DAY OF WEEK, MONTHLY AND SEASONAL VARIATION OF ACUTE MYOCARDIAL INFARCTION

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Abstract- ***The chronobiology of the acute myocardial infarction (AMI) is an interesting matter for recognition of the biological mechanism that might trigger AMI. The present study was aimed to investigate the circadian, seasonal and circannual variation of the AMI occurrence with solar, lunar, and Christian months. A retrospective study of 1174 cases with diagnosis of AMI was conducted. All cases included in our study were admitted to the coronary care unit of Shahid Behashti and Yahyanejad Hospitals in Babol, the north of Iran, between 1990 and 2000. The data was extracted by the day and month of diagnosis based on the solar, lunar and Christian calendar from hospital charts. The Chi-square test was used to test the uniformity of the observed frequencies of AMI onset in relation to the time factors based on solar, lunar, Christian and the days of week. The results showed that there was a significant trend toward higher rate of MI at the beginning of the week, on the Saturday (18.1%) and the least (12.3%) on Friday. Although, the observed frequency of AMI tended to be higher in Ordibehesht of solar month and Shaban in lunar month than other months, the monthly variation was not statistically significant (P >0.05). However, there was significant difference in MI occurrence in Christian months with high peak in November (P<0.05). Also, we did not found a significant seasonal variation of AMI where 26.2%, 23.1%, 26.8% and 23.9% of MI occurred in the spring, summer, fall, and winter respectively (P>0.05). The average number of AMI occurrence, was significantly greater in three days of full moon phase in lunar months than other days (P <0.05). Our results indicated a significant day of week variation in AMI occurrence with higher peak on Saturday and full moon phase of lunar month. With regard the lunar and solar month variation, more investigation, with larger sample sizes is still necessary, but in Christian months, MI occurrence was significantly increased in November.***
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Key Words: ***Myocardial infarction, chronobiology, moon, solar, time factors***

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INTRODUCTION

Cardiovascular diseases, especially myocardial infarction(MI) are the major causes of morbidity and mortality in the world (1). The knowledge of chronobiologic variation of some events and diseases, particularly, myocardial infarction is an issues of interest in the epidemiologic studies for the recognition of biological mechanism that might trigger myocardial infarction. Chronobiological variation was defined as a systematic biological rhythm in the alive creatures (2). Many alive creatures have a chronological mechanism that can change their situation automatically by temporal changing of day, month and seasonal variation. This mechanism is affected by different factors such as hormonal, neurological, chemical, genetical and immunological changes (3). There is a relationship between the changes of biological process and rhythmic pattern of arterial practices in the cardiovascular events. The biological mechanism causes that the indicators of behaviours of cardiovascular system such as pulse rate, hypertension, vasomotor tone and aggregation of platelets change during a day (4). The neurologic and hormone activities are the major factors in initiation of daily changes of cardiovascular function. For example, the vasomotor tone is a neurological and hormonal factor which affects on the resistance of arterial and it is increased when the ischemic attack occurs more in the morning than at other times of the day. Also, the platelet aggregation is a function of a specific daily changes and it is increased in the morning. Thus, the MI occurrence has a specific daily pattern; it has an obvious peak between at 6 AM to 12:00; the rate of its occurrence is greater about 2 to 3 times than other hours of the day (4). The reasons for this high occurrence in the morning are the morning increases in catecholamine concentration, blood pressure, serum cortisol and platelet aggregability (5). In addition to the circadian rhythm, some of behaviours have a seasonal variation. This rhythm is a function of environmental factors such as availability of food and environmental temperatures. It has been shown that some of hormones and vitamins, neurological and biochemical factors have a seasonal variation in

human being (4). For example, melatonin has a maximum rate in fall and winter and a minimum rate in spring and summer; the platelet activities increase in the spring and winter and decrease in fall for men and in the summer for women. In addition, T3 and T4 hormones have a maximum stimulation in the spring and summer. This high stimulation causes overfeeding and over activities in the animal (4). The occurrence of the some of events such as suicide, cardiac arrhythmias, especially atrial fibrillation, depression, labor, schizophrenia attack, the number of emergency ward admissions have been attributed to the sun and lunar rotation in the literature (6,7). Although, most epidemiologic studies focused on the circadian rhythm of MI occurrence, the seasonal and circannual rhythm is an issue of interest for investigation. With regard to the rotation of earth and month, it has been judged that some of the events occurred at specific time of these rotations. Particularly, when the moon is in full phase, its relation with some events has been considered in the literature (6). Although, the circadian rhythm of the MI occurrence has been documented by several studies in the literature, the effect of seasonal, circannual and circaseptan rhythm is still controversial. The aim of the present study was to determine the monthly variation of the MI occurrence with respect to the solar, lunar, Christian months and the days of week.

MATERIALS AND METHODS

A retrospective study of 1174 cases with diagnosis of MI was conducted. The consecutive patients with AMI were included in this study, who were admitted to the coronary care unit of two central educational hospitals of Shahid Behashti and Yahyanejad in Babol, the north of Iran, during 1990 to 2000. A standardized diagnostic criteria was used and all cases were diagnosed under supervision of the cardiologist based on the criteria of typical chest pain, typical electrocardiogram (ECG) changes and typical increase in CK and LDH cardiac isoenzyme. We reviewed the hospital charts of all patients with diagnosis of AMI. The data was including age, gender, type of MI: Q-wave, non-Q-wave) and the date of chest pain onset based on the day, month of solar, lunar and Christian calenderl. The statistical analysis was carried out using the Chi-square test to determine the homogenecity of observed frequency of MI onset over the different time periods based on day of week and monthly variation of solar, lunar and Christian calender.

RESULTS

The results showed that 62.6% of patients were male; the mean (mean±MSD) age of patients was 58.5 (±8.8) years and 47.7% cases were Q-wave MI and 52.3% non-Q-wave MI. Figure 1 showed that there was a significant trend toward higher admission rates at the beginning of the week on Saturday ($p<0.05$) where most cases(18.1%) were admitted on Saturday (the first working day in Iran) and the least cases (12.3%) on Friday (weekend).

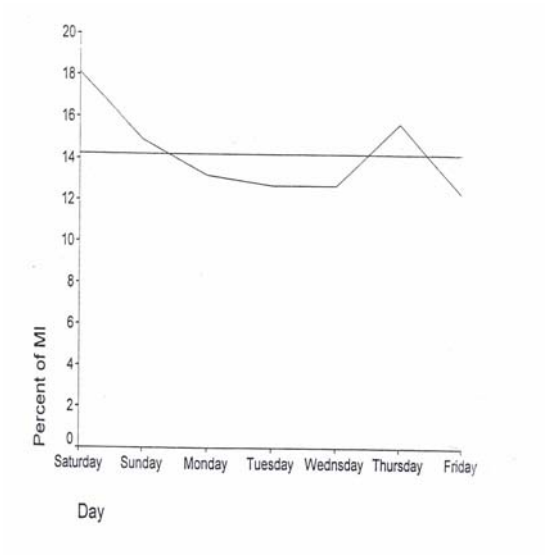

Fig. 1. Daily variation of MI occurrence

With respect to seasonal variation, 26.2%, 23.1%, 26.8% and 23.9% of MI occurred in the spring, summer, fall, and winter respectively and the difference in seasonal variation was not statistically significant ($P> 0.05$). We did not find a different variation of MI occurrence in the three decades of each month in solar and lunar rotation (roughly 33% of MI for each decade), but with respect to Christian calender months, the frequency of MI was significantly increased to 37.2 % in the third decade. Regarding the solar month variation, the results showed that most cases (10.3%) were admitted in Ordibehesht as a first peak of MI and the second peak was in Aban (9.7%); the least frequency (7.1 %) was in Esfand (Fig. 2). Based on the lunar month, the relative frequency tended to be greater in Shaban (10.3%) and the least (6.8%) was in Rabi-AL-Avval (Fig. 3). However, we did not observe a statistical significant monthly variation wit respect to the solar and lunar months ($P>0.05$). With the Christian calender, the highest rate (9.9%) was in November and the least (6.1%) in February (Fig. 4) and the difference in variation was significant ($P <0.05$). In addition, the daily average of MI occurrence was significantly greater in the three days of lunar month with full moon phases than other days ($P< 0.05$). We also did not find a significant difference of monthly variation of MI between males and females (Fig. 5), and also between Q-wave and non-Q-wave MIs (Fig.6).

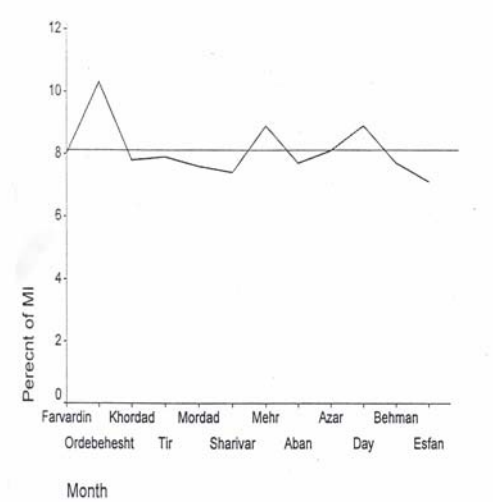

Fig. 2. Solar months and MI occurrence

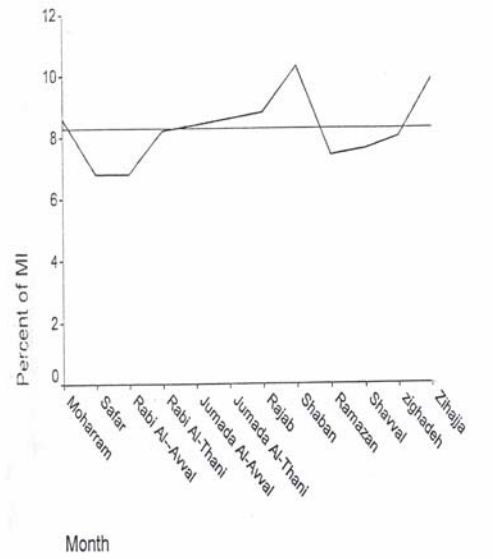

Fig. 3. Lunar months and MI occurrence

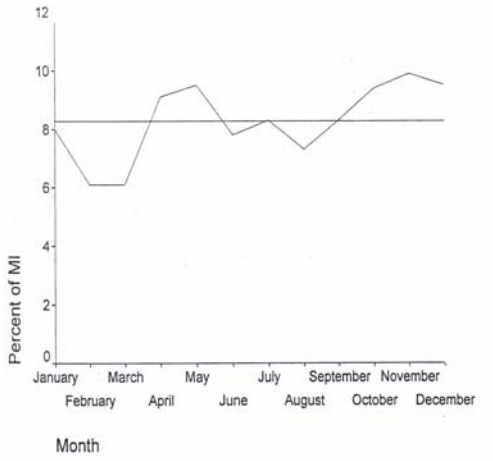

Fig. 4. Christian months and MI occurrence

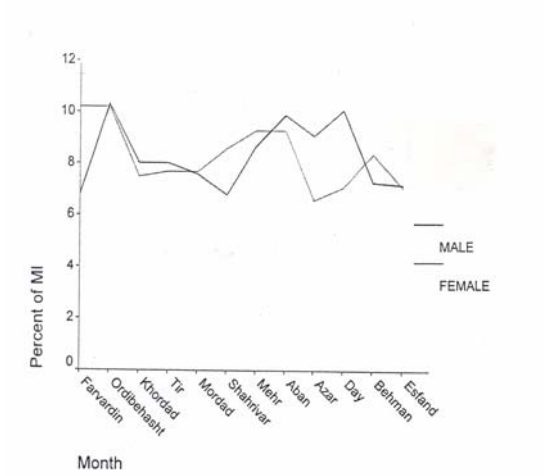

Fig. 5. Solar months and MI occurrence with respect to gender

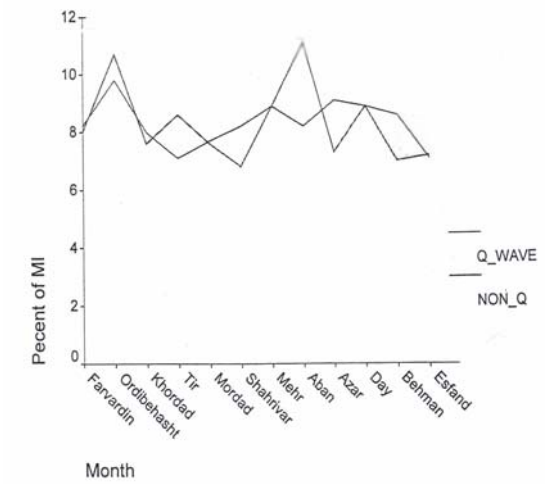

Fig. 6. Solar months and MI occurrence with respect to Q-wave and non-Q-wave MI

DISCUSSION

Out results showed that there was a weekly and monthly variation in the MI occurrence with respect to solar and lunar and Christian months. In particular, we found a significant increasing trend of MI occurrence on Saturday and the three days of full moon-days (14th.15th and 16th) in lunar months. In comparison with other studies, Shiva et al (2000) in Brazil, Genechi-Roscone et al (1994) in Italy (8), Willich et al (1994) in Germany (9), Vander-Palen and et al (1995) in Newziland(I0), had reported a greater occurrence of MI on Monday. Also, in studies of Spelberg et al (1995) in Germany (6) and Chiang et al (1999) in Taiwan (11), the least of MI was found on Saturday. Our resultsare inherently consistent with those reported in the literature since

the starting weekly working day is on Saturday in Moslem population of Iran that is similar to Monday in Christian calender and also Friday in Moslem population is the same as Sunday in Christian calender as a weekend. We think that people have more opportunity for resting and more flexibility for daily activities and less constraints and less working pressure on Friday (or Sunday in Christian calender). Thus, the rate of stress and spiritual pressure will be decreased essentially on Friday. On the other hand, on the first working day, people are exposed to more physical activities and more stress and they should plan their time with a specific schedule. Thus, in our study, the changing from the situation of low stress to high stress can explain the high incidence of MI on Saturday and the fewer number of cases on Friday compared to other week days. It is suggested that the freedom from stress or workload on Friday might have an important impact on low incidence of MI in Iranian population. Regarding monthly variation of MI based on solar month, we found that the occurrence of MI tended to be greater in Ordibehesht (10.3%) and the least occurrence of MI was in Esfand (7.1%). Also the observed frequency of MI tended to decrease in Shahrivar, and then again, it suddenly increases after summer holidays in Mehr and Aban as a second peak of MI; however, the difference was not achieved statistically significant. Since in Iranian population, Norouz national holiday lasts for the two first weeks of Farvardin, thus, the increasing number of MI in the Ordibehesht as second month of year might be due to the lack of tending of hospitalization duration Norouz holidays and the impact of the workload in the second month of the year, which can induce more physical stress in the occurrence of the first peak of MI in Ordibehesht. Again, in our findings, the increasing physical and mental activities can explain the second peak of MI in Mehr and Aban after summer holidays. In particular, changing from situations without stress(holidays) to high stress due to the working pressures can induce more number of MI. In the literature, also, the increasing of MI was reported after national Christian holidays and after summer. Spielberg et al (1996) observed an increasing number of MI in March and September (5) which are also consistent with those we found, in our study. With regard the lunar rotation, we observed frequency of MI tended to be greater in Shaban and the least was observed in Rabi AI-Avval. This increasing number of MI in Shaban might be due to the changing of nutritional regimens. Many of marriages and religious celebrations in Shaban may be a reason for avoiding from usual nutritional regimens. This also might be a reason to explain the increasing number of MI in Zihajja as a second peak of MI occurrence in the lunar months. The rate of MI decreased in Ramadan; it is probably due to fasting of Moslem population in this month. In terms of Christian monthly variation of MI, we found that the number of MI was significantly increased in November (9.9%) and the least was in February (6.1 %) and March (6.1 %) which are concurrent with Esfand and Farvardin respect to the solar months. In comparison to other studies, Spielberg et al (1996) found that the most and the least occurrence of MI was in March and June respectively (5). Also, Meal et al(2000) in England, reported most of the MI occurred in January (12). The results of both studies are not consistent with those we found These differences might be due to cultural differences and the lack of using Christian calender in Iran. In addition, the changes of climate, particularly, changing to cold weather might explain this variation. Thus, the increasing number of MI in November which is concurrent with Aban and Azar might be due to sudden changing of warm weather to the cold weather. In relation to seasonal variation of MI, we found that most cases (26.8%) was in fall and the least (23%) in summer. however the difference in pattern of seasonal variation of MI was not statistically significant. In other studies, (1998) in Taiwan (13) and Chiang and et al (1999) (11) also did not find any seasonal relation of occurrence of MI, which are also consistent with those we observed In contrast, in the other studies (14-17), in Europe and North America, more cases of MI were reported in the winter. These results might be due to the cold winter in the European countries and the North America. The difference in seasonal variation of MI in different countries may be due to the difference of variation of temperature. Since the north of Iran has a moderate climate which has not a large difference of temperature between seasons, this can explain the uniformity of distribution of MI in different seasons in our studies. In our study, the rate of observed frequency of MI occurrence was significantly greater during the full moon days of lunar months in comparison with the other days. In contrast, Sha et al (1989) in China, reported that the rate of MI occurrence obviously decreased around the full moon days and the sharp peak of incidence of MI and hemorragical characters were observed at the beginning and end of the lunar months (8), which do not conform with what we found in this study. This difference might be due to differences in cultural believes regarding accident with the phase of moon in different population. However, the effects of full moon on the occurrence of some accidents has been suggested in the literature. For example in a study of labour and lunar rotation, around the full moon, the more deliveries were observed (7). In addition, it has been reported that the occurrence of atrial fibrillation attack was decreased obviously during the three days with fullphase moon(19). In another study, the increasing consumption of food and decreasing consumption of alcohol had been reported during full moon days (20). While Wilkinson et al (1997) did

not find an increasing rate of depression and anxiety during the full phase moon (21). However, people in some cultures, might believe in the effects of days of full moon on the unpleasant accidents. Then, they might limit their physical activities in these day. In conclusion, our results showed a significant chronologic pattern of M1 occurrence with higher peak on Saturday and three days of full moon phase in the north of Iran. Thus, it is necessary to provide enough equipments to the hospitals and coronary care units in these days and to transmit load of working from the beginning of the week to middle. It probably decreases the MI occurrence. With regard to lunar and solar monthly variations, further investigations with larger sample sizes could help to detect some of the underlying possible triggering mechanisms of myocardial infarction for improving prevention of the disease.

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