Prognosis of Economy Class Syndrome Treated in Intensive Care Unit

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Abstract

Objective The aim of this study was to clarify the prognosis of economy class syndrome (pulmonary thromboembolism following long distance flight) patients discharged from the intensive care unit.

Method Medications, daily activities, recurrence of pulmonary thromboembolism, and quality of life were investigated for an average of 471 days following discharge from the intensive care unit. The information from the patients was obtained by means of a mailed questionnaire or telephone interview.

Patients Ten patients with economy class syndrome were enrolled in this study. Nine were female and one was male (61±9 years).

Results In addition to appropriate acute care, additional management was given including the placement of an inferior vena cava filter in 3 patients and a course of oral anticoagulation therapy in 7 patients. None of them died or had recurrence of pulmonary thromboembolism. Four patients took subsequent air flights. No thromboembolic episodes were seen during the follow-up period.

Conclusion The long-term prognosis in these patients can be favorable with appropriate management of the acute episode in conjunction with adequate preventive measures.

Introduction

Acute pulmonary thromboembolism (PTE) following a long distance flight has been recently referred to as economy class syndrome (1). These patients typically develop symptoms during the flight or within several minutes following disembarkation from the aircraft. Through active surveillance of an outpatient clinic located at an international airport and a major medical center located within minutes of the airport, we identified 12 patients with economy class syndrome during a 2-year observation period. Previous reports have described the pathogenesis and characteristics of this disorder (2–9), however there are no reports to date evaluating the prognosis of these patients. Therefore, the aim of this study was to evaluate the long-term prognosis of patients with economy class syndrome.

Methods

Thirty-one potential patients with symptoms consistent with acute PTE following a prolonged flight (economy class syndrome) were evaluated from May 1998 to October 2000. Individuals with ischemic heart diseases (13 patients) and other diseases (6 patients) were excluded (Fig. 1). Twelve patients were diagnosed with acute PTE by the combination of symptoms (dyspnea, chest pain, disturbance of consciousness), cardiac ultrasonography, chest computed tomography scan, pulmonary angiography and radionuclide examination. Of the 12 patients with PTE, 1 patient was male, 11 were female, and the mean age was 62±9 years. The mean interval between the onset of their symptoms and admission to the hospital was 2.6±1.4 hours. Two patients died immediately upon admission due to prolonged hypoxia. The remaining 10 patients (1 male and 9 females; 61±9 years) were enrolled in the study. Five patients were from Europe, 3 were from North America, and 2 were from South America. Two were Japanese-Brazilian, one was Australian, and the other 7 were Japanese. Their flight duration was an average of 15 hours (range 12–24 hours, Fig. 2). The clinical characteristics of patients in the acute phase are shown in Table 1. None of them had a history of PTE or deficiency of protein S and/or C. Two patients received estrogen therapy and one had lupus anticoagulant. Urokinase and heparin were used for the initial treatment in all cases. However, tissue type plasminogen activator, aspiration of emboli and/or
Patients evaluated from the airport clinic

31 cases

Ischemic heart disease

13 cases

Other disease

6 cases

Pulmonary thromboembolism (PTE)

12 cases

Death

2 cases

Alive

10 cases

Figure 1. Patients transported from airport clinic. Thirty-one patients were transferred from the airport clinic to the intensive care unit. Of those patients, 12 were diagnosed with acute pulmonary thromboembolism (economy class syndrome). Two patients died immediately after admission; 10 patients survived the acute event and went on to be discharged from the intensive care unit.

antiplatelet therapy were indicated when initial treatment failed in reperfusion of obstructed pulmonary arteries. A temporary inferior vena cava (IVC) filter was inserted when deep vein thrombosis (DVT) was demonstrated to be in the acute phase. This IVC filter was removed about 5 days after insertion, but a permanent IVC filter was implanted when DVT persisted for more than 5 days after insertion of the temporary IVC filter. Heparin therapy was followed by medication with warfarin within one week after onset of PTE. Treatment of all cases is shown in Table 2. Six patients were transferred to other hospitals which were near their home, and the remaining 4 patients were discharged from the intensive care unit to the general ward. No precise reevaluation was done after discharge from the intensive care unit.

In November 2000, the patients were contacted by telephone or mail. At this time, the patients were questioned regarding their medication regimen, the presence of symptoms, recurrence of PTE, and complications postdischarge (including death).

Results

Follow-up period

The follow-up period was 471±250 days (mean±SD) after the onset of disease (21–909 days). We were able to contact all

Table 1. Clinical Features of Patients with Economy Class Syndrome

<table>
<thead>
<tr>
<th>Case</th>
<th>BP (mmHg)</th>
<th>HR (min)</th>
<th>PaO₂ (mmHg)</th>
<th>PaCO₂ (mmHg)</th>
<th>O₂ inhalation (l/min)</th>
<th>Abnormal ECG</th>
<th>PAG (Site of embolism)</th>
<th>mPAP (mmHg) before</th>
<th>mPAP (mmHg) after</th>
<th>Risk factor</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>102/75</td>
<td>86</td>
<td>57.7</td>
<td>31.8</td>
<td>5.0</td>
<td>S1Q3, IRBBB</td>
<td>bilateral</td>
<td>47</td>
<td>32</td>
<td>DVT</td>
</tr>
<tr>
<td>2</td>
<td>134/74</td>
<td>84</td>
<td>51.8</td>
<td>36.8</td>
<td>none</td>
<td>S1Q3, IRBBB</td>
<td>right (upper and middle)</td>
<td>27</td>
<td>20</td>
<td>DVT</td>
</tr>
<tr>
<td>3</td>
<td>109/59</td>
<td>116</td>
<td>47.8</td>
<td>43.0</td>
<td>3.0</td>
<td>none</td>
<td>bilateral</td>
<td>21</td>
<td>14</td>
<td>lupus anticoagulant</td>
</tr>
<tr>
<td>4</td>
<td>136/70</td>
<td>65</td>
<td>59.2</td>
<td>37.9</td>
<td>none</td>
<td>IRBBB</td>
<td>right (upper)</td>
<td>16</td>
<td>16</td>
<td>estrogen therapy</td>
</tr>
<tr>
<td>5</td>
<td>132/82</td>
<td>94</td>
<td>78.1</td>
<td>29.9</td>
<td>5.0</td>
<td>S1Q3, IRBBB</td>
<td>bilateral</td>
<td>17</td>
<td>12</td>
<td>none</td>
</tr>
<tr>
<td>6</td>
<td>142/90</td>
<td>140</td>
<td>88.2</td>
<td>37.8</td>
<td>2.0</td>
<td>S1Q3, atrial fibrillation</td>
<td>right (middle and lower)</td>
<td>14</td>
<td>14</td>
<td>smoking</td>
</tr>
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<td>150/70</td>
<td>100</td>
<td>77.3</td>
<td>35.9</td>
<td>3.0</td>
<td>none</td>
<td>right (upper)</td>
<td>10</td>
<td>10</td>
<td>smoking</td>
</tr>
<tr>
<td>8</td>
<td>110/70</td>
<td>95</td>
<td>77.1</td>
<td>32.9</td>
<td>3.0</td>
<td>S1Q3</td>
<td>bilateral</td>
<td>29</td>
<td>29</td>
<td>none</td>
</tr>
<tr>
<td>9</td>
<td>146/94</td>
<td>116</td>
<td>46.1</td>
<td>31.9</td>
<td>5.0</td>
<td>S1Q3</td>
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<td>25</td>
<td>estrogen therapy</td>
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<tr>
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<td>70/30</td>
<td>110</td>
<td>390.5</td>
<td>49.9</td>
<td>10.0</td>
<td>PSVT, VT</td>
<td>bilateral</td>
<td>20</td>
<td>13</td>
<td>none</td>
</tr>
</tbody>
</table>

BP: blood pressure, HR: heart rate, ECG: electrocardiography, PAG: pulmonary arteriography, mPAP: mean pulmonary artery pressure, before: before initial treatment, after: after initial treatment, S1Q3: S wave in lead 1 and Q wave in lead 3, IRBBB: incomplete right bundle branch block, DVT: deep vein thrombosis, PSVT: supraventricular tachycardia, VT: ventricular tachycardia.
The economy class syndrome otherwise known as “traveler’s pulmonary thromboembolic disease” or “coach class thrombosis” has been defined as the development of PTE following a prolonged flight (1–3, 6–8, 10–14). We encountered 12 patients with this syndrome in Japan, and 9 of them were Japanese. Two Japanese died immediately after arrival to our hospital. PTE is a life-threatening disease and the management of this syndrome is very important because the number of overseas travelers will increase in the future. Ferrari et al (15) also reported the same phenomenon following short journeys. In our study, only 5 of 10 patients sat in economy class, while the others sat in business class. So, the name “economy class syndrome” is not appropriate; “traveler’s pulmonary thromboembolic disease” may be more suitable for this syndrome. Nevertheless, we retained the name “economy class syndrome”, because it is commonly used.

One of the largest studies of traveler-associated thrombosis was done by Simon (7), who reported 121 cases of DVT and 43 patients with PTE. In his report, the first symptoms of DVT were observed an average of 3.1 days following travel. In our study, all patients developed symptoms at the airport or within 1 hour of the termination of the flight. Therefore, our study may underestimate the number of patients with thrombosis who may declare symptoms after leaving the airport.

The pathogenesis of economy class syndrome has been postulated to be the result of the combination of hemostasis of the lower extremities and hemoconcentration due to dehydration (3, 4, 8, 10). The presence of underlying patients or cabin-related risk factors such as antithrombophilic syndrome most likely exacerbate the venous stasis (2, 16–21). Eklof et al (4) further investigated potential risk factors and found that insufficient fluid intake, the diuretic effect of alcohol, smoking, hypoxia, the presence of malignant diseases, the use of hormone therapy, a history of trauma in the lower extremities, or a history of surgical operations or femoral catheterizations, appeared to increase the risk. In addition, they reported that cabin-related factors including low humidity, prolonged flexion of the knee, and immobilization also played a role. Two additional studies by Landgraf et al (11, 12) reported an increased risk of DVT in passengers with predisposing risk factors, with no evidence of thrombotic changes in healthy volunteers during simulated 12 hour flights. On the other hand, Sinzinger (8) failed to demonstrate an association between the development of economy class

<table>
<thead>
<tr>
<th>Case</th>
<th>Medication</th>
<th>PA intervention</th>
<th>IVC filter</th>
<th>At discharge</th>
<th>Follow-up</th>
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<tr>
<td>1</td>
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<td>temporary, permanent</td>
<td>W</td>
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</tr>
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<td>UK, H, W</td>
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<td>none</td>
<td>W</td>
<td>none</td>
</tr>
<tr>
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<td>W</td>
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</tr>
<tr>
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<td>none</td>
<td>W, aspirin</td>
<td>none</td>
</tr>
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<td>none</td>
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<td>W</td>
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</tr>
<tr>
<td>6</td>
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<td>none</td>
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<td>W</td>
<td>aspirin</td>
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<tr>
<td>7</td>
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<td>temporary</td>
<td>W, aspirin</td>
<td>aspirin</td>
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<td>8</td>
<td>UK, H</td>
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<td>temporary, permanent</td>
<td>W, aspirin, ticlopidine</td>
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<tr>
<td>10</td>
<td>UK, H, aspirin, ticlopidine</td>
<td>none</td>
<td>temporary, permanent</td>
<td>W</td>
<td>W</td>
</tr>
</tbody>
</table>

syndrome and haemostatic defects or clinical risk factors.

Recently, Kraaijenhagen et al suggested that the risk of thrombosis does not differ from other methods of transportation including bus, train, car or ship (22). However, air travel is often non-stop, can be prolonged, and passengers are often confined to a narrow space, therefore possibly resulting in an increased frequency of episodes. As Milne (23) suggested that carefully controlled studies are needed to clarify the relationship between venous thromboembolism development and modes of travel.

Ingestion of nonalcoholic beverages and stretching legs or walking during the flight have been recommended for prevention of economy class syndrome (3, 4, 8–10). Finally, IVC filters may be indicated for the prevention of recurrent PTE in high risk patients (24–27). Other prevention methods include elastic stockings (9) and heparin (14), particularly in those patients with a history of DVT.

In this study, 3 of 10 patients did not receive medication for the prevention of recurrent thromboemboli. One such patient did not receive medication or an IVC filter and took subsequent flights without recurrence of symptoms. We advised our patients to perform leg exercises and to intake appropriate non-alcoholic beverages during the flight for prevention of recurrent PTE. And a permanent IVC filter was inserted in cases with persistent DVT before discharge from the intensive care unit. We suspected that the prognosis was favorable because our patients had no history of previous PTE and half of them had no risk factor for thrombosis.

In conclusion, the long-term prognosis of economy class syndrome appears to be favorable. Preventive measures including pharmacologic therapy, IVC filter placement, and in-flight behavioral modifications most likely contribute to the absence of recurrent thromboemboli during subsequent air travel.

Acknowledgements: The authors greatly thank all of the staff in the airport clinic and in the Chiba Hokusoh Hospital, Nippon Medical School for their efforts in the management of these patients. We also thank all persons involved in the transportation of patients from the airport clinic to our intensive care unit.

References


