VENTRICULOGRAPHY FOR THE STUDY OF TAKO-TSUBO SYNDROME

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ABSTRACT

Tako-Tsubo Cardiomyopathy (TTC) is an acute syndrome, identified in the early 1990s by Japanese researchers, which mimics an acute myocardial infarction. Cardiomyopathy is transient and begins with a clinical picture similar to that of an acute myocardial infarction. This pathology seems to be related to intense psychological and physical stress with a prevalence in the female sex (95%) in post-menopause. The term Tako-Tsubo means 'octopus trap' in Japanese: the left ventricle takes on a peculiar appearance in systole, similar to a narrow-necked amphora, morphologically identical to the vessel (tsubo) that Japanese fishermen use to catch octopuses (tako). The appearance of the left ventricle (tako-tsubo shape) is due to a 'complete' depletion of cardiac muscle activity (myocardial stunning), a kind of 'stunning' or paralysis of the middle and apical portions of the heart. Coronarography and ventriculography are an essential step in the diagnosis of TTC. The mere demonstration of a coronary tree free of angiographically significant stenosis is not sufficient for the diagnosis of TTC. The other key diagnostic element is, in fact, the demonstration of left ventricular hypokinesia or akinesia. Since left ventricular wall motility disorders change rapidly, ventriculography performed immediately after coronary examination is the gold standard examination to allow the characteristic appearance of the syndrome to be verified and, consequently, to distinguish it from an acute coronary syndrome with uninjured coronary arteries, thus avoiding a diagnostic error.

INTRODUCTION

Tako-Tsubo Syndrome (TTC) is an acute cardiac syndrome, identified in the early 1990s by Japanese researchers, which mimics acute myocardial infarction; other synonyms reported in the literature are: "Broken Heart" Syndrome (letteralmente "cuore rotto"), Neurogenic Myocardial Stunning, Stress Cardiomyopathy, Stress-induced Cardiomyopathy, "Ampulla" Cardiomyopathy (Fig.1).

Cardiomyopathy is transient and begins with a clinical picture very similar to that of an acute myocardial infarction (STEMI or IMA) or acute coronary syndrome, in view of the symptoms, the typical electrocardiographic and echocardiographic changes and the biochemical changes detected.
This pathology seems to be related to intense psychic stress (a sudden bereavement, a frightening situation, domestic abuse, the discovery of a serious pathology, the loss of a job, are just a few examples), and physical stress (asthma attacks, flare-ups of chronic obstructive pulmonary disease, gastric endoscopy, surgery) with a prevalence in the female sex (95%) in the post-menopause period. The diagnosis of Tako-Tsubo syndrome can only be made after excluding: IMA with underlying coronary artery disease, acute coronary syndrome, myocarditis, pericarditis, aortic dissection.
The term Tako-Tsubo means 'octopus trap' in Japanese: the left ventricle takes on a peculiar appearance in systole, similar to a narrow-necked amphora, morphologically identical to the vessel (tsubo) that Japanese fishermen use to catch octopuses (tako). The appearance of the left ventricle (tako-tsubo shape) is due to a 'complete' depletion of cardiac muscle activity (myocardial stunning), a sort of 'stunning' or paralysis of the middle and apical portions of the heart with compensatory hyperkinesis of the basal segments (Fig. 2).

Tako-Tsubo cardiomyopathy presents a symptomatology that is very similar to that developed by patients with acute myocardial infarction: in approximately 50-60% of cases, chest pain at rest develops that is very similar to that of angina, or, in approximately 18% of cases, the onset is dyspnea. Usually there is no severe hemodynamic compromise, although the syn-

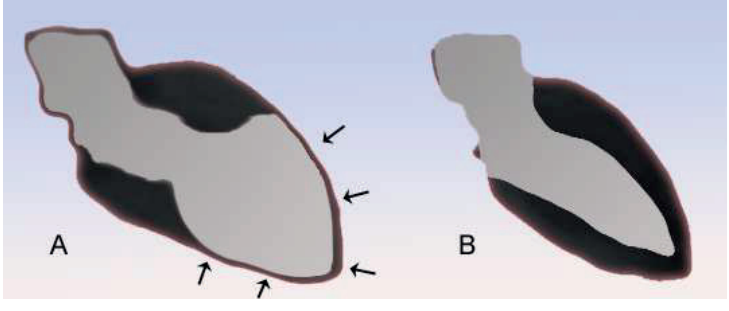

Fig. 1

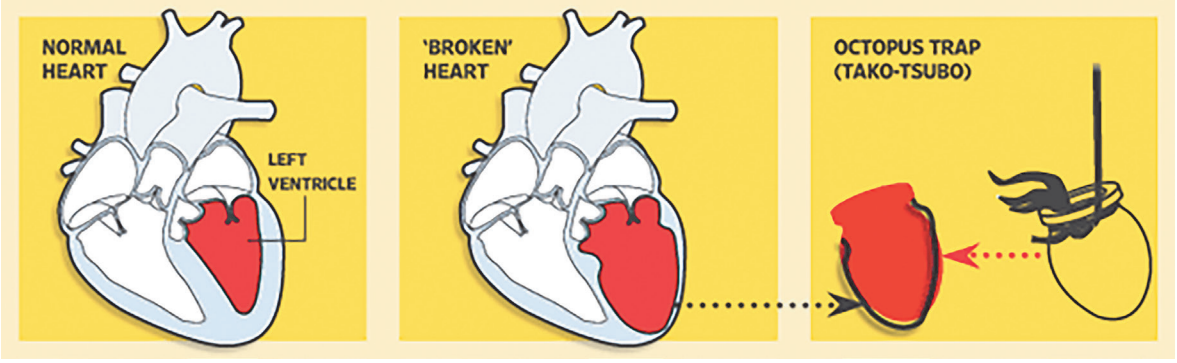

Fig. 2

drome may be associated with acute heart failure. It is recommended that coronary anatomy should always be checked, even using non-invasive techniques, when cardiac catheterization is deemed unsafe or impracticable. However, the mere demonstration of a coronary tree free of angiographically significant stenosis is not sufficient for the diagnosis of TTC. The other key diagnostic element is, in fact, the demonstration of left ventricular hypokinesia or akinesia, extending beyond the coronary distribution territory of a single epicardial vessel. Since left ventricular wall motility disorders change rapidly, ventriculography performed immediately after coronary examination is essential to allow the characteristic appearance of the syndrome to be verified and, consequently, to distinguish it from an acute coronary syndrome with uninjured coronary arteries, thus avoiding a diagnostic error.

By definition, TTC develops in the presence of normal or mild atherosclerotic coronary findings in the absence of signs of plaque rupture or significant coronary obstruction. Although very rare, there may still be cases of TTC developing in patients with incidental obstructive coronary artery disease, due to the frequency with which it can occur in the elderly population with cardiovascular risk factors.

Left ventriculography shows the typical appearance of akinesia of the apex and middle portions of the left ventricular chamber extending beyond the distribution territory of a single coronary vessel, with compensatory hyperkinesia of the basal portions (Fig.3).

The extent of the akinetic area varies during the early stages: ventricular kinetic abnormalities improve from the basal to the apical area and resolve over a period of a few days. Occasionally, some authors have observed a change in the pattern of ventricular dysfunction (from midventricular to apical, for example) in the same patient.

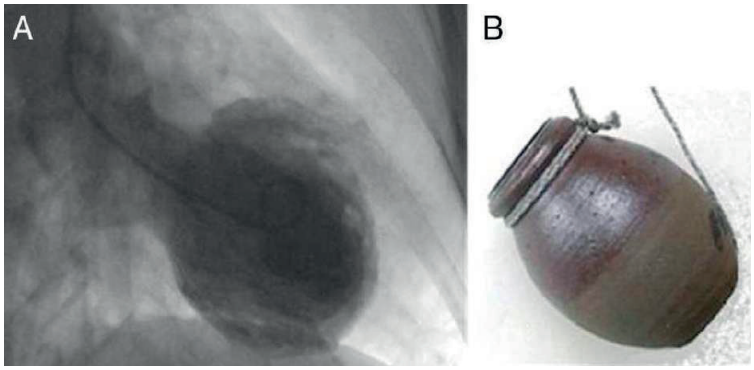

Fig. 3

By definition, TTC appears suddenly, but resolves completely within a few days to a few weeks, with complete recovery of ventricular function. In the acute setting, however, a number of potentially dangerous complications can develop, which usually appear at onset or within 24 hours of symptoms. Generally, the prognosis is good if there are no underlying co-morbidities.

Coronarography and Ventriculography

Coronarography is an invasive method of assessing the anatomy of the coronary tree by administering contrast medium intra-arterially, using guides and catheters, while taking images in succession acquired in various projections. It is the gold standard for the diagnosis and treatment of patients with known or suspected coronary artery disease.

For the study of the left coronary artery, generally, four standard projections are performed, in some cases also some additional projections, and they are:

- **30° L.A.O. 30° CAU (SPIDER) Projection**: is performed by positioning the detector and consequently the C-arm in an Oblique Anterior Left (or L.A.O.) projection of 45° and in caudal (CAU) projection of 30° with a range between 30°- 60° L.A.O. and 20°- 45° CAU. This projection is ideal for visualising the ostium and body of the common trunk, the Left Anterior Descending Artery (LAD) - Circumflex bifurcation (CX), the ostial tracts of the diagonal branches and the proximal and middle ostial tracts of both the Circumflex and the intermediate and marginal branches (Fig.4).
- **30° R.A.O. 30° CAU Projection:** is carried out by positioning the detector in 30° R.A.O. and 30° CAU with a range between 20°- 35° R.A.O. and 20°- 40° CAU.
- **10° R.A.O. 40° CRA Projection:** is carried out by positioning the detector in O.A.R. of 10° and in CRA of 40° with a range between 10°- 30° O.A.R. and 30°- 45° CRA.
- **45° L.A.O. 30° CRA Projection:** is carried out by positioning the detector in L.A.O. of 45° and in CRA of 30° with a range between 30°- 60° L.A.O. and 25°- 45° CRA.
- **Lateral Projection 90°:** is carried out by positioning the image detector at the side.
- **A.P. Projection:** is performed by positioning the detector perfectly perpendicular to the patient's coronal plane.

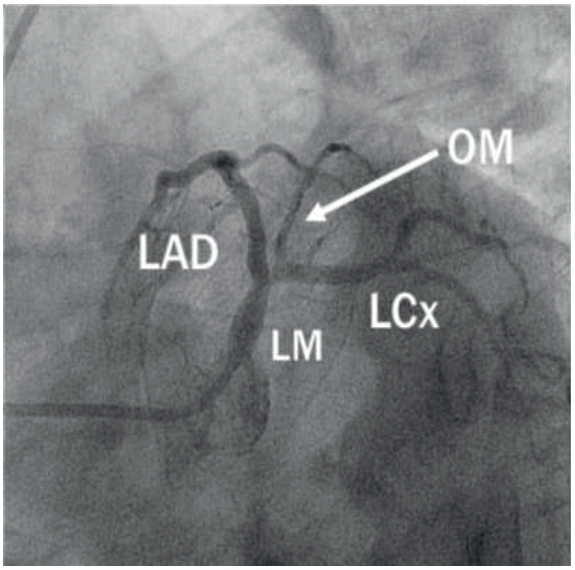

Fig. 4

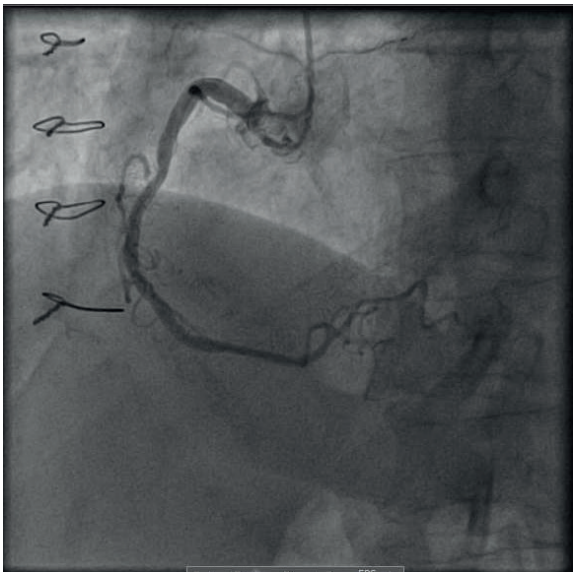

Fig. 5

- **A.P. Caudal 45° Projection:** is carried out by placing the detector in 45° CAU with a range of 30°- 45° CAU.
- **L.A.O Projection:** is performed by positioning the detector in L.A.O. with a range between 30°- 60° L.A.O.
- **R.A.O Projection:** is performed by positioning the detector in R.A.O. with a range between 30°- 45° R.A.O.
- **ALDRIDGE laterale 110° CRA 20° Projection:** is carried out by positioning the detector laterally 110° and CRA 20°.

For the study of the right coronary artery, three standard projections are generally performed, plus an additional one, which in order of execution are:

- **L.A.O. 30° Projection:** is performed by positioning the detector in L.A.O with a range between 30°- 45° (Fig.5).
- **30° L.A.O. 20° CRA Projection:** is performed by positioning the detector in L.A.O with a range between 30°- 40° L.A.O. and 10° - 30° CRA.
- **30° R.A.O. Projection:** is performed by positioning the detector in R.A.O with a range between 30°- 40°.
- **Lateral Projection 90°:** is carried out by positioning the image detector at the side.

As mentioned above, the gold standard examination for the diagnosis of TTC is left ventriculography, performed immediately after coronarography. **Ventriculography** is an invasive diagnostic test used to determine ventricular function. A pig-tail catheter is placed inside the left ventricle through the lunate valves and is injected approximately 30-40 ml of agent of contrast at a high injection rate (10-15 ml/s). The acquisition frame-rate, given the high cardiac motility, is set at about 25-30 images per second, acquiring the images (Fig.6-7) with a C-arm obliquity of 30° R.A.O. and 45-60° R.A.O.

CONCLUSIONS

By definition, TTC appears suddenly, but resolves completely within a few days to a few weeks, with

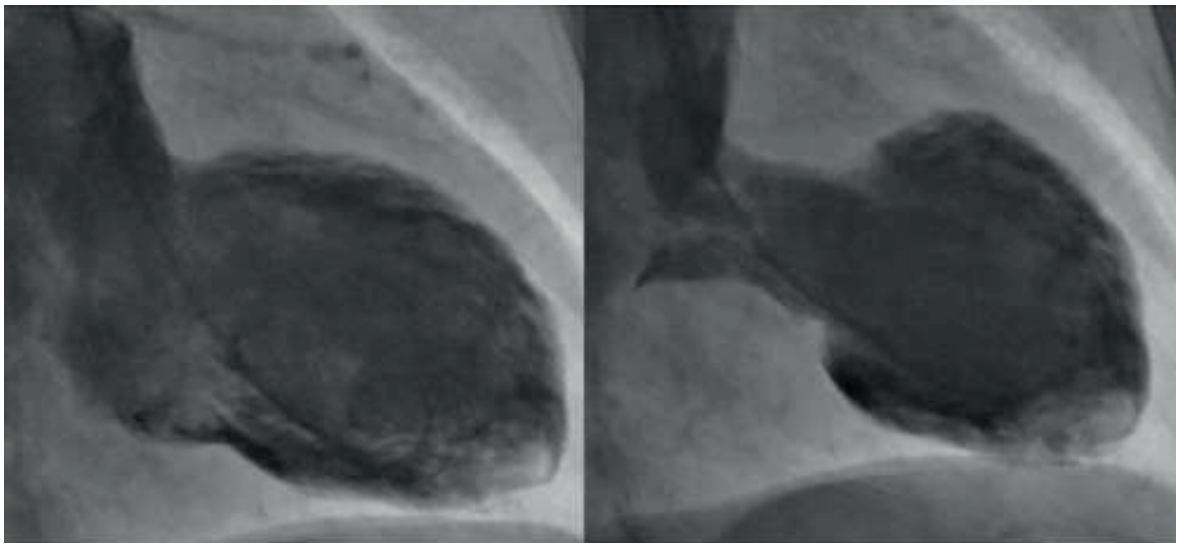

Fig. 6

complete recovery of ventricular function. Generally, the prognosis is good if no underlying co-morbidities are present. Therefore, the aim of this article was to describe the angiographic study technique of the left ventricle in Tako-Tsubo syndrome. As demonstrated in the past, ventriculography (following coronarography) is the gold standard examination to assess ventricular function and thus diagnose Tako-Tsubo. A summary of the projections for the coronographic study was also made in order to provide further support to interested healthcare professionals, with the help of some of the articles cited in the bibliography.

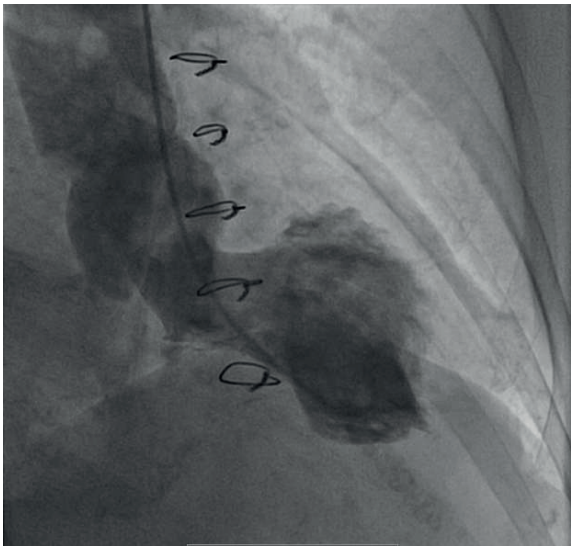

Fig. 7

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