

EFFECT OF SEASONAL VARIATION ON HOSPITAL ADMISSION IN CARDIOLOGY DEPARTMENT OF CHITTAGONG MEDICAL COLLEGE HOSPITAL, CHATTOGRAM

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Abstract

Background: Seasonal variation in the hospital admission of cardiac patients has been widely reported. However, limited data on Bangladesh is available regarding this matter. The aim of the current study was to investigate the effect of seasonal variation on hospital admission of cardiac patients in Cardiology Department of Chittagong Medical College Hospital.

Materials and methods: Over a period of two years (From April 2016 to March 2018) the number of patients hospitalized due to various cardiac ailments and number of death among these hospitalized patients were recorded on a day-to-day basis. The data were recorded according to the chief reason of hospital admission such as acute myocardial infarction (STEMI, NSTEMI) Unstable Angina (UA) Heart failure, cardiomyopathy (Ischemic and Dilated) arrhythmia. The data were cumulated and analyzed on month-wise and season-wise manner.

Results: A total of 22985 patients were admitted over the study period. 13408 were male and 9577 were female, M/F ratio 1.4:1). The highest number of patients were admitted during winter 7375(32.08%) and lowest during summer 4623 (20.11%). The hospital admission was also significantly higher in winter compared to other seasons. Acute MI (n = 2374) acute LVF (n = 1582) and UA (n = 1277) were the top three reasons for hospitalization. Number of death also significantly higher in winter compared to other seasons.

Conclusion: A seasonal variation in the hospital admission due to CVDs with a peak in winter was clearly demonstrated in the study. These data could be useful to improve causative prevention measures, therapeutic management and educational strategies.

Key words : Seasonal variation; CVD; Hospital admission.

Introduction

Cardiovascular diseases are the number one cause of death worldwide. These are leading cause of death in Bangladesh. Increasing prevalence of cardiovascular diseases in our country results in a sharp increase in hospital admission here. Also, death due to acute coronary syndrome, heart failure and other cardiac illness gradually increasing in our hospitals. Several studies reported a seasonal variation in the hospital admission due to cardiac diseases with an increased rate during winter.^{1,2} However Bangladeshi data on seasonal variations in hospital admission are scanty. This study was conducted to find out such variation in hospital admission and death among patients admitted with various cardiac ailment in the Department of Cardiology of Chittagong Medical College Hospital.

Materials and Methods

This was an observational study using medical records as database from Feb 2017 to January 2018. Purposive sampling was done in data collection. Over a period of two years (From April 2016 to March 2018) the number of patients hospitalized due to various cardiac ailments and number of death among these hospitalized patients were recorded on day-to-day and month-to-month basis. Data were recorded according to the chief reason of hospital admission such as acute myocardial infarction (STEMI, NSTEMI) Unstable Angina (UA) heart failure, cardiomyopathy (Ischemic and dilated) arrhythmia. The data were cumulated and analyzed on month-wise and season-wise manner. Data recording were done according to chief reasons of hospital admission e.g. AMI (STEMI & NSTEMI) UA, heart failure (Acute LVF & CHF) syncope, arrhythmia, valvular, congenital, cardiomyopathy etc. Diagnosis were done according to standard practice in cardiology. Patients dying after hospitalization were recorded

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under cardiac death. Seasons were defined as follows: Summer=May to July (Average temp- 29.3^oC) Autumn=August to October (Average temp- 25.1^oC, Winter=November to January (Average temp=19.8^oC) Spring=February to April (Average temp- 27.4^oC). Seasonal temperature collected from weather authority. Primary study end points were adjusted seasonal average of patients admitted and died. Adjusted seasonal average of patients admitted was calculated by normalizing the total number of cases for each season to a standard 90 day long length. For example, the number of cases occurring in the winter equaled the number of cases from 1st Nov to 31st January divided by the total number of days in this period (i.e 92) multiplied by 90.³ Statistical analysis was done by using SPSS-21. Confidence Interval (CI) was set at 95% and a p value < 0.05 was considered as significant.

Results

Total patient admitted were 22,985. Out of them 13,408 were male and 9,577 were female (Male: Female=1.4:1). Highest number admitted were during winter: 7, 375 (32.08%) lowest number admitted during summer were 4,623 (20.11%). During spring it was 5,750 (25.01%) and during autumn it was 5, 237(22.78%).

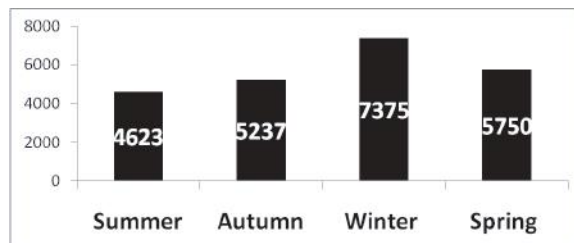


Fig 1 : Diagram showing number of patients admitted in four seasons (n=22985).

The hospital admission was also significantly higher in winter compared to other seasons (p-value versus summer, autumn and spring was 0.018, 0.020 and 0.023 respectively).

Acute myocardial infarction, unstable angina and heart failure were three major reasons for admission. Acute myocardial infarction comprised both ST elevated myocardial infarction and non ST elevated myocardial infarction. All three reasons of admission were more during winter season compared to other seasons. Table I shows number of patients with their diagnosis admitted in different seasons.

Table I : Diagnosis of patients admitted in different seasons (n= 22985).

Clinical Diagnosis	Summer	Autumn	Winter	Spring	Total	%
AMI	1288	1446	2209	1752	6695	29.13
UA	1051	1303	1706	1192	5252	22.85
HF	1006	1177	1679	1237	5099	22.18
Valvular	281	346	534	465	1626	7.07
Arrhythmia	103	138	221	202	664	2.89
Cardiomyopathy	61	63	88	71	283	1.23
Syncope	48	62	91	67	268	1.17
Congenital	62	69	98	77	306	1.33
Nonspecific chest pain	257	176	170	178	781	3.40

Fig 2 shows graphical representation of admission trend of patients in different months during the study period. There was peaking of admission which started in October and continued upto end of February.

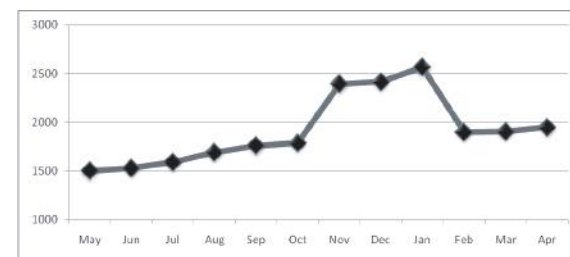


Fig 2 : Trend of admission of the patients (n=22985).

Fig 3 shows disease wise tendency of admission with peaking of admission of the three major disease i.e. acute myocardial infarction, unstable angina and heart failure.

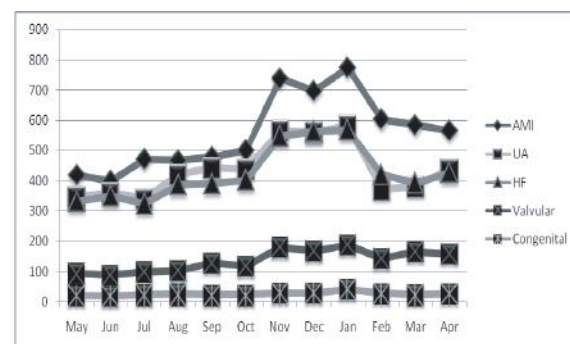


Fig 3 : Trend of admission of diseases (AMI-Acute Myocardial Infarction, UA-Unstable Angina, HF-Heart Failure).

Analysis of season wise admission shows significant variation in admission during Summer (p=0.016) autumn (p=0.019) winter (p=0.021) and spring (p=0.017). A higher number of admission during winter was found (Table II).

Table II : Season wise mean hospital admission (n=22985).

Per month Admission (Season)	Mean	SD	p value
Summer	154.10	±10.63	0.016*
Autumn	174.57	±9.41	0.019*
Winter	245.83	±12.50	0.021*
Spring	191.67	±11.20	0.017*

Analysis by pearson correlation showed a significant strong correlation with seasonal variation in clinical outcome during summer (p=0.021) during autumn (p=0.01) during winter (p=0.007) and during spring (p=0.009). The hospital admission was also significantly higher in winter compared to other seasons (p-value versus summer, autumn and spring was 0.018, 0.020 and 0.023 respectively). Total number of death were also more during winter season compared to other seasons. Table III shows the mortality pattern in different seasons.

Table III : Number of death of patients admitted in different seasons (n=22985).

Season	No. of deaths	Percentage
Summer	466	23.17
Autumn	457	22.73
Spring	509	25.31
Winter	579	28.79
Total	2011	100

Thus a higher Number of admission of different cardiac illness and consequent death were recorded during winter compared to other seasons (p-value versus summer, winter and spring was 0.044, 0.050 and 0.014 respectively).

Discussion

The present study showed a statistically significant seasonal variation in the hospital admission due to CVDs with a peak in winter in a leading hospital of Bangladesh. Findings of our study are similar with the results of several other studies, performed in different countries.^{1,2} The cold weather and its relationship with the increased incidence of various CVDs leading to hospitalization have been explained by several authors.^{3,4} In particular, the greater incidence of cardiovascular mortality and acute MI during the winter is well known.^{5,6} The mechanisms involved here are multi-factorial. In cold conditions both increased sympathetic nervous activity and greater sodium intake lead to an increase in blood pressure, heart rate, and left ventricular end-diastolic pressure

and volume with, in turn, greater heart oxygen requirement and reduction of ischemic threshold that may be clinically relevant in patients whose coronary circulation is already compromised.⁷ There may be also more dramatic events, such as sudden death, due to the increased frequency of cardiac arrhythmias or perhaps through rises in blood pressure, abrupt rupture of atherosclerotic plaques.⁸ In cold weather, a greater tendency to clot in circulatory system has been demonstrated.^{9,10} This could be related to plasma volume contraction (Hemoconcentration).^{11,12} The greater incidence and severity of Heart Failure (HF) leading to hospitalization during the winter is also widely reported.¹³ A patient with HF has little physiological reserve to deal with an increase in cardiac workload. Temperature reduction can cause physiological changes leading to HF decomposition and increased hospitalization rates (eg, overload secondary to increased heart rate and total peripheral resistance, changes of total extracellular volume secondary to decrease in water loss by transpiration and perspiration, increased blood pressure values and arrhythmias).^{8,14} Moreover, higher rates of infectious diseases in winter, particularly respiratory tract infections, may play a role. Again, C-reactive protein levels, a well-recognized marker of the potential risk of cardiovascular events, shows a seasonal variation as well, characterized by a winter peak. Blood pressure levels are higher during winter months.¹⁵ When the temperature falls, a compensatory vasoconstrictive response, particularly to the skin, is observed. This is associated with an increased afterload for the failing heart and is achieved by upregulation of the neurohumoral cascade and increased levels of vasoconstrictors. Therefore, cardiac work increases to overcome the rise in afterload, and at the end-stage the failing heart is unable to cope with this increased demand.^{6,16,17} Khan RC et al in a study of 8371 patients found the percentage of hospital admission as:AMI 30.1%,UA 33.1%,HF 32.5%.¹⁸ Death rate in their study were: winter 31.5%, autumn 24.6%, spring 21.5%, summer 22.6%. An increase in AMI and death due to AMI in colder weather was reported in USA (Wisconsin) UK, India and Australia.^{19,20} Although, a Tasmanian study showed no correlation between maximum & minimal temperature and AMI occurrence. Increased AMI in winter noticed

first in 1930. Increased morbidity and mortality from AMI during winter and autumn in most age and sex group.²¹ Highest hospitalization due to UA in winter, in a study of 2489 patients in Italy correlated with combination of critical low temperature and humidity. In a study in Canada admission due to unstable angina was more in summer. Heart failure admission were more in winter and less in summer in USA, Europe, Argentina, Australia, Japan, Canada, Nigeria.

Limitations

It is a single centre study and may not reflect the complete scenario of Bangladesh. Temperature of a geographical area may not accurately represent actual individual temperature exposure, which may be influenced by personal factors. Hemodynamic and rheological alterations of temperature variability has not been investigated. Influence of demographic factors such as age, sex, occupation on hospital admission & mortality has not been investigated. Data on relative humidity is missing

Conclusion

A seasonal variation in hospital admission of CVDs and its mortality exists. Both number of hospital admission and mortality is highest during winter and lowest during summer. Risk of CVD appears to be greatest during winter months. These findings may be helpful in determining therapeutic strategies, such as managing effectively the hospital beds and other resources in winter. Data may be useful in improving preventive measures in susceptible patients.

Recommendations

The authors suggest multicenter large scale prospective study to get more relevant information.

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Contributions of authors

PKD-Conception, data acquisition, drafting & final approval.

AA-interpretation of data, critical revision & final approval.

AIYMJ-Data acquisition & interpretation of data, drafting & final approval.

NI-Interpretation of data, analysis data, critical revision & final approval.

RR-acquisition of data, analysis, drafting & final approval.

SS-Interpretation of data, critical revision & final approval.

SR-Data analysis, drafting & final approval.

Disclosure

All the authors declared no competing interest.

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