CASE REPORT

Four Elderly Cases Developing Takotsubo Cardiomyopathy Associated with Flexible Bronchoscopy

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ABSTRACT — Introduction. Flexible bronchoscopy is a safe, widely applied procedure for the diagnosis of airway diseases or lung abnormalities. In cases of the elderly, however, we should take account of uncommon adverse events such as Takotsubo cardiomyopathy. Takotsubo cardiomyopathy is recognized as stress-induced cardiomyopathy preceded by emotional or physical stress, which is typically associated with transient dyskinesia or akinesia of the left ventricular apical wall with normal findings or hyperkinesis of the basal wall. Flexible bronchoscopy can give elderly patients so much stress that it is at risk for developing Takotsubo cardiomyopathy. Case Reports. We report a series of cases diagnosed as Takotsubo cardiomyopathy during or after flexible bronchoscopy as follows. Case 1: A woman aged 85 developed Takotsubo cardiomyopathy one day after flexible bronchoscopy. She was associated with arrhythmias, and died partly because of heart failure and progression of lung cancer. Case 2: A woman aged 85 developed Takotsubo cardiomyopathy 6 days after the procedure. Her case was associated with intraventricular thrombus and was treated with anticoagulant. Case 3: A man aged 85 developed Takotsubo cardiomyopathy 6 days after the procedure. His condition was associated with acute heart failure and was treated with non-invasive positive-pressure ventilation. He was also treated with anticoagulant, but developed cerebral embolism and led to right hemiplegia. Case 4: A man aged 78 developed Takotsubo cardiomyopathy during the procedure. He had no complications and was treated for lung cancer with irradiation. Conclusion. Takotsubo cardiomyopathy is an uncommon, but an important adverse event of flexible bronchoscopy on the elderly, partly because it can lead to severe events such as pump failure, arrhythmia, or thromboembolism. Once Takotsubo cardiomyopathy develops, activities of daily living and cognitive functions may decline before recovering from it and it can be attributed to their poor prognosis, especially in the frail elderly. To prevent Takotsubo cardiomyopathy during bronchoscopy, we should prevent emotional and physical stress with administration of the appropriate sedative or anti-anxiety medicine.

KEY WORDS — Flexible bronchoscopy, Takotsubo cardiomyopathy, Elderly

INTRODUCTION

Flexible bronchoscopy is a safe, widely applied procedure for the diagnosis of airway diseases or lung abnormalities. The complication rate related with bronchoscopy is several percent or less and procedure-related mortality is extremely rare.¹ Major complications are pneumothorax, hemorrhage, transient hypotension, and hypoxemia. Although it is rare that bronchoscopy is associated with severe cardiovascular events, it is commonly associated with elevations of blood pressure and heart rate. When there are some risks of cardiac ischemia, arrhythmia and hypoxemia, routine electrocardiogram monitoring during bronchoscopy is recommended in the guideline from British Thoracic Society.² Moreover, in cases of the elderly, uncommon adverse events

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such as Takotsubo cardiomyopathy should be taken into account.

Takotsubo cardiomyopathy is recognized as stress-induced cardiomyopathy, which is typically associated with transient dyskinesia or akinesia of the left ventricular apical wall with normal or hyperkinesis of the basal wall. Takotsubo cardiomyopathy is much more common in postmenopausal women than men.\textsuperscript{3,4} It is often preceded by an emotional trigger such as death of relatives, financial problems, and nature disasters or a physical trigger such as respiratory failure, fracture, severe infection, malignancy and medical procedure.\textsuperscript{3,4} The most common symptoms are chest pain, dyspnea, and syncope.\textsuperscript{3} Some patients develop symptoms and signs of heart failure and arrhythmias. Elevated cardiac enzymes are sometimes detected with blood tests and it is necessary to differentiate Takotsubo cardiomyopathy from acute coronary syndrome.

In the electrocardiogram, ST segment elevation occurs at the onset. T wave inversion occurs several hours after the onset. It is improved a few days later, becomes worse after about a week and is normalized within a few months.\textsuperscript{5} Echocardiogram and left ventriculography show hypokinesis, dyskinesia or akinesia of the left ventricle apical wall with hyperkinesis of the basal wall and the shape of the left ventricle during systolic phase is similar to Takotsubo. These are improved within a few weeks. These wall motion abnormalities extend beyond the territory perfused by a single coronary artery. Coronary angiography typically shows no obstructive lesions that can explain left ventricular wall motion abnormalities. Although Takotsubo cardiomyopathy can lead to some severe complications, including arrhythmia such as ventricular tachycardia, ventricular thrombus, thromboembolism, ventricular rupture, cardiac shock, acute heart failure, left ventricular outflow tract obstruction and mitral valve regurgitation, it is typically managed with supportive therapy, including anticoagulant, anti-arrhythmic, diuretic, catecholamine until the improvement of cardiac function.\textsuperscript{3,4}

It is rare that Takotsubo cardiomyopathy occurs in association with bronchoscopy and there are only nine cases reported before now. We report four cases of Takotsubo cardiomyopathy associated with bronchoscopy.

**CASE REPORTS**

From April 2014 to September 2015, we had performed 250 bronchoscopies and 68 cases were from age 75 to 79, 61 cases were from age 80 to 84 and 50 cases were over the age of 85.

**Case 1**

An 85 year-old woman underwent flexible bronchoscopy to examine the mass lesion of the right upper lobe of lung (Figure 1a). She had a history of tuberculosis and had taken antihypertensive medication. She had been associated with decline of cognitive function and activities of daily living. Before the bronchoscopy, her electrocardiogram had shown only complete right bundle branch block.

During the procedure, she underwent transbronchial biopsy and washing at the entry of the right upper lobe of lung and it ended in 20 minutes. She had transient elevation of blood pressure up to 220 mmHg during the procedure and was used isosorbide dinitrate patch. She also had sinus tachycardia up to 120 beats per minute, bleeding and hypoxemia.

One day after the procedure, she got a cold sweat and electrocardiogram showed atrial fibrillation with a rapid ventricular response, non-sustained ventricular tachycardia and T wave inversion in II, III, aVF and V2-6. The elevated troponin I level and catecholamine concentration were detected with the blood test. The echocardiogram showed hypokinesis of the left ventricle apical wall and she was suspected of developing Takotsubo cardiomyopathy. However, she did not undergo coronary angiography because of her primary disease and poor general condition and received conservative treatment. Although she was treated with continuous use of heparin and nicorandil, verapamil for atrial fibrillation and furosemide and tolvaptan for congestive heart failure, type 2 respiratory failure got worse on day 6 and she was treated with non-invasive positive-pressure ventilation. The electrocardiogram showed improvement and worsening of T wave inversion with time. The echocardiogram on day 22 showed improvement of the wall motion of the left ventricle. After the improvement of the cardiac function, hemodynamic and respiratory condition also improved transiently, and she could be disconnected from non-invasive positive-pressure ventilation. However, she was dead on day 24, because hemodynamic and respiratory condition got
worse again with the progression of the lung carcinoma and malnutrition leading to the increase of the pleural effusion and hypotension.

Although she was diagnosed as non-small cell carcinoma after pathological evaluations, she could not receive anticancer treatments because of Takotsubo cardiomyopathy and its complications.

Case 2
An 85 year-old woman underwent flexible bronchoscopy to examine multiple granular and branched shadow in the bilateral lung suspected of mycobacterial infection (Figure 1b). She had a history of Parkinsonism, hypertension and diabetes mellitus and her hypertension had been successfully treated with antihypertensive medication. She had been associated with decline of cognitive function and activities of daily living. Before the bronchoscopy, her electrocardiogram had shown only first-degree atrioventricular block and echocardiogram had shown normal left ventricular wall motion and good systolic function.

During the procedure, she underwent bronchial brush and washing at the left B10 and it ended in 23 minutes. She had transient elevation of blood pressure up to 210 mmHg during the procedure and was used isosorbide dinitrate patch. No mycobacterium was cultivated.

Six days after the procedure, she complained of chest discomfort and the electrocardiogram showed T wave inversion in II, III, aVf and V2-6. The elevated troponin I level was detected with the blood test and the echocardiogram showed hypokinesis of the left ventricle apical wall. Although coronary angiography was considered because ischemic heart disease was also suspected, the patient and her family did not agree with

**Figure 1.** Chest X-ray films and computed tomography (CT) images of each cases. (a) Case 1. The air space consolidation was observed in the right upper lung field on the chest X-ray film. The mass with low density area in the right upper lobe and right pleural effusion were observed on the CT image. (b) Case 2. The granular shadows were observed in the bilateral lower lung fields on the chest X-ray film. The branched and granular shadows were observed in the right middle lobe and the left lower lobe on the CT image. (c) Case 3. The air space consolidation was observed in the right lower lung field on the chest X-ray film. The diffuse reticular shadow and air space consolidation were observed in the right lower lobe on the CT image. The area with high contrast enhancement was observed in the subpleural area of the right S1 and S10. (d) Case 4. The mass in the right hilar region in the right lower lung field were observed on the chest X-ray film and the CT image.
the examination and she received conservative treatment. She was treated with continuous use of heparin and nicorandil, morphine hydrochloride for chest pain. In the electrocardiogram, T wave inversion typically improved on day 6, got worse on day 9 and improved again on day 12. Although the intraventricular thrombus had been detected with the echocardiogram (Figure 2), it shrank on day 14 after continued anticoagulant therapy and the wall motion of the apex of the left ventricle also improved on day 14. However, this case ended in death on day 24 because of pneumonia in the course of treatment of Takotsubo cardiomyopathy.

Case 3
An 85 year-old man underwent flexible bronchoscopy to examine the consolidation of the right lower lobe (Figure 1c). He had a history of hypertension, multiple cerebral infarction treated with antiplatelet and chronic obstructive pulmonary disease and his hypertension had been treated with antihypertensive medication successfully. His cognitive function and activity of daily living were intact. Before the bronchoscopy, his electrocardiogram had shown only complete right bundle branch block and echocardiogram had shown normal left ventricular wall motion with well systolic function.

During the procedure, he underwent transbronchial biopsy and washing at the right B8 and B9 and it ended in 28 minutes. He had transient elevation of blood pressure up to 210 mmHg during the procedure and was used isosorbide dinitrate patch. He also had sinus tachycardia up to 110 beats per minute.

Six days after the procedure, he had dyspnea and acute heart failure was suspected with chest X-ray. The electrocardiogram showed Q wave and ST segment elevation in V5-6 and ischemic heart diseases were suspected. The elevated troponin I level and catecholamine concentration were detected with the blood test. The echocardiogram showed hypokinesis of the left ventricle apical wall extended beyond the territory perfused by a single coronary artery and he clinically diagnosed as Takotsubo cardiomyopathy without coronary angiography. He was treated with continuous use of heparin and non-invasive positive-pressure ventilation. On day 2, he could be disconnected from non-invasive positive-pressure ventilation. In the electrocardiogram, T wave inversion progressed with time and the left ventricular systolic dysfunction and wall motion abnormality were shown to be improved on day 22 by echocardiogram. Although this case was also treated with anticoagulant, he developed cerebral embolism on day 5 and treated with continuous use of heparin and edaravone (Figure 3). Right hemiplegia and cognitive dysfunction led to impaired activity of daily living and finally he was transferred.

Although he was diagnosed as adenocarcinoma after pathological evaluations, he could not receive treatments because of Takotsubo cardiomyopathy and its complications.

Case 4
A 78 year-old man underwent flexible bronchoscopy to examine the mass lesion of the hilum of the right lung (Figure 1d). He had a history of tuberculosis, prostate cancer and hypertension. His cognitive function and activity of daily living were also intact. Before the bronchoscopy, his electrocardiogram had shown no significant abnormality.

He had transient elevation of blood pressure up to 200 mmHg after 2 minutes of the start of the examination and was used isosorbide dinitrate patch. The examination was discontinued because of ST segment elevation detected with the electrocardiograph monitors 9 minutes after the start of the examination. He was suspected of ischemic heart diseases because the electrocardiogram showed ST segment elevation in II, III and aVF. He directly underwent emergent coronary angiography and it ended in no obstructive lesions in the right coronary artery and only 75% stenosis in the left anterior descending artery segment 7, which is not the culprit of his cardiac wall dyskinesia. In addition, because
Figure 3. Diffusion weighted imaging of brain magnetic resonance imaging of case 3 showed the multiple high intensity areas within the different vascular territories, suggesting the cerebral embolism.

Figure 4. Left ventriculography of case 4 typically showed hypokinesis of the left ventricle apical wall and hyperkinesis of the basal wall. (a) End-diastolic frame. (b) End-systolic frame.

the left ventriculography showed hypokinesis of the apical wall and hyperkinesis of the basal wall, he was diagnosed as Takotsubo cardiomyopathy (Figure 4). The elevated cardiac enzymes were not detected, but the elevated catecholamine concentration was detected with the blood test. He was treated with continuous use of heparin to prevent thrombus formation in the apex of the left ventricle until confirmed improvement of the wall motion with the echocardiogram on day 9. He was also treated with aspirin and nicorandil for left coronary artery stenosis. In the electrocardiogram, T wave inversion detected on day 2, typically improved on day 6, got worse on day 8 and improved again on day 83 (Figure 5). He was diagnosed as squamous cell carcinoma after pathological evaluations and was treated with irradiation.

DISCUSSION

Takotsubo cardiomyopathy, first described by Sato H, et al. in 1990 in Japan, is characterized by transient regional systolic dysfunction of the left ventricle. Although there is no definite diagnostic criterion for Takotsubo cardiomyopathy, it is recognized as needed for its diagnosis that the course of the onset is similar to acute coronary syndrome with electrocardiographic abnormalities, elevated cardiac enzymes, transient systolic dysfunction of the left ventricle, or no definite coronary culprit for its dyskinesis. In our cases (Table
1, 2), there are no patients with a past medical history of ischemic heart disease and all their electrocardiographic and echocardiographic findings before bronchoscopy did not suggest ischemic heart disease. We could not undergo coronary angiography in three cases except case 4, therefore we could not completely exclude ischemic heart disease. However, we diagnosed their Takotsubo cardiomyopathy from typical electrocardiographic and echocardiographic findings as mentioned above.

It is reported that women account for more than 80% of the patients with Takotsubo cardiomyopathy,3,4 and seven cases were also women in the prior nine cases with Takotsubo cardiomyopathy associated with bronchoscopy (Table 3). On the other hand, the male patients are reported to more often have physical stress prior to the onset than the female patients.5 In our cases, men accounted for half of the cases partly because the procedure could cause physical stress on the men. It is also reported that the patients with Takotsubo cardiomyopathy are more often associated with a neurologic or psychiatric disorder compared with the patients of acute coronary syndrome.3 Although it has not been reported a case of Takotsubo cardiomyopathy around bronchoscopy that is associated with neurologic or psychiatric disorder, here we report two cases associated with neurologic disorder; Parkinsonism and cerebral infarction. Cognitive dysfunction was also recognized in two cases. Cognitive function is not routinely tested on the patients along with bronchoscopy, however, cognitive impairment is one of the most popular psychiatric disorders among the elderly, and hence we should take care of it as the risk of developing Takotsubo cardiomyopathy associated with bronchoscopy. Additionally, in our four cases, case 1, 3, and 4 were diagnosed as advanced lung cancer. It is known that Takotsubo cardiomyopathy is preceded by physical stress, whereas we have experienced some other patients with lung cancer at the end of their life who developed Takotsubo cardiomyopathy without any other triggers. The three cases could have been exposed to physical stress associated with advanced lung cancer until bronchoscopy and developed Takotsubo cardiomyopathy by further stress associated with bronchoscopy.

Although the pathogenesis of Takotsubo cardiomyopathy is not well understood, postulated mechanisms include catecholamine excess, microvascular dysfunction and coronary artery spasm.4 Catecholamine excess after emotional or physical stress is likely to be important in the pathogenesis of Takotsubo cardiomyopathy because similar reversible cardiomyopathy is occasionally associated with pheochromocytoma which raises the plasma concentration of catecholamine. It is also reported plasma catecholamine levels are markedly higher among patients with Takotsubo
Table 1. Characteristics of the Patients

<table>
<thead>
<tr>
<th>No.</th>
<th>Age</th>
<th>Sex</th>
<th>Background</th>
<th>Smoking (pack years)</th>
<th>Barthel Index</th>
<th>MMSE</th>
<th>Procedures</th>
<th>Time (min)</th>
<th>Medication</th>
<th>Complications</th>
<th>Results</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>85</td>
<td>F</td>
<td>Hypertension Tuberculosis Dyslipidemia</td>
<td>90</td>
<td>55</td>
<td>21</td>
<td>Biopsy Wash</td>
<td>20</td>
<td>2% lidocaine jelly and spray pentazocine 15 mg hydroxyzine 25 mg isosorbide dinitrate patch</td>
<td>Blood pressure elevation</td>
<td>Non-small cell carcinoma cT3N1MX, stage IIIA-IV</td>
<td>Best supportive care</td>
</tr>
<tr>
<td>2</td>
<td>85</td>
<td>F</td>
<td>Hypertension Parkinsonism Diabetes mellitus Dyslipidemia</td>
<td>0</td>
<td>40</td>
<td>8</td>
<td>Brush Wash</td>
<td>23</td>
<td>2% lidocaine jelly and spray pentazocine 15 mg hydroxyzine 25 mg isosorbide dinitrate patch</td>
<td>Blood pressure elevation</td>
<td>No malignancy Culture negative</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>85</td>
<td>M</td>
<td>Hypertension Cerebral infarction COPD</td>
<td>170</td>
<td>100</td>
<td>N/A</td>
<td>Biopsy Brush Wash</td>
<td>28</td>
<td>2% lidocaine jelly and spray pentazocine 15 mg hydroxyzine 25 mg isosorbide dinitrate patch</td>
<td>Blood pressure elevation Adenocarcinoma cT3N0M1a, stage IV</td>
<td>Best supportive care</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>78</td>
<td>M</td>
<td>Hypertension Tuberculosis Prostate cancer</td>
<td>175</td>
<td>100</td>
<td>30</td>
<td>Watch</td>
<td>10</td>
<td>2% lidocaine jelly and spray pentazocine 15 mg hydroxyzine 25 mg isosorbide dinitrate patch midazolam 2 mg</td>
<td>Blood pressure elevation Bigeminy Squamous cell carcinoma cT3N1M0, stage IIIA</td>
<td>Radiation therapy</td>
<td></td>
</tr>
</tbody>
</table>

N/A: not assessed, MMSE: mini mental state examination, COPD: chronic obstructive pulmonary disease.

cardiomyopathy than among those with myocardial infarction. It is suggested that catecholamine excess induces microvascular spasm or dysfunction, resulting in myocardial stunning, or is directly associated with myocardial toxicity. We consider that catecholamine excess affects the onset of Takotsubo cardiomyopathy because the elevated catecholamine concentrations were also detected in all measured three cases except case 2 and all our cases had blood pressure elevation up to 200 mmHg during the procedure, which might have been affected by catecholamine excess. In the prior nine cases with Takotsubo cardiomyopathy associated with bronchoscopy, there is no report referring to transient elevation of blood pressure during bronchoscopy. It may be suggested from our cases that emotional or physical stress associated with bronchoscopy induced catecholamine excess and this led to hypertension and the onset of Takotsubo cardiomyopathy. Therefore, we should use appropriate sedation or anti-anxiety medication to prevent emotional or physical stress during bronchoscopy. For this purpose, benzodiazepines, propofol and opioids are recommended as the sedatives for bronchoscopy because of their nature to inhibit innate catecholamine release against stress. Although all our cases kept sedated with pentazocine and hydroxyzine during bronchoscopy, after we had experienced the four cases, we have aimed to sedate patients adequately, especially with neurologic or psychiatric disorder, using midazolam and we subsequently have had no more cases developing Takotsubo cardiomyopathy associated with bronchoscopy. It is also reported that propofol is associated with lower heart rate and systolic blood pressure than midazolam when used as a sedative for bronchoscopy, however, we cannot use propofol for bronchoscopy because of our hospital rules. Multifocal coronary vasospasm sometimes provoked by acetylcholine loading test and plaque rupture followed by thrombosis with spontaneous thrombolysis are other
postulated mechanisms of Takotsubo cardiomyopathy. Our cases except case 4 did not undergo coronary angiography and even case 4 did not show coronary vasospasm nor plaque rupture and thrombosis.

Additionally, there may be some cases experiencing transient elevation of blood pressure after using catecholamine or beta-agonists followed by developing Takotsubo cardiomyopathy.10 In our cases, there are no cases administrated these drugs around bronchoscopy.

Takotsubo cardiomyopathy is typically managed with supportive therapy until the improvement of cardiac function. It can lead to some severe complications, including arrhythmia like ventricular tachycardia, ventricular thrombus, thromboembolism, ventricular rupture, cardiac shock, acute heart failure, left ventricular outflow tract obstruction and mitral valve regurgitation. They are treated with anti-arrhythmic agents, anticoagulants, diuretics and catecholamine. In our cases, paroxysmal atrial fibrillation, non-sustained ventricular tachycardia, intraventricular thrombus, congestive heart failure and cerebral embolism are developed, and they are treated with anti-arrhythmic agents, anticoagulants, diuretics and non-invasive positive-pressure ventilation. In our cases, only one case could keep activity of daily living despite development of Takotsubo cardiomyopathy and was led to treat the primary disease. However, two cases ended in death. In the prior nine cases with Takotsubo cardiomyopathy associated with bronchoscopy, there was only one dead case and all the other cases had good outcomes (Table 3). It is reported that the presence of physical triggers, acute neurologic or psychiatric diseases, elevated troponin level and decreased left ventricular ejection fraction leads to poor prognosis and the prognosis also depends partly on the primary diseases.37 In our cases, two had neurologic or psychiatric diseases and three were diagnosed as advanced lung cancer. These were considered to be the factors that contribute to their poor prognosis. In addition, our cases with decline of activities of daily living and cognitive function tended to get worse in general condition before the improvement of cardiac function. The decline of activity of daily living and cognitive function also might be poor prognostic factor of Takotsubo cardiomyopathy. Although Takotsubo cardiomyopathy is characterized by transient cardiac dysfunction, it is said that the risk of acute severe complications is similar to that in the patients with acute coronary syndrome. Particularly, the frail elderly patients are considered that their general condition gets worse before the improvement of cardiac function and that

### Table 2. Characteristics of Takotsubo Cardiomyopathy

<table>
<thead>
<tr>
<th>No.</th>
<th>Onset</th>
<th>Electrocardiogram</th>
<th>Transthoracic echocardiogram</th>
<th>Complications</th>
<th>Treatments</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>One day after</td>
<td>T wave inversion in II, III, aV(_f), V2, V6</td>
<td>Ejection fraction 57.6% Akinesis of apical segment and apex Severe hypokinesis of mid segment</td>
<td>pAF NSVT Congestive heart failure</td>
<td>Antiocoagulant Antiplatelet Anti-arrhythmic Diuretic Coronary vasodilator Vasopressor NPPV</td>
<td>Death</td>
</tr>
<tr>
<td>2</td>
<td>Six days after</td>
<td>T wave inversion in II, III, aV(_f), V2, V6</td>
<td>Ejection fraction 55.9% Severe hypokinesis of apex</td>
<td>Intraventricular thrombus Pneumonia</td>
<td>Antiocoagulant Coronary vasodilator Antibacterial agent</td>
<td>Death</td>
</tr>
<tr>
<td>3</td>
<td>Six days after</td>
<td>ST segment elevation in V3, V6</td>
<td>Ejection fraction 50% Akinesis of basal to apical anterior segment and apex</td>
<td>Acute heart failure Cerebral embolism</td>
<td>Antiocoagulant Antiplatelet NPPV</td>
<td>Transferred</td>
</tr>
<tr>
<td>4</td>
<td>During procedure</td>
<td>ST segment elevation in II, III, aV(_f), V6</td>
<td>Severe hypokinesis of mid segment and apex Hyperkinesis of basal posterior segment</td>
<td>None</td>
<td>Antiocoagulant Anti-arrhythmic Coronary vasodilator</td>
<td>Discharged</td>
</tr>
</tbody>
</table>

pAF: paroxysmal atrial fibrillation, NSVT: non-sustained ventricular tachycardia, NPPV: non-invasive positive-pressure ventilation.
Table 3. Other Cases of Takotsubo Cardiomyopathy Associated with Bronchoscopy

<table>
<thead>
<tr>
<th>No.</th>
<th>Age</th>
<th>Sex</th>
<th>Past medical history</th>
<th>Purpose of bronchoscopy</th>
<th>Characteristics of patients</th>
<th>Takotsubo cardiomyopathy</th>
<th>Complications</th>
<th>Treatments</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>85</td>
<td>F</td>
<td>-</td>
<td>Evaluation of lung tumor</td>
<td>Lung MALT lymphoma (after surgery)</td>
<td>Loss of consciousness Bradycardia Hypotension Impaired consciousness Spasm Hypoxia</td>
<td>During procedure ST segment elevation</td>
<td>Wall motion normalized 3 days after the onset</td>
<td>Spasm</td>
</tr>
<tr>
<td>2</td>
<td>59</td>
<td>F</td>
<td>-</td>
<td>Evaluation of lung tumor</td>
<td>-</td>
<td>Loss of consciousness Bradycardia Hypotension Impaired consciousness Spasm Hypoxia</td>
<td>During procedure -</td>
<td>-</td>
<td>Lidocaine intoxication</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
<td>F</td>
<td>-</td>
<td>Evaluation of lung tumor</td>
<td>-</td>
<td>Dyspnea</td>
<td>Shortly after procedure ST segment elevation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>74</td>
<td>F</td>
<td>-</td>
<td>Evaluation of lung tumor</td>
<td>-</td>
<td>Hypoxia</td>
<td>During procedure Tachycardia ST segment elevation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>612</td>
<td>74</td>
<td>F</td>
<td>-</td>
<td>Evaluation of recurrence</td>
<td>Lung adenocarcinoma (after surgery)</td>
<td>Loss of consciousness Mydriasis Respiratory arrest</td>
<td>During procedure T wave inversion</td>
<td>Ejection fraction 45% Hypokinesis of apex Hyperkinesis of basal segment</td>
<td>Spasm Cerebral infarction</td>
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<tr>
<td>713</td>
<td>68</td>
<td>M</td>
<td>-</td>
<td>Pulitation Chest pain Dyspnea</td>
<td>Tuberculosis</td>
<td>-</td>
<td>Shortly after procedure ST segment depression</td>
<td>Ejection fraction 40% Hypokinesis of apex Hyperkinesis of basal segment</td>
<td>-</td>
</tr>
<tr>
<td>814</td>
<td>77</td>
<td>M</td>
<td>Stent placement</td>
<td>Cardiogenic shock Loss of consciousness</td>
<td>Esophageal cancer</td>
<td>30 min after procedure No change</td>
<td>ST segment depression Abnormal Q</td>
<td>Ejection fraction 15% Akinesis of apex Hypokinesis of apex Hyperkinesis of basal segment</td>
<td>Pneumonia IABP Vasopressor</td>
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<tr>
<td>915</td>
<td>90</td>
<td>F</td>
<td>Stent placement</td>
<td>Hypotension</td>
<td>None</td>
<td>6 days after</td>
<td>-</td>
<td>Death</td>
<td>-</td>
</tr>
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</table>

they may have worse prognosis, therefore it is necessary to prevent Takotsubo cardiomyopathy, especially in the elderly.

CONCLUSION

Takotsubo cardiomyopathy is an uncommon, but an important adverse event of flexible bronchoscopy on the elderly, partly because it can lead to severe events such as pump failure, arrhythmia, or thromboembolism. However, once Takotsubo cardiomyopathy is developed, activities of daily living and cognitive functions may decline before recovering from it and attribute to their poor prognosis, especially in the frail elderly. By the rapid aging of society, it is predicted that the more elderly patients undergo bronchoscopy, the more patients develop Takotsubo cardiomyopathy associated with the procedure. To prevent Takotsubo cardiomyopathy associated with bronchoscopy, we should prevent emotional and physical stress with administration of the appropriate sedative or anti-anxiety medicine. Therefore it should be mentioned in the safety guidelines of flexible bronchoscopy that Takotsubo cardiomyopathy is an important adverse event in the elderly.

No potential conflicts of interest are disclosed.

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