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Cerebrovasc Dis 2007;24:146–148
DOI: 10.1159/000103620

Takotsubo Cardiomyopathy – A Rare Cause of Cardioembolic Stroke

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Apart from the classic macro- and microangiopathic vascular changes, cardiac embolism represents an important factor in the etiology of stroke. Most people suffering a cardioembolic stroke have atrial fibrillation as the major cause, but cardiac dysfunction is also a potential risk factor for embolic ischemia [1].

Case Report

We present 2 female patients who were admitted to our stroke unit due to acute neurological deficits. The first patient was an 85-year-old woman who developed an acute palsy of her right arm. Cranial MRI revealed multiple ischemic lesions in both hemispheres (fig. 1).

The 64-year-old second patient presented with a Broca aphasia on admission. In the cranial CT scan a middle cerebral artery territorial infarction of the left hemisphere was seen.

Both women also had signs of an acute coronary syndrome on admission, with an ST segment depression and T wave negativity of the anterior wall in the ECG and moderately elevated troponin levels in the blood assay (3.31 and 3.70 ng/ml) but without typical clinical symptoms like chest pain or dyspnea.

In both patients, a coronary angiography showed normal arteries without any signs of stenosis or sclerosis. In the ventriculography, a midventricular and apical hypokinesia was present, appearing like an ‘apical ballooning’ (fig. 1, 2). The left ventricular function (LVF or ejection fraction, EF), measured by echocardiography and ventriculography, was reduced to 30 and 45%, respectively. Patient 2 additionally had an apical thrombus in the left ventricle (fig. 2), therefore an anticoagulation therapy with warfarin was started to prevent further embolic lesions.

Due to the findings in the coronary angiography a relevant coronary heart disease was excluded. In further investigations other causes of a stroke (e.g. stenosis of the brain-supplying arteries, arrhythmias or atrial fibrillation) were not identified.

Within the following days the troponin levels decreased to a normal level.

The control echocardiography performed a few weeks later showed normalized cardiac function in both patients.

The diagnostic findings and the course of this syndrome suggest that both patients had an embolic ischemic stroke due to a tako tsubo (or stress) cardiomyopathy.

Discussion

Takotsubo cardiomyopathy or ‘stress cardiomyopathy’ is a rare syndrome, which was first described in the early 1990s in Japan [2]. Its Japanese name is derived from the antique octopus trap (takotsubo), which is shaped like an ampulla. Within the last few years, several case reports and few small case series were published with a total number of less than 400 patients [3–17]. In most cases takotsubo cardiomyopathy affected elderly women with previous emotional, psychological or physical stress. It often looks like an acute coronary syndrome with chest pain, dyspnea, ECG changes, elevated troponin and a left ventricular dysfunction [18] (EF often less than 50% [10, 16, 19]), which is seen as the typical ‘apical ballooning’ in the ventriculography, but without any signs of coronary heart disease in the coronary angiography. The left ventricular dysfunction in this syndrome is a reversible phenomenon and the prognosis was generally excellent [18]. However, the cardiac dysfunction itself as well as ensuing complications like the formation of an intraventricular thrombus, as seen in the second patient of our report, can lead to a cardioembolic stroke. So far, only 4 case reports can be found in the literature describing ventricular thrombus in apical ballooning [20, 21]. In 2 of these cases patients suffered a cerebral ischemia [22, 23]. In one case series 3 patients with stress cardiomyopathy had a previously described ‘cerebrovascular accident’ [24].

In our case report the conclusion that the cerebral ischemia was the result of the left ventricular dysfunction with cardiac embolism seemed to be very likely due to the exclusion of other causes of cardiac embolism. But on the other hand one has to consider other explanations, e.g. that takotsubo cardiomyopathy might be the consequence of ‘stroke-related stress’. This stress-related phenomenon was seen in our hospital in some patients after having an operation. These patients had a normal ECG before the operation, and in their further course they showed ECG changes and an apical ballooning. In our opinion the clinical course is an important factor in the etiological considerations, whereas stress factors (e.g. operations or acute onset of diseases) might implicate that apical ballooning is secondary.

Another more hypothetical explanation might be that the cerebral ischemia itself may cause a ‘neurocardiac-injury syndrome’ as seen in some patients with subarachnoid hemorrhage [25, 26]. In these cases a stress-related phenomenon is possible as well [27]. Since large series of stroke patients with stress-induced cardiomyopathy do not exist, the ‘chicken or egg’ question is not easy to answer and further research, especially epidemiological data, is necessary. In view of the increasing number of stroke patients every year, takotsubo cardiomyopathy cer-

Fig. 1. Patient 1. In the ventriculography an apical hypokinesia which looks like an ‘apical ballooning’ was seen (arrows; **a** end-diastole, **b** end-systole). **c** Left coronary artery without relevant coronary stenosis. **d** Diffusion-weighted MRI with multiple ischemic lesions in both hemispheres.

Fig. 2. Patient 2. The ventriculography of end-diastole (**a**) and end-systole (**b**) shows an apical hypokinesia (dotted line). **c** Left coronary artery without coronary stenosis. **d** An apical thrombus was seen in the echocardiography (dotted line).

tainly plays a secondary role in the etiology of cardioembolic stroke. Or is it an underestimated phenomenon? However, the acute left ventricular dysfunction is a known potential pathomechanism in cardiac embolism disease, as well as in stroke patients, when other risk factors are excluded. A therapeutic relevance exists if the LVF is reduced and an anticoagulatory therapy is recommended until the function is normal (e.g. with low-molecular-weight heparin or warfarin). Since not every patient with takotsubo cardiomyopathy has a typical history (‘stress’) or signs (‘chest pain’) on admission, a routine 12-lead ECG in patients with acute cerebral ischemia is obligatory. If relevant ECG changes are present, an additional troponin test is an advisable diagnostic step.

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Cerebrovasc Dis 2007;24:148–151
DOI: 10.1159/000103621

Contrast-Induced Neurotoxicity and Selective Cortical Injury

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Contrast-induced neurotoxicity has been reported after the administration of ionic and nonionic agents and is characterized by encephalopathy, seizures, cortical blindness or focal neurological deficits. Selective cortical injury is well described following hypoxic-ischemic insults, hypoglycemia or prolonged seizure. We present the case of a patient who developed focal neurological deficits and MRI abnormalities consistent with selective cortical injury after receiving an intra-arterial contrast agent.

Case Report

A 59-year-old right-handed woman, with a history of rash due to contact with iodoform, presented with a headache and was found to have an unruptured left supraclinoid internal carotid artery aneurysm, which was successfully occluded with endovascular coiling. Eight months later the patient had an elective follow-up angiogram and received 50 ml of iohexol contrast medium into her left common carotid artery. The patient received fentanyl and diazepam for the procedure. Her blood pressure, which was monitored noninvasively every 3–5 min throughout the angiogram, ranged from 120/68 to 150/80 mm Hg, with a pulse of 100–120 beats/min and O₂ saturation of 100%.

Immediately following the angiogram the patient was noted to have left gaze deviation, left head turning, right hemiparesis and no speech output. Her right arm was held in a dystonic flexion