Original Contribution

Meteorologic parameters and migraine headache: ED study

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ABSTRACT

Aim: Migraine is common in society and is one of the primary causes of chronic headache with episodes. In this study, we aimed to determine the role of meteorologic parameters and moon phase on triggering migraine attacks and effects on the number of patients presenting to the emergency department with migraine headaches.
Materials and Methods: Patients admitted to the emergency department due to a migraine headache during a 1-year period were studied retrospectively.
Correlation between moon phases, pressure, temperature, humidity, wind speed values of meteorologic observation, and recording station located in the same city and daily number of patients was analyzed.
Results: A total of 3491 patients, of whom 72% (n = 2518) were women, were enrolled. The average daily number of patients was 9.6 ± 4 (3-24). A statistically significant correlation was found between the number of daily patients and daily maximum temperature ($P = .005$), mean temperature ($P = .013$), minimum temperature ($P = .041$), and daily temperature change ($P = .003$). In addition, a negative correlation was found between the daily number of patients presenting to the emergency department and daily relative humidity (in percentage; $P = .031$). No significant relationship was found between moon phases and the number of patients.
Conclusion: We have determined that the number of patients admitted to the emergency department with migraine headache has increased with high temperature and low humidity and that there is no relationship between the number of patients and moon phases.

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1. Introduction

Migraine, most common disease in the community, is one of the primary causes of chronic headache with periods of remission and exacerbations. It is seen in about 12% of population, and it is more common in women [1,2]. Migraine causes individuals to limit their daily activities because it has attacks that last for hours and even days, and these attacks cause occasional severe headaches [3,4]. Although causes that trigger migraine attacks and their mechanisms of action are not fully identified, many internal (personal) or external (environmental) factors such as hormonal changes, menstrual periods, emotional stress, hunger, fatigue, odors, noise, and sleep pattern changes trigger a migraine attack or cause an increase in headaches [5]. Identification and avoidance of the factors that trigger or aggravate migraine attacks constitutes the first and most important step in the prevention of migraine attacks. Because avoidance of trigger factors can significantly decrease severity or frequency of attacks, studies for identifying factors that trigger migraine attacks continue [6,7]. The results of the studies that examine whether

there is a relationship between migraine attacks and meteorologic parameters, an external cause, are different, so this suggests that the mystery of this issue is still unsolved and further studies are needed. Although positive correlations between migraine and bright snow cover, atmospheric pressure, wind, and temperature have been reported, some meteorologic parameters have been shown to have negative correlation or even no relationship. Hence, those results reveal the difference between the results of studies [7–13].

In the literature, the number of studies examining the correlation between the meteorologic parameters and the number of emergency department patients presenting with migraine attack is very low [14,15]. In our study, we also aimed to investigate whether meteorologic parameters affect the daily number of patients admitted to the emergency department with migraine headaches. In addition, we also investigated whether the daily number of patients with migraine attacks is affected according to moon phases. Our study differs from several previous studies because there are no subjective records such as headache diaries, personal comments are avoided by not making individual interviews, and a more objective evaluation was done. In addition, we aimed to determine the effect of our regional weather variables on the number of patients admitted to the emergency department with a migraine attack and share the results because most studies examining the effects of meteorologic parameters on migraine headache have different results.

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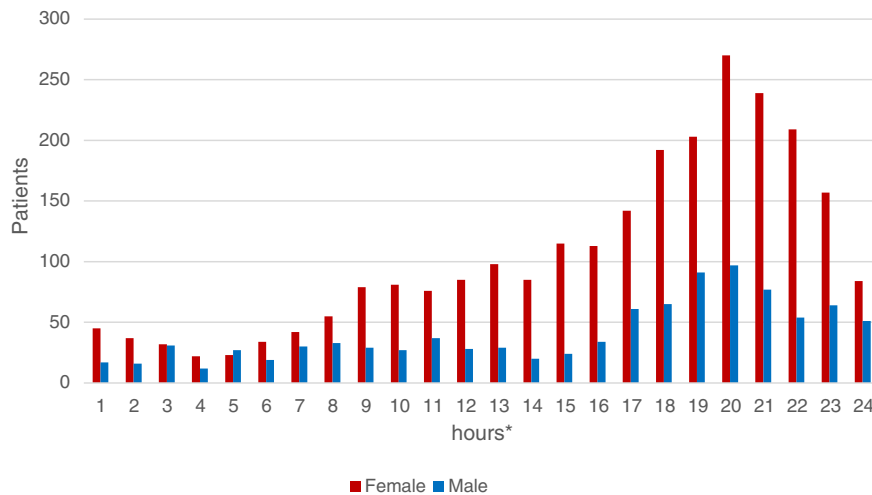
Fig. 1. The number of patients presenting to the emergency department by hours (*1 = 0100-0159; 2 = 0200-0259; 3 = 0300-0359 ... etc).

2. Materials and methods

2.1. Study patients

A total of 3491 patients older than 18 years who admitted to emergency department of a regional hospital located in Turkey between January 1 and December 31, 2013, with a headache that is consistent with migraine and whose diagnosis were encoded as G-43 from *International Classification for Diseases, 10th Revision* coding system were retrospectively evaluated. Patients who had other diseases causing headache (hypertension, subarachnoid bleeding, sinusitis, trauma, etc) were excluded from the study. Patients with recurrent hospital visits due to migraine attacks in 1 year were also included in the study.

2.2. Meteorologic data

Daily average-maximum-minimum (max-min) temperature (in degrees Celsius), atmospheric pressure (in millibars), humidity (in percentage), and wind speed (in meters per second) values were obtained from meteorologic observation and recording station located in the same city. Also daily max-min difference of atmospheric pressure and temperature was calculated. In addition, for each month, moon phases were enrolled in the study as new moon, first quarter, full moon, last quarter, and other days. For each moon phase (new moon, first quarter, full moon, last quarter), 1 day before and 1 day after were also included. Thus 3-day data were assessed for each moon phase. Number of patients in the days including each moon phase for a year was identified, and correlation between moon phases and number of patients admitted to the emergency department with a migraine headache was examined.

2.3. Statistical analysis

Statistical Package for the Social Sciences (SPSS 21, Chicago, IL) statistical software was used for data analysis. Numerical variables were expressed as mean $\pm$ SD and categorical variables as percentage. Independent-sample *t* test or 1-way analysis of variance was used for numerical data analysis and χ^2 test for categorical variables analysis. Pearson correlation test was used to determine the relationship between the numerical parameters. $P < .05$ was considered statistically significant.

3. Results

A total of 3491 patients who admitted to the emergency department with migraine headaches for a period of 12 months were included in our study. Patients with migraine headaches constituted 1.97% of all patients (3491/176 909) who admitted to the emergency department within 1 year. Seventy-two percent (n = 2518) of patients were female, and the average age of all patients was 36 $\pm$ 11 years. There was no difference between men and women according to the mean age ($P > .05$).

The average daily number of patients was 9.6 $\pm$ 4 (3-24). Regarding the time of day, migraine attacks were highest between 2000 and 2100 hours, and a total of 367 patients (270 female and 97 male) with migraine headaches were admitted to emergency department. Also, it was found that more migraine patients were admitted to the emergency department in the evening compared with other times of the day. Fifty-five percent (n = 1921) of all migraine patients were admitted to emergency department in the evening between 1700 and 2359. More than half (73.5%; n = 1412) of these patients were female. Arrival times of the patients by sex are shown in Fig. 1.

Most of the female patients had migraine attacks on Sunday (16.6%) and Saturday (15.3%). Most of the male patients were admitted to emergency department on Tuesday (15.4%) and Sunday (15.2%) (Fig. 2).

Most of the patients were admitted to emergency department with a migraine headache in October (10.5%) and November (10.6%). The number of patients presenting to the emergency department by month was presented in Fig. 3.

Statistically significant correlations were found between the daily number of patients and daily maximum temperature ($P = .005$), mean temperature ($P = .013$), minimum temperature ($P = .041$), and daily temperature change ($P = .003$). A negative correlation was found between the number of patients presenting to the emergency department and daily average relative humidity ($P = .031$). The relationship between daily number of patients and average temperature (minimum, average, and maximum) and the relationship between daily number of patients and average relative humidity are shown in Figs. 4 and 5.

No statistically significant correlation was found between the daily number of patients presenting to the emergency department and daily maximum-minimum, mean pressure, and daily pressure changes ($P > .05$).

Although a positive correlation was seen between the number of patients with migraine and daily average wind speed (in meters per second), this was not statistically significant ($P > .05$). The correlation between the daily number of patients and weather variables is shown in Table.

No significant correlation was found between the number of patients with migraine headaches and moon phases ($P > .05$). We also compared the moon phases and the number of patients for 4 seasons, but it did not provide a meaningful result.

4. Discussion

Causes that trigger migraine attacks are not elucidated and internal or external factors play a role. The effects of changes in meteorologic