THE IMPACT OF JET LAG ON ROMANIAN TRAVELERS AND ITS PREVENTION

Niculescu Iulia¹, Hristea Adriana¹,², Arama Victoria¹,², Olaru Ioana¹, Jipa Raluca¹

1. Matei Bals National Institute for Infectious Diseases
2. University of Medicine and Pharmacy Carol Davila Bucharest

Abstract. Jet lag (JL) develops as a consequence in the disruption of the circadian rhythm. This may occur when rapidly crossing more than 2 time zones. Travel medicine counseling can be very useful in minimizing JL effects by teaching the traveler how to plan the trip in advance, by using phototherapy and melatonin. Objective. The aim of our study was to investigate the knowledge and the impact of jet lag on Romanian international transmeridian travelers, as well as the risk factors related to the development of this syndrome. Methods. Retrospective study based on a questionnaire survey of international Romanian travelers who sought medical advice at the travel medicine department of the “Medicover” clinic in Bucharest between January 2010 and May 2012. Results. 110 international travelers, 66 men (M/F sex ratio 1,5/1), median age 30, with university education and a medium-to-high socioeconomic level; 64 (58%) traveled to Asia and 45 (70%) of them to India for professional purposes. The median travel duration was 30 days (range 4-365 days). Only 12 (10%) described themselves as cautious tourists, 67 (70%) practiced risky activities, 81 travelers (73%) stayed in a hotel. More than a half (63) experienced jet lag during their current trip, of whom 50 people traveled to the East (p < 0.001, 95%, OR=8.2, CI 3.4-19.4). The majority of this group (90) came for the first time to a pre-travel consultation and 60 of them were referred by their employer, only 12 came by their own initiative. Only 5 subjects had taken melatonin before. Conclusion. Although JL develops almost universally factors like travels to the east, purpose of travel (involving physical and mental performance at destination- professional purpose, risky activities), young age, and frequent transmeridian flights are linked to a more severe form of this syndrome. An increase of awareness in the Romanian international traveler about travel medicine could prevent many health problems related to international travels.

Keywords: jet lag, travel, risk factors, prevention

Introduction

The circadian rhythm is a biological process that creates a 24 hour cycle in humans and animals. It is important in determining sleep patterns, coordinates internal metabolic processes and plays a key role in synchronizing the body with the environment. Although endogenously generated and genetically controlled, it can be modulated by external cues called “Zeitgebers”, of which the most important ones are core body temperature and light exposure. Hence the body clock has 2 components: the endogenous and the exogenous component, which are usually in phase. This circadian rhythm is driven by the so-called biological clock, located in humans in the suprachiasmatic nuclei (SCN) of the hypothalamus. The SCN receives information about illumination from photosensitive cells of the retina called the ganglion cells through the retinohypothalamic tract and transfers it further to the pineal gland which produces melatonin in response. The melatonin secretion reaches its peak during the night and decreases during day time, modulating the sleep-wake cycle [1].

Research has shown that circadian rhythm persists in the absence of external cues, however the body clock is not an exact timekeeper and tends to extend from the usual 24 to around 24.5-25 hours
during free-running experiments (isolation from external periodic influences such as the alternation of day and night)[2,3,4].

The so-called Zeitgebers (ex. Light-Dark cycle, core body temperature) can adjust the body clock by delaying or advancing it. The temperature rhythm associated with the body clock exerts important influences on: going to sleep (easiest when the temperature is low or falling), waking up (easiest if the temperature is high or rising) and staying asleep (best if it spans throughout the temperature). Minimum body temperature is usually reached in the middle of sleep (around 4 A.M.). Hence, exposure to light in the late evening and first part of sleep delays the body clock, exposure to light in the second part of sleep and the early morning advances the body clock, while exposure to light during the middle of sleep (around 4 A.M.). Hence, exposure to light in the late evening and first part of sleep delays the body clock, while exposure to light in the second part of sleep and the early morning advances the body clock [1,5].

Disruptions of the circadian rhythm may arise when the two components of the body clock (the endogenous and the exogenous component) are no longer in phase. This may occur for example when rapidly crossing more than 2 time zones while traveling on airplane (east-west or west-east) and can produce a syndrome known as jet lag (JL).

Symptoms appear when arriving at destination and include headache, irritability, loss of concentration, loss of motivation and commitment, indigestion and bowel irregularities, fatigue in the new daytime and yet inability to sleep at night. Circadian rhythms may take up to 2 weeks to adjust, showing that the body clock (the endogenous component) is slow to adjust, it stays for some days on “old” time, but the new time zone has an exogenous component that is timed differently. One has to make the difference between “travel fatigue” and “jet lag”. Travel fatigue accompanies any long journey (even if there are no time zones crossed). This negative effect represents a mixture of causes, including: a changed routine, possible sleep loss, dehydration, stress associated with travel (dealing with security, catching connections etc.) [6].

It is possible to minimize the effects of jet lag by planning the trip well in advance, by good hydration during the trip (alcohol beverages being contraindicated). On arrival, adjustment of the body clock by using phototherapy (appropriate exposure to bright light in the new time zone) can be useful [7]. Timely ingestion of the epiphyseal hormone- melatonin- for short term use can also help resetting the body clock. Its efficacy in reducing JL was proven particularly during eastward travels when crossing more than 5 time zones [8]. When traveling to the West, it is recommended to take a low dose of melatonin (0,5 mg) in the second half of the sleep period (early morning at destination), while for eastward flights ingestion of a higher dose of melatonin (0,5- 3 mg) in the evening of the new time zone could be useful [9]. Side effects include daytime sleepiness, headache, dizziness. Interactions with various comediations are also to consider.

Objective
The aim of our study was to investigate the knowledge and the impact of JL on Romanian international transmeridian travelers, as well as the risk factors linked to the development of this syndrome.

Methods
We performed a retrospective study based on a questionnaire survey of international Romanian travelers who sought medical advice at the Travel Medicine Department of the “Medicover” clinic in Bucharest between January 2010 and May 2012. Each participant filled in two questionnaires- one before leaving, containing information about medical history, travel history and current travel data (destination, duration of stay, purpose, accommodation, risk activities, traveler’s typology, knowledge on travel medicine, possible risk factors during travel, JL, melatonin use) and the other after returning from the journey, comprising information about medical incidents of the returned traveler.

The data was statistically analyzed using SPSS v17.0 (Statistical Package for the Social Sciences Inc, Chicago, IL, USA). The Mann-Whitney U-test was used to analyse differences between groups for continuous variables (age, stay, number of time zones crossed). For categorical variables, the \( \chi^2 \) test or Fisher’s exact test were used to test for differences between groups. The level of significance was set at \( \alpha =0.05 \).

To diagnose jet lag we used the Jet Lag Disorder criteria recognized by the American Academy of Sleep Medicine’s diagnostic manual under the section of Circadian Rhythm Sleep Disorders [10]. The diagnostic criteria are the following:

There is a complaint of insomnia or excessive daytime sleepiness associated with transmeridian jet travel across at least two time zones.

There is an associated impairment of daytime function, general malaise, or somatic symptoms such as gastrointestinal disturbance within one or two days after travel.

Sleep disturbance is not better explained by another current sleep disorder, medical or neurological disorder, mental disorder, medication use, or substance use disorder.

Results
Our group included 110 international travelers, 66 men (M/F sex ratio 1.5/1), median age 36 (range 24-60), all of them from urban areas, with university...
education and a medium-to-high socioeconomic level. Ten (9%) suffered from chronic illnesses and 7 (6.3%) were taking chronic treatment. Their travel history during the past five years is summarized in table 1, showing that 106 (96%) had traveled at least once internationally and 51 of them more than 10 times. The most visited continent in the last 5 years was Europe and the least visited one was Australia.

### Table I. Travel history on continents in the past 5 years

<table>
<thead>
<tr>
<th>Continent</th>
<th>≥ 1 travel N (%)</th>
<th>2-10 travels N (%)</th>
<th>≥ 10 travels N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>106 (96)</td>
<td>77 (72)</td>
<td>29 (27)</td>
</tr>
<tr>
<td>America</td>
<td>35 (31)</td>
<td>34 (97)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Asia</td>
<td>16 (14)</td>
<td>16 (100)</td>
<td>0</td>
</tr>
<tr>
<td>Africa</td>
<td>18 (6)</td>
<td>18 (100)</td>
<td>0</td>
</tr>
<tr>
<td>Australia</td>
<td>1 (0.9)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>International travels in the past 5 years</td>
<td>106 (96)</td>
<td>55 (51)</td>
<td>51 (46)</td>
</tr>
</tbody>
</table>

### Table II. Information about current travel

<table>
<thead>
<tr>
<th>Duration of travel (days)</th>
<th>N (%)</th>
<th>Median [range]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>64 (58)</td>
<td>30 [4-365]</td>
</tr>
<tr>
<td>Africa</td>
<td>24 (22)</td>
<td>11 (10)</td>
</tr>
<tr>
<td>Europe</td>
<td>6 (5)</td>
<td>5 (4)</td>
</tr>
<tr>
<td>South America</td>
<td>6 (5)</td>
<td>5 (4)</td>
</tr>
<tr>
<td>North America</td>
<td>6 (5)</td>
<td>5 (4)</td>
</tr>
</tbody>
</table>

### Table III. Degree of knowledge of tourists about jet lag and melatonin

<table>
<thead>
<tr>
<th>Knowledge about jet lag and melatonin</th>
<th>Number of tourists N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know the meaning of the term „jet lag”</td>
<td>68 (62)</td>
</tr>
<tr>
<td>Have experienced jet lag before</td>
<td>34 (31)</td>
</tr>
<tr>
<td>Have experienced jet lag during current trip</td>
<td>63 (57)</td>
</tr>
<tr>
<td>Have heard about Melatonin</td>
<td>7 (6)</td>
</tr>
<tr>
<td>Have taken Melatonin before</td>
<td>5 (4)</td>
</tr>
</tbody>
</table>

### Discussions

Out of 71 travelers who crossed more than 2 time zones, 63 (89%) experienced jet lag. Fifty (79%) of these traveled to the East, compared to only 13 (21%) to the West and the difference was statistically significant (p < 0.001, OR= 8.2 95% CI 3.4-19.4), showing that travels to the East represent a greater risk factor for developing jet lag than East to West travels, confirming literature data that advancing our body clock is more difficult to achieve than delaying it [9, 11, 12]. We found that JL for travels to the East developed at a median of 4 (range 4-7) crossed time zones, while in the case of East to West journeys more crossed time zones were needed: median 7 (range 3-8). Among the 63 travelers of our group who experienced jet lag, 62 crossed more than 3 time zones. This result is consistent with studies showing that over 90% of long distance travelers suffer from the effects of jet lag. A major US study of long distance travelers found that 94% suffered jet-lag symptoms, and 45% considered their symptoms severely bothersome [13].

The purpose of travel also played an important role in the development of JL: 47 (75%) of those who experienced jet lag traveled on professional purposes, compared to only 16 (25%) who traveled as tourists. The difference was statistically significant (p = 0.005, OR= 3.06, 95% CI 1.37-6.86), proving once more that the effects of jet lag can be debilitating if soon after arrival in the new time zone, the traveler needs to undertake physical or mental tasks that require a high standard of performance: errors in pilots, reduced functioning among athletes, decreased mental performance among diplomats are ascribed to jet lag (14, 15, 16). Things are similarly when it comes to risky activities during the journey: 33 (52%) of those who had jet lag undertook risky activities and only 10 (21%) of those who didn’t develop jet lag (p= 0.001, OR= 4.95% CI 1.7-9.5). This proves that jet lag is not just the bane of tourists, it can impair the judgment of businesspeople and politicians and compromise the performance of
athletes. Leger et al. (1993) reported that among 507 business travelers, nearly half suffered from fatigue during international business trips, approximately 78% reported sleep disturbances and approximately 27% complained of decreased intellectual performance [17]. Age-related variability of JL was seen in our group, younger travelers (< 40 years) were more likely to develop JL than older travelers, as shown in a number of studies [18, 19], although other studies did not find any important differences due to age.

Being a frequent transmeridian traveler also increased the likelihood of our travelers to experience jet lag: 49 (78%) of the group with JL during current trip had undertaken more than 5 international transmeridian travels in the past year (p = 0.043, OR= 8.4, 95% CI 1.9-72). Studies suggest that repeated episodes of jet lag may have long term health risks, including neuro-anatomic changes and cognitive deficits [20, 21, 22, 23].

Most of the travelers of our group – 90 (82%) came for the first time to a pre-travel consultation: 60 (70%) of them were referred by their employer, 18 (20%) by their general practitioner and only 12 (13%) came by their own initiative. Forty-six (73%) of those who had jet lag during the current trip knew the meaning of JL (p= 0.006 95%, OR=3.07, CI 1.38-6.83) Only 7 (6.4%) had heard about melatonin and only 5 of them had taken it before. These results highlight the importance of travel medicine counselling prior to the journey in informing the traveler about risks and their prevention and shows that this field needs to develop in Romania.

Conclusions

The incidence of JL in Romanian international travelers crossing more than 2 time zones is almost general, but factors like travels to the East, purpose of travel (involving physical and mental performance at destination), risk activities, young age, frequent transmeridian flights are linked to a more severe form of JL. Pre-travel medicine counselling teaches the traveler how to minimize these debilitating effects by planning the trip in advance, using scheduled light exposure at destination and prescribing timely administration of melatonin. The Romanian traveler has a poor- to- medium knowledge about the effects and prevention of JL. An increase of awareness of the Romanian international traveler about travel medicine could prevent many health problems.

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