



## Air Travel: Does It Present A Risk For Pregnant Women?

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**Abstract:** **Introduction:** whether they are occasional, frequent travelers, or are part of the flight crew, is no longer uncommon to meet pregnant women on flights, because air travel has become very common and accessible. **Objective:** study the different risks that pregnant women are exposed to during commercial flights, because traveling during pregnancy raises the question of safety for the fetus and the pregnant woman. **Methods:** Using the PUBMED database, a review of the literature was carried out, including articles from the 2000s to the present, with a search using four keyword combinations, which allowed us to collect 35 articles only in English. **Results:** Four main risks were identified. The ionizing risk due to cosmic radiation that exposes the risk of cancer and injury to DNA. The thromboembolic risk which is multifactorial and depends on the duration of flight, physiological changes in pregnancy and physical constraints related to flights. The risk of complicating pregnancy outcomes: premature birth, malformation, low birth weight, metrorrhagia. Finally, the physical risks associated with flights do not expose to particular complications. **Conclusion:** Until 36 SA, Flight do not pose any particular problem. Care should be taken not to exceed a certain number of flying hours in order not to overexpose the fetus to ionizing radiations. Simple physical measures are sufficient to prevent the thromboembolic risk except in pregnant women with comorbidities, an anticoagulation will be discussed.

**Keywords:** pregnant women, pregnancy, travel, thromboembolic risk, flight.

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## Research Article

### INTRODUCTION :

Today millions of people travel by air every day. Air travel has indeed become very common and accessible, with 3.7 billion people traveling by air worldwide in 2016, and this number is constantly increasing. It has become common to see pregnant women in the passengers. In fact, the incidence of pregnancy during flights is 0.93 per 1,000 passengers (Sammour, R. N. *et al.*, 2012). Air travel may be necessary for some pregnant women whether traveling, going to work, or because they are part of the cabin crew (CC) or the flight crew (FC). In addition, 80% of the cabin crew are women, 60% of whom are of reproductive age, and among civilian pilots, 5% are women (Luton, D. 2012).

Traveling during pregnancy therefore raises the question of safety for the fetus and for women, and doctors are frequently asked about this subject.

We have therefore tried to highlight the various risks to which the fetus and the pregnant woman may be exposed during flights.

### MATERIALS AND METHODS :

The main objective of this article is therefore to review the current state of knowledge on the particular risks to which pregnant women are exposed during commercial flights. These risks concern passengers, cabin crew and pilots. In a second step, we will review the recommendations and information for pregnant women wishing to travel during pregnancy.

To address the problem, a systematic review of scientific literature was carried out. First, simple searches were carried out in the literature to identify a certain number of keywords which subsequently made it possible to identify research themes. The electronic database used for our literature review is Pub Med. We used different keyword combinations which allowed me to identify two problems:

- What are the maternal-fetal risks linked to thefts?
- What are the recommendations of good practices concerning pregnancy and commercial flights?

**The exclusion criteria were:**

- article not in English
- article prior to the year 2000.

**RESULTS :**

During this literature review, various risks were highlighted, we will now detail these various risks. We will therefore take stock of the various studies published concerning the risks in pregnant women during air travel. First of all

## **THE THROMBOEMBOLIC RISK:**

### **Specific factors related to the flight :**

Economy class air travel takes place in narrow seats, resulting in an uncomfortable position during long flights. Anatomically, the compression of the seat causes a "bending" of the external popliteal veins.

This position causes venous stasis with a reduction of venous blood flow by 2/3 in the lower limbs, which induces a pre-thrombotic state.

These factors therefore cause hemoconcentration and decrease the fibrinolytic activity contributing to this pre-thrombotic state (Cannegieter, S.C. 2012; Bartholomew, J. R. *et al.*, 2011 ; & Sándor, T. 2008).

Elevation-induced hypoxia and hypobarism are also factors that reduce fibrinolytic activity and lead to the release by the wall of veins of the relaxing factor, which causes venous stasis (Schreijer, A. J. M. *et al.*, 2010).

Hypoxia during long distance flights activates the factors of inflammation and platelet activation which lead to increased coagulation and platelet activity.

In addition, the humidity level in the cabin is around 15%. The drop in humidity gradually decreases with the rise in altitude, and during prolonged flights, resulting in sweating and increased phlegm in the passengers. This effect is seen after approximately 3-4 h of flight (Sándor, T. 2008).

Associated with this, coffee and alcohol consumption during flights increase diuresis.

These factors combined lead to a state of dehydration which can aid in the formation of thrombi (Chee, Y. L., & Watson, H. G. 2005).

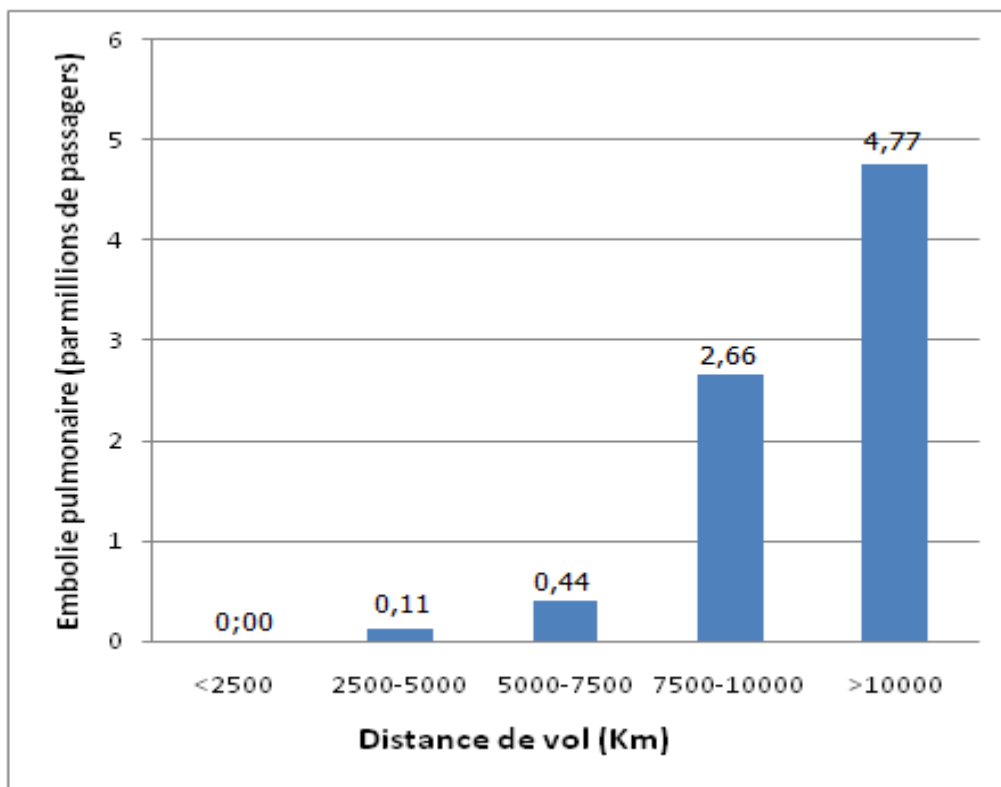
### **Influence of flight time:**

Different articles have looked at the influence of flight time and the thromboembolic risk. Chandra *et al.*, in a meta-analysis summarized the results of 14 studies. With a total of 4055 cases of thrombosis, the relative risk of thrombosis in all travelers was 2.8. In addition, the relative risk increases by 26% each time the flight duration increases by 2 hours (Chandra, D. *et al.*, 2009).

Two other studies have been done on the risk of pulmonary embolism immediately after passengers arrive at the airport. These 2 studies find a risk of 0.1 per million passengers for short flights and this risk increases the longer the journey, increasing to 5 per million passengers when the flight exceeds 10,000 km (Lapostolle, F. *et al.*, 2001 ; & Pérez-Rodríguez, E. *et al.*, 2003).

A French study analyzed patients with pulmonary embolism (PE) at Charles de Gaulle Airport. More than 135 million passengers made up the control group.

The incidence of pulmonary embolism was 0.4 cases per million passengers, it rose to 4.8 cases for flights of more than 10,000 km with a break in the curve for flights between 5,000 and 7,500 km (Lapostolle, F. *et al.*, 2014) (figure 1) .



**Figure 1:** Incidence of pulmonary embolism as a function of flight distance, expressed in number of cases per million passengers, arriving at Roissy-Charles-de-Gaulle airport per 2,500 km, according to Lapostolle.

This clearly shows that the duration of the flight is a predominant risk factor in the occurrence of a pulmonary embolism during a flight.

**Pregnancy, flight and thromboembolic risk:**

According to these various studies, there is a risk of thrombosis in pregnant women during flights, it is estimated at 1 per 1000 pregnant women traveling by plane. This risk is multifactorial, it largely depends on the duration of the flight, physiological changes in pregnancy, and finally physical constraints related to the flight.

**The risk of ionizing radiation:**

During flights at high altitudes, the doses of cosmic radiation are greater than those at ground level. In addition to cosmic radiation, solar flares greatly increase radiation levels at the altitude of airliners for brief periods. They therefore constitute a risk for pregnancy. We are investigating whether exposure to cosmic rays can pose a risk to the fetus. Remember that the dose used to discuss a medical termination of pregnancy is 200 mSv at 17 weeks.

**What do the studies say?**

For a pregnant woman traveling occasionally the impact of radiation is negligible (Royal College of Obstetricians and Gynaecologists. 2013). For a frequent traveler the exposure can be above the recommended doses, an adaptation of the duration and the trajectory of the flight

(privilege the low altitudes and the low latitudes) is to be studied, as well as the total dose received (companies' calculation system) so as not to exceed the dose of 1mSV over the entire pregnancy and not more than 0.5mSV per month.

**The risk on pregnancy outcomes during flights:**

According to Royal College of Obstetricians And Gynaecologists, there is no data which suggests that commercial flights are associated with increased risk premature delivery, early rupture of membranes or termination of pregnancy (Royal College of Obstetricians and Gynaecologists. 2013).

Another 2004 study assessed the effects of flight on pregnancy complications. Out of 222 primiparous pregnant women with no fetal abnormality, up to 20 years of age, 118 (53%) had traveled on average 2 times on flights lasting around 4 hours.

No difference was found on the date of delivery (39.1 versus 38.4 weeks p = 0.07), birth weights (3.379 versus 3.273 gr p = 0.24), bleeding (2% versus 5%, p = 0.26), delivery before 37 weeks (9% versus 14% p = 0.29), preeclampsia (5% versus 6%, p = 0.76) or admission to intensive care (13% versus 16% p = 0.56) among those who have traveled and those who did not travel during pregnancy.

They concluded that thefts do not appear to increase pregnancy complications such as prematurity, pre-eclampsia, birth weight abnormalities, metrorrhagia, intensive care admissions at birth (Freeman, M. *et al.*, 2004). On the whole the results are rather discordant and not very significant. There is a lack of large-scale studies

## PHYSICAL RISKS:

**There are specific risks linked to the aeronautical environment which can raise questions during pregnancy such as:**

1. the seat belt, due to the unpredictability of turbulence, and knowing the risks of abdominal trauma of it in pregnant women, the wearing of the seat belt must be permanent (Luton, D. 2012). The belt should be at hip level between the pelvis and the abdomen.
2. vibrations: concerning vibrations, no study was found.
3. noise: noise pollution is a stress factor, the WHO has set the danger threshold at 85 dB, this threshold is not reached during commercial flights. On the other hand, the noise level measured on the runway around an aircraft can reach 92.6 db (averaged over 8 hours), imposing protection for the flight attendant during the pre-flight visit.

## CONCLUSION:

The question of air travel during pregnancy remains frequent; to respond to this, we therefore carried out a literature review to define the risks as well as the recommendations. Flights longer than 4 hours are associated with a small increase in the relative risk of venous thrombosis. The advice given on the prevention of thromboembolic disease applies particularly to pregnant women for flights longer than 4 hours (physical and behavioral measures, compression stockings). Low molecular weight heparin thromboprophylaxis for pregnant women with important risk factors such as a history of thrombosis or morbid obesity should be discussed. Low-dose aspirin should not be used during pregnancy for thromboprophylaxis associated with air travel. It is considered that even for a long-haul flight the exposure to cosmic radiation represents only 15% of the maximum recommended doses, on the other hand, for cabin crew and frequent travelers, there is a risk of exceeding the maximum dose. There are tools available to travelers and companies to calculate the radiation dose based on the flight. Regarding body scanners using ionizing radiation for security checks, they do not present a risk for the mother or the fetus. There is no evidence that passenger air travel increases the risk of pregnancy complications

such as premature labor and rupture of membranes. In all cases, any additional or foreseeable medical or obstetric complications must postpone the air trip. It would be useful for the future to determine exactly the absolute risk of thrombosis for a pregnant woman during a flight in order to decide on the relevance of anticoagulation. In addition we have updated that the risk concerning pregnancy outcomes remains unclear and poorly evaluated. Large-scale prospective and controlled studies would be necessary, but difficult to implement.

## Competing interests:

The authors declare that they have no competing interests.

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