Invited Review

Characteristics of woman`s heart with disorder of coronary circulation

Leilim M. Actaiyeva[1], Kuat B. Abzaliyev[1], Simbat A. Abzaliyeva[2], Gulum A. Aldangarova[3]
[1] Al Farabi Kazakh National University, Almaty, Kazakhstan
[2]Faculty of Medicine and Public Health, Al Farabi Kazakh National University
[3]AN Syzganov National Research Center of Surgery

Abstract:
We present review of current evidence on ischemic heart disease in women. The risk factors, clinical manifestations, diagnosis and treatment and prevention of ischemic heart diseases in women are discussed.

Key words: female, coronary artery disease, risk factors, treatment, prevention
(Heart, Vessels and Transplantation 2018; 2: doi: 10.24969/hvt.2018.98)

Introduction

Problem of ischemic heart disease (IHD) development in women is actively being discussed among cardiologists across the world (1). There are literature data on traditional risk factors do not characterize risk of IHD development in women. Risk factors for IHD in female are: increased levels in blood of homocysteine, lipoprotein (a), triglycerides, fibrinogen, oxidative stress, left ventricular hypertrophy, and one of the pretest markers – leptin level, which is always higher in women than in men. In addition, gender differences in female and male are based on features related to XX or XY chromosomes. Gene differences of X chromosome in men and women influence physiological processes as well as heterogeneity of phenotype.

In June 2005 in Nice, there was a conference on cardiovascular diseases in women, which made resolution and defined main goal to analyze reduction of increased mortality rate in males and females. Special program on investigation of ``woman heart`` was initiated. The main goal of the study was to answer the question whether treatment of male and female should be based on unified standards and principles, represented in the international expert recommendations that are based on data of studies including mostly males (2).

Cardiovascular mortality in women was 55% and in men 43% (3). Outcomes of IHD are less favorable in females than in males. According to the Infarction Triage and Intervention Registry, hospital mortality from acute myocardial infarction (MI) in women was 16% and 11% in men (3). Hsia et al. (4), demonstrated that 31% of women are at risk of coronary artery disease mortality being different from 3% risk of hip fracture or 4% risk of mortality from breast cancer. Women are characterized by worse cardiovascular diseases prognosis as compared to men – more women die from the 1st MI and during first year after MI. American College of Cardiology reported that during first year after documented MI 25% men and 38% women died (5).

According to GUSTO-1 study, female s mortality from MI at any age is higher than in males, reaching maximum at younger age (6). Moreover, female sex is an independent risk factor of hospital mortality and high frequency of complications after coronary bypass surgery (7).

Framingham Heart Study demonstrated that 40% of all coronary events in women end up with sudden cardiac death, and 64% of cases had no history of coronary artery disease (8).

Address for Correspondence: Kuat B. Abzaliyev, Al Farabi Kazakh National University, Almaty, Kazakhstan
Email: abzaliev_kuat@mail.ru
Received: 13.10.2018 **Revised:** 27.11.2018 **Accepted:** 27.11.2018
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The most frequent manifestation of IHD in women is chest pain of squeezing and burning character (88%), while debut of diseases as MI is determined in 12% of cases. Not uncommon symptom is the manifestation of IHD as vasospastic angina pectoris with series of night chest pain and satisfactory condition during day (9). Manifestation of IHD in women increases during post-menopause, after 50, indicating that young women have protective factor when there is a reproductive function that usually disappears after 50 years (10). It is known that breakpoint between periods with relatively low and high probability of coronary symptoms in life of women is menopause, i.e. after ovarian functions discontinue (11-13).

According to opinions of several authors, menopause before 46 years, increases risk of cardiovascular diseases (CVD) independently of other risk factors (14). Results of initial epidemiological studies show a quite significant reduction (by 40-50%) of coronary pathology risk in women who received after menopause hormone replacement therapy (15, 16).

Because of opinion about hormonal `` protection`` of women from cardiovascular pathology, risk of IHD in women is underestimated. Thus, according to the one of the latest NHANES reviews (National Health and Nutrition Examination Survey), there has been increase of MI rate in women of 35-54 years, while in men of the same age incidence of MI for past two decades reduced (17). Therefore, several factors promoting lack of diagnosis and treatment of coronary pathology in women should be acknowledged:

- Risk of coronary pathology in women is underestimated due to belief that women of reproductive age are protected by hormones from development of CVD. That is why women are referred for exercise testing, diagnostic coronary angiography and interventional methods of diagnosis less often than men do;
- Coronary artery disease due to atherosclerosis develops in women by 7-10 years later than in men. However, risk of cardiovascular complication is by 3 times less in women as compared to men, after 65 years CVD are the main reason of mortality in females;
- Underestimation of CVD significance in women underlies less ``active`` identification of risk factors, less clinical investigations and treatment of new symptoms and signs in women by cardiologists than among men (1).

According to Chang et al. (18), women have fewer interventions as compared to men even in presence complaints characteristics for acute coronary syndrome (ACS). Coronary arteries condition, degree of stenosis defines main risk of IHD surgery. Anatomically women's heart is smaller; coronary arteries are thinner than in men, that is the main reason for unsatisfactory results of revascularization of myocardium (19).

Anatomic features of cardiovascular system in women

AS mentioned above, adult women have smaller heart chambers and left ventricular mass is less by 10% as compared to men. Due to smaller mass and body surface area in women diameter of coronary arteries are markedly smaller than in men.

It was considered that smaller diameter of coronary vessels must affect negatively the results of medical treatment as well as surgical revascularization. Smaller diameter and quantity of collateral vessels in women explains faster progression of IHD, documented by coronary angiography (20). Despite smaller diameter of coronary vessels, women had less often ACS, due to complete occlusion of coronary artery, and more often manifests with symptoms of unstable angina pectoris and challenging for diagnosis symptoms (21).

Clinical manifestation of IHD in women

Challenges in interpretation of symptoms and clinical manifestation of IHD are more often encountered in women. In a study involving more than 500 women with acute MI, the first symptoms were fatigue (71%), disorders of sleep (48%) and dyspnea(42%) (22). Pain usually is of atypical character, appear during rest, sleep, not only in chest, irradiating to neck, left hand, shoulder, sometimes in abdominal area, and there is no relation between physical exercise and appearance of pain (22).

That is why, there might be life-threatening chest pain due to ACS, pulmonary artery thromboembolism, pericarditis, myocarditis and also, physicians might evaluate these as non-dangerous for life like vertebral disorders, gastric and esophageal pain. Accordingly, treatment applied in wrong direction that often ends fatally. In opposite situation, when non-dangerous for life situations are evaluated as acute coronary pathology or chronic IHD and as a consequence - unnecessary investigations, treatment and interventions take place.

Atypical pain syndrome in women is related to more frequent vasospastic components and microvascular ischemia. In addition, another mechanism through sex hormones might influence the sensitivity and pain threshold (23).

Risk factors of IHD in women and men

Dyslipidemia

It is well-known that relative risk of hypercholesterolemia is lower in young woman than in man. However, cholesterol starts to increase in women of age 55-65 reaching peak levels, that is later by 10 years than in men. This can be explained by that during menopause atherogenic fractions of lipids, i.e. total cholesterol (TC), low-density lipoprotein cholesterol (LDL) and lipoprotein (a) (Lp(a)) are increased by 10%, 14% and 4-8% respectively . At the same time the high-density lipoprotein cholesterol (HDL) does not change which causes increase of atherogenic index (IA) (24).

HDL level is always higher by 5-10 mg/dL in women lifelong than in men (25). However in postmenopausal women, HDL not always has cardioprotective features. Some HDL particles, because of ion mobility, better reflect antiatherogenic activity of HDL. Cardioprotective features of large HDL particles depend on menopause period (26).

Arterial hypertension

Arterial hypertension (AH) is the most prevalent risk factor in women>65 years old as compared to men. The most prevalent form of AH in women is isolated systolic hypertension (27). Isolated systolic hypertension is associated with marked left ventricular hypertrophy (LVH), stroke and heart failure (HF). Moderate AH is characterized by frequent cardiovascular complications. White coat hypertension in women is related to high variability of blood pressure and frequency of AH (12).

Smoking

Women smoke less than men do. According to statistics, smoking of the same amount of cigarettes causes significantly more negative effect in women than in men. Tobacco smoking according to NHANES I study increases risk of heart failure development by 45% in men and by 88% in women (28). Risk of myocardial infarction development in premenopausal women smokers is by 3 times higher than in women nonsmokers. Smoking of 35 cigarettes per 24 hours by women increases risk of myocardial infarction by 20 times than in nonsmoking women (29).

Obesity

Obesity is prevalent in women after 45 years age; in opposite in men it is prevalent before 45 years. There is a correlation between IHD development and body mass index (BMI): coronary artery disease risk is increased by 3.6 times in women with BMI 29 kg/m^2 as compared to women with BMI < 21 kg/m^2 (30). WISE (Women`s Ischemia Syndrome Evaluation) study in evaluation of cardiovascular risk recommends to rely on impairments of metabolism rather than only obesity (31). This study failed to show obesity as a predictor of IHD in women (31). Metabolic syndrome in presence of three risk factors more often occurs in women with IHD than in men (32).

Diabetes mellitus

Glucose intolerance and diabetes mellitus (DM) in women are associated with increase in prevalence of IHD and underlies it severe course as compared to men. In the setting of DM risk of mortality due to CVD in men increases by 1.7 times and in women by 3.3 times, and risk of IHD in women raise by 3.7 times and by 2.3 times in men (33). Presence of DM in premenopausal period significantly reduces protective role of estrogen in women. There is also an association between smoking and DM, where mortality risk in DM women smokers doubles as compared to nonsmoking woman. In addition, women with DM and IHD have an early and significant signs of left ventricular contractility reduction (34).

Alcohol

Alcohol consumption in postmenopausal women with dyslipidemia is accompanied by increase in triglycerides level by 35% and insulin level by 54%, and the risk of atherosclerosis development does not reduce (35).

Psycho-social risk factors

In nowadays, psychological and behavioral characteristics are accepted as possible risk factors for IHD, because women more often suffer from anxiety and depression as compared to men (36). Mental health in patients, survivors of myocardial infarction (MI) affects their quality of life (QOL) (37). In a study of Dickens et al. (38), presence of anxiety and depression developed 6 months after MI was the predictor of further decline in physical QOL at 6^{th} months and 1 year after hospitalization. Patients with postinfarction depressive disorders had low level of QOL, low work capacity and more often complaints of cardiological and general character (38).

Mental status of women affects dynamics of quality of life (QOL) after myocardial revascularization. Middel et al. (39) showed that in women with increased level of anxiety, negative emotions (type D of an individual), QOL 6 months after myocardial revascularization was worse than in patients with low level of anxiety. That is why authors concluded that in clinical practice it is important to pay attention to the symptoms of anxiety and depression in patients after coronary bypass surgery (39).

High rate of cardiac diseases in women negatively correlates with income, socio-economic status and education level. After ACS during first year women have less physical, sexual and social activity than men (40). Women less likely to return to work during first year after ACS and surgery, and complain on low level of social support. Women having deficiency in communication had the risk of fatal IHD outcome by 3 times higher than in women with high income and social connections. It is shown, that lack of social activity among women of 40 years of age is connected to mortality from IHD (41).

Conclusion

For prevention and strengthening of women health one should take in account:

-Diagnosis, treatment and prevention of CVD in women have certain characteristics as compared to men that should be considered in real clinical practice

-Women are referred to gynecologists and obstetricians more often than to cardiologists. That is why these specialists can make their significant contribution to modification of risk factors and primary CVD prevention in women.

-During menopause collaborative work of cardiologists and gynecologists will allow attaining optimal results in preservation and strengthening of women health.

Absence of clinical investigations, built on principles of evidence- based medicine, comparing efficacy of medical therapy of CVD in women and men worth mentioning.

Peer-review: Internal and external
Conflict of Interest: None to declare
Authorship: L.M.A., K.B.A., S.A.A., G.A.A. equally contributed to preparation of manuscript
Acknowledgement and funding: None to declare

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