

The Ethnic Characteristics and Prevalence of Diabetes Mellitus, Hypertension and Hyperlipidaemia in Patients Who Underwent Coronary Artery Bypass Grafting in Hospital Universiti Kebangsaan Malaysia

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Summary

A retrospective study was done on 302 patients who had undergone coronary artery bypass grafting (CABG) in Hospital Universiti Kebangsaan Malaysia - 46.0% were Chinese, 40.1% were Malays and 11.6% were Indians. Overall and irrespective of race and sex, the prevalence of diabetes mellitus, hypertension and hyperlipidaemia was 45.7%, 78.8% and 89.1% respectively indicating that hyperlipidaemia was the most prevalent risk factor amongst this cohort. The Indians had the highest prevalence of the three risk factors. The Chinese and the Malays most frequently presented with the combination of hypertension and hyperlipidaemia.

Key Words: Diabetes mellitus, Hypertension, Hyperlipidaemia, Malays, Chinese, Indians, CABG

Introduction

Cardiothoracic surgical services started in HUKM in December 1998, and coronary artery bypass grafting (CABG) operation stands as the most frequent procedure performed. Up to date, there are as yet no published figures on the risk factors of ischaemic heart disease (IHD) pertaining to CABG patients in Malaysia, therefore this paper attempts to shed some light on the matter.

Since the Framingham Heart Study in 1948, numerous experimental and epidemiologic

studies in various countries have been undertaken. Several risk factors related to the development of IHD have been identified and these include a high serum cholesterol, glucose intolerance, and high blood pressure. Epidemiological research in diabetes, hypertension, hyperlipidaemia and IHD has been made difficult by inconsistent definitions and methods of ascertainment of the risk factors. Despite this, many population-based and demographical studies have shown increased rates of IHD^{1,2}.

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Studies on the prevalence of IHD risk factors among Malaysians have been on the rise since the early 1960s³. Various literature reviews showed some distinctive ethnic characteristics related to the prevalence of IHD risk factors and mortality in peninsular Malaysia over the last three decades. The life expectancy at birth has risen from 56 years in 1955 to 69.3 years in 2000 for men, and from 58 years to 74.0 years for women during the same period⁴. As people live longer, degenerative diseases including cardiovascular diseases are becoming more evident.

Khoo et al⁴ reported that cardiovascular mortality in Malaysia has increased 15 fold from 1950 to 1989. Since 1970, cardiovascular disease has been the most commonly reported cause of death with coronary artery disease specifically identified as the leading cause of mortality.

Materials and Methods

A retrospective cohort study was conducted in the HUKM. The cohort comprised of 302 patients of different ethnic groups who have undergone CABG operation from the 8th of December 1998 to the 10th of September 2001. The patients' medical backgrounds were obtained from a database collated by a cardiothoracic surgeon working in HUKM. The medication history was acquired from the hospital's computer network file.

The three main risk factors of IHD i.e. diabetes mellitus (defined as fasting glucose of more than 7.0 mmol/l), hypertension (blood pressure of more than 160/95 mmHg) and hyperlipidaemia (defined as serum cholesterol of more than 7.0 mmol/l and/or serum triglycerides of more than 3.0 mmol/l) were considered. Smoking as a risk factor was ignored due to much inconsistency in smoking habit and pattern in most patients (e.g. smoking of cigars and pipes), and from previous experience patients may not provide accurate information on the number of cigarettes smoked. The patients were divided into seven groups according to the presence of risk factors or their combination. The groups were analysed with

regards to their sex, age and ethnic background. The groups are as follows:

1. Diabetes mellitus (DM) only,
2. Hypertension (HT) only,
3. Hyperlipidaemia (HL) only,
4. A combination of DM and HT,
5. A combination of DM and HL,
6. A combination of HT and HL,
7. Presence of all these risk factors, namely DM, HT, and HL.

The mean age and standard deviation for each race were calculated using statistical functions in the Microsoft® Excel 2000 package. Statistical significance tests between proportions were performed using a conventional scientific calculator.

Results

The age range of the cohort was from 36- to 77-year-old. The mean age was 58.0-year-old, and the standard deviation was 8.6 years. The percentages of male and female patients were 78.1% and 21.9% respectively. The majority of the patients, 139 (46.0%), were of Chinese origin. There were 121 (40.1%) Malays, 35 (11.6%) Indians, and 7 (2.3%) patients of other races. The demographic characteristics of the patients are illustrated in Table I. The distribution of age and sex in the Malays, the Chinese and the Indians are shown in Figure 1, Figure 2 and Figure 3 respectively.

Out of the 302 patients who underwent CABG operation from the 8th December 1998 to the 10th September 2001, 138 patients had diabetes mellitus (45.7%), 238 were hypertensive (78.8%), and 269 (89.1%) had hyperlipidaemia, indicating that hyperlipidaemia was the most prevalent single risk factor.

A significant proportion of patients (34.4%) had a combination of all three risk factors. The presence of hypertension and hyperlipidaemia (two risk factors) was equally prevalent at 34.8%.

There were 4 patients (3 Malays and 1 Chinese) who did not qualify into any of these groups i.e. they neither had DM, HT nor HL. Table II, Table III and Table IV show the prevalence of single risk factor in each race. Table V, Table VI and Table VII demonstrate the prevalence of double risk factors in the different races, and Table VIII, the prevalence of all three risk factors.

A substantial proportion of Indians (45.7%) possessed all three risk factors when compared to the Chinese ($p < 0.05$) or the Malays ($p < 0.05$). There was no significant difference between the Chinese and the Malays in this group.

The Indians also had the highest prevalence of diabetes (57.1%) compared to the Chinese ($p < 0.05$) or the Malays ($p < 0.05$).

The combination of hypertension and hyperlipidaemia seemed to be more prevalent in the Chinese. 41.0% of the Chinese fell into this group compared to only 31.4% of the Malays, and 22.9% of the Indians (both $p < 0.05$).

Like the Chinese, hypertension and hyperlipidaemia were most prevalent amongst the Malays.

Table I: Demographic characteristics of patients

| | Mean age \pm standard deviation deviation | Gender | | Total (%) |
|--------------|---|-------------------|------------------|------------|
| | | Male (%) | Female (%) | |
| Race | | | | |
| Malay | 48.8 \pm 9.2 | 109 (36.1) | 12 (4.0) | 121 (40.1) |
| Chinese | 64.2 \pm 8.0 | 94 (31.1) | 45 (14.9) | 139 (46.0) |
| Indian | 56.7 \pm 7.4 | 29 (9.6) | 6 (2.0) | 35 (11.6) |
| Others | 59.0 \pm 7.1 | 4 (1.3) | 3 (1.0) | 7 (2.3) |
| Total | | 236 (78.1) | 66 (21.9) | |

Table II: Prevalence of Single Risk Factor - DM (sexes combined)

| Patients | No | No with DM | % with DM |
|------------------|------------|------------|------------|
| Malays | 121 | 1 | 0.8 |
| Chinese | 139 | 1 | 0.7 |
| Indians | 35 | 0 | 0 |
| Others | 7 | 0 | 0 |
| All races | 302 | 2 | 0.7 |

Table IV: Prevalence of Single Risk Factor - HL (sexes combined)

| Patients | No | No with HT | % with HT |
|------------------|------------|------------|-------------|
| Malays | 121 | 19 | 15.7 |
| Chinese | 139 | 15 | 10.8 |
| Indians | 35 | 4 | 11.4 |
| Others | 7 | 0 | 0 |
| All races | 302 | 38 | 12.6 |

Table III: Prevalence of Single Risk Factor - HT (sexes combined)

| Patients | No | No with HT | % with HT |
|------------------|------------|------------|------------|
| Malays | 121 | 7 | 5.8 |
| Chinese | 139 | 7 | 5.0 |
| Indians | 35 | 3 | 8.6 |
| Others | 7 | 0 | 0 |
| All races | 302 | 17 | 5.6 |

Table V: Prevalence of Two Risk Factors - DM and HT (sexes combined)

| Patients | No | No with DM and HT | % with HT and HT |
|------------------|------------|-------------------|------------------|
| Malays | 121 | 4 | 3.3 |
| Chinese | 139 | 4 | 2.9 |
| Indians | 35 | 3 | 8.6 |
| Others | 7 | 0 | 0 |
| All races | 302 | 11 | 3.6 |

Table VI: Prevalence of Two Risk Factors - DM and HL (sexes combined)

| Patients | No | No with DM and HT | % with HT and HT |
|------------------|------------|-------------------|------------------|
| Malays | 121 | 12 | 9.9 |
| Chinese | 139 | 7 | 5.0 |
| Indians | 35 | 1 | 2.9 |
| Others | 7 | 1 | 14.3 |
| All races | 302 | 21 | 7.0 |

Table VII: Prevalence of Two Risk Factors - HT and HL (sexes combined)

| Patients | No | No with HT and HL | % with HT and HT |
|------------------|------------|-------------------|------------------|
| Malays | 121 | 38 | 31.4 |
| Chinese | 139 | 57 | 41.0 |
| Indians | 35 | 8 | 22.9 |
| Others | 7 | 2 | 28.6 |
| All races | 302 | 105 | 34.8 |

Table VIII: Prevalence of Three Risk Factors - DM, HT, and HL (sexes combined)

| Patients | No | No with DM, HT and HL | % with Dm, HT and HL |
|------------------|------------|-----------------------|----------------------|
| Malays | 121 | 37 | 30.6 |
| Chinese | 139 | 47 | 33.8 |
| Indians | 35 | 16 | 45.7 |
| Others | 7 | 4 | 5.7 |
| All races | 302 | 104 | 34.4 |

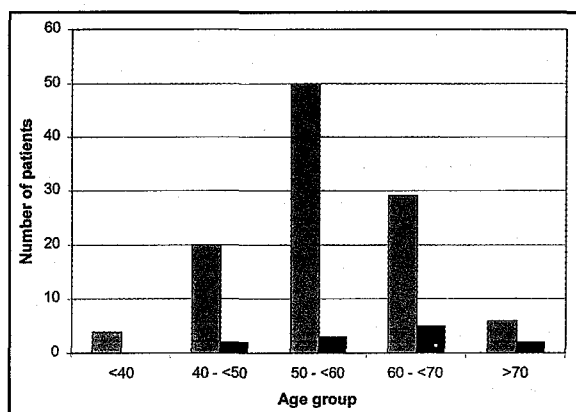


Fig. 1: Distribution of age and sex in the Malays

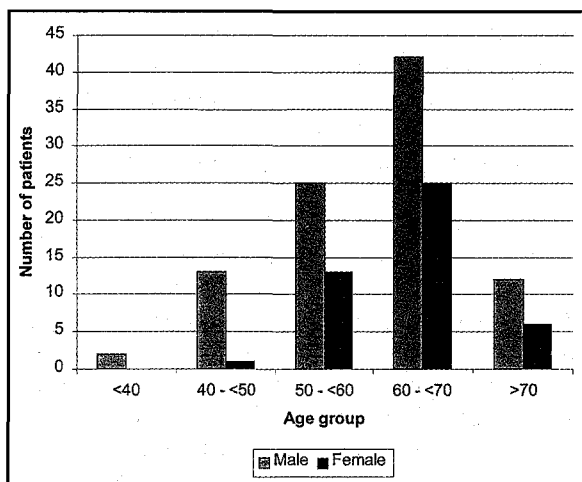


Fig. 2: Distribution of age and sex in the Chinese

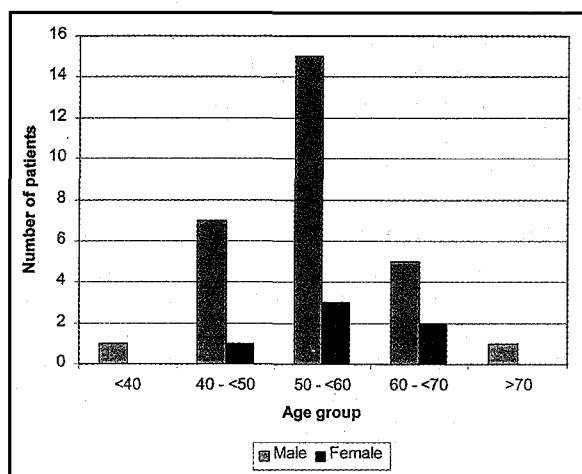


Fig. 3: Distribution of age and sex in the Indians

Discussion

The mean age of the cohort (58.0 years) was relatively young. The mean age quoted in similar types of study in the Western world ranges from 61.4 years in Britain to 64.4 years in France⁵.

For males, the highest percentage of CABG patients originated from the age group 40 to 50 years, in agreement with published findings^{2,3}.

For females, the most frequent age group was between 60 to 70 years. This trend could well be

due to the loss of the cardio-protective effect of oestrogen after the menopause (average age at 50.7 year old⁶). The risk of developing IHD in post-menopausal women has been shown to approach that of their male counterparts⁶.

Diabetes mellitus

Diabetes mellitus is an established independent risk factor for significant morbidity and mortality after coronary artery bypass grafting. Although the sample size of this study was small and statistical significance could not be achieved, the prevalence of diabetes observed at 45.7% (race and sex combined) was higher than those of the Western counterparts. Vinod et al (1998)⁷ cited 18.7% of his patients in Georgia, USA; Roques et al (1999)⁸ quoted 16.7% amongst 19,030 French CABG patients; Nashef et al (2000)⁹ found diabetes was present in 20.34% of 11,731 European patients (ranging from 11.8% in Britain to 27.7% in Spain); and 29.0% of 9,965 Texan (USA) patients in the study by Magee et al (2001)⁹ had diabetes mellitus.

A high prevalence of diabetics correlates to an increased frequency of intra-operative complications. Angiographic and necropsy studies show that patients with diabetes have more extensive and severe coronary artery disease than those without diabetes. Plaque rupture with intracoronary thrombosis is increased, as are subsequent cardiac events¹⁰.

This study concurs with various published literatures,^{7,9} which found the prevalence of hypertension was higher in the diabetic group compared to the non-diabetic group (83.3% vs. 74.4%, $p < 0.05$). However, there was no significant difference in the number of female patients in both groups (23.2% in diabetics vs. 20.7% in non-diabetics). The difference in the prevalence of hyperlipidaemia was also not statistically significant.

Hypertension

The prevalence of hypertension in this cohort (race and sex combined) was 78.8%. A European

study (EuroSCORE) and an American study quoted 43.6% (amongst 19,030 patients) and 47.2% (amongst 12,198) respectively.

The majority of the patients did not realize that they had hypertension, and were only diagnosed when they consulted a physician regarding their coronary heart disease symptoms. Even though some patients were told they were hypertensive, the disease was poorly controlled. Most of them did not understand the consequences of the disease, and therefore were not compliant with their medication or did not take the necessary precautionary steps. Some chose to seek traditional therapy (e.g. 'village medicine man', herbs) instead of consulting a physician. Also, a number of patients were unable to access the health service due to the lack of transportation.

Hyperlipidaemia

Among the three IHD risk factors in this cohort, the prevalence of hyperlipidaemia was the highest at 89.1%. The prevalence of hyperlipidaemia among CABG patients is not well reported in the literature.

In the Lipid Research Clinics Prevalence Study¹¹, it was found that abnormal lipid levels occurred commonly among hypertensive patients. There was also a strong correlation between glucose and triglyceride levels.

The mean level of serum cholesterol in Malaysians seemed to have risen gradually from below 4.8 mmol/l in the 1960's to 5.0 mmol/l in 1970's and then to 5.4 mmol/l in the 1980's^{12,13}.

In this study, we found that HL was the single most common presentation (alone or in combination with other risk factors). Considering all three single risk factor groups, the HL group constituted the highest number of patients. In the double risk factor groups, those that involved HL had more patients.

IHD risk factors among the races

At the moment no reliable explanation can be put forward for any particular predisposition,

although genetic factors could play a role. Even so, the findings in this study differ from the previous trends reported.

Teo et al¹³ in a study in 1982-1985, found that the Malay male subjects had the highest prevalence of hypertension, and elevated triglycerides. Hypercholesterolaemia was most prevalent among the Indian respondents, while the Chinese were in between the Malays and Indians for all these risk factors.

The IHD risk factors among Malays in both community and hospital settings became the subject of a number of studies in the 1980s. A high prevalence of hypertension was also found among rural Malay adults in a study in 1984¹⁴. Of the 359 people examined, 26% had hypertension.

Although the prevalence of hypertension in urban areas of peninsular Malaysia appeared to be higher than that in rural areas, there was no statistically significant difference. In a study by Kandia et al¹⁵ of 963 subjects, 14% were found hypertensive and of these, 16.8% were from the urban areas and 12.3% from rural areas. With regards to ethnicity, this study reported that the Malays had the highest prevalence of hypertension (14.7%) followed by Chinese (14.5%) and Indians (10.8%). This trend seemed to differ in our CABG patients, where hypertension seemed to occur equally in the Chinese and the Indians (83.3% and 85.7%; not statistically significant) compared to the Malays (72.9%) ($p < 0.05$ for both).

Diabetes mellitus is reported to be on the rise in Malaysia¹⁶. Among the Malays, the prevalence of diabetes is lower in rural areas (2.8%) than in urban areas (8.2%)¹⁷. It is more prevalent in the Indians (16%) than in Chinese (4.9%) and Malays (3%) as shown by a study involving 2000 railway workers¹⁸. The particularly high prevalence of diabetes among the Indians in Malaysia reflects similar findings in Singapore¹⁹. This study hypothesized that Indians have a genetic

predisposition to diabetes. This proposition was reflected in the results of our study, which found the prevalence of diabetes mellitus among Indians to be 57.1% compared to only 45.8% among the Malays and 42.8% among the Chinese ($p < 0.05$ for both). We also found that the Indians were more likely to present with the combination of diabetes, hypertension and hyperlipidaemia.

Urbanization in Malaysia has resulted in an increase in the Malay proportion of the urban population, being attracted largely by better economic opportunities in the urban areas²⁰. Parallel to the fast pace of urbanization is a rapid rise in the IHD mortality rate with Malays showing the most rapid increase. Between 1970 and 1991 the Malay IHD mortality rate rose by 3.4 times, compared to 2.2 and 1.9 times for the Chinese and Indians respectively. Concurring with this finding, a study in the 1980's showed that urban Malays had a high prevalence of IHD risk factors, particularly hypertension and hypertriglyceridemia.¹³ This trend appears to be similar in our study. The Chinese also had the highest prevalence of these two diseases.

Conclusion

The prevalence of diabetes mellitus and hypertension was high in CABG patients in HUKM, which could be reflective of the Malaysian CABG patients. This inherently poses more intra-operative technical difficulties and post-operative complications. Any international comparison of surgical results must therefore take into account the risk profile of these patients by using a compatible risk stratification system.

Each ethnic group had a different propensity to present with a different combination of diseases; the Indians - the three combination of risk factors; whilst the Chinese and the Malays - hypertension and hyperlipidaemia. Strategies to look into amendable determinants amongst the races (e.g. diet, cultural practice, life style) should be part of a continuous health education promoted through public health campaigns.

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