.01-25.00)	0.087
Ejection fraction (%)	46±10	51±14	0.117

CKMB = creatine kinase-MB; HDL = high-density lipoprotein; LDL = low-density lipoprotein; PND = paroxysmal nocturnal dyspnea
All data presented as n (%), mean ± standard deviation, or median, unless otherwise specified
p-value <0.05 indicates statistical significance

older (p = 0.001), and more likely to be female (p = 0.001) than STEMI patients. TC patients also had a lower frequency of angina (p = 0.001) and a greater rate of physical stress, especially non-cardiac surgery (p = 0.001), and illness triggered by an acute episode (p = 0.001).

Laboratory data

Regarding laboratory investigations, hematocrit (p = 0.001), total cholesterol (p = 0.003), low-density lipoprotein (p = 0.001), creatinine (p = 0.001), and peak CKMB (p = 0.001) values were significantly lower in TC patients (Table 1).

Electrocardiographic data

ECG features are presented in Table 2. The most common ECG finding in patients with TC was anterior ST-segment elevation. Patients with TC have more leads with ST-segment elevation than patients with STEMI; however, this difference between groups was not statistically significant. Patients with TC have more generalized ST-segment elevation involving both anterior (V2-6) and inferior leads (II, III, aVF), but a lower rate of Q wave presentation and ST-segment depression (p = 0.008).

TC and anterior STEMI

We separately analyzed a subgroup of patients with anterior STEMI (Fig. 1, 2). When we compared ECG findings in TC with patients with anterior STEMI, patients with TC had a higher rate of ST-segment elevation in the inferior leads (II, III, aVF), while patients with anterior STEMI had more reciprocal change with ST-segment depression in the inferior

Table 2. Electrocardiographic (ECG) features of patients in the TC group and acute STEMI group

	TC (n = 20)	STEMI (n = 155)	*p*-value
Q wave	6 (30.0)	95 (61.3)	0.008
ST-segment elevation			
Anterior and/or lateral	19 (95.0)	102 (65.8)	0.008
Anterior and inferior	7 (35.0)	2 (1.3)	0.001
Inferior	1 (5.0)	53 (34.2)	0.008
Number of leads	5.4±2.6	4.3±1.7	0.083
ST-segment depression	4 (20.0)	96 (62.3)	0.001
Negative T wave	18 (90.0)	147 (94.8)	0.320

All data presented as n (%) or mean ± standard deviation, unless otherwise specified
p-value <0.05 indicates statistical significance

leads ($p = 0.001$) (Fig. 1). TC patients also had a lower rate of lead V1 elevation, but a higher rate of lead aVR and V1 depression. TC patients had a lower rate of Q wave presentation in anterior leads (Fig. 2). Typical ECG features of TC patients in our study are shown in Fig. 3.

The sensitivity and specificity of previous proposed ECG criteria were quite different when applied to our population as demonstrated in Table 3. This could be due to unique characteristic of Thai population. When used only the ECG criteria, the specificity was high but the sensitivity was low. We proposed the criteria to use both clinical and ECG characteristic to improve diagnostic accuracy in our population.

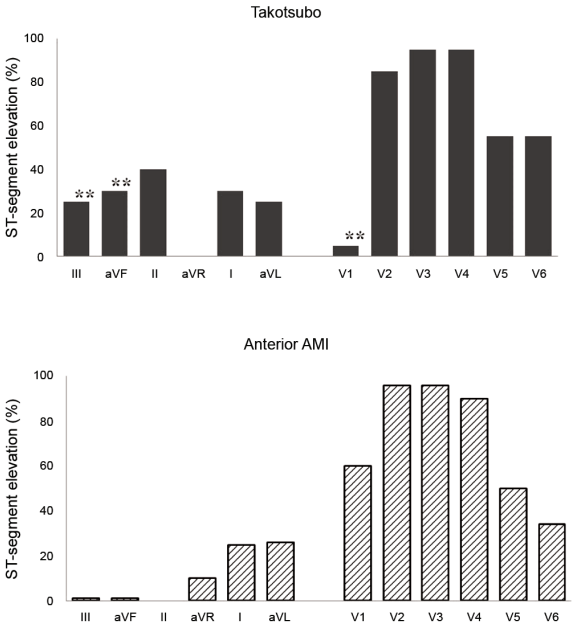

Fig. 1 Prevalence of ST segment deviation presentation in patients with Takotsubo cardiomyopathy and those with anterior STEMI. More generalized ST elevation was observed in precordial leads, except in V1. ST segment elevation in V1 was more frequently found in anterior STEMI. TC patients demonstrated higher prevalence of ST segment depression in V1. Reciprocal change (ST depression in II, III, and aVF) in inferior leads was more common in anterior STEMI; whereas, TC patients had higher prevalence of ST segment elevation in II, III, and aVF (* $p<0.05$, ** $p<0.01$).

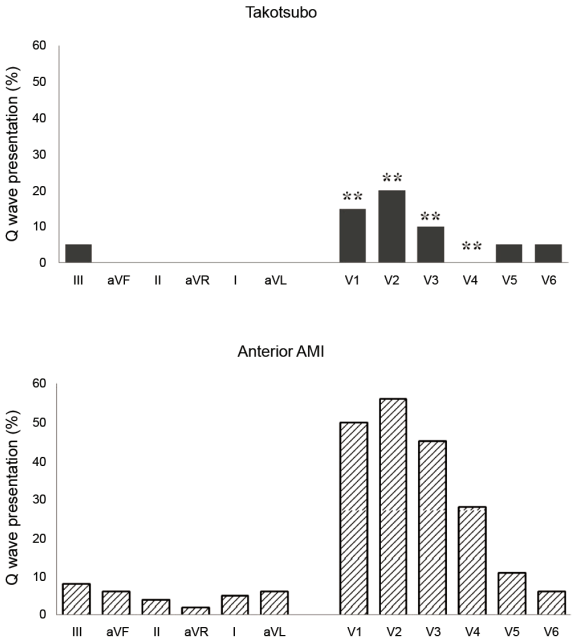

Fig. 2 Prevalence of Q wave presentation in patients with Takotsubo cardiomyopathy and those with anterior STEMI. Prevalence of Q wave presentation in TC patients was lower than in patients with STEMI (** $p<0.01$).

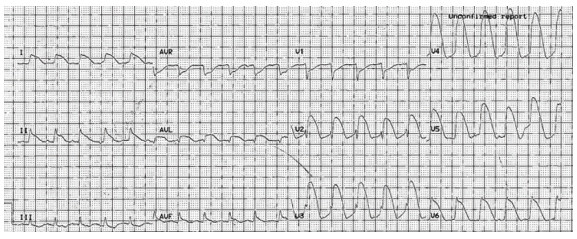

Fig. 3 Electrocardiographic features of Takotsubo cardiomyopathy, which showed generalized ST elevation involving both anterior and inferior leads with ST depression in aVR and V1. Absence of ST elevation in V1 and absence of reciprocal change in the inferior leads was also observed.

Based on our data, we identified clinical and ECG findings that differentiate TC from acute anterior STEMI. Based on an analysis of patient demographic data, ROC curve identified age older than 70 as having sensitivity of 65% and specificity of 75% in differentiating TC from acute anterior STEMI (AUC = 0.78, $p<0.001$). Female gender had sensitivity of 90% and specificity of 73% in differentiating TC from acute anterior STEMI. History of major illness, such as sepsis or shock had sensitivity of 60% and specificity of 97%. History of non-cardiac surgery had sensitivity of 40% and specificity of 99% in differentiating the two conditions. For ECG criteria, presence of greater than 1 mm ST elevation in lead II, III, or aVF in setting of ST elevation in precordial lead had sensitivity of 40% and specificity of 99%. Absence of greater than 1 mm ST elevation in lead V1 in setting of ST elevation in precordial lead had sensitivity of 5% and specificity of 40% in identifying between TC and acute anterior STEMI.

The point scoring model were determined by coefficient of odds ratio (OR) from Logistic regression analysis. We developed to help differentiate TC from acute anterior STEMI is described as follows:

1. Age older than 70 (1 point)
2. Female gender (1 point)
3. History of illness (e.g., severe sepsis, shock) (3.5 points)
4. History of non-cardiac surgery (4.5 points)
5. Presence of greater than 1 mm ST elevation in lead V1 in setting of ST elevation in precordial lead (3 points)
6. Presence of greater than 1 mm ST elevation in any of lead II, III, or aVF in setting of ST elevation in precordial lead (2.5 points)

For point, score total of greater than 4, sensitivity improved to 90% and specificity improved to 98% (Table 4). ROC curve analysis yielded AUC = 0.976, $p<0.001$ (OR 427, 95% CI 56-3,234). The score range 4 to 15.5 will favor the diagnostic of TC where score range lower than 4 will lower the diagnostic of TC to alternative diagnosis of STEMI.

Discussion

Dominant characteristics of patients that we identified as being associated with diagnosis of TC included advanced age, female gender, low number of risk factors for coronary heart disease, and triggering by physical stress, especially non-cardiac surgery and illness. Conversely, patients with STEMI presented at younger ages, were predominantly male, had higher number of risk factors for coronary heart disease, and reported no triggering stress at onset of the event. El-Sayed et al compared demographic data, co-morbidities of patients with TC, myocardial infarction, and orthopedic joint injury from National Inpatient

Table 3. Comparison of ECG criteria between previous studies and the present study

	Previous studies		The present study	
	Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)
ST depression in aVR + absence of ST elevation in V1[9]	91.0	95.0	20.0	97.9
ST elevation ≥ one lead of V3 to V5 + absence of ST elevation in V1[10]	74.2	80.6	90.0	61.9
Positive T waves in aVR + absence of negative T waves in V1[11]	94.0	95.0	5.0	97.9

Table 4. Diagnostic accuracy and area under the curve (AUC) for each clinical and ECG finding and proposed model that combines clinical and ECG findings into a score to differentiate TC from anterior STEMI

Clinical and ECG findings	Cut-off	Sensitivity	Specificity	PPV	NPV	Accuracy	AUC (95% CI)
Age	70	65%	75%	35%	91%	74%	0.781 (0.670-0.892)
Female	-	90%	73%	41%	97%	76%	-
History of non-cardiac surgery	-	40%	99%	89%	89%	89%	-
History of major illness (sepsis, shock)	-	60%	97%	80%	92%	91%	-
Presence of ST elevation in II, III, or aVF	-	40%	99%	89%	89%	89%	-
Presence of ST elevation in V1	-	5%	40%	2%	67%	34%	-
Point scoring summation of score ≥4	4	90%	98%	90%	98%	97%	0.976 (0.943-1.000)

PPV = positive predictive value; NPV = negative predictive value

Samples (NIS) hospital discharge database[5]. From an analysis of patients with TC, they found that 89% were woman and they were less likely to have cardiovascular risk factors, but were more likely to have anxiety disorders, cerebrovascular disease, and sepsis. Dominant risk factors in patients diagnosed with TC from our study, such as older woman with lower CV risk, but higher history of ischemic stroke, were similar to findings from the El-Sayed et al case-control study. We also found that patients who were diagnosed with TC were less likely to present with angina symptoms, but that a majority of TC patients had history of non-cardiac surgery or major illness. Observation data from Cacciotti et al found that 83% of patients diagnosed with TC had identifiable precipitating events[6]. Sudden severe emotional and/or physical stress activated neuron cells expressing estrogen receptors of central autonomic network, followed by marked increase in sympathetic neuronal and adrenomedullary hormonal outflows. This leads to a significant release of epinephrine and norepinephrine into blood circulation and heart-induced catecholamine toxicity in cardiomyocytes. Hypercontraction and functional basal obstruction of the left ventricular outflow tract increases mechanical wall stress into the LV apex, which leads to a stunning of apical myocardium[1].

Regarding laboratory data, TC patients had lower level of hematocrit and LDL. For cardiac enzyme concentrations, TC patients had lower peak CKMB concentrations than STEMI patients. Peak CKMB concentration from a previous report ranged from 10-51 ng/mL[6,7,13].

The most common ECG finding was ST-segment elevation involving anterior leads. The high percentage of precordial leads ST elevation and low percentage of Q wave presentation was similar to results from a systemic review reported by Pilgrim et al[14]. We compared a subgroup of patients with anterior wall STEMI to TC patients and found that TC patients had a statistically significantly higher rate of ST-segment elevation involving inferior leads and a lower rate of Q wave presentation. Patients diagnosed with TC had a lower rate of ST-segment depression in inferior leads, which represents a lack of reciprocal changes.

TC has a unique wall motion abnormality. From the pathophysiology, a surge of epinephrine and norepinephrine into blood circulation causes hypercontraction and functional basal obstruction of the left ventricular outflow tract, which leads to the effect of stunning the apical myocardium. ECG findings in patients diagnosed with TC had more predominant ST-segment elevation in the apical lead, such as: 1) summation of ST-segment elevation in V4 to 6 more than in V 1-3; 2) ST-segment usually elevated in II, III, and aVF; 3) ST-segment elevation usually not present in V1; 4) ST-segment elevation may present in lead aVR; and 5) lack of reciprocal change (ST-segment depression in II, III, and aVF). However, these criteria only apply when the anterior STEMI culprit lesion is involved in the proximal left anterior descending artery (LAD) above the first diagonal branch (D1) and the first septal perforator (S1). Inoque et al compared ECG findings between patients diagnosed with TC and anterior STEMI[15]. They separated anterior STEMI patients into three groups: group A - culprit lesion above both D1 and S1, group B - culprit lesion either above D1 or S1, and group 3 - culprit lesion distal to both D1 and S1. The criteria of summation of ST-segment in V4 to 6/ST-segment in V1 to 3 or ST-segment elevation in inferior leads only applies when the culprit lesion in patients with anterior STEMI is above both D1 and S1. Q wave formation was also found to be less common in patients diagnosed with TC. However, Q wave formation may also not be found in patients who present early with anterior STEMI.

The previously proposed criteria[9-11] had lower sensitivity, but high specificity in our population. The ECG criterion of presence of ST elevation ≥ one lead of V3 to V5 in absence of ST elevation in V1[10] had higher sensitivity, but lower specificity in our study. For the other two of the previously proposed ECG criteria[9,11] (presence of ST depression in aVR in absence of ST elevation in V1 and presence of positive T waves in aVR in absence of negative T waves in V1), sensitivity in our study subjects was considerably lower than described in the original reports, with specificity being similar. This discrepancy may not only reflect some unique aspect of our study subjects, but may also be due to some STEMI patients having culprit lesion distal to the first septal perforator and the first diagonal branch. Clearly, none of these sets of criteria were suitable for screening our subjects.

Ability to differentiate TC from true anterior wall STEMI would result in reduced workload due to a reduction in inappropriately activated for emergent coronary angiography for STEMI patients. Admittedly, serial measurement of cardiac biomarkers and adherence to hospital course is not useful or advised when decision-making time is limited. STEMI is time dependent for myocardial salvage. The combined use of both clinical findings and ECG findings is the

practical way to differentiate these two diseases since both are easily obtainable at first presentation. Using this information, we developed a point scoring system model that uses both clinical and ECG findings to differentiate TC from acute anterior STEMI. The model uses summation of score from clinical and ECG findings to improve sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of diagnosis. Using summation of score from 1) age older than 70, 2) female gender, 3) history of illness, 4) history of non-cardiac surgery, 5) absence of greater than 1 mm ST elevation in V1, and 6) the presence of greater than 1 mm ST elevation in any of lead II, III, or aVF in setting of ST elevation in precordial lead improves diagnostic accuracy in separating TC from acute anterior STEMI (Table 4).

The clinical scenario involving older female patients in a postoperative status who are suspected of anterior ST elevation MI without angina symptoms would qualify as a clinical clue for suspecting TC. The prior proposed ECG criteria for TC had low sensitivity, but high specificity in our patients. However, the use of both clinical and ECG findings in our proposed point scoring system significantly improved ability to differentiate TC from acute anterior STEMI.

Conclusion

In patients underwent emergent coronary angiography because of suspected STEMI, clinical clues for diagnosis of TC include older female subjects with no angina symptoms, no or few risk factors for coronary heart disease, and events triggered by severe emotional or physical stress, especially following non-cardiac surgery. Compared to the subgroup with anterior wall segment elevation, TC patients had higher rate of more generalized ST-segment elevation in precordial lead excluding V1, summation of ST-segment elevation in V4 to 6 more than in V 1 to 3, higher rate of ST-segment elevation in aVR, lower rate of Q wave presentation, and no reciprocal change in the inferior leads. However, ECG criteria are only helpful when the culprit lesion in anterior STEMI is positioned above the septal and diagonal branches. In this report, we propose a point scoring model that incorporates the use of both clinical and ECG findings that improves diagnostic accuracy by differentiating TC from acute anterior STEMI.

Limitations

This study had some inherent limitations. First, because of the retrospective nature of this study, some important variables, such as psychological stress or follow-up events, may not have been documented. One hundred forty four suspected STEMI patients were excluded due to diagnostic criteria for STEMI or TC is not met therefore selection bias might occur. A prospective study should be undertaken for purposes of comparing data. Second, because there were so few subjects, some apparent differences between groups did not reach statistical significance as such, a larger study is required.

What is already known on this topic?

TC has clinical clues that help to differentiate it from ST elevation myocardial infarction, such as older female, no angina symptoms, no or few risk factors for coronary heart disease, and triggered by intense emotional or physical stress.

What this study adds?

We proposed a point scoring model that uses both clinical and ECG findings. Our proposed model improves diagnostic accuracy in differentiating TC from acute anterior STEMI.

Potential conflicts of interest

None.

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การศึกษาเพื่อแยกความแตกต่างระหว่างภาวะ Takotsubo cardiomyopathy (TC) จากภาวะหัวใจขาดเลือดเฉียบพลันแบบ ST elevation myocardial infarction (STEMI) ในผู้ป่วยที่มารับการฉีดสีแบบฉุกเฉินจากการสงสัยภาวะหัวใจขาดเลือดเฉียบพลันแบบ STEMI

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วัตถุประสงค์: *การศึกษาเพื่อเปรียบเทียบลักษณะความแตกต่างทางคลินิกและการตรวจคลื่นไฟฟ้าหัวใจระหว่างผู้ป่วยภาวะ TC กับผู้ป่วยภาวะหัวใจขาดเลือดเฉียบพลันแบบ STE MI*

วัสดุและวิธีการ: *การศึกษาแบบย้อนหลังโดยเก็บข้อมูลลักษณะทางคลินิก การตรวจคลื่นไฟฟ้าหัวใจ (ECG) และผลการตรวจทางห้องปฏิบัติการ ระหว่างผู้ป่วยที่มีภาวะ TC เทียบกับผู้ป่วยภาวะหัวใจขาดเลือดเฉียบพลันแบบ STE MI ในผู้ป่วย 175 ราย (TC 20 ราย และ STEMI 155 ราย) ที่ได้รับการฉีดสีแบบฉุกเฉินในข้อบ่งชี้จากการสงสัยภาวะหัวใจขาดเลือดเฉียบพลันแบบ STEMI*

ผลการศึกษา: *การศึกษาพบว่าผู้ป่วยภาวะ TC มีอายุมากกว่า (p = 0.001) พบมากกว่าในผู้หญิง (p = 0.001) และมักมีความเครียดทางร่างกายหรืออารมณ์นำมาก่อน (p = 0.001) หรือนำมาด้วยการเจ็บป่วย (p = 0.001) ทั้งนี้ประวัติการสูบบุหรี่จะพบน้อยกว่าเมื่อเปรียบเทียบกับผู้ป่วยภาวะหัวใจขาดเลือดเฉียบพลันแบบ STEMI เมื่อเลือกเฉพาะผู้ป่วย STEMI แบบ anterior wall มาเปรียบเทียบ พบว่าผู้ป่วยภาวะ TC พบ Q wave และ reciprocal change และ ST-T ใน lead V1 น้อยกว่า ST-T depression ใน lead aVR มักพบในผู้ป่วย TC ผู้นิพนธ์ได้นำเสนอการจัดรูปแบบการช่วยวินิจฉัยภาวะ TC แยกจากภาวะหัวใจขาดเลือดเฉียบพลันแบบ STEMI โดยให้ point scoring model ซึ่งพบว่าหากมีค่า score รวมกันมากกว่า 4 จะได้ความไวจากการตรวจที่ 90% และความจำเพาะจากการตรวจที่ 98% (AUC = 0.97, p<0001)*

สรุป: *ในผู้ป่วยที่มารับการฉีดสีแบบฉุกเฉินเนื่องจากสงสัยภาวะหัวใจขาดเลือดเฉียบพลัน สามารถใช้ลักษณะทางคลินิกและการแสดงของการตรวจคลื่นไฟฟ้าหัวใจในการช่วยแยกภาวะ TC ออกจากผู้ป่วยที่มีภาวะหัวใจขาดเลือดเฉียบพลันแบบ STEMI การใช้การจัดรูปแบบ point scoring ของลักษณะทางคลินิก และการตรวจคลื่นไฟฟ้าหัวใจที่พบจะช่วยให้การแยกมีความไวและความจำเพาะมากขึ้น*