TORSADES DE POINTES ASSOCIATED WITH TAKOTSUBO CARDIOMYOPATHY IN AN ANOREXIA NERVOSA PATIENT DURING EMERGENCE FROM GENERAL ANESTHESIA

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Takotsubo cardiomyopathy, also known as stress-induced cardiomyopathy, is a disease in which the patient exhibits transient, reversible left ventricular dysfunction that is triggered by physical or emotional stress. Prolongation of QT interval, a risk factor for arrhythmia and sudden death, has been reported to be prevalent among patients with Takotsubo cardiomyopathy and is also observed in those with severe anorexia nervosa. In this report, we describe the rare case of a 30-year-old female patient with anorexia nervosa who developed Torsades de Pointes associated with Takotsubo cardiomyopathy during emergence from general anesthesia for emergency exploratory laparotomy.

Keywords: Torsades de Pointes, Takotsubo cardiomyopathy, Anorexia nervosa, General anesthesia.

Introduction

Takotsubo cardiomyopathy, also known as stress-induced cardiomyopathy, is a disease that exhibits an acute left ventricular apical ballooning associated with physical or emotional stress1. There are increasing case reports of patients who developed Takotsubo cardiomyopathy in the perioperative period because of the stress of anesthesia and a surgical procedure2-7. Prolongation of QT interval, a risk factor for arrhythmia and sudden death, has been reported to be prevalent among Takotsubo cardiomyopathy patients8. Prolonged QT interval also appears in severe anorexia nervosa patients9. In this report, we describe a rare case of a young woman with anorexia nervosa who presented with Torsades de Pointes (TdP) associated with Takotsubo cardiomyopathy during emergence from general anesthesia.

Case report

A 30-year-old woman patient (height 160 cm, weight 43 kg) was brought to our hospital in an ambulance with self-inflicted neck, left upper arm, and abdominal wounds. Her medical history included alcoholic liver injury for one year and anorexia nervosa for 10 years. Physical findings included thinness, abdominal distension with ascites, and leg edema. Laboratory data...
showed anemia (hemoglobin 9.4 g/dL), liver dysfunction (total bilirubin 1.7 mg/dL, aspartate aminotransferase 58 U/L, lactate dehydrogenase 261 U/L, γ-glutamyltranspeptidase 70 U/L, and prothrombin time 17.2 s), malnutrition (cholinesterase 55 U/L, total protein 4.8 g/dL, and albumin 1.9 g/dL), and electrolyte imbalance (Na 134.7 mEq/L, and K 3.16 mEq/L). The electrocardiogram (ECG) performed on admission showed QT prolongation measuring 497 ms in the QTc interval (Fig. 1).

ECG on admission showed QTc prolongation (QTc 497 ms).

Bazett’s formula was used to correct QT interval.

The patient was scheduled for emergency exploratory laparotomy. Preanesthetic medication was not administered. On arrival in the operating room, her blood pressure was 108/65 mmHg, heart rate was 132 beats per minute (bpm), and peripheral oxygen saturation was 96% on room air. General anesthesia was induced with intravenous remifentanil (0.3 µg/kg/min), propofol (40 mg), and rocuronium (25 mg), and endotracheal intubation was performed. Anesthesia was maintained with oxygen (1 L/min), air (2 L/min), sevoflurane (1.0%), remifentanil (0.15-0.25 µg/kg/min), and intermittent dose of fentanyl (total 100 µg). Neuromuscular blockade was maintained with intermittent rocuronium. The patient was monitored with ECG, noninvasive blood pressure measurement, capnography, pulse oximetry, and the bispectral index (BIS). The patient’s intraoperative systolic blood pressure was 80–100 mmHg, heart rate was 85–105 bpm, and BIS was 40–55. Careful review of intraoperative ECG revealed QTc prolongation (QTc 613 ms), probably because of the decrease of heart rate (Fig. 2). Surgery, which lasted for 55 min, was performed uneventfully. Intraoperative total blood loss was 50 ml, urine output was 50 ml, and total infusion volume was 800 ml. At the end of surgery, sugammadex 200 mg was administered for the reverse of muscle relaxation. Approximately 5 min after reversal, TdP degenerating into ventricular fibrillation ensued (Fig. 3). External cardiac massage was immediately performed, and 2% lidocaine (100 mg) and adrenaline (1 mg) were administered. After DC shock (200 J), she recovered sinus rhythm. An arterial blood gas analysis showed pH, partial pressure of oxygen (PaO2), and partial pressure of carbon dioxide (PaCO2) of 7.354, 545.2 mmHg, and 38.6 mmHg, respectively. The serum potassium concentration was 3.08 mEq/L, and other serum electrolytes were within normal limits. A transthoracic echocardiogram performed in the operating room revealed the akinesis of the apical segment, preserved basal function, and reduced left ventricular function (35% ejection fraction), which are consistent with Takotsubo cardiomyopathy (Fig. 4).

The patient was transferred to the intensive care unit (ICU). The QTc interval on ICU admission was 499 ms (Fig. 5). The correction of hypokalemia and a continuous infusion of intravenous amiodarone were provided to treat arrhythmia. Although the QTc prolongation persisted even after hypokalemia correction, further TdP or ventricular fibrillation was not observed. However, she developed massive ascites with liver dysfunction, and the control of massive ascites was difficult. A large dose of catecholamine (dopamine, dobutamine, and noradrenaline) was continuously administered, but the patient’s hemodynamic status remained unstable with systolic blood pressure at approximately 60–70 mmHg. The patient died one day after surgery.
Discussion

Takotsubo cardiomyopathy is characterized by reversible left ventricular dysfunction, chest pain or dyspnea, ECG alterations (i.e., ST segment elevation and T wave inversion), and only modest elevations of serum levels of cardiac enzymes and troponin\(^1\). Moreover, significant organic stenosis or spasm of a coronary artery is not usually detected in the coronary angiography.

It has been reported that reversible left ventricular dysfunction is precipitated by physical or emotional stress\(^1\). Although the exact mechanism of Takotsubo cardiomyopathy remains unclear, it has been suggested that activation of cardiac adrenoceptors is the primary cause of this syndrome\(^11,12\). Moreover, Takotsubo cardiomyopathy has higher incidence in elderly females, and it is rare in young premenopausal women\(^1\); thus, a decrease in estrogen may be involved in the development of this syndrome.

There are increasing case reports of Takotsubo cardiomyopathy during the perioperative period, likely due to the stress of anesthesia and a surgical procedure. Most of these cases are reported during induction of anesthesia\(^2,4\) or in the postoperative course after procedures such as cholecystectomy\(^5\), total gastrectomy\(^6\) or electroconvulsive therapy\(^4\). However, there are few reports that occurred during emergence from general anesthesia. Shin et al.\(^7\) presented a case of Takotsubo cardiomyopathy after percutaneous endoscopic lumbar discectomy under general anesthesia, confirming that seizure activities after general anesthesia may lead to a higher risk for Takotsubo cardiomyopathy.

Malignant arrhythmia in the setting of Takotsubo cardiomyopathy has been reported. This includes ventricular fibrillation, ventricular tachycardia, atrial fibrillation, and atrioventricular block. Gianni et al.\(^13\) reviewed a total of 286 patients with Takotsubo cardiomyopathy and reported that cardiogenic shock (4.2% of the patients) and ventricular fibrillation (1.5%) were not infrequent. In addition, according to a report by Syed et al.\(^14\), there were 15 reported cases of ventricular fibrillation [prevalence of 1.8% (15 of 816 cases)], 10 cases of sustained ventricular tachycardia [prevalence of 1.2% (10 of 816)], 38 cases of atrial fibrillation [prevalence of 4.7% (38 of 816)], and 24 cases of atrioventricular block [prevalence of 2.9% (24 of 816)]. Therefore, these reports suggest that ventricular arrhythmia is clinically important in Takotsubo cardiomyopathy, although it is considered that malignant arrhythmia is less likely to occur in Takotsubo cardiomyopathy than in acute myocardial infarction. Furthermore, Torsade de Pointes, a potentially life-threatening ventricular arrhythmia has been reported in association with Takotsubo cardiomyopathy. Although the prevalence of QT interval prolongation among patients with Takotsubo cardiomyopathy is high, TdP has been reported less frequently in these patients\(^5\). TdP occurring in patients...
with Takotsubo cardiomyopathy was first reported by Denney et al.\textsuperscript{15} and subsequently by several other authors\textsuperscript{16,17}. In that report, Denny et al.\textsuperscript{15} reported that Takotsubo cardiomyopathy could be considered among the causes of long QT syndrome and TdP. However, we could not find any report of TdP associated with Takotsubo cardiomyopathy in the perioperative period. This is the first case of TdP related to Takotsubo cardiomyopathy during emergence from general anesthesia.

As mentioned above, it is well recognized that physical or emotional stress cause Takotsubo cardiomyopathy. It is therefore possible that emotional stress and the stress of anesthesia and a surgical procedure can cause Takotsubo cardiomyopathy, which in turn can lead to QT interval prolongation. On the other hand, it is known that factors such as hypokalemia, bradycardia, or antiarrhythmic drugs can prolong the QT interval and may induce TdP. Since the QTc interval on ECG obtained approximately 4 years earlier had been normal (QTc 444 ms), an acquired cause of QT prolongation was suspected. In the present case, QT interval prolongation was induced by hypokalemia and Takotsubo cardiomyopathy and subsequently resulted in TdP.

Furthermore, the patient had suffered from anorexia nervosa during the preceding 10 years. Several cardiovascular complications, such as QT interval prolongation or arrhythmia appear in patients with severe anorexia nervosa\textsuperscript{9}, and a high proportion of deaths in these patients are due to cardiac arrhythmia\textsuperscript{18}. There are several reports on the association of Takotsubo cardiomyopathy with anorexia nervosa\textsuperscript{19,20}. Rotondi et al.\textsuperscript{20} reported a case of a woman with anorexia nervosa showing evidence of Takotsubo cardiomyopathy complicated by recurrent TdP. In that report, the authors concluded that the QT prolongation caused by Takotsubo cardiomyopathy was apparently amplified by anorexia nervosa and resulted in malignant and recurrent ventricular arrhythmias. Therefore, it is thought that the QT interval prolongation in our patient was amplified by anorexia nervosa in the same way as the previous reported case. It has been reported that sevoflurane induces significant QT interval prolongation\textsuperscript{21-23}. By contrast, propofol is considered to be less likely to prolong QT interval\textsuperscript{21,23}. Therefore, propofol may be a more appropriate anesthetic for patients with anorexia nervosa.

The present case demonstrates that TdP associated with Takotsubo cardiomyopathy can occur during emergence from general anesthesia. Furthermore, QT interval prolongation may be enhanced by anorexia nervosa.
References


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* Train-of-four
\(^2\) Post-tetanic count
\(^3\) Second twitch

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