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Review on prevention of cardiovascular disease

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Article History	Abstract
	Cardiovascular disease is a significant and ever-growing problem in the united kingdom, accounting for nearly one third of particular and pressing interest as developed countries experienced a change in life style. With an ageing population and increasing cost of chronic medication care, primary prevention of cardiovascular disease is an important target for healthcare provides. The new international guidelines have been produced regarding hypertension and lipid lowering therapies. Firstly it discusses common types of cardiovascular diseases common types of cardiovascular around the global and their causes. Secondly, it analyses different risk factors associated with cardiovascular diseases and then discusses incoming technological trends in cardiovascular disease prediction and finally provides an insight into the importance of prevention of cardiovascular disease.

Introduction

Cardiovascular disease [CVD] is an umbrella term for number of linked pathologies commonly defined as coronary heart disease [CHD] cerebrovascular disease, peripheral article disease [1]. Despite a fall in the propotion of CVD related deaths over last 40 years the rate of decling is slowing while mobility from CVD raisin.The financial implication of the healthcare provides substancial it is estimated that CVD now costs NHS in the u.k 210 billion across the europian union compared direct costs1. The traditional Mediterranean diet is characterized by a high intake of olive oil, fruit, nuts, vegetables, and cereals; a moderate intake of fish and poultry; a low intake of dairy products, red meat, processed meats, and sweets; and wine in moderation, consumed with meals [2].

There are three types of prevention mechanisms to prevent and reduce the impacts of a disease. Primary

Prevention refers to the steps taken by an individual to prevent the onset of the disease. This is achieved by maintaining a healthy lifestyle choice such as diet and exercise. Secondary prevention focuses on reducing the impact of the disease by early diagnosis prior to any critical and permanent damage [8]. This facilitates avoiding life threatening situations and long term impairments from a disease. Tertiary prevention is used once long term effects set in, by helping the patients to manage pain, increase life expectancy, and increase the quality of life [10]. The secondary prevention of CVD includes diagnosis and prevention. Most critical step of secondary prevention is early diagnosis which allows medical professionals to provide required care for patients and improve the quality of life [4]. This requires identifying risk factors, criticality of risk factors, and how the variation of these factors relates to CVD. Upon early diagnosis, patients could be directed to required

treatments affording a higher quality of life. Main attraction of secondary prevention over tertiary prevention comes from two factors. Factor one is the cost where the cost of secondary prevention is far less relative to tertiary prevention [10]. Secondly it effects on the quality of life of the patient. Tertiary prevention involves major procedures that could cause discomfort to the patient as well as disrupt the daily activities, whereas secondary prevention focuses on less intense treatments which include drugs and lifestyle changes.9 Therefore creating awareness on secondary prevention could create positive impacts on individual lives as well as on a macroeconomic level [18]. Types of Common **Cardiovascular Diseases Cardiovascular diseases**

Cardiovascular disease refers to all illnesses associated with heart and circulatory system. These illnesses are sometimes caused by modifiable risk factors such as diet, exercise, and other lifestyle choices while on certain occasions they are caused by unmodifiable factors such as age, gender, family history, and genetic predisposition for the disease [6]. These cardiovascular diseases have long lasting effects if not treated properly and are considered to be one of the most significant causes of death all around globe.4 Most common types of CVD include coronary artery diseases (CAD), cerebrovascular disease, peripheral arterial disease, and congenital heart disease.10 This section will provide an insight into common types of CVD's impacts and possible causes [11]

Coronary Artery Diseases

CAD, the most common type of CVD, refers to the condition where circulatory vessels that supply oxygenated blood to the heart get narrowed. This occurs due to a deposition of plaque inside coronary arteries. This condition is referred to as atherosclerosis [14]. Once these plaques rupture, blood clots are formed inside the arteries which could lead to the partial or complete blockage of blood supply to the heart muscles. Symptoms of CAD include dyspnoea (shortness of breath), myocardial infarction, and angina pectoris [9]. Out of the above-mentioned symptoms, myocardial infarction and angina pectoris are frequently interchanged. Angina pectoris is a state in which the blood supply to the myocardium is significantly reduced thereby creating a squeezing or burning sensation at the sternum. However, myocardium necrosis has not yet occurred at this stage [8]. In contrast, myocardial infarction which is commonly known as a heart attack is a state where, due to the unavailability of oxygenated blood, death of myocardial

cells occurs.9 Both of these conditions can be identified using an electrocardiogram (ECG) where myocardial infarction presents with a ST segment (fat section of the ECG between the end of the S wave and the beginning of the T wave) depression or elevation and T wave inversion and angina pectoris present with only ST segment inversion [17].

Cerebrovascular Diseases

Cerebrovascular disease is a type of CVD associated with circulatory vessels that supply blood to the brain, causing the patient to have a stroke. The most common cause of cerebrovascular disease is hypertension which causes the artery inner lining to damage. Tis damage results in aggregation if there are platelets in the area where collagen is exposed [9]. Four most common types of cerebrovascular diseases are stroke, transient ischemic attack (TIA), subarachnoid haemorrhage, and vascular dementia [15]. Stroke occurs by a blockage of oxygenated blood to the brain due to thrombosis or embolism, which would lead to brain damage [10]. Tree /exist three main types of causes for cardio embolic strokes, namely, arrhythmia, valve disorders, and cardiac chamber and wall abnormalities [11]. Out of these causes atrial fibrillation (type of arrhythmia) is considered a major etiology of stroke. Atrial fibrillation is a condition where the atrium fibrillates instead of fully contracting there by creating an irregular heartbeat. This fibrillation causes blood to pool allowing the formation of clots [14]. These clots could block arteries that supply blood to the brain resulting in a stroke. TIA is a type of stroke that occurs temporarily with symptoms similar to a stroke. Subarachnoid haemorrhage is caused by blood leaking onto the surface of the brain or out of the arteries. *This leaked* **blood results in damaging brain tissue and neural structures [**18]

Congenital Heart Disease

Congenital heart diseases are associated with the structure of the heart [8]. This condition is most commonly identified as birth defects, in the new-born children. Defects may vary such as structural defects of heart walls, heart valves, or even veins and arteries around the heart which could result in blocking blood flow, forcing the blood to flow in the wrong direction, and slowing down the blood flow [10] Symptoms of CHD are mostly identified at birth, but in certain cases patients may go undiagnosed for a long time or even their entire life [19]. Common symptoms of CHD are heart murmur, underdeveloped limbs, and shortness of breath, fatigue, and cyanosis. Causes for congenital

heart diseases may not be directly identifiable [15]. They could be caused by different factors such as infections during pregnancy (rubella), use of certain drugs, alcohol, and tobacco, genetic predisposition, or even poor nutrition [18].

Peripheral Arterial Disease

A condition caused by reduced blood supply to limbs due to atherosclerosis (fatty deposits) in arteries is referred to as peripheral arterial disease (PAD). This is commonly associated with legs [20]. Common symptoms of PAD include discoloration of legs, cramps in hip and calf muscles, and hair loss on limbs. However in many instances, these symptoms may go unnoticed. Most common risk factors of PAD include high blood pressure, smoking, diabetes, high blood lipids, and high levels of homocysteine [20].

Risk Factors of Cardiovascular Disease

Cardiovascular diseases may be caused as a result of many risk factors. These factors can be generally categorized into two groups, namely, modifiable risk factors and no modifiable risk factors. Modifiable risk factors refer to controllable causes of cardiovascular disease such as obesity, blood lipids, and behavioural factors. Nonmodifable risk factors are those which cannot be controlled such as age, gender, and genetic predisposition. Awareness of these risk factors is highly critical in both stages of secondary prevention, early diagnosis and treatment [18].

Gender

CVD is one of the most leading causes of death for people in both genders. However, statistical analysis shows that certain manifestations of CVD are more common in one gender relative to the other [20]. It has been established that males are more prone to coronary heart diseases while women have a higher risk of being subjected to strokes and heart failures [25].

Genetic Factor

Due to genetic factors, women over 65 are at more risk to develop hypertension, but until the age of 45, men are more likely to have hypertension. Additionally, there is a direct correlation between body weight and high blood pressure.10 Physical inactivity and an unhealthy diet also increase your risk, and smoking and even stress may contribute to hypertension [12].

Diabetes

Diabetes is another strong factor that increases the risk of cardiovascular disease, including atherosclerosis. Unhealthy diet, physical inactivity, and obesity all increase the risk to develop type 2 diabetes [13]

Age

Age is one of the most common non modifiable factors considered in almost all CVD risk prediction models. Age factor affects the two genders in a different manner for developing cardiovascular diseases [11]. As mentioned in Figure 1, at a younger age, females have a less risk of developing CHD. However, this advantage reduces drastically over time. It has been found out that risk of CHD increases with age [12].
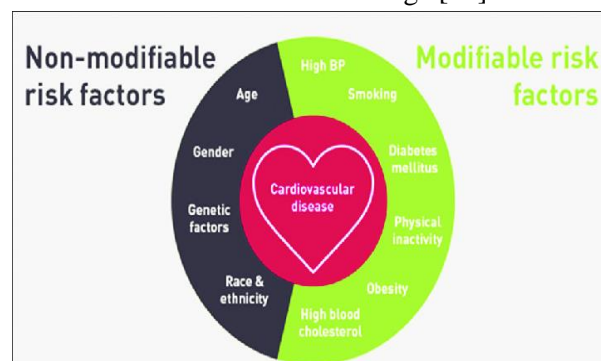
Obesity

Obesity refers to the condition of accumulating of body fat leading to health risks. However association of obesity and CVD has been a long debated topic [20]. While many studies show that obese individuals have a relative to higher risk to gain CVD, not many show a direct a correlation between weight/ obesity and CVD. Obesity is associated with many other risk factors such as lipids (cholesterol), glucose, and blood pressure which lead to the general consensus that risk of CVD for obese individuals is primarily due to the above said risk factor [21].

However, most risk factors are related to lifestyle and these can be modified. **The most important behavioral risk factors for cardiovascular disease are physical inactivity, unhealthy diet, and tobacco use**. Many cases of cardiovascular disease can be prevented by altering these risk factors [20].

Secondary Prevention

Secondary prevention Intervention for CVD and Its Importance. Secondary prevention aims to identify a disease within a patient before the onset of symptoms and reduce the impact on the life of the patients [21]. While knowledge on the variation of risk factors aids in the screening process, it is important to have an understanding of medical interventions necessary to reduce the impact of the disease [22].

Quality of Life Improvement: In cases where primary prevention fails due to unmodifiable risk factors, secondary prevention becomes the next best choice in maintaining the quality of life of the patient. Secondary

prevention comprises identifying risks of CVD before it does permanent damage or create critical medical situations and then conducting necessary interventions to reverse the effects of the disease [15].

Thirdly, secondary prevention reduces the socioeconomic burden on the nation as well as to individual households [16]. Considering household burden, it comes in short term as well as long term. Short term costs include hospitalizations costs, ambulance rides, and surgery expenditure [17].

Medical Interventions: The most common cause of CVD is dyslipidemia (abnormal amounts of lipids in the blood). This leads to atherosclerotic CVD. Statin therapy is used in order to manage blood lipids by medical professionals. This is a lipid lowering drug type/drug class that inhibits the body from creating [20].

Lifestyle Interventions: Nonmedical interventions for CVD are mainly comprised of behavior modifications of high risk individuals for CVD. Weight reduction is one of the most discussed lifestyle interventions under this topic. It is advised to maintain an average weight with a BMI between 18.5 and 24.9.13
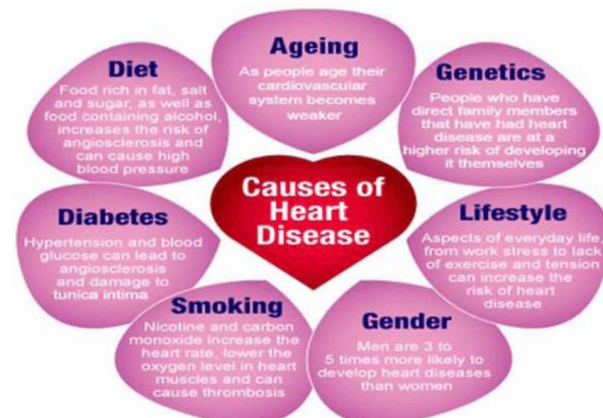
Causes of Cardiovascular Disease

Primary Cause- Build-up of fatty deposits on the inner walls of the arteries and restricts blood flow. Atheroscleroisis- a condition in which fatty deposits build up on inner walls of arteries, causing narrowing of arterial passageways Heart Attack- When the coronary artery is completely blocked Stroke-When an artery that supplies blood to the brain is blocked [22].
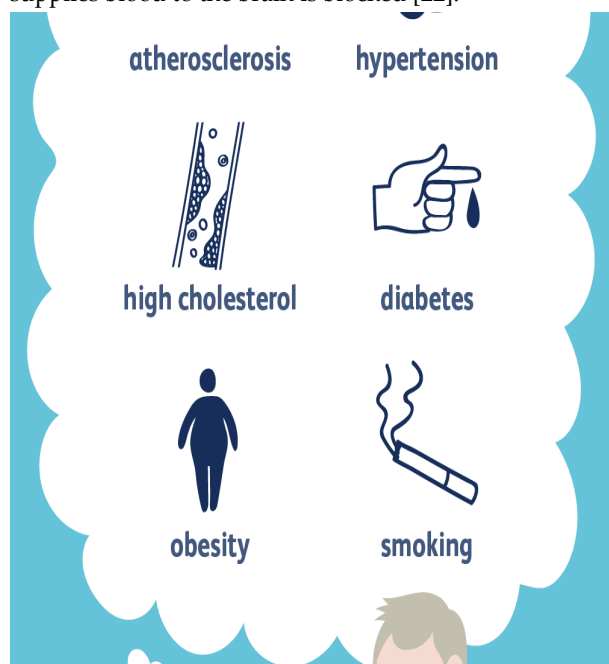
Smoking

Smoking is the main cause of cardiovascular disease. Smoke is the leading preventable cause of disarability and cause 1 out of 20 deaths. Nicotine and carbon dioxide increases the heart rate, lower the oxygen level in heart muscles and can cause thrombosis [14].

Treatment of Cardiovascular Disease

- Drugs to lower cholesterol.
- Angioplasty – inserting a balloon catheter to compress plaque against the vessel wall therefore opening clogged arteries.
- Stent – small wire mesh tubes to prop open the arteries [9].
- By-pass surgery – blood vessels removed from leg and sewn onto heart to shunt blood around a blocked artery.
- Heart transplant or artificial heart.
- These only treat symptoms not the causes…problems will return if lifestyle changes are not changed [17].
- Blood thinners that decrease the clotting ability of the blood, used to certain treat certain blood vessels, heart and heart rhythm conditions.
- These drugs help to prevent harmful blood clots from the forming in the blood vessels or heart [10].
- Beta Blocker: - Work by the slow heart rate down and decreasing the effects of adrenaline on the heart this helps to low blood pressure so that heart has to do less work [19].
- **Surgery:** if both lifestyle changes and medications are not enough surgery, surgery may be needed. The type of heart disease you have to how much damage has been done to your heart will determine which produce your doctor recommends [1].

Conclusion

Cardiovascular disease is a non-communicable disease with one of the highest fatality rates. Approximately 44% of total NCD deaths are caused by CVD. Even if the patient survived, long term treatments and procedures once the symptoms are set could be unaffordable to middle class individuals which in the long run would create a socioeconomic burden at the national scale. Due to this criticality of CVD, there exists a demand for procedures to reduce the negative impact of CVD. Secondary prevention plays a vital role in the said task, as it aims to identify diseases at early stages and then treat them prior to any critical damage. Preventive healthcare is comprised of three main platforms. First, there is primary prevention, which suggests that patients should live in a way that h/she would not be a victim of the disease in the first place. In relation to CVD, this means maintaining ideal bodyweight, balanced diets, and cessation from unhealthy practices such as smoking and excessive alcohol consumption. However, CVD is a result of many factors which are modifiable as well as unmodifiable risk factors. Tertiary prevention aims to treat patients when the symptoms have been set and critical damage has already occurred. This in general aims to increase the life expectancy and quality of life of the patient via intensive procedures such as pacemaker placement and bypass surgery. Early diagnosis plays a crucial role in secondary prevention. This requires intensive knowledge of risk factors contributing to CVD and different interactions among them. Some common risk factors of CVD include obesity, gender, age, blood lipids, and smoking. Since the invention of artificial intelligence CVD prediction has evolved into a new level, where machines are able to analyse millions of data sets and identify relations between different risk factors. These systems include either statistical model or artificial neural networks where some showed an accuracy rate over 85%. Average accuracy rates of these systems lie within 70–80%. This technological application has enabled medical to diagnose high risk individuals of CVD, who are then treated prior to any critical condition such as myocardial infarction. This is advantageous as once such situation occurs, damage that occurs may be irrecoverable which may cause long term complications. For instance, cell death in heart may cause remaining cells in the heart to deform (enlarge), which could cause arrhythmia in the long run. Another benefit of secondary prevention is the significant cost savings it has over tertiary prevention. Tertiary prevention takes place when permanent damage or critical conditions occur. They focus on extending patient life and quality. However, constant care must be given after tertiary prevention treatments where it takes a prolonged time for the patient to adjust to daily activities. Furthermore, these said procedures may have financial costs which are unaffordable for middle income families. Upon early stage diagnosis, patients are prescribed with drug interventions as well as lifestyle interventions to reduce the risk of CVD. Drugs such as beta blockers and statin therapy could reduce risk factors of patients thereby relieving their risk of severe CVD diseases with long term effects. Lifestyle interventions include weight loss, cessation of smoking, limiting alcohol usage, and dietary restrictions.

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