International Journal of Travel Medicine & Global Health

Review Article

Venous Thromboembolism Following Travel

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Abstract

International travel has become increasingly common and accessible, hence, about two billion passengers undertake international and domestic air travel each year. Venous thromboembolism (VTE) is a serious public health disorder which may occur following prolonged travel, especially after air travel. A direct relation between VTE development and prolonged travels has been documented, while some references did not confirm this relation. The travel-related VTE is a multi-factorial disorder, and the risk of thrombosis is higher in individuals with pre-existing risk factors. Some believe that hypobaric hypoxia was a more likely explanation for thrombus formation during prolonged travel. Other factors including immobilization, dehydration, excessive alcohol or coffee consumption, lower air pressure, and lower humidity can make the traveler prone to thrombus formation. Herein we tried to evaluate previous studies and available guidelines thereby providing information on the association of thrombosis and travel, risk factors, risk assessment, and strategies for the prevention of VTE following travel.

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Keywords: Venous Thromboembolism, Travel

Received: 2 February 2014
Accepted: 14 March 2014

Introduction

International travel has become increasingly common and accessible [1, 2]. In 2010, there were 711 million international outbound trips worldwide, a 7% increase compared to 2009 [3]. Approximately two billion passengers undertake international and domestic air travel each year [4, 5].

The possible relationship between air travel and the development of venous thromboembolism (VTE) was first described by Homans in 1954 [6]. Definition of traveler's thrombosis according to the Vienna meeting in 2001 is "Occurrence of deep vein thrombosis (DVT) of the lower extremities (with/without pulmonary embolism) in connection with a journey lasting several hours in the sitting position in people who did not have signs of acute VTE when starting the travel" [7]. This definition based on a follow-up conference to the meeting in Vienna had been held in Hall/Austria and an updated international consensus statement was published in 2008, was converted to "the term of traveler's thrombosis used to indicate VTE that occurs during or within four weeks after long-haul travel"; also, subgroup of air-travel thrombosis was referred to "thrombosis that occurs when the main part of the journey was undertaken by plane" [8]. Although according to guidelines of British Committee for Standards in Haematology (BCSH), VTE may be attributable to travel if it occurs up to eight weeks following the journey [9].

During recent years, the relationship between prolonged travel and increased risk of VTE has been established. Among healthy individuals, VTE has been associated with long-distance travel. In 2001, World Health Organization (WHO) suggested that an association between air travel and VTE probably exists, but that the risk was not quantifiable because of the lack of adequate data [10]. In this regard, a scientific committee project entitled the WHO Research into Global Hazards of Travel (WRIGHT project) has been established for evaluate any relationship between VTE and air travel. They found that prolonged travel in general, including car or train, increased VTE risk, but that risk was most impacted by air travel [11]. Travel-related VTE has emerged as an important public health concern over the past decade. Thus, in this review article, we tried to provide information on the association of VTE and travel, risk factors, risk assessment, and strategies for the prevention of thrombosis following travel.

Association of VTE and travel

The annual incidence of DVT in the general population is estimated to be about 1 per 1000 [12], however, the incidence of VTE is different among travelers. In various studies, estimates of the incidence of VTE among travelers was attributed to variable factors such as the observation period, the mode and duration of travel, method of diagnosis, and the study design and criteria. In a randomized controlled trial, Scurr et al. indicated that symptomless DVT could occur in up to 10% among air travelers of 50 years old traveling for more than 8 hours [13]. In one prospective study, Schwarz et al. enrolled 964 travelers returning from prolonged flights (more than eight hours) and 1213 non-travelling controls. They diagnosed VTE events in 2.7% of the air travelers and 1.0% of the control group. Of the 20 cases who had isolated calf muscle venous thrombosis in the traveler group, 19 were symptomless [14]. While the clinical importance of asymptomatic DVT has not yet been determined, it has been suggested that the increased risk of DVT can lead to an increased risk of incidence of symptomatic VTE, post-thrombotic syndrome,

or even mortality [15-18].

The incidence of VTE closely depends on duration and distance of travel, especially in air traveling. In a retrospective study, Perez-Rodriguez et al. reviewed the cases of pulmonary thromboembolism (PTE) among international travelers arriving at Madrid Barajas Airport between January 1995 and December 2000. They found that the overall incidence of PTE was 0.39 per one million passengers. On flights that lasted between 6 and 8 hours, the incidence of PTE was 0.25 per 1 million passengers, while on flights longer than 8 hours, this was 1.65 per 1 million passengers [19]. Lapostolle et al. systematically reviewed the cases of PTE requiring medical care on arrival at France's busiest international airport between November 1993 and December 2000. They indicated that incidence of PTE was much higher among traveler flying more than 5000 km. Incidence of PTE was 1.5 cases per million passenger among those traveling more than 5000 km, as compared with 0.01 case per million among those traveling less than 5000 km. Moreover, the incidence of PTE was 4.8 cases per million for those traveling more than 10,000 km [20].

Kuipers et al. in a cohort study evaluated 8775 employees of large international companies and organizations, who were followed between January 2000 and December 2005. In the follow-up period, they found 53 thromboses. Twenty-two of them were occurred within 8 weeks of a prolonged flight (more than 4 hours). Also, the risk of thrombosis increased with exposure to more flights within a short time frame and with increasing duration of flights. The absolute risk of symptomatic VTE was calculated as 215 per million travelers after flight longer than 4 h, whereas this risk increased with travel duration up to 793 per million, after flight longer than 16 h. The incidence was highest in the first 2 weeks after travel and gradually decreased to baseline after 8 weeks [21].

Available information about association between VTE and travel is conflicting in different systematic review and meta-analysis articles, although majority of them confirmed this association (Table 1). For example, Adi et al. (2004) in a systematic review and meta-analysis study found no definitive evidence that prolonged air travel, increases the risk of DVT [22]. While Kuipers et al. (2007) in a systematic review observed that the risk of VTE in long-distance travel increases approximately 2 to 4-fold [23]. Also, Chandra et al. (2009) in a meta-analysis confirmed this association and showed that travel is associated with a approximately 3-fold higher risk for VTE, with a dose–response relationship of 18% higher risk for each 2-hour increase in travel duration [24].

Chee and Watson in a review article in 2005 concluded that there is a weak association between prolonged travel and VTE. The risk is largely confined to asymptomatic thrombosis in individuals with additional risk factors for VTE and travelling for more than 8 hours. Up to 5% of travelers with additional risk factors for VTE may develop asymptomatic calf thrombosis and overall, 0.5% of prolonged travelers may develop symptomatic VTE. The risk of both symptomatic and fatal PTE is very small (less than 0.5 per million passengers) [25].

The guidelines published by the BCSH concluded that long duration travel is a weak risk factor for the development of VTE. The incidence of VTE after prolonged flights (more than 4 hours) is 1 in 4656 and for flights of more than 8 hours in low and intermediate risk flyers is around 0.5%. Severe symptomatic PTE in the period immediately after travel is extremely rare after flights of less than 8 hours, and in flights over 12 hours the rate is 5 per million [9]. While, The WRIGHT project in phase 1 highlighted the possible link between air travel and VTE and a similar association for other types of travel. They reported that traveling by plane for more than 4 hours approximately doubled the risk of VTE. Also, the increased risk of thrombosis applies to other forms of travel (such as car, bus or train) where travelers are exposed to prolonged seated immobility; and the risk increases with the duration of the travel and with multiple flights within a short period. They reported that the absolute risk of VTE in healthy individuals who flying more than 4 hour is 1 in 6000, and rising to about 1 to 1000 travelers for individuals who had multiple flights (were taken in the four-week exposure period) and longer journeys [11].

Risk factors of travel-related VTE

Traveler-related risk factors

It seems that multiple factors contribute to development of VTE following travel and the accumulation of risk factors added to an individual's inherent thrombotic risk. The risk of VTE increases with age and a number of environmental and genetic factors are known to predispose to thrombosis. Risk factors of community acquired VTE include advancing age, cancer, history of prior VTE, venous insufficiency, pregnancy, trauma, and frailty and immobility [29]. Anderson and Spencer divided the risk factors of VTE in three groups [30]: strong risk factors (odds ratio more than 10) included hip or leg fracture, hip or knee replacement, major general surgery, major trauma, and spinal cord injury; moderate risk factors (odds ratio between 2-9) included arthroscopic knee surgery, central venous lines, chemotherapy, congestive heart or respiratory failure, hormone replacement therapy, malignancy, oral contraceptive therapy, paralytic stroke, pregnancy/postpartum, previous VTE, and thrombophilia; and weak risk factors (odds ratio less than 2) contained bed rest more than 3 days, immobility due to sitting (e.g. prolonged car or air travel), increasing age, laparoscopic surgery (e.g. cholecystectomy), obesity, pregnancy/antepartum, and varicose veins [30].

Some risk factors are specific to air travelers, including people in more than 185 cm or less than 165 cm height, single long-haul flights of more than 8 to 10 hours, multiple long-haul flights of at least 4 hours (risk may persist up to 8 weeks after the flight), and more frequent flights of any duration within a short time frame (ie, days or 3 weeks) [31]. Also, gender can affect the incidence of travel-related thrombosis. Lapostolle et al. systematically reviewed the records of all patients with confirmed PTE after arrival at Roissy-Charles-de-Gaulle Airport (Paris, France) during 13-year period. They found that among

Table 1. Review articles about association of travel and development of VTE

Study, year	Design	Detail of evaluated studies	Pooled odds ratios or relative risk (95% CI)	Main Conclusion
Adi et al, 2004 [22]	Systematic review and meta-analysis	6 incidence studies and 4 risk studies	1.70 (0.89 - 3.22)	No definitive evidence that prolonged (> 3-hours) air travel, increases the risk of DVT
Ansari et al, 2005 [26]	Systematic review	16 studies (9 case-control, 2 prospective controlled, and 5 other observational studies)	-	There is controversial over any association between travel and VTE. Studies of higher quality have shown a strong and significant association between prolonged air travel and VTE.
Philbrick et al, 2007 [27]	Systematic review	25 studies (6 case-control, 10 cohort, and 9 randomized controlled trials).	-	27 PTE per million flights, 0.05% symptomatic DVT, but asymptomatic thrombi were more common
Kuipers et al, 2007 [23]	Systematic review	10 case-control studies, 20 observational follow-up studies	-	The long-distance travel increases the risk of VTE approximately 2 to 4-fold. The absolute risk of a symptomatic event within 4 weeks of flights longer than 4 h is 1⁄4600 flights. The risk of severe PTE occurring immediately after air travel increases with duration of travel, up to 4.8 per million in flights longer than 12 h.
Trujillo-Santos et al, 2008 [28]	systematic review and meta-analysis	For systematic review (8 cases-control studies), For meta-analysis (2 cases-control studies) studies)	For air travel: 1.21 (0.95 - 1.55). For all types of transport: 1.46 (1.24 - 1.72)	There is weak association between VTE and a long travel, and this relation with the travels by plane is only nearly significant.
Chandra et al, 2009 [24]	Meta-analysis	14 studies (11 case-control, 2 cohort, and 1 case-crossover)	2.8 (2.2 - 3.7)	Travel is associated with a 3-fold higher risk for VTE, with a dose–response relationship of 18% higher risk for each 2-hour increase in travel duration

287.6 million travelers in this period, proportion of male to female in long-distance travel was to be 50.5% to 49.5%. Whereas, of 116 patients experienced PTE after landing, 78% were female. They estimated that incidence of PTE was 0.61 cases per million travelers in females and 0.2 in males, and reached 7.24 and 2.35 cases, respectively, in travelers flying over 10,000 km [32].

Pregnancy is another risk factor for travel-related VTE. However, most commercial airlines allow pregnant women to fly up to 36 weeks of gestational age. In women not using oral contraceptives who travelled by air, the risk of VTE is about 1 in 5000 passengers [21]. This risk would be increased 5-folds during pregnancy [33]; in the other word, this would lead to a risk of 1 per 1000 pregnant women travelling by air. It is interesting that this risk increases 60-fold during the first 3 months after delivery compared with non-pregnant women [33]. Cannegieter and Rosendaal recently (2013) in a review article evaluated association of pregnancy and travel-related VTE. They used results from studies performed in air travelers and pregnant women separately to estimate the risk of the combination; subsequently they estimated that this risk was between 0.03 and 0.1% [34].

The risk of travel-related thrombosis is higher in individuals with pre-existing risk factors for the development of VTE [9, 25]. In a series from Hawaii, 92% of patients with VTE following travel had one or more patient-related risk factors; the mean was three [35]; And Hosoi et al. showed that 87% of patients with travel-related thrombosis had another coexisting risk factor [36].

Martinelli et al. showed that when thrombophilia or oral contraceptive use is present in person whom travel by plane, the risk of VTE increases to 16-fold and 14-fold, respectively [37]. Schreijer et al. found an increase of coagulation activation on asymptomatic carriers of factor V Leiden mutation after 8-hours flight. Also they observed that when a women with factor V Leiden mutation uses oral contraceptives, a more significant increase of thrombin generation and decrease of fibrinolysis were occurred [38]. The MEGA study indicated that traveling in general, 2-fold increase the risk of VTE; whereas this was an 8-fold for travelers by bus, car or train who carried the mutation factor V Leiden , and an even higher risk (12-fold) for air travelers [39]. The WRIGHT project reported that risk factors including obesity, extremes of height, use of oral contraceptives and the presence of prothrombotic blood abnormalities or variants were contributed to the increased risk of travel-related VTE [11].

In the other hand, approximately 40% of patients with travel-related VTE suffer from chronic illness, such as

chronic heart disease, chronic diabetes, rheumatoid arthritis, chronic renal insufficiency, or HIV positivity [40].

Cabin-related risk factors

There are several explanations for the increased risk of thrombosis after travel. It was deduced that development of VTE could be occurred following immobilization by sitting for several hours, plus additional patient-related risk factors, may be regarded as a trigger, especially in air traveling [41]. Travelers should be sitting on narrow seating in airplanes, resulting in a cramped position during prolonged flights. This position for long period can lead to venous stasis and DVT [31, 42]. Prolonged immobility in a sitting position can lead to reduction of velocity of venous blood flow up to 2/3 in the lower limbs; and it may be sufficient to activate prethrombotic state [43]. Venous stasis induces hemoconcentration and depressed fibrinolytic activity contributing to prethrombotic state [40]. The prethrombotic state can be assessed by sensitive biochemical markers of thrombin generation (prothrombin fragment 1+2), of ongoing fibrin formation (fibrinopeptide A) and lysis (D-dimer) [44].

Although the effect of immobilization on the coagulation system is contradictory, more frequent studies agree with this phenomenon. Ansari et al. revealed that even in the lower limbs, prolonged daytime cramped sitting is not associated with significant procoagulant changes in healthy adult male volunteers [26]. Stricker et al. found a decrease in markers of thrombin formation during 6 hours of immobilization in a sitting position simulating travel conditions, whereas no change occurred in participants during the ambulant situation [45]. Whereas, Schreijer et al. in a crossover study showed that activation of coagulation occurs in some individuals after an 8 hours flight [38]. In another study, Schobersberger et al found that thrombin activation can occur during a 10 hours bus journey in a group of 19 healthy volunteers [46].

Generally, air travel provides only narrow seat-pitches where travelers have not enough space and can sit only in cramp position. This causes more venous stasis due to external compression from the seat and by kinking the popliteal veins especially in elderly and obese travelers [40]. So, the Civil Aviation Authority recommends that seat-pitch should be increased to a minimum of 71.6 cm, or ideally to at least 74.7 cm to adopt the brace position [47].

Except immobilization, flight specific factors, such as dehydration, excessive alcohol or coffee, lower air pressure, lower humidity, circadian dysrhythmia, and hypobaric hypoxia may affect the coagulation system [23, 40, 48, 49]. It was suggested that hypoxia associated with decreased cabin pressure can lead to development of thrombosis. Above sea level the atmospheric pressure is 101 kPa and oxygen makes up 21% of inspired air. Thus the partial pressure of oxygen is 21.2 kPa. Normally when red blood cells pass through the lung 95% of them are saturated with oxygen. So the oxygen saturation in healthy individuals is 95%. At high altitude when partial pressure of oxygen decreases, most hemoglobin is deoxygenated and the oxygen saturation of hemoglobin decreases. During air travel, cabin pressure drops to 75.8 kPa, which is equivalent to an altitude of 2400 m above sea level. In this situation, the partial pressure of oxygen would be 16.7 kPa. Consequently, oxygen saturation can drop as low as 90-93%, and even to 80% in passengers who are asleep [40, 50, 51].

In the cabin of plane, the decrease in air pressure and induction of relative hypoxia named hypobaric hypoxia. The hypobaric hypoxia caused to increase in fibrinolytic activity and lead to release of relaxing factors from vein wall, that may enhance venous stasis [52, 53]. Also, hypoxia after prolonged air travel could be triggered systemic inflammation and platelet activation, leading to coagulation induction and degranulation of platelets [54]. In a recent study, new mechanism about the association of hypoxia and thrombosis was described. Activation of endothelial cells of valve pocket sinus of veins by hypoxia or possibly inflammatory stimuli would lead to surface expression of adhesion receptors that facilitate the binding of circulating leukocytes. Subsequent activation of the leukocytes induces expression of the potent procoagulant protein tissue factor that triggers thrombosis [55]. Some believe that hypobaric hypoxia was a more likely explanation for thrombus formation during prolonged travel than any of the other factors [41, 54].

Low humidity within the cabin of plane is another factor which can stimulate the development of thrombosis. The dry atmosphere coupled with decreased fluid intake causes dehydration and hemoconcentration. The relative humidity in the cabin gradually falls on high altitude and prolonged flights, although sweating and moisture from travelers will cause it to increase [40]. The noticeable effect of low humidity on travelers such as drying of the skin and mucous membranes are present after 3 to 4 hours of flight [56]. A study showed that low humidity in prolonged air travel, travelers compared the controls, had increase in mean plasma osmolarity, mean urine osmolarity, and urine specific gravidity, indicating dehydration [50]; whereas some studies did not confirmed dehydration secondary to low humidity [57, 58]. Nevertheless, it is suggested that alcohol or coffee drinking (which promotes diuresis), together with the lower humidity of the cabin, may lead to some degree of dehydration and a consequent thrombus formation [25, 40].

Risk assessment

According to previous studies, Gavish and Brenner in 2011 described seven risk factors for VTE related to flying or travelling by car, train or bus [59], including 1) the length of the travel: in prolonged flights (over 6 h), the risk is increased by 2.3-fold in comparison with shorter flights; 2) age over 40 years; 3) women who use oral contraceptive drugs or hormone replacement therapy had 2.4-fold increased risk; 4) lower limb varicose veins; 5) obesity (BMI more than 30 kg/m^2); 6) thrombophilia or elevated levels of coagulation factors II and VIII; 7) other risk factors, e.g. tall stature, short stature, etc.

Based on a conference to the meeting in Vienna held in Hall/Austria and an updated international consensus statement published in 2008, the travelers regarding level of probability of VTE development were divided into three groups: low, moderate, and high (Table 2) [8].

Table 2. Regarding probability of VTE development, travelers were divided into three groups [8,60].

	Hall meeting	BTS guideline
Low risk group	In passengers without additional personal risk factors (as listed below) every prolonged journey is associated with a slightly increased but indeterminate risk	all passengers not in the categories list below
Moderate risk group	The following factors may increase the individual risk for VTE. The presence of two or more factors may increase risk in a supra-additive fashion: Pregnancy or post-partum period Age over 60 Documented thrombophilia/family history of VTE Large varicose veins, chronic venous insufficiency Oral contraceptives, hormone replacement therapy Obesity (body mass index >30 kg/m^2)	family history of VTE, past history of provoked VTE, thrombophilia, obesity (BMI >30 kg/m^2), height >1.90 m or <1.60 m, significant medical illness within previous 6 weeks, cardiac disease, immobility, pregnancy or estrogen therapy (including hormone replacement therapy and some types of oral contraception) and postnatal patients within 2 weeks of delivery.
High risk group	The presence of the following factors is associated with particularly high risk: Previous VTE Manifest malignant disease or other severe illness Immobilization (eg, limb in plaster cast) Recent major surgery	Past history of idiopathic VTE, those within 6 weeks of major surgery or trauma, and active malignancy.

The British Thoracic Society (BTS) in 2011, also, three risk groups are distinguished, listed in table 2 [60]. In the recent guidelines of American College of Chest Physicians (2012) travelers at increased risk of VTE, was defined as persons with previous VTE, thrombophilic disorders, severe obesity, recently active cancer, or recent major surgery, who are traveling on flights more than 6 hours [61].

Prevention of travel-related VTE

There is still insufficient evidence to make firm recommendation for prophylaxis of VTE for general population. Although thromboprophylaxis for travelers who are considered to be at particularly high risk for VTE must be made on an individual basis, considering that adverse effects may outweigh any benefit [8, 9, 60, 61].

According to Hall meeting and an updated international consensus statement (was published in 2008), the travelers in long-distance travel were divided into three groups, regarding probability of VTE development. General recommendations were listed in table 3. They advised a prophylactic dose of low-molecular weight heparin or fondaparinux immediately before start of journey in travelers at high risk (Enoxaparine 40 mg S.C.; Dalteparin 5000 IU S.C.; or fondaparinux 2.5 mg S.C.) [8], same to other references [31, 62]. Repeated administration may be necessary in the case of a prolonged travel but may be associated with an increased risk of bleeding and other adverse effects. Also, they not recommended aspirin, because of its limited efficacy and the potential risks associated with its consumption [8], same as other guidelines. Also, BTS guidelines (2011] were divided the travelers who flight more than 8 hours or had multiple shorter journeys over a short period into three groups, regarding VTE risk (Table 3). It is interesting that this guideline recommended that patients who have had a VTE should ideally not travel for four weeks or until proximal DVT has been treated and symptoms resolved [60].

Against Hall meeting and BTS guidelines, BCSH guidelines (2011) concluded that there is no evidence for an association between dehydration and travel-associated VTE and so whilst maintaining good hydration is unlikely to be harmful, it cannot be strongly recommended for prevention of thrombosis (2B). The recommendations of BCSH guidelines were listed in table 4 [9]. The recent guidelines of American College of Chest Physicians (2012) recommended travelers at increased risk of VTE (including previous VTE, recent surgery or trauma, active malignancy, pregnancy, estrogen use, advanced age, limited mobility, severe obesity, or known thrombophilic disorder), considering decreasing their risk of VTE by frequent ambulation or sitting in an aisle seat if feasible and avoiding dehydration; and other recommendations were listed in table 5 [61].

Conclusion

Although there is inconsistency among previous studies, altogether it seems that the burden of travel-related VTE is remarkable, especially following prolonged air traveling. The travelers with pre-existing risk factors are more prone to thrombosis formation, although healthy individuals especially women, are at risk for VTE during long-distance flights or multiple flights within short period. Among cabin-related risk factors, immobilization and dehydration are the modifiable, so it was recommended that all travelers should avoid excess alcohol or coffee consumption, maintain normal fluid intake, and perform regular leg exercises, isometric exercises, and walking. Also, during travel by car or bus, take regular breaks to walk around. The high risk travelers, especially prior to long flights, should be recognized and advice them to use mechanical or pharmacological prophylactic modes.

Table 3. Recommendations for prevention of travel-related VTE based on Hall meeting and BTS guidelines [8,60]

	Hall meeting	BTS guidelines
Low risk group	General measures Perform regular leg exercises, e.g. ankle movements, isometric exercises, and walking. During travel by car and bus, take regular breaks to walk around. Maintain normal fluid intake (at least 250 ml every 2 hours) and avoid excessive alcohol consumption. Avoid the use of tranquillisers and sleeping pills whilst sitting position.	Passengers should avoid excess alcohol and caffeine-containing drinks, and preferably remain mobile and/or exercise their legs during the flight (D)
Medium risk group	General measures, as for low risk group Graduated compression stockings (compression at least 10 - 20 mmHg but 20 - 40 mmHg in subjects with chronic venous insufficiency). In special cases, consider low-molecular weight heparin, as for high risk group.	These patients should be advised to wear below-knee elastic compression stockings in addition to recommendations for low-risk passengers. In addition, they should be advised against the use of sedatives or sleeping for prolonged periods in abnormal positions. (D) Passengers with varicose veins may be at risk of superficial thrombophlebitis with use of stockings; the risk/benefit ratio here is unclear
High risk group	General measures, as for low risk group Graduated compression stockings (compression at least 10 - 20 mmHg but 20 - 40 mmHg in subjects with chronic venous insufficiency). Consider low-molecular weight heparin or fondaparinux.	Pre-flight prophylactic dose low molecular heparin should be considered or formal anticoagulation to achieve a stable INR between 2 and 3, for both outward and return journeys, and decisions made on a case-by-case basis. The recommendations are in addition to the general advice for those at low to moderate risk (D) Patients who have had a VTE should ideally not travel for 4 weeks or until proximal (above-knee) DVT been treated and symptoms resolved, with no evidence of pre- or post-exercise desaturation (D)

Table 4. Recommendations of BCSH guidelines for prevention of travel-related VTE [9]

There is indirect evidence that maintaining mobility may prevent VTE and, in view of the likely pathogenesis of travel-related VTE, maintaining mobility is a reasonable precaution for all travelers on journeys over 3 h (2B).
Global use of compression stockings and anticoagulants for long distance travel is not indicated (1C).
Assessment of risk should be made on an individual basis but it is likely that recent major surgery (within 1 month), active malignancy, previous unprovoked VTE, previous travel-related VTE with no associated temporary risk factor or presence of more than one risk factor identifies those travelers at highest thrombosis risk (1C).
Travelers at the highest risk of travel-related thrombosis undertaking journeys of >3 h should wear well fitted below knee compression hosiery (2B).
Where pharmacological prophylaxis is considered appropriate, anticoagulants as opposed to anti-platelet drugs are recommended based on the observation that in other clinical scenarios they provide more effective thromboprophylaxis. Usual contraindications to any form of thromboprophylaxis need to be borne in mind (2C).

Table 5. Recommendations of guidelines of American College of Chest Physicians for prevention of travel-related VTE [65]

For long-distance travelers at increased risk of VTE, we suggest frequent ambulation, calf muscle exercise or sitting in an aisle seat if feasible (Grade 2C).
For long-distance travelers at increased risk of VTE, we suggest use of properly fitted, below-knee graduated compression stockings providing 15 to 30 mm Hg of pressure at the ankle stockings during travel (Grade 2C).
For all other long-distance travelers, we suggest against the use of graduated compression stockings (Grade 2C).
For long-distance travelers, we suggest against the use of aspirin or anticoagulants to prevent VTE (Grade 2C).

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