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CASE REPORT

A case of reinitiation of modified electroconvulsive therapy 2 weeks after modified electroconvulsive therapy-induced Takotsubo cardiomyopathy in a male patient with major depressive disorder

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Abstract

Background: Takotsubo cardiomyopathy (TCM) is a left ventricular dysfunction resembling acute coronary syndrome. Its prognosis is generally favorable; however, a subset of patients may present with severe complications. TCM is a rare side-effect of modified electroconvulsive therapy (ECT); it has been reported in 22 female and two male patients. Eight cases of ECT reinitiation after TCM have been reported (all females), with the shortest duration being 3 weeks.

Case Presentation: We report the case of a 61-year-old man with a history of major depressive disorder and no history of heart disease or previous ECT treatment. Antidepressants had been ineffective, and ECT was indicated. After the third ECT session, the patient complained of chest pain and shortness of breath. Electrocardiography revealed ST elevation, and catheter angiography was used to diagnose TCM. The patient had mild heart failure but remained stable. Recognizing that ECT was effective, the patient asked for it to be reinitiated. We confirmed that the cardiac function had been normalized, applied a bisoprolol fumarate patch as a preventive measure, and reinitiated ECT 14 days after the onset of TCM. ECT was performed five times, with no recurrence of TCM and a marked improvement in depression.

Conclusion: We describe a male patient with major depressive disorder who underwent reinitiation of ECT 2 weeks after ECT-induced TCM. Therefore, TCM should be recognized as a side-effect of ECT, even in men. Moreover, depending on whether the patient's condition is stable, ECT can be successfully performed in patients with TCM.

KEYWORDS

β-blocker, major depressive disorder, modified electroconvulsive therapy, Takotsubo cardiomyopathy

BACKGROUND

Takotsubo cardiomyopathy (TCM) is a left ventricular dysfunction resembling acute coronary syndrome, with symptoms of chest pain, shortness of breath, ST elevation and T-wave inversion upon electrocardiography (ECG), and elevated cardiac troponin.[1–3] The diagnostic tool for TCM is coronary angiography with left ventriculography showing apical hypokinesis, basal hypercontractility, and no significant coronary artery stenosis.[1–3] TCM is transient and reversible, and its prognosis is generally favorable; however, a subset of patients may present with complications such as heart failure, arrhythmia, and cardiogenic shock.[2,4] Its pathogenesis is not fully understood; however, exaggerated sympathetic stimulation and catecholamine elevation are likely central roles of TCM.[1,3,5–7] Many patients with TCM experience emotional and/or physical stress, anxiety, and depression before disease onset.[3,6,7] In fact, the prevalence of TCM is higher in patients with psychiatric and neurological disorders than in healthy individuals, possibly because these disorders activate the sympathetic nervous system.[3,6,7] Most patients treated with TCM are postmenopausal women, with a female-to-male ratio of approximately 9:1.[3,8] However, men in the acute phase of TCM have more severe complications, fatal arrhythmias, and in-hospital mortality rates than women.[9–11] Therefore, more careful observation and interventions are required for men than for women. It is unclear why most patients with TCM are women and why complications are more severe in men; however, this may be due to different stress-coping strategies between men and women.[1,9]

In rare cases, TCM occurs as an adverse effect of modified electroconvulsive therapy (ECT); there are only 24 known cases.[12] Of these cases, only two were male, and both had schizophrenia and were treated with clozapine and ECT.[13,14] Previously, eight female patients underwent reinitiation of ECT after TCM, with a duration until reinitiation of between 3 weeks and 9 months.[12,15–17] In this report, we describe the case of a male patient with major depressive disorder who underwent reinitiation of ECT 2 weeks after ECT-induced TCM.

CASE PRESENTATION

We report the case of a 61-year-old man with a history of severe major depressive disorder and no history of heart disease. The patient had undergone one psychiatric hospitalization for a depressive episode 2 years previously, was treated successfully with duloxetine 40 mg/day, and had no previous ECT. Although the patient continued to receive duloxetine at 40 mg/day after leaving the hospital, the depression worsened, and an additional dose of 20 mg/day of escitalopram (the maximum dose in Japan) for several months did not improve the symptoms. Therefore, the patient was admitted to our hospital.

The patient had obvious suicidal ideation and prior suicide attempts, with a Hamilton Depression Rating Scale (HAM-D) score of 32, indicating severe or very severe depression. Although we increased duloxetine to 60 mg/day (the maximum dose in Japan) for 3 weeks, the depressive mood did not improve, and suicidal ideation worsened. Due to drug resistance and exacerbation of psychiatric symptoms, ECT was indicated according to the guidelines,[18,19] and the patient consented to undergo ECT. Pre-ECT, the ECG revealed sinus rhythm without any abnormalities (Figure 1a). Blood tests and somatic pre-evaluations were also unremarkable, and there was no significant medical history, including no history of heart disease.

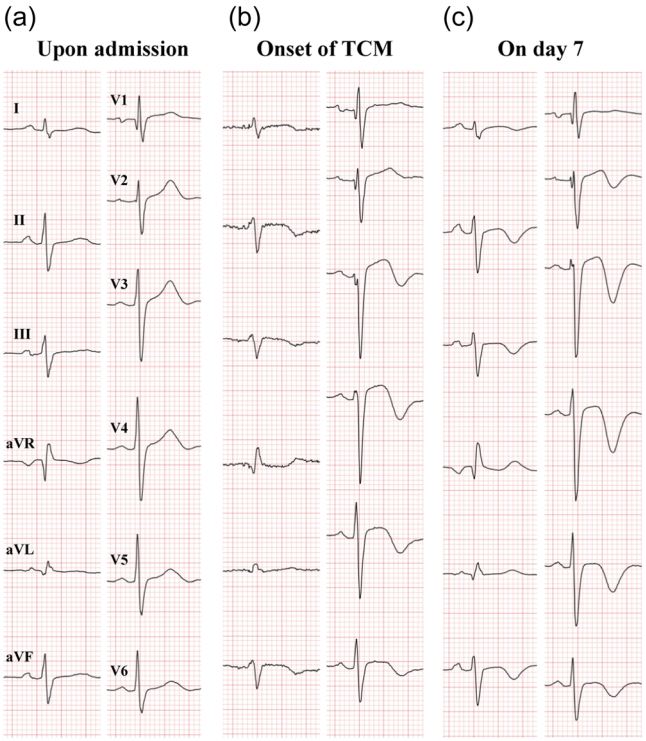

FIGURE 1 Electrocardiographic changes before and after the onset of Takotsubo cardiomyopathy (TCM). (a) Electrocardiogram (ECG) upon admission showed sinus rhythm without any abnormalities. The QTc (=QT/RR$^{1/2}$) interval was 406 ms. (b) ECG at the onset of TCM showed ST elevation and T-wave inversion in leads V3–V5 and a prolonged QTc interval of 545 ms. (c) ECG on Day 7 showed improved ST elevation. The QTc interval was 464 ms.

We used a standard general anesthetic protocol in this case. After premedication with thiopental and succinylcholine, bilateral ECT was performed. The anesthesia dose and ECT technique are described in Table 1. Because motor seizure occurred in the first session, the succinylcholine dose was increased in the second and subsequent sessions (Table 1). The second ECT session was performed without any problems. However, shortly after the third ECT session, the patient complained of chest pain and shortness of breath. The ECG showed marked ST elevation (Figure 1b) and T-wave inversion in leads V3–V5, and the QTc interval was prolonged to 545 ms. In addition, the blood test results were positive for qualitative troponin T, a marker of myocardial disorders. The vital signs were as follows: blood pressure, 122/77 mmHg; pulse rate, 64 beats/min; and oxygen saturation, 97% (room air). The patient was, therefore, transferred to a general hospital for coronary angiography. The quantitative troponin I and B-type natriuretic

TABLE 1 Anesthesia dose and modified electroconvulsive therapy technique

	First session/Second to eighth session
Height	180 cm
Body weight	70 kg
Anesthesia	
Thiopental	2.1 mg/kg
Succinylcholine	0.57 mg/kg/0.86 mg/kg
Thymatron®	
Electrode placement	Bilateral
Electrical dose	152 mC
Pulse width	0.5 ms
Frequency	30 Hz
Program	LOW 0.5[a]

Note: The succinylcholine dose was increased in the second and subsequent sessions. Other parameters remained consistent across all sessions, including those before and after the onset of Takotsubo cardiomyopathy.

[a]LOW 0.5: Fixed 0.5-ms pulse width, varies frequency to maximize duration.

peptide (BNP) levels were 386.0 and 190.6 pg/mL, respectively. Coronary angiography revealed no stenosis or occlusion of the coronary arteries, ruling out acute cardiac syndrome. However, the left ventriculogram revealed hypokinesia at the apex and hypercontraction of the basal segment; therefore, the patient was diagnosed with TCM and was closely monitored, remaining stable without any complications. Three days later, the patient was transferred to our hospital where he acknowledged improvement in depression and denied suicidal ideation. Additionally, the HAM-D score improved to 17, indicating that ECT was effective. For further improvement, the patient requested a reinitiation of ECT. The psychiatrists and cardiologists carefully considered and agreed with the reinitiation of ECT under the following three conditions: (1) the patient had to show stable vitals, negative troponin T, improvement in left ventricular motion and ECG changes, and no appearance of heart failure or arrhythmias; (2) β-blocker had to be applied as a preventive measure; and (3) ECG had to be performed every time after ECT, regardless of TCM symptoms.

On Day 5, ECG showed normal left ventricular function, and blood tests showed negative troponin T and a BNP level of 36.1 pg/mL. On Day 7, the ECG showed improved ST elevation (Figure 1c). The plasma catecholamine levels measured at rest were all within the normal range, with adrenaline (AD) at 20 pg/mL, noradrenalin (NA) at 90 pg/mL, and dopamine (DA) at a low level (<10 pg/mL). Subsequently, cardiac function normalized.

Before reinitiating ECT, we considered the recurrence rate of TCM, which is estimated to be 1.8% per patient year[2]; however, we also considered the fact that ECT could be reperformed without TCM recurrence under the use of β-blockers.[12,20] There was a possibility of ECT-induced TCM recurrence; however, there was also a possibility of TCM recurring due to depressive stress. In previous reports, the most common preventive measures of ECT reinitiation were β-blockers; however, the type, dose, and route of administration varied.[12] We selected a bisoprolol fumarate patch (equivalent to 1 mg/day of the tablet form), which was applied all day and daily from Day 5. We reinitiated ECT on Day 14. A bisoprolol fumarate patch was continued during ECT. After the ECT, the patient complained of shortness of breath but no chest pain. Although the catecholamine levels were markedly elevated 30 min after ECT, with AD, NA, and DA levels of 1070, 2250, and 100 pg/mL, respectively, the ECG was normal.

In total, ECT was performed five times after the onset of TCM (eight times including before the onset of TCM), with no recurrence of TCM. The patient's depression improved remarkably, with a HAM-D score of 8 at the end of treatment; therefore, the patient was discharged. As a preventative measure, the bisoprolol fumarate patches were continued after hospital discharge. A follow-up echocardiogram after 1 month showed normal wall motion.

DISCUSSION

This study describes the rare case of a male patient with major depressive disorder who underwent reinitiation of ECT 2 weeks after ECT-induced TCM. This case is novel because TCM is rare in male patients, and the duration until ECT reinitiation was shorter in this case than in previous reports. Our report presents two clinical implications.

First, TCM should be recognized as a side-effect of ECT, even in men. Second, depending on the case and the condition of the patient, ECT can be successfully performed in patients who have recently experienced TCM.

ECT-induced convulsions produce strong sympathetic stimulation with concomitant changes in plasma catecholamine levels, with plasma AD and NA levels steeply increasing two to six times higher than normal levels.[21,22] The mean plasma catecholamine levels at the onset of TCM are 1264, 2284, and 111 pg/mL for AD, NA, and DA, respectively, whereas those for myocardial infarction are 376, 1100, and 61 pg/mL, respectively.[23] After reinitiation of ECT in our case, the patient did not have a recurrence of TCM; however, the catecholamine levels were elevated. Therefore, the measurement of plasma catecholamines after ECT may be a good reference as a risk assessment for TCM.

In a previous report, 70.8% of patients developed TCM within the third session of ECT.[12] Similarly, the onset also occurred at the third session in our case. Therefore, more careful observation is required during the first several sessions, and if patients complain of chest pain and/or shortness of breath, electrocardiography and echocardiography should be performed.

The onset of TCM is significantly associated with psychiatric stress and/or disorders that stimulate the sympathetic nervous

system and increase plasma catecholamines.[3,6,7] For example, in a subset of patients with major depression, panic, or anxiety disorder, emotional stress decreased the reuptake of NA, which increased the plasma NA levels.[24,25] Therefore, patients with severe psychiatric disorders who are indicated for ECT may have a history of TCM. In this case, we showed that ECT can be successfully performed in a patient who has recently had ECT-induced TCM 2 weeks prior, provided that cardiac function is normalized and that β-blocker administration is maintained. This may also be applicable to patients indicated for ECT who have a recent past history of TCM. Although this case report cannot definitively prove safety and careful consideration is required when indicating ECT, it is significant to demonstrate the possibility of reducing the time to indicate ECT from 3 to 2 weeks after the onset of TCM. These findings may be particularly important for patients with severe suicidal ideation or catatonia, who often require immediate ECT.

In conclusion, we report the case of a male patient with major depressive disorder who underwent reinitiation of ECT 2 weeks after ECT-induced TCM. As a result, TCM should be recognized as a side-effect of ECT, even in men. Furthermore, depending on the case and condition of the patient, ECT can be successfully performed in patients who have recently experienced TCM. However, future prospective studies are required to show the efficacy and safety of ECT in patients with prior TCM.

AUTHOR CONTRIBUTIONS

Dai Kezuka wrote the original draft of the manuscript. Dai Kezuka, Akiko Haruyama, Eiji Suzuki, and Kei Sakuma contributed to the editing and reviewing of the final manuscript. All authors have approved the final manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper.

ETHICS APPROVAL STATEMENT

This study received approval from Asaka Hospital Ethics Committee.

PATIENT CONSENT STATEMENT

We obtained written informed consent from the patient to publish this case presentation.

CLINICAL TRIAL REGISTRATION

Not applicable.

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REFERENCES

1. Lyon AR, Citro R, Schneider B, Morel O, Ghadri JR, Templin C, et al. Pathophysiology of Takotsubo syndrome. J Am Coll Cardiol. 2021;77(7):902–21.
2. Ghadri JR, Wittstein IS, Prasad A, Sharkey S, Dote K, Akashi YJ, et al. International Expert Consensus Document on Takotsubo Syndrome (Part I): clinical characteristics, diagnostic criteria, and pathophysiology. Eur Heart J. 2018;39(22):2032–46.
3. Templin C, Ghadri JR, Diekmann J, Napp LC, Bataiosu DR, Jaguszewski M, et al. Clinical features and outcomes of Takotsubo (stress) cardiomyopathy. N Engl J Med. 2015;373(10):929–38.
4. Uribarri A, Núñez-Gil IJ, Conty DA, Vedia O, Almendro-Delia M, Duran Cambra A, et al. Short- and long-term prognosis of patients with Takotsubo syndrome based on different triggers: importance of the physical nature. J Am Heart Assoc. 2019;8(24):e013701.
5. Wittstein IS, Thiemann DR, Lima JAC, Baughman KL, Schulman SP, Gerstenblith G, et al. Neurohumoral features of myocardial stunning due to sudden emotional stress. N Engl J Med. 2005;352:539–48.
6. Ghadri JR, Sarcon A, Diekmann J, Bataiosu DR, Cammann VL, Jurisic S, et al. Happy heart syndrome: role of positive emotional stress in Takotsubo syndrome. Eur Heart J. 2016;37(37):2823–9.
7. Summers MR, Lennon RJ, Prasad A. Pre-morbid psychiatric and cardiovascular diseases in apical ballooning syndrome (Tako-Tsubo/stress-induced cardiomyopathy). J Am Coll Cardiol. 2010;55(7):700–1.
8. Sharkey SW, Windenburg DC, Lesser JR, Maron MS, Hauser RG, Lesser JN, et al. Natural History and expansive clinical profile of stress (Tako-Tsubo) cardiomyopathy. J Am Coll Cardiol. 2010;55(4):333–41.
9. Kelly MM, Tyrka AR, Price LH, Carpenter LL. Sex differences in the use of coping strategies: predictors of anxiety and depressive symptoms. Depress Anxiety. 2008;25(10):839–46.
10. Murakami T, Komiyama T, Kobayashi H, Ikari Y. Gender differences in Takotsubo syndrome. Biology. 2022;11(5):653.
11. Brinjikji W, El-Sayed AM, Salka S. In-hospital mortality among patients with takotsubo cardiomyopathy: a study of the National Inpatient Sample 2008 to 2009. Am Heart J. 2012;164(2):215–21.
12. Kinoshita M, Kinoshita M, Takahashi R, Mutoh S, Kakuta N, Tanaka K. The safety and strategies for reinitiating electroconvulsive therapy after ECT-induced Takotsubo cardiomyopathy: a case report and systematic review. J ECT. 2023;39(3):185–92.
13. Grubisha M, Gopalan P, Azzam PN. Takotsubo cardiomyopathy in a young man after maintenance electroconvulsive therapy and clozapine initiation: a case report. J ECT. 2014;30(4):e40–1.
14. Medved S, Ostojić Z, Jurin H, Medved V. Takotsubo cardiomyopathy after the first electroconvulsive therapy regardless of adjuvant beta-blocker use: a case report and literature review. Croat Med J. 2018;59(6):307–12.
15. Clifford K, Chaudhry W, Muscat S, Connors C, Whitesell D. Reinitiation of electroconvulsive therapy 4 weeks after the diagnosis of ECT-induced takotsubo cardiomyopathy. Psychosomatics. 2019;60(1):93–6.
16. Guiné JB, Rooze P, Bukowski N, Nicolet L, Martin-Grellier M, Laurin A, et al. Electroconvulsive therapy-induced Takotsubo cardiomyopathy: a successful retrial of ECT with 1-year follow-up in a 69-year-old woman. J ECT. 2022;38(2):e22–3.
17. Kent LK, Weston CA, Heyer EJ, Sherman W, Prudic J. Successful retrial of ECT two months after ECT-induced Takotsubo cardiomyopathy. Am J Psychiatry. 2009;166(8):857–62.
18. Motohashi N, Awatha S, Isse K, Ueda S, Okubo Y, Okumura M, et al. Recommendations for ECT practice, Second Edition. Psychiat Neurol JPN. 2013;115:586–600.
19. Thirthalli J, Sinha P, Sreeraj V. Clinical practice guidelines for the use of electroconvulsive therapy. Indian J Psychiatry. 2023;65:258–69.

20. Agarwal SK, Pothineni N, Payne J, Vallurupalli S, Uretsky B. Left ventricular thrombus and Takotsubo cardiomyopathy in a patient receiving electroconvulsive therapy: case report and literature review. Curr Res Cardiol. 2015;2:202–4.
21. Ito M, Hatta K, Usui C, Arai H. Urine catecholamine levels are not influenced by electroconvulsive therapy in depression or schizophrenia over the long term. Psychiatry Clin Neurosci. 2012;66(7):602–10.
22. Gravenstein JS, Anton AH, Wiener SM, Tetlow AG. Catecholamine and cardiovascular response to electro-convulsion therapy in man. Br J Anaesth. 1965;37(11):833–9.
23. Wittstein IS, David RT, Lima JAC, Baughman KL, Schulman SP, Gerstenblith G, et al. Neurohumoral features of myocardial stunning due to sudden emotional stress. N Engl J Med. 2005;10(6):539–48.
24. Mausbach BT, Dimsdale JE, Ziegler MG, Mills PJ, Ancoli-Israel S, Patterson TL, et al. Depressive symptoms predict norepinephrine response to a psychological stressor task in Alzheimer's caregivers. Psychosom Med. 2005;67(4):638–42.
25. Alvarenga ME, Richards JC, Lambert G, Esler MD. Psychophysiological mechanisms in panic disorder: a correlative analysis of noradrenaline spillover, neuronal noradrenaline reuptake, power spectral analysis of heart rate variability, and psychological variables. Psychosom Med. 2006;68(1):8–16.

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