

## **Q: ‘Coach class thrombosis’: Is the risk real? What do we tell our patients?**

**DANIEL J. BROTMAN, MD**

Section of Hospital and Preoperative Medicine, Department of General Internal Medicine, The Cleveland Clinic

**AMIR JAFFER, MD**

Medical Director, Internal Medicine Preoperative Assessment Consultation and Treatment (IMPACT) Center, and the Anticoagulation Clinic, Department of General Internal Medicine, The Cleveland Clinic

**A:** We believe that “coach class thrombosis”—deep venous thrombosis or pulmonary embolism associated with cramped conditions on long airline flights—is in fact a real phenomenon. However, the risk is small, and only those already at increased risk of venous thromboembolism need to be concerned about it.

Therefore, we advise patients with risk factors for deep venous thrombosis to take simple, nonpharmacologic measures—eg, to use compression stockings, stretch frequently, walk about the plane, and stay hydrated—during air trips of 5,000 km (about 3,000 miles) or more.

We need more studies, however, before we can recommend pharmacologic measures to prevent flight-related deep venous thrombosis. Aspirin is not a good idea because it has gastrointestinal adverse effects and lacks efficacy. A single injection of low-molecular-weight heparin has shown promise in preventing deep venous thrombosis in at-risk patients on long flights, but further studies are needed to prove that it is safe and cost-effective when used for this purpose.

### ■ MECHANISMS ARE PLAUSIBLE

About 150 years ago, Rudolf Virchow identified three adverse consequences of pulmonary arterial obstruction: blood coagulation, stasis, and irritation of the vessel wall.<sup>1</sup> Subsequently, these consequences of thrombosis have also been recognized as predisposing factors for thrombosis and are referred to as Virchow’s triad.

Long plane flights pose an obvious risk of thrombosis: immobility for long periods in the sitting position leads to venous pooling in the legs. There may also be endothelial damage resulting from the pressure of the seat on the popliteal vein, although this is speculative. Plasma thrombogenicity may be increased by reduced ambient oxygen tension and by hemoconcentration resulting from dehydration.<sup>2</sup>

### ■ FACT OR FICTION?

A number of reports<sup>3–9</sup> have linked deep venous thrombosis with air travel, often dubbing it “coach class thrombosis” or “economy class syndrome,” while others dismiss the association as either coincidental or clinically unimportant.<sup>10–15</sup> Several recent studies, however, suggest that subclinical deep venous thrombosis associated with prolonged air travel is surprisingly common, and that life-threatening pulmonary embolism can occur, albeit rarely.

### **Risk is greater on longer flights**

Lapostolle et al<sup>16</sup> reviewed the records of all patients arriving at a major French airport between 1993 and 2000 who required immediate medical attention for suspicion of pulmonary embolism, including 56 patients in whom severe pulmonary embolism was confirmed.

The risk was greater on longer flights. None of the patients with pulmonary embolism had flown less than 2,500 km (1,554 miles), only 1 had flown less than 5,000 km (3,107 miles), 4 had flown 5,000 to 7,499 km (3,107 to 4,660 miles), and 51 had flown at least 7,500 km (4,660 miles). Compared with flights of less than 5,000 km, and when the total number of arriving passengers was factored in, the risk of severe pulmonary embolism was more than 100 times higher after flights of 5,000 to 10,000 km, and more

**The risk  
of venous  
thrombo-  
embolism  
during air  
travel is real  
but small**



than 400 times higher after flights longer than 10,000 km (6,214 miles).

Although the overall risk of severe pulmonary embolism associated with flights over 10,000 km was low (about 1 in 200,000), the study only identified patients with severe, symptomatic pulmonary embolism diagnosed within 1 hour of arrival. Passengers presenting with venous thromboembolism after leaving the airport were not included. We can safely assume that the true incidence of clinically important venous thromboembolism following long air trips is probably much higher than was found in these reports.

### ■ WHO IS AT RISK?

Flight-related venous thromboembolism rarely occurs in people who have none of the general risk factors for venous thromboembolism, eg:

- Obesity
- Recent surgery or trauma
- Estrogen therapy
- Pregnancy
- Systemic malignancy
- Chronic venous stasis
- Heart failure
- Advanced age
- History of venous thromboembolism.<sup>8,9,17,18</sup>

On the other hand, recent prospective studies have demonstrated that about 3% to 10% of patients with risk factors develop radiographically apparent thrombi during long flights.<sup>19–21</sup> Most of these thrombi are asymptomatic.

Although these prospective studies may have been biased because they were not blinded, the surprisingly high incidence of thrombosis suggests that preventive measures may be appropriate for some patients, especially those with multiple risk factors going on intercontinental flights.

### ■ PREVENTIVE MEASURES

Three randomized studies examined the efficacy of drug and nondrug prevention of thrombosis.<sup>19–21</sup>

Two of these studies<sup>19,20</sup> examined the use of elastic compression stockings (supplying 20 to 30 mm Hg of pressure) during flight.

Subjects underwent bilateral lower-extremity duplex ultrasonography before and after the flight to document development of new thrombi. In all, more than 1,000 people were randomized to wear elastic compression stockings or no stockings; deep venous thrombosis developed in 31 control subjects vs 1 in the stocking groups.

In the third study,<sup>21</sup> 300 people were randomized to receive either aspirin, a single injection of low-molecular-weight heparin, or no treatment; 249 people completed the study. Four thrombi were found in the control group, three in the aspirin group, and none in the heparin group. Although the number of events was small, this study suggests that low-molecular-weight heparin may prevent flight-associated deep venous thrombosis, but that aspirin has little or no benefit.

Most of the thrombi in these studies were asymptomatic. We do not know how many of them would ever have become symptomatic had they gone undiagnosed.

### ■ WHAT SHOULD WE TELL PATIENTS?

Patients going on relatively short flights (ie, less than 5,000 km), such as from New York to Denver, should be reassured that the risk of developing a thrombus is extremely low. For those with risk factors for deep venous thrombosis, periodic ambulation or flexing of the leg muscles can help to minimize the small risk of flight-related deep venous thrombosis.

For patients planning longer flights (ie, more than 5,000 km), such as a transatlantic flight from New York to London, we recommend that clinicians advise patients as follows:

- Walk around as much as possible, or at least flex and stretch the leg muscles periodically if walking around is not possible
- Avoid becoming dehydrated by abstaining from or minimizing the intake of alcohol and by drinking plenty of nonalcoholic beverages. If the patient prefers to drink alcohol, then frequent trips to the restroom after consuming alcohol may negate the risk of thromboembolism associated with dehydration.
- Patients who are pregnant or have prior thrombosis, active malignancy, heart failure, or recent surgery may be prescribed compression stockings with 20 to 30 mm Hg of pres-

### On long flights:

- Get up
- Stretch
- Avoid alcohol



sure for use during long flights. Those who already own compression stockings for venous stasis edema should be advised to wear them during the flight.

- Aspirin is not recommended to prevent flight-related deep venous thrombosis in patients with no other indications for aspirin, as it may be associated with gastrointestinal bleeding and likely has little or no efficacy in preventing flight-related thrombosis.

Prophylactic use of low-molecular-weight heparin may be effective but can be associated with adverse effects such as bleeding and heparin-induced thrombocytopenia. Furthermore, there is no evidence that this is more effective than compression stockings. Therefore, we do not recommend the routine prophylactic use of any drug at this time, although future studies may demonstrate that this is safe and cost-effective.



## REFERENCES

1. Virchow R. Thrombosis and emboli. Translated by Matzdorff AC, Bell WR. Canton, Mass: Science History Publications/USA, 1998.
2. Ansell JE. Air travel and venous thromboembolism: Is the evidence in? *N Engl J Med* 2001; 345:828–829.
3. Homans J. Thrombosis of the leg veins due to prolonged sitting. *N Engl J Med* 1954; 250:148–149.
4. Arfvidsson B, Eklof B, Kistner RL, Masuda EM, Sato DT. Risk factors for venous thromboembolism following prolonged air travel. Coach class thrombosis. *Hematol Oncol Clin North Am* 2000; 14:391–400.
5. Cruickshank JM, Gorlin R, Jennett B. Air travel and thrombotic episodes: the economy class syndrome. *Lancet* 1988; 2:497–498.
6. Sahiar F, Mohler SR. Economy class syndrome. *Aviat Space Environ Med* 1994; 65:957–960.
7. Sarvesvaran R. Sudden natural deaths associated with commercial air travel. *Med Sci Law* 1986; 26:35–38.
8. Eklof B, Kistner RL, Masuda EM, Sonntag BV, Wong HP. Venous thromboembolism in association with prolonged air travel. *Dermatol Surg* 1996; 22:637–641.
9. Kesteven PJ, Robinson BJ. Clinical risk factors for venous thrombosis associated with air travel. *Aviat Space Environ Med* 2001; 72:125–128.
10. Kraaijenhagen RA, Haverkamp D, Koopman MM, Prandoni P, Piovella F, Buller HR. Travel and risk of venous thrombosis. *Lancet* 2000; 356:1492–1493.
11. Weir E. The weak connection between venous thromboembolism and air travel. *CMAJ* 2001; 164:1037.
12. Davis RM. Air travel and risk of venous thromboembolism. Pulmonary embolism after air travel may occur by chance alone [letter]. *BMJ* 2001; 322:1184.
13. Geroulakos G. The risk of venous thromboembolism from air travel [editorial]. *BMJ* 2001; 322:188.
14. Bagshaw M. Traveller's thrombosis: a review of deep vein thrombosis associated with travel. The Air Transport Medicine Committee, Aerospace Medical Association. *Aviat Space Environ Med* 2001; 72:848–851.
15. Dimberg LA, Mundt KA, Sulsky SI, Liese BH. Deep venous thrombosis associated with corporate air travel. *J Travel Med* 2001; 8:127–132.
16. Lapostolle F, Surget V, Borron SW, et al. Severe pulmonary embolism associated with air travel. *N Engl J Med* 2001; 345:779–783.
17. Arfvidsson B. Risk factors for venous thromboembolism following prolonged air travel: a prospective study. *Cardiovasc Surg* 2001; 9:158–159.
18. Giangrande PL. Air travel and thrombosis. *Int J Clin Pract* 2001; 55:690–693.
19. Belcaro G, Geroulakos G, Nicolaides AN, Myers KA, Winford M. Venous thrombosis from air travel: the LONFLIT study. *Angiology* 2001; 52:369–374.
20. Scurr JH, Machin SJ, Bailey-King S, Mackie IJ, McDonald S, Smith PD. Frequency and prevention of symptomless deep-vein thrombosis in long-haul flights: a randomised trial. *Lancet* 2001; 357:1485–1489.
21. Cesarone MR, Belcaro G, Nicolaides AN, et al. Venous thrombosis from air travel. The LONFLIT 3 study. Prevention with aspirin vs low-molecular-weight heparin in high-risk subjects: a randomized trial. *Angiology* 2002; 53:1–6.

ADDRESS: Amir Jaffer, MD, Department of General Internal Medicine, A72, The Cleveland Clinic Foundation, 9500 Euclid Avenue, Cleveland, OH 44195; e-mail jaffera@ccf.org.

**Patients at risk should wear compression stockings on long flights**