



## Attempted suicide as a trigger of Takotsubo syndrome: a minireview of available case reports

Roberto Manfredini<sup>1,2,3</sup>  · Fabio Fabbian<sup>1,2,3</sup> · Rosaria Cappadona<sup>1</sup> · Beatrice Zucchi<sup>1</sup> · Pablo Jesus Lopez-Soto<sup>2</sup> · Maria Aurora Rodriguez-Borrego<sup>2</sup>

Received: 22 January 2018 / Accepted: 25 February 2018 / Published online: 1 March 2018  
© SIMI 2018

Dear Editor,

Takotsubo syndrome (TS) is a relatively uncommon condition, with a clinical presentation often mimicking acute myocardial infarction [1]. Its estimated prevalence is approximately 1.7–2.2% of patients with suspected acute coronary syndrome [1], and diagnosis is defined by Mayo Clinic criteria [2]. Many stressful medical conditions, as well as emotional stressors, such as death of a family member, bad news, assault, and many others, are established causes capable of triggering TS [3]. We aimed to test the hypothesis that suicide attempt could represent a cause of TS.

We systematically explored PubMed database, using the searching keywords ‘Takotsubo cardiomyopathy’ or ‘stress-induced cardiomyopathy’, in combination with ‘suicide’ and ‘attempted suicide’. A further search was performed on Google Scholar source. For each case, we reported gender,

age, suicide method, possible triggers, presentation signs, outcome, author, journal, and year of publication. Deadline for electronic search was December 31, 2017. We found 12 items, reporting 13 cases (Table 1). The majority of patients were women ( $n=9$ , 69%), and the mean age was  $37.5 \pm 21.8$  years (range 65, 15–80). Suicide methods included self-poisoning ( $n=6$ , 46%), hanging ( $n=6$ , 46%), and jumping from a height ( $n=1$ , 8%). Potential triggering conditions were present in six cases (46%), not present in one (8%), and not reported in six (46%). The outcome was always favorable.

Suicidal ideation is a common condition evaluated in the Emergency Department (ED), with more than 400,000 annual ED visits in the United States [4]. For many patients with suicidal ideation, ED represents the first option for treatment, and it has been estimated that as many as one in ten individuals with completed suicide have been seen in the ED within the prior 2 months [5]. In agreement with the previous literature reports, in our mini-cohort of case reports with attempted suicide followed by TS, self-poisoning and hanging represents more than 90% of the cases. Data from the United Kingdom show that both deliberate self-harm and suicides are increasing in the youngest age groups, and particularly in males [6]. Among methods of suicidal self-poisoning, drug overdose is the preferred choice in most females, in the young, and in the medical profession [6]. According to data from the United States, the overall suicide rate has increased by 16% between 2000 and 2010 (10.4–12.1 per 100,000 population) [7]. The great part of this increase is attributable to suicide by hanging/suffocation (52%) and by poisoning (19%). In particular, hanging is a suicide method characterized by a high mortality: the case fatality rates for suicide by hanging/suffocation range from 69 to 84% [7]. Emotional or physical stress is a common trigger for the development of TS, and attempting suicide undoubtedly represents a highly stressful condition. The circadian variation of some biological functions, some of

---

✉ Roberto Manfredini  
roberto.manfredini@unife.it

Fabio Fabbian  
f.fabbian@ospfe.it

Rosaria Cappadona  
rosaria.cappadona@unife.it

Beatrice Zucchi  
beatrice.zucchi@unife.it

Pablo Jesus Lopez-Soto  
pablolopezsoto90@gmail.com

Maria Aurora Rodriguez-Borrego  
en1robom@uco.es

<sup>1</sup> Center for Studies on Gender Medicine, Faculty of Medicine, Pharmacy and Prevention, University of Ferrara, Ferrara, Italy

<sup>2</sup> Instituto Maimonides de Investigacion Biomedica de Cordoba (IMIBIC), University of Cordoba, Córdoba, Spain

<sup>3</sup> Clinica Medica Unit, Department of Medical Sciences, University of Ferrara, via L. Ariosto 35, 44121 Ferrara, Italy

**Table 1** Systematic review of case reports with attempted suicide followed by onset of Takotsubo syndrome (TS)

Sex/age (years) method	Condition/trigger	Presentation signs	Outcome	Author/journal/year
F/19 Self-poisoning Venlafaxine	Depression	Asymptomatic on admission. 8 h: tonic–clonic seizures. Recurrent cardiac arrest, hemodynamic instability, cardiogenic shock, multi-organ dysfunction	Favorable	Schroeder et al., <i>Int J Artif Organs</i> 2017
F/15 Self-poisoning Amphetamine/dextro- amphetamine + sertra- line + loratidine	School-related stress	No general/neurological signs. Tachycardia + chest pain (after 12 h). ↑ QT, ↓ ST segment, ↑ troponin T. Severe LV ejection fraction, regional wall motion abnormalities	Favorable	Toce et al., <i>J Pediatr</i> 2017
M/40 Self-poisoning Risperidone + barbitu- rates + BZD + biso- prolol	Borderline personality disorder	Comatose state	Favorable	Romanò et al., <i>Case Rep Med</i> 2013
F/75 Self-poisoning Herbicide	No trigger event	Delayed respiratory failure, ventilator with intubation; 20 h: circulatory failure	Favorable	Tominaga et al., <i>Case Med Rep</i> 2012
F/29 Self-poisoning Rodenticide	Not reported	Chest pain, breathlessness on exertion, conscious, ST elevation, ↑ cardioenzymes	Favorable	Joshi et al., <i>Ind J Sci Res Technol</i> 2014
F/80 Self-poisoning Pesticide	Not reported	Comatose state, respiratory failure. 4 h: conscious; 8 h: ↑ ST segment, ↑ cardioenzymes, LV apical + MV akinesis	Favorable	Lin et al., <i>Resuscitation</i> 2010
M/21 Hanging	Not reported	Unconscious, respiratory distress, heart failure, desaturation	Favorable	Sengupta et al., <i>Indian Heart J</i> 2016
F/36 Hanging	Not reported	Stupor, breathless, heart failure	Favorable	Sengupta et al., <i>Indian Heart J</i> 2016
F/54 Hanging	Schizophrenia	Unconscious, hypotension. Day 3: successful extubation, onset of chest + back pain, inverted T waves + ↑ QTc	Favorable	Sawamoto et al., <i>J Emerg Med</i> 2015
F/25 Hanging	Quarrel with her husband	Admission 12 h after receiving preliminary treatment at a district hospital. Unconscious	Favorable	Chaudhary et al., <i>J Assoc Physicians India</i> 2014
F/21 Hanging	Not reported	Gasping, oxygen desaturation	Favorable	Gnanavelu et al., <i>J Assoc Physicians India</i> 2008
F/19 Hanging	Not reported	Confusion, restless, dyspnea, chest pain. 4 h: ↓ T wave	Favorable	Ratnayaka et al., <i>Sri Lank J Anaesthesiol</i> 2015
M/53 Jumping from high	Bipolar affective disease	Fractures + pneumothorax. ↑ ST segment + ↑ troponin I	Favorable	Nowak et al., <i>Kardiol Pol</i> 2015

F female, LV left ventricle, M male, MV midventricular, TS Takotsubo syndrome

which stress-related [8], may explain, at least in part, the preference for a morning onset for either TS and suicidal behavior [9, 10]. Stress favors catecholamine excess, potentially harmful to the heart [8], and cardiac damage in TS seems to be due to catecholamine hypersecretion and actions on  $\beta$ -adrenoceptors [11]. Catecholamine hyperactivity is also the basis for the typical regional negative inotropism of different segments of the heart, characterized by different densities of  $\beta_1$ - and  $\beta_2$  adrenoceptors [11]. Moreover, a further possible emerging trigger factor for TS may be acute respiratory failure. In fact, Ghadri et al. [12] describe the onset of transient severe reduction of ejection fraction and

haemodynamic instability, secondary to acute respiratory distress, in a female patient undergoing bilateral lung transplantation seven years before. In the same year, Fujiwara and Kobata [13] report the case of a 29-year-old woman who attempted suicide by hanging. She was found pulseless and in a deep coma by her mother, who started chest compressions. After admission to the intensive care unit, generalized tonic–clonic convulsions and abrupt increase of body temperature > 39 °C appeared [13].

The common underlying mechanism of both cases could be Paroxysmal sympathetic hyperactivity (PSH), a syndrome characterized by a striking presentation, with paroxysmal

tachycardia, arterial hypertension, tachypnea, hyperthermia, and decerebrate posturing occurring in response to afferent stimulation [14]. Patients surviving a brain injury can develop a sympathetic hyperactivity for weeks or months, with episodes of increased heart rate and blood pressure, maybe secondary to loss of inhibitory control over excitatory autonomic centres [14]. Thus, given the catecholamine storm based on these mechanisms, it is likely that severe anoxic brain injury by hanging/suffocation and severe hypotension following acute drug poisoning may trigger the onset of TS.

Contrary to common opinion, TS should no longer be simply considered as a benign disease. In fact, although the prognosis of TS patients is generally thought to be favorable with complete recovery of left ventricular function, prognosis depends on many factors, including comorbidities, clinical presentation, gender, and in-hospital or out-hospital setting [15].

Attempted suicide, as a high stressful condition, can be included among possible triggers of TS, and self-poisoning and hanging may also share with severe respiratory distress and PSH as underlying causes. Since patients presenting with attempted suicide are mostly evaluated by ED physicians, a high level of attention could be maintained even during the immediate hours following successful rescue intervention, keeping in mind the possible risk of a TS. In particular, protection toward severe hypoxemia should be promptly provided in the case of either self-poisoning or hanging, although the final outcome has been favorable in all reported cases.

**Acknowledgements** The authors thank Dr Claudia Righini and Dr Donato Bragatto, from the Biblioteca Interaziendale di Scienze della Salute, Azienda Ospedaliera-Universitaria ‘S. Anna’, Ferrara, for their generous assistance.

**Funding support** Supported, in part, by a research grant “Fondo Ateneo Ricerca—FAR”, University of Ferrara, Italy (prof. Roberto Manfredini).

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Statement of human and animal rights** Retrospective study on anonymous case reports just previously published in the available literature. Not approved by the Ethics Committee.

**Informed consent** Patients’ signature of informed consent is needed.

## References

1. Bossone E, Savarese G, Ferrara F, Citro R et al (2013) Takotsubo cardiomyopathy: overview. *Heart Fail Clin* 9:249–266
2. Prasad A, Lerman A, Rihal CS (2008) Apical ballooning syndrome (Tako-Tsubo or stress cardiomyopathy): a mimic of acute myocardial infarction. *Am Heart J* 155:408–417
3. Summers MR, Prasad A (2013) Takotsubo cardiomyopathy. Definition and clinical profile. *Heart Fail Clin* 9:111–122
4. Ting S, Sullivan A, Boudreaux ED et al (2012) Trends in US emergency department visits for attempted suicide and self-inflicted injury 1993–2008. *Gen Hosp Psychiatry* 34:557–565
5. Gairin I, House A, Owens D (2003) Attendance at the accident and emergency department in the year before suicide: retrospective study. *Br J Psychiatry* 183:28–33
6. Camidge DR, Wood RJ, Bateman DN (2003) The epidemiology of self-poisoning in the UK. *Br J Clin Pharmacol* 56:613–619
7. Baker SP, Hu G, Wilcox HC et al (2013) Increase in suicide by hanging/suffocation in the U.S., 2000–2010. *Am J Prev Med* 44:146–149
8. Manfredini R, Boari B, Tiseo R et al (2007) Circadian rhythm on cardiovascular and other stress-related events. In: Fink G (ed) *Stress: neuroendocrinology and neurobiology*. Academic Press, New York, pp 401–409
9. Bossone E, Citro R, Eagle KA et al (2011) Tako-tsubo cardiomyopathy: is there a preferred time of onset? *Intern Emerg Med* 6:221–226
10. Gallerani M, Avato FM, Dal Monte D et al (1996) The time for suicide. *Psychol Med* 26:867–870
11. Lyon AR, Rees PS, Prasad S et al (2008) Stress (Takotsubo) cardiomyopathy—a novel pathophysiological hypothesis to explain catecholamine-induced acute myocardial stunning. *Nat Clin Pract Cardiovasc Med* 5:22–29
12. Ghadri JR, Bataisou RD, Diekmann J, Lüscher TF, Templin C (2015) First case of atypical Takotsubo cardiomyopathy in a bilateral lung-transplanted patient due to acute respiratory failure. *Eur Heart J Acute Cardiovasc Care* 4:482–485
13. Fujiwara A, Kobata H (2015) Paroxysmal sympathetic hyperactivity after near-hanging. *Am J Emerg Med* 33:735.e1–2
14. Meyfroidt G, Baguley IJ, Menon DK (2017) Paroxysmal sympathetic hyperactivity: the storm after acute brain injury. *Lancet Neurol* 16:721–729
15. Templin C, Ghadri JR, Diekmann J et al (2015) Clinical features and outcomes of Takotsubo (stress) cardiomyopathy. *N Engl J Med* 373:929–938