Onset of spontaneous pneumothorax and the synodic lunar cycle

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Summary The relation between spontaneous pneumothorax events and synodic lunar cycle was studied in a retrospective analysis of patients with a first or recurrent spontaneous pneumothorax. The study included a total of 244 patients, 203 males and 41 females. The data were arranged along the first (new moon) to 28th day (one day before another new moon) of the synodic lunar cycle. Periodogram analysis revealed a 14-day rhythm, significant for the male and pooled sample. Cosinor analysis found the whole synodic lunar cycle and its 2nd, 4th and 5th harmonics as significant. Maximal accumulation of cases happened 1 week before and 1 week after the new moon. Mechanisms of a putative moon influence are not clear.

INTRODUCTION

The etiology of spontaneous pneumothorax (SP) is unknown. The most likely pathoanatomical substrates are subpleural blebs, emphysematous bullae of the lung and airway obstruction (1–3). Some authors report that the development of SP is related to air pressure changes. There should be minimal but frequent air pressure falls occurring before the onset of spontaneous pneumothorax as a result of weather change (4,5). However Scott and co-workers (6) have concluded that factors other than frequent air pressure falls must play a part in the development of SP. Recently, the role of atmospheric pressure rise or fall was challenged: an association with temperature rise and thunderstorms was found (7). The experience has been accumulated that the occurrence of SP is not a random event. Smit et al. (8) speak about ‘predictable miniepidemics’ – clusters of 2–3 days, when these cases are admitted. In connection with the seasonality of SP occurrence, peaking in summer and winter, a correlation with low relative humidity was described (9). Besides environmental factors, intrinsic physiologic cycling can have an influence on occurrence of SP. This is the case of ‘catamenial’ pneumothorax, observed during menstrual cycle (10).

The latter clinical experience is particularly interesting for ourselves, as we have formed the impression that SP incidents in our patients were unusually frequent at certain lunar phases. So far there is sparse evidence to support involvement of the moon in physiologic or pathologic states in man, although – according to popular belief – it probably affects some human conditions. There are some reports which support involvement of the moon in delivery of multiparae and plurigravidae (11), occurrence of acute infectious diarrhea (12), atrial fibrillation (13), nutrient intake (14), consultations for anxiety or depression in general practice (15) and traffic accidents (16). However, in some other reports no relationship between lunar cycle and spontaneous deliveries (17), frequency of suicide (18), aggression in a prison setting (19), traffic accidents (20), emergency department visit (21) and postoperative outcome (22) was found.

The aim of the present paper is therefore to test the hypothesis that the time distribution of SP attacks is not randomly distributed along the synodic lunar cycle (SLC).
PATIENTS AND METHODS
A retrospective study was carried out on patients with SP treated at the Department of Thoracic Surgery, University Medical Centre, Ljubljana. The study group included patients with first and recurrent SP episodes. Patients with a traumatic or iatrogenic pneumothorax, cases of pneumothorax occurring in infants and cases established on follow-up examination a week after treatment of a pneumothorax episode, were excluded from analysis. The time of hospital admission did not always correspond to the time of SP onset. The criteria for inclusion in the survey required that the patient was located on the wide territory of Ljubljana when he developed SP, and that the available history data allowed precise determination of the day and hour of its onset.

The studied group consisted of 244 patients treated between January 1970 and December 1989. There were 41 women and 203 men; 198 patients had a first SP, while 46 had a second or further recurrence; 43% of the patients were under 30 years-of-age. There were no women with catamenial SP.

The attacks were allocated to the appropriate day of an ideal 29-day SLC, irrespectively of calendar date. Thus, for example, the first day of this cycle is always the day ‘zero’, and its last day the day ‘28’. The resulting sequence of 29 daily frequencies of SP is shown in Table 1. Absolute number of male or female patients, their percentage from the total (203 for male, 41 for female) is displayed, to compare the male and female pattern.

The data were processed by periodogram analysis (23,24), to search for statistically significant periodicities. Thereafter, Halberg’s cosinor regression (25,26) was applied. The latter tests the null hypothesis of absence of SLC with the period lengths of SLC (29 days) and its 2nd (SLC/2, 14.5 days) to 6th (SLC/6, 4.8 days) harmonics. The statistical significance was modified according to Bonferroni (27), to eliminate spurious significance. The graphic output has the form of plexogram, showing the course of frequencies during an ideal SLC from one new moon to the other, then back to the start again and again.

RESULTS
The periodogram analysis disclosed one significant period in the male sample (period length 14 days; \( P = 0.043 \)) and one in the total sample (period length 14 days; \( P = 0.017 \)). A similar peak in female data did not reach the level of significance, obviously due to low sample size. The resulting synodic lunar plexograms are in Figure 1. The most outstanding finding is the peak located 1 week before the new moon. The second highest peak in that 1 week after the new moon. This finding confirms the 14-day periodicity found by periodogram. In the cosinor analysis, the significant rhythms are for the total data the circasemi-lunar one (SLC/2, 14.5 days, \( P = 0.0001 \)), the lunar cycle (SLC, 29 days, \( P = 0.0398 \)), its 4th harmonic (SLC/4, 7.2 days, \( P = 0.0421 \)) and 5th harmonic (SLC/5, 5.8 days, \( P = 0.0398 \)). For the total data, 80% of the total variance were explained by the cosinor regression. A significant departure of the 95% confidence corridor from the expected value of 8.1 cases per day (corresponding with the mesor) is shown in Figure 1B by two shadowed areas covering the day 12±13 (depression) and the day 20±23 (elevation).

It is noteworthy that the pattern of the male and female plexogram is very similar, thus testifying to the validity of these findings. The only difference concerns the highest frequency peak: it is significantly higher in females as shown by a small area of non-overlapping in Figure 1A (black marked by the arrow).

DISCUSSION
Our results show that the SP attacks are distributed non-randomly along the synodic lunar cycle. Maximum
The gravitational force in the erect human posture has been described as a potential factor precipitating the development and rupture of subpleural blebs and bullae in the upper lung lobes close to the apex (30,31). On the other hand, a moon tidal effect on the human body has been challenged as extremely minimal (32). An indirect effect of lunisolar gravitation, e.g. through changes induced in geomagnetic activity and in weather, appears more acceptable. It was documented that lower-tropospheric global temperature changes are influenced by synodic lunar cycle. Recent sophisticated measurement of global temperature based on microwave emissions of molecular oxygen made with the aid of polar-orbiting satellites found variation of about 0.02-0.03°C during the synodic lunar cycle, with the warmest daily values around the full moon (33). These changes are extremely minimal in comparison to seasonal and daily temperature changes. On the other hand, lunar effect on global temperatures can influence some climatic parameters, such as precipitation, cloudiness and thunderstorm activity (34). Here we can speculate some possible connection: maximum precipitation occurred before the first and the last quarter of the new moon (35) and the highest frequency of SP in our study occurred synchronously with 2 days delay. Similar connections between semilunar fluctuation and meteorological factors were found in cardiovascular mortality (36). Mini-epidemics of SP admission described by Smit et al. suggest a prolonged effect of some unknown variable on the lung, resulting in SP (8). Our results confirm Smit’s mini-epidemic occurrence of SP and locate it 1 week before and 1 week after the new moon.

It is generally accepted that rupture of subpleural blebs or emphysematous bullae leads to SP. It seems that changes in atmospheric pressure have limited influence (6) and that other weather factors such as temperature changes and thunderstorm activity are involved (7). Airway anomalies, septal thickening and obstruction are characteristic of SP (3,37). We suggest that temporal and local pulmonary small airway obstruction in pathological changed airways could be dynamics event and is paramount for SP as subpleural blebs are an objective and permanent findings in patients with SP and are not dynamic event. Local and transitional airway obstruction is probably induced more easily on small and narrowed pulmonary airways in the beginning of the respiratory zone by mucus and impaired hygiene in smoking patients. Hypothetical lunar influence on SP could be suspected also in terms of some fluid imbalance in small airways which can cause airway obstruction.

Some further studies and new statistical observations are needed to rechallenge the statement that lunar phenomena are an artifact of romance or just a myth.

Fig. 1 (A) The percentage proportion of the 203 male SP patients for separate days (dots) of the synodic lunar cycle with the narrower 95% confidence limit (for the mean estimate of the approximating function, heavy lines). Corridor M = mesor (the overall mean value of cycling, showing the expectation of 100%:30°⁄3.3% of cases per day according to the null hypothesis). For 41 females, only the 95% confidence corridor (dashed lines) is shown. The placed of non-overlapping (black area) of the male and female confidence corridor is indicated by the arrow. (B) Analogy of A for the pooled data represented by absolute frequencies (N). The theoretical expectation (m) is 244:30 = 8.1 cases per day. Significant departures of the 95% confidence corridor from this theoretical expectation are shown.
ACKNOWLEDGEMENTS

The authors are thankful to Dr Jaroslav Strestik CSc, Geophysical Institute of the Academy of Czech Republic, Prague, and Herman Mikúž PhD, University of Ljubljana, Department of Physics, Slovenia for valuable advice concerning possible connections between moon phases and meteorologic factors.

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