Characteristics of Deep Vein Thrombosis Associated with Prolonged Travel

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Objectives: to identify the incidence of prolonged travel among consecutive patients with deep venous thrombosis (DVT) and to investigate any differences in the patterns of traveller’s thrombosis versus DVT’s with no history of prolonged recent travel.

Methods: of 137 consecutive patients, who were confirmed to have DVT by duplex ultrasonography, 36 were excluded because of either prolonged immobilisation or recent surgery. All patients were asked whether they had travelled within 2 weeks for more than 3 h. The presence of other classic risk factors for DVT was also recorded. Patients who were unlikely to travel as a result of prolonged immobility for more than 2 weeks and those who underwent surgery within 2 weeks were excluded from the study. The extent and location of thrombi was also verified by duplex scanning in each patient.

Results: of 101 patients, eligible for the final analysis, 15 (15%) claimed to have a recent travel, of whom 9 (9%) travelled by air. By comparison of a group of 106 patients with similar symptoms at presentation, but who had negative duplex findings 12 (11%) had a history of prolonged travel (p = 0.8, Fisher’s exact test). Travel-related DVT occurred to a significantly younger age group than non travellers. Thirteen (87%) out of 15 patients with travel-related DVT had another concomitant risk factor and 7 out of 10 patients had a positive thrombophilia screen.

Conclusion: The majority of those with travel-related DVT had other concomitant risk factors and a high incidence of a positive thrombophilia screen, suggesting that travel itself may act as an additive risk among those with pre-existing risk factors for DVT.

Key Words: Deep vein thrombosis; Travel; Traveller’s thrombosis; Economy class syndrome.

Introduction

There has been an increase in the public interest of the risk of venous thromboembolism after prolonged travel, following the death of a young passenger who travelled from Australia to England.1 Although there have been several reports2–7 suggesting a link between long travel and deep vein thrombosis (DVT) during the last decade, the incidence of travel-related DVT obtained from each study reveals a considerable variance and the true magnitude of this entity still remains unknown and controversial. In addition, the specific characteristics of this type of DVT, in comparison with other forms of DVT, have also been poorly defined.

In consideration of these conditions, we sought to identify the incidence of prolonged travel among consecutive patients with deep venous thrombosis (DVT), with an attempt to limit the subjects to those who had had an actual chance to travel. Moreover, we intended to elucidate any specific features in patients who had a history of travel, comparing with those in patients without travel.

Methods

In the current study, we analysed a part of the data obtained from a case-control study that we conducted. During the period between April 2000 and June 2001, consecutive patients who were referred to our vascular laboratory with clinically suspected DVT were prospectively included in the study. At presentation, the medical history of each patient, including the presence or absence of several classic risk factors for DVT (Table 1), was obtained using a standardised questionnaire. All patients were also asked whether they had had a travel by any means of transport for more than 3 continuous hours in the past 2 weeks. The patients who had an episode of travel were further asked about the details such as means of transport and duration of travel. Moreover, the additional two
Table 1. Classic risk factors considered in the study.

(1) History of previous DVT or PE.
(2) Family history of DVT or PE.
(3) Hormone replacement therapy.
(4) Known malignant disease.
(5) Pregnant or postpartum status.
(6) Recent trauma in the past 2 weeks.
(7) Age over 60 years.
(8) Prolonged immobilisation.
(9) Recent surgery in the past 2 weeks.

DVT: deep vein thrombosis; PE: pulmonary embolism.
* These factors were excluded from the final analysis (see text for description).

Results

There were 15 (15%) patients who had an episode of recent travel among 101 patients with DVT. Nine (9%) travelled by air and the other 6 had a surface travel (3 by car, 1 by bus, 1 by train, and 1 by boat). The median duration of travel was 5 h (interquartile range, 4.5–9 h), and the median interval between the journey and the onset of symptoms was 1 day (interquartile range, 0–4 days). Two patients (both travelled by air) developed symptoms during travel.

Thirteen controls (12%) out of the 106 with no evidence of DVT gave a history of recent travel. Comparing these controls with 101 cases who had DVT, there was no statistical difference in the incidence of prolonged travel (\( p = 0.8 \), Fisher’s exact test; odds ratio, 1.3; 95% confidence interval, 0.6–2.8). Even limiting the means of travel to aeroplane alone, the corresponding proportion (9 of 101 cases vs 12 of 106 controls) did not show a significant difference between the two groups (\( p = 0.6 \), Fisher’s exact test; odds ratio, 0.8; 95% confidence interval, 0.3–1.9).

Thirteen (87%) out of 15 patients with travel-related DVT had another coexisting factor such as pregnancy and previous episode of DVT. Nine of 10 patients with age less than 45 years had a concomitant risk factor, whereas only 1 of 5 counterparts aged 45 and more had an additional factor (\( p = 0.02 \), Fisher’s exact test). The details of 15 patients with travel-related DVT are listed in Table 2. Of the 10 patients who had a thrombophilia screen, 7 had a positive result.

Among all 101 patients, the demographic differences between travellers and non-travellers were examined to identify the characteristics of DVT associated with travel. Fifteen patients with travel-related DVT consisted of 9 men and 6 women with a median age of 40 years (interquartile range, 34–57). The median age of 86 patients (37 men and 49 women) with DVT and no history of recent travel was 62 years (interquartile range, 55–63). Thus
patients with DVT and history of travel were younger than non travelling DVT patients ($p \leq 0.01$, Mann-Whitney U-test).

The incidence of DVT confined within a popliteal vein or more distal veins was significantly higher in patients with travel, as compared with those who had had no history of travel (11 of 15 vs 32 of 86; $p \leq 0.01$, Fisher’s exact test).

### Discussion

The frequency of traveller’s thrombosis among previous reports, in fact, varies widely from 4.1% to 24.4%. Such a discrepancy would arise from the diversity of travelling habits in the population studied or the different properties of institutions where the studies were conducted. Differences in methodologies employed (retrospective or prospective) or those in definitions of “long distance travel” as a risk factor for DVT could also contribute to causing the variance among studies. In this study, we arbitrarily defined the “travel” as travel within previous two weeks before the onset of the symptoms, because the closer the interval from prior travel to onset the stronger the causality is thought to be. As a result, 15% of patients had a previous episode of long travel in our study population, which was within a range of published series referring to this issue.

In the current study, we made an additional attempt to identify whether there is a real connection between prolonged travel and occurrence of DVT by using the same inclusion criteria for controls with negative duplex finding. As a result, 15% of cases and 12% of controls had a previous episode of long travel, indicating no significant difference in the incidence of prolonged travel between these two groups. Although our results may suggest that there is no definite link between thrombosis and recent travel, the number of individuals exposed by this risk factor in our study is thought to be too small to prove such an association. A far larger number of patients will be needed to clarify this entity. A detailed account of this comparison will be presented elsewhere.

Another aim of our study was to elucidate the features of DVT induced by travel. We found that almost all patients (13 out of 15) with travel-related DVT had a concomitant risk factor. This figure is in accord with several earlier observations, which have revealed the high incidence of pre-existing additional risk factors in patients with travel-related DVT. Furthermore, we examined the presence of other predisposing factors in association with the age. We observed a significantly high exposure rate of other concomitant risk factors in the young aged less than 45 years, as compared with the old. These findings obtained from our study would fit the “multiple hit” theory with a time-dependent model proposed by Rosendaal, who emphasised venous thrombosis as a multicausal disease. From this point of view, it seems to be reasonable to assume that developing DVT in association with travel requires some other predisposing factors especially in the young.

We found a significant difference in age between patients with DVT associated with travel and those without travel. Indeed, the incidence of recent travel in the young aged 40 and less was significantly higher than that in the old aged over 40 (8 of 21 vs 7 of 80; $p = 0.003$, Fisher’s exact test). These data coincide with other previous reports demonstrating that

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<th>Patients</th>
<th>Age</th>
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HRT: hormone replacement therapy; I: iliac vein; F: femoral vein; P: popliteal vein; C: calf veins.

* Obesity was defined as a body mass index of more than 30 kg/m².
† Overweight was defined as a body mass index of more than 25 kg/m².

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traveller’s thrombosis occurred in a relatively younger generation despite age ranges being similar to those found in other forms of DVT. Considering immobilisation and recent surgery as risk factors for DVT, which we excluded from the analyses in the current study, the corresponding figure exaggerating the high exposure to travel in the young might be more striking because these major factors are thought to be more prevalent among the old than among the young.15

Focusing on the proximal extent of thrombi, ultrasonographic studies revealed that the thrombi formed in association with travel had a preference for being confined to distal veins (popliteal vein and calf veins). Schmitt et al.16 analysed 3556 venographically proven DVT and found that 54 (1.5%) were confined to popliteal vein. Of these 54 isolated popliteal vein thrombosis, 14 (26%) were related to long distance travel. The authors also showed the leg flexion produces rings and folds in a wall of popliteal vein in another series of phlebograms, and subsequently revealed in their necroscopic study, that the popliteal lesion develops a transverse rippling during a knee bending position. Our results reflect these morphological findings mentioned above to some degree, and may support the conceivable assumption that the prolonged sitting position is a more significant aetiological factor to develop DVT during air flights, rather than decreased air pressure, hypoxia, or low humidity. However, further study including rheological and biomedical approach will be needed to appreciate the mechanism of thrombus formation especially induced by air travel.

In recent years, an expanding array of inherited or acquired thrombophilic disorders including factor V Leiden and antithrombin III deficiency has been recognised as a predisposing factor for DVT. It is well conceivable that such a hypercoagulable state induced by thrombophilia plays an important role for thrombus formation in travel-related DVT. Actually, in our study population, 7 of 10 patients had a positive thrombophilia screen, which might suggest the significant impact of these underlying disorders on developing thrombi during travel. This issue merits further investigation.

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