Broken Heart Syndrome in a Patient on Maintenance Hemodialysis

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Abstract
Context: Broken heart syndrome or Takotsubo cardiomyopathy (TC) is a disorder characterized by transient left ventricular apical ballooning that almost invariably precedes emotional or physical stress. Although the patients with chronic kidney disease on hemodialysis have shown to exhibit sustained activity of sympathetic nervous system, the presentation of TC in these patients is a rare entity with few case reports in the literature. Case Report: A 75-year-old female with past medical history of end-stage renal disease presented with chest pressure and heaviness that started during her maintenance hemodialysis session. Electrocardiogram showed ST elevation and T wave inversion in V3-V6 leads. Emergent left heart catheterization was done that showed normal coronaries and akinesis of apical left ventricle wall consistent with TC. She was started on maximal medical management and underwent hemodialysis the next day without recurrence of the symptoms. Conclusion: TC may an underdiagnosed entity in patients on hemodialysis. However, it should be considered in the differential diagnosis in hemodialysis patients, particularly who presents with chest pain and/or symptoms.

Keywords
broken heart syndrome, Takotsubo cardiomyopathy, end-stage renal disease, hemodialysis

Introduction
Broken heart syndrome or Takotsubo cardiomyopathy (TC) is a disorder mimicking acute coronary syndrome characterized by transient regional wall motion abnormality in the absence of coronary artery disease. The entity is often preceded by emotional or physical stress. Patients with chronic kidney disease and/or on hemodialysis have been found to be associated with increased risk of cardiovascular mortality. However, TC in the setting of maintenance hemodialysis is a rare entity with few case reports in the literature.

Case Report
A 75-year-old female presented to our hospital with chest pressure and heaviness that started during her maintenance hemodialysis session. She had past medical history of end-stage renal disease (ESRD) on hemodialysis for the last 5 years, diabetes, and hypertension. She reported recent hospitalization of her husband for an acute illness. Physical examination was normal except for lower extremity edema. On presentation, her blood pressure was 122/61 mm Hg, heart rate of 71 beats/minute, and respiratory rate of 18/minute. Initial laboratory tests were remarkable for hemoglobin of 9.1 g/dL and creatinine of 2.21 mg/dL. Electrocardiogram showed ST elevation and T wave inversion in V3-V6 leads (Figure 1). Troponin

Figure 1. Electrocardiogram showing ST elevation and T wave inversions in V3-V6 leads.

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levels were also found to be elevated 8.06 ng/mL (reference range = 0.00-0.02 ng/mL). Emergent left heart catheterization (LHC) was done that showed normal coronaries but the ventriculogram revealed mildly reduced left ventricular (LV) systolic function with ejection fraction of 45% to 50% and akinesis of apical LV wall consistent with TC (Figure 2). Echocardiography demonstrated akinetic apex of LV with ejection fraction of 65%. She underwent hemodialysis the next day after undergoing LHC without recurrence of symptoms. She was discharged on atorvastatin, metoprolol, and lisinopril and follow-up course was uneventful. The follow-up echocardiogram was performed at 2 months, which was consistent with the resolution of the akinetic LV apex with the ejection fraction of 68%.

**Discussion**

TC or broken heart syndrome is a disorder characterized by transient left ventricular apical ballooning which mimics presentations of acute coronary syndrome but without any angiographic evidence of coronary artery disease. It is generally seen in postmenopausal women following an emotional or physical stress and/or critical illness. The prevalence is estimated to be approximately 1% to 2% of cases of acute coronary syndrome. The exact pathophysiology remains undetermined, but it has been postulated that inappropriate catecholamine release in relation to emotional stress may be the underlying pathological factor. The hypothesis is further supported by Giavarini et al in a retrospective study who reported that up to 11% cases of pheochromocytomas and paragangliomas may present as Takotsubo-like cardiomyopathy. Additionally, Wittstein et al demonstrated that plasma catecholamine

| Authors            | Age and Gender of Patient | Interval of Development of Symptoms | Past Medical History | Precipitating Factors | Duration of Hemodialysis | Outcome                  |
|--------------------|---------------------------|-------------------------------------|----------------------|-----------------------|--------------------------|--------------------------|
| Fukui et al^15     | 84 years, female          | Chest discomfort, several days before admission | Chronic nephritic syndrome and renal parenchymal hypertension | Smoking cessation | 2 years                  | No recurrence of symptoms |
| Muratsu et al^16    | 63 years, female          | No symptoms, second day of hospitalization | Glomerulonephritis   | Seizure              | 32 years                 | No recurrence of symptoms |
| Muratsu et al^16    | 59 years, female          | Fatigue on admission                | Glomerulonephritis   | Family illness       | 12 years                 | No recurrence of symptoms |
| Kusaba et al^17     | 65 years, male            | Severe left shoulder pain, sixth day of admission | Diabetic nephropathy | Meningitis and cervical epidural abscess | 9 years                  | No recurrence of symptoms |
| Takemoto et al^18   | 61 years, female          | Severe chest pain during hemodialysis session | Glomerulonephritis   | Cervical spondylosis surgery | 20 years                 | No recurrence of symptoms |
| Shin et al^19       | Age range 54-68 years, 2 females and 1 male | Dyspnea on admission               | Diabetes and hypertension | Pneumonia and hypoxia in 2 patients and colitis in third | —                        | No recurrence of symptoms |
| Current case        | 75 years, female          | Chest pressure during hemodialysis   | Diabetes and hypertension | Family illness    | 5 years                  | No recurrence of symptoms |
levels were significantly high in patients with TC than patients with acute myocardial infarction. Moreover, the drugs with excessive catecholamine and beta receptor agonist effect may precipitate TC. Similarly, sustained activity of sympathetic nervous system and excess catecholamine release has been exhibited in patients with ESRD on hemodialysis in context to the development of TC in these patients. ESRD patients, in addition to physiological changes, also suffer from a significant psychological illness that can adversely affect their lifestyle. González-De-Jesús et al demonstrated that up to 55% to 60% of these patients exhibits either depressive or anxious symptoms based on the hospital anxiety and depression scale. Initiation of dialysis has also been reported as a triggering factor for TC in 4 patients. We believe activation of sympathetic nervous system releasing catecholamine, particularly in patients who have emotional stress, may be the potential cause of TC. So far, to the best of our knowledge, only 8 cases of TC were found after extensive literature search. Table 1 summarizes the data of TC in patients on hemodialysis. These patients have the age range from 54 to 84 years. Including our case, 7/9 (77.7%) patients are women. Interestingly, more than half of these patients (5/9; 55.5%) did not have chest pain. Considering this, it is worth to mention here that condition may be underdiagnosed considering its atypical or asymptomatic presentation. Nevertheless, all of these patients have an uneventful recovery.

Conclusion

Takotsubo cardiomyopathy may be an underdiagnosed entity in patients on hemodialysis. However, it should be considered in the differential diagnosis in hemodialysis patients, particularly who present with chest pain and/or symptoms.

Declaration of Conflicting Interests

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References

1. Sarnak MJ, Levey AS, Schoolwerth AC, et al. Kidney disease as a risk factor for development of cardiovascular disease: a statement from the American Heart Association Councils on Kidney in Cardiovascular Disease, High Blood Pressure Research, Clinical Cardiology, and Epidemiology and Prevention. Circulation. 2003;108:2154-2169.
2. Virani SS, Khan AN, Mendoza CE, Ferreira AC, de Marchena E. Takotsubo cardiomyopathy, or broken-heart syndrome. Tex Heart Inst J. 2007;34:76-79.
3. Ueyama T. Emotional stress-induced Tako-tsubo cardiomyopathy: animal model and molecular mechanism. Ann N Y Acad Sci. 2004;1018:437-444.
4. Kurowski V, Kaiser A, von Hof K, et al. Apical and midventricular transient left ventricular dysfunction syndrome (Tako-tsubo cardiomyopathy): frequency, mechanisms, and prognosis. Chest. 2007;132:809-816.
5. Kume T, Kawamoto T, Okura H, et al. Local release of catecholamines from the hearts of patients with Tako-tsubo-like left ventricular dysfunction. Circ J. 2008;72:106-108.
6. Giavarini A, Chedid A, Bobrie G, Plouin PF, Hagege A, Amar L. Acute catecholamine cardiomyopathy in patients with phaeochromocytoma or functional paraganglioma. Heart (British Cardiac Society). 2013;99:1438-1444.
7. Wittstein IS, Thiennard DR, Lima JA, et al. Neurohumoral features of myocardial stunning due to sudden emotional stress. N Engl J Med. 2005;352:539-548.
8. Abraham J, Mudd JO, Kapur NK, Klein K, Champion HC, Wittstein IS. Stress cardiomyopathy after intravenous administration of catecholamines and beta-receptor agonists. J Am Coll Cardiol. 2009;53:1320-1325.
9. Mauriello A, Rovella V, Anemona L, et al. Increased sympathetic renal innervation in hemodialysis patients is the anatomical substrate of sympathetic hyperactivity in end-stage renal disease. J Am Heart Assoc. 2015;4:e002426.
10. Augustyniak RA, Tuncel M, Zhang W, Toto RD, Victor RG. Sympathetic overactivity as a cause of hypertension in chronic renal failure. J Hypertens. 2002;20(1):3-9.
11. Poorgholami F, Koshkaki AR, Kargar Jahromi M, Parniyan R. A study of the influence of group-based learning of stress management on psychology symptoms levels of hemodialysis patients. Glob J Health Sci. 2016;8(11):52525.
12. Mapes DL, Bragg-Gresham JL, Bommer J, et al. Health-related quality of life in the Dialysis Outcomes and Practice Patterns Study (DOPPS). Am J Kidney Dis. 2004;44(5 suppl 2):54-60.
13. González-De-Jesús LN, Sánchez-Román S, Morales-Buenrostro LE, et al. Assessment of emotional distress in chronic kidney disease patients and kidney transplant recipients. Rev Invest Clin. 2011;63:558-563.
14. Tsuchihashi K, Ueshima K, Uchida T, et al. Transient left ventricular apical ballooning without coronary artery stenosis: a novel heart syndrome mimicking acute myocardial infarction. J Am Coll Cardiol. 2001;38:11-18.
15. Fukui M, Mori Y, Tsujimoto S, et al. “Takotsubo” cardiomyopathy in a maintenance hemodialysis patient. Ther Apher Dial. 2006;10:94-100.
16. Muratsu J, Morishima A, Ueda H, Hiraoka H, Sakaguchi K. Takotsubo cardiomyopathy in two patients without any cardiac symptom on maintenance hemodialysis. Case Rep Nephrol. 2013;2013:640976.
17. Kusaba T, Sasaki H, Sakurada T, et al. Takotsubo cardiomyopathy thought to be induced by MRSA meningitis and cervical epidural abscess in a maintenance-hemodialysis patient: case report [in Japanese]. Nihon Jinzo Gakkai Shi [in Japanese]. 2004;132:809-816.
18. Takemoto F, Chihara N, Sawa N, et al. Takotsubo cardiomyopathy in a patient undergoing hemodialysis. Kidney Int. 2009;76(4):467.
19. Shin MJ, Rhee H, Kim IY, et al. Clinical features of patients with stress-induced cardiomyopathy associated with renal dysfunction: 7 case series in single center. BMC Nephrol. 2013;14:213.