

## CASE REPORT

# Cardiogenic cerebral embolism caused by a severe hypoglycemic attack : a case report

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**Abstract :** The direct relationship between a hypoglycemic attack and cerebral infarction remains unknown. It has been reported that a hypoglycemic attack can result in takotsubo syndrome, leading to cerebral infarction. We report a case of a cardiogenic cerebral embolism caused by a hypoglycemic attack, with additional literature review. A 71-year-old woman was admitted to our hospital in a semi-comatose state due to a severe hypoglycemic attack ; she developed hemiplegia one day after admission. Magnetic resonance imaging revealed cerebral infarction in the area supplied by the left middle cerebral artery. Takotsubo syndrome was suspected based on echocardiography. We diagnosed cerebral embolism due to takotsubo syndrome, caused by the hypoglycemic attack. *J. Med. Invest.* 67 :362-364, August, 2020

**Keywords :** hypoglycemic attack, cerebral infarction, takotsubo syndrome, takotsubo cardiomyopathy, cardiogenic cerebral embolism

## INTRODUCTION

Severe hypoglycemia is associated with a higher risk of cerebral infarction (1). This is biologically plausible because severe hypoglycaemia has acute effects on sympathoadrenal activation (2), inflammation (3), and endothelial function (4), all of which have potential adverse cardiovascular effects. Takotsubo syndrome is a reversible cardiomyopathy, predominantly occurring in post-menopausal women and commonly triggered by emotional or physical stress. Hypoglycemic attacks can induce Takotsubo syndrome (5-8). In several studies, this syndrome was associated with cerebral infarction by thrombus formation on hypokinetic cardiac walls (9). Therefore, hypoglycemic attack could theoretically cause cerebral infarction via takotsubo syndrome-associated cardiogenic emboli, even though this has not been reported. The present report describes a rare case of a cerebral infarction caused by a hypoglycemic attack via takotsubo syndrome.

## CASE REPORT

A 71-year-old woman was brought to our emergency department for altered mental status. She had a past medical history of type 2 diabetes mellitus, lacunar stroke, and angina pectoris. At the time of the first medical examination, her blood pressure was 133/80 mmHg, and her pulse rate was 95/min and regular. The electrocardiogram (ECG) showed sinus rhythm, negative T waves in leads II, III, and V3-V6, and ST elevation in V2-V4 (Figure 1A). We did not perform transthoracic echocardiogram because there was no clinical technologist or doctor who could perform the test at the time. The Glasgow Coma Scale (GCS)

score was E1V1M4 ; however, she had no paralysis. Laboratory analysis revealed a blood glucose level of 37 mg/dl, serum creatinine of 1.55 mg/dl, CPK of 470 U/l, CK-MB of 20.7 ng/ml, and troponin I of 1578 pg/ml. She was taking glimepiride, and we speculated that this was the cause of the hypoglycemic attack. Magnetic resonance imaging (MRI) showed a high signal in the corpus callosum suggesting hypoglycemic encephalopathy ; however, there was no evidence of occlusion of a major artery or acute cerebral infarction (Figure 2A, 2B). We prescribed 50% hypertonic glucose solution in a 50-ml vial for intravenous injection. Her blood glucose level increased to 125 mg/dl, and her GCS score rose to E4V3M6. Our diagnosis was that the mental status change was caused by severe hypoglycemia. One day after admission, she suddenly developed right hemiparesis. MRI revealed cerebral infarction in the area supplied by the left middle cerebral artery (Figure 2C). Magnetic resonance angiography (MRA) revealed left middle cerebral artery (MCA) occlusion (Figure 2D). We detected a susceptibility vessel sign on T2\*-weighted imaging, suggesting an occlusion site (Figure 2E). ECG revealed normal sinus rhythm ; however, negative T waves were more profound in leads I, II, III aVF and V2-6. ST elevation was present in V2-V3 (Figure 1B). Restricted wall motion of the left ventricular apex was seen on echocardiography (Figure 3A, 3B). We could not detect paroxysmal atrial fibrillation on Holter ECG, and there was no patent foramen ovale or plaque in the aortic arch on transesophageal echocardiography. Eight days after admission, MRA revealed that the left MCA had recanalized spontaneously. This observation suggested that this cerebral infarction was not an atherosclerotic cerebral infarction but was rather a cerebral embolism. Furthermore, an increase of cardiac muscle enzymes, ECG, and echocardiography suggested takotsubo syndrome. As we could not detect left ventricle (LV) thrombi on transesophageal echocardiography, we did not start anticoagulation therapy. Cardiac catheterization did not detect significant stenosis in the coronary arteries, and wall motion of the apex improved over time. Her final diagnosis was cardiogenic cerebral embolism caused by takotsubo syndrome. The abnormal motion of the apical wall normalized one month after admission, and she was discharged from the hospital with a modified

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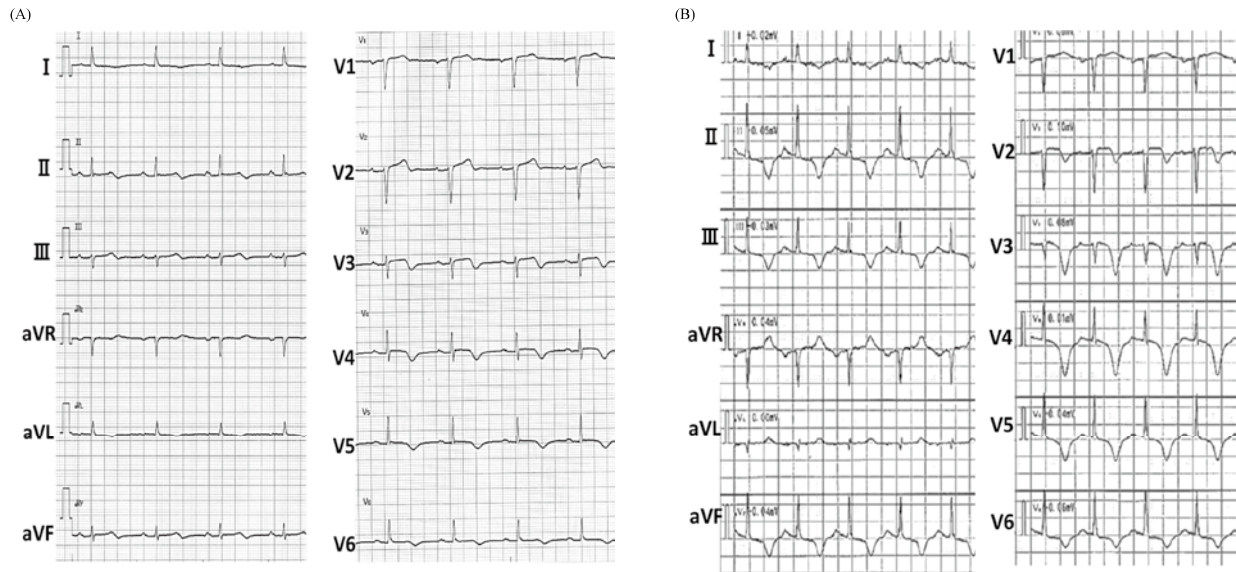


Figure 1 (A) The ECG on admission, showing negative T waves in leads II, III, and V3-V6. (B) One day after admission, the ECG showed more profound negative T wave in leads I, II, III, aVF, and V2-6.

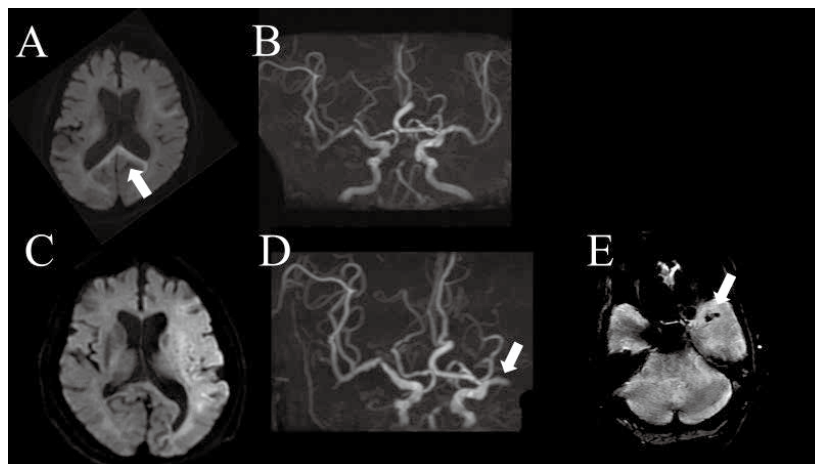


Figure 2 (A) Diffusion-weighted (DW)-MRI of the brain on admission. There was no sign of acute cerebral infarction ; however, the high signal in the corpus callosum suggested hypoglycemic encephalopathy. (B) Magnetic resonance angiography (MRA) on admission revealing no evidence of occlusion of major arteries. (C) The second DW-MRI demonstrated cerebral infarction in the area supplied by the left middle cerebral artery. (D) The second MRA revealing left middle cerebral artery occlusion. (E) The second T2\*-weighted MRI revealing a susceptibility vessel sign, suggesting an occlusion site.

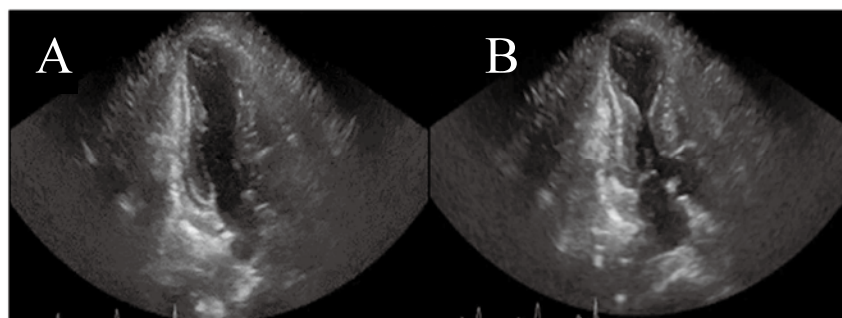


Figure 3 Abnormal wall motion of the apex deteriorated on echocardiography. (A) End diastole (B) End systole

Rankin Scale score of 5.

## DISCUSSION

We believe that in this case, hypoglycemia was the trigger of LV dysfunction and may have been the cause of a cardiogenic embolism. We reviewed the hypothesis that hypoglycemia led to takotsubo syndrome that causes LV thrombi secondary to hypokinesis of the apical LV wall. First, it has been reported that takotsubo syndrome is caused by activation of sympathetic nerves (10). When blood glucose levels are low, sympathetic nerves are activated to raise serum glucose levels (11). Several cases have been reported in which takotsubo syndrome was caused by a hypoglycemic attack (5-7). One retrospective cohort study of 88 patients with takotsubo syndrome demonstrated that one patient developed the syndrome from hypoglycemia (8). Second, LV thrombi were detected in 2.2% of patients who developed takotsubo syndrome (10). Predictors of LV thrombi in takotsubo syndrome are increased levels of troponin and ST elevation at admission (12). Women over 71 years of age presenting with deep giant negative T-waves on admission ECG are at high risk for thrombus-related embolic complications (13). These features are consistent with the findings in our case. Based on these results, theoretically, a hypoglycemic attack can induce cardiogenic embolism; there was no other cause of cerebral infarction. This case demonstrated that a severe hypoglycemic attack could cause cardiogenic embolism.

Many authors have reported on takotsubo syndrome since Sato *et al.* reported the first case in 1990 (14); however, the pathophysiology of this disorder has not been clarified adequately. We should note that this syndrome may be overlooked because subjective symptoms are not always clear in severe hypoglycemia. Oral anticoagulation therapy for 3 months appears reasonable in high-risk patients with LV thrombi (10). Nevertheless, we did not administer anticoagulation therapy because we could not detect LV thrombi on transesophageal echocardiography. To prevent cerebral infarction, we should check the patient's ECG if they have a hypoglycemic attack.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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