Systemic arterial hypertension and flight

Kaan Okyay

Department of Cardiology, Faculty of Medicine, Başkent University; Ankara-Turkey

INTRODUCTION

Conventionally, hypertension is defined as office systolic blood pressure (SBP) values ≥140 mm Hg and/or diastolic blood pressure (DBP) values ≥90 mm Hg or requiring antihypertensive medication (1). On the basis of office BP, approximately 1.13 billion people were affected by hypertension in 2015, and hypertension is the major preventable cause of cardiovascular disease (CVD) and all-cause death (2). In the PatenT2 (the prevalence, awareness, treatment, and control of hypertension in Turkey) trial, the overall age and sex-adjusted prevalence of hypertension was found as 30.3% (3).

Approximately, 40 million people use commercial flights annually (4). It is estimated that by 2030, half of the passengers in commercial flights will be over 50 years of age because of increased life spans. At the same time, our ability to care for patients with cardiac diseases and advancement in flying technology improve continuously. Accordingly, we can predict a higher number of “older” individuals or those with cardiac diseases will travel in commercial flights (5). Given its overall prevalence mentioned above, hypertension would be one of our major concerns. The management of hypertension should be considered, both for the passengers and the flight crew.

The main pathophysiological factor during a flight is altitude related decrease in oxygen saturation. Commercial airplanes fly at 30,000–40,000 feet (corresponding to 9,000–12,000 m) above the sea level. However, commercial flights maintain a relative cabin altitude between 5,000 and 8,000 feet during routine flights. However, at this altitude, the barometric pressure decreases from a normal sea level value of 760 to 560 mm Hg. This pressure change is related to the decrease in arterial oxygen tension, which is well tolerated in healthy individuals but might trigger ischemia and arrhythmia in susceptible patients. The inspired PO$_2$ falls by 4 mm Hg per 1,000 feet above sea level. Consequently, the patients with concomitant pulmonary diseases such as chronic obstructive pulmonary disease and pulmonary hypertension may require supplemental oxygen during travel. In addition, some patients with cardiovascular diseases such as severe left and/or right ventricular dysfunction and congenital heart diseases can be more sensitive to changes in arterial oxygen saturation (4, 6, 7). The details of acute and chronic cardiovascular changes for adaption to high altitude will not be mentioned in detail. Basically, an increase in heart rate, cardiac contractility, and cardiac output could alter systemic blood pressure. Hypoxia triggers peripheral vasodilatation and activation of the sympathetic nervous system. In patients with hypertension, however, endothelial dysfunction may inhibit hypoxic vasodilatation and even induce peripheral vasoconstriction. In healthy individuals, these mechanisms overall result in a non-significant increase of blood pressure, but with high inter-individual variability. Only a modest increase was observed in patients with controlled blood pressure (8-10). However, there is still a potential risk for significant elevation in systemic arterial pressure in those with uncontrolled blood pressure. Stressful factors related to flight such as increased anxiety especially during take-off and landing, changes in body position induced by
The cabin crew should be informed in case of serious cardiac conditions and medications during commercial flights. They must seek specific advice from their physician. General recommendations should be followed by the passengers and the flight crew for trouble-free air travel.

Conclusion

The number of air travelers with cardiac diseases is continuing to increase. All passengers with cardiovascular disease should take tailored advice based on their current status. High-altitude exposure is well tolerated by the hypertensive except for those with uncontrolled blood pressure levels and/or with accompanying serious cardiovascular problems. These patients must seek specific advice from their physician. General recommendations should be followed by the passengers and the flight crew for trouble-free air travel.

Conflict of interest: None declared.

References

1. Williams B, Mancia G, Spiering W, Agabiti Rosei E, Azizi M, Burnier M, et al.; ESC Scientific Document Group. 2018 ESC/ESH Guidelines for the management of arterial hypertension. Eur Heart J 2018; 39: 3021-104. [Crossref]
2. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in blood pressure from 1975 to 2015: a pooled analysis of 1479 population-based measurement studies with 19.1 million participants. Lancet 2017; 389: 37-55.
3. Sengul S, Akpolat T, Erdem U, Derici U, Arici M, Sindel S, et al.; Turkish Society of Hypertension and Renal Diseases. Changes in hypertension prevalence, awareness, treatment, and control rates in Turkey from 2003 to 2012. J Hypertens 2016; 34: 1208-17. [Crossref]
4. Possick SE, Barry M. Air travel and cardiovascular disease. J Travel Med 2004; 11: 243-8. [Crossref]
5. Sand M, Bechara FG, Sand D, Mann B. Surgical and medical emergencies on board European aircraft: a retrospective study of 10189 cases. Crit Care 2009; 13: R3. [Crossref]
6. Higgins JP, Tuttle T, Higgins JA. Altitude and the heart: is going high safe for your cardiac patient? Am Heart J 2010; 159: 25-32. [Crossref]
7. Silverman D, Gendreau M. Medical issues associated with commercial flights. Lancet 2009; 373: 2067-77. [Crossref]
8. Hofstetter L, Scherrer U, Rimoldi SF. Altitude exposure is not a contraindication for patients with heart disease in general. Going to high altitude with heart disease. Cardiovascular Medicine 2017; 20: 87-95. [Crossref]
9. Savonitto S, Cardellino G, Doveri G, Pernpruner S, Bronzini R, Milloz N, et al. Effects of acute exposure to altitude (3,460 m) on blood pressure response to dynamic and isometric exercise in men with systemic hypertension. Am J Cardiol 1992; 70: 1493-7. [Crossref]

10. Palatini P, Businaro R, Berton G, Mormino P, Rossi GP, Racioppa A, et al. Effects of low altitude exposure on 24-hour blood pressure and adrenergic activity. Am J Cardiol 1989; 64: 1379-82. [Crossref]

11. Chandra A, Conry S. In-flight Medical Emergencies. West J Emerg Med 2013; 14: 499-504. [Crossref]

12. Arazi HC, Waldman S, Casso N, Abello M. Hemodynamic Effects of Commercial Flights. Potential Implication on Patients. Clin Surg 2017; 2: 1389.

13. Oliveira-Silva I, Leicht AS, Moraes MR, Simões HG, Del Rosso S, Córdova C, et al. Heart Rate and Cardiovascular Responses to Commercial Flights: Relationships with Physical Fitness. Front Physiol 2016; 7: 648. [Crossref]

14. Norsk P, Asmar A, Damgaard M, Christensen NJ. Fluid shifts, vaso-dilatation and ambulatory blood pressure reduction during long duration spaceflight. J Physiol 2015; 593: 573-84. [Crossref]

15. Smith D, Toff W, Joy M, Dowdall N, Johnston R, Clark L, et al. Fitness to fly for passengers with cardiovascular disease. Heart 2010 Aug; 96 Suppl 2: ii1-16. [Crossref]

16. Oğuz AK. Uçuş hekimliği ve hipertansiyon. Türk Kardiyoloji Seminerleri 2015; 15: 163-71. [Turkish]