CHAPTER 13

CARDIOVASCULAR DISEASES

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Introduction

Cardiovascular disease (CVD) covers all diseases and conditions of the heart and blood vessels (arteries and veins). CVD includes coronary heart disease (CHD), stroke, aortic aneurysm and dissection, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep venous thrombosis and pulmonary embolism and other CVD. CVD is the number one cause of death globally. By the year 2020, there will be an increase by almost 75% in global CVD prevalence, and almost all of these increases will occur in developing countries. The leading causes of death in the world in 2030 are predicted to be heart disease and stroke, both components of CVD. CVD is the reason for a large proportion of all deaths and disability worldwide. The prevalence of CVD is rising worldwide and it accounts for 17 per cent of the total mortality.

Cardiovascular diseases

The cardiovascular system is made up of the heart and blood vessels. Cardiovascular disease (CVD) is defined as any serious, abnormal condition of the heart or blood vessels (arteries, veins). Cardiovascular disease includes coronary heart disease (CHD), stroke, peripheral vascular disease, congenital heart disease, endocarditis, and many other conditions. Cardiovascular disease (CVD) is a collective term designating all types of afflictions affecting the blood circulatory system, including the heart and vasculature, which, respectively, displaces and conveys the blood. This

multifactorial disorder encompasses numerous congenital and acquired maladies.

Cardiovascular disease encompasses atherosclerosis. Atherosclerosis is a specific type of arteriosclerosis. Atherosclerosis is the buildup of fats, cholesterol and other substances in and on the artery walls. This buildup is called plaque. The plaque can cause arteries to narrow, blocking blood flow. The plaque can also burst, leading to a blood clot. Its subtypes (coronary [CoAD], cerebral [CeAD], and peripheral artery disease [PAD]) with two major complications, myocardial infarction it is a heart attack (medically known as a myocardial infarction) is a deadly medical emergency where your heart muscle begins to die because it isn't getting enough blood flow, and ischemic stroke (more common than hemorrhagic stroke, heart failure (HF), cardiac valvulopathies and arrhythmias, rheumatic heart disease (damage of the myocardium and cardiac valves caused by streptococci bacteria), congenital heart disease, and deep vein thrombosis with its own complication, pulmonary embolism.

Types and Complications

Types of cardiovascular disease

There are many types of heart disease, and each one has its own symptoms and treatment. For some, lifestyle changes and medicine can make a huge difference in improving your health. CHD, also referred to as Coronary Artery Disease (CAD), is a disease affecting arteries supplying blood to the heart. It then results in obstructive changes in the coronary circulation of the heart and the impairment of heart function due to inadequate blood flow. Atherosclerosis, the process of buildingup of plaque and forming of blockages in the wall of the articles, is the underlying cause a common substrate for CHD.

Angina Pectoris

Angina is an episodic clinical syndrome of CHD. When the blockages are more than 60 to 70 per cent but less than 100 per cent, any increased

demand for blood will starve the heart of essential requirement of oxygen. The result of such deprivation is mainly the experience of pain in center of the chest (behind the breastbone) and then it may radiate to the left shoulder and to both arms, especially to the ulnar surfaces of the forearms and hand. It can also arise in or radiate to the back, neck, jaw, throat, teeth and epigastrium (upper abdomen). Sometimes the pain is felt only down the left arm.

Myocardial Infarction

When blockages are 100 per cent and the deprivation of blood is prolonged, the pain continues for a long time and eventually the portion of heart muscle deprived of blood dies (necrosis) and no regeneration is possible. This is called myocardial infarction. (Jason, 2009). If a large portion of the muscle is damaged in the process of infarction, the heart will not be able to pump enough blood to meet the demands of the body and then the person dies immediately. In many cases infarct does not destroy so much muscle that will cause death.

Most of the time, the heart may be able to cope with routine functioning while resting but not when there is increased demand. Or it may cause reduction in the blood supply to the organs involved in various bodily functioning and they start collapsing as they are short of the essential nutrients. Thus, angina pectoris and MI occur due to imbalance between oxygen demand and actual oxygen supply by the blood vessels. Such an impaired blood circulation results not only because of the thickening of blood vessels, but also when the heart muscle suddenly demandsmore oxygenated blood. (World Health Organization, 2007)

Atherosclerosis

Atherosclerosis is the buildup of fats, cholesterol and other substances in and on the artery walls. This buildup is called plaque. The plaque can cause arteries to narrow, blocking blood flow. The plaque can

also burst, leading to a blood clot. Although atherosclerosis is often considered a heart problem, it can affect arteries anywhere in the body. Atherosclerosis can be treated. Healthy lifestyle habits can help prevent atherosclerosis.

Atherosclerosis is a slowly worsening disease that may begin as early as childhood. The exact cause is unknown. It may start with damage or injury to the inner layer of an artery. The damage may be caused by, High blood pressure, High cholesterol, High triglycerides, a type of fat (lipid) in the blood, Smoking or chewing tobacco, Diabetes, Insulin resistance, Obesity and Inflammation from an unknown cause or from diseases such as arthritis, lupus, psoriasis or inflammatory bowel disease

Once the inner wall of an artery is damaged, blood cells and other substances may gather at the injury site and build up in the inner lining of the artery. Over time, fats, cholesterols and other substances also collect on the inner walls of the heart arteries. This buildup is called plaque. Plaque can cause the arteries to narrow, blocking blood flow. The plaque can also burst, leading to a blood clot.

Hypertension

Blood pressure is the force exerted by circulating blood against the walls of the body's arteries, the major blood vessels in the body. Hypertension is when blood pressure is too high. Blood pressure is written as two numbers. The first (systolic) number represents the pressure in blood vessels when the heart contracts or beats. The second (diastolic) number represents the pressure in the vessels when the heart rests between beats. Hypertension is diagnosed if, when it is measured on two different days, the systolic blood pressure readings on both days is ≥140 mmHg and/or the diastolic blood pressure readings on both days is ≥90 mmHg.

Hypertension is called a "silent killer". Most people with hypertension are unaware of the problem because it may have no warning signs or symptoms. For this reason, it is essential that blood pressure is measured

regularly. When symptoms do occur, they can include early morning headaches, nosebleeds, irregular heart rhythms, vision changes, and buzzing in the ears. Severe hypertension can cause fatigue, nausea, vomiting, confusion, anxiety, chest pain, and muscle tremors. The only way to detect hypertension is to have a health professional measure blood pressure. Having blood pressure measured is quick and painless. Although individuals can measure their own blood pressure using automated devices, an evaluation by a health professional is important for assessment of risk and associated conditions. (Tabrizi, *et al.,* 2016)

Symptoms of cardiovascular disease

Symptoms will vary depending on the specific condition. Some conditions, such as type 2 diabetes or hypertension, may initially cause no symptoms at all. However, typical symptoms of an underlying cardiovascular issue include:pain or pressure in the chest, which may indicate angina, pain or discomfort in the arms, left shoulder, elbows, jaw, or back, shortness of breath, nausea and fatigue, lightheadedness or dizziness, cold sweats.

Risk factor of cardiovascular disease

Over 300 risk factors are associated with CVD. The major established risk factors contain three criterion such as high prevalence in many populations; significant independent impact on the risk of CVD; and their treatment and control result in reduced risk (WHO, 2009). Risk factors for CVD may be categorized mainly into three groups as follows:

NON-MODIFIABLE RISK FACTORS

Advancing age

According to WHO (2009), advancing age is the most powerful independent risk factor for CVD. Risk of stroke doubles every decade after age 55. More than 83% of people who die from CHD are 65 or older. A large increase in death rates from heart disease is seen with increasing age in

both men and women. CVD is extremely common in elderly patients and is their leading cause of death. As the number of elderly persons increases world wide (Jackson and Wenger, 2011).

Sex

The rate of CHD is higher among men compared with women (premenopausal age). The risk of stroke is similar for men and women (WHO, 2009).

Family history

There is an increased risk of CVD if a first-degree blood relative has had CHD or stroke before the age of 55 years for a male relative or 65 years for a female relative (WHO, 2009). A person with a family history of heart disease is ten times more likely to have any CVD. (Das, *et al.,* 2012).

Ethnicity

Ethnic origin plays a role. There was an increased risk of stroke noted among Blacks, some Hispanic Americans, Chinese and Japanese populations. Increased CVD deaths were noted among South Asians and American Blacks in comparison with Whites (WHO, 2009). Asian ethnicity was suggested to be more predisposed to MS than other ethnicities (Yusuf, *et al.,* 2001).

MODIFIABLE RISK FACTORS

High blood

Pressure High blood pressure (BP) is the major risk for heart attack and the most important risk factor for stroke (WHO, 2009). Hypertension (HT) is the leading cause of CVD worldwide. High blood pressure is defined as a repeatedly elevated systolic pressure of 140 mmHg or higher and/or diastolic pressure of 90 mmHg or higher (WHO, 2013).

The risk of CVD doubles for each incremental increase of 20 mmHg in systolic blood pressure (SBP) or each incremental increase of 10 mmHg in diastolic blood pressure (DBP), starting as low as 115/75 mmHg. Globally CVD accounts for approximately 17 million deaths a year, nearly

one third of the total (WHO, 2008). Of these, complications of hypertension account for 9.4 million deaths worldwide every year (Lim, *et al.,* 2012).

Abnormal blood lipids

High Total Cholesterol (TC), Low Density Lipoprotein (LDL) Cholesterol and Triglyceride (TG) levels and low levels of High-Density Lipoprotein (HDL) Cholesterol increase risk of CHD and ischaemic stroke (WHO, 2009). Excess calories in the body are converted into TG and stored in fat cells throughout the body. LDL cholesterol is deposited in the walls of arteries and causes atherosclerosis. In general, lower LDL cholesterol numbers are better for vascular health. HDL cholesterol protects against vascular disease by removing the "bad" cholesterol (LDL) out of the walls of arteries. High TG increases the risk of atherosclerotic CVD. Raised blood cholesterol increases the risk of heart disease and stroke (WHO, 2007).

Obesity

Obesity is major risk for CHD and diabetes (WHO, 2009). Obesity is a growing health problem in both developed and developing countries (WHO, 2010). Obesity is strongly related to major CVD risk factors such as raised blood pressure, glucose intolerance, type 2 diabetes mellitus (T2DM) and dyslipidemia. Overweight and obesity cause adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. (WHO, 2007).

Type 2 diabetes mellitus

Type 2 diabetes mellitus (T2DM) is a major risk factor for CHD and stroke (WHO, 2009). In 2012, diabetes caused 1.5 million deaths. Diabetes was defined as having a fasting plasma glucose value ≥ 7.0 mmol/l (126 mg/dl) (WHO, 2006). Impaired glucose tolerance and impaired fasting glycaemia are risk categories for future development of diabetes and CVD (WHO, 2007).

In some age groups, people with diabetes have a two-fold increase in the risk of stroke. The prevalence of diabetes was 20-folds higher in fifth decade of life compared to fourth decade of life and same was observed in

South-east Asian countries but a decade earlier than the western population (Ravikumar, *et al.,* 2011).

LIFESTYLE PATTERN

Socioeconomic status

Socioeconomic status (SES) refers to an individual's social position relative to other members of a society. It has consistent inverse relationship with risk of heart disease and stroke. SES indirectly influences cardiovascular health as well as health in general. It shapes a set of socioeconomic positions within hierarchies of power, prestige and access to resources. It also shapes individual health status as well as CVD outcomes by impacting behavioral and metabolic cardiovascular risk factors, psychosocial status, living conditions and the health system (WHO, 2010).

Tobacco use

Use of tobacco increases risks of CVD, especially in people who started young and heavy smokers. Even passive smoking is an additional risk (WHO, 2009). There are currently about one billion smokers in the world. Risks to health from tobacco use result not only from direct consumption of tobacco, but also from exposure to secondhand smoke. Nearly six million people die from tobacco use and exposure to second hand smoke each year, accounting for 6% of all female and 12% of all male deaths in the world (WHO, 2010).

The three main components of tobacco smoke are nicotine, carbon monoxide and tar. Nicotine makes the heart beat faster and it increases the heart's demand for oxygen, narrows the blood vessels, reducing the blood supply to tissue cells. Carbon monoxide reduces the oxygen supply carried by the blood to all parts of the body including the heart itself (WHO,2009).

Alcohol use

Alcohol is the fifth leading risk factor for death and disability accounting for 4% of life years lost due to disease (Lim, *et al.,* 2012). One to two drinks per day may lead to a 30% reduction in heart disease but heavy drinking damages the heart muscle (WHO, 2009). The most widely

proposed mechanism for the cardio-protective effect of alcohol is an increase in HDL cholesterol (Brien, *et al.,* 2011).

Physical inactivity

Physical inactivity increases the risk of CVD (Warren, *et al.,* 2010). Physical inactivity increases risk of heart disease and stroke by 50% (WHO, 2009). Insufficient physical activity is the fourth leading risk factor for mortality. People who are insufficiently physically active have a 20% to 30% increased risk of all-cause mortality compared to those who engage in at least 30 minutes of moderate intensity physical activity most days of the week (WHO, 2010).

Unhealthy diets

Low fruit and vegetable intake is estimated to cause about 31% of CHD and 11% of stroke worldwide. High saturated fat intake increases the risk of heart disease and stroke through its effect on blood lipids and thrombosis (WHO, 2009). The amount of dietary salt consumed is an important determinant of blood pressure levels and overall CVD risk (WHO, 2003; 2010).

Novel risk factors

Apart from modifiable and non-modifiable risk factors there is another group of risk factors called "Novel" risk factors (Padmanabhan, *et al.,* 2009) such as:

C - reactive protein (CRP)

Elevated CRP is associated with increased cardiovascular risk. Used as a marker of systemic inflammation, elevated serum levels of CRP have been associated with a wide range of detrimental outcomes, and are often clinically used to guide risk factors modification of stable CAD.

Interleukins (IL)

ILs are major cytokines that may have clinical applications in the evaluation of potential acute coronary syndrome. IL-6 is a multifunctional cytokine and it plays a 16 central role in inflammation and tissue injury.

Similar to IL-6, elevated levels of serum IL-18 may be an independent predictor of higher cardiovascular mortality.

Fibrinogen

Elevated blood levels of fibrinogen and other markers of blood clottingincrease the risk of cardiovascular complications.

Growth Factor (GF)

GFs have been getting significantly more attention in recent years given the importance of angiogenesis in collateralization during progression ofatherosclerosis. The most studied factors as pertains to coronary disease are vascular endothelial growth factor (VEGF), placental growth factor (PlGF) and hepatocyte growth factor (HGF).

Troponin

Troponin has become the gold standard in detection of MI. Its efficacy in diagnosis of MI has been well-validated.FTO (Fat mass and obesity).A common variant in the FTO gene is associated with BMI and predisposesto childhood and adult obesity

Dietary pattern in cardiovascular diseases

Dietary patterns encompass the balance, variety, and combination of foods and beverages habitually consumed. This includes all foods and beverages, whether prepared and consumed at home or outside the home. Adherence to heart-healthy dietary patterns is associated with optimal cardiovascular health. (Ghosh et al., 2003).

- Adjust Energy Intake and Expenditure to Achieve and Maintain a Healthy Body Weight
- Eat Plenty of Fruits and Vegetables, Choose a Wide Variety
- Choose Foods Made Mostly with Whole Grains Rather Than Refined Grains
- Choose Healthy Sources of Protein
    - Mostly Protein from Plants (Legumes and Nuts)
    - Regular Intake of Fish and Seafood

- Low-Fat or Fat-Free Dairy Products Instead of Full-Fat Dairy Products
- Meat or Poultry Are Desired, Choose Lean Cuts and Avoid Processed Forms

- Use Liquid Plant Oils Rather Than Tropical Oils (Coconut, Palm, and Palm Kernel), Animal Fats (Butter and Lard), and Partially Hydrogenated Fats.
- Choose Minimally Processed Foods Instead of Ultra-Processed Foods.
- Minimize Intake of Beverages and Foods with Added Sugars.
- Choose and Prepare Foods with Little or No Salt.
- If You Do Not Drink Alcohol, Do Not Start; If You Choose to Drink Alcohol, Limit Intake

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