Seizure 31 (2015) 84–87

Contents lists available at ScienceDirect

Seizure

journal homepage: www.elsevier.com/locate/yseiz

Review

Seizure-triggered Takotsubo syndrome rarely causes SUDEP

Josef Finsterer [a,*], Anna Bersano [b]

[a] Krankenanstalt Rudolfstiftung, Postfach 20, 1180 Vienna, Austria
[b] Cerebrovascular Unit, IRCCS Foundation Neurological Institute 'C.Besta', Milan, Italy

ARTICLE INFO

Article history:
Received 17 June 2015
Received in revised form 18 July 2015
Accepted 20 July 2015

Keywords:
Epilepsy
Seizure
Takotsubo
Cardiomyopathy
Heart failure
Complication
Sudden unexpected death in epilepsy

ABSTRACT

Since almost 20 y it is known that seizures may trigger Takotsubo syndrome (TTS). Since then it has been repeatedly proposed that TTS could be the cause of sudden unexpected death in epilepsy (SUDEP).

A review of the so far reported cases of seizure-triggered TTS was carried out to see how often seizure-triggered TTS is fatal.

Altogether 59 papers were identified which reported altogether 74 patients with seizure-triggered TTS. Age was reported in 70 patients and ranged from 18 to 82 y. Gender was reported in 70 cases and was female in 60 cases (86%). The type of triggering seizure was reported in 47 cases. In 28 patients (60%) the trigger was a generalized tonic clonic seizure, in 15 cases (32%) a generalized status epilepticus, and in 3 cases a complex partial seizure. The outcome was mentioned in 63 of the 74 patients. Full recovery was reported in 61 cases (97%), incomplete recovery in none of the patients, and a fatal outcome in 2 patients (3%).

Fatalities are rare in patients experiencing seizure-triggered TTS. This is why seizure-triggered TTS does not seem to play a major role in the pathogenesis of SUDEP.

1. Introduction

Central nervous system (CNS) disease is increasingly recognized as a trigger of Takotsubo syndrome (TTS), also known as Tako-tsubo cardiomyopathy, ampulla cardiomyopathy, apical ballooning, neurogenic stress cardiomyopathy, broken heart syndrome, neurogenic stunned myocardium, transient regional left ventricular dysfunction, transient myocardial dysfunction, transient systolic dysfunction, neurogenic stressed myocardium, catecholamine cardiomyopathy, or reversible acute heart failure [1,2]. TTS mimics myocardial infarction clinically, electrocardiographically, and chemically. Clinically, TTS is characterized by acute onset chest pain and dyspnea, occasionally associated with palpitations, coughing, edema, tiredness, syncope, fever, nausea, vomiting, or anxiety [3]. Creatine-kinase (CK), troponin-T, and proBNP may be elevated. Electrocardiography (ECG) may show initial ST-elevation, which dynamically changes to negative T-waves, and finally complete resolution of the abnormalities [4]. Echocardiography may show segmental hypokinesia or akinesia and reduced systolic function and compensatory hyperkinesia of segments not affected by the stunning. Most frequently, stunning affects the apical or midventricular segments of the left ventricular myocardium (classical type), but rarely also the midventricular segments (midventricular type), the basal or midventricular segments (inverted type), or all segments (global type) are affected [2]. According to a recent review [3], the CNS disorder most frequently triggering TTS is subarachnoid bleeding but the CNS disorder second most frequently triggering TTS is epilepsy [3]. This mini-review aimed at highlighting recent advances concerning the prevalence, age at occurrence, gender distribution, TTS type, and outcome of TTS triggered by epileptic seizures or an epileptic state. Additionally, we were interested in the cause of epilepsy, the seizure type, and the antiepileptic drug (AED) therapy prior to the TTS.

2. Methods

Data for this review were retrieved by searches of MedLine and references from relevant articles using the search terms "epilepsy" and "seizures" combined with "Takotsubo syndrome", "Takotsubo cardiomyopathy", "ampulla cardiomyopathy", "stress cardiomyopathy", "apical ballooning", "broken heart syndrome", and "stunned myocardium". Randomized (blinded or open label) clinical trials, longitudinal studies, case series, and case reports were pondered. Only articles published in English between 1966 and 2015 were considered. Appropriate papers were studied and discussed for their suitability to be incorporated in this review.

* Corresponding author. Tel.: +43 1 71165 92085; fax: +43 1 4781711.
E-mail address: fifigs1@yahoo.de (J. Finsterer).

http://dx.doi.org/10.1016/j.seizure.2015.07.015
1059-1311/

3. Results

Altogether 59 papers matching the search terms were selected. Full access was available to 47 articles (80%) and 12 papers were accessible only as an abstract. Fifty-one papers were case reports or single cases with epilepsy in a cohort study. Eight papers reported more than 1 patient but none of the papers reported more than 5 patients (Table 1). Altogether, 74 patients with epilepsy-triggered TTS were identified (Table 1). Among the nine papers reporting >2 patients, all were accessible as full papers. In the study with 5 patients nothing is reported about the cause, type, or treatment of seizures [5]. None of the five patients experienced cardiac symptoms prior or during hospitalization [5]. The only indication for cardiac disease in these 5 patients was elevated

Table 1
Seizures triggering TTS.

Cause of epilepsy	ST	AED at TTS	NOP	Sex	Age	TTST	TTSTr	OC	Reference	FP/AB
Nm	nm	nm	5	f	49–78	nm	nm	FR	[5]	FP
Nm	nm	nm	3	nm	nm	nm	nm	nm	[9]	FP
Nm	TCS	nm	3	f	43–80	Classic	nm	FR	[10]	FP
Nm	SE	nm	3	2f, 1 m	18–47	Global	nm	nm	[11]	FP
Stroke, alcohol, amitryptillin	nm	nm	3	2f, 1 m	40–73	nm	nm	FR	[6]	FP
Nm	nm	nm	2	f	41 + 78	Classic	nm	FR	[12]	FP
Nm/psychosis	TCS	PHT/LEV, CBZ	2	f	63/50	Classic	BB, ACEI	FR	[13]	FP
SAB/ICB	TCS	nm	2	1 m, 1f	50 + 62	Mid	HFT	FR	[14]	FP
Nm	nm	nm	1	nm	nm	nm	nm	nm	[15]	AB
Nm	nm	nm	1	f	73	Classic	None	FR	[16]	FP
Previous stroke	nm	VPA	1	f	68	Classic	nm	na	[17]	AB
Bleeding right frontotemporal	sTCS	PHT, LEV	1	f	55	Classic	Stent	FR	[18]	FP
Genetic	CPS	ZNS, LMT	1	f	19	nm	None	nm	[7]	FP
Previous stroke	TCS	PHT	1	f	44	Classic	ACEI	FR	[19]	FP
Genetic	SE	None	1	f	47	Classic	nm	FR	[20]	FP
Alcohol withdrawal	nm	LEV	1	f	57	Classic	HFT	FR	[21]	FP
Genetic	TCS	CBZ, VPA, PRM	1	f	67	Classic	None	FR	[22]	FP
Nm	TCS	None	1	f	50	Classic	BB, ACEI	FR	[23]	FP
Cryptogenic, left temporal	SE	VPA, ZNS, DZP	1	f	43	Classic	None	FR	[24]	FP
Nm	TCS, SE	CBZ	1	f	68	Classic	None	FR	[25]	FP
Subarachnoid bleeding	TCS	None	1	f	60	Classic	None	FR	[26]	FP
Nm	SE	LEV, CLB	1	f	79	Classic	None	FR	[27]	FP
Na	SE	na	1	f	50	Classic	nm	FR	[28]	AB
Trauma	SE	nm	1	m	50	Classic	None	FR	[29]	FP
Alcohol	TCS	None	1	m	63	Classic	None	FR	[30]	FP
Genetic	TCS	None	1	f	69	Classic	nm	FR	[31]	AB
Stroke	nm	nm	1	m	78	Classic	nm	Death	[32]	FP
Anesthesia	NES	na	1	f	67	Mid	nm	FR	[33]	AB
Previous stroke	TCS	None	1	f	67	Classic	None	FR	[34]	FP
Genetic	TCS	VPA	1	f	81	Classic	nm	FR	[35]	FP
Na	na	na	1	f	59	nm	nm	nm	[36]	AB
Subdural hematoma	CPS	CBZ	1	m	73	nm	nm	nm	[37]	AB
Nm	TCS	None	1	f	50	Classic	nm	FR	[38]	AB
Cavernoma bleeding	TCS	None	1	f	74	Classic	None	FR	[39]	FP
Right mesial temporal sclerosis	sTCS	CBZ, PHT, ZNS, TPM	1	f	51	Classic	None	FR	[40]	FP
Alcohol	nm	None	1	f	25	Classic	nm	FR	[41]	AB
Nm	nm	nm	1	f	75	MId	nm	nm	[42]	FP
Cavernoma mesotemporal	TCS	GBT	1	f	71	Classic	None	Death	[43]	FP
Na	Na	na	1	f	42	Mid	nm	FR	[44]	AB
Stroke	CPS	nm	1	f	75	Classic	nm	FR	[45]	FP
Nm	nm	nm	1	f	79	Classic	nm	FR	[46]	FP
Opiate withdrawal	TCS	None	1	f	58	Classic	BB	FR	[47]	FP
PRES	SE	None	1	f	82	Classic	None	FR	[48]	FP
Nm	nm	nm	1	m	57	Classic	Dobutamine	FR	[49]	FP
Electroconvulsive therapy	TCS	None	1	f	71	Classic	None	FR	[50]	FP
Nm	nm	nm	1	f	77	Mid	nm	FR	[51]	FP
Ischemic stroke	TCS	nm	1	f	62	Classic	ACEI, DR	FR	[52]	FP
Ischemic stroke	TCS, SE	nm	1	f	54	Classic	ACEI, DR	FR	[53]	FP
Genetic	TCS, SE	nm	1	m	62	Mid	None	FR	[54]	FP
Genetic	TCS, SE	DZP, PHT, VPA	1	f	75	Classic	Nitro	FR	[55]	FP
PRES	TCS	None	1	f	55	Classic	None	FR	[56]	FP
Mesiotemporal sclerosis	TCS, SE	CBZ, LEV	1	f	61	Classic	BB, DR	FR	[57]	FP
Genetic	TCS	CBZ, PHT	1	f	64	Classic	BB, DR	FR	[58]	FP
Multiple sclerosis	TCS	None	1	f	69	Classic	None	FR	[59]	FP
Astrocytoma surgery	TCS, SE	na	1	f	59	Classic	nm	FR	[60]	AB
Alcohol withdrawal	na	na	1	f	49	Classic	nm	FR	[61]	AB
Genetic	TCS	None	1	f	82	Classic	None	FR	[62]	FP
Left frontal hypodensitiy	nm	nm	1	m	39	Inverted	nm	FR	[63]	FP
Nm	TCS	nm	1	f	67	Classic	nm	FR	[64]	FP

AED, antiepileptic drug; ST, seizure type; NOP, number of patients; TTST, TTS-type; TTSTr, treatment of TTS; OC, outcome; FP/AB, full paper or only abstract available; SAB, subarachnoid bleeding; ICB, intracerebral bleeding; PRES, posterior reversible encephalopathy syndrome; CPS, complex partial seizures; (s)TCS, (secondary) tonic clonic seizure; SE, status epilepticus; NES, non-epileptic seizure; f, female; m, male; FR, full recovery; IR, incomplete recovery; *, epileptic state; nm, not mentrioned; na, not accessible; CLB, clobazam; DZP, diazepam; PHT, phenytoin; CBZ, carbamazepine; VPA, valproic acid; LEV, levetirazetam; LMT, lamotrigine; ZNS, zonisamide; PRM, primidone; TPM, topiramate; BB, beta-blockers; ACEI, angiotensin converting enzyme inhibitors; HFT, heart failure therapy; DR, diuretics.