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Fatal Coronary Heart Disease in Urban Women: An Autopsy-Based Study Nur Ilyani Nor Azmal ^{1,} Faridah Mohd Nor², Mohamed Swarhib Shafee ³ Nadiawati Abdul Razak⁴*

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ARTICLE INFO Abstract

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Keywords:

Autopsy, coronary heart disease, forensic science, obesity, urban women. Background: Coronary heart disease (CHD) has remained the primary cause of mortality globally. Contrary to the long-held belief that CHD is primarily a male health concern, recent research has revealed that women are also at significant risk, especially following menopause when hormonal fluctuations can contribute to increased cardiovascular risk. Aim: The present study aimed to determine the demography of coronary heart disease (CHD) in women in Kuala Lumpur, Malaysia. Method: This retrospective cross-sectional study involved 158 autopsy cases of women with CHD received at the Forensic Unit, National University of Malaysia, between the years 2000 and 2019. They were between 20 and 90 years old and analyzed in different age groups, including risk factors, clinical presentations, and types of coronary artery occlusions. Results: Coronary heart disease was found to be the highest between 50 and 59 years old (34%). Most women had several risk factors for CHD (80%), such as obesity (51%), hypertension (23%) and diabetes mellitus (19%). They were predominantly asymptomatic before death (56%). For those with symptoms, they were more chest-related (65%), with single-vessel occlusion being the commonest pattern (42%). This study concluded that fatal CHD cases in women in urban areas showed alarming issues. Despite the disease's risk factors, most of them were asymptomatic. Hence, the detection of CHD in women is warranted to provide careful planning of healthcare services for early screening and treatment purposes.

I. Background

Cardiovascular disease (CVD), especially coronary heart disease (CHD), has remained the primary cause of mortality globally. At the end of the 20th century, coronary heart disease (CHD) remains the most common cause of death among both men and women in most of the Westernized world. The increased relative risk for CHD death in men (2.5- to 4.5-fold) compared with women is

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seen in countries with high or low rates of heart disease (Barrett-Connor and Grady, 1998). This male surplus of CVD in diverse populations with very divergent lifestyles, eating patterns, and disease rates are only compatible with an intrinsic female advantage or a male disadvantage (Barrett-Connor and Stuenkel, 1999). The female advantage has naturally been attributed to estrogen. There are many reasons to believe that estrogen is cardioprotective. The fact that CHD is uncommon in women before 50 years of age age of menopause 49-51 years), (average that postmenopausal women demonstrate increased rates of CHD compared to premenopausal women of the same age range. The increased risk of CHD after premature menopause lends support to the estrogen-CHD hypothesis (Lerner and Kannel, 1986). Numerous in vivo and in vitro studies show at least a dozen estrogen effects that would be expected to prevent or delay CHD (Subbiah, 1998). Observational studies have almost universally reported a lower risk of CHD in postmenopausal women who take estrogen alone or with progestin as compared with those women who do not (Wolf et al., 1991). This trend has also been demonstrated in women with established CHD (Sullivan et al., 1990). Despite improvement in cardiovascular mortality in recent decades, CHD has remained understudied, underdiagnosed, and undertreated in women. Recently, CHD has afflicted almost 6.6 million women in the United States (US) annually and remained the leading morbidity and mortality threat in women (Mehta et al., 2016). On the other hand, women in Asian countries, such as Japan, Korea, China, Hong Kong, Taiwan, and Thailand, were reported to have a higher mortality rate of stroke than CHD compared to Western women (Odegaard et al., 2011).

Nevertheless, in Malaysia, CVD and stroke were the leading causes of death in women compared to all cancers combined (Malaysia et al., 2016). A previous 10-year study conducted on similar urban women in Kuala Lumpur found that female deaths were due to cardiac diseases with advanced coronary artery disease (CAD) or CHD, hypertensive heart disease, and coronary arterv atherosclerosis (Ang and Chan, 2016). Hence, this present study was designed to provide the demography of CHD in women in urban areas of Kuala Lumpur based on autopsy cases to assist the health authorities in future prevention and treatment of the disease in women.

II. Subjects and Methods

The sample population comprised autopsy cases of CHD in women received at the Forensic Unit, UKM, between the years 2000 and 2019 (20-year study). All cases had fulfilled the inclusion criteria, i.e., women aged between 20 and 90 years old, the cause of death was either coronary heart disease (CHD), coronary artery disease (CAD), acute myocardial infarction (AMI) due to CAD and ischemic heart disease (IHD) due to CAD, with estimated gross luminal coronary artery occlusion more than 75% (Rahimi et al., 2018). The exclusion criteria were CHD cases without a post-mortem, other cardiovascular diseases not related to CHD, pediatric age and youth (below 20 years of age), and traumatic deaths with incidental findings of CHD.

All cases were taken from post-mortem reports, and descriptive statistics analyzed the data. The sociodemographic data were age groups, risk factors of CHD in women's bodies such as body mass index (BMI), diabetes hypertension, and others mellitus, (smoking, hyperlipidemia, and family history of CHD), and clinical symptoms. The BMI was calculated using mh2, where m is the mass in kilograms, and h is the length in meters of the deceased. The BMI categories in this study were based on the WHO Asian-BMI classifications (Girdhar et al., 2006). The other risk factors, namely diabetes mellitus, hypertension, and others (smoking, hyperlipidemia, and family history of CHD), enquired from the next of kin and previous medical records. The symptoms of CHD were subdivided into two, i.e., chest-related (chest pain or discomfort, palpitation) and non-chest-related (abdominal pain, fatigue, nausea, and vomiting), and the number of coronary arteries occluded (Malaysia, et al., 2016). The coronary artery occlusions were divided into three types, i.e., single-vessel occlusion (any one of the major coronary arteries), double-vessel occlusions (two of the major coronary arteries), and triple-vessel occlusions (all the major coronary arteries) (Rahimi et al., 2018).

III. Results

The results indicated that the majority of women with CHD were within the age range of 50 to 59 years (34%, N = 54), as illustrated in the bar chart figure (1) and as shown in the pie chart, 80% of the individuals had risk factors for CHD (Figure 2). Of 158 women, body weights were not stated in 18 cases, and they were excluded from the study.

The pie chart figure (3) reveals that 51% of women were obese Type 1 and Type 2, followed by those with a normal BMI (26%).

Clinically, the majority of the women were more asymptomatic (56%) than symptomatic (44%), and their symptoms were predominantly chest related. The singlevessel occlusion displayed the highest prevalence (41%), followed by double-vessel occlusion (30%) and triplevessel occlusion (29%). The single-vessel occlusion was further analyzed in different age groups, whereby there were three age groups, i.e., 40-44, 45-59, and 55-59, who were more affected than the elderly age group, such as 75-79 and 85-90 as depicted in the bar chart (Figure 4).



Figure 1. The bar chart shows the distribution of cases according to age groups.



Figure 2: The pie chart shows the distribution of cases based on the presence of risk factors for coronary heart disease.



Figure 3. The pie chart shows the distribution of cases according to body mass index (BMI).



Figure 4: The bar chart shows the distribution of cases of single-vessel occlusion according to age group

IV. Discussion

Cardiovascular diseases (CVD) have been recorded as the leading cause of death in Malaysia for the past 30 years. The latest death statistics in 2018 showed that IHD had remained the principal cause of death in women in urban areas (14.4%) (Mohamad, 2019). This study supported several studies on CHD in women based on age distribution and risk factors. Most women less than 65 years old with premature CHD had risk factors such as obesity, hypertension, and diabetes mellitus (Ang and Chan, 2016; Muda et al., 2013; Vikulova et al., 2019; Bossard et al., 2020). Besides, the occurrence of depression and perceived stress in younger women were also more rampant, leading to a greater risk of CHD (Bossard et al., 2020).

Results also showed that the second-highest group of women affected by CHD had normal BMI. This indicated that a normal BMI was not a guarantee of protection from CHD, particularly for women with mild obesity and larger waist circumference (Flint et al., 2010), but a normal BMI (Willett et al., 1995). Mild obesity was also associated with an increased risk of CHD, regardless of BMI (Canoy et al., 2013). Most of the women were asymptomatic before death, whereas two-thirds of Malaysian women with sudden cardiac death had no symptoms (Malaysia et al., 2016). However, it should be cautious that these women may not be seeking treatment for some atypical chest pain and, hence, be asymptomatic.

In a study performed at the Universiti Teknologi Mara in 2018, it was stated that single-vessel occlusion predominated in women less than 65 years old with CHD, which supported that single-vessel occlusion was more common in younger women (Zimmerman et al., 1995). This is probably true because the highest incidence was those with the single-vessel occlusion, and they still have some reserves in the other two vessels and hence showed no symptoms. This may be attributed to the rapidity of CHD progression into more fatal complications, such as plaque rupture, bleeding, or other complications, compared to a more gradual progression in older women (Tamrakar et al., 2013). In contrast, younger women are a group with higher psychosocial burden and mental stress events, and the presence of CHD may further elevate the level of Interleukin-6 (IL-6). This important pro-inflammatory biomarker will enhance their susceptibility to adverse cardiovascular outcomes (Sullivan et al., 2018).

Our study found that the majority of women with CHD were within the age range of 50 to 59 years (34%), which supports the high incidence of cardiovascular (CV) complications experienced by a large proportion of the aging female population. Studies have shown that low estrogen levels correlate with coronary artery disease in men (Bajelan et al., 2019). CVD occurs more frequently in men than in women before menopause (Stanhewicz et al., 2018). As the increased risk of CVD coincides with menopause, studies have shown that female hormones, especially estrogens, are cardioprotective and play significant roles in reproductive and non-reproductive both systems (Stanhewicz et al., 2018). Menopause is associated with a significant increase in blood pressure, body mass index (BMI), obesity, and body fat distribution (Paduszyńska et al., 2021). Hormone Replacement Therapy (HRT) has been explored as a potential strategy for reducing cardiovascular risk in postmenopausal women. One of the key advantages of HRT is its ability to alleviate menopausal symptoms, such as hot flashes and bone loss, while also potentially improving lipid profiles by increasing HDL ("good" cholesterol) and reducing LDL ("bad" cholesterol). This can help lower the risk of cardiovascular disease in some women. However, the use of HRT also comes with significant disadvantages. Studies have shown that, in some instances, HRT may increase the risk of stroke, blood clots, and certain types of cancer, particularly breast cancer. Additionally, the cardiovascular benefits of HRT may be limited to women who begin the therapy shortly after menopause. At the same time, those who start it later may experience an increased risk of heart disease. As a result, the decision to use HRT must be carefully weighed, considering individual risk factors and overall health. With the prevention of CVD as a top priority, HRT is a safe and potentially highly beneficial therapeutic modality for appropriately selected women.

V. Conclusion

Fatal CHD cases in urban women in this study were alarming, particularly in the younger age group. The presence of risk factors and symptoms were no longer prerequisites for the occurrence of CHD. The fatality of CHD in women was also not determined by the number of coronary arteries occluded. This study urges healthcare professionals and policymakers to prioritize women's heart health. Improved screening for early detection and interventions for treatment and prevention of cardiovascular diseases align with the United Nations Sustainable Development Goal (SDG) Target 3.4, which aims to reduce premature mortality from cardiovascular disease by onethird by 2030.

Limitations

A key limitation of this study is its reliance on retrospective autopsy data, which may not fully capture the clinical progression of coronary heart disease in living patients. Additionally, the sample is limited to a single urban area, potentially restricting the generalizability of the findings to other populations or geographic regions. Further research with broader demographic data is needed to validate these results.

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Declarations

Ethics approval and consent to participate

Ethical approval was granted by the UKM Research Ethics Committee (Ethics No: UKM PPI.800-1/5/JEP-2019-365). No consent for participation was required, as only the decedent's secondary data and images were retrospectively utilized without clinical intervention. The manuscript has been sufficiently anonymized and will not harm the patient or their next of kin.

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Conflicts of interest

The authors declare no conflicts of interest.

List of Abbreviations Section

Acute myocardial infarction – AMI (BMI): Body mass index (CV): cardiovascular (CVD): Cardiovascular disease (CAD): Coronary artery disease (CHD): Coronary heart disease (SDG): Sustainable Development Goal

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