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Original Article

Effects of Seasonal Variations on the Outcome of Coronary Artery Bypass Graft Surgery

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Abstract

Background: For all the reports on the association between seasons and coronary artery disease, there is a paucity of information on the possible effects of seasonal variations on the outcome of patients after coronary artery bypass grafting surgery (CABG). The aim of this study was to assess the short-term outcome of post-CABG patients in the four different seasons to find any correlation between seasonal variations and the outcome of such patients.

Methods: Data on patients who underwent cardiac surgery between 2007 and 2009 were analyzed. In-hospital mortality, length of Intensive Care Unit (ICU) stay, and length of hospital stay in the four different seasons were considered as outcome measures. The EuroSCORE was calculated for all the patients, and the Kruskal-Wallis, Mann-Whitney, Student *t*, and chi square tests were used as appropriate.

Results: Of a total of 402 patients, who underwent CABG during the mentioned period, 292 patients were male (M/F ratio=2.65). There were no differences in terms of mean age, sex ratio, and mean EuroSCORE of the patients between the seasons. The mean length of ICU stay was significantly more in the spring than that of the other seasons (P<0.001), while the difference between the four seasons regarding the mean length of hospital stay did not constitute statistical significance (P=0.22). No effect of seasonal variations was found for the lengths of ICU and hospital stay in the presence of the EuroSCORE after multiple logistic regression analysis (P=0.278, 0.431).

Conclusion: Psychological mood changes caused by regional cultural differences rather than environmental factors should be considered in the optimal management of patients after CABG.

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Introduction

It is believed that many systems in the body have diurnal variations, including daily, monthly, and seasonal ones.[1] Such variations can be of far more significance when it comes to specific critical situations. For example, it has been reported that the mortality rate in the wake of cardiopulmonary arrest is higher in winter than that in summer.[2]

There are various reports on the association between seasons and coronary artery disease as well as acute myocardial

infarction.[3,4] It has been suggested that coronary events are more prevalent in winter because of possible changes in the blood pressure caused by lower temperature,[5] or in consequence of changes in the levels of fibrinogen, which might be induced by winter respiratory infections that can activate the acute phase reactants.[6] Lifestyle risk factors are likely to play a part as well.[7]

Animal studies have shown that higher sympathetic tones or catecholamine levels are responsible for seasonal variations in sudden death after myocardial infarction.[8] Even though the existing literature contains information on the role of seasonal variations in the effects of some drugs on patients prepared for coronary artery bypass grafting surgery (CABG),[9] precious little is currently available on the possible effects of seasonal variations on the outcome of patients following CABG.[1] The aim of this study was to assess the short-term outcome of post-CABG patients in the four seasons to seek any possible correlation between seasonal variations and CABG outcome.

Patients and Methods

The data on all patients who underwent CABG between January 2007 and December 2009 in two private hospitals in Shiraz, Iran were analyzed. The seasons were defined as spring (March 21 to June 21), summer (June 22 to September 22), autumn (September 23 to December 21), and winter (December 22 to March 20).

In-hospital mortality, length of Intensive Care Unit (ICU) stay, and length of hospital stay were considered as outcome measures. The EuroSCORE (European System for Cardiac Operative Risk Evaluation) was calculated for all the patients. The EuroSCORE is a risk model which can calculate the risk of death after cardiac surgery. In this model, 17 different questions (regarding age, sex, arteriopathy, previous surgery, serum creatinine, pulmonary disease, etc.) are asked, and specific software is utilized to calculate the risk via logistic regression.

SPSS software version 17 was used for statistical analysis. The continuous variables are reported as mean±standard deviation or median, and the categorical variables are reported as frequencies and proportions. The Kruskal-Wallis, chi square, and ANOVA tests were employed as appropriate.

The effect of seasonal variations on hospital mortality, length of ICU stay, and length of hospital stay was assessed using multiple logistic regressions in the presence of the EuroSCORE to adjust for the other confounding factors that could affect the outcome of operations.

Results

Of all the patients who underwent CABG between January 2007 and December 2009 in our centers, only 436 patients had complete archived files to permit the required analysis. Of the 436 patients, 402 received CABG and the remaining 32 patients had CABG combined with some other types of cardiac surgery. The latter group was excluded from the analysis.

There were no differences as regards the mean age and the sex ratio of the patients between the four seasons (table 1).

In the mentioned period, only 3 deaths occurred: 2 deaths in spring and one in summer. None of the mortalities occurred in the ICU. No statistical differences could be found between the seasons for the death variable.

The mean EuroSCORE was not different between the patients in the four seasons (P=0.37, table 1). The mean length of ICU stay was significantly more in spring than that in the other seasons (P<0.001, Kruskal Wallis test), whereas there were no such significant differences in the mean length of hospital stay between the four seasons (P=0.22, Kruskal Wallis test). There was no significant difference in the frequency of

Table 1: Characteristics of the patients who underwent coronary artery bypass grafting surgery in various seasons

Characteristics	Spring	Summer	Autumn	Winter	P value
Mean age (SD)	59.87±12.06	59.88±13.26	60.92±10.27	58.68±12.02	0.086
Male sex/total (%)	107/136 (78.7%)	93/132 (70.5%)	68/94 (72.3%)	25/40 (62.5%)	0.17
Mean EuroSCORE (SD)	5.99±3.04	6.33±2.77	6.19±2.74	6.35±3.16	0.37
Mean ICU stay (SD)	4.00±1.45	3.75±1.55	2.87±1.33	3.70±1.30	<0.001
Mean hospital stay (SD)	5.49±2.92	5.27±2.66	5.40±2.74	5.10±1.17	0.22
ICU mortality	0	0	0	0	
Hospital mortality	2	1	0	0	-----
Hypertension (%)	77 (56.6%)	47 (35.6%)	58 (61.7%)	17(42.5%)	0.082
Previous myocardial infarction (%)					
<6 months	19 (67.9%)	28 (87.5%)	15 (62.5%)	9 (69.2%)	0.15
>6 months	9 (32.1%)	4 (12.5%)	9 (37.5%)	4 (30.8%)	0.15
Chronic pulmonary disease	7 (5.1%)	13 (9.8%)	11 (11.7%)	4 (10.0%)	0.31

hypertension, chronic pulmonary disease, and previous myocardial infarction in the patients in the various seasons (table1).

Our results demonstrated no effect of seasonal variations on the mean lengths of ICU and hospital stay in the presence of the EuroSCORE after multiple logistic regression analysis (P=0.278, 0.431).

Discussion

In this study, we found no demographic variation between the patients who underwent CABG in our centers in the four seasons of the year, and nor was the mortality of such patients different in the various seasons, which can mostly be attributed to the lower mortality rate in our centers. Other reports have also shown that there is no difference with respect to early mortality rates between patients who undergo CABG in winter and those who are operated on in summer.[1] Tan and colleagues,[10] reported that elective CABG can be performed in any month of the year, without compromising the outcome. This is in contrast with the findings of Shuhaiber and colleagues,[11] who reported higher hospital mortality rates in winter than in the other seasons. The authors also reported decreased odds of mortality in summer. Changes in the seasonal patterns of coronary mortality with time have been previously reported, and they were attributed to the improvements in indoor and vehicular heating and air conditioning.[12] Nevertheless, in patients undergoing cardiac surgery whose environmental condition is under control, such differences in mortality reports require further elucidation.

We also found that although the total length of hospital stay was not different in the four seasons, the patients having undergone CABG in spring had lengthier ICU stays than those having undergone CABG in the other seasons. It has been previously reported that hospital admissions due to coronary heart disease rise in spring.[13] Our finding is in contrast with other reports showing lengthier ICU stays in winter in post-CABG patients.[11] This difference might partly be explained by the specific culture of our community and the impact of the psychological status of the patients. Spring marks the beginning of the Iranian New Year and is as such the traditional festive season; it can, therefore, be argued that patients scheduled for major operations such as CABG in spring might be more prone to depression by comparison to their counterparts scheduled for similar surgical modalities in the other seasons. In this regard, Sher,[14] hypothesized that winter-induced depression might suppress the immune system and increase the mortality rate of cardiovascular diseases. However, such depression might be credited to the start of the New Year and related holidays in western countries and the effect of major illnesses on people in the festive season rather than the cold weather.[15] And finally to reiterate, the controlled environmental heating in CABG patients during operations and ICU and hospital stays overshadows the role of cold weather in CABG patients.

Conclusion

Different factors can be associated with the effect of seasonal variations on the outcome of CABG. Regional cultural differences rather than environmental factors should be taken into account for a more desirable management of post-CABG patients.

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Conflict of Interest: None declared.

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