

Air travel during pregnancy: an update review and practical recommendation

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Summary

Objective: Nowadays it is easier for pregnant women to travel abroad. The purpose of this review is to insure that healthcare providers advise pregnant women of the risks to travel by airplane. **Materials and Methods:** The authors provide an overview of the risks of thrombosis in pregnancy to travel by airplane and the risks of miscarriage and preterm labor. This study is based on electronic literature using the best available evidence from PubMed, Medline, Google Scholar, the American College of Obstetricians and Gynecologists (ACOG), the American College of Chest Physicians (ACCP), the Royal College of Obstetricians and Gynecologists (RCOG), and the British Thoracic Society (BTS). **Results:** In the lack of evidence-based information, physicians and pregnant women should only rely on guidelines and experts' opinions. **Conclusions:** In the absence of a reasonable expectation for obstetric or medical complications, occasional air travel is safe in pregnancy. The specific airline recommendations should be always kept in mind.

Key words: Air travel; Pregnancy; Miscarriage; Preterm delivery; Venous thrombo-embolism; Aspirin; Low molecular weight heparine; Progesterone; Magnesium; Ritodrine.

Introduction

Air travel has become an important part of modern life and nowadays more than two billion passengers fly each year. Furthermore many women are employed in jobs that involve frequent flying and most flight attendants are women in reproductive age [1-3]. The incidence of pregnancy during travel is 0.93 per 1,000 travelers [4]. In the United States 68.2 million citizens have crossed international borders in 2014, compared with 61.3 million in 2013 and 28.5 million in 2010 [5, 6]. Air travel in pregnancy does not seem to be harmful to the pregnancy and it is generally considered to be safe, therefore the most commercial airlines allow pregnant women to fly until 36 weeks of gestational age. Despite this, the issue of air travel during pregnancy has not been sufficiently studied, information on the effect of air travel on thromboembolism, miscarriage, preterm labor, and pregnancy outcomes is limited [7-10]. Women should not be informed about possible risks of air-travelling during pregnancy. The majority of women do not receive medical advice before travelling and lose an opportunity to improve their knowledge. Travelling abroad could reflect on pregnancy, so pregnant women should be advised by healthcare providers. They should also consider to be

more careful with the type of accommodation they are going to choose, including food and water [11, 12].

Although the American College and Royal College of Obstetricians and Gynecologists (ACOG) gives guidance on precautions for air travel, the organisations do not provide destination-specific risks for pregnant women [7, 13]. Therefore in this present study the authors attempt to evaluate the association of air travel and pregnancy and the related complications based on available evidence. The level of evidence for most recommendations is based on expert opinion due to the lack of controlled prospective studies.

Association of thrombosis and air travel during pregnancy

Venous thromboembolism (VTE) including deep vein thrombosis (DVT) and pulmonary thromboembolism (PTE) is a serious public health disease. A combination of environmental and genetic risk factors contributes to VTE risk. Within environmental risk factors some are provoking (pregnancy and postpartum period, cancer, surgery, trauma, immobilization, long-distance travel, and hospitalization) and others are non-provoking (e.g. age, sex, ethnicity, body mass index, oral contraceptive or steroid use, physical ac-

tivity) [14]. Additionally, VTE has a strong genetic basis, therefore it is beyond the association between thrombosis and air travel in pregnancy. Approximately 50-60% of VTE incidence are attributed to genetic effects [14, 15]. The term ‘travel related thrombosis’ indicates venous thromboembolism (VTE) that occurs within four weeks after long air travel [9]. Medium- to long distance travelers have a two- to four-fold increased risk of thrombosis compared with non-travelers [15]. The reasons that air travel increases risks to VTE are: immobilization for several hours, hypoxia associated with decreased cabin pressure, and dehydration because of low cabin humidity [7, 8]. During pregnancy major changes in the maternal hemostasis occur and particularly an increase of coagulation factors which increase the coagulability. In pregnant women, thrombophilia increase the risk to develop VTE, on the hand during the first trimester of pregnancy, thrombophilia is a risk with decreased bleeding, miscarriage, and childbirth [16-18]. The risk of venous thromboembolism is four- to five-fold higher in pregnant women than in non-pregnant of the same age and an absolute risk is around 1 in 1,000 pregnancies [19, 20].

Other studies describe the risk of VTE of five- to ten-fold greater in pregnant women [21-23]. This thrombosis risk increases upon the venous stasis in the lower extremities due to a hormone-induced increase in venous capacitance and the compression of the inferior vein cava by the enlarged uterus [24]. The actual risk of venous thromboembolism during air travel is unknown, but according to the American College of Chest Physicians (ACCP) (2012), pregnant women who have travelled once by airplane are at relative risk [25]. Studies among the nongravid population have proved that flights longer than eight hours increase the VTE risk up to four-fold and the risk begins after four hour duration of flight [10, 12, 15, 26-29]. Additional factors are immobilization, venous stasis, dehydration, lower humidity, caffeine or alcohol intake, and hypobaric hypoxia, which reduce fibrinolytic activity and increases systemic inflammation [8, 12, 30, 31].

Prevention, current recommendations

In the absence of evidence-based information, physicians and women should only rely on guidelines and experts’ opinions to minimize the risks that occur during air travel. A survey of advice given by 1349 registered members of the Royal College of Obstetricians and Gynecologists (RCOG) revealed that 67% of obstetricians regard flying as being safe throughout pregnancy, 33% only in the 2nd and 3rd trimesters. Fifty-three percent of them are advised to use as prophylactic aspirin (75 mg), 49% to use compression stockings, 4% therapeutic administration of low molecular weight heparin, and all of them are advised to use simple prophylactic measures such as mobilization, hydration, and leg exercise. Both the British Thoracic Society

Table 1. — Risk factors and recommendations to reduce the risk of travel-related VTE.

Risk group	Risk factor	Recommendations
Low-risk	No additional risk factor	General measures: exercises, walking, normal fluid intake, avoid alcohol and caffeine consumption
Medium-risk	Pregnancy, postpartum period, age over 60 years, family history of VTE, large varicose veins, chronic venous insufficiency, oral contraceptives, hormone replacement therapy, and obesity (BMI over 30 kg/m ²)	General measures: as above, Compression stockings
High-risk	Previous VTE, recent major surgery, malignant disease or severe illness, and immobilization	General measures: as above, compression stockings, consider low-molecular weight heparin

Table 2. — Recommendations to reduce the risk of VTE in pregnancy.

Choosing an aisle seat: a easier way to exercise
Taking regular walks on board: periodic movement of the lower extremities
Exercises every 30 minutes: advised for medium or long-haul flights (> 4 hours)
Avoid restrictive clothing
Hydration: maintain good fluid intake, avoid dehydration: minimise caffeine and alcohol
Individualised risk assessment for thrombosis with aspirin, low weight heparine molecules

(BTS) and the ACCP report that pregnant women are at increased risk of VTE [32-34].

Table 1 highlights the risk factors and the recommendations for prevention of travel-related VTE [8-9]. The present authors’ recommendations in order to minimise the risk of VTE in pregnancy are summarized in Table 2 [2, 7, 13, 32]. These simple preventive proceedings can be used to reduce the risk of VTE; nevertheless pharmacological thrombosis-prophylaxis is not in general indicated.

Association of air travel and miscarriage

Naturally the first studies on reproductive risks originate from research in flight attendants. Even today it is a hot topic whether occupational exposures in female aircrew may cause adverse pregnancy outcomes. An association between air travel and miscarriage is controversial. Laura *et al.* did not find higher rates of miscarriage associated with active work. However they found higher rates of menstrual

disorders among current flight attendants and 60% higher rates of infertility [35]. Cone *et al.* HAVE also presented A lack of risk of spontaneous abortions among female flight attendants. However, crew members with spontaneous abortions had more flight hours (74 hours per month) than air hostesses who had labor (64 hour per month) [36]; an older and a newer study however had proved the opposite. A Finnish study in 1999 noted a 30% increased risk of miscarriage among air hostesses who worked in first trimester of pregnancy [37]. Grajewsky *et al.* found associations between miscarriage in flight attendants and occupational exposure to circadian disruption and physical job demands. Furthermore they found evidence of an association between cosmic ionizing radiation during pregnancy and miscarriage among flight attendants, although the association was modest and may have been affected by multicollinearity with circadian disruption metrics [38]. They found an increased risk of miscarriage in flight attendants who flew 15+ hours during their home-base sleep hours, it is consistent with reports of adverse reproductive outcomes associated with night or rotating shift work [39, 40]. Future studies of reproductive health in flight attendants should address personal and work-related risk factors in more detail and include comparative occupational groups. These results support the hypothesis that occasional flying among healthy pregnant women should not be a concern [7]. In contrast, women at higher risk of spontaneous abortion should limit their flights.

Association of air travel and preterm labor

Literature is poor concerning the effect of air travel during pregnancy, and is also controversial. Freeman *et al.* supported a potential risk in late pregnancy (≥ 20 weeks), in a cohort of women who delivered singletons. They concluded that air travel was not associated with increased risk of complications for pregnancies that reached 20 weeks' gestation. Furthermore air travel was not associated with birth weight, shorter gestation, rate of vaginal bleeding, preterm delivery, preeclampsia or neonatal intensive care admission [41]. Chibber *et al.* presented conflicting results with a larger sample size. They supported that primigravid women who travel by air appear to be at a higher risk for preterm birth [42]. Such researches are vital and multicentric large studies are required to confirm these findings and to define new strategies for preventing adverse birth outcomes with progesterone magnesium or ritodrine. The management of pregnant women who suffer from serious medical or obstetric conditions need to be individualized. Women with preexisting cardiovascular illness require a special management. In pregnancy, it is essential to evaluate the patient's anamnesis considering cardiovascular, cardiac and pulmonary diseases, renal insufficiency, hypertension, diabetes or a recent VTE [2, 43-45]. Hypoxia in the cabin might increase the risk in pregnant women with unstable angina,

Table 3. — Air travel is contraindicated in the following medical complications.

Obstetrical or gynecological complications:
Cervical insufficiency
Active labor or preterm labor
Placenta praevia, placenta insufficiency, placental abruption
Premature rupture of membranes
Abortus imminent or incomplete
Severe anaemia: hemoglobin < 7.5 g/dl
Vaginal bleeding
Ectopic pregnancy
Other medical complications:
Otitis media and sinusitis
Serious cardiac or pulmonary disease: unstable angina, cardiomyopathy, congestive heart failure, pulmonary hypertension
Renal insufficiency
Sickle cell anaemia: recent crisis
Recent gastrointestinal surgery: including gastrointestinal suture
VTE
Fracture: where leg swelling can occur in flight

Table 4. — Air travel information for pregnant women [12, 56].

CDC Traveler's Health	https://www.nc.cdc.gov/travel
CDC Travelers' Health Yellow Book	www.cdc.gov/yellowbook
WHO International Travel	http://www.who.int/ith/en/
International Society of Travel Medicine	http://www.istm.org/bodyofknowledge
National Travel Health Network and Centre-UK	http://travelhealthpro.org.uk
US Department of State country-specific travel alerts	http://www.travel.state.gov/content/passports/en/alertswarnings.html
Travel Health Online	www.tripprep.com
Travel Risk Map	https://www.internationalsos.com/risk-outlook

congestive heart failure or chronic pulmonary conditions [7]. Pressurized cabins have decreased the risk of sickle crisis for women with sickle cell disease [46, 47]. Moreover, pregnant women with risk of placental insufficiency or preterm labor should not travel on the third trimester. Examples of complications between air travel and pregnancy are presented in Table 3 [13,48].

Conclusion

Air travel during pregnancy nowadays is very common especially when international travel for work and pleasure is a more commonplace [4, 49-52]. Despite the increasing number of reviews focusing on air-travel in different stages of pregnancy, the present authors' knowledge about the real effects of international flights is limited. Few women are fully aware of the potential risks of travelling while pregnant, particularly the risk of delivering abroad. During

pregnancy, the obstetrician may be the first clinician who approached with questions regarding air-travel. Pretravel consultation should include careful information of length of travel, antimalarial prophylaxis, insect avoidance, food and water hygiene, vaccination, and body fluid precautions [52]. Medical providers should also ask about whether travel has already occurred in order to offer relevant post-travel testing for infectious diseases [53]. Generally air travel is safe during pregnancy when there are no risks for complications. There is not strong evidence that random air travel increases the risk of pregnancy complications, such as preterm labor, rupture of membranes or abruption placenta [13]. In case of increasing risk, a preventive short treatment to avoid uterine contractions could be proposed.

The radiation dose to the fetus from exposure to cosmic radiation is negligible [54]. Body scanners for security checks are also no harmful. Flights of more than four hours duration are associated with a small increase in the relative risk of venous thrombosis. A specific risk assessment should be evaluated for thrombosis in travelling pregnant women. Specific prevention methods e.g. elastic compression stockings should be applied for women who fly medium or long-haul flights (> 4 hours), and LMWH should be proposed in case of significant risk factors such as previous thrombosis or morbid obesity [13]. Low dose aspirin in contact with low heparine is not indicated in pregnancy for thromboprophylaxis associated with air travel [13]. Moreover, specific recommendations of each airline should always be considered. Useful information for pregnant travelers are listed in Table 4 [12]. A meticulous risk assessment should be completed to identify the main risks and special management strategies in order to avoid complications while travelling [55].

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